



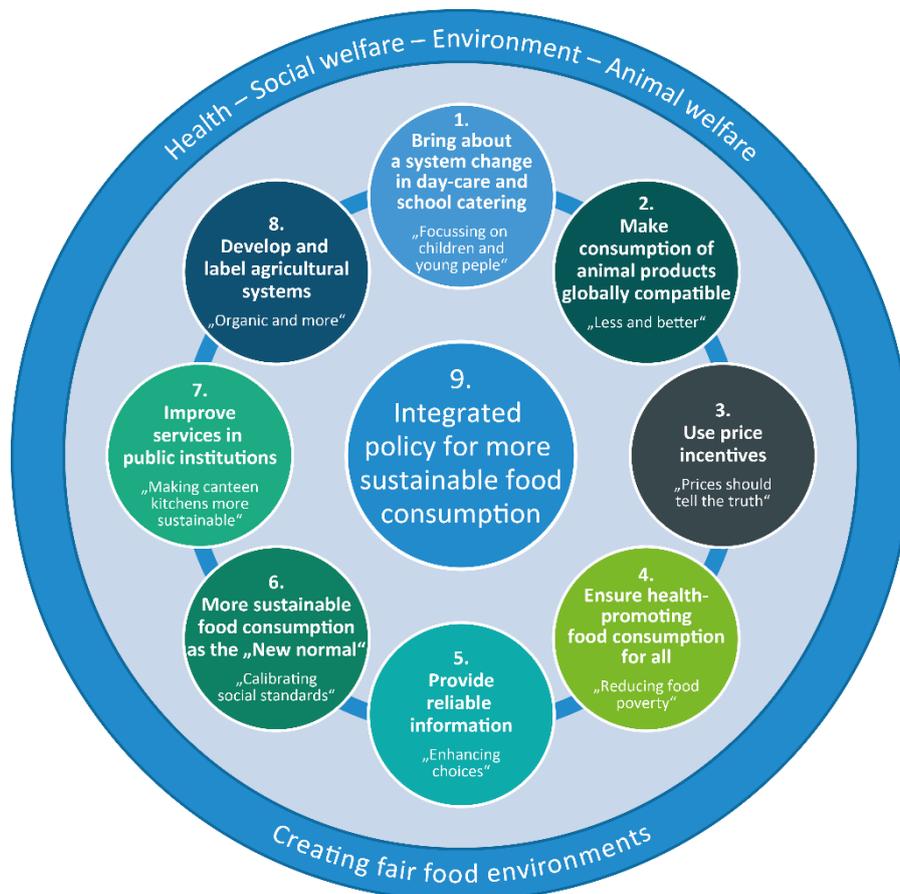
Scientific Advisory Board  
on Agricultural Policy, Food and  
Consumer Health Protection  
at the Federal Ministry of Food and  
Agriculture

# Promoting sustainability in food consumption

## Developing an integrated food policy and creating fair food environments

Expertise

June 2020<sup>1</sup>



<sup>1</sup> English translation of the expertise “Politik für eine nachhaltigere Ernährung: Eine integrierte Ernährungspolitik entwickeln und faire Ernährungsumgebungen gestalten” handed over to the German Federal Ministry of Food and Agriculture in June 2020.

## **Scientific Advisory Board on Agricultural Policy, Food and Consumer Health Protection (WBAE) at the BMEL**

**Prof. Dr. Harald Grethe (chair);** Humboldt University of Berlin, Albrecht Daniel Thaer Institute of Agricultural and Horticultural Sciences

**Dr. Hiltrud Nieberg (vice-chair);** Thünen Institute, Institute of Farm Economics

**Prof. Dr. Britta Renner (vice-chair);** University of Konstanz, Department of Psychology, Psychological Assessment and Health Psychology working group

**Prof. Ulrike Arens-Azevedo<sup>2</sup>;** Hamburg University of Applied Sciences, Department of Nutrition and Home Economics

**Prof. Dr. Alfons Balmann;** Leibniz Institute of Agricultural Development in Transition Economies (IAMO); Martin Luther University Halle-Wittenberg (MLU), Institute of Agricultural and Food Sciences

**Prof. Dr. Hans Konrad Biesalski<sup>2</sup>;** University of Hohenheim, Institute of Nutritional Sciences

**Prof. Dr. Regina Birner;** University of Hohenheim, Institute of Agricultural Economics and Social Sciences in the Tropics and Subtropics

**Prof. Dr. Wolfgang Bokelmann<sup>2</sup>;** Humboldt University of Berlin, Albrecht Daniel Thaer Institute of Agricultural and Horticultural Sciences

**Prof. Dr. Olaf Christen<sup>†</sup>;** Martin Luther University Halle-Wittenberg, Institute of Agricultural and Nutritional Science

**Prof. Dr. Dr. Matthias Gauly;** Free University of Bozen-Bolzano, Faculty of Science and Technology

**Prof. Dr. Uwe Latacz-Lohmann;** University of Kiel (CAU), Institute of Agricultural Economics

**Prof. Dr. José Martínez;** University of Göttingen, Institute for Agricultural Law

**Prof. Dr. Monika Pischetsrieder;** University of Erlangen-Nürnberg, Henriette Schmidt-Burkhardt Chair of Food Chemistry

**Prof. Dr. Matin Qaim<sup>2</sup>;** University of Göttingen, Department of Agricultural Economics and Rural Development

**Prof. Dr. Achim Spiller;** University of Göttingen, Department of Agricultural Economics and Rural Development

**Prof. Dr. Friedhelm Taube;** University of Kiel (CAU), Institute of Crop Science and Plant Breeding

**Dr. Lieske Voget-Kleschin;** University of Kiel (CAU), Philosophy course

**Prof. Dr. Peter Weingarten;** Thünen Institute, Institute of Rural Studies

## **Research for the expertise**

**Dr. Julia C. Schmid;** Humboldt University of Berlin, Albrecht Daniel Thaer Institute of Agricultural and Horticultural Sciences

## **Acknowledgement**

The WBAE would like to thank the many external experts from science, politics and society who provided valuable support in the drafting of this expertise. The Scientific Advisory Board would like to thank Prof. Dr. Robert Arlinghaus (Humboldt University of Berlin), Dr. Alexander Brinker (Fishery Research Centre in Langenargen) and Dr. Christopher Zimmermann (Thünen Institute for Baltic Sea Fisheries) for the particularly extensive and valuable suggestions and feedback on “Sustainable fisheries”. The Scientific Advisory Board cordially thanks Susanne Brakebusch, Heidrun Fornahl, Justina Prank, Andrea Spiller, Anne Gillner (Thünen Institute of Farm Economics), Petra Geile (University of Göttingen) and Bettina Ott (University of Konstanz) for the technical and editorial support.

## **WBAE administrative office**

BMEL, Division 721, WBAE@bmel.bund.de

## **This document is available online at**

<https://www.bmel.de/EN/ministry/organisation/advisory-boards/AgriculturalPolicyPublications.html>

## **The expertise in German is available online at**

[https://www.bmel.de/DE/Ministerium/Organisation/Beiraete/\\_Texte/AgrVeroeffentlichungen.html](https://www.bmel.de/DE/Ministerium/Organisation/Beiraete/_Texte/AgrVeroeffentlichungen.html)

Editorial deadline: 16 March 2020

---

<sup>2</sup> End of the term of appointment in 2019. Subsequently formally involved in the expertise as external expert.

The WBAE dedicates this expertise to Prof. Dr. Olaf Christen<sup>†</sup>, who was a highly esteemed WBAE Member between 2006 and 2020 and who passed away a few weeks before the expertise was concluded after a long and serious illness.



# Promoting sustainability in food consumption

Developing an integrated food policy and creating fair food environments

**Expertise by the Scientific Advisory Board on Agricultural Policy, Food and Consumer Health Protection (WBAE) at the Federal Ministry of Food and Agriculture (BMEL)**

June 2020

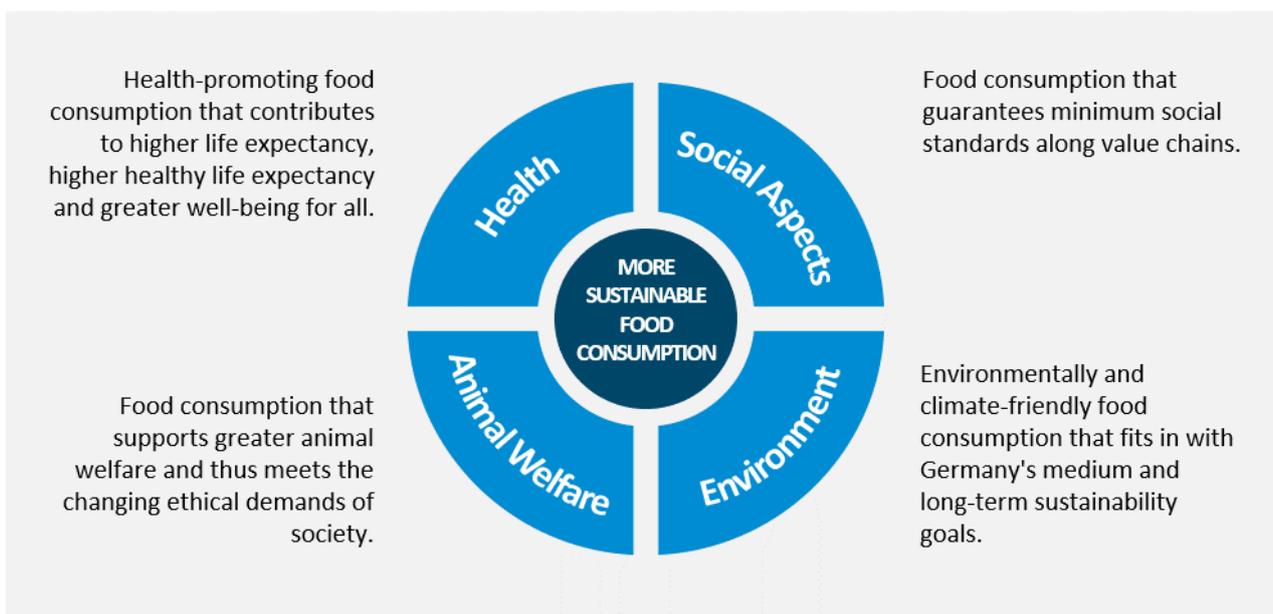
Cite as: WBAE - Scientific Advisory Board on Agricultural Policy, Food and Consumer Health Protection of the BMEL (2020). Promoting sustainability in food consumption – Developing an integrated food policy and creating fair food environments. Expertise, Berlin



## Executive Summary

How we eat has a major impact on our individual health status, our quality of life and our well-being. Many of the foods we eat have a major social, environmental, climate and animal welfare footprint. This expertise defines policies to promote sustainability in food consumption as policies that integrate all four target dimensions: human health, social aspects, the natural environment (including climate) and animal welfare (Fig. ES-1). Achieving greater sustainability in food consumption poses great challenges. The necessary progress can only be achieved with a comprehensive transformation of today's food system.

**Figure ES-1:** The four key goals of more sustainability in food consumption ("Big Four")



Source: WBAE illustration.

The question of what constitutes greater sustainability in food consumption is more difficult to answer than often assumed by the public. As consumers, we are at the same time confronted with food environments that run counter to more sustainable shopping and eating habits. In view of this, the WBAE recommends that consumers should be given much more support in achieving greater sustainability in food consumption through the design of appropriate food environments. To this end, it is first of all necessary to reduce factors in today's prevailing food environments that hamper sustainability in food consumption (e.g. large portion sizes and high advertising expenditure on unhealthy foods). Secondly, it is important to offer food choices that are more health-promoting and have greater social, environmental and animal-welfare compatibility to make it easier to identify more sustainable options, to facilitate access to information and to set price incentives that entice consumers to opt for the more sustainable choice.

The WBAE describes such food and eating environments as fair, because and insofar as they are (1) attuned to our human perception, decision-making possibilities and behaviour; and (2) are more health-promoting and have greater social, ecological and animal-welfare compatibility and thus contribute to sustaining the livelihoods of the world's current and future generations.

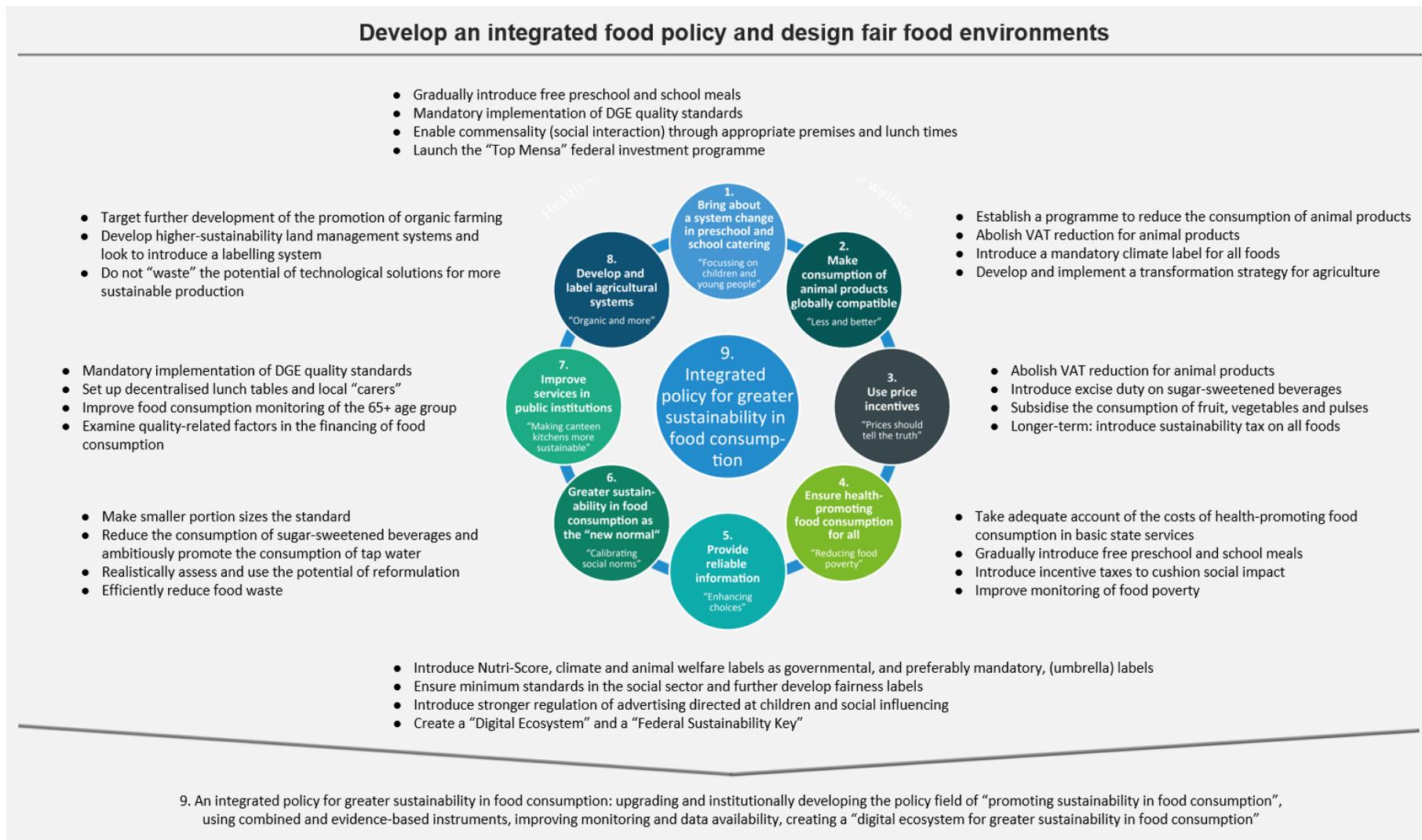
Existing conditions and environments in Germany are not very conducive to sustainability, too much responsibility is shifted to the individual and many available support instruments are not used. This expertise shows that Germany is lagging behind other European countries in this area. Emphasising the importance of appropriate food environments thus implies that a national policy for promoting sustainability in food consumption should use significantly more and deeper interventions, such as incentive taxes. In this expert opinion, the WBAE provides recommendations for a number of significant steps towards fair food environments. One main approach is to provide high-quality and free school and preschool meals.

The WBAE recommends a comprehensive reorientation and strengthening of the food policies, integrating the following four dimensions of sustainability: health, social aspects, environment and animal welfare. This requires policy to adopt a learning approach based on long-term, verifiable objectives. The necessary mix of instruments should be systematically tested, evaluated and adapted based on evidence. This necessitates stronger networking between the ministries (especially between the Ministry of Food and Agriculture, the Ministry of Health and the Ministry for the Environment) and between the various levels of government (ranging from the municipal level to EU level), as well as the scaling-up of personnel capacities with considerable budgetary increases for food and nutrition policy.

The proposed integrated food policy, with its coordinated mix of policy instruments and greater intervention intensity than hitherto (Figure ES-2: Key policy recommendations of the expertise) constitutes an important and necessary step to protect our health and environment, enhance climate stewardship, mitigate food poverty, ensure compliance with minimum social standards and enhance animal welfare. Fair food environments protect and benefit all of us. Implementation of the recommended measures requires considerable additional governmental expenditure. However, in relation to the current high costs of our present food consumption for society and individuals, and the expected high (follow-up) costs in the future, this additional expenditure represents a worthwhile investment in our society as a whole. Postponing the necessary reorientation would exacerbate both the problems to be addressed and the need for adjustment. The analysis presented in this expertise shows:

**A comprehensive transformation of the food system is meaningful, feasible and should begin without delay.**

Figure ES-2: Key policy recommendations



Source: WBAE illustration.



## Content overview

<b>EXECUTIVE SUMMARY</b>	<b>I</b>
--------------------------	----------

<b>ABSTRACT</b>	<b>i</b>
-----------------	----------

<b>I An integrated food policy is essential</b>	<b>i</b>
---	----------

<b>II The food environment as a crucial but underestimated key driver</b>	<b>v</b>
---	----------

<b>III A policy targeting consumption is legitimate and necessary</b>	<b>vii</b>
---	------------

<b>IV Towards greater sustainability in food consumption: Recommendations</b>	<b>ix</b>
---	-----------

<b>V Financing a policy for a more sustainable nutrition</b>	<b>xxii</b>
--	-------------

<b>VI Conclusion</b>	<b>xxiii</b>
----------------------	--------------

## LONG VERSION

<b>Table of contents</b>	<b>xxv</b>
--------------------------	------------

<b>1 Introduction</b>	<b>1</b>
-----------------------	----------

<b>2 Our own understanding of sustainability</b>	<b>13</b>
--	-----------

<b>3 Why we eat what we eat – Consumer behaviour regarding food consumption</b>	<b>35</b>
---	-----------

<b>4 Problem analysis</b>	<b>61</b>
---------------------------	-----------

<b>5 Identification and measurement of sustainable food consumption</b>	<b>207</b>
---	------------

<b>6 Legitimation of a food and nutrition policy?</b>	<b>339</b>
---	------------

<b>7 Governance of the food system</b>	<b>373</b>
--	------------

<b>8 Instruments of a policy for greater sustainability in food consumption</b>	<b>475</b>
---	------------

<b>9 On course for greater sustainability in food consumption: recommendations</b>	<b>623</b>
--	------------

<b>Literature</b>	<b>673</b>
-------------------	------------

<b>Lists of figures, tables, text boxes, and abbreviations</b>	<b>785</b>
--	------------



## ABSTRACT

### I An integrated food policy is essential

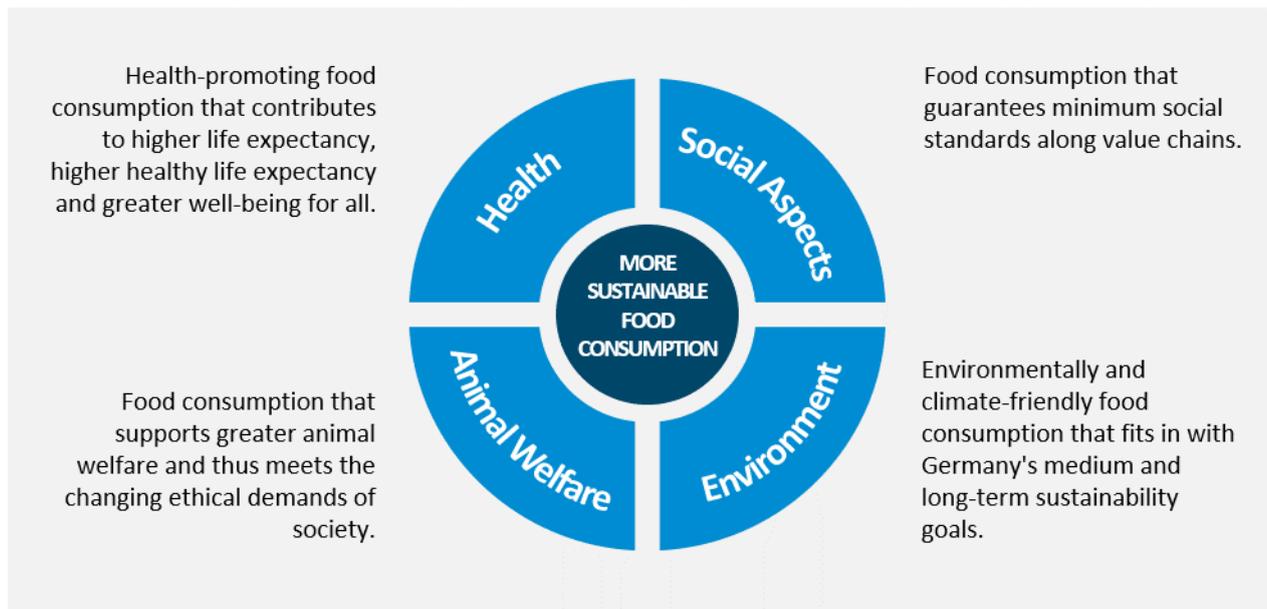
If sustainability goals at national, European and global levels (e.g. Sustainable Development Goals/SDGs and climate action goals) are to be achieved, all sectors must make far-reaching contributions – including the agricultural and food sector. Besides adjustments to agricultural production, this also requires changes to consumer habits. Our food consumption plays an important role in this regard: how we eat has a major impact on our individual health status, our well-being and our quality of life. Many of the foods we eat have a significant social, environmental, climate and animal-welfare footprint. At the same time, food consumption is the subject of intense social debate. Many consumers want to eat healthier and more environmentally-friendly food. They want to know under what social conditions the food is produced and how the animals are kept. They are motivated to make a contribution to both their own health and to social goals. They are, however, often overwhelmed due to insufficient and in some cases contradictory information, limited choices and an unsupportive food and eating environment.

It is therefore necessary to establish an independent policy area: an integrated policy for promoting sustainability in food consumption that significantly improves the food environment. Compared with other European countries and beyond, Germany is lagging behind in this area. Existing **conditions and environments in Germany are not very conducive to sustainability, too much responsibility is shifted to the individual** and insufficient use is made of many available support instruments (cf. Sections 6 - 8 in the original report).

In this expertise on promoting sustainability in food consumption, the German Scientific Advisory Board on Agricultural Policy, Food and Consumer Health Protection (WBAE) takes an in-depth look at food policy for the first time since the WBAE was formed from the former Scientific Advisory Board on Agricultural Policy (WBA, existed until 2015) and given an expanded remit. This expertise does not claim to comprehensively define sustainable food consumption, but instead aims, for a wealthy country such as Germany, to differentiate between **less sustainable and more sustainable food consumption patterns and to show how policies can support people in eating more sustainably** (Section 2 in the original report “Our own understanding of sustainability”). The issue of what is regarded as more or less sustainable is inevitably also based on value judgements. This expertise has set itself the goal of identifying the corresponding value decisions and thus enabling a discussion about them to take place.

With the focus on promoting sustainability in food consumption, the expertise focuses on the **four most important goals** in this regard: **human health – social aspects – the natural environment – and animal welfare** – i.e. the “**Big Four**” (Fig. 1, cf. Section 1 and 4 in the original report). Besides many synergies, there are also relevant trade-offs between these goals. An integrated food policy is ambitious and requires the policy area to be developed conceptually and better funded.

**Figure 1:** The four key goals of promoting sustainability in food consumption (“Big Four”)



Source: WBAE illustration.

With reference to the four key goals of a policy for promoting sustainability in food consumption, the expertise describes the following **main problems** (cf. Section 4 in the original report):

- (1) **Health** (Section 4.2): Measured against its wealth, Germany is only mediocre in terms of its food-related health indicators (e.g. high prevalence of overweight or obesity). Poverty clearly correlates with health impairments caused or contributed to by food.
- (2) **Social aspects** (Section 4.3): Germany has enacted extensive labour and social legislation. At the same time, there appear to be deficits in implementation, especially regarding seasonal workers, agency workers, the slaughtering industry and the restaurant and catering sector. Forced labour, serious forms of child labour and other violations of the International Labour Organisation's (ILO) core labour standards are common in the global agricultural sector.
- (3) **Environment** (Section 4.4): Avoidable negative ecological effects occur in the food value chain (from manufacturing the means of production and agricultural production to processing, trade and consumption), particularly regarding biodiversity, nitrogen emissions and greenhouse gas emissions. One of the main focuses of food-related environmental protection and climate action is on shifting consumption to more environmentally and climate-friendly foods, in particular, in the cases of Germany and other industrialised countries, by reducing food waste and the consumption of animal products.
- (4) **Animal welfare** (Section 4.5): In recent years, some individual steps have been taken towards modifying livestock husbandry with a view to improving animal welfare. However, no politically legitimised decision-makers have, as yet, adopted any comprehensive strategy that also

includes the funding of the necessary restructuring of livestock husbandry and that would consequently enable greater progress to be made.

Politicians, consumers and industry are confronted with many – often inconsistent – recommendations on sustainability in food consumption. In order to be able to systematically pursue the goal of greater sustainability in food consumption, they need some kind of “compass” which both provides guidance and also permits systematic monitoring.

The WBAE has evaluated **popular food consumption recommendations** with regard to the four key goals of promoting sustainability in food consumption (cf. Section 5 in the original report “Identification and measurement of sustainable food consumption”). An evaluation such as this is necessarily a simplification and is subject to methodological limitations. The expertise identifies in particular one **problem regarding evaluation**, namely that of the (different) reference systems under consideration: many recommendations on what makes food consumption more sustainable refer to agricultural production systems (e.g. organic farming versus conventional farming, Section 5.2). Other recommendations focus on individual foods and their impact during their life cycle, while others consider specific food groups or food consumption patterns (Section 5.3). In addition to these different viewpoints, there is, finally, also the spatial dimension of food systems (global, national, regional) (Section 5.4).

It is **not easy to integrate these different dimensions when evaluating sustainable food consumption**, which is a key reason for the inconsistency of many sustainability recommendations. This problem is exacerbated by the fact that these assessment systems are at different stages of development in respect of the various different aspects of sustainability.

Despite all the limitations, it is possible to draw a number of reasonably sound conclusions for consumers (cf. Section 5.5 and Tables 5-13 to 5-15 in the original report):

- (1) The various recommendations on the consumption of **health-promoting** products make only limited contributions – there is no “superfood”. A key recommendation is instead to adopt a health-promoting dietary pattern i.e. a balanced combination of foods with predominantly favourable nutrient profiles. There are a number of different recommended dietary patterns (recommendations by the German Nutrition Society (Deutsche Gesellschaft für Ernährung, DGE), the Healthy Eating Index, the DASH diet, the Mediterranean diet), which consumers can use as guidance. Which of these dietary patterns the consumers then decide to follow is a matter of personal preference.
- (2) The recording and evaluation of the **social dimension** of food consumption has not been sufficiently conceptualised. The social footprint generated by a food along the value chain is at present insufficiently recorded and not apparent to consumers. At global level – and quite often also in the EU and sometimes in Germany – it is unclear whether foods are produced in compliance with minimum social standards. Of all the labels considered, the only ones that can be positively recommended overall in respect of their social effects are the organic label

and the fair trade label. The Advisory Board believes that the greatest medium-term to long-term potential for positive social effects relating to greater sustainability in food consumption, social participation and “social cohesion” here in Germany lies in cooking in or for a group of people and in eating as a group (e.g. in preschools and schools). This has a positive impact on psychological well-being, social ties and physical and mental performance, and can create important social learning spaces.

- (3) There are many different approaches to **promoting environmental compatibility** in food consumption. One important approach is to reduce the consumption of meat and other animal products, while another is to avoid food losses. The consumption of organic produce can also contribute to some extent to promoting environmental compatibility in food consumption (e.g. positive biodiversity effects). Another meaningful measure is to avoid air-freight goods and products from greenhouses heated using fossil fuels. By contrast, regional production is not always the best choice from the standpoint of sustainability, and re-usable packaging is not always more environmentally-compatible than single-use packaging.
- (4) **Animal-welfare orientated** food consumption stands and falls with choosing products with higher animal-welfare standards. Consuming fewer animal products can contribute to higher levels of animal welfare if consumers adopt the policy of “less and better”. If animal products are primarily replaced with more vegetables and legumes, this will result in significant synergies with health and environmental goals. However, the transformation to “less and better” poses a considerable social and economic challenge to the agricultural sector.

There are many possible **synergies** between the four objectives of health, social aspects, the environment and animal welfare; however, there are also **trade-offs**. An important example illustrates this: the productivity of pig and poultry farming is of top priority in terms of climate change mitigation. However, very rapid growth and very high performance often go hand in hand with animal-welfare problems. To a certain extent, improved husbandry conditions and targeted breeding for animal welfare-related functional traits can mitigate the trade-offs, but the WBA (2015) has also highlighted the limitations of this approach. From an animal welfare perspective, it would be necessary to “de-intensify” the current intensive husbandry systems for most farm animals. This trade-off with the goal of climate change mitigation can be mitigated by reducing the consumption of animal products.

The WBAE believes it is imperative to have an integrated approach, given the multi-dimensionality of the goals, the existence of synergies, and also the trade-offs between goals that exist in some cases. In political practice, however, the responsibilities for health-promoting food consumption, minimum social standards of decent work, environmental protection and animal welfare lie with different ministries and departments and are therefore mostly viewed separately.

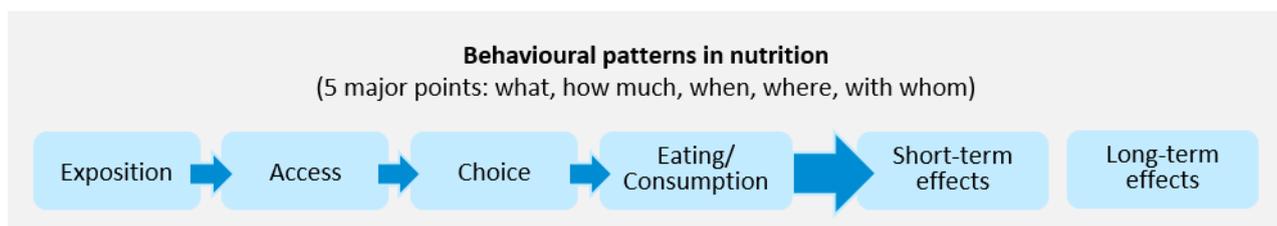
A policy to promote sustainability in food consumption therefore necessitates significantly greater networking between the different policy areas (health, social, environmental, animal welfare, and also agricultural policy). There is still a lot of work to be done to develop the conceptual framework

for such an **integrated food policy**. This expertise therefore recommends that the Federal Government should institutionalise the policy area of “promoting sustainability in food consumption” to a greater degree, engage in capacity-building, expand monitoring and pursue a science-based “learning by doing” approach (cf. Sections 8 and 9 in the original report).

## II The food environment as a crucial but underestimated key driver

One of the main focuses of this expertise is on the **food environment**, which exerts a major influence on food consumption and eating behaviour (cf. Section 3 in the original report). The influence of the food environment on eating behaviour is very far-reaching and must be understood in far greater depth than is currently the case in food policy. The **food environment** encompasses the entire **behavioural process**. The latter can be divided into four phases: **exposure – access – choice – consumption** (Fig. 2).

**Figure 2:** Phases of the behavioural process



Source: Renner (2019, 2015).

The food environment begins with the **exposure** to food and food stimuli (e.g. in advertisements and on social media). This determines how aware we are of food in our everyday lives and what we consider normal. Exposure calibrates our perceptual field; currently, this field is often calibrated towards products with an unfavourable nutrient profile (e.g. fast food, soft drinks) and a poor climate footprint.

**Access** to food depends on various factors, including price, availability of information, and social eating and behavioural norms. The latter determine what food it is acceptable and appropriate to offer in the first place. The social structure (e.g. meal times) and the variety of foods on offer (e.g. convenience aspects, portion sizes) exert a particularly strong influence on how much food consumers want to consume, what food they wish to consume, and when, where and with whom they can (and want to) consume it. Recently, so-called “digital ecosystems” (cf. Section 8.10.3 in the original report) in and around private households and in the away-from-home sector have increasingly been developed by networking digital technologies, mobile sensors and apps. These are designed to increase availability and convenience and thus, ultimately, consumption. The development of such smart “digital ecosystems” means that food is now on offer 24/7 practically everywhere and the demands on individuals to self-regulate their behaviour (“to control oneself in view

of the omnipresent food supply”) continue to increase. At the same time, however, “digital ecosystems” can also allow simple, networked access to reliable information on making food consumption more sustainable.

Actual food **choices** are shaped by socio-economic aspects, preferences, attitudes, knowledge, social norms and habits. Marketing and – to an increasing extent – social media are influential environmental factors that associate food with certain values and characteristics, which then influence consumer preferences. Products are often associated with emotions and social aspects (e.g. status, popularity, affiliation) that are independent of the actual nutritional value or taste of the products (cf. Sections 6.4 and 8.5 in the original report). In the food sector, foods with unfavourable nutrient profiles often yield the highest returns and are therefore the focus of marketing activities.

The above-mentioned environmental factors play a role in determining **consumption**, i.e. what food is eaten, and how much and how quickly it is eaten. In addition to this, there are a number of other crucial aspects relating to the actual food environment, such as the range of foods and dishes on offer (quality, quantity, choice), the properties of the foods and dishes (e.g. portion size), the environment (e.g. noise, time pressure, stress), the ambience (space, light, temperature, smell, music) and the social environment (community, type of social event). The eating environment, notably the ambience and whether people eat and drink together, performs key emotional and social functions. Empirical findings provide impressive evidence that eating together significantly enhances our psychological well-being, social ties, cohesion and our physical and mental performance (cf. Section 3.1 in the original report). The atmosphere in which food is eaten conveys social norms and appreciation of food implicitly and with long-term effects.

A key finding of the expertise is that **the influence of food environments is underestimated** in the public and political debate, whereas **individuals’ control over their actions is significantly overestimated**. Consumers and political decision-makers are frequently unaware of the influences of the food environment, as the focus is usually only on the consumption phase and on individual food decisions. It is therefore assumed that eating more sustainably and healthily is a “simple” individual decision and thus primarily a question of motivation and self-regulation. However, consumers actually have to make a lot of food decisions every day, namely in deciding what they eat, how much they eat, and when, where and with whom they eat, and in explicitly saying “no” and suppressing the corresponding behavioural impulses in an environment that draws attention to food and eating almost constantly.

In everyday life, which makes so many demands of consumers, food consumption behaviour is not just the result of conscious and reflective decisions; it is often also the result of the available options for action and of habitual influences that consumers are not aware of at the time. Food environments have an impact before the consumption phase as well as during it. How and where food is placed and advertised, how attractive the packaging is and how large the portions are all have an influence on consumers’ perception and learning processes. The food environment also defines the framework for consumer choices and thus the standards for consumer behaviour.

The design of the food environment may focus – as is currently usually the case – on individual economic goals or – as is proposed in this expertise – more strongly on health, social objectives, the environment and animal welfare. In this expertise, the WBAE recommends that consumers should be given much more support than hitherto in making their food consumption more sustainable through the design of appropriate food environments. To this end, it is first of all necessary to reduce the factors in today's prevailing food environments that make food consumption less sustainable (e.g. large portion sizes, high advertising expenditure on unhealthy foods). Secondly, it is important to offer food choices that are more health-promoting and have greater social, environmental and animal-welfare compatibility, to make it easier to identify more sustainable options, to facilitate easier access to information and to set price incentives that entice consumers to opt for food that is healthier and has greater social, environmental and animal-welfare compatibility.

The WBAE describes such food environments as **fair** because and insofar as they are (1) attuned to our human perception, decision-making possibilities and behaviour; and (2) are more health-promoting and have greater social, ecological and animal-welfare compatibility and thus contribute to sustaining the livelihoods of the world's current and future generations.

Conversely, this is also a criticism of making food consumption too dependent on individual responsibility. The WBAE believes that food policy in Germany has hitherto made the promotion of sustainability in food consumption too dependent on individual responsibility. Emphasising the importance of appropriate food environments thus implies that a national policy for promoting sustainability in food consumption requires significantly more and deeper interventions.

Key measures to improve food environments include, for example, high-quality communal catering, especially having more sustainable catering in preschools and schools that is accessible to all children, advertising-free spaces, drinking-water dispensers in public buildings, suitable price incentives and the provision of behaviour-orientated and action-orientated information, more transparency about and restrictions on advertising in social media (social influencing), appropriate portion sizes and the creation of pleasant eating environments in preschools, schools, nursing homes and hospitals.

### III A policy targeting consumption is legitimate and necessary

There is growing empirical evidence of a partial market failure in the food industry which leads to considerable sustainability deficits and high economic costs due to an increasing number of diseases caused or contributed to by diet (cf. Section 6 in the original report “Is governmental food control legitimate?” and Section 7 “Governance of the food system”). This makes it **necessary to focus interventions more strongly on the consumption side**. Measures focusing on the consumption side complement the classic regulatory and economic instruments that target the supply side; the latter reach their limits in open economies and due to varying levels of international regulation.

By international standards, Germany is a country with a **relatively lax regulatory framework** in the area of food consumption. Germany relies particularly heavily on the individual and on the family and, in the WBAE's opinion, overburdens them. Analysis of the political and administrative system shows that an active governmental food policy tends to be regarded sceptically in political circles. The political parties that call for the government to play a more active role concentrate their proposals on aspects of preschool and school catering. With regard to the environmental dimension of sustainable food consumption, the proposals mainly concern the use of organic food in school and preschool catering and in general, the promotion of organic farming; this is, however, not sufficient. Food poverty and poor working conditions in various sectors of the food chain generally receive little attention from any political parties. The election manifestos of all parties are also restrained in respect of measures that aim to influence the food consumption habits of adults. This is presumably due to the fear of a lack of acceptance, exacerbated by the great media impact that food-related topics generally have. This fear was not unfounded in the past, but the acceptance of more interventionist measures, which are increasingly being used globally, is also rising in Germany.

There is no ideal, intervention-free situation which could be used as a **benchmark** to measure the **legitimacy** of governmental intervention focusing on the consumption side. Contemporary food environments are characterised by a large number of interventions. In this sense, "free" nutritional decisions are an illusion: what we consume and how we eat is always heavily influenced by the food environment. Some aspects of the food environment are prescribed or at least influenced by governmental action, in particular through information and labelling policies, but also through differential taxation of food products and the resultant effect on food-price ratios. Other aspects (e.g. advertising, product placement, the location of retail outlets, pricing policies) are mainly influenced by the companies along the food chain. These aspects are in turn more or less strictly regulated by the state. In view of this, the question is not so much whether it is permissible for the state to actively influence food environments, but rather what kind of influence citizens find socially desirable and what helps them to eat more sustainably in their busy day-to-day lives. The core issue is to strike the right balance between the legally guaranteed freedom of the individual and considerations of the common good. In particular, decisions must be made regarding the extent of food-policy interventions in consumer behaviour and the choice of instruments. This concerns the effectiveness and efficiency of instruments and their potential unintended side-effects. This expertise shows that there are good reasons for a comprehensive policy to promote sustainability in food consumption and that instruments targeting consumers and the food environment should be an integral part of the instrument mix.

One central control problem is that the responsibility for food consumption in Germany's federal system is distributed across different levels of government, and different ministries deal with different aspects of food consumption. This currently leads to a **diffusion of responsibility**. This is particularly evident in the field of school and preschool catering policies. A first few coordinating institutions have been established to improve coordination and networking between the many stakeholders in the field of school and preschool catering policies. However, their organisational

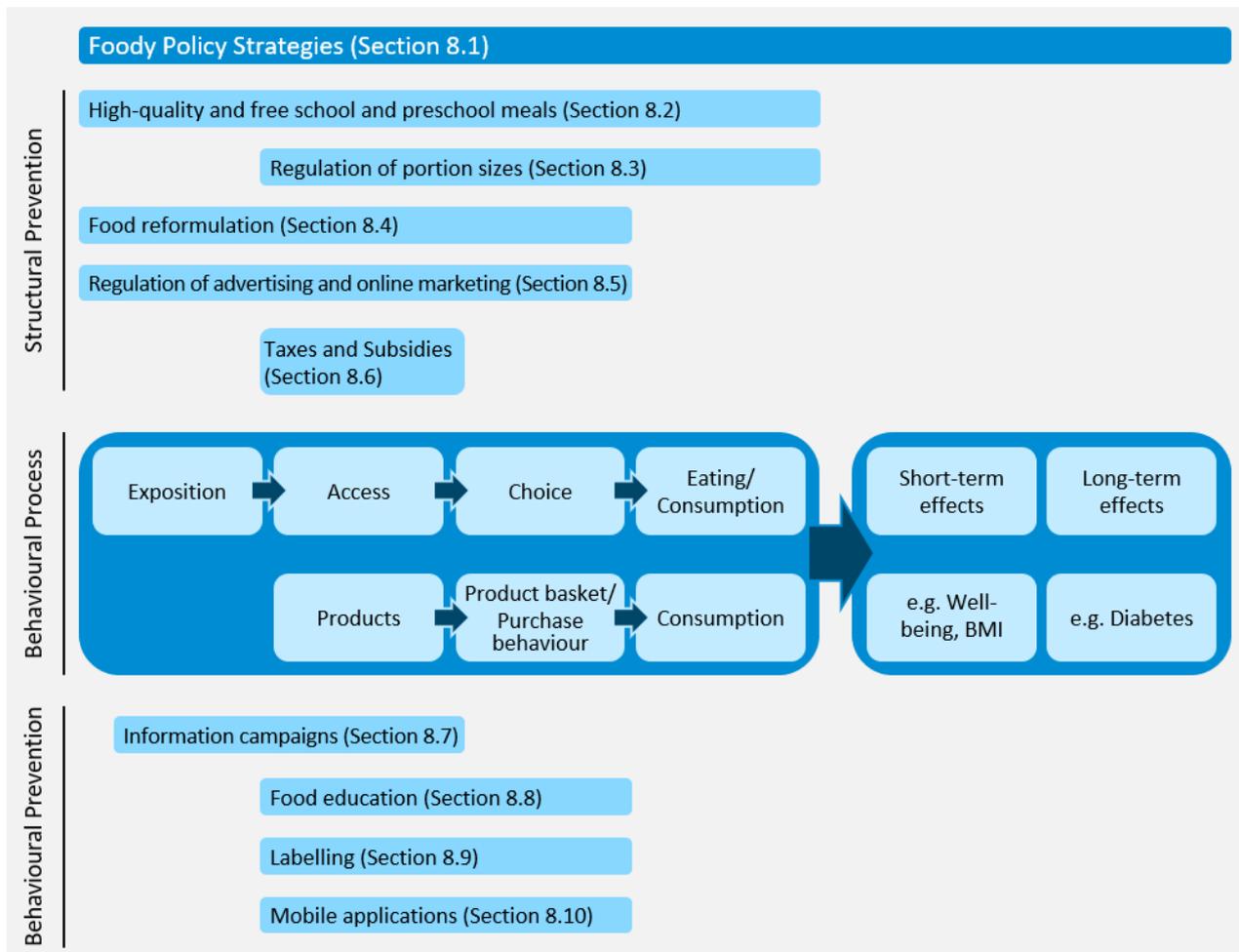
structures and financial resources are not currently up to the task. Organisational and funding deficits are particularly problematic because the market in the communal catering sector does not function well enough. Enhanced public governance and support are therefore needed. The responsible municipalities are, however, reaching their limits – both regarding their management capacities and in relation to their sources of financing. Further governance problems exist in the area of the internalisation of external costs and of labelling (cf. Section 7.5 in the original report).

#### **IV Towards greater sustainability in food consumption: Recommendations**

Food-policy instruments can be applied to the different **phases of the behavioural process** (Fig. 2). Some instruments, such as free, high-quality school and preschool catering, address all phases of the behavioural process: this increases the exposure to health-promoting foods and meals, but also changes the general access to the respective offers and the range of options available. The design of the food on offer (e.g. quality, portion size) and of the food environment (e.g. equipment in the dining room) also directly influences eating behaviour. Free, high-quality school and preschool catering therefore has a broad effect on behaviour.

Other instruments, by contrast, mainly address only one phase of the behavioural process, but then usually also have knock-on effects on the other phases of the behavioural process (Fig. 3). Taxes, for example, primarily influence access to food by making the respective food more expensive and thus less accessible and less attractive. This change then has secondary effects, for example on choice and consumption and, potentially, also on exposure, if products are no longer offered due to falling demand. Generally, it appears plausible to assume that an instrument is more effective (in terms of promoting sustainability in food consumption) the more phases this instrument directly addresses.

**Figure 3:** Systematic representation of policy instruments according to which phase of the behavioural process they primarily address



Source: WBAE illustration; cf. also Section 8.1 and Section 3.3 in the original report.

In general, a single instrument is significantly less effective than a well-coordinated **instrument mix** (cf. Section 8 in the original report). The fact that food consumption is so heavily dependent on habit means that what is needed is a coherent and consistent policy mix and a conceptual and budgetary expansion of the policy field. The necessary instrument mix should, as part of a comprehensive strategy with long-term, verifiable targets, be tested in a targeted and committed manner in the sense of a reflexive policy, consistently evaluated and then adapted based on evidence and lessons learned. This presupposes a transparent monitoring system. Institutional development and strengthening of the policy field also requires stronger networking between the relevant ministries (in particular food and agriculture, health and environment) and between the various levels of government (from municipalities to the EU). On the basis of this analysis, the WBAE makes **nine key recommendations for an integrated policy to promote sustainability in food consumption** in Germany, as shown in Figure 4 (cf. Section 9 in the original report).

**Figure 4:** Nine key recommendations for an integrated policy to promote sustainability in food consumption



Source: WBAE illustration; cf. section 9.1 in the original report.

These main, and in some cases overlapping, recommendations for a policy to promote sustainability in food consumption are presented below.

**Recommendation: Bring about a system change in preschool and school catering – “Focusing on children and young people”**



The current catering situation in schools and preschools is characterised predominantly by the food on offer being of poor quality and the food environment being largely unattractive. This leads to low participation and consequently high costs per meal. Preschools and schools are important places of learning and social integration for children and young people. Clear governmental steering impulses are needed in order to utilise this potential for greater sustainability in food consumption.

The WBAE recommends bringing about the necessary system change in school and preschool catering by means of the following elements (cf. Section 9.2 in the original report):

- **Gradual, evidence-based introduction of free meals in preschools and schools** (target group: municipalities, federal states, Federal Government).
- **The creation of fair food environments** through: (1) the mandatory adoption of the DGE quality standards (Federal Government, federal states, municipalities, and school and preschool management); (2) the provision of appropriate premises, facilities and meal times that promote commensality (social interaction) (Federal Government, federal states, municipalities, and school and preschool management); (3) the regulation of competing catering services (private cafeterias, kiosks and vending machines) (federal states, municipalities, school authorities); and (4) the qualitative strengthening of action-orientated food consumption education (federal states, school authorities).
- Launch of **“Best canteen”, a federal investment** programme for a qualitative and quantitative expansion of preschool and school catering (Federal Government, federal states, municipalities).

**Recommendation: Make the consumption of animal products globally compatible – “Less and better”**

---



Globally compatible food consumption urgently requires a reduction in the high consumption of animal products in wealthy countries. Reducing the consumption of these products could result in beneficial health effects in Germany. On the production side, a transformation of livestock husbandry would open up opportunities for greater animal welfare and contribute towards climate change mitigation and the protection of biodiversity. This transformation should be embedded in a comprehensive livestock and food consumption strategy.

---

The WBAE recommends in particular (cf. Section 9.3 in the original report):

- **Promote the reduction of the consumption of animal products by designing appropriate food environments as part of a comprehensive programme** by: (1) abolishing the reduced VAT rate for animal products and, in the long term, introducing a specific sustainability tax (Federal Government); (2) developing and introducing a mandatory climate label for all foods (Federal Government); (3) conducting an information campaign to raise consumer awareness of the climate relevance of animal products and to motivate consumers to change their behaviour (Federal Government); and (4) implementing the DGE quality standards on a mandatory basis for communal catering (Federal Government, federal states and municipalities).
- **Counteracting undesired side-effects** by: (1) socially cushioning the increased tax burden (value-added tax, in the longer term sustainability tax) (Federal Government); (2) monitoring whether a reduction in the consumption of animal products leads to problematic substitution effects and, if necessary, counteracting these effects (Federal Government); (3) paying due regard to undesired side-effects of climate-action efforts in livestock production in relation to animal welfare; and (4) drafting and implementing a transformation strategy to improve added value in the food and agricultural sector (Federal Government, federal states).

---

**Recommendation: Use price incentives – “Prices should tell the truth”**


---



The necessary transition towards more sustainable consumption patterns will not be able to be built on intrinsic motivation and conscious decisions alone. The WBAE recommends significantly strengthening the price incentives for greater sustainability in food consumption in key areas of action. This should be made socially compatible by reducing the burden on lower-income households.

---

The WBAE recommends (cf. Section 9.4 in the original report):

- **Setting price incentives for reducing consumption of less sustainable products** by: (1) abolishing the reduced VAT rate for animal products (Federal Government); (2) introducing a new excise tax on all sugary beverages proportional to the free-sugar content which is then gradually increased over time (Federal Government); and (3) in the longer term introducing a specific sustainability tax on all foods (Federal Government).
- **Using the financial leeway this provides at federal and state level to invest in promoting sustainability in food consumption**, in particular through: (1) a tax rebate in the sense of a sustainability bonus for lower-income households; (2) a reduction in VAT on fruit, vegetables and pulses; (3) a conversion to more animal-friendly livestock husbandry; and (4) high-quality, free school and preschool catering (Federal Government, federal states, municipalities).

---

**Recommendation: Ensure health-promoting food consumption for all – “Reducing food poverty”**


---



Even in a relatively prosperous country such as Germany, there is poverty-related malnutrition and even hunger. A policy promoting sustainability in food consumption should take greater account of the living conditions of low-income population groups and further develop support services aimed at specific target groups.

---

The WBAE recommends (cf. Section 9.5 in the original report):

- **Ensuring access to health-promoting food consumption for all** through: (1) taking adequate account of the costs of health-promoting food consumption in the calculation of social security benefits by the state (Federal Government); and (2) gradually introducing high-quality, free school and preschool catering (Federal Government, federal states, municipalities).
- **Avoid adverse effects of a policy for promoting sustainability in food consumption on low-income sections of the population** through: (1) social cushioning of changes in the taxation of

food products (Federal Government); and (2) a fundamental review of the effects of the food-policy instrument mix on low-income households (Federal Government).

- **Improve monitoring of food poverty** (Federal Government, federal states).

---

**Recommendation: Provide reliable information – “Enhancing choices”**

---



The availability and the reliability of information on key sustainability characteristics are key for promoting sustainability in food consumption. Currently there is a great lack of reliable information on and about products. Advertising, modern information media and digital applications (e.g. Apps) are often fragmented, not very user-friendly and not targeted to more sustainable choices.

---

The WBAE recommends significantly expanding the information infrastructure by means of the following elements (cf. Section 9.6 in the original report):

- **Developing an effective labelling policy**, in particular by: (1) introducing compulsory government labels for the key sustainability dimensions (Federal Government); (2) promoting the development of EU-wide sustainability labels (Federal Government); (3) reducing the flood of labels by means of summary labels; (4) laying down a standard design for governmental food labels (“umbrella labels”) (Federal Government); (5) strengthening the development of methods and data collection for sustainability labels by commissioning a (governmental) agency (Federal Government, federal states); and (6) creating a valid, integrated, open-access database (“federal sustainability key”) (Federal Government).
  - **With regard to the health dimension**, the WBAE recommends: (1) continuing to promote the introduction of Nutri-Score in Germany (Federal Government, industry); (2) supporting the EU-wide mandatory introduction of Nutri-Score (Federal Government, EU); (3) continuing to improve the validity of Nutri-Score through research (Federal Government); (4) emphasising the value of many unprocessed raw products not included in Nutri-Score (Federal Government, industry); (5) restricting the use of health claims to products with a positive health rating (levels A and B of Nutri-Score) (Federal Government, EU); (6) making it mandatory for companies to display the Nutri-Score in food advertising (Federal Government); and (7) monitoring and, if necessary, prohibiting the use of so-called “feel-good labels” and “feel-good claims”, i.e. marketing terms and signs which refer indirectly to health and are not regulated by law (Federal Government, federal states).
  - **With regard to the social dimension**, the WBAE recommends ensuring minimum standards in the social field so that consumers can rely on the fact that these are actually complied with, in particular: (1) ensuring appropriate monitoring of compliance with the Minimum Wage Act along the value chain for food produced in Germany (Federal Government); (2) strengthening the commitment to securing EU-wide minimum social standards (Federal

Government, EU); (3) monitoring the food industry's voluntary commitment under the National Action Plan on Business and Human Rights and, if necessary, enacting appropriate legislation (Federal Government); and (4) further developing the WTO regulations on ethical matters (e.g. labelling obligations) (Federal Government, EU, WTO). The WBAE also recommends, in respect of fairness aspects that go beyond minimum standards: (5) promoting the advancement of international fairness labels for the protection of dependent employees (Federal Government, industry, NGOs); and (6) developing and reviewing a legal framework for the use of voluntary fairness labels in Germany (Federal Government).

- **With regard to the environmental dimension**, the WBAE particularly recommends: (1) introducing a climate label based on product-specific standard values and supplementary company-specific values (Federal Government, industry); (2) examining the introduction of a mandatory requirement to display the climate label in food advertising; and (3) take action at EU level to advocate the EU-wide mandatory introduction of a climate label (Federal Government). In addition to this, the WBAE recommends: (4) creating a database on average greenhouse gas emissions of various different foods and promoting methodological conventions (Federal Government); and (5) promoting methods for measuring greenhouse gas emissions in agriculture (Federal Government, industry).
- **With regard to the animal-welfare dimension**, the WBAE particularly recommends: (1) developing a multi-stage governmental animal welfare label with increasing requirements over time (Federal Government); (2) integrating the animal welfare label into a national livestock strategy (Federal Government, federal states); (3) working towards mandatory labelling at EU level (Federal Government, EU); and (4) regulating under law the use of animal-welfare terms (Federal Government).
- **Making the advertising environment more sustainable** by: (1) restricting adverts for foods with little or no health-promoting effects that are aimed at children (Federal Government); and (2) banning advertising for foods in schools and preschools (federal states, municipalities); (3) making the Nutri-Score mandatory in food advertising (Federal Government); and (4) making it mandatory for advertising measures in social media to always be identified as such (Federal Government).
- **Creating a “digital ecosystem for promoting sustainability in food consumption”** by: (1) developing and advancing apps and digital applications into a “digital ecosystem for promoting sustainability in food consumption”, which provides applications and data in the field of food consumption for the entire behavioural process and integrates them in a comprehensible manner (Federal Government); (2) creating a valid, integrated, open-access database (“Federal Sustainability Key”) (Federal Government); (3) providing greater legal protection regarding the availability of consumers’ personal data and enabling voluntary data donations to be made (Federal Government); and (4) subjecting private, smart “digital ecosystems” to quality control measures (Federal Government, federal states).

## Recommendation: Greater sustainability in food consumption as the “new normal” – “Calibrating social norms”



The foods on offer and the portion sizes “calibrate” what people perceive as “normal” and “appropriate” (social norm). Social norms have a decisive influence on consumer behaviour. It is therefore important that greater attention is paid to exposure and access as important elements of the food environment and that greater exposure and access to more sustainable products becomes the “new normal”.

The WBAE recommends (cf. Section 9.7 in the original report):

- **Making smaller portion sizes the standard** by: (1) making adoption of the DGE quality standards mandatory for public communal catering (Federal Government, federal states, municipalities); and (2) ensuring availability of smaller portion sizes in the away-from-home catering (Federal Government, federal states, municipalities, industry). In addition to this, the WBAE recommends: (3) increasing the population’s awareness of the effect of portion sizes and acceptance of measures to regulate and avoid the effect by integrating the issue of portion sizes more strongly into the BMEL’s “Too Good for the Bin” campaign (Federal Government); (4) testing innovative measures to reduce or avoid the portion-size effect (Federal Government, federal states); and (5) initiating voluntary measures by industry (Federal Government, industry).
- **Reducing consumption of sugar-sweetened drinks and ambitiously promoting consumption of tap water.** The WBAE recommends launching a national Action Programme on Reducing Sugar-Sweetened Drinks that combines the following measures: (1) the introduction of a tax on sugar-sweetened beverages according to their free-sugar content (Federal Government); (2) the free provision of tap water in public places (Federal Government, federal states, municipalities); (3) the mandatory labelling of beverages with the Nutri-Score (Federal Government); (4) ambitious promotion of tap water offers in the restaurant and catering sector and in retail (Federal Government, federal states); (5) the mandatory requirement to offer water or other non-caloric beverages as the standard option in children’s menus (Federal Government, federal states, municipalities); (6) a reduction in the supply of sugar-sweetened beverages in public institutions and an increase in the attractiveness of tap water consumption (federal states, municipalities, Federal Government); (7) a widespread information campaign on avoiding the “beverage trap”; (8) the promotion of small beverage sizes in the restaurant and catering sector and in the away-from-home market (Federal Government, federal states); (9) a ban on advertising for products with a high sugar content that is aimed at children (Federal Government); and (10) promotion of the consumption of light spritzers through reformulation (Federal Government).
- **Realistically assessing and exploiting the potential of reformulation** by continuing and advancing the BMEL’s national reduction and innovation strategy. The reformulation measures should in particular be: (1) prioritised and initially focused on sugar content and specific product

groups (Federal Government, industry); (2) systematically underpinned by scientific evidence (Federal Government); and (3) extended, based on this scientific evidence, to include other product groups and the away-from-home sector (Federal Government, industry). In addition to this: (4) food manufacturers should be provided with a science-based toolbox of reformulation options and strategies (Federal Government, industry); and (5) the achievement of reformulation goals should be monitored and food-law requirements tightened where necessary (Federal Government).

- **Efficiently reducing food waste** by: (1) establishing a system for monitoring food waste and making the data available for scientific analyses (Federal Government); (2) using the monitoring data to evaluate reduction measures more systematically (Federal Government) and expanding the BMEL's "Too Good for the Bin" campaign. In addition to this: (4) the reduction potential of smaller portion sizes should be researched (Federal Government), (5) food banks should be better supported through infrastructure funding (federal states, municipalities); and (6) a legal requirement for retailers and bakeries to donate food which is still edible should be examined (Federal Government, federal states). Finally, (7) public communal catering should set a good (management) example, e.g. by using planning tools and implementing DGE standards (Federal Government, federal states, municipalities).

---

**Recommendation: Improve services in public institutions – “Making canteen kitchens more sustainable”**

---



Food and nutrition currently tends to be a secondary topic in the health system. This means that considerable quality deficits are accepted and the wrong signals are sent to clients and society at large. The WBAE therefore recommends, in residential care homes for the elderly, hospitals and rehabilitation centres, that food consumption should not just be considered from a practical perspective; instead, it should also be ensured that the food and food environment is of a high quality.

---

The WBAE recommends (cf. Section 9.8 in the original report):

- **Rethinking catering for senior citizens.** In order to improve the nutritional and health-related care situation of the elderly: (1) the DGE quality standards for catering for senior citizens should be made compulsory in all senior-citizen institutions (Federal Government, municipalities); and (2) decentralised eating arrangements (“Meals on Wheels”) and municipal “carers” (federal states, municipalities) should be made available. In order to improve the data situation on the living situation of the over 65s: (3) monitoring of the care situation and evaluation of measures for the over 65s, with a focus on old-age poverty, should be improved (Federal Government, federal states, municipalities); and (4) nutritional screenings should be introduced in clinics, inpatient institutions and GP practices, and nursing staff and physicians sensitised for nutritional issues (Federal Government, SHI & private health insurers, Medical Associations).

- **Advocating health-promoting food in the health system** by: (1) prescribing and monitoring the DGE quality standards for catering in hospitals and rehabilitation clinics (Federal Government, federal states, SHI and private health insurers); and (2) examining the possibility of including quality-related factors (e.g. results of external quality audits) in the financing of catering services (Federal Government, federal states, SHI and private health insurers).

### Recommendation: **Develop and label agricultural systems – “Organic and more”**



Organic farming is a comparatively environmentally-friendly system, which also provides impetus for innovation for the entire agricultural sector. It should therefore continue to be supported financially. However, having more organic farming does not provide greater sustainability in every respect; the aim should therefore not be to completely convert agriculture to organic farming. Often, (overly) sweeping comparisons of “conventional” versus “organic” are not appropriate since they do not reflect the reality of agriculture and its myriad farming concepts. Viewed globally, it is possible to conceive of farming systems that are more sustainable and have greater land-use efficiency than organic farming as it is currently defined.

The WBAE recommends (cf. Section 9.9 in the original report):

- **Advancing the promotion of organic farming in a targeted manner** (Federal Government, federal states). Organic farming support should continue to be expanded in areas where particularly high benefits are expected (e.g. in Section 13-Defined areas in the Fertiliser Application Ordinance (“red areas”)), and by better combining organic aid with other agri-environmental measures.
- **Reviewing the positive effects of organic farming at intervals** (e.g. if the 20% target is reached) while also taking into account the potential negative displacement effects (Federal Government).
- **Developing farming systems with greater sustainability and making them recognisable to food processors and, in later development stages, also to consumers.** To achieve more sustainable development, organic farming should be advanced (aim: to reduce the yield gap between organic and conventional farming). In addition to this, policies should support the development of intermediate forms of farming systems with greater sustainability that can compete with organic farming in terms of environmental performance but that achieve higher yields. Such approaches should, in the longer term, be developed towards a certifiable agricultural standard and a (possibly multi-level) label (Federal Government).
- **Developing and introducing a climate label** (Federal Government).
- **Rethinking technological developments with regard to their sustainability assessment and approval processes** (EU, Federal Government, federal states). New technologies, e.g. in the areas of robotics, sensor technology and genome editing, can open up new prospects for sustainable food security and mitigation of adverse environmental effects arising from farming

systems. Plant protection agents, used selectively and in a targeted manner, can reduce food losses and contribute towards enhanced sustainability in farming systems. Policy-makers should ensure that the potential of technological solutions for greater sustainability in production is not wasted. Otherwise, there would be an undesired risk of displacing production to regions or countries with lower environmental and climate stewardship standards. The social debate on technological developments in the agricultural and food system should be intensified.

---

**Recommendation:**    **Strengthen and advance the policy field of “promoting sustainability in food consumption” – “Establishing an integrated food policy”**

---



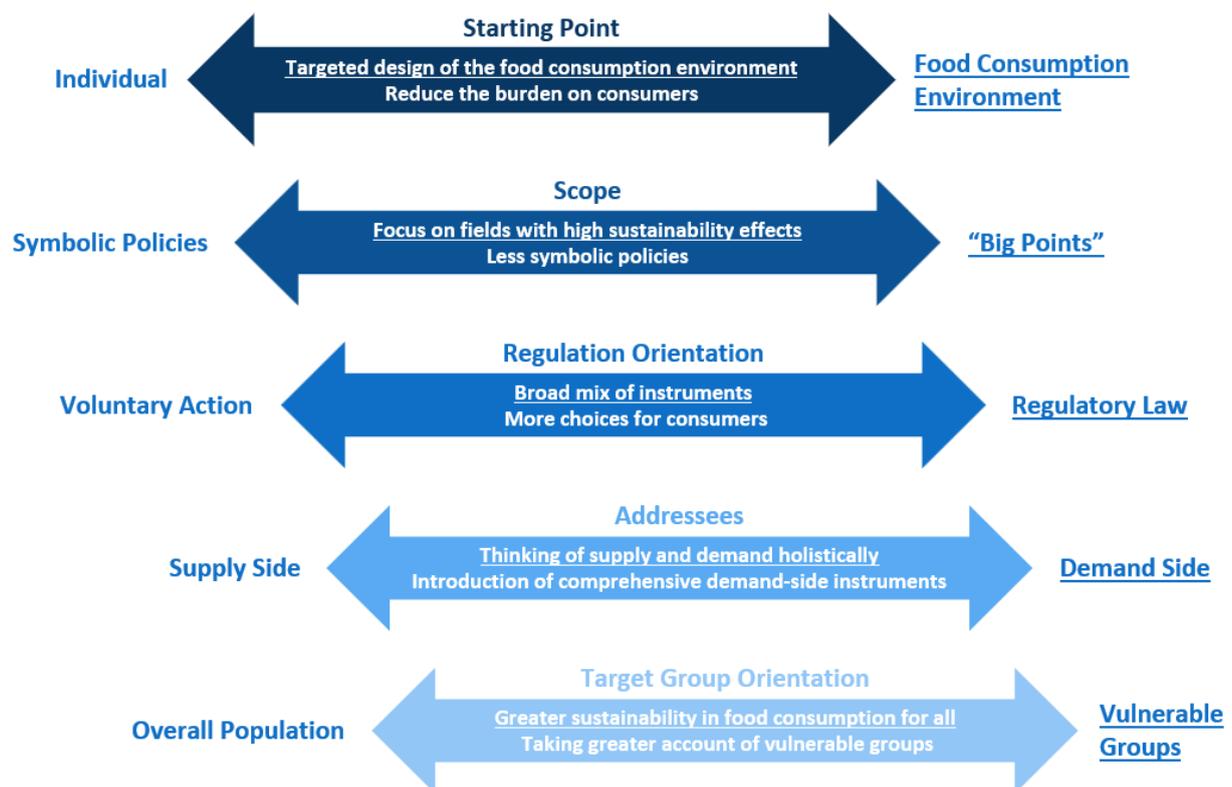
The policy field of “promoting sustainability in food consumption” is still at the beginning of its conceptual development and is heavily influenced by vested interests. In order to be able to act in this field, the WBAE recommends a comprehensive reorientation and strengthening of food policies that integrate the following four dimensions of sustainability: health, social aspects, environment and animal welfare.

---

An integrated policy for greater sustainability in food consumption requires a conceptual realignment of food policies along five decision areas (Fig. 5, cf. Section 9.10 in the original report):

- **Starting point:** The government should be given greater responsibility to shape and improve the food environment in a targeted manner so that the burden on consumers is reduced and consumers are given more, and more sustainable, options.
- **Scope:** A concentration on the main areas of action is necessary in order to increase the scope of food policies.
- **Regulatory targeting:** A broad and coordinated mix of instruments should be implemented; in particular, regulatory law and economic incentives should be strengthened and information made more reliable in order to attune the food environment to our human perception, decision-making possibilities and behavioural patterns.
- **Addressees:** Comprehensive demand-side policy instruments should be introduced to better link demand-side and supply-side instruments.
- **Target-group orientation:** A clear target-group orientation is necessary to ensure that vulnerable groups (children, households affected by food poverty, senior citizens) are given greater consideration.

**Figure 5:** Conceptual reorientation of food policies along five decision fields



Source: WBAE illustration; cf. Section 8.1 in the original report.

The WBAE recommends (cf. Section 9.10 in the original report):

- **Reinforcing and institutionally advancing the policy area of "Promoting sustainability in food consumption"**, in particular by: (1) dedicating a higher budget to food policies - appropriate to the challenges (Federal Government); (2) developing consistent goals and performance indicators for the policy area of "Promoting sustainability in food consumption" (Federal Government); (3) promoting the networking and collaboration of the ministries in charge of the various aspects of food policy (Federal Government); and (4) reinforcing food policy within the BMEL and strengthening it vis-à-vis agricultural interests (BMEL).
- **Employing food policy instruments in a combined and evidence-based manner** by: (1) using them in a conceptually sound and coordinated manner (Federal Government); and (2) comprehensively evaluating the implementation and effectiveness of food-policy measures. The Federal Government should adopt a learning approach i.e. with a focus on evidence-based design and evaluation of implementation and the effects achieved (cf. the "WIE" programme (Section 8.2.4)) (Federal Government, federal states).
- **Improving monitoring and data availability** by: (1) expanding the monitoring of developments relevant to food policy (Federal Government, federal states); (2) making monitoring data from public research institutions available for research more quickly (Federal Government, federal

states); and (3) establishing a system of regular reporting on “Promoting sustainability in food consumption”.

- **Creating a “digital ecosystem for promoting sustainability in food consumption”** (Federal Government) by: (1) developing and advancing apps and digital applications into a “digital ecosystem” for greater sustainability in food consumption, which makes applications and data in the field of food consumption available for the entire behavioural process and integrates them in a readily comprehensible manner; and (2) creating a valid, integrated open-access database (“Federal Sustainability Key”) (cf. Section 9.6.7 in the original report).
- **Focus the health insurance funds for prevention measures more on prevention in the area of food consumption** and do so in an objective and evidence-based manner (Federal Government, SHI).
- **Provide voluntary measures with clear transparency requirements and clearly defined goals** (Federal Government)

## V Financing a policy for a more sustainable nutrition

The nine key policy recommendations listed above and their proposed specification have different effects on public budgets. These are presented below in terms of their magnitude for the most important measures (cf. Section 9.11 in the original report).

- Abolition of the VAT concession on animal products (approx. 4.3 - 5.0 billion euro per year), and the introduction of an excise tax on sugar-sweetened beverages (approx. 1.0 - 1.9 billion euro per year) would generate additional governmental revenue totalling 5 - 7 billion euro per year.
- The recommended reduction of the value added tax on fruit and vegetables would lead overall to a shortfall in revenue of approx. 0.5 billion euro per year.
- Compensating the 40% lowest-income households with 50 euro per capita and year would result in additional governmental expenditure of approx. 1.6 billion euro per year.
- In respect of the government-funded school and preschool meals, it can be assumed that there would be additional governmental expenditure totalling approx. 5.5 billion euro per year.
- Around 2 billion euro per year additional governmental expenditure is proposed for the conversion to more animal-friendly livestock husbandry.
- In total, the Federal Government, federal states and municipalities would thus incur reduced revenue and additional expenditure of approx. 9.6 billion euro per year. On balance, this would result in a financing gap of approx. 2.7 - 4.3 billion euro per year, which would have to be covered by additional tax revenue or reduced expenditure in other policy areas and would require a redistribution of taxes between the Federal Government, federal states and municipalities.

- Other expenditure for the public budgets, which has not been estimated, would result from the other measures proposed, e.g. the accompanying research programme on expanding school and preschool catering, the implementation of the DGE quality standards, the investments in the public drinking water supply, the expansion of monitoring, the conducting of information campaigns, the establishment of “digital ecosystems”, the development of sustainability labels and the expansion of the data infrastructure of the Federal Food Code.
- In economic terms, this preventative and sustainability expenditure would be offset by considerable potential for savings. Government expenditure for school and preschool catering, for example, would substitute expenditure by parents. In the long term, most of the proposed measures offer great potential for reducing health care and environmental costs.
- A change in food consumption styles, in particular by reducing the consumption of animal products, is likely to save consumers money. On the other hand, it would require the agricultural sector – just as it would with higher levels of animal welfare – to make great adjustments in changing over to business strategies focused on value added. This process would have to be flanked by appropriate policies.

## VI Conclusion

The proposed integrated food policy, with its coordinated mix of policy instruments and greater intervention intensity than hitherto, represents an important and necessary step to protect our health and environment, enhance climate stewardship, mitigate food poverty, ensure compliance with minimum social standards and enhance animal welfare. Fair food environments protect and benefit all of us. Implementation of the recommended measures requires considerable additional governmental expenditure. However, in relation to the current high costs of our present food consumption for society and individuals, and the expected high (follow-up) costs in the future, this additional expenditure represents a worthwhile investment in our society as a whole. Postponing the necessary reorientation would exacerbate both the problems to be addressed and the need for adjustment.

The analysis presented in this expertise shows:

**A comprehensive transformation of the food system is meaningful, feasible and should begin without delay.**



## LONG VERSION

### Table of contents

<b>1</b>	<b>Introduction</b>	<b>1</b>
1.1	Need for political action	1
1.2	Background to the development of a policy to promote sustainability in food consumption	7
1.3	Structure of the expertise	10
<b>2</b>	<b>Our own understanding of sustainability</b>	<b>13</b>
2.1	Existing definitions of sustainable development and sustainable food consumption	13
2.2.	Sustainable development as a “regulatory idea”	15
2.3	Sustainability as a means of making it always possible to satisfy basic needs	16
2.4	Satisfying basic needs in the context of SDGs	21
2.5	Animal welfare as an additional sustainability criterion	23
2.6	Multidimensionality, comparability and trade-offs	26
2.7	Operationalisation as a challenge	28
2.8	Summary and relevance to the expertise	31
<b>3</b>	<b>Why we eat what we eat – Consumer behaviour regarding food consumption</b>	<b>35</b>
3.1.	Eating as a behavioural pattern: influences and functions	36
3.1.1	Eating as a basic biological need	36
3.1.2	Reward value of foods	37
3.1.3	The influence of signals from the food environment and expectations	38
3.1.4	Why we eat: Multifunctionality of normal food consumption habits	38
3.1.5	Changing food consumption habits: influence of the societal and social context	40
3.2	Conscious, purposeful (“ratio”) and automatic, habitual behavioural decisions (“autopilot”) in complex environments	42
3.3	Food environment: Types of environmental influences in the different phases of the behavioural process	45
3.3.1	Exposure	45
3.3.2	Access	47
3.3.3	Choice	49
3.3.4	Eating/consumption	51

3.4	Focus: the portion size effect	54
3.4.1	The portion size effect: developments and current data	54
3.4.2	Why we eat more when portions get bigger	58
3.5	Conclusion “Why we eat what we eat”	59
<b>4</b>	<b>Problem analysis</b>	<b>61</b>
4.1	Food consumption in a global context	61
4.2	Food consumption and health	66
4.2.1	What are the characteristics of health-promoting food consumption?	67
4.2.2.	Food-consumption and health situation in Germany	72
4.2.2.1	Adults	75
4.2.2.2	Pregnant women and infants – “1,000-day window”	82
4.2.2.3	Children and adolescents	84
4.2.2.4	Senior citizens	87
4.2.3	Health-promoting food consumption in households affected by poverty?	93
4.2.4	Food safety	102
4.2.5	Conclusions with regard to the health dimension	107
4.3	The social dimension of our food consumption	108
4.3.1	Key issues	109
4.3.2	Identifying social aspects using existing approaches to promote sustainability in the food system	110
4.3.3	Social problems in connection with food production in Germany	116
4.3.3.1	Social situation of family farms	117
4.3.3.2	Social situation of employed earners in the agricultural sector	132
4.3.3.3	Social situation in other areas of the agri-food sector	140
4.3.4	International trade and social problems	141
4.3.4.1	Social problems in connection with food imports	142
4.3.4.2	Social problems in connection with exports to developing countries	149
4.3.5	Conclusions regarding the social dimension	150
4.4	Environmental effects of our diet	153
4.4.1	Environmental effects of agricultural production – planetary boundaries	154
4.4.1.1	Crossing planetary boundaries I: Climate change (GHG emissions)	158
4.4.1.2	Crossing planetary boundaries II: Nitrogen cycle and excesses of reactive nitrogen compounds	163
4.4.1.3	Crossing planetary boundaries III: Biodiversity	167
4.4.1.4	Other environmental impacts of primary agricultural production (soil protection)	170

4.4.2	Environmental effects at the further stages of the food value chain including losses	173
4.4.2.1	Processing	175
4.4.2.2	Cooling	177
4.4.2.3	Packaging	178
4.4.2.4	Logistics	184
4.4.2.5	Retail sector	186
4.4.2.6	Away-from-Home Catering	188
4.4.3	Environmental effects at consumer level	190
4.4.4	Conclusions on the environmental dimension	197
4.5	Animal Welfare	200
4.6	Conclusion: The challenge of transformation	203
<b>5</b>	<b>Identification and measurement of sustainable food consumption</b>	<b>207</b>
5.1	Conceptual and methodological challenges of assessing sustainability	207
5.2	Assessment of various farming systems	210
5.2.1	Concepts for assessing the sustainability of agricultural holdings and production systems	211
5.2.2	Sustainability potentials of organic farming	215
5.2.2.1	Challenges of comparing organic farming with conventional farming	217
5.2.2.2	Contribution of organic farming to food security	219
5.2.2.3	Contribution of organic farming to environmental protection, climate change mitigation and animal welfare	223
5.2.2.4	Contribution of organic farming to health-promoting food consumption	230
5.2.2.5	Contribution of organic farming to the income situation of farmers	233
5.2.2.6	Other effects of organic farming	233
5.2.2.7	Conclusion: assessment of organic and conventional farming systems	235
5.2.3	Perspectives of (greater) sustainability in farming systems	237
5.2.4	Further issues of sustainable agriculture	240
5.2.5	Conclusion	246
5.3	Assessment of dietary patterns and foodstuffs	247
5.3.1	Comparative assessment of health contributions	250
5.3.1.1	Methods of assessing health benefits	250
5.3.1.2	Current knowledge on dietary patterns and health-promoting foodstuff groups	255

5.3.2	Comparative assessment of social effects	268
5.3.2.1	Methods for social assessments	268
5.3.2.2	Current knowledge on social problems associated with food and dietary patterns	270
5.3.3	Comparative assessment of environmental compatibility	274
5.3.3.1	Overview of the life cycle assessment method	275
5.3.3.2	Current knowledge on environmental effects associated with food and dietary patterns	284
5.3.4	Comparative animal welfare assessment	299
5.3.4.1	Overview of the methods of assessing animal welfare	299
5.3.4.2	Current state of knowledge regarding the animal welfare standards of products	303
5.3.5	Integrative consideration of all four perspectives	306
5.3.6	Conclusion	312
5.4	Community-supported agriculture, food co-ops, regional and direct marketing: assessment of “alternative food networks”	314
5.5	Conclusion	323
<b>6</b>	<b>Legitimation of a food and nutrition policy?</b>	<b>339</b>
6.1	Policies may interfere in the freedom of individuals in order to protect others from harm	340
6.1.1	The perspective of political philosophy	340
6.1.2	The economic perspective	341
6.1.3	The legal perspective	343
6.2	Supply-oriented versus demand-oriented policies: the necessity of a mix of instruments for the promotion of sustainable food consumption	345
6.2.1	Environmental economic arguments for supply-side policies	345
6.2.2	Limitations of supply-side economic governance instruments	346
6.2.3	Limitations of demand-side policy instruments	348
6.3	Limits of consumer sovereignty – or: should we as consumers sometimes protect ourselves from ourselves?	353
6.4	Influence on consumption by other actors – restrictions on marketing	359
6.5	Approval of food-policy interventions among the population	365
6.6	Conclusion	370
<b>7</b>	<b>Governance of the food system</b>	<b>373</b>
7.1	Analytical framework	374
7.2	Organisations and stakeholders	376
7.2.1	Food system	376

7.2.2	Political and administrative system	381
7.2.2.1	Government bodies	382
7.2.2.2	Political parties	388
7.2.2.3	Associations	392
7.2.3	Innovation system	405
7.3	Public governance problems	412
7.3.1	Governance problems regarding policy measures in the field of agricultural production	412
7.3.2	Governance problems regarding policy measures that target consumers	415
7.4	Governance problems in the innovation system	419
7.5	Specific governance problems	421
7.5.1	Governance problems concerning catering in schools and preschools	422
7.5.1.1	Status quo of catering in schools and preschools in Germany	422
7.5.1.2	Catering in schools and preschools as a merit good	430
7.5.1.3	Opportunities and limits of governance by the federal government	433
7.5.1.4	Conclusions	434
7.5.2	Governance problems due to financial disincentives and possibilities of steering taxes	436
7.5.2.1	Relative prices of different food categories	436
7.5.2.2	Influencing demand by consumption-side steering taxes	439
7.5.2.3	Steering effect of consumption-side steering taxes	440
7.5.2.4	Distribution effect of consumption-side steering taxes	443
7.5.2.5	Acceptance of consumption-side steering taxes	444
7.5.2.6	Conclusions	446
7.5.3	Governance problems regarding labelling	448
7.5.3.1	Types of label, objectives and general challenges	448
7.5.3.2	Cost of labelling	454
7.5.3.3	EU and WTO regulatory framework for labelling	460
7.5.3.4	Conclusion	466
7.6	Rebound effects as a fundamental governance challenge facing eco-friendly nutrition	467
7.7	Conclusion	469
<b>8</b>	<b>Instruments of a policy for greater sustainability in food consumption</b>	<b>475</b>
8.1	Development of an integrated food policy strategy	478
8.2	High-quality, free meals in schools and preschools	488

8.2.1	High quality	489
8.2.1.1	What is eaten: High quality through (mandatory) quality standards	489
8.2.1.2	How food is eaten: High quality through a fair food environment	491
8.2.2	Free lunch in preschools and schools	493
8.2.3	Estimation of public expenditure in the case of complete public funding	498
8.2.4	Evaluation of the implementation and achieved effects of high-quality and free preschool and school meals	503
8.2.5	Conclusion	507
8.3	Regulation of portion sizes	507
8.3.1	Instruments for addressing the portion-size effect	508
8.3.2	Legal framework applicable to the regulation of portion-size effects	514
8.3.3	Conclusion	518
8.4	Product reformulation	518
8.4.1	Objectives and ways of implementing reformulation in Germany	519
8.4.2	Fat reduction: reasonable from a nutritional point of view, but individual solutions required	520
8.4.3	Reformulation with regard to sugar and salt	521
8.4.4	Conclusion	526
8.5	Regulating advertising and online marketing	527
8.5.1	Restrictions on advertising for food with unfavourable nutrient profiles, particularly in the case of children	527
8.5.2	Transparency and restrictions on online marketing	532
8.5.3	Conclusion	532
8.6	Taxes and subsidies	533
8.6.1	Subsidies for sustainable products	534
8.6.2	Health-oriented tax on sugar-sweetened beverages	536
8.6.3	Sustainability tax on animal products	546
8.6.4.	In future: a label-based sustainability tax on all foods	555
8.6.5	Conclusions	557
8.7	Information campaigns	558
8.7.1	Aims, content and forms of information	558
8.7.2	Design and evaluation of information campaigns	563
8.7.3	Conclusion	565
8.8	Dietary education	565
8.8.1	Aims of dietary education	566
8.8.2	Institutional responsibilities and contents of dietary education in preschools and schools	569
8.8.3	Media of dietary education	571
8.8.4	What can dietary education achieve?	572
8.8.5	Conclusion	573

8.9	Labelling	574
8.9.1	Health-related labels	574
8.9.2	Social label	585
8.9.3	Environment-related labels	591
8.9.4	Animal welfare label	599
8.9.5	Conclusion	603
8.10	Mobile applications	604
8.10.1	Mobile apps in the behavioural process	604
8.10.2	Are dietary apps effective in terms of behaviour? Food consumption habits and nutrition-related health parameters	605
8.10.3	Digital applications and the merging of different settings: smart “digital ecosystems”	606
8.10.4	Challenges and measures of digital applications and apps	607
8.10.5	Conclusion	609
8.11	Reduction of food losses	610
8.11.1	Supplier-focused instruments	611
8.11.2	Consumer-focused instruments	614
8.11.3	Conclusion	617
8.12	Voluntary self-restraint and corporate social responsibility: integrating corporate commitment into food policy	618
8.13	Conclusion Transformative policy	621
<b>9</b>	<b>On course for greater sustainability in food consumption: recommendations</b>	<b>623</b>
9.1	Tackling sustainability in food consumption as a transformation challenge	623
9.2	Bring about a system change in preschool and school catering – “Focusing on children and young people”	628
9.3	Make the consumption of animal products globally compatible – “Less and better”	631
9.4	Use price incentives – “Prices should tell the truth”	634
9.4.1	Abolishing the reduced VAT rate for animal products	634
9.4.2	Introducing a tax on sugar-sweetened beverages	635
9.4.3	Subsidies on the consumption of fruit, vegetables and pulses	636
9.4.4	Introducing a sustainability tax on all foods in the long term	637
9.5	Ensure health-promoting food consumption for all – “Reducing food poverty”	637
9.6	Provide reliable information – “Enhancing choices”	639
9.6.1	Establishing an effective labelling policy	640
9.6.2	Introducing a health-related label	642
9.6.3	Ensuring minimum standards in the social field and labelling fairness aspects	644
9.6.4	Advancing a climate label	646
9.6.5	Introducing a broad-impact animal welfare label	647

9.6.6	Making the advertising environment more sustainable	649
9.6.7	Creating a “digital ecosystem for greater sustainability in food consumption”	650
9.7	More sustainable food consumption as the “new normal” – “Calibrating social norms”	651
9.7.1	Making smaller portion sizes the standard	652
9.7.2	Reducing consumption of sugar-sweetened beverages and ambitiously promoting consumption of tap water: Avoiding the “beverage trap”	653
9.7.3	Realistically assessing and harnessing the potential of reformulation	655
9.7.4	Efficiently reducing food waste	657
9.8	Improve services in public institutions – “Making canteen kitchens more sustainable”	659
9.8.1	Rethinking catering for senior citizens: “On wheels to meals” (auf Rädern zum Essen)	659
9.8.2	Advocating health-promoting food in the health system: “Making the connection between nutrition and health tangible”	661
9.9	Develop and label agricultural systems – “Organic and more”	661
9.10	Strengthen and advance the policy field of “promoting more sustainable food consumption” – “Establishing an integrated food policy”	664
9.11	Financing of a policy to promote more sustainable food consumption	669
9.12	Conclusion	671
	<b>Literature</b>	<b>673</b>
	<b>List of figures</b>	<b>785</b>
	<b>List of tables</b>	<b>790</b>
	<b>List of text boxes</b>	<b>793</b>
	<b>Abbreviations</b>	<b>794</b>

# 1 Introduction

## 1.1 Need for political action

If sustainability goals at national, European and global levels (e.g. Sustainable Development Goals/SDGs and climate action goals) are to be achieved, all sectors must make far-reaching contributions – including the agricultural and food sectors. It is not enough to simply modify production; consumption must change too. Food consumption plays an important role in this context. How we eat has a major impact on our individual health status and our well-being. Many of the foods we consume have a major social, environmental, climate and animal welfare footprint. At the same time, food consumption is the subject of intense social debate: it is undisputed that food consumption could be more sustainable. However, the issue as to who can or should play what role in achieving this aim (politics, industry or consumers) is a matter of great controversy in society. Many consumers want to eat healthier and more environmentally-friendly food; they want to know under what social conditions the food is produced and how the animals that produce the meat, milk or eggs are kept (Christoph-Schulz et al. 2018, Zühlsdorf et al. 2018, Kühl et al. 2019). Many consumers are therefore motivated to make a contribution to both their own health and to social goals. However, we as consumers (too) rarely make sustainable food choices due to unclear and contradictory information and unsupportive food environments.

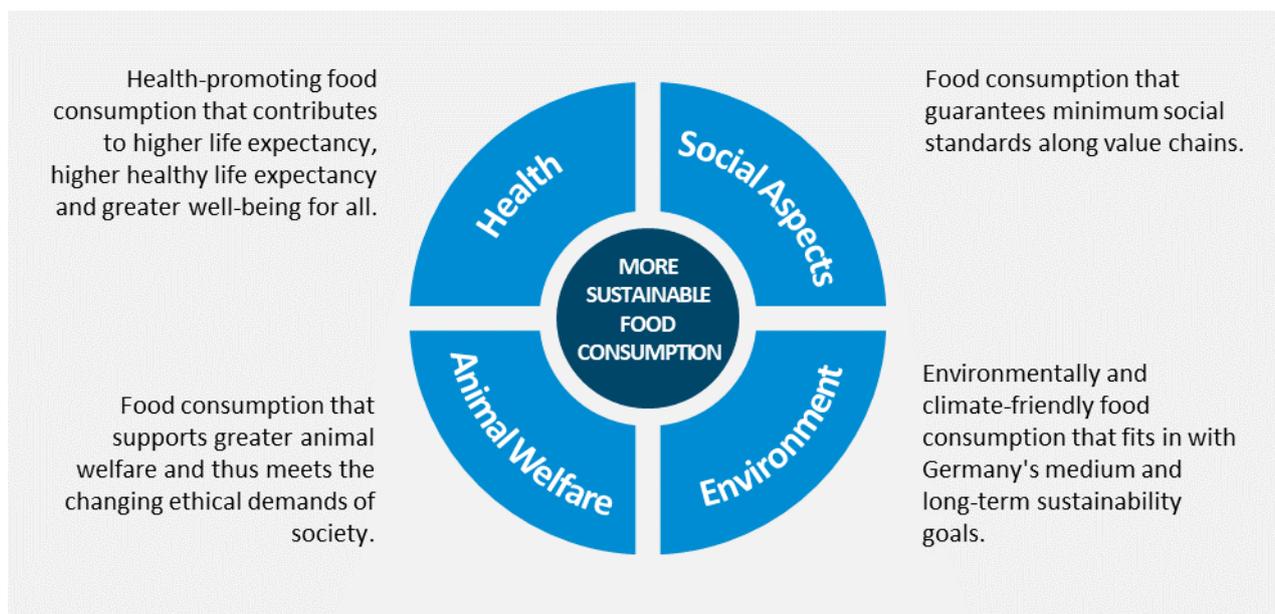
In this expertise on promoting sustainability in food consumption, the German Scientific Advisory Board on Agricultural Policy, Food and Consumer Health Protection (WBAE) takes an in-depth look at food policy for the first time since the WBAE was formed from the former Scientific Advisory Board on Agricultural Policy (WBA, existed until 2015) and given an expanded remit. The expertise is based on the one hand on the view that, if Germany wants to achieve key sustainability objectives, such as the Sustainable Development Goals (SDGs), and climate action goals, changes in eating habits are necessary and feasible (Section 4.4) and, on the other, on the realisation that food consumption issues have become far more important for German consumers (Sections 3 and 6). While global discussions on food policy are increasing (Mozaffarian et al. 2018, Willett et al. 2019), the subject remains far less established on the political agenda than agricultural policy (Branca et al. 2019). Although society is currently conducting intensive debates on food issues such as vegetarianism or obesity, the focus is often not on the political dimensions of these issues. If it is, then it is usually on particular policy instruments. The Federal Government has not yet formulated broader strategic approaches for a consistent and effective food policy.

Traditionally, food policy is understood as a policy field “that performs the task of monitoring and structuring production, processing, distribution and trade in and of food as well as the fostering of a health-conscious diet” (WBVE 2005:9 et seq). In recent years, the range of objectives has been widened to cover more comprehensive consumer protection and sustainability goals. Today, consumer interests are at the forefront of food policy. The former Scientific Advisory Board on Consumer and Nutrition Policy therefore also defined food policy as “consumer policy in the food sector” (WBVE 2005: 10). In this expertise, the WBAE takes **food policy to mean the totality of all**

**measures aimed at contributing to increasing sustainability in consumer food consumption.** With its recommendations, the WBAE aims to establish and develop this view of food policy to help achieve sustainability goals, such as those set in the United Nations' Sustainable Development Goals (SDGs) and the Paris climate target.

With its focus on more “sustainable food consumption”, the expertise combines the four most important targets of today’s food policy (Fig. 1-1): (1) health-promoting food consumption<sup>1</sup> for all consumers; (2) minimum social standards of decent work and social justice<sup>2</sup>; (3) environmental protection and climate change mitigation; and (4) animal welfare.

**Figure 1-1:** The four key goals of more sustainability in food consumption (“Big Four”)



Source: WBAE illustration.

While there are many possible synergies between these goals, there are also various, and sometimes serious, trade-offs (Sections 2, 4 and 5). In addition, the underlying problems are sometimes significant and the goals and expectations of society, and the demands on policymakers, are correspondingly high: diet-related diseases (Section 4.2) cause high economic costs. In 2017, for example, 52.7% of adults in Germany were overweight, of which 16.3% were obese (Federal Statistical Office 2018a). While Germany, gauged by international standards, spends an unusually high

<sup>1</sup> People who eat health-promoting food will not per se become or remain healthy as a result. Good health results from the interplay of food consumption with a variety of other factors (genetics, epigenetics, exercise, socio-economic conditions, etc.). However, health-promoting food consumption reduces certain risks of disease. For this reason, the term “health-promoting food consumption” is used in this expertise instead of “healthy food consumption”, cf. Section 5.3.1.2.

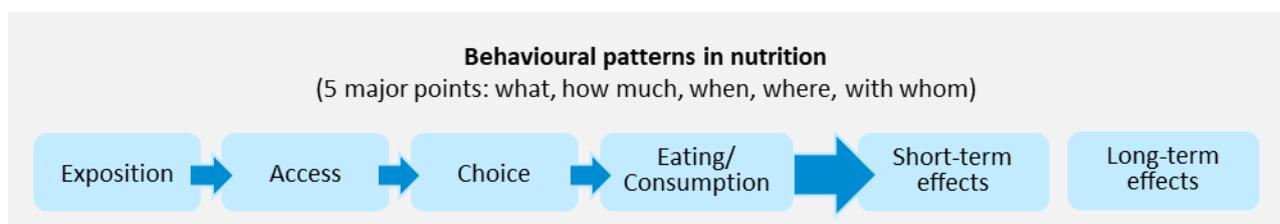
<sup>2</sup> This objective, and the questions and arguments associated with this objective, are also referred to in this expertise as the “social dimension”. The question of the effects of food consumption on health also numbers among these social questions. Given that health is of such outstanding importance for the policy field of food, it is addressed in this expertise as a separate objective or dimension.

amount of money on its healthcare system and provides excellent care in case of illness, it lags behind in prevention, namely in encouraging health-promoting lifestyles and behaviour. Food poverty is hardly perceived as a problem in Germany today, although there is a clear concentration of unfavourable dietary patterns and corresponding health burdens among persons and households with low incomes (Section 4.2). Along globalised value chains, social conditions are often opaque and in some cases very problematic (Section 4.3). Food policy will have to make major contributions in order to achieve the climate change mitigation goals to which Germany and the EU have committed themselves. After all, our food consumption habits have an impact on the natural environment in areas where existing binding targets have not yet been reached and where there is a great need for action, such as the need to improve water quality and preserve biodiversity (Section 4.4). There are major shortcomings in the area of animal welfare, and the financial resources made available to enhance animal welfare in Germany are disproportionate to the size of the challenge (Section 4.5). Here too, food consumption habits play an important role.

Policies aimed at promoting sustainability in food consumption should focus on the key fields of action relating to food consumption habits and not continue to “argue about plastic bags” for decades to come. Consumers are faced with a multitude of – often contradictory – recommendations on how to eat more sustainably. In science and society, the debate on what constitutes sustainable food consumption relates to very different reference or assessment systems, which the WBAE discusses in detail in Section 5. The Advisory Board essentially confirms some recommendations that have been under discussion for some time, such as the recommendations to significantly reduce the intake of animal products and to minimise food waste. At the same time, however, the Advisory Board also puts some widespread ideas into perspective. For example, while a further expansion of organic farming makes sense due to its positive environmental impacts, 100% organic farming is not a suitable sustainability goal.

The expertise places a central focus on the **food environment**, which exerts a major influence on food consumption and eating behaviour (Section 3). The influence of the food environment on our food consumption habits is very far-reaching and must be understood much more comprehensively than is currently the case in food policy. The food environment and the corresponding environmental factors influence the entire behavioural process. This can be divided into four phases (exposure, access, choice, consumption) (Fig. 1-2 and Section 3.3).

**Figure 1-2:** Phases of the behavioural process



Source: Renner (2019, 2015).

- The **exposure** to food and food stimuli (e.g. in advertising and social media, density and placement of vending machines and supermarkets) determines how permanently aware we are of “food” in our daily lives and what we perceive as “normal” and “appropriate”. Today, exposure often seems to be mainly to products with an unfavourable nutrient profile (e.g. fast food) and a problematic environmental profile (e.g. high CO<sub>2</sub> footprint).
- **Access** to food is determined by price, availability of information and social eating and behavioural standards. The social structure (e.g. meal times) and the variety of foods on offer (e.g. convenience aspects, portion sizes) exert a particularly strong influence on how much food consumers want to consume, what food they wish to consume, and when, where and with whom they can (and want to) consume it. The fact that food is now on offer 24/7 practically everywhere means that consumers’ attention is almost constantly drawn to food. This increases the demands on individuals to self-regulate their behaviour (“to control oneself in view of the omnipresent food supply”). Price relations between products do not adequately reflect environmental costs. Products with an unfavourable nutrient profile are often (too) cheap compared with those with a more favourable nutrient profile.
- Actual food **choices** are shaped by socio-economic aspects (in particular income), preferences, attitudes, knowledge, social norms and also habits and routines. Marketing and – to an increasing extent – social media and “social influencers” not only increase exposure to food stimuli, but also associate food with certain values and characteristics which then influence consumer preferences. Products are often associated with emotions and social aspects (e.g. status, popularity, affiliation) that are independent of the actual nutritional value or taste of the products.
- The above-mentioned environmental factors play a role in determining **consumption**, i.e. what food is eaten, and where, how much and how quickly it is eaten. In addition to this, there are a number of other crucial aspects relating to the actual food environment, such as the range of foods and dishes on offer (quality, quantity, choice), the properties of the foods and dishes (e.g. portion size), the environment (e.g. noise, time pressure, stress), the ambience (space, light, temperature, smell, music) and the social environment (community, type of social event). The eating environment, notably the ambience and whether people eat and drink together, performs key emotional and social functions. The atmosphere in which food is eaten conveys social norms and appreciation of food implicitly and with long-term effects. For example, having huge litter bins near where crockery is returned in a canteen can convey the impression that, rather than taking just what you can eat, it is normal to take overly large portions and then throw leftover food in the bin.

A key finding of the expertise is **that the influence of food environments is underestimated in the public and political debate, whereas individuals’ control over their actions is significantly overestimated**. Consumers and political decision-makers are frequently unaware of the highly effective influences of the food environment (Section 3), as the focus is usually only on the consumption phase and on individual food decisions. It is therefore assumed that eating more sustainably and healthily is a “simple” individual choice and thus primarily a question of motivation and self-regulation (e.g. choosing to eat an apple rather than chocolate). Consumers actually have to make a lot

of food decisions every day, namely in deciding what they eat, how much they eat, and when, where and with whom they eat, and in explicitly saying “no” and suppressing the corresponding behavioural impulses in an environment that draws attention to food and eating almost constantly.

In this expertise, the WBAE recommends **that consumers should be given much more support than hitherto in making their food consumption more sustainable through the design of appropriate food environments**. To this end, it is firstly necessary to reduce the factors in today’s prevailing food environments that make food consumption less sustainable (e.g. large portion sizes, high advertising expenditure on unhealthy foods, ubiquitous availability of foods, especially foods with unfavourable nutrient profiles). Secondly, it is important to offer food choices that are more health-promoting and have greater social, environmental and animal-welfare compatibility, to make it easier to identify more sustainable options, to facilitate easier access to information and to set price incentives that entice consumers to opt for food that is healthier and has greater social, environmental and animal-welfare compatibility.

The WBAE describes such food environments as fair because and insofar as they are (1) attuned to our human perception and decision-making possibilities as well as behaviour; and (2) are more health-promoting and have greater social, ecological and animal-welfare compatibility and thus contribute to sustaining the livelihoods of the world’s current and future generations.

Conversely, the focus on food environments is also a criticism of making food consumption too dependent on individual responsibility. Compared with other European countries, Germany is lagging behind in this area (Section 6). Emphasising the importance of appropriate food environments thus implies that a national policy for promoting more sustainable food consumption requires significantly more and deeper interventions than currently in place.

The WBAE regards **communal catering** as a key approach. In view of the fact that (early) childhood dietary experiences are particularly important and have a lifelong effect on health, the WBAE emphasises the need for a system change in catering in schools and preschools, but also recommends changes in catering for the elderly and in hospitals and rehabilitation clinics (“healthy food in the healthcare system”). Levying higher tax rates on animal products and introducing a tax on sugar-sweetened beverages can play a pivotal role in bringing about food-price ratios that promote sustainability in food consumption. The WBAE also recommends providing reliable information via the mandatory introduction of the Nutri-Score, the introduction of a climate label and the use of a high-profile animal welfare label as further instruments to create fair food environments.

After all, people in Germany are also affected by income-induced restrictions on access to adequate, nutritious food – we too have poverty-related malnutrition, which starts very early on in life. To address food poverty, the WBAE recommends the introduction of high-quality, government-funded catering in schools and preschools, the provision of social cushioning for steering taxes and a review of the calculation basis and methods used to determine the basic requirements for a minimum subsistence level.

In view of the challenging and unsupportive food environments, a single instrument can only make a limited contribution to change. A single new label, a new quality standard or a single tax rise will not bring about a real “breakthrough” on their own. There is clear evidence in recent research that an inclusive approach (multisectoral approach, instrument mix) is more effective because of the multifactorial influencing factors (World Cancer Research Fund International 2017, Sisnowski et al. 2017). The measures proposed below are all important – but it is only as part of a comprehensive, firmly applied **instrument mix** that they will gain the necessary outreach to achieve the politically agreed sustainability targets and the individual health objectives that many people have.

The WBAE champions a policy that, based on expanded monitoring, measures the success of its steps more than before and uses the lessons learned to continue to develop (Mozaffarian et al. 2018). The WBAE recommended such a “**learning-by-doing**” approach in its earlier expertise on climate change (WBAE & WBW 2016) to generate empirical evidence on the effectiveness of available measures (Section 8.2.4) and also to develop new measures and implement them in a targeted manner in selected model facilities or regions, in order to then systematically develop them further based on data.

The WBAE is aware that some of the proposed policy instruments are more interventionist than has so far been customary in Germany in food policy and could thus trigger a discussion about paternalism. By international standards, Germany currently focuses very much on individual and family responsibility for a successful diet (Section 6). Globally, however, a large number of new instruments are currently being tested, for example to combat the obesity epidemic (Garnett et al. 2015). Germany should implement some of these instruments in a timely manner and systematically evaluate their success in order to establish a more effective food policy.

The need for food policies, i.e. for political interventions on the demand side, is also emphasised in view of the integration of the agri-food industry in the global economy and open markets. The WBAE highlighted the limits of a supply-side policy in an open economy in its expertises on livestock farming (WBA 2015) and climate change mitigation policy (WBAE & WBW 2016): the conventional supply-side regulatory and economic instruments reach their limits in open economies and when faced internationally with different levels of regulation. They can be effectively complemented by consumption-side measures. However, the wide range of demand-side instruments is conceptually far less developed. Moreover, the control instruments on the supply and demand sides have so far hardly been aligned with each other. Finally, given the systemic connections between agriculture and food consumption, there is a lack of conceptual analyses of how steering instruments on both sides can be effectively and efficiently combined.

Food consumption is crucial for key sustainability goals, but is by no means the most important or only starting point. For example, the number of cars, the number of kilometres driven, the number of flights and the size of the home are more relevant to climate change mitigation in many households than, for example, the level of consumption of animal products. It is sometimes not without reason that the agri-food industry feels that there was a disproportionate focus on the sector. As

the WBAE showed in its climate change mitigation expertise (WBAE & WBW 2016), the aim is not to pillory the agricultural sector or individual food consumption habits in general (“agricultural or food blaming”), but to achieve key sustainability goals. To achieve these goals, all sectors must make far-reaching contributions.

It is at present not evident in Germany that there is any coherent food policy that comprehensively addresses the considerable current problems regarding diet-related illnesses as well as climate action, environmental conservation and animal welfare. From the perspective of the WBAE, the problems regarding food consumption are so great and the need for change so fundamental that the food system needs not to be merely reformed, but instead thoroughly transformed. The WBAE takes the view that the great importance of food consumption and the need for a strategic food policy has not been sufficiently addressed by political parties to date (see also Section 7). The WBAE sees this as a major challenge for a Federal Ministry which has placed food in front of agriculture in its title, but which in its draft budget for 2020 earmarked only about 3.2% of its budget for consumer health protection and food (BMEL 2019a).

## **1.2 Background to the development of a policy to promote sustainability in food consumption**

Politics includes setting out and implementing strategies to achieve social goals or solve problems. It thus represents the response of the politico-administrative system to a state of affairs in society that is deemed politically suboptimal. In many cases, the starting point for the awareness and discussion of the need for policy changes are visible symptoms of a problem perceived by society or the discussion of these symptoms in the media.

Policy-makers in developed countries today are increasingly faced with the demand that a change in food consumption habits is necessary in order to achieve the UN Sustainable Development Goals of 2015 and the targets of the Paris Climate Agreement (Willett et al. 2019). Animal welfare goals are also increasingly being discussed in society. The demand for greater sustainability in food consumption and policies that promote this is increasingly being voiced by various national and international organisations and non-governmental organisations (for an overview see Mason & Lang 2017, HLPE 2017, WWF 2015, WBAE & WBW 2016).

When public intervention is being developed, the actual causes of the problem are often neither identified with reasonable certainty nor are they unanimously defined by public or private actors (Knoepfel 2011). The discussion about more sustainable food consumption is a particularly good example of the fact that this is inspired by very different historical debates which have over time led to the development of fields of political activity in very different areas of responsibility.

Although the concept of sustainable diets did not appear in political discourse until the past two decades, its scientific origins date back to the dietary guidelines for sustainability by Gussow and

Clancy (1986). These authors regarded sustainability as a composite term in which food consumption and the environment were to be brought into line with each other in accordance with the sustainability concept proposed at the time and summarised one year later in the Brundtland Report (Hauff 1987, cf. Section 2.1). The book by Frances Moore Lappé entitled “Diet for a Small Planet” and published in 1971 (see Lappé 1991) also provided major impetus for public debate. Lappé considered a change in food consumption imperative in order to protect the environment.

However, the public debate initially focused on the ecological problems associated with farming. This discussion started early in Germany. While in the 1960s and 1970s the public was only aware of the impressive productivity increases and thus of a better and more cost-effective food supply, attention gradually shifted to the associated external effects as well. In the expertise on “Environmental Problems in Agriculture” delivered by the Advisory Board on Environmental Issues (SRU 1985) and the follow-up reports (Haber & Salzwedel 1992, Haber 2014, Heißenhuber et al. 2015), the debate initially focused on national environmental problems, such as the considerable loss of biodiversity. Thus, the increase in agricultural productivity was linked to an increase in plot sizes, a degradation of the countryside, specialisation and the increasing intensity of land use. In addition, the increasing concentration of animal production in some regions resulted in serious problems regarding groundwater and surface water quality (WBA et al. 2013).

The environmental and climatic impacts in the processing, transport, distribution and commercial stages downstream of the farming sector must also be taken into account, especially in view of the global increase in greenhouse gas emissions. In an increasingly differentiated and urbanised society, value chains, which are based on a division of labour and frequently global in nature, have rapidly gained in importance. Transportation by air and road, in particular, are frequently discussed in this context.

Overall, food consumption accounts for 25 to 30% of greenhouse gas emissions around the globe (WBAE & WBW 2016, IPCC 2019, Food and Land Use Coalition 2019). The discussion about the so-called “ecological footprint” (Wackernagel et al. 2014) has also raised awareness of the fact that the causes of these problems are not to be found solely in production, but are closely linked to consumption and dietary patterns. The WBAE has already repeatedly concluded from this fact that focusing exclusively on production-based climate change mitigation is not efficient without a change in consumption, as these measures would be partly counteracted by increasing imports or the relocation of production (WBA et al. 2013, WBA 2015, WBAE & WBW 2016).

However, current food consumption habits can pose a problem not only for environmental protection, nature conservation and animal welfare, but also for public health. Problematic dietary patterns and over-consumption cause high economic costs. In the United Kingdom, it is estimated that more than 5% of National Health Service (NHS) expenditure is on obesity-related health problems; the economic cost of diabetes incurred in the United States has been estimated at 1.3% of the gross domestic product (GDP) (Garnett 2013, Sandler 2015).

Although the health policy challenges of food consumption and, in particular, the growing problem of obesity have, over time, been increasingly recognised in Germany, they were addressed more as the result of individual misguided decisions and as an information problem. Politicians responded primarily by enacting laws to improve food labelling so that consumers could find nutritional information on the product (Food Information Ordinance – LMIV). It is only recently that a greater focus has been placed on the question of how big a role the food environment (physical, political, economic, socio-cultural) plays in the individual problems such as malnutrition and obesity. In this context, there are discussions about areas where the availability of health-promoting food is very limited (so-called “food deserts”) or where there is a high supply of energy-dense but nutrient-poor products (“food swamps”). The role of marketing and the price ratios of various foods are also discussed (Cooksey-Stowers et al. 2017, Lobstein et al. 2015, Headey & Alderman 2019).

Another relatively new development is studies that link public health challenges to environmental and climate policy targets (Reynolds et al. 2014). There is a growing number of studies that ask whether better implementation of health-focussed dietary recommendations, for example by professional associations such as the German Nutrition Society (DGE), would also contribute to environmental and climate policy improvements, or whether there are trade-offs (Aleksandrowicz et al. 2016). In general, there is still comparatively little attention paid to the social dimension of more sustainable food consumption and animal welfare. Food policy becomes more complicated if it wishes to (and must) tackle these problems in parallel and in a coordinated manner.

Overall, it is thus clear that food policy has become considerably more complex and nowadays has major interfaces with environmental, health, agricultural and animal welfare policy. This expertise therefore develops an integrated approach to food policy, well aware that gaps will remain, given the broad spectrum of issues involved. For example, the WBAE does not elaborate further on legal psychotropic substances such as alcohol and cigarettes. The expertise also only deals in passing with instruments of agricultural and environmental policy, on which the Advisory Board has commented in detail elsewhere (WBA 2015, WBAE & WBW 2016, WBAE 2018, 2019).

### 1.3 Structure of the expertise

The broad understanding of a more sustainable diet, which forms the basis of the scientific debate and also of this expertise, requires an integrated approach that picks up on the different levels of the problem and relates them to each other. In the past, the Advisory Board has elaborated policy measures for the supply side (especially agriculture) in several expertises and statements (WBA 2015, WBAE & WBW 2016, WBAE 2018, 2019). By contrast, this expertise focuses on the question: **What can consumers do to promote sustainability in their food consumption and how can policymakers support them?** Agriculture also has a role to play in this regard, and the expertise deals in depth with the role of organic farming, for example, but primarily from a consumer perspective.

**Section 2** first explains what the expertise **takes sustainability to mean**. Four target dimensions run through the entire expertise: health; minimum social standards; environmental protection and climate change mitigation; and animal welfare. An integrated consideration of these dimensions and of the existing synergies and trade-offs is one of the main challenges facing a policy to promote sustainability in food consumption.

**Section 3** focuses on consumers. The potential of the policy instruments discussed later can only be properly assessed if we understand **why we eat what we eat**. The section points out that our everyday eating behaviour is highly complex and not exclusively based on conscious and reflected decisions. Rather, our everyday eating behaviour often results from habitual factors that we are not aware of at the time and is therefore strongly influenced by the range of actions that are available. Environmental factors that address our biological, psychological, social and economic dispositions and needs therefore have a decisive influence on our eating behaviour, i.e. from the time of exposure to the actual consumption.

**Section 4** then addresses the various policy challenges arising from more sustainable food consumption. The section starts with global goals, ranging from the problem of hunger in many developing and emerging countries via questions of malnutrition to international climate targets. The term “triple burden” refers to the simultaneous occurrence of undernourishment, malnutrition and obesity. The consumption of animal products is increasing on a global scale and particularly strongly in many developing countries, which, due to the corresponding losses in processing, results in a significant increase in demand for agricultural goods. Section 4 starts by placing food consumption in Germany in its global context, not least because the demand for food in Germany has – via the global markets – repercussions on agriculture and food consumption in other countries. This is followed by an explanation of the four principal social problems: (1) the issue of the **health effects of food consumption**, which is key for many consumers, is explained. This section discusses what characterises health-promoting food consumption and gives an overview of the nutrition-related health situation in Germany. Particular consideration is given to the problem of sustainable food consumption in households afflicted by poverty and in vulnerable groups of people (pregnant women, infants, children, adolescents and senior citizens). (2) **Social problems regarding food production and manufacturing conditions** are addressed. (3) The main **environmental problems** caused by our food consumption are discussed and (4) the challenges arising in **animal welfare** are addressed.

It is immediately clear that a food policy that takes account of the four problem areas outlined in Section 4 raises **questions of measurement and evaluation**. Which foods are (more) sustainable? **Section 5** discusses three different frameworks of reference or perspectives: (1) the comparative assessment of different **farming systems**, (2) the assessment of different **dietary patterns and food groups** and (3) the comparison of different **food systems**. The first perspective (Section 5.2) focuses on the sustainability of agricultural production and asks, among other things, whether organic food is more sustainable than conventional products. The second perspective (Section 5.3) deals with

important food groups and dietary patterns, particularly from the viewpoint of health and environmental policy. The third perspective (Section 5.4) focuses on “alternative food systems”, i.e. other forms of agri-food production that are characterised by close interaction with consumers. All three perspectives demonstrate that not all of the recommendations for a more sustainable diet that are focussed on in media discussions are actually also sound and scientifically substantiated.

**Section 6** discusses the **legitimacy of governmental control of food consumption habits**. The state already intervenes in consumers’ food consumption habits, e.g. in the context of institutional settings such as school catering, but also through food labelling regulations. However, expanding the range of food policy instruments to include more interventionist control instruments is controversial. Section 6 examines the arguments for and against greater intervention in the food consumption habits of consumers. The section shows that, on balance, there are legitimate arguments supporting greater government control in this policy area.

Before concrete policy recommendations can be made in the two concluding sections, it is important to grasp the basic structure of food consumption as a policy field. **Section 7** therefore examines the **governance of the food system**. Consideration is given to key organisations and actors, their policy strategies, and the functioning of market and policy systems. The following are analysed in greater depth: (1) governance problems faced by the state, (2) governance problems in the innovation system, and (3) specific governance problems raised by certain instruments. These problems include catering in schools and preschools, consumption taxes and labels. Finally, rebound effects are discussed as a fundamental challenge to the governance of eco-friendly food consumption.

A coherent and effective food policy requires appropriate instruments. **Section 8** provides an overview of the **current state of the debate on various instruments**, where they take effect and what the current data situation on the effectiveness of these instruments is like, before discussing various implementation options. The WBAE takes the view that the success of food policy also depends to a large extent on the strategic and conceptual approach and thus on the organisation of the policy process and the coherence of an instrument mix.

**Section 9** covers the **policy recommendations** at federal, state and municipal levels and sheds light on the overall financial implications.

The subtitle of the expertise is: “Developing an integrated food policy and designing fair food environments”. This suggests two central findings.

- (1) **An integrated food policy comprises a parallel focus on all four central dimensions of a more sustainable diet:** health; social objectives; environmental protection and climate change mitigation; and animal welfare (cf. Sections 4 and 5). Food policy becomes even more challenging conceptually if it is to address these “Big Four” simultaneously (cf. Chap. 2). A

second meaning of “integrated food policy” is therefore that various different Federal Ministries (BMEL, BMG, BMU, BMAS, BMWi, BMBF, BMFSFJ) will have to cooperate even more closely in future (cf. Section 8).

**The food environment is paramount**, since many consumers are particularly motivated to behave in a sustainable manner particularly when it comes to food consumption, but are not always able to reflect and consciously weigh up how they behave (cf. Section 3) and, given today’s conditions, (must) repeatedly fail here. With this emphasis on the food environment, the expertise also rejects excessive moralising of consumption, which polarises between “right” and “wrong” food consumption and heavily individualises responsibility for problems, which in turn contributes to exacerbating problems through stigmatisation. The sustainable choice should be the easy choice, food environments should be fair – which requires more interventionist instruments (cf. Sections 6, 8 and 9).

## 2 Our own understanding of sustainability

This expertise aims to show how politics can help make food consumption more sustainable. This requires an understanding of what types of food consumption are more sustainable and what types are less sustainable. More sustainable food consumption is part of sustainable development. Against the backdrop of existing definitions of sustainability (Section 2.1), this section outlines an understanding of sustainable development as a regulatory idea (Section 2.2), which focuses on satisfying the basic needs of present and future generations (Section 2.3) whilst taking animal welfare into consideration as an additional criterion (Section 2.4). This is followed by a discussion of the challenges that such an understanding involves at the conceptual level (Section 2.5) and in practice (Section 2.6). Section 2.7 addresses the relationship between the understanding of sustainable development and more sustainable food consumption as set out here and in the following sections of the expertise.

### 2.1 Existing definitions of sustainable development and sustainable food consumption

The best known and most influential definitions of **sustainable development** include the so-called Brundtland definition, the so-called three-pillar model and the 17 sustainable development goals of the 2030 Agenda (Sustainable Development Goals, SDGs).

- The so-called **Brundtland report** (Hauff 1987: 43) characterises sustainable development on the one hand as a development “that meets the needs of the present without compromising the ability of future generations to meet their own needs.” On the other hand, “sustainable development would be a process of change in which the exploitation of resources, the direction of investments, the orientation of technological development and institutional change are all in harmony and enhance both current and future potential to meet human needs and aspirations”.
- The so-called **three-pillar model** goes back to the final report delivered by the Commission of Inquiry of the Federal German Parliament on “Protection of man and the environment – Objectives and framework conditions for sustainable development in the future” (Deutscher Bundestag 1998). This expertise stresses the necessity of “reconciling the, in part, rapid technological and economic change with the much slower traditional socio-political and socio-cultural structures and the ecological and natural processes, which in turn have their own regularities and speeds. (...) Due to the complex interrelationships between the three dimensions or perspectives of ecology, economy and social issues, they need to be treated in an integral manner. Figuratively speaking, this is not a question of bringing together three pillars that stand side by side, but of developing a three-dimensional perspective” (ibid.: 17 et seq.). The so-called three-pillar model was developed based on this report, presenting sustainability as a roof resting on

the three pillars of economy, ecology and social welfare. This model is highly influential in the public and also political debates.<sup>3</sup>

- The 2030 Agenda adopted by the United Nations in September 2015 contains **17 Sustainable Development Goals (SDGs)** with 169 associated targets. At the level of the international community, the SDGs replaced the Millennium Development Goals (MDGs) that had been in force previously. In contrast to the MDGs, the SDGs are addressed not only to developing countries but to all countries. Moreover, they no longer contain social goals alone, but instead integrate the main idea of sustainable development, namely that people need natural resources to meet their needs. The Federal Government aligned the new 2016 version of the German Sustainability Strategy with the 2030 Agenda and committed itself to implementing the 2030 Agenda.

The 2030 Agenda formulates a broad vision of sustainable development. Accordingly, the SDGs address different levels: the satisfaction of basic needs (e.g. 2: zero hunger; 3: good health and well-being), the relationships between people (e.g. 10: reducing inequality), the means by which basic needs can be satisfied (e.g. 6: clean water and sanitation), prosperity (e.g. 8: decent work and economic growth, 9: industry, innovation and infrastructure), institutions (e.g. 16: peace, justice and strong institutions) and the process of achieving the goals (17: partnerships for the goals).

The first international attempt to address **sustainable dietary habits** was a scientific conference organised by the United Nations' Food and Agriculture Organisation (FAO) and Bioversity International, a member of the Consultative Group on International Agricultural Research (CGIAR) for the protection of plant biodiversity, which was held in Rome in 2010. Sustainable diets were defined as follows: "Sustainable diets are those diets with low environmental impacts which contribute to food and nutrition security and to healthy life for present and future generations. Sustainable diets are protective and respectful of biodiversity and ecosystems, culturally acceptable, accessible, economically fair and affordable; nutritionally adequate, safe and healthy; while optimizing natural and human resources."<sup>4</sup> (Burlingame 2010).

The FAO High Level Panel of Experts on Food Security and Nutrition (HLPE) defined "food systems" in a similar way as "food system[s] that ensures food security and nutrition for all in such a way that the economic, social and environmental bases to generate food security and nutrition of future generations are not compromised" (HLPE 2014: 31).

---

<sup>3</sup> Cf. for example <http://www.ble.de/DE/Projektfoerderung/Foerderungen-Auftraege/Innovationen/Programm-BMEL/InnovationsfoerderungNachhaltigkeit.html> (last access: 04.12.2019), <http://www.bmub.bund.de/themen/bauen/bundesbauten/nachhaltiges-bauen/> (last access: 04.12.2019).

<sup>4</sup> In the original: "Sustainable Diets are those diets with low environmental impacts which contribute to food and nutrition security and to healthy life for present and future generations. Sustainable diets are protective and respectful of biodiversity and ecosystems, culturally acceptable, accessible, economically fair and affordable; nutritionally adequate, safe and healthy; while optimizing natural and human resources. The agreed definition acknowledged the interdependencies of food production and consumption with food requirements and nutrient recommendations, and at the same time, reaffirmed the notion that the health of humans cannot be isolated from the health of ecosystems." (ibid.).

## 2.2. Sustainable development as a “regulatory idea”

All the definitions of sustainable development mentioned in Section 2.1 are multidimensional in two respects: on the one hand, they take current and future generations into account and, on the other, they focus on (different) ecological, social and economic aspects. The fact that this multidimensionality opens up considerable scope for trade-offs is often not explicitly taken into account in the political use of the definitions, i.e. the fact that answers to the question of what sustainable development is “depend on time, situation (...), culture and knowledge” (Federal German Parliament 1998: 16) and that “the perceptions of problems and political priorities associated with the guiding vision (...) depend on the respective level of social and economic development” (ibid.) is overlooked.

Against this background, this expertise therefore uses the term “sustainable development” rather than “sustainability”: The guiding vision of sustainable development does not describe a specific target state that a particular society, or indeed any society, can achieve. Instead, it calls for the ongoing development of society to be made *more* sustainable.<sup>5</sup>

Secondly, this expertise does *not* claim to define sustainable development in a comprehensive way.<sup>6</sup> Instead, along the lines of the Commission of Inquiry, the Advisory Board understands sustainable development as a “‘regulatory idea’ (...) for which there can only be provisional and hypothetical interim provisions”.<sup>7</sup> The aim of the expertise is to distinguish between less sustainable and more sustainable types of food consumption in the German context and to point out how politics can contribute to making people eat more sustainably. The expertise therefore uses the term “sustainable development” and understands it as an open, broadly interpreted regulatory idea. In line with such an open, dynamic understanding, this expertise uses terminology such as “promoting more sustainability” or “greater sustainability”, avoiding the term “sustainable food consumption” in order not to evoke the (misguided) association that it is possible to conclusively define or realise “the (one, ultimate) sustainable diet”.

---

<sup>5</sup> Society is not static but is constantly evolving. Such a dynamic view of society is therefore more appropriate. Furthermore, this view alleviates a problem that arises from the multitude of existing definitions of sustainability: if one works towards a target state of “sustainability”, it is extremely problematic if different persons or groups involved in this work process interpret this target state differently. Even if it does not disappear completely, this problem becomes less relevant if the people involved endeavour to shape a development process (i.e. sustainable development) on an ongoing basis.

<sup>6</sup> For a comprehensive theoretical framework covering sustainable development – and thus also sustainable food consumption, cf. Ott & Döring (2008), Voget-Kleschin (2015), Voget-Kleschin & Meisch (2015).

<sup>7</sup> The Commission of Inquiry proposes defining “sustainable, future-proof development similarly to the positive and open concepts of freedom or justice as a ‘regulatory idea’ for which there can only be provisional and hypothetical interim provisions. (...) Sustainable, future-proof development is open to the extent that nobody could derive a generally binding target state of society from it. At the same time, it is binding insofar as a society can agree on variable guard rails which, if not complied with, will result in social developments that are obviously not felt to be viable for the future. On the other hand, this also definitely provides for the possibility of setting specific and binding targets to aim at, which have the character of milestones or interim goals and which, by being subjected to an ongoing review, retain the possibility of making choices on offer and decision-making processes at a later date.” (Federal German Parliament 1998: 16).

Thirdly, the Advisory Board thus acknowledges that it is not possible to distinguish a correct understanding of sustainable development from various false ones. What a person or group regards as sustainable or less sustainable at a particular point in time cannot be decided solely on the basis of factual information, but is always also based on value choices. This expertise identifies the relevant value choices and opens them to discussion.

### 2.3 Sustainability as a means of making it always possible to satisfy basic needs

In the view of the Advisory Board, satisfying the basic needs of people living now and in the future is central to sustainable development. This understanding of sustainable development follows on from two of the best-known and most politically influential declarations on sustainable development: the Brundtland report (Hauff 1987: 43) and the 2030 Agenda (UN 2015).

#### Text box 1: Basic needs

The question as to what a basic need exactly means is quite controversial (cf. from an ethical-philosophical perspective e.g. Max-Neef 1992, Alkire 2002, Qizilbash 2002, Crocker 2008). From a legal perspective, it is undisputed that the needs required for the physiological existence of human beings, such as in particular food, (basic) personal hygiene, clothing, heating and accommodation cf. Section 27a of the *Social Security Code* (SGB) XII; Section 20 SGB II. It is also undisputed that a certain physical and mental freedom must be possible, although the scope is not clearly defined either in case law or in literature, cf. BeckOK SozR/Knispel, 54<sup>th</sup> edition, 1.9.2019, SGB V Section 33 margin no. 13. The following four aspects are relevant for the context of this expertise:

- Firstly, all the authors mentioned agree that food consumption is obviously a basic human need. All human beings need a certain quantity of calories as well as certain amounts of macronutrients and micronutrients in order to stay alive and healthy (see Section 4.2). In addition, people have other food-related needs, such as the need to share meals with others or the need for positive reinforcement and social recognition expressed through and with food (cf. Section 3.1.4). Whether these needs are basic needs cannot be answered at this point. In many regions of the world, people cannot, at present, satisfy their basic needs in terms of a specific quantity of calories, macronutrients and micronutrients. What this means for a policy aiming at more sustainable food consumption is that it must not disregard the global perspective. The way in which we produce and consume food is relevant to whether people in other regions of the world are able to feed themselves adequately (cf. Section 4.1). In Germany, too, there is poverty-related malnutrition and in some cases hunger, as well as limited socio-cultural participation regarding food-consumption needs (cf. Section 4.2.3). Thus, even in Germany, certain population groups cannot adequately satisfy their basic needs regarding food consumption. This is partly due to poverty (cf. Section 4.3.2), but also partly due to overall conditions that make it hard for people to successfully satisfy their basic needs for health-promoting food consumption, irrespective of their income (cf. Section 3).
- Secondly, all the above-mentioned authors assume that people have several different basic needs (Max-Neef 1992, Alkire 2002, Qizilbash 2002, Crocker 2008). This also results in potential trade-offs between the satisfaction of different basic needs. The resolution of such trade-offs requires value-based decisions (cf. Section 2.6).

- Thirdly, the question of what is deemed an appropriate way of satisfying basic needs can only be answered depending on the socio-economic situation of a country. For example, the legislator did not remove the categories of tobacco and alcoholic beverages from the standard benefits of the Hartz IV rates until 2019. Until then, these categories had been regarded as an expression of the socio-cultural minimum to enable the socially expected sharing in these “social drugs”. On the other hand, a discussion took place in Germany as to whether an internet connection and access to an internet-capable computer should be regarded as part of the socio-cultural minimum subsistence level, which was to enable people to satisfy basic needs connected with participation in social, cultural and political life. Given that the question of what a person needs to satisfy his or her basic needs depends on what people have in their environment (e.g. in the country or region where they live), poverty in wealthy countries like Germany is mostly measured in relative terms (cf. Section 4.2.3). With regard to food consumption, the question arises, for example, whether in a country like Germany basic food-consumption needs also include inviting friends to dinner once a month or visiting a restaurant (cf. Section 4.2.3).
- Fourthly, many authors regard the ability to decide, within limits, how to spend one’s life, as an important basic need (cf. e.g. Nussbaum 2007, Sen 2007). A diet that – in the light of the general freedom of action – illegitimately restricts the satisfaction of this basic need – for example through very strict political requirements, cannot be considered more sustainable. This does not answer the question of to what extent the state may intervene in eating habits (cf. Section 6). However, it does show that a discussion of this question is necessary to understand what constitutes more sustainable development.

More sustainable development requires different, more sustainable food consumption, because people harm themselves and others through the way they eat (in Germany today) (Fig. 2-1).

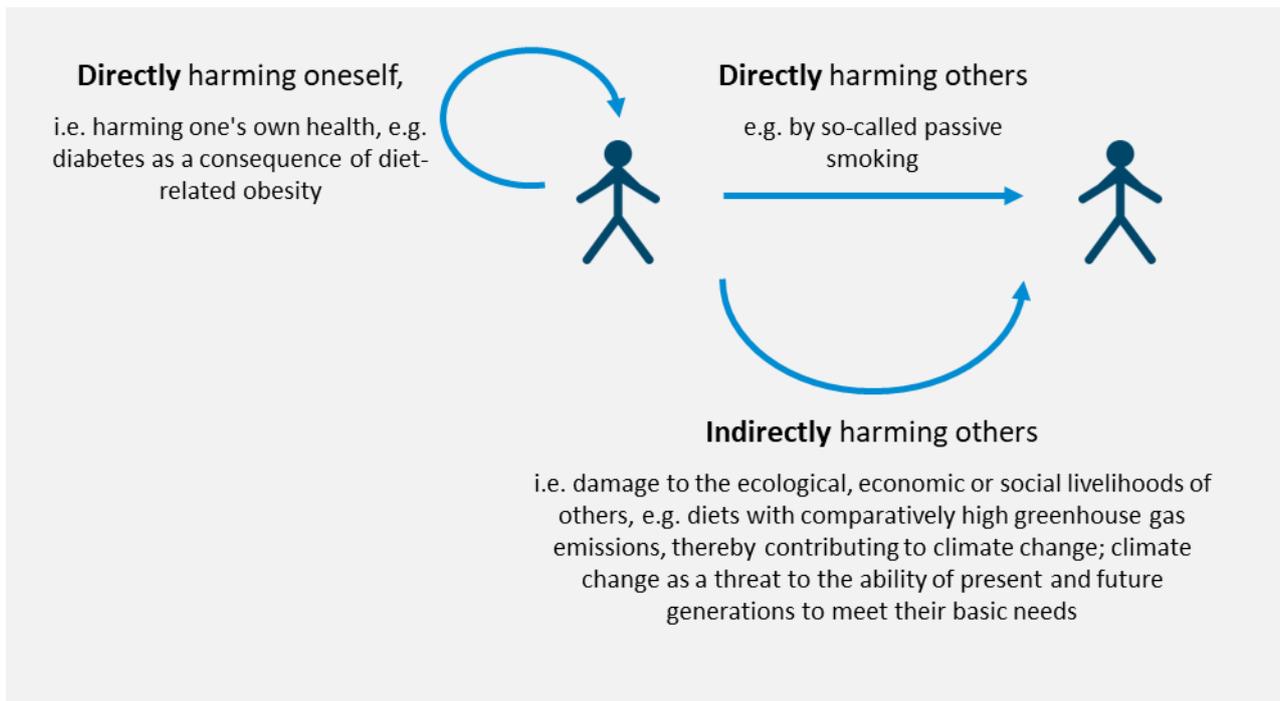
Firstly, people can jeopardise their *own* ability to satisfy their basic needs today and/or in the future through the consumption of food, beverages and tobacco. For example, the consumption of certain substances endangers their own current<sup>8</sup> or future health, e.g. if food consumption-related obesity increases the likelihood of suffering from diabetes in the future.

Secondly, people can directly harm others through the consumption of food, beverages and tobacco. A smoker, for example, harms those around him by exposing them to so-called passive smoking.

---

<sup>8</sup> Alongside drugs and excessive intake of alcohol, the excessive consumption of specific foods (for example Cassia cinnamon, nutmeg, bitter almonds and saffron) can also result in acute health risks.

**Figure 2-1:** Three ways of harming people through one's own consumption of food, beverages and tobacco



Source: WBAE illustration.

Finally, the consumption of food, beverages and tobacco can indirectly harm others.<sup>9</sup> For example, the ecological effects associated with certain diets are relevant because they indirectly harm other people. Thus, the production of certain foods causes comparatively high greenhouse gas emissions and therefore contributes to climate change. Climate change, in turn, is a process that threatens the ability of people living in the present and future to meet their basic needs. Most of the negative effects that group A's food consumption has on *others* takes the form of such indirect negative impacts.

<sup>9</sup> Directly harming one's own health can also indirectly harm others. This is the case, for example, if the health effects of the diet cause high economic costs due to the fact that such negative effects are covered by the social security system. Cf. Section 6.2.1 on the economic costs incurred through obesity.

In the light of this understanding of sustainable development, a particular diet would be considered **more sustainable** if, *on the one hand*, it satisfied the basic needs with respect to food consumption<sup>10</sup> of individuals living today and, *on the other hand*, does so in a way that threatens the ability of the current and future population to satisfy their basic needs *less* than current diets.<sup>11</sup>

*On the one hand*, a more sustainable diet should, for example, be “culturally acceptable, accessible, economically fair and affordable, nutritionally adequate, safe and healthy” (Burlingame 2010), and *on the other hand*, sustainable diets are those diets “with low environmental impacts which contribute to food and nutrition security and to a healthy life for present and future generations” (ibid.).

The understanding, underlying this expertise, that sustainable development aims to make it possible for people living in the present and future to satisfy their basic needs, to cause less damage to them or even to promote them, has (at least) three functions in the context of this expertise. Firstly, this understanding allows demands for cultural acceptability, economic fairness, nutritional adequacy, and also for a reduction of negative environmental impacts to be *justified*: these demands are important because and insofar as they contribute to the ability of people living in the present and future to satisfy their basic needs. In concrete terms:

- People should be able to eat a health-promoting diet (cf. Section 4.2) because the possibility of eating a health-promoting diet is a basic need. But people should also be able to meet their other food-related needs. This expertise therefore emphasises the importance of a food environment that is based on our human perception and decision-making possibilities as well as behaviour.
- The conditions under which people produce foodstuffs should be such that the possibilities of these people to satisfy their basic needs are not restricted. This includes at least the fact that certain basic norms are observed, such as the prohibition of child and (slave-like) forced labour (cf. Section 4.3).
- Natural resources, which are necessary to enable people to satisfy their basic needs both now and in the future, must be preserved in the long term. What resources are absolutely essential for this, and whether and to what extent parts of the so-called natural capital can be replaced by knowledge, technical innovations, etc., is the subject of an intensive debate on “strong” vs. “weak” sustainability (cf. Section 2.7.1, e.g. Neumayer 2010). This expertise assumes that if the “planetary boundaries” continue to be exceeded, people will not be able to satisfy their basic needs in the long run, either now or in the future. In this sense, the environmental impacts of

---

<sup>10</sup> In addition to the basic need for food, a certain way of eating also contributes to the satisfaction of other basic needs, for example to the satisfaction of the need for relationships with other people or social participation, insofar as food is a social process, or to the satisfaction of a need for self-expression/expressivity or autonomy, insofar as food is an expression of one's own ego (see text box 1 “Basic needs”). Therefore, the definition does not use the phrase “need for food consumption”, but “needs with respect to food consumption”.

<sup>11</sup> This definition is obviously based on the Brundtland definition of sustainable development and is similar to the HLPE definition of a sustainable diet (cf. Section 2.1).

food production and consumption that contribute to the “planetary boundaries” being exceeded are not deemed sustainable (cf. Section 4.4).

Secondly, this understanding of sustainability allows *limits* to be imposed on the corresponding demands: negative ecological, economic or social impacts due to food consumption are only relevant insofar as they affect the ability of people living in the present and future to satisfy their *basic needs*. The demand to avoid or reduce certain negative impacts arising from food consumption is therefore not an end in itself, but is justified by the fact that it contributes to the ultimate goal of satisfying basic needs.

With regard to the environmental dimension, sustainable development requires, for example, the protection of natural resources, i.e. those aspects of the natural environment that are necessary in order to satisfy basic human needs. While this reasoning can justify many (possibly even all) targets concerning the protection of environmental media, it does not justify all objectives of nature conservation. For example, the preservation of grassland can certainly be justified by the demand for sustainable development – because the preservation of grassland makes a key contribution to climate change mitigation, and climate change mitigation is necessary so that humans in the present and future can satisfy their basic needs. The return of certain large mammals such as the lynx and wolf to certain regions is, on the other hand, a great success in terms of nature conservation – but it is more difficult to make a clear connection with the satisfaction of basic human needs.<sup>12</sup>

This expertise also relates institutional and procedural goals to the ultimate goal of satisfying basic needs: whether certain institutions or a certain way of structuring processes are necessary or beneficial for sustainable development is thus gauged by the extent to which these institutions or this way of structuring processes contribute better to enabling people in the present or future to satisfy their basic needs than alternative institutions or processes.<sup>13</sup>

Thirdly, the definition of more sustainable food consumption on which this expertise is based refers to the satisfaction of basic needs rather than to the satisfaction of all needs or even preferences: people can directly and indirectly harm others by the way they organise their lives in various fields of need (food consumption, mobility, housing, etc.). Policies for sustainable development aim to prevent such harm to current and future populations. This expertise is based on the assumption that such a policy for sustainable development cannot be achieved by controlling the supply side

---

<sup>12</sup> One argument that attempts to establish such a reference is based on the assumption that the preservation of human livelihoods is based on providing a wide range of ecosystem services and that, in order to safeguard these ecosystem services in a stable manner, it is imperative that all biodiversity that still exists today should be preserved (Ott 2008). However, it is not readily apparent what necessary contribution the existence of lynxes and wolves in Germany/Central Europe would make to ensure ecosystem services that can plausibly be regarded as non-substitutable human livelihoods.

<sup>13</sup> This expertise uses the terms “sustainable development” and “promoting more sustainable food consumption” to express the fact that it is not meaningful or even possible to label a particular state as “sustainable”. Societies are constantly evolving and sustainable development aims to change decision-making processes and institutions in terms of better satisfying basic needs.

alone, but must necessarily also take account of the demand side<sup>14</sup>. A policy for sustainable development can, may and should (cf. Section 6) intervene to a certain extent in the way we shape our diets in order to protect others from harm.

The focus on basic needs has a double function in this context: on the one hand, it justifies the necessity and legitimacy of such interventions. A policy for sustainable development is necessary and legitimate, if not imperative, where people that could potentially be affected by damage are indeed so badly harmed that they are no longer able to satisfy their *basic* needs. If they are merely restricted in satisfying needs or preferences that go beyond basic needs, this does not suffice – especially as justification for interventions on the demand side.

On the other hand, the focus on basic needs also has a protective function: in the light of the basic right to a socio-cultural subsistence level, basic needs must be guaranteed by the state without limitation and at all times (Martinez Soria 2005). The focus on basic needs provides protection for us, i.e. the people that are affected today by policies promoting sustainability in food consumption, for example protection from inadequately justified interventions in our lifestyles: interventions may only be made to an extent and in a manner that will continue to enable those affected by these interventions to meet *their* basic needs. The concept of basic needs is broadly defined here, i.e. the expertise assumes that basic needs also encompass needs for social affiliation and autonomy (see text box 1 “Basic needs”). The above-mentioned protective function therefore also includes demands such as that food consumption with greater sustainability must be culturally acceptable and that policy measures that not only foster but also demand food consumption with greater sustainability must not violate a basic need for autonomy.

## 2.4 Satisfying basic needs in the context of SDGs

The 2030 Agenda includes 17 SDGs<sup>15</sup> that are described as “indivisible and integrated” (United Nations 2015: 3). In order to answer the question of what sustainable development means for a specific problem area (in this case food consumption) or policy area (in this case food policy), the co-

---

<sup>14</sup> Closely related to the distinction between supply-side versus demand-side policies are the terms efficiency, consistency and sufficiency. Efficiency and consistency aim to “deliver the same benefits in a more eco-friendly manner: efficiency, by quantitatively reducing the resource input or emission output in producing the same set of benefits. Consistency, by qualitatively modifying the resource input or emission output through new technologies – so that they can be embedded in natural cycles” (Fischer & Griebhammer 2013). A typical example of a consistency measure is the substitution of fossil fuels with renewable energies. Sufficiency refers to “changes in consumption patterns that help to remain within the limits of the earth's ecological carrying capacity, whereby aspects regarding the benefits of consumption change” (ibid.). The distinction goes back to the so-called IPAT formula (cf. Meadows et al. 2005), which defines the human influence on the environment (Impact, I) as the product of population size (Population, P), standard of living (Affluence, A) and the level of technological development (Technology, T) and points out that sustainable development strategies could address each of the three factors, i.e. curb population growth, address the standard of living (sustainable lifestyles, i.e. sufficiency) and strive for technical solutions (efficiency, consistency).

<sup>15</sup> For an overview cf. [http://www.bmz.de/de/themen/2030\\_agenda/index.html](http://www.bmz.de/de/themen/2030_agenda/index.html).

existence of different objectives at different levels poses a major challenge: For example, it is neither possible nor desirable to place sustainable food consumption solely in the context of Goal 2, which is the goal primarily related to food consumption: “End hunger, achieve food security and improved nutrition and promote sustainable agriculture.” On the contrary, food consumption is relevant to the implementation of all SDGs, and the implementation of many of the goals in turn affects the social and individual ability to feed oneself.<sup>16</sup>

If, on the other hand, the various prerequisites, conditions and implications of food consumption were to be assigned to different SDGs (e.g. food production to Goal 2, working conditions to Goals 5 and/or 8, environmental implications of food consumption to Goals 14 and/or 15), this would hamper an integrated view of the entire problem or policy area.

In addition, many measures aimed at enhancing sustainable food consumption can be called into question regarding whether they impair one of the other 17 goals. This is not to say that some goals (e.g. Goals 8 or 10) are less important than others (e.g. Goal 2) or that certain measures cannot benefit several goals at the same time. A comprehensive transition towards sustainable development, as envisaged by the 2030 Agenda, should be geared to the achievement of all objectives. However, a (too) direct reference to individual goals may well lead to a situation where a measure that is beneficial for one goal can be rejected with reference to other, equally important goals. For example, measures aimed at curbing the consumption of animal products, which (may) lead to job losses in the livestock sector, could be rejected with reference to the goal of “sustainable economic growth and full and productive employment” (as part of Goal 8). A tax on sugar-containing drinks aimed at preventing diet-related illnesses could also be rejected, for example, with reference to the fact that this would change the price structure and hit less well-off people harder, thus contradicting the objective of “reducing inequality within (...) countries” (as part of Goal 10).

For this reason, this expertise does not directly refer to the SDGs but to an understanding of sustainable development that is based on satisfying basic needs. Understanding sustainable development with a focus on one central goal (the satisfaction of basic needs) allows, firstly, to put the above-mentioned levels (basic needs, means of satisfying basic needs, institutional goals, procedural goals) into perspective by relating them to the central goal. Secondly, a reflection on how one’s own eating habits can harm or enhance other people’s ability to satisfy their basic needs (Fig. 2-1) makes it possible to justify which dimensions are central to sustainable development and how these are interrelated. It thus enables or simplifies an integrated view of the problem or policy area of “promoting more sustainable food consumption”.

Such an integrated view is, of course, also possible in the context of the SDGs themselves. It would, however, not just require a reference to the SDG that appears relevant to be made for each problem description and each recommendation of measures; it would also be necessary each time to

---

<sup>16</sup> Cf. <http://scalingupnutrition.org/wp-content/uploads/2016/06/VISUAL-EN.jpg>.

ask which of the other 16 SDGs this problem description or recommendation of measures is relevant to and what each of these other 16 SDGs entails regarding the respective problem description or recommendation of measures. The goal of permanently ensuring that people living in the present and future are able to satisfy their basic needs is in some ways less ambitious than the goals formulated in Agenda 2030. Nevertheless, as this expertise shows, even this foundation, which at first glance appears to be less challenging, allows far-reaching demands to be formulated with regard to promoting sustainability in food consumption. In *conceptual* terms, the reference to the concept of basic needs (which is simple compared to the 2030 Agenda) makes it easier to relate the various sections of the expertise back to a common, shared understanding of sustainable development. Insofar as this understanding of sustainable development as a permanent possibility for satisfying basic needs is fully covered by the 2030 Agenda and differs from it only in that it demands less than the SDGs, most of the statements contained in this expertise can be related to an understanding of sustainable development as set out in the 2030 Agenda. In this sense, the reference to basic needs in the context of this expertise can be seen as a heuristic tool in order to operationalise the 2030 Agenda for the problem or policy area of “promoting more sustainable food consumption”.<sup>17</sup>

The expertise goes beyond this basic-need position in two key respects: firstly, this expertise considers the satisfaction of the basic needs of farm animals, i.e. animal welfare, as a relevant dimension of sustainable development and food consumption. The following section (2.5) specifies the reasons for this. Secondly, with respect to the social dimension of food consumption (i.e. the question of the well-being of people involved in food production and trade), this expertise does not solely discuss whether these people are able to satisfy their basic needs. Beyond this focus on minimum social standards (the so-called protection perspective, cf. Section 4.3.1), the expertise also discusses wider objectives, especially the alleviation of social inequality and the realisation of social justice (the so-called justice perspective, cf. *ibid.*). Thus, this justice perspective notably follows up on SDGs 8 “Decent Work and Economic Growth” and 10 “Reduces Inequalities”, which are particularly relevant to the context of promoting more sustainable food consumption in general and specifically to the social dimension of greater sustainability in food consumption (cf. Section 4.3).

## 2.5 Animal welfare as an additional sustainability criterion

The understanding of greater sustainability in food consumption which has been developed in this section is related to the satisfaction of human needs. At various points, but especially in its expertise on livestock farming, the WBAE has firmly advocated that agri-food policies should take greater account of the needs of farm animals (WBA 2015). In addition to the above criteria for food con-

---

<sup>17</sup> Here, an understanding of sustainable development as permanently maintaining the possibility of satisfying basic needs only implies the following: in cases in which two demands (a and b) arising from the SDGs conflict and only one demand (a) refers to the permanent maintenance of the possibility of satisfying basic needs, but the other demand (b) is justified by objectives that go beyond the satisfaction of basic needs, the general rule is that (a) takes precedence over (b).

sumption to be deemed more sustainable, this expertise therefore assumes that greater sustainability in food consumption can only be considered desirable if it does not worsen the ability of farm animals to satisfy their needs or, ideally, contributes to their improvement.

In this expertise, the WBAE does not consider the ability of farm animals to satisfy their basic needs as an integral part of sustainable development, but as an additional criterion. The reason for this is that it is ethically difficult to justify *at one and the same time* that the basic needs of sentient animals have a similar moral status to those of humans *and* that it is morally acceptable to keep sentient farm animals in order to kill them.<sup>18</sup> This will be briefly outlined in the following.

A basic question of ethics is what beings we should consider in moral terms.<sup>19</sup> Anthropocentric<sup>20</sup> positions assume that we must only consider humans in moral terms. Sentientist<sup>21</sup> positions assume that we should also act morally towards sentient animals and thus also towards farm animals.<sup>22</sup> Within sentientism, gradualist positions can be distinguished from egalitarian positions (Bossert 2014, 2015, Krebs 2016).

If an **egalitarian position** is adopted, all individuals who have moral status are equally entitled to it. This does not mean that we should treat them equally. For example, mandatory schooling or voting rights for sentient animals obviously make little sense. Rather, an equal moral status means that the interests of humans and sentient animals should be considered equally (cf. Ott 2003). Well, it is quite plausible to assume that sentient animals, at a basal level, have similar interests to humans, i.e. that they have an interest in living in self-chosen family groups for as long as their species-specific life expectancy allows (Nussbaum 2007). An equal consideration of these interests is not compatible with how and why we keep farm animals today. Even major improvements in husbandry conditions – as proposed by the WBA (2015) – would not change this conclusion. There are approaches to husbandry systems that attempt to strike a balance between the need for equal consideration of animal interests on the one hand and the possibility of keeping animals for pro-

---

<sup>18</sup> This problem is further exacerbated if the circle of entities that are to be taken into moral consideration is further extended and if, for example, plants or supra-individual entities such as species or even “biodiversity” are accorded a moral status. The question then arises to what extent agriculture would be admissible at all (cf. Voget-Kleschin & Hampicke 2016).

<sup>19</sup> In ethics, a distinction is made between moral agents and the recipients of morals, the so-called moral patients. Moral agents are people who are cognitively capable of morality (e.g. not babies, children, mentally handicapped or people suffering from dementia). The “we” in the above sentence refers in this sense to the group of moral agents. Moral patients, on the other hand, encompass the group of beings to whom moral agents are obliged to act morally, e.g. to not harm them. The group of moral patients is also called the moral community.

<sup>20</sup> The term goes back to the Greek “anthropos” (human) as well as the Latin “centrum” (centre)

<sup>21</sup> The term goes back to the Latin “sentire” (feel) and describes the group of sentient beings. Most authors assume that mammals and birds definitely belong to this group (cf. for example Regan 2003); some also include fish (cf. Wild 2012). In addition to the sentientist positions mentioned here, which are based on the argument that animals have a moral intrinsic value, there are also approaches in the literature dealing with animal ethics that are sensitive to pity (cf. Schopenhauer 1977), virtue (cf. Hursthouse 2011), care (cf. Donovan & Adams 1996) and context (cf. Palmer 2010).

<sup>22</sup> In (environmental) ethics there are, in addition to the above-mentioned, further positions regarding the question of which beings (or entities) belong to the moral community and which do not (Ott et al. 2016).

ductive use on the other, but they go far beyond what is commonly understood today as high animal welfare standards. At the conceptual level, Grimm et al. (2016: 81), for instance, point to the “basic idea of assuming moral responsibility towards individuals”. Ahimsa holdings in Great Britain, which produce so-called slaughter-free milk, provide a practical example of this. On these holdings, neither bull calves nor bulls or dairy cows are slaughtered and the calves are kept together with the cows (<https://www.ahimsamilk.org/who-we-are/>).

If a **gradualist position** is adopted, moral status is graded in line with specific characteristics. This almost always goes hand in glove with the view that humans have a higher moral status than animals. Such a view allows the interests of humans to be considered more relevant than those of animals, regardless of whether they are fundamental interests (survival) or less fundamental (appetite for meat). From the perspective of a gradualist position, the husbandry and killing of farm animals therefore need not be rejected. At the same time, a gradualist position permits the demand for improvements in husbandry conditions, because farm animals are considered sentient and their sensations are considered morally relevant. However, the justification of a gradualist position poses problems. Sentientist positions assume that animals should be given moral consideration because of their sentience. In order to justify gradualism, this sentience must be further differentiated. In order to justify that animals have a lower moral status than humans, gradualist sentientists point out that certain abilities are less pronounced in animals than in humans. Abilities that are often referred to in this context are, for example, reason, language, awareness of the future or self-awareness. The problem with this argumentation is that it is always possible to find groups of people who also do not possess these abilities or only to a small extent. Typical examples include infants and toddlers, people suffering from dementia or mentally handicapped people. But if one now wants to justify that these people should not be treated like animals with reference to the lesser extent of their abilities, which have been proven to be morally relevant, one can only point out that they are human beings and not animals. Such a position, however, exposes itself to the accusation of so-called speciesism. The term “speciesism” is used by animal ethicists in analogy to the terms racism and sexism. They use it to point out that the idea that human beings are superior to others because they have a certain origin (racism) or gender (sexism) is based on the same mechanism as the argument that human beings are superior to others because they are human beings (and not animals). In all three cases, moral significance would be attributed to a (morally) irrelevant characteristic (origin, gender, being human) (Singer 1975).

The presentation of ethical positions regarding animals in this section is greatly abridged and does not do justice to the wide range of the (animal-related) ethical discussion. What it is intended to show is the following: The ethical justification of a position which on the one hand allows the husbandry and killing of animals, but on the other hand provides an ethically stringent justification for demands to improve the conditions under which animals are kept, is not trivial. However, the WBAE adopts such a gradualist sentientistic position and has comprehensively elaborated it in its expertise, pathways to a socially accepted livestock husbandry.

This expertise takes sustainable development to mean a development which permanently maintains the ability of all people to meet their basic needs. The WBAE regards it as very important that farm animals can satisfy their basic needs. This assessment is also enshrined in the Basic Law as the national goal of “animal welfare”. However, the WBAE considers the satisfaction of the basic needs of farm animals to be subordinate to the satisfaction of the basic needs of humans. The latter is an expression of human dignity, which is defined as a key basic right in the Basic Law and as illimitable. Animal welfare, on the other hand, being a mere national objective, does not enjoy comparable protection in our value system. In case of conflict (i.e. only in case of conflict with basic human needs), the basic needs of farm animals must therefore take a back seat.

It is not possible in the context of this expertise to explore more precisely the implications of a gradualist sentientist position for a conception of sustainable development. For this reason, the WBAE treats the demand for an enhancement of the conditions under which farm animals are kept as an **additional**, but equally central criterion of sustainable development, which is not, however, justified in this expertise with reference to the chosen understanding of sustainability.

## 2.6 Multidimensionality, comparability and trade-offs

The understanding of sustainable development on which this expertise is based is multidimensional in several respects: it comprises the demand for the satisfaction of *different* basic needs and it comprises the demand for the satisfaction of these basic needs for *different* people (both current and future populations). Thus, the satisfaction of these basic needs is, as a rule, not substitutable but complementary.

This means, firstly, that the satisfaction of one basic need (e.g. the basic need for food) cannot be offset by or compared with the satisfaction of another basic need (e.g. the basic need for medical care).<sup>23</sup> This makes comparisons between situations in which different basic needs are met more difficult.<sup>24</sup>

---

<sup>23</sup> The two basic needs cannot be reduced to one form of measurement (lat. mensura), as they are incommensurable. This does not mean that the satisfaction of different basic needs cannot interact – for example, people who are not well-nourished are more susceptible to illnesses and people suffering from certain diseases (and, also, other groups such as pregnant women and small children), cf. Sections 4.2.2.2, 4.2.2.3) require a different diet from that required by healthy people.

<sup>24</sup> At the conceptual level, comparisons can only be made between situations that differ only in terms of the fulfilment of a particular basic need but that are exactly the same in terms of the fulfilment of all other basic needs. In practice, of course, it is also necessary to take decisions that are not based on such easily decidable comparisons. In practical terms, this is, as laid out further below in the expertise, a challenge in respect of environmental labelling, for example, as there is as yet no accepted method to make a comparative assessment of the various ecological dimensions (climate, biodiversity, etc.) (cf. Sections 5.3.3 and 8.9.).

Secondly, this may result in trade-offs.<sup>25</sup> Given that the concept of sustainable development requires the satisfaction of the basic needs of different people (current and future populations), and because the concept of basic needs encompasses several dimensions that cannot be offset (i.e. incommensurable), trade-offs cannot be explained away at the conceptual level. For if one were to argue that it is admissible to improve the satisfaction of the basic needs of A at the expense of the satisfaction of the basic needs of B, one would implicitly drop the principle according to which satisfaction of the basic needs of *all* people living in the present and future is equally important. It would then become difficult to justify at the conceptual level why it is not also legitimate to satisfy the basic needs of many people by totally sacrificing the satisfaction of the basic needs of a few people.

When it comes to practical implementation, societies must of course find a way of dealing with trade-offs. The first step is to check whether a situation is actually a trade-off. At the conceptual level, such a trade-off only exists if the satisfaction of the basic needs of A limits the possibility of satisfying the basic needs of B. If, on the other hand, a basic need conflicts with a need that goes beyond basic needs or with preferences, the satisfaction of the basic need would prevail.

Beyond that, it is important to distinguish between basic needs and strategies for satisfying needs<sup>26</sup>. Sometimes, basic needs can be satisfied in different ways, and it may be legitimate to satisfy a basic need in a different manner than previously. For example, making food consumption more sustainable aims to satisfy food needs in a different (i.e. more sustainable) way. To the extent that it satisfies nutritional needs, more sustainable food consumption should be, for example, “culturally acceptable, accessible, economically fair and affordable, nutritionally adequate, safe and healthy” (Burlingame 2010). However, if, for example, the consumption of animal products is only one possible way of satisfying nutritional needs, a more sustainable diet may well be characterised by cutting the intake of animal products.<sup>27</sup>

Another important point in dealing with trade-offs, which relates not only to the conceptual level, is what is colloquially called “you cannot do nothing” or “no decision is also a decision”. If no change is made to a situation in which the satisfaction of A’s basic needs limits the satisfaction of B’s basic needs, then this is tantamount to a decision to put A in a better position at the expense of B. If there is a trade-off, leaving everything as it is is as much a decision or positioning as the decision to change something.

---

<sup>25</sup> The prioritisation of different goals can also be subsumed under the term “trade-offs between objectives”, insofar as the non-priority/ lower priority objectives are initially achieved only in part or not at all.

<sup>26</sup> So-called satisfiers, cf. Max-Neef (1992).

<sup>27</sup> Exceptions apply to people for whom a high consumption of animal products is a vital part of their (cultural) identity. For such people it could be argued that curbing the consumption of animal products violates basic needs associated with cultural identity or ethnicity. Such arguments are discussed in particular with respect to the way of life and food consumption of indigenous peoples such as the Inuit or Masai.

Societal value decisions are required wherever such trade-offs exist – i.e. choices that should be factually correct, but are ultimately made on the basis of value convictions.<sup>28</sup> From a scientific point of view, it is important that such decisions are made transparent as value decisions, and that the underlying values are made explicit and thus opened to discussion (Ott 1997). In a democracy it is essential that such value decisions are made through democratically legitimised procedures.

To recapitulate: Given that sustainable development requires the satisfaction of the *different* basic needs of *different* people (current and future populations), and because these basic needs cannot be offset, it is first of all difficult to compare situations in which certain basic needs of certain people are met but others are not, and secondly the possibility of trade-offs arises. Bearing this in mind, the understanding of sustainable development on which this expertise is based is complex and its implementation is not easy. It necessitates value decisions and thus intensive debates (deliberative processes) in a democracy.

In this context, it is important to acknowledge that all existing understandings of sustainability (even those that are completely different in substance) are multidimensional, at least in the sense that they take into account the needs, abilities, rights, basic goods or livelihoods of different people. Multidimensionality, lack of comparability and the possibility of trade-offs are therefore not specific characteristics of the understanding of sustainable development underlying this expertise, but challenges to which any understanding of sustainable development must be able to respond.

## 2.7 Operationalisation as a challenge

Operationalising a complex concept such as sustainable development poses a number of challenges. A distinction can be made between structural and contingent challenges. Structural challenges are challenges that arise from the structure of the problem itself, i.e. in this case from the claim to make a complex, multidimensional normative concept measurable. Structural challenges can and must be tackled, but they cannot be “got rid of once and for all”.

In contrast, contingent challenges result from the currently existing contingent (i.e. real but not necessary) situation. They can therefore be resolved by modifying the situation. A typical example,

---

<sup>28</sup> Although value decisions are made on the basis of value convictions, they are not independent of facts. For instance, the demand that all people should be placed in a position to meet their basic needs now and in the future is a value decision, and there are people who do not share this value decision but assume that it suffices if people of their own nationality or ethnicity can meet their basic needs. If, however, the statement that all people should be able to satisfy their basic needs is invoked as an argument for the call to reduce greenhouse gas emissions in order to contribute to climate change mitigation because climate change mitigation threatens people's livelihoods, then descriptive information feeds into this call, e.g. information on the relation between anthropogenic greenhouse gas emissions and climate change or on the relation between climate change and specific human livelihoods, such as the (climatic) possibility of engaging in farming. If the descriptive information on which a normative demand or argument is based is incorrect, it devalues the demand or argument. For example, if anthropogenic greenhouse gas emissions did not contribute to climate change, this would render the demand that we should reduce greenhouse gas emissions in order to contribute to climate change mitigation meaningless. For a detailed discussion of the role of descriptive assumptions in ethical judgements cf., for example, Dietrich (2009).

which is also relevant to the operationalisation of sustainable development, is lack of knowledge (or lack of data); this can be remedied by research (or the collection of data). Table 2-1 summarises the structural and contingent challenges that arise in the course of operationalising the understanding of sustainable development set out in this section.

**Demarcation of bases of human life (What should be measured?).** Since future humans do not exist today, it is not yet possible to measure whether and to what extent their basic needs will be met. Almost all customary indicators of sustainable development therefore do not directly relate to the satisfaction of basic needs,<sup>29</sup> but to the preservation of the ecological, economic and social bases of human life. The associated structural challenge is first of all to ascertain what can and cannot be regarded as (part of) the ecological, social and other bases of human life. In the sustainability sciences, for example, there is a broad debate on which aspects of nature should be classified as natural capital, i.e. the ecological bases of our existence to be preserved for future human beings, or more specifically, whether, for example, all of biodiversity should be regarded as part of the ecological bases of our human existence in the sense that its preservation is necessary so that future humans can meet their basic needs.<sup>30</sup>

**Table 2-1:** Structural and contingent challenges of operationalising sustainable development

<b>Structural challenges</b>	
•	Delimitation of human livelihoods
•	Substitutability versus incommensurability
•	Choice of indicators
•	Choice of system boundaries
<b>Contingent challenges</b>	
•	Poorly established indicator (research) or underconceptualised dimension
•	Insufficient availability of data

Source: WBAE presentation.

**Substitutability versus incommensurability.** The ecological, economic and social bases of human life are multidimensional in themselves, i.e. they encompass various aspects. For example, the ecological bases of human existence, i.e. the ecological conditions that must be met to enable people to meet their basic needs now and in the future, certainly include certain climatic conditions, water availability and fertile soils. The fact that the bases of human life comprise various aspects raises the question of whether or which of these individual aspects can be substituted for each other. This question arises firstly within, for example, the ecological bases of our existence. For example,

<sup>29</sup> For example, if an understanding of sustainability does not focus on basic needs, but rather on capabilities, rights, basic goods or the like, these capabilities, rights or basic goods.

<sup>30</sup> Cf. the work of the Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services (IPBES), <https://www.ipbes.net/> on this issue.

one can ask whether it is imperative to preserve an ecosystem that provides certain ecosystem services necessary for the fulfilment of basic needs, or whether it is permissible for another ecosystem to evolve in the corresponding area as long as it provides equivalent ecosystem services. Secondly, the issue of substitutability also arises between, for example, ecological and economic bases of life. In this respect, there is a broad-based debate in the sustainability sciences as to whether natural capital (in the sense of ecological bases of human existence) can be substituted by other capital (especially physical capital). This discussion is entitled “strong” vs. “weak” sustainability (Neumayer 2010).

Substitutability and lack of offsettability (i.e. incommensurability) are in a sense two sides of the same coin: if A can be substituted by B, this implies that A and B can be given a commonality.<sup>31</sup> For instance, in relation to the above-mentioned question of when it is admissible to substitute one ecosystem with another, the ecosystem services that are provided by both ecosystems and are necessary to fulfil basic needs constitute such a commonality. If, on the other hand, certain aspects cannot be substituted for each other, this means nothing other than that they cannot be offset, i.e. they are incommensurable. This results in the challenges mentioned above (Section 2.3) and below.

**Choice of indicators.** Sections 4 and 5 discuss a variety of indicators that aim to measure the sustainability of agricultural production systems, individual products or dietary patterns. In view of the complexity of the sustainability challenge, different frameworks for measuring sustainability have been developed that address very different levels of systems (farming systems, products, eating habits). Furthermore, the various dimensions of sustainability, which have been explained in the previous sections, must be considered: health, social objectives, environmental protection, climate change mitigation and animal welfare.<sup>32</sup> The fields formed by the various combinations of system levels and dimensions thus contain widely differing measurement systems and indicators.

---

<sup>31</sup> For example, there is a saying that one should not compare apples with oranges. This means that apples and oranges are so different that they cannot be compared; apples and oranges would be incomparable, that is, incommensurable. This implies that you cannot replace an apple with an orange. If, on the other hand, you assign a price to both, you give them a commonality (money) and make them commensurable (i.e. comparable) and you can substitute them for each other (if, for instance, you can buy either 1 kg of oranges or 1.5 kg of apples for a certain amount of money).

<sup>32</sup> In addition to those mentioned here, both the three-pillar model and Agenda 2030 treat the economic dimension as a separate category. The economic development plays an important role in the possibilities of satisfying basic needs in the long term. However, while the health, environmental, animal welfare and social dimensions can meaningfully be related directly to the problem and policy area of food consumption by asking what effects food consumption has on health, the environment, animal welfare and certain social aspects (i.e. the conditions under which people who produce food work), economic sustainability refers to the functioning of the economic system and is more indirect in nature. Important indicators would accordingly be, for example, the resilience of companies and value chains or the functioning of formal and informal institutions. These indicators provide information on the extent to which, for example, food security, food safety, access to food or incentive compatibility with respect to the ecological and social dimension of food choices is ensured. In view of this rather indirect character, economic issues are not addressed as a separate dimension in this expertise, but are discussed with reference to the dimensions of health, environment, working conditions in food production and animal welfare.

Some sub-areas that are relevant to more sustainable food consumption have already been covered by the German operationalisation of the SDG goals (cf. Table 8-1). The Federal Statistical Office reports on a regular basis on these. However, the SDG goals do not cover the spectrum of sustainable nutrition sufficiently.

Of similar complexity is the question concerning the relevant **system limits**, which arises to varying degrees for the various reference frameworks (farming system, product, dietary patterns). Section 5 discusses this issue too.

The expertise's claim that it pursues an integrative approach is therefore considerably more complex than concepts that only focus on health or only on the environment. Sustainable food consumption has been and in some cases still is equated with a reduction of the negative environmental impacts of human and economic activities. In contrast, this expertise focuses not only on the ecological effects of food production and consumption, but also on their health and social impacts and on animals.

The operationalisation of the objectives when jointly considering the four dimensions of more sustainable food consumption ("Big Four") is a challenging task, because common indicator systems and assessment procedures have to be developed that can take into account the entire spectrum of sustainability. It becomes even more complex because the **social dimension** of sustainability is **under-conceptualised** and there is a lack of indicators which could be used to assess the types of food production and consumption in terms of their impact on people's social bases of life (cf. Section 4.3).

**Data availability.** Finally, there are – especially with regard to the dimensions of health and social affairs – major shortcomings and gaps in the data situation in Germany.

## 2.8 Summary and relevance to the expertise

The guiding vision of sustainable development does not denote a specific target state, but calls for the ongoing social development to be made more sustainable. This expertise therefore does not claim to define sustainable development more broadly, but rather aims to distinguish between less sustainable and more sustainable forms of food consumption in the German context and to point out how politics can contribute to ensuring that people eat more sustainably. The expertise also highlighted that the question of what is considered more sustainable and less sustainable is always based on value decisions. Such value decisions cannot be avoided. This expertise aims to disclose the corresponding value decisions and thus make them open to discussion. The comparatively detailed description of the various sustainability challenges in Section 4 can be seen in this context.

This section (i.e. Section 2) explains the understanding of sustainable development underlying the expertise as the long-term preservation of the possibility that people (current and future generations) can meet their basic needs. The focus on basic needs has a dual function in this context: On

the one hand, it justifies the necessity and legitimacy of a policy for sustainable development. This is necessary and legitimate (only) where people potentially affected by harm are so badly harmed that they can no longer satisfy their basic needs. On the other hand, the focus on basic needs also fulfils a protective function for the people who are currently affected by a policy aimed at promoting more sustainable food consumption. This focus protects us from an excessive interference in our lifestyles: such interventions must only be on a scale and in a way that will continue to enable us to satisfy our basic needs. There is tension between these two functions. What this means precisely for the question of when and to what extent a policy promoting sustainability in food consumption is legitimate is discussed in Section 6.

More sustainable nutrition is necessary to the extent that people harm themselves and others through the way they eat (in Germany today) (cf. Fig. 2-1). Section 4.2 describes both how people in Germany eat today, that this has a negative impact on health, how this negative impact manifests itself, and the extent to which people harm themselves and others through the way they eat. In addition, Section 3 and Section 4.2 show that and to what extent certain contexts (e.g. Section 4.2.3 poverty) play a role in determining how people eat and how this affects their health. Section 3 explains the key influence that the food environment has on when, what, how much, how quickly, where and with whom we eat or do not eat, and justifies the need for fair food environments that are both conducive to healthy food consumption that is socially, environmentally and animal welfare-compatible, as well as aligned with our human perceptions, choices and behaviours.

Further sections describe social (4.3) and environmental (4.4) impacts of food production and food consumption. Hence in the terminology used in this section, they analyse how the way we eat today indirectly harms others by having a negative impact on their (social and environmental) bases of life (cf. Fig. 2-2). Sections 4.3 and 4.4 thus also make (indirectly) clear what social and ecological aspects are regarded in this expertise as the bases of life necessary for current and future populations to be able to meet their basic needs. They thus (indirectly) answer the question in Table 2-1 of what is to be measured at all.

In order for the concept of sustainable development to become politically effective, it must be operationalised, i.e. indicators must be defined that allow a distinction between more sustainable and less sustainable food consumption. In view of the complexity of this challenge and against the background of the current social debate, various reference frameworks for measuring sustainability have been proposed, which are based on widely varying system levels. These are presented and discussed in detail in Section 5. Section 5 thus answers the question posed in Table 2-1 as to which indicators can be used to distinguish more sustainable from less sustainable types of food production and consumption (and how system boundaries are to be drawn in the process).

This expertise points out how politics can contribute to ensuring that people in Germany eat more sustainably. To answer this question, it is not only important to distinguish between more sustain-

able and less sustainable types of food production and consumption. For policy-makers to intervene effectively, it is also necessary to know what actors in the food system play what roles, what institutional framework these different actors act within, and how they contribute to how we currently produce and consume food. This is dealt with in Section 7. These two sections therefore provide important “control knowledge” that political actors need.

Sections 1 to 7 of this expertise show that a complex, multidimensional understanding of sustainable development such as that underlying this expertise poses diverse challenges, both at the conceptual level itself and in terms of its operationalisation. In the further course of this expertise, this results, inter alia, in a recommendation being made to the Federal Government to more strongly institutionalise the policy field of “promoting sustainability in food consumption”, to engage in capacity-building, to expand monitoring and to pursue a science-based “learning by doing” approach (cf. Sections 8 and 9).



### 3 Why we eat what we eat – Consumer behaviour regarding food consumption

Nowadays we can choose between many different foods, and although we are better informed than ever and very interested in food, nutrition, calories and diets, it is nevertheless often hard for many of us to implement a health-promoting and balanced diet day by day, meal by meal and snack by snack (“behavioural paradox”).

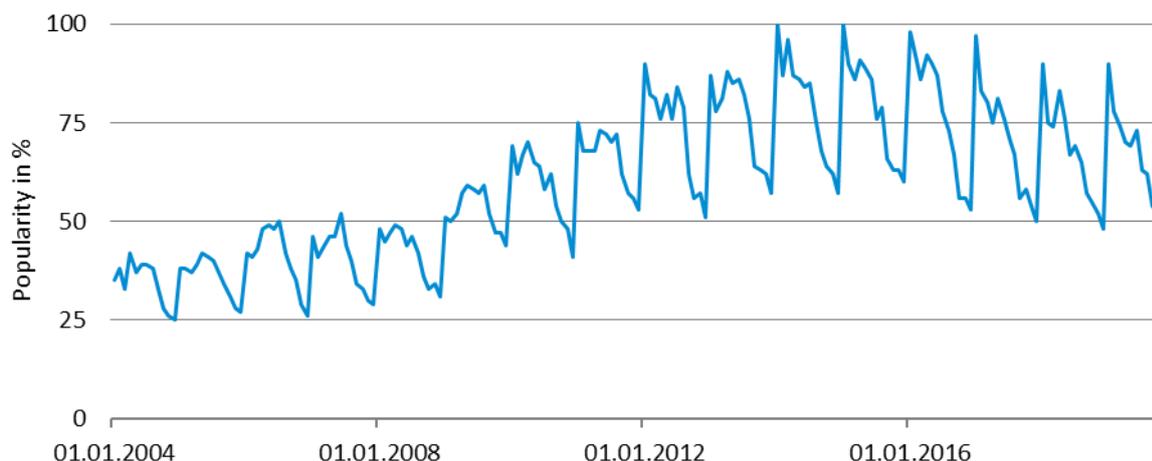
In an individual food situation, opting for the healthier alternative may be comparatively easy and under our own control. However, we have to make many such decisions during our lives: A 30-year-old woman, for example – even if you assume that she only makes 20 food choices per day in her day-to-day life<sup>33</sup> – will still have to cope with around 380,000 decisions in the course of her life. Food consumption in everyday life consists of a large number of decisions. To consciously control all these decisions, i.e. to decide when, what, how much, how quickly, where and with whom we eat, after having considered the potential consequences, is a great challenge in everyday life that makes manifold demands on us. This is therefore not a question of individual decisions and comparatively “simple” behaviour (e.g. choosing the apple instead of chocolate), but of a complex behavioural pattern (Renner 2015).

In everyday life, even very disciplined consumers therefore do not always have a choice or everything under their own control. What we eat is not only the result of us making conscious and carefully considered decisions, but often also the outcome of available options for action and habitual influences that we are not aware of at the time (cf. also Section 3.2). Overall, therefore, food environment influences, which address our biological, psychological, social and economic dispositions and needs, therefore, have a decisive influence on our eating behaviour. We often overestimate our own control over our actions and underestimate the influence of food environments (Marteau 2017, cf. Section 3.3). One expression of this conviction and also of the often great willingness to change one’s own diet manifests itself regularly at the turn of each year: every New Year brings a new peak in Google search queries on the subject of “losing weight”, which then flattens out again in the course of the year. These incisive and regular ups and downs illustrate the tension between conscious, targeted self-regulation on the one hand and the challenges of implementing goals and intentions in everyday life on the other hand (Fig. 3-1).

---

<sup>33</sup> Other estimates assume up to 200 eating decisions per day (Wansink & Sobal 2007).

**Figure 3-1:** Chronological sequence of the relative popularity of Google queries for the search term “losing weight”, 2004–2018 in Germany



Note: Google Trends data is a random selection of data from Google search queries. Each data point is divided by the total number of search queries in the corresponding geographic area and time period to ascertain the relative popularity. The results are scaled on a range between 0 and 100 based on the popularity of the subject compared with all search queries for all subjects.  
([https://support.google.com/trends/answer/4365533?hl=de&ref\\_topic=6248052&visit\\_id=637020570567312875-2794338256&rd=1](https://support.google.com/trends/answer/4365533?hl=de&ref_topic=6248052&visit_id=637020570567312875-2794338256&rd=1)).

Source: Google Trends, accessed on: 10 October 2019

Measures aimed at individual responsibility and self-regulation can therefore only be one element in an effective policy promoting healthier and generally more sustainable food consumption. In addition, we need support through fair food environments, i.e. an environment that is adapted to our human perception and decision-making options and behavioural patterns, so that a more sustainable diet becomes more widely possible in everyday life.

### 3.1. Eating as a behavioural pattern: influences and functions

#### 3.1.1 Eating as a basic biological need

Eating is a basic biological need and “physiological” hunger, triggered by an energy deficit, is a correspondingly strong behavioural incentive (homeostatic eating, e.g. Lowe & Butryn 2007, Woods & Ramsay 2011, Woods 2009).

Given that our ideas and expectations greatly influence our appetite and our sense of hunger and satiety, a distinction is made between food intake due to a physiological energy or nutrient deficit, so-called “homeostatic” eating, and food intake without an existing deficit, so-called “hedonic” eating (“homeostatic eating” vs. “hedonic eating”, Lowe & Butryn 2007).

Subjective assessments of hunger therefore do not simply reflect physiological states and often do not differentiate between homeostatic and hedonic hunger (Martin 2016, Mattes 2010).

The energy status is regulated by various complex, biological mechanisms (e.g. blood sugar level, stomach tension, visceral fat tissue, microbiota), and this can manifest itself in the perceived hunger or sense of satiety. When a food is eaten, a reward circuit is activated in the brain, which causes a positive reinforcement of the associated behaviour (in this case food intake). The rewarding effect of a foodstuff is all the greater the lower the energy status of the consumer. Accordingly, while it is more difficult to consciously regulate food intake when one is hungry, the rewarding value tends towards zero when one is satiated and thus most people automatically stop food intake.

### 3.1.2 Reward value of foods

The rewarding value of a foodstuff depends on various properties. For example, animal experiments have shown that a test feed composed of approx. 43% carbohydrates and 34% fat results in a particularly strong activation of the reward signal and in maximum feed intake (Hoch et al. 2015). The fat-to-carbohydrate ratio was more important for the food intake than the energy density (calorie content). It can be assumed that, for foods with a very high rewarding effect, the (eating) behavioural reinforcement effect is so high as to overcompensate negative feedback signals caused by satiety. This means that the consumers (continue to) eat these foods although they are full (hedonic eating). It has not yet been proven whether these results can be applied to humans. They are, however, consistent with studies in which consumers perceive “addiction-like” eating habits in close connection with foods that have a high carbohydrate (glycemic load) and fat content (Schulte et al. 2015). An example of this is potato chips, which have a composition similar to that of the test feed described above.

In addition, other characteristics of food also influence its intake, such as positively associated multi-sensory impressions, in particular taste and aroma, but also appearance, haptics (mouth and hand) and noises produced during the eating process. The response to such sensory impressions is partly innate (preference for sweet taste), and the neuronal and peripheral control mechanisms are also modulated by individual genetic and epigenetic predispositions (e.g. Spence 2015). However, longitudinal twin studies show that in the course of development genetic influences decrease in terms of behavioural relevance compared with environmental influences (e.g. family situation, peers) (Dubois et al. 2013).

### 3.1.3 The influence of signals from the food environment and expectations

How hungry or full we feel, how appealing a food is, how good it tastes to us, depends not only on our actual energy status or the properties of the food; our experiences, learning processes and expectations sometimes influence our sensory and physiological reactions quite substantially without us being aware of it. For example, we learn to associate times of day with food, and these learning processes (conditioning) lead us to develop pangs of hunger before lunch, even though our physiological energy status is quite sufficient. These learned expectations (e.g. 12 o'clock = lunchtime = meal) trigger anticipatory physiological reactions (i.e. before the actual intake of food). Thus, insulin is already released before the actual food intake, e.g. lunch (Woods 1991, 2009). This can then in turn lead to the strengthening of this association.

It is not only times of day, but many other signals of the food environment that can be associated with food, hunger, taste, etc. and that can give rise to corresponding expectations. For instance, we learn to associate certain colours with taste, so that specific colours can trigger taste expectations and physical reactions. In a classical study, for example, Wheatley (1973) showed that expectationally discrepant but physiologically irrelevant colour characteristics of food (e.g. blue-coloured steak) can lead to strong rejection or even nausea. Clydesdale et al (1993) estimate that food colour may account for up to 10% of the perceived sweetness of a food (see Spence 2015 for an overview).

Learning processes can also give rise to massive aversions to food or even avoidance of foodstuffs, for example in the context of subjective food intolerances, without the persons concerned being aware of this. These conditioned taste aversions (Lin et al. 2017), also called “Sauce-Béarnaise syndrome”, are very well documented. For example, if nausea occurs during or after eating a meal, most of us develop an aversion to this meal, even if the nausea has other causes. However, even if other people display an aversion, this can lead to an acquired taste aversion. Taste aversions can be learned in a few, sometimes even one learning phase, but they are often very resistant to change. The sight or smell alone can sometimes elicit massive reactions (e.g. strong nausea). The increase in subjective food allergies or intolerances can only be accounted for to a limited extent by medical data. One example is the rising demand for gluten-free foods (10%), although the incidence of coeliac disease remains unchanged at around 1% (cf. Section 4.2, Biesalski & Meyer 2018, Kim et al. 2016).

### 3.1.4 Why we eat: Multifunctionality of normal food consumption habits

Our everyday, “normal” food consumption habits are a complex pattern of behaviour that is largely learned and characterised by an enormous ability to adapt to different food environments (de Castro 2000, Rozin 1996, 2007). In the course of our lives we learn to eat an impressive variety of different foods and dishes in different contexts (Renner 2015, Rozin 1996, 2007). The great variety of what we eat, but also the flexibility as to when, where and with whom we eat, illustrates the

great adaptability of food consumption habits. One person's preferred favourite dish may not be acceptable as food for another person.

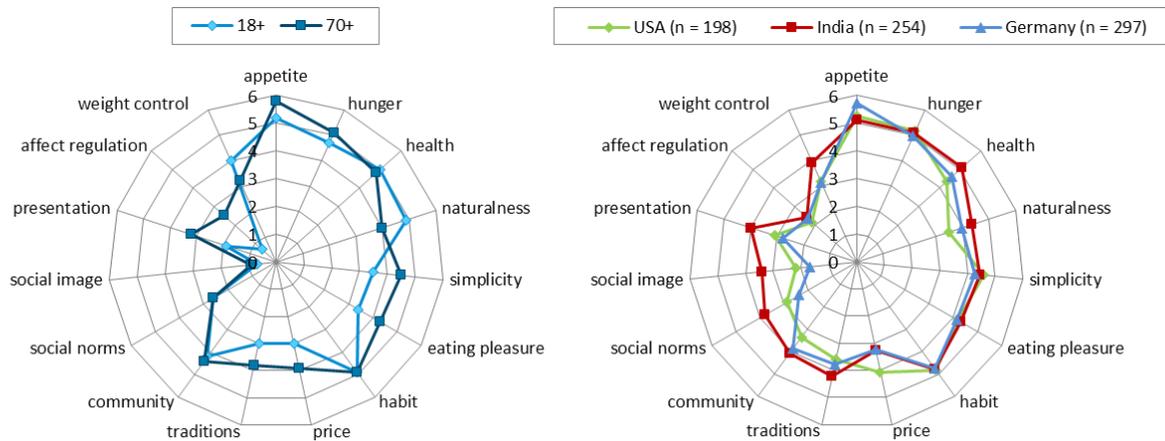
Besides their great adaptability, normal food consumption habits are also characterised by multifunctionality, i.e. we eat what we eat for a variety of reasons. Eating fulfils vital functions, but we do not eat solely because we are hungry or in order to optimise our biomarkers and physical health; we also eat for many other reasons which are a basal element of our normal, i.e. human, behavioural repertoire in respect of eating, which, exaggerating slightly, could also be described as our "species-typical" behavioural repertoire. For instance, eating constitutes one of the most important and common social human activities (de Castro 1994, 1997, Fischler 2011, Gahagan 2012, Rozin 1990, 2007), and food is a key "social currency" that is often used as a positive reinforcement and reward (Baughcum et al. 1998, Birch et al. 1980, Epstein et al. 2007, Shepherd 1999, Sherry et al. 2004, Wahl et al. 2017). Eating behaviour can therefore be classified not only on the basis of nutrients and ingredients, but also according to their basic functions for human experience and behaviour (Barlösius 2016, Rozin 2007, Fischler 2011, Renner 2015). This multifunctionality and diversity of reasons for human eating behaviour is described and discussed in various specialist disciplines, with, in part, different emphases (e.g. Stok et al. 2017)<sup>34</sup>. An exemplary, empirically based systematisation, which could be replicated in different samples and countries, refers to 15 different reasons for eating or functions of eating (Fig. 3-2).

These 15 basic motives of eating behaviour can be found in different groups of people, with the expression of the individual motives varying between groups of people and individuals. For instance, older people tend to attach more importance to the health aspects compared with younger people, while hunger or simplicity take a back seat (Rempe et al. 2019, Renner et al. 2012). Furthermore, not all motives or functions steer behaviour in the same way in all eating situations. While appetite and hunger are relevant in many situations, social motives, such as social norms or the regulation of emotions and affects, play a key role in specific situations. Which reasons for particular eating behaviour determine our actions depend on the respective eating culture, the respective person (inter-individual differences) and situation (situational differences) and, as data from the Ecological Momentary Assessment (EMA) studies show, there are also, in some cases, major differences within individual persons regarding motivations in different eating situations and contexts (intra-individual differences, Hofmann et al. 2012, Schüz et al. 2015, Wahl et al. 2020).

---

<sup>34</sup> See also <https://www.uni-konstanz.de/DONE/>.

**Figure 3-2:** Basic motives of normal food consumption regarding younger and older respondents in Germany (left side) and regarding respondents from the USA, India and Germany (right side).



Source: WBAE figure based on Renner et al (2012), Sproesser et al (2018).

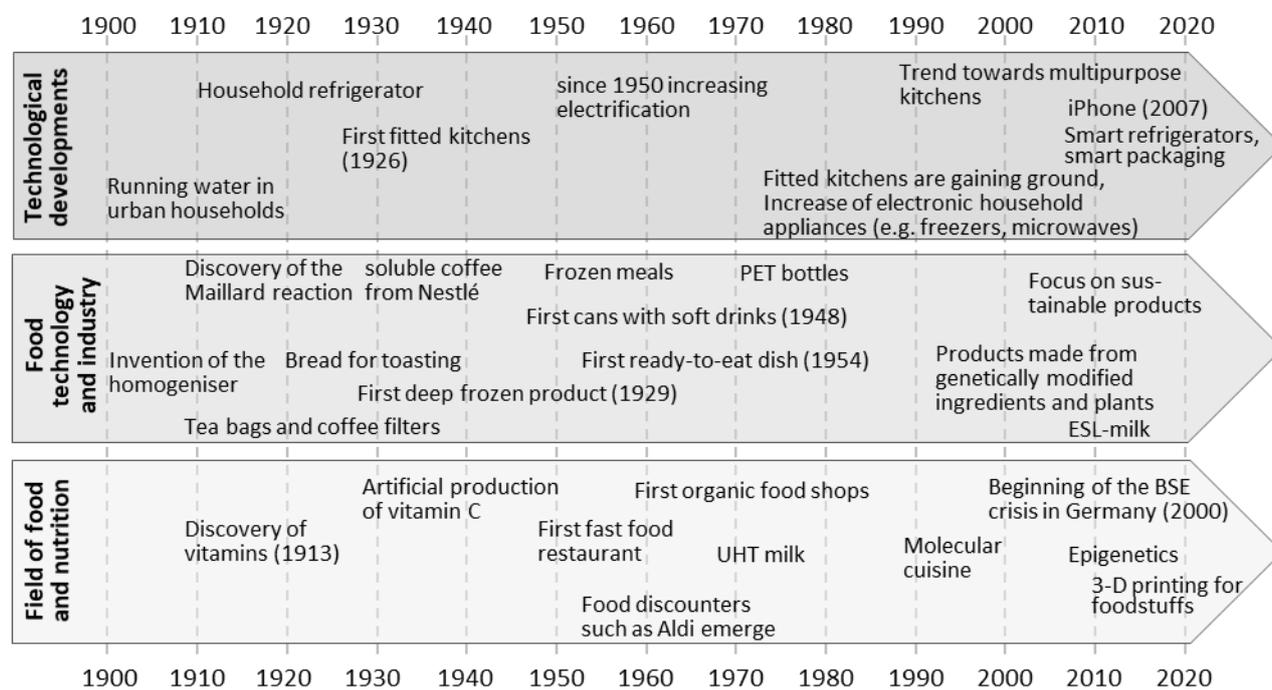
### 3.1.5 Changing food consumption habits: influence of the societal and social context

The choice of food, eating behaviour and the handling of food are significantly influenced by the societal and social contexts. Thus, in the historical context there are clear changes in what is perceived and accepted as “normal” or “typical” food. One example is carrots, most of which were originally purple until the 16<sup>th</sup> century. The social preference for the colour orange has led to this colour being specifically selected over the past centuries and today orange is the “natural” or “normal” colour for carrots in the eyes of most consumers (Spence 2015). A number of food chains, such as TESCO in the UK, have partially reintroduced the original colour variations into their product range, with some of these variations perceived at the time, and in some cases, still currently, as new, innovative and healthy (Macrae 2011).

These changes in preferences and behaviour over time, which in some cases have been quite significant, are determined by many factors, with political, economic, technological and social developments forming important overall conditions or the “food environment” (Brombach et al. 2014, see also Popkin et al. 2012). Brombach et al. (2014) have summarised various historico-cultural developments that have caused a social change in the preference structure and in food consumption habits and eating behaviour (Fig. 3-3). One example is the microwave oven, which emerged in Germany in the 1980s; it was initially viewed sceptically but then became a standard kitchen device for subsequent generations (cf. Der Spiegel 1985). Digital and “convenience” innovations are further developments that will increasingly shape consumer and food consumption habits. For example, a study of around 28,000 households in the USA (Kuhns & Saksena 2017) shows that the so-called “Millennials” (those born between 1981 and 1996) demonstrate a stronger preference for

convenience products and ready-to-eat foods, that they shop for food less frequently and that they eat out more often than older generations.

**Figure 3-3:** Exemplary developments and innovations in the food sector



Source: Modified according to Brombach et al (2014: 14).

These societal changes in eating behaviour are currently frequently discussed under the heading of “nutrition transition” (e.g. Drewnowski & Popkin 1997) or the switch from “traditional” to “modern” eating behaviour (e.g. Monteiro et al. 2013, Neumark-Sztainer et al. 2013, Popkin et al. 2012, Story et al. 2008; see as a summary Sproesser et al. 2019). For example, Michael Pollan argues in his New York Times bestseller “Food Rules” (Pollan 2009) that non-traditional foods should be viewed sceptically and that traditional eating habits are generally healthier than modern (Western) eating habits which include processed foods. On closer inspection, however, it becomes clear that a simple dichotomy between “traditional” and “modern” eating habits falls far short of the mark. In fact, “traditional” and “modern” food consumption habits differ not only in terms of “what” is eaten (e.g. energy or nutrient density, degree of processing of the respective foodstuff), but also in terms of “how” it is eaten (e.g. in a community, at certain times of the day, away from home, en route; see also the “Traditional Eating Project in 10 Countries” (TEP10) framework, Sproesser et al. 2019). This shows that “eating” is multifunctional and that a focus on individual aspects, e.g. nutritional and physiological goals such as nutritional values, only reflects the actual eating habits to a limited extent.

If consumers focus, first and foremost, on health aspects, this can therefore trigger trade-offs in everyday life. For example, the situational availability of foodstuffs (e.g. sweet snacks), time pressure or societal norms and traditions can conflict with the goal of eating more healthily. Eating often takes place in the company of others, so that social aspects in particular (e.g. community, social relationships, exchange of information) are a basal component of normal human eating behaviours. Accordingly, changes in food consumption behaviours can be better maintained in the long term and more comprehensively if these different aspects of behaviour are addressed or taken into consideration. For this reason, this expertise recommends that, in the context of communal catering such as catering in schools and pre-schools, consideration should be given not only to the qualitative and quantitative range of food on offer, but also to the entire eating situation and environment in order to thus also promote aspects such as social participation and inclusion (cf. Section 3.3). Alongside the parental home, preschool and school meals are a particularly crucial framework for early implicit learning experiences that can have a decisive influence on behaviour and preferences later on: the food on offer and the ambience convey, for instance, what kind of what food is socially appropriate and to what extent children and adolescents are valued as consumers (e.g. offers of “convenience food”, vending machines and short breaks convey the image that food is first and foremost a quick and cheap “nutrient intake”). Peers as well as educators and teachers convey – alongside the parental home – social norms for eating and behaviour through their behaviour and shape the preferences and behaviour of children and adolescents by means of model learning.<sup>35</sup>

### 3.2 Conscious, purposeful (“ratio”) and automatic, habitual behavioural decisions (“autopilot”) in complex environments

Food consumption behaviour is being conducted in an increasingly complex food environment, where practically any amount of a variety of foods are available almost 24/7 and at relatively low cost. For example, the first supermarket in Germany was opened in 1957, and today Germany has a particularly high density of supermarkets and discounters (cf. Neumeier 2015 on density in Germany). The per capita sales area is larger than in practically any other country. On average, a large supermarket carries over 43,000 products in the USA and over 25,000 in Germany (EHI Retail Institute 2014, Food Marketing Institute 2013).

We are conscious and purposeful in regulating some aspects of how we behave in everyday life, what we eat, how much we eat, when, where and with whom we eat or do not eat; in such cases, we decide “in a sovereign manner”. In light of the host of demands we face in everyday life, however, our eating behaviour is also significantly influenced by habits and automatic, implicit or unconscious processes.

---

<sup>35</sup> Preschool and school meals can and should also be used as a framework for explicit learning experiences and education. Such explicit offers are particularly effective if they are coherent with implicit learning experiences. However, if implicit learning experiences (e.g. the offer of convenience food or short breaks) and explicit learning experiences (e.g. the appeal to eat healthily and consciously) contradict each other, then explicit educational schemes are not very effective.

**Two behavioural systems: “ratio” and “autopilot”.** There is a broad consensus in current psychological research that our reactions and behaviour can be traced back to two different control systems (e.g. Epstein 1994, Kahneman 2011, Strack & Deutsch 2004). While Kahneman (2011) has referred to them as System 1 and System 2, others have described them as impulsive and reflexive systems (Strack & Deutsch 2004, see also Marteau 2017). These two systems could also be strikingly designated as “autopilot” and “ratio” (Renner 2015). Our actions in the ratio mode take place in a carefully considered manner, i.e. we are aware of these actions, their motivation and consequences, the actions are purposeful and we can regulate them, i.e. modify or interrupt them. In contrast, when we are in autopilot mode we act without conscious reflection in response to environmental stimuli and situations.

In our everyday lives we constantly switch back and forth between these two different behavioural control systems (e.g. Marteau et al. 2012, Marteau 2017), whereby both systems have their pros and cons. While the ratio mode allows for targeted and flexible actions based on rational appraisal processes, it is comparatively slow and makes heavy demands on our limited cognitive attention and processing capacities. It is therefore less suitable for routine situations. In contrast, the autopilot mode allows swift actions that require few cognitive resources despite their complexity, so that we can devote our attention to other tasks. For example, after only 0.2 seconds, i.e. before conscious information processing, we differentiate between food categories with varying energy levels (Toepel et al. 2009). Effects of hunger and deprivation (e.g. restriction of energy intake) on the processing of food stimuli also manifest themselves within this time period (Schupp & Renner 2011, Stockburger et al. 2008), and many learning processes also occur implicitly (e.g. the association between unhealthy and tasty). Such unconscious or automatic processes are triggered by stimuli from the food environment (e.g. other people, portion sizes, smells) and certain situations (e.g. specific environments, stressors). Due to automation, corresponding actions are far less flexible and may also deviate from our explicit targets.

In many cases, the two behavioural systems allow efficient behavioural control. Routines and habits as well as rapid associative learning enable us to act efficiently and safely even in very complex environments (such as e.g. road traffic) and at the same time to focus our attention on relevant information (e.g. danger signals, processing of new information). When we are confronted with different tasks and requirements at the same time, e.g. if we are under time pressure, then targeted, carefully considered decisions are more difficult to implement and accordingly our behaviour is then based more on routines and automatic processes. In this case, for example, we eat more of the crisps or cookies that are within our reach than we are aware of at that moment. This distinction between two behavioural control systems has corresponding implications for the possibilities and shaping of behavioural changes (e.g. Marteau 2017, Renner 2015), each of which can start at different stages of the behavioural process and address explicit and implicit areas of behavioural control (see Fig. 3-4 and Section 8).

**Explicit measures** to modify behaviour require a targeted control or regulation of individual behaviour and therefore, first and foremost, address our ratio mode. This includes in particular educational approaches, which are chiefly intended to impart knowledge (e.g. information campaigns such as “five-a-day”). However, enhancing knowledge does not necessarily result in a change in behaviour (e.g. Ölander & Thøgersen 2014). There are certainly a number of reasons for this; the obvious one is that knowledge itself increased, but the preference structure and self-regulation skill did not change in a positive way. Other approaches aim to increase motivation to change behaviour (e.g. through appeals intended to instil fear that stress the negative health or social consequences) or to increase self-regulation skills (e.g. by assisting intention formation and planning of behaviour; see e.g. implementation intentions, Gollwitzer 1999). These various Behaviour Change Techniques (BCTs), Michie et al. 2013) are quite effective to a certain extent. Moreover, the development of mobile technologies offers the possibility to make these approaches accessible to wider sections of the population. In a meta-analysis comprising 41 studies (Villinger et al. 2019), it was possible to identify significant positive small effects for various food consumption-related indicators for mobile, smartphone-based interventions that used apps to apply various techniques aimed at a change in behaviour (goals/planning, self-monitoring, social support, knowledge transfer). Thus, the analysis identified positive effects both on food consumption behaviour (e.g. fruit and vegetable consumption) and on various health parameters (e.g. reduction of body weight and blood lipid levels). Similar results are also discussed in other areas of behaviour and with respect to other implementation methods (e.g. intention-behaviour gap, Webb & Sheeran 2006).

**Implicit measures** aimed at behavioural changes do not require explicit and targeted regulation of individual behaviour; they are more responsive to our autopilot. Influences of the food environment with regard to exposure and access represent “upstream” factors that do not have to be consciously present when individual decisions are taken (e.g. choosing an apple instead of chocolate), but still influence food consumption behaviour. These factors include, for example, the change in exposure through a restriction of advertising and the change in access based on economic measures (e.g. taxes). Measures that focus on the “downstream” influences of the food environment, i.e. aim to influence choice and actual consumption, also contribute significantly to the design of fair food environments<sup>36</sup>. It is not realistic to assume that in everyday life we permanently make conscious, individual, sometimes very costly and targeted decisions and change our behaviour accordingly. For this reason, the design of food environments, e.g. with respect to the availability of tap water or health-promoting, balanced menu options and smaller portion sizes, i.e. changing the standard (e.g. through nudging), is of vital importance to ensure that the “sustainable choice” is the “easy choice”.

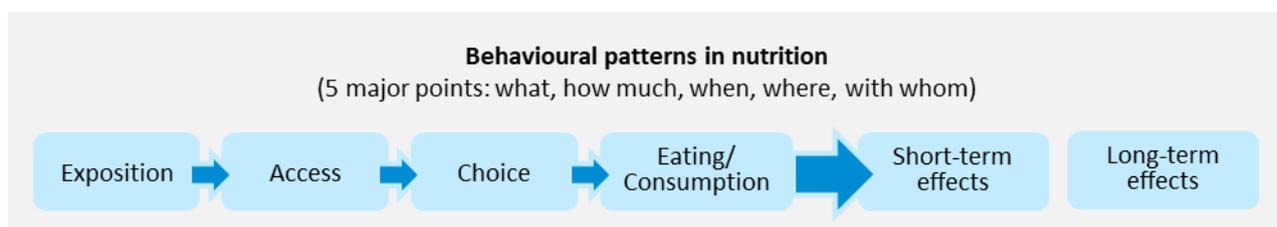
---

<sup>36</sup> To sum it up, these could also be described as “humane” or “species-appropriate” food environments that are optimally adapted to our human perception and decision-making options and behavioural patterns.

### 3.3 Food environment: Types of environmental influences in the different phases of the behavioural process

Food environments constitute environmental influences that not only have an impact when individual decisions are being taken (e.g. choosing an apple instead of chocolate), but also at different stages of the behavioural process (Fig. 3-4). The behavioural process ranges from exposure to food to consumption (what, how much, when, where and with whom we eat). Food environments can therefore influence our food consumption habits not only directly, but also indirectly by influencing preceding phases, such as exposure and access. These phases are mutually dependent to the extent that we can only consume food to which we have access, and access to certain foods also means that we are exposed to them. Furthermore, this behavioural process refers not only to specific foods, but also to all stimuli associated with them (e.g. exposure to food advertising). The behavioural process can in turn result in short-term, i.e. immediate effects (e.g. enjoyment, social acceptance) as well as long-term effects (e.g. social cohesion, weight gain). Accordingly, measures to change food consumption behaviour can start at different points and can also be assessed on the basis of different short-term and long-term criteria.

**Figure 3-4:** Phases of the behavioural process



Source: Renner (2019, 2015).

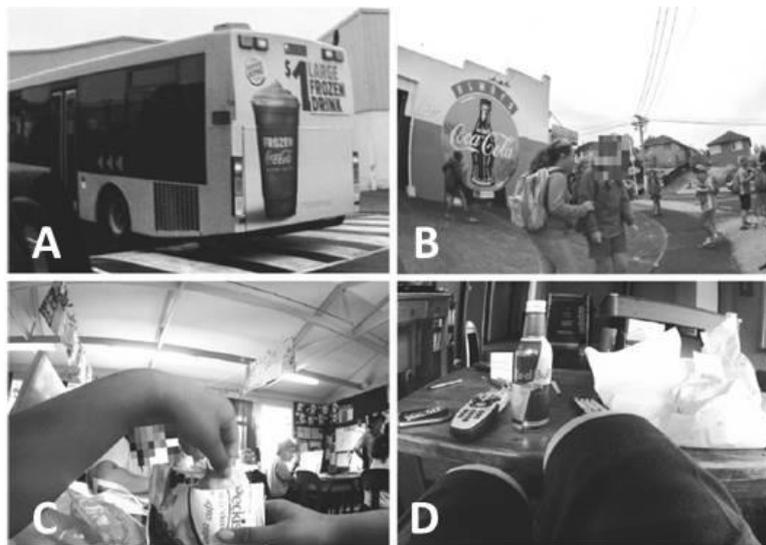
#### 3.3.1 Exposure

The growing number of articles in supermarkets and discounters, as well as a wide range of catering and fast food offers, has significantly increased our exposure to food and food products. This also increases the likelihood of “food” being the focus of our attention. In other words, we are made aware of and reminded of food more often, so that we have to decide for or against an offer more or less frequently. There are geographical differences, for example, in the distribution of supermarkets and discounters. These spatial differences in the distribution of such food “sources” (Steeves et al. 2014) are also categorised as so-called “food deserts” or “food swamps” and show systematic connections with overweight and obesity in US studies (e.g. Cooksey-Stowers et al. 2017). However, no comparable data are, to date, available for Germany. The size of supermarkets also shows a correlation with the frequency of obesity. In a comparison between countries and within France the body mass index (BMI) and the obesity rate were higher the larger the supermarkets were (shelf length, square metres; Cameron et al. 2014, Chaix et al. 2012). Offers of soft

drinks and snacks at schools, universities or canteens also represent an “exposure factor” that influences consumer behaviour (e.g. Taber et al. 2014, Johnson et al. 2009). Burgoine and Mon-sivais (2013) analysed the exposure in the workplaces and homes of more than 2,600 adults in England. They were able to show that exposure to snack and takeaway services was 125% higher in workplaces than in residential areas. Accordingly, exposure to “unhealthy” food is higher in environments where we are under greater time pressure. Initial big-data analyses suggest that different spatial exposure patterns favour diet-related diseases. Aiello et al. (2019) analysed data from 1.6 million users of customer cards in London and discovered in some cases major spatial differences in terms of shopping patterns (e.g. buying food with a high fat or sugar content). Linking this data with medical data from 1,174 general practitioners showed that certain city districts not only had unhealthier shopping patterns but also shouldered a higher burden of disease (e.g. higher rates of diabetes).

Advertising represents a key exposure factor both for adults and also for children and adolescents. Observational data based on so-called Kids’Cam<sup>37</sup> (see Fig. 3-5 for exposure examples), which 168 children in New Zealand carried over a period of four days, showed that the highest rates of exposure were to sugar-sweetened drinks (9.1 per day), followed by sweets (6 per day) and snacks (2.9 per day). All in all, the rates of exposure to “unhealthy” foods were significantly higher than those to “health-promoting” foods (Section 8.5).

**Figure 3-5:** Examples of exposures in the everyday life of children, recorded with Kids’Cam



Note: A) and B) advertising of soft drinks in public places, C) packaging for snacks in schools, D) consumption of soft drinks at home

Source: Signal et al (2017), graphically adjusted.

<sup>37</sup> Small portable cameras that children wore around their necks during daytime.

Advertising for products, product placements in social media, e.g. through social influencing, or sponsoring, e.g. in the field of sports, also constitute exposures (“brand exposure”) that influence consumption patterns (Bragg et al. 2018). For example, after the 2015 Super Bowl the sales figures for the sponsor M&M’s increased by 9.2% and were thus markedly higher than the increase for chocolate with 3.2% (Bragg et al. 2018). The fact that advertising and marketing for food in the traditional media or in so-called “advergames”<sup>38</sup> increase consumption has been shown in numerous experimental and field studies as well as meta-analyses. This applies to both children (Russell et al. 2019) and to adolescents and adults. Typically, parents and consumers underestimate the influence of advertising on their preferences and consumption patterns. For example, a study in the USA showed that mothers questioned believed that advertising aimed at children had stronger effects on other children than on their own (Yu 2012).

Social media represent an increasingly relevant exposure factor, especially for children and young adults. In Great Britain in 2016, around 50% of 8 to 11-year-old children said they were using Instagram and over 80% of 5 to 15-year-olds said they were using YouTube. Social media have produced a new form of “celebrities”, so-called “social influencers”, who often have several million “followers”. On the topic of baking and cooking, Saliha Özcan (Sally’s World), for instance, has millions of followers in Germany (currently around 1.7 million followers on YouTube, for example). Companies use the reach and credibility of influencers for marketing. Product advertising is often embedded in other content (see e.g. Jahnke 2018), and the dividing line between sales and relationship situations is blurred. Coates et al. (2019) showed in an experiment that even merely associating people (influencers) and products already has an impact on behaviour: 9 to 11-year-old children ate more “unhealthy” snacks if they had previously seen Instagram profiles of influencers who consumed “unhealthy” snacks.

Spence et al (2016) argue that the increased exposure to images of food via social media implicitly triggers appetite, which must be additionally regulated. In fact, numerous neuropsychological studies show that images of food trigger neuronal, physiological and psychological effects (Schupp & Renner 2011, Spence et al. 2016). In general, exposure and availability have an influence, among other things, on the social norm, i.e. on the perception of what is perceived as “normal”, typical and acceptable.

### 3.3.2 Access

Exposure does not necessarily mean that the offer is accessible to everyone. Depending on income, for example, major differences in access can occur even if exposure is similar (cf. Section 4.2). The connection between income and changes in food consumption is examined in studies on income elasticities. On a global scale, it has been observed over centuries that as income increases, staple

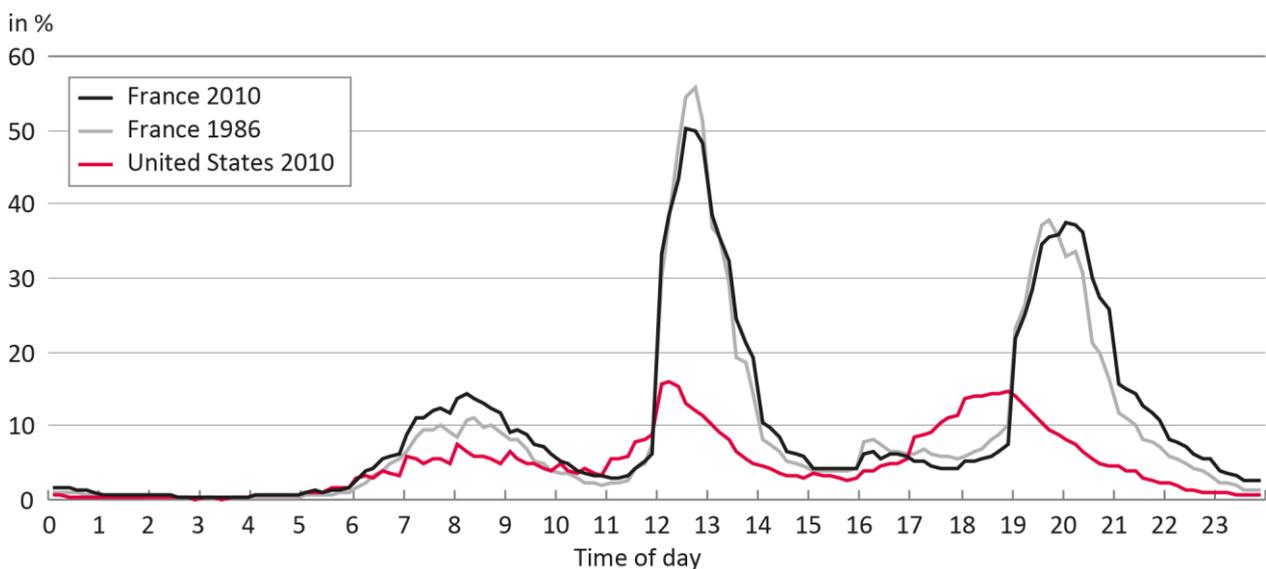
---

<sup>38</sup> Advergames or “Ad-Games” refer to advertising games. These games (e.g. computer games) are produced specifically for advertising and marketing. “Game Advertising” refers to advertising placement within a game and is similar to conventional product placement (see also Waiguny 2011).

foods are consumed less, but consumption of more expensive foodstuffs such as meat and cheese, as well as more highly processed foods, rises. These clear income correlations lose some of their importance in rich societies, and the relationships between income and food consumption become more complex (cf. Sections 4.2.3 and 7.5.2.1).

Other factors that can influence access include the availability of relevant information and social standards that determine the extent to which offers or food are deemed acceptable or attractive. Social standards therefore implicitly define what constitutes appropriate behaviour and thus, among other things, which foods are “accessible”, at what times and with whom. For example, times of day when meals are taken are also socially defined. In France, around half of all respondents eat at lunchtime, with another peak in the evening (Fig. 3-6, De Saint Pol & Ricroch 2012). In the USA, however, this distinct eating norm does not exist (any more). Given that the USA has significantly higher overweight levels than France, various researchers argue that the de-structuring of meals could be an influencing factor (German data: Claupein et al. 2001). Socially defined mealtimes thus have important social and regulatory functions (see also Section 3.3.4, section on short- and long-term effects).

**Figure 3-6:** Distribution of mealtimes during the day in France in 1986 and 2010 and in the USA in 2010



Source: De Saint Pol & Ricroch (2012), translated and graphically adjusted

Access to eating opportunities is also influenced by the structure and variety of the food on offer, e.g. the possible combinations of certain foods, dishes or portion sizes or convenience aspects. Portion sizes, for example, have increased over the decades (cf. Section 3.4 on the “portion size effect”). These changes in portion sizes have also changed perception, i.e. the social norm for “appropriate” or “normal” portions (Chandon 2013, Stok et al. 2018). The increase in larger portions is not simply due to a widening of the range of products on offer, as a corresponding widening in

the small item segment has not occurred to this degree. Thus, here we can speak of a shift in choice for consumers.

Other up-to-date developments, such as delivery services (as with pizza), are also aimed at making food, meals and snacks accessible and available to us more easily, at any time and almost anywhere. Vending machines in public places and buildings are another example. Mobile technologies are making it increasingly possible to tailor offers to individual consumers and provide them “just-in-time” in more and more places. For example, Stockwell (<https://www.stockwell.ai>) offers the option of setting up computer-controlled vending machines at almost any location, with individual product stocking and smartphone-based payment.

### 3.3.3 Choice

Our specific choice of food is determined by socio-economic aspects, preferences and attitudes, knowledge, social norms, but also habits and routines (cf. Section 3.2.1 and the multifunctionality of food). Correspondingly, the food environment, for example the existing range of products, and the availability and degree of convenience, also plays a decisive role in choices.

A key factor in the choice of food is disposable income and the price or price ratio of substitutes to each other. For instance, it is discussed whether agricultural and food technology developments have made the supply of highly processed, energy-dense products relatively cheaper, while fruit and vegetables have become relatively expensive (Headey & Alderman 2019). Less healthy products then become more attractive for low-income households. The consumption of foods with a high percentage of added sugar or fat or, overall, of rather unhealthy (energy-dense) foods is particularly “cheap”. This may have contributed to certain class-related dietary problems (Drewnowski & Darmon 2005, Rao et al. 2013, Thiele 2014).

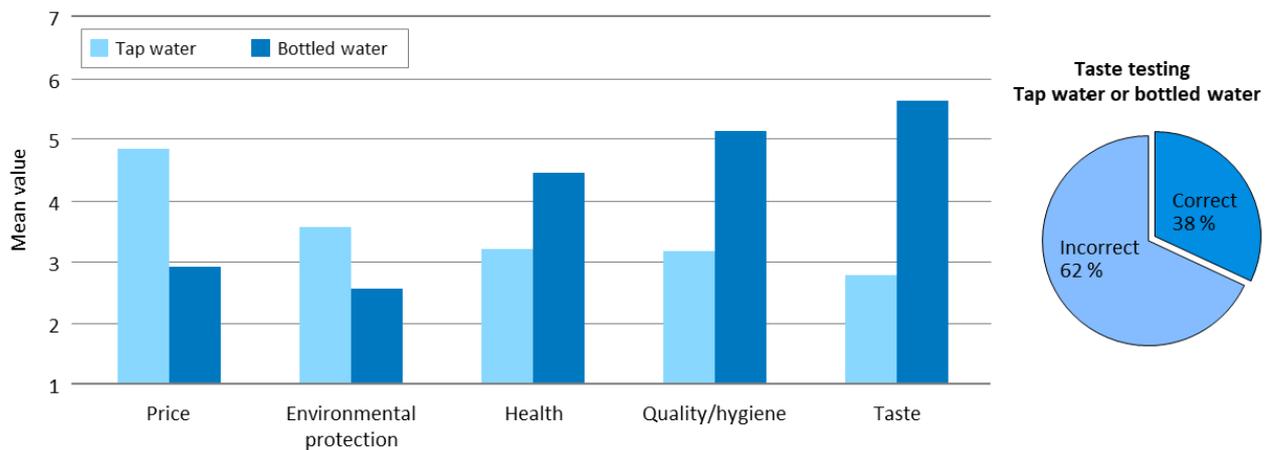
In particular, the convenience of offers and products constitutes a central factor in the food environment. One example is so-called food pouches for small children (pureed ready-to-eat meals or pureed fruit and vegetable products in a flexible plastic bag that children can suck out of the packaging as a liquid snack). The processing and handling primarily addresses “convenience” aspects (easy availability regardless of place, time and situation) and the desire to give your children “healthy” foods, such as fruit and vegetables. Due to the higher convenience and the minimal effort involved in preparation, this type of product has very quickly become very popular. However, high or permanent availability is also the subject of critical discussion, as the structure of meals (time and place) is broken down as a result, “snacking behaviour” is learned and more is eaten on account of hedonic hunger (Cernansky, 2018, Richtel 2012).

Marketing is also a factor that influences the food environment; this factor not only increases exposure to food stimuli, but also associates them with certain values and characteristics that influ-

ence our explicit and implicit preferences. Emotions and social aspects (e.g. status, popularity, affiliation) are often associated with products (see e.g. Happy Meals from McDonalds), which are often independent of the actual nutritional value or taste of the products (see also Section 6.4). If a food is packaged with a corresponding cartoon, it is already given greater preference by 4 to 6-year-olds than if the same food is offered neutrally (Roberto et al. 2010). Marketing effects with respect to soft drinks are discussed in detail (e.g. Bragg et al. 2018, Zühlsdorf & Spiller 2015). This visual information can, in some cases, significantly influence sensory information such as taste or the feeling of satiety (Martin 2016) and, in some cases, decisively shape attitudes to, and evaluations of, products and dietary patterns.

A current example is the consumption of bottled water. As WBAE and WBW (2016) have set out, the consumption of mineral and medicinal water has risen sharply since 1970. In 2015, the German population consumed around 149 litres of “bottled water” per capita and year (Verband Deutscher Mineralbrunnen 2019). Since “bottled water” is far more expensive than tap water, but tap water is of high quality and subject to stringent controls, the preference for “bottled water” is also known as the “water paradox”. A recent survey of consumers in Germany shows, consistent with other studies, that consumers of “bottled water” rate it as better tasting, healthier and more positive in terms of quality and hygiene. However, when blind tasting of different water samples was carried out, neither the consumers of “bottled water” nor the consumers of tap water could tell which sample contained tap water and which “bottled water” (Fig. 3-7). The subjectively perceived differences are therefore, first and foremost, learned “perceptual illusions”. Since water is a neutral stimulus, i.e. it is (almost) colourless and taste-neutral, packaging and marketing play a key role here; they ultimately define the difference between bottled and tap water. Various advertising campaigns present “bottled water” as a lifestyle product and link it, for example, to taste, health, attractiveness and vitality. These are associations that consumers learn quickly and easily. Corresponding campaigns for drinking water are lacking. Any reports on drinking water usually relate to the occurrence of hazardous situations.

**Figure 3-7:** Assessment of tap and “bottled water” by consumers who prefer to consume “bottled water”.



Source: Debbeler et al. (2018).

### 3.3.4 Eating/consumption

What, how much, when and how fast we eat is also influenced by the factors already mentioned. As factors influencing the food environment, aspects relating to the specific eating environment, such as the range of food and dishes on offer (quality, quantity, choice), characteristics of the food and dishes (e.g. portion size, size of dishes and cutlery), the direct and indirect environmental design (e.g. noise, time pressure, stress) or the ambience (space, light, temperature, smell, music) and the social environment (community, type of social event) are also of vital importance.

All dietary recommendations suggest a certain quality and amount of energy (Section 4.2). For consumers, estimating quantities for a particular dish is often a complex task and can lead to considerable overestimations and underestimations. Various studies show that the amount of calories or energy, or also weight and volume, is sometimes largely underestimated, especially with increasing portion size (cf. also Section 3.4). This applies not only to consumers but also to experts (cooks) (Chandon 2013). These underestimates are caused, among other things, by misperceptions that are not consciously controlled. Portions are perceived to be larger when they are served on smaller plates (“Delbeuf Illusion”); the same applies to beverages and glasses. Portion size is not the only aspect of the food environment that influences quantity estimation and consumption levels; other aspects such as labelling also have a major impact here. The effect known as the “health halo” describes the fact that foods called healthy, low-fat or low-calorie are implicitly perceived as less energy-rich and are associated with higher consumption levels (cf. also Section 7.5.3.1). Vague portion designations such as “normal”, “small” or “mini” also influence perception. The combination with something “healthy” (salad leaves, fruit) also leads to calories being underestimated (Chernev & Gal 2010). The energy levels in “healthy” food variants are sometimes quite considerably underestimated compared with “unhealthy” variants (Oakes 2005). Other studies also point

to considerable misinterpretations of the energy and sugar levels, with substantial underestimations being observed in some cases. Dallacker et al. (2018) showed parents pictures of different foods (orange juice, cola, pizza, yoghurt, muesli bars and ketchup) and asked them to estimate the sugar content in sugar cubes: 74% of the parents interviewed underestimated the sugar content, in some cases considerably. For a 250 g pot of yoghurt<sup>39</sup>, 92% of the parents interviewed underestimated the sugar content by an average of seven sugar cubes.

Another significant problem arises from the perspective of learning psychology. Based on experience (associative learning), we learn the connection between food and meals on the one hand and taste and satiety on the other (“flavour-nutrient learning”, see also Section 3.1). On this basis we form corresponding expectations (e.g. saturation content), which in turn control our intake (Martin 2016). In individual cases, it is therefore possible to precisely estimate or even know the energy density of a food or product based on learning experiences. However, many product classes (e.g. ready-to-eat meals, processed products) differ widely in their energy density (as well as other characteristics such as macronutrients, texture etc.), and this makes learning considerably more difficult or impossible for us. In addition, there are different, often competing stimuli in the food environment (e.g. labels) and, given the many decisions and compositions of the dishes, learning and remembering this huge amount of information (i.e. for each decision and food choice we make) is, on balance, impossible. It is therefore questionable whether more educational offers and schooling would prevent these distortions of perception and estimation errors with respect to quantity (e.g. calories, sugar or fat levels) and would fundamentally improve choices and consumption in everyday life.

Most people prefer to eat with others rather than on their own (Fischler 2011). “Commensality”, i.e. eating and preparing food together, fosters social relationships and pro-social behaviour (Spence 2016). Eating is thus not only an intake of energy and nutrients, but also key to mental health and social belonging, which in turn has an impact on physical health. Eating with others offers the possibility of “synchronisation” with other people and is central to the exchange of information and social norms that implicitly define what is appropriate behaviour (see, for instance, mealtimes). Various studies (e.g. Renner et al. 2012, Wahl et al. 2019) demonstrate that it is not only “what we eat”, i.e. the quality and quantity of food and meals consumed, that is central to mental and physical health, but also when, where, how and with whom we eat. Fulkerson et al. (2014) compiled studies on the relationship between the frequency of family meals and the quantity and quality of the diet and reported that eating together in families is on average associated with a better quality diet. In various countries, partly due to demographic developments, there is an increasing trend towards eating alone (see also Section 4.2.2.4 on the situation in Germany). However, there has so far been only little research into the impact of the social destructuring of meals. In a sample, comprising more than 38,000 Japanese men, the relative risk of obesity was found to be 34% higher for men who ate alone than for men who ate together (Tani et al. 2015).

---

<sup>39</sup> A 250 g cup of yoghurt can contain 32 g of sugar (10.7 sugar cubes). See e.g.: <https://www.bauer-milch.de/der-grosse-bauer-himbeere/info>.

In a large representative Korean sample, in a longitudinal analysis, men and women who ate their main meals alone subsequently showed a higher risk of metabolic syndrome<sup>40</sup> (Kim et al. 2018).

**Short-term and long-term effects.** Decisions for or against buying foods, and actual eating behaviour, have numerous short-term as well as long-term consequences. This expertise focuses on the long-term health consequences described in Section 4, such as obesity or chronic diseases (Section 4.2), as well as the long-term social effects with respect to food production (Section 4.3) and the environmental effects of our diet (Section 4.4).

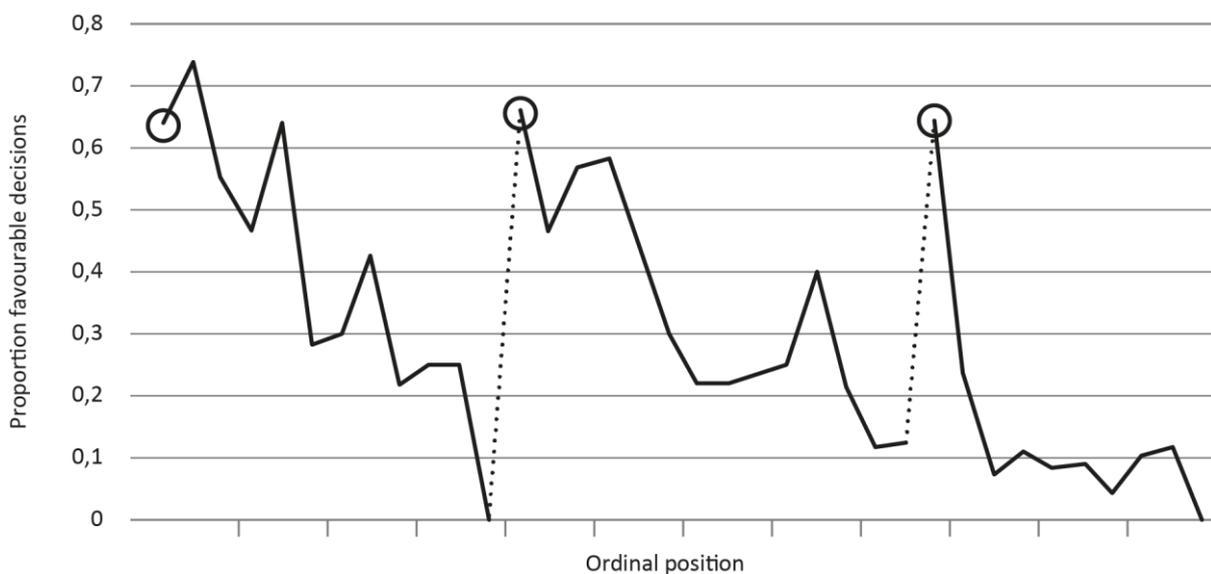
The physiological and psychological effects experienced immediately during and after eating are particularly crucial for individual behaviour, such as the feeling of satiety, enjoyment and well-being, as these directly experienced consequences have a reinforcing or inhibiting effect on behaviour. Ideally, food should satiate us, be enjoyable, make us fit and efficient and ultimately also fulfil core emotional and social functions (cf. Section 3.1). The energy and nutrient content is therefore only one important aspect when the physiological and health consequences are considered. Empirical findings provide strong evidence that eating significantly enhances our psychological well-being, social bonds and cohesion as well as our work performance (overview: Fischler 2011, Spence 2016). This is illustrated by various studies related to judicial or political decisions, business decisions or the performance of firefighters. For example, Danziger et al. (2011) examined over 1,000 court decisions regarding motions of appeal in Israeli courts. They found that the type of judgment varied systematically depending on the two daily meal breaks: the proportion of positive judgments regularly dropped from an initial 65% to almost zero before the meal break, only to rise abruptly to 65% again afterwards (Fig. 3-8)<sup>41</sup>.

---

<sup>40</sup> The term “metabolic syndrome” refers to the simultaneous occurrence of severe overweight, high blood pressure, elevated blood sugar levels and disturbed fat metabolism. It is associated with a higher risk of type 2 diabetes and cardiovascular disease.

<sup>41</sup> The non-positive decisions included rejections and adjournments. Results were similar when statistical checks were carried out for different aspects (number of previous favourable decisions taken during the day in order to check for a “quota” effect; seriousness of the offence, length of sentence served, previous detentions, rehabilitation programme and sex and nationality of the prisoner). Moreover, there was no significant correlation between the characteristics of each case and the position taken during the day.

**Figure 3-8:** Percentage of judicial probation decisions in favour of the prisoner depending on the meal break according to the Israeli study



Note: Circles mark the first decision in the three different sessions throughout the day; dashes on the x-axis mark every third case; dotted lines indicate meal breaks.

Source: Danziger et al. (2011: 6890).

### 3.4 Focus: the portion size effect

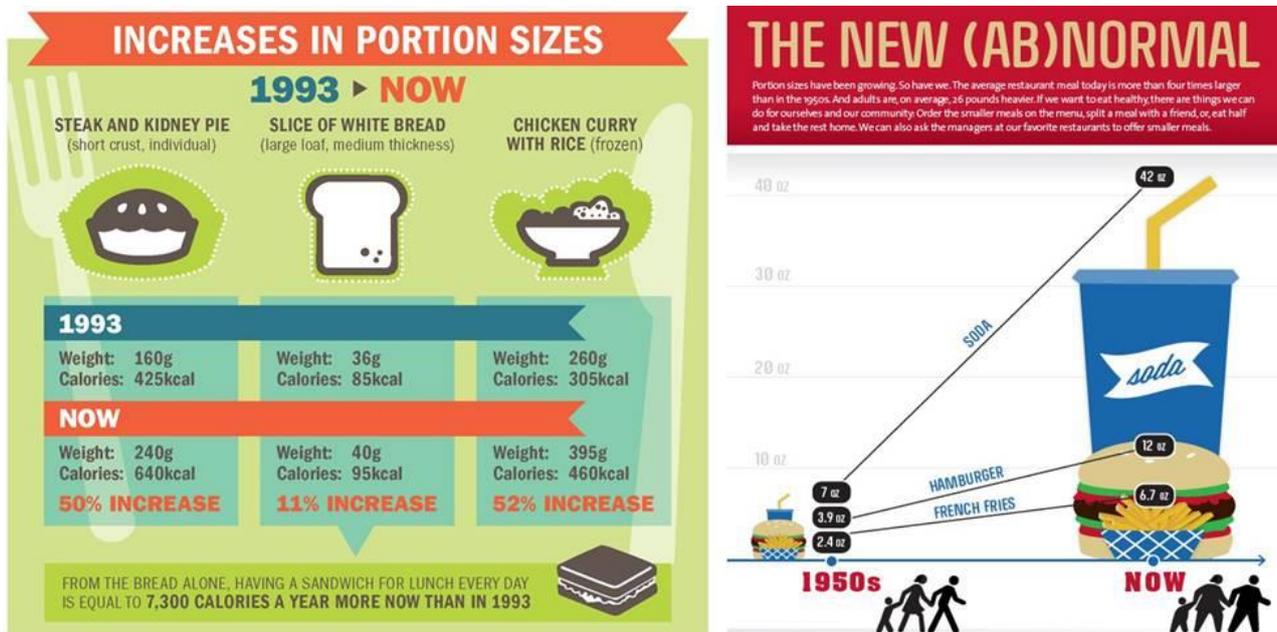
The availability of certain portion sizes is an important food-environment factor which is of significance at various stages of the behavioural process and thus influences our eating behaviour both indirectly and directly. For example, exposure to larger portions affects the social norm, i.e. what we call an appropriate or “normal” portion. The availability of certain portion sizes determines our access to and choice of food, e.g. when small portion sizes are not available or are more expensive. And finally, portion sizes also directly influence our consumption; we eat and drink more when portions are larger without being aware of it (“portion size effect”). This effect will therefore be examined in greater detail below.

#### 3.4.1 The portion size effect: developments and current data

Observations have been made in various countries such as the USA, Great Britain, Denmark and the Netherlands which suggest that pack and portion sizes have increased over the decades, in some cases quite substantially (Benton 2015, Steenhuis & Poelman 2017, see Fig. 3-9). Whereas, in the 1960s, a Coca-Cola in the USA was only 6.5 ounces (192 ml) in size, today’s sizes are up to 10 times larger, such as 7-Eleven Double Big Gulp (64 ounces, 1893 ml) with about 800 calories (“supersizing”). Portion sizes are also increasing in Europe. In the Netherlands, for example, the largest available packaging unit for soft drinks rose from 750 ml to 2,000 ml per bottle of Coca-Cola, for

instance, between 1957 and 1993. Snacks, such as the “regular” family pack of Lays potato crisps, increased from 175 g in 1987 to 225 g in 2004. This increase in portion or serving sizes can be observed with respect to both the retail sector and “fast food” – as well as for other restaurants (Herman et al. 2016). Such trends are also evident in the portion and serving sizes in at-home consumption. For example, portion sizes in US-American and Danish cookbooks have increased over the decades (Eidner et al. 2013, Wansink & Payne 2009).

**Figure 3-9:** Changes in portion sizes since 1950 in the USA and Great Britain

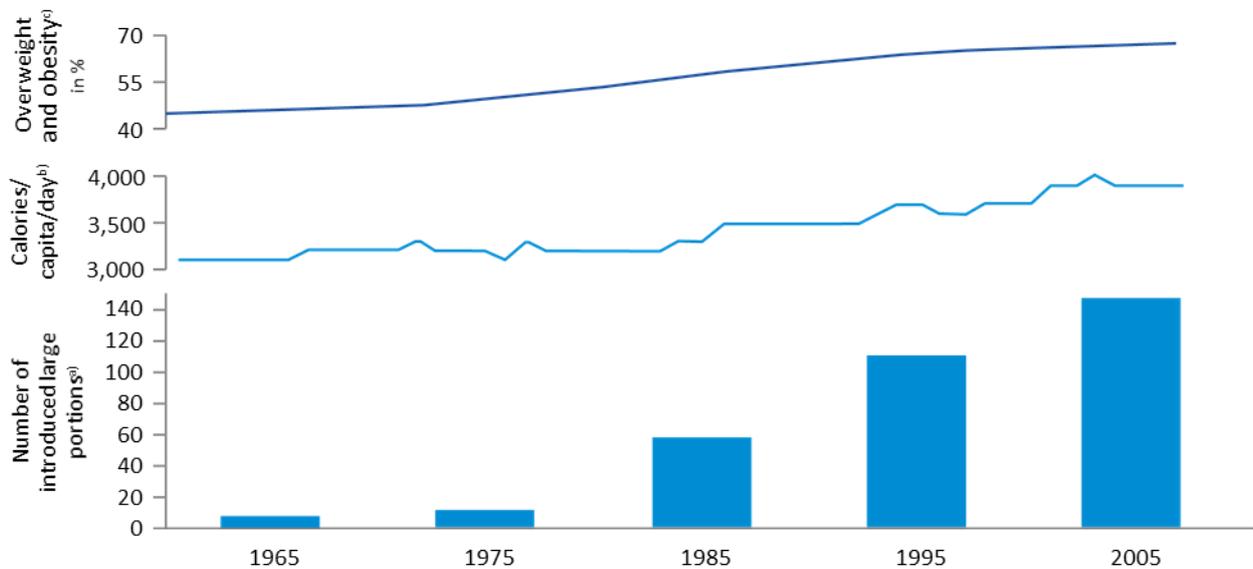


Source: Marteau et al. (2015).

Unfortunately, there is no comparable data available for Germany, but it can be observed that with regard to soft drinks and energy-rich snacks, large packaging sizes are also offered, which tends to have developed over recent decades. For example, McDonalds advertises the “Big Tasty” Burger (880 kcal, see <https://www.mcdonalds.com/de/de-de/product/big-tasty-bacon-200079.html>). However, some countervailing trends can be seen since smaller packaging sizes are also on offer, e.g. for sweets.

Young and Nestle (2012) summarised the trends in the USA between 1965 and 2009 (Fig. 3-10) and point out that the number of large portion sizes has steadily increased and that there are parallels here with the increase in average energy intake and body weight. However, these are associated correlations that do not permit any causal statement to be made (see Herman et al. 2016).

**Figure 3-10:** Trends in overweight/obesity, calorie supply/per capita, number of product launches with large portion sizes in the USA between 1965 and 2009



Note: Independent observational data are presented here; whether a causal relationship exists between the trends cannot be proven based on these data; a) number of large portions introduced within a decade; bars indicate the average year within a decade, b) data based on the US Department of Agriculture, <https://www.ers.usda.gov/Data/FoodConsumption/>, c) adults aged 20 and over in the USA with a BMI of > 25 kg/m<sup>2</sup> (NHANES surveys, 1960-2008, [https://www.cdc.gov/nchs/data/hestat/overweight/overweight\\_adult.htm](https://www.cdc.gov/nchs/data/hestat/overweight/overweight_adult.htm); [https://www.cdc.gov/NCHS/data/hestat/obesity\\_adult\\_07\\_08/obesity\\_adult\\_07\\_08.pdf](https://www.cdc.gov/NCHS/data/hestat/obesity_adult_07_08/obesity_adult_07_08.pdf)).

Source: Young & Nestle (2012: 566), graphically adjusted.

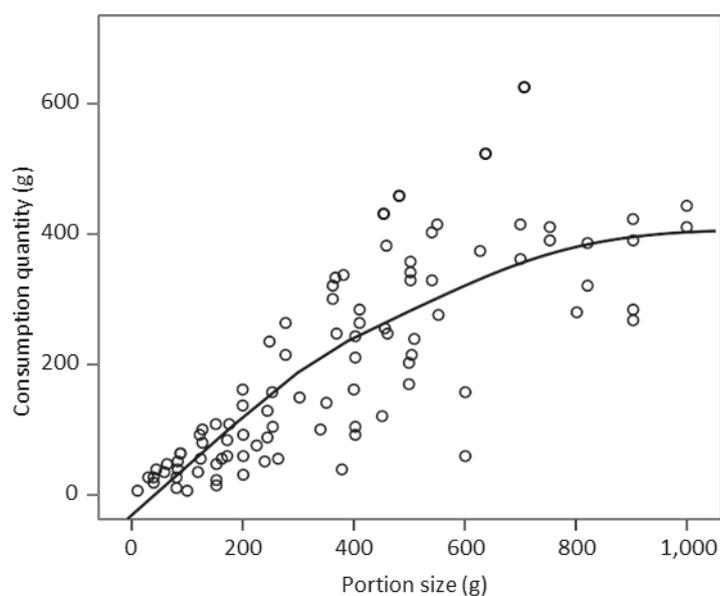
Even if the direct link between portion size, increased energy intake and overweight is not clearly and directly proven (see e.g. the studies of French et al. 2014, Rolls et al. 2007, Livingstone & Pourshahidi 2014), the connections between increased energy intake and weight gain as well as between portion size and energy intake are comprehensively documented. Various epidemiological studies suggest that the average energy intake has risen over the decades. Vandevijvere et al. (2015) have compiled the development of energy intake and body weight for 56 countries, including Germany, and showed a positive correlation between energy intake and body weight gain, notably in high-income countries.

The “portion size effect” itself is empirically very well substantiated; this describes the effect that the larger the available portions are, the more we eat without necessarily being aware of it (Hollands et al. 2015, Zlatevska et al. 2014). For example, a 50% increase in portion size in a sample encompassing 23 adults resulted in an increase in average daily energy intake by 423 kcal. Over a period of eleven days this amounted to 4,636 kcal. This increase could be observed for almost all meals and food categories and for both men and women (Rolls et al. 2007). Similarly, larger pizza portions resulted in higher energy intake in children and adolescents (Piernas & Popkin 2011).

Even if this portion size effect is explicitly pointed out to us, it cannot be avoided. Test subjects to whom this effect was explicitly pointed out still consumed significantly more of a dish if it contained a larger portion and did not differ from a control group who did not receive this additional information. On the contrary, the subjects subjectively believed that hunger and taste were decisive for the amount consumed, but not the portion size.

The “portion size effect” was shown in different study designs and samples and for different foods. It occurs in children, adolescents and adults and is independent of socio-demographic characteristics such as class, gender or body weight (Livingstone & Pourshahidi 2014). Zlatevska et al. (2014, see Fig. 3-11) collated the large number of studies in a meta-analysis on portion size and showed that the amount consumed increased with portion size.

**Figure 3-11:** Relationship between portion size and amount consumed, N = 109 studies



Note: 109 observations are shown. Modelling consumption as a square function of portion size resulted in the following equation:  $\text{consumption} = 0.81 \times \text{portion size} - 3.65 \times 10^{-4} \times (\text{portion size})^2$ ,  $R^2 = 0.74$

Source: Zlatevska et al. (2014: 148).

Hollands et al. (2015) estimate, based on the results of a systematic Cochrane review and meta-analysis, that differences in package sizes cause variations ranging from 215 to 279 kcal in daily energy intake. Similar effects were also shown for crockery sizes (Section 8.3).

### 3.4.2 Why we eat more when portions get bigger

We are often not explicitly aware of the increased amount and energy consumed, but these are, as a rule, regulated implicitly or intuitively. Consumers often find estimating portion sizes in the form of kcals or grams difficult and imprecise (but this also applies to experts) in everyday life and also require permanent self-regulation. The self-perceived accuracy of the estimate is also only moderately related to the actual accuracy of the estimate (e.g. Chandon 2013, Dallacker et al. 2018, König et al. 2019). Our experienced sense of satiety, which is typically used as a gauge, is only partially related to the physiological energy requirements. Rolls et al. (2007) and French et al. (2014) showed by means of controlled field experiments that larger meals and portions led to a higher energy intake, which was apparently not offset in later eating behaviour. The fact that such additional quantities of consumed food are often not consciously perceived is also shown by the fact that the experienced sense of satiety does not increase linearly with the amount consumed.

How much we eat and drink, and how full we feel afterwards, therefore depends not only on the biological energy requirements and the actual amount consumed, but also heavily on various food-environment factors. Even if the mechanisms underlying the portion size effect are not fully understood, it is clear that four implicit factors influence it (Benton 2015):

- (1) **Size of the serving unit (“unit-bias”, “segmentation-bias”).** The size of the serving unit (e.g. a sandwich, piece of cake) implies what is the appropriate amount to be consumed at a meal (social norm). Another reason why smaller serving units are linked to lower consumption is because the consumption of several smaller serving units is considered more impulsive and less appropriate than the consumption of a single larger unit.
- (2) **Expected satiety per portion (“previous experience expectation” effect) and taste expectations.** The expected satiety per portion based on previous learning experiences or hints and design on the packaging (“light”, “low in sugar”) also influence the choice and later consumption. In general, people elect to have larger portions of a food if the food is associated with lower satiety. However, there is often only a moderate consistency between expected satiety, experienced satiety and the food’s energy density.
- (3) **What portion size is perceived as socially appropriate (“social norm”).** The more often we are presented with large portion sizes (supersize, big size) (exposure), the more “appropriate” or “normal” we perceive them to be. Even if people do not choose certain portion sizes themselves, the offer of particularly large variants alone can have an influence on their choice of product. For example, offering a larger portion size and omitting a small portion size leads to an overall shift towards the selection of larger portions (Chandon 2013, Sharpe et al. 2008). The offer “calibrates” our perception and ultimately also our patterns of consumption without us being explicitly aware of this (Marteau et al. 2015; cf. Section 8.3).
- (4) **Design of the packaging or crockery (e.g. “Delbeuf illusion”).** The shape of the packaging or crockery sometimes has a significant impact on the estimation of the volume. For example, portions on smaller plates are perceived as larger (“Delbeuf illusion”). If a single dimension

of the packaging is modified, we underestimate the increase in quantity less drastically than if the height and width are both changed (Chandon 2013). Hollands et al. (2015) were able to show in a meta-analysis of crockery size, pack size and portion size that the larger these were by default, the more people ate compared with a control group or in a pre-post comparison (cf. Section 8.3).

These food-environment factors are sometimes even more important for the amount consumed than actual energy requirements and energy intake (Benton 2015, Brunstrom 2011, Chandon 2013, Raynor 2014, Steenhuis & Poelman 2017, Herman & Polivy 2005).

### 3.5 Conclusion “Why we eat what we eat”

Our dietary habits are highly complex and connected in many different ways with other everyday activities and our food environment. Consumers and policy-makers often overestimate their own control over their actions and underestimate the influence of food environments, from exposure to food to consumption. Accordingly, there are various food-environment factors that hamper a more sustainable diet:

- Some foods have such a high rewarding effect that negative feedback signals caused by satiety are overcompensated.
- The situational availability of food (e.g. (sweet) snacks), time pressure and societal norms can conflict with the goal of a healthier or more sustainable diet.
- Enlarged portion sizes change (“calibrate”) perception, i.e. the social norm for “appropriate” or “normal” portions.
- Delivery services and vending machines are targeted at making food, meals and snacks more and more easily accessible, at any time and almost anywhere. However, the temporal or social destructuring of food consumption tends to be problematic.
- Highly processed, calorie-dense products are often particularly time-saving, especially in terms of shopping and preparation.
- There is considerably more advertising for unhealthy foods than for health-promoting ones.
- Environmental design (e.g. noise, time pressure, stress) and ambience (space, light, temperature, smell, music) contribute to people eating more than under other conditions.
- Certain product classes (e.g. ready-to-eat meals, highly processed products, beverages) exhibit a wide variation in energy density and in characteristics such as macronutrients and texture, making it hard to accurately assess energy density based on learning experiences.

The above factors make it difficult for people to achieve their goals. Food retailers, food industry and (fast food) catering shape the food environment to a considerable extent. In recent decades there have been numerous improvements in the food environment, such as a wide range of fruit

and vegetables being offered in supermarkets. At the same time, however, exposure and access to less health-promoting foods have increased, with the result that these are selected more often. Marketing concepts, such as increasing portion sizes, initially focus on sales and profit, not on health or eco-friendliness. The implicit distortions of perception and decision-making described above usually have an impact even when we are aware of them. For food policy, this means that we must look more closely than before at the design of the food environment.

To date, however, food policy has been heavily focused on explicit measures and specifically on the area of improving consumer information and consumer education. The development of problems over the past decades (Section 4) indicates the limits of these instruments. Targeting measures towards individual responsibility and self-regulation can therefore only be one element of an overall policy aimed at promoting more sustainability in food consumption. There is also an urgent need for further measures to assist our options for action as consumers in our everyday lives. Action to change the food environment requires a mix of explicit and implicit measures that takes into account the different phases of the behavioural process, ranging from exposure and access to food to selection and consumption (Section 8, Fig. 8-1). We need easier alternative courses of action and transparent support to succeed in promoting more sustainable food consumption. Only in this way can we address the behavioural paradox so that more sustainable and balanced food consumption can be implemented in our everyday lives.

## 4 Problem analysis

### 4.1 Food consumption in a global context

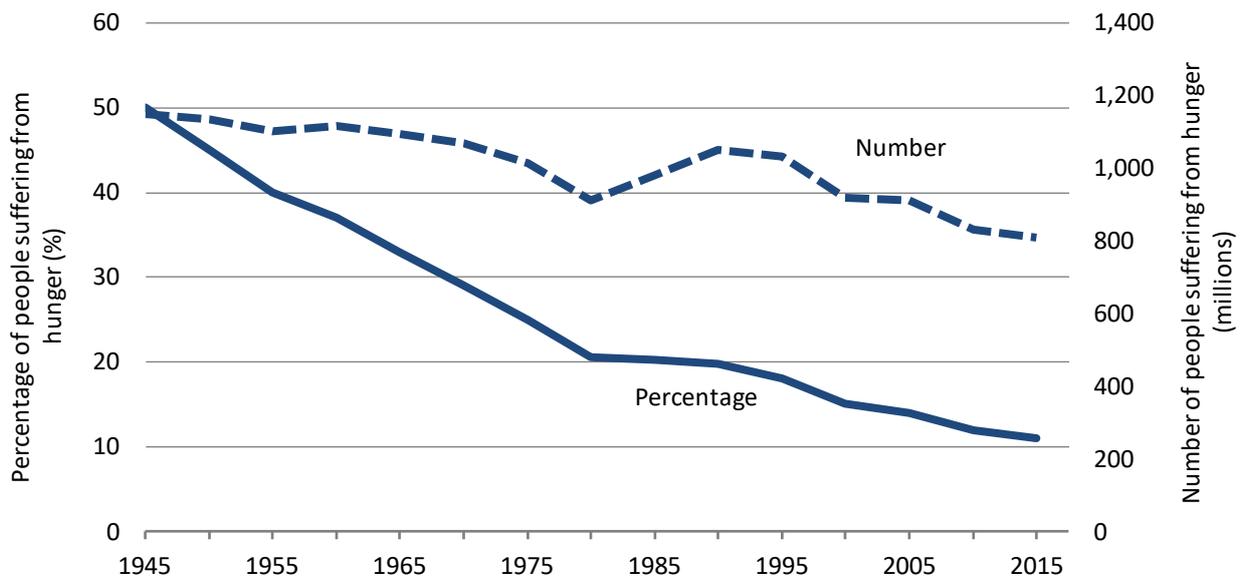
Agricultural production and consumption in Germany and Europe have both a direct and indirect impact on food production and consumption in the rest of the world. Even though this expertise focuses on issues related to nutrition and consumption in Germany and Europe, the **global food situation** must not be overlooked. Section 4.1 gives a short overview of this situation. With respect to health as a sustainability dimension (Section 4.2), it is highlighted that – in contrast to Germany – (chronic) hunger in the form of a sustained lack of calories continues to play a major role around the globe (even though declining relatively over time), and that – as in Germany (Section 4.2.3) – micronutrient deficiency (hidden hunger) and the simultaneous occurrence of micronutrient deficiencies and overweight/obesity, the so-called double burden of malnutrition<sup>42</sup>, are of vital importance. With regard to the dimension of environmental sustainability (Section 4.4), it is shown that the past and future reduction of hunger is closely associated with increases in production. It ensues from this that environmental and nature conservation measures that contribute to a reduction in yields per unit area in Germany will, if patterns of consumption remain unchanged, lead to more food having to be imported or less food being able to be exported, which would exacerbate the global supply situation. For the same reason, a change in consumption patterns that leads to lower demand for agricultural produce in Germany, such as cutting the intake of animal products (Section 9.3) and reducing food waste (Sections 8.11 and 9.7.4), can contribute to improving the global supply situation.

Figure 4-1 shows how **hunger** has developed around the globe over the past 70 years. These figures refer to the pure lack of calories (see below for other important forms of malnutrition). Overall, the percentage of people who are not adequately supplied with calories has fallen sharply. Whereas half of all people suffered from a calorie deficit in the middle of the 20<sup>th</sup> century, this now affects only 11% of the global population (FAO 2019a). Most people who still suffer from calorie deficits today live in Asia and Africa. The significant decrease in the proportion of people who are undersupplied with calories is largely due to increases in agricultural production (Qaim 2017). Global food production has more than tripled since the mid-20<sup>th</sup> century. The area of land used for agriculture has only expanded slightly during this period. However, yields have increased considerably in most regions of the world, chiefly through the development of new varieties, improved technology, increased use of chemical fertilisers, plant protection and irrigation. Increases in production have improved the availability of and access to food for consumers and raised the incomes of agricultural producers (Evenson & Gollin 2003).

---

<sup>42</sup> Globally, we are in some cases facing a so-called triple burden of malnutrition, i.e. the simultaneous occurrence of (1) calorie deficits, (2) micronutrient deficiency and (3) overweight/obesity and the associated health problems.

**Figure 4-1:** Development of the proportion and number of people affected by calorie deficit (hunger) worldwide



Source: WBAE presentation based on FAO data.

However, despite the sharp drop in the percentage of people affected by calorie deficit, the absolute number of these people has only fallen slightly (Fig. 4-1). Over 800 million people still suffer from calorie deficit (FAO 2019a). The reason for the different development in percentage and absolute number is the growing world population.

Even though calories are, at present, being produced in sufficient quantities, many people in developing countries are simply too poor to adequately provide for themselves. Hunger is therefore, first and foremost, an **issue of poverty**. However, global production and consumption volumes also have an impact on hunger via the market price mechanism. Without the increases in production in the past decades, food prices would be far higher today. Given the same distribution of income, higher prices would mean more limited access and an even greater number of starving and poor people.

How will the global interrelationships develop in the future? By the year 2050, the world population is likely to grow to well over 9 billion people, so that the demand for food will continue to rise. In addition, agricultural products are increasingly being used to produce materials and energy and are thus being withdrawn from the food sector. Climate change will probably have a negative impact on agricultural production, notably in developing countries. In order to prevent a surge in food prices and an associated rise in hunger in developing countries, global trends in supply and demand must be monitored and influenced in an appropriate manner. Curbing average meat consumption in rich countries can help to some extent because it reduces processing losses (Qaim & Klümper 2013, Cordts et al. 2014, WBAE & WBW 2016). Other losses and wastage along the value chain should also be reduced (WBAE & WBW 2016). At the same time, however, the consumption of

meat and other animal products is on the rise in most developing countries, so that processing losses are likely to increase there. In a previous statement, the WBAE addressed global supply and demand trends in greater detail, emphasising that, in addition to poverty reduction and more sustainable consumption as factors to help secure global food supplies, agricultural production increases were still necessary, both globally and particularly in developing countries (WBA 2012). Yield gaps are currently large in many developing countries, where high yield increases could be achieved even with relatively simple improvements in technology and institutions. Moreover, production increases in developing countries have the potential to contribute to alleviating hunger not only through lower market prices, but also through income growth in agriculture. This is particularly the case if yield increases can be achieved in the smallholder farmer sector, because smallholders account for a considerable proportion of the world's starving people (Qaim 2017).

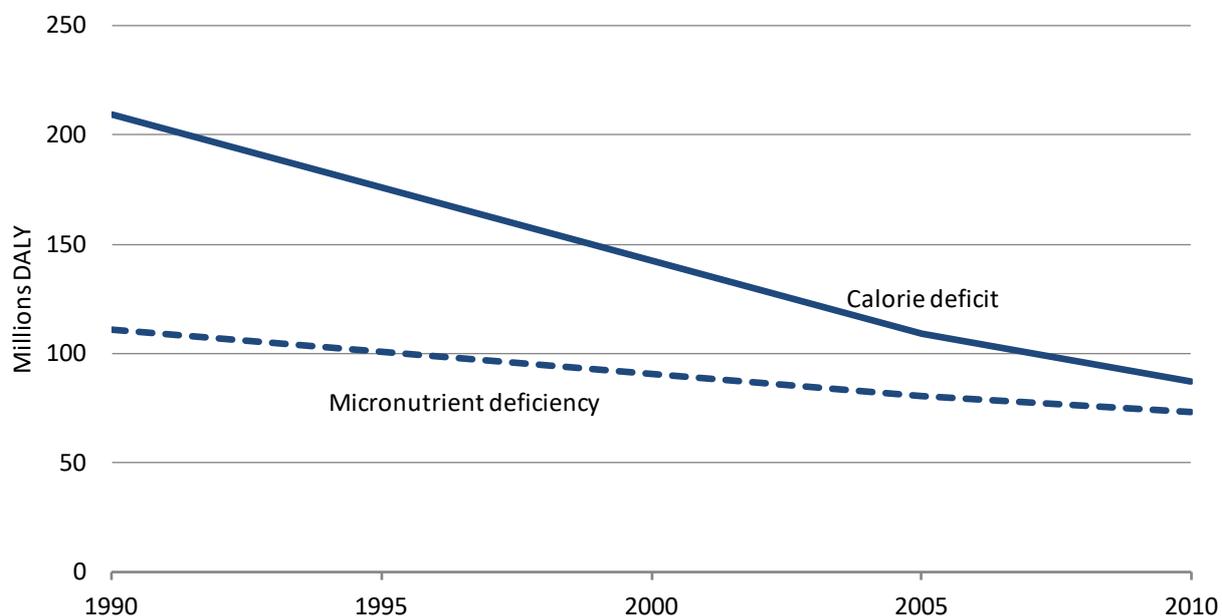
The need for global production increases also has important implications for determining what type of agriculture in Europe can be deemed particularly sustainable. In Central Europe, more chemical inputs will hardly be able to act as the lever for sustainable productivity increases. There is a tendency at many European sites to instead reduce such chemical inputs on account of the environmental impacts of the currently (by global comparison) high/intensive deployment of chemical inputs and the need for efficient use of fossil resources. Conversely, however, a switch to **extensive forms of agriculture cannot generally be considered sustainable**, at least not if it results in a significant reduction in yields (cf. Section 5.2.2). If consumption patterns remain unchanged, lower yields in Europe would result in more food having to be imported or less food being able to be exported. This would worsen the global supply situation. Developments in Europe must therefore always be viewed against the backdrop of the global food situation.

Yet the global food situation is not just a question of calories. It is equally important to have a balanced intake of nutrients, such as essential amino acids and various micronutrients (vitamins, minerals). Over 2 billion people worldwide suffer from various micronutrient deficiencies that contribute to high infant mortality, physical and mental developmental disorders and many other health issues (Development Initiatives 2018). In recent decades, global agricultural and food policies have focused primarily on increasing cereal production. While this focus has helped to reduce calorie deficits, it has not promoted the diversity and quality of nutrition (Khoury et al. 2014).

The **one-sided focus on calories** in the fight against hunger and malnutrition is also the main reason why the scale of health problems associated with calorie deficit has decreased more over time than the extent of health issues related to micronutrient deficiencies. In Figure 4-2, the health impact of the various forms of malnutrition is assessed on the basis of the so-called DALY index, the loss of life years due to mortality or health impairment (disability-adjusted life years). The DALY index is a gauge often used in the health economic literature to compare widely varying health issues (e.g. mortality, infectious diseases, physical and mental developmental disorders) (GBD 2018). Other nutritional and health indicators also indicate that the problem of calorie deficits has decreased at a greater rate than the problem of micronutrient deficiency. For example, the problem

of child underweight (i.e. too little weight compared with a reference group of the same age, primarily an indicator of calorie deficit) has fallen relatively sharply in recent years, while the problem of child stunting (i.e. too little height compared with a reference group of the same age, a more inclusive indicator of nutritional quality) has been decreasing very slowly overall (Development Initiatives 2018).

**Figure 4-2:** Global health problems caused by different forms of malnutrition over time



Source: Gödecke et al. (2018).

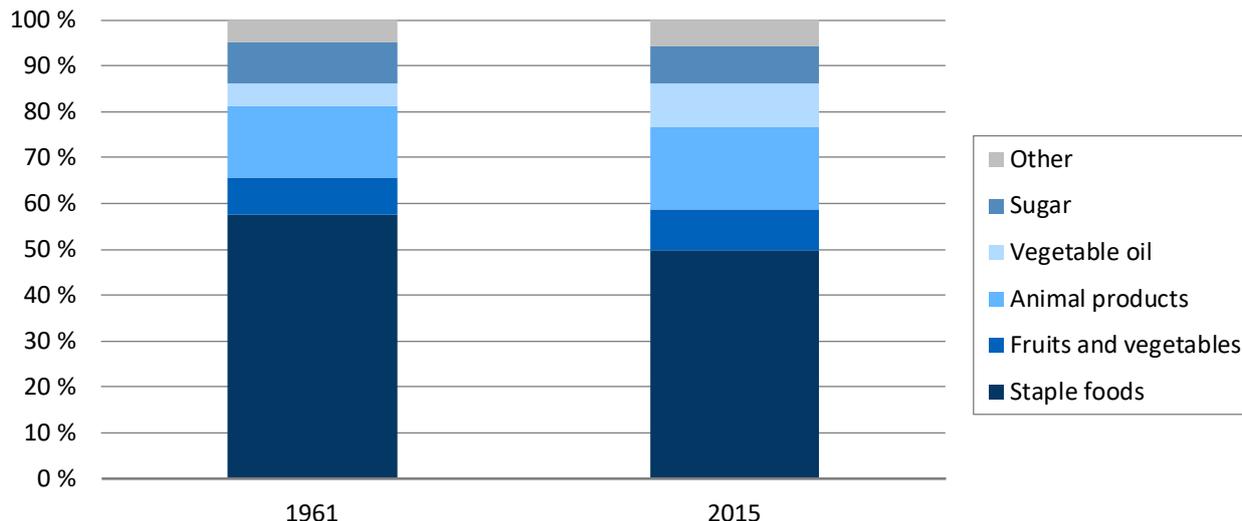
For the sake of completeness, it should be mentioned that, alongside the problem of malnutrition, the problems associated with **overweight, obesity and related chronic diseases** are also rapidly increasing in developing countries (Development Initiatives 2018). In many developing countries, the various forms of malnutrition (triple burden) occur not only in the same geographical context, but also in some cases within the same households. For example, many people are simultaneously affected by obesity and micronutrient deficiency. The parallel occurrence of different forms of malnutrition increases the complexity of an appropriate food policy, an issue which will be further described and discussed in the following sections and chapters with respect to Germany. It should only be noted here that the incidence of chronic diseases related to food consumption also poses increasing challenges for developing countries.

The quality and balance of the food supply is – among other factors – also influenced by productivity developments in the farming sector. As a result of the major progress in productivity, notably with respect to wheat, rice and maize, in recent decades, real prices for cereals have fallen over time; in comparison, fruit, vegetables and other higher-value foods have become relatively more expensive (cf. Section 7.5.2, text box 19 “Long-term influence of agricultural subsidies on food and nutrition”). Higher incomes gradually lead to a more varied and nutritious diet for poor people,

because cheaper food is supplemented and substituted by higher quality products. The **divergent development of relative prices** has presumably slowed down a more diversified diet, especially in developing countries (Gómez et al. 2013). About half of all calories consumed on a global scale still come from starchy staple foods, another 30% from sugar, fats and oils (Fig. 4-3). Less than 20% of calories come from fruit, vegetables and animal products – i.e. products that are particularly important for the intake of essential amino acids, vitamins and minerals. It is therefore not surprising that micronutrient deficiencies are still more widespread than pure calorie deficits.

In order to foster dietary diversity and combat micronutrient deficiencies more effectively, the diversity of production in global agriculture must be increased (Global Panel on Agriculture and Food Systems for Nutrition 2016). This does not mean that everything must be produced locally. The connection between production diversity and food-consumption diversity is often relatively weak at the local level, because if markets function well, local supply can be supplemented by regional and international trade (Sibhatu et al. 2015). But especially in the case of fresh products, which are perishable and cause high transport and storage costs if the infrastructure is deficient, there is a positive correlation between availability and production at local level. Good access to nutritious fresh produce therefore also requires improved infrastructure and logistics for transport, storage and marketing, particularly in developing countries.

**Figure 4-3:** Proportion of different food groups in global calorie consumption



Source: WBAE presentation based on FAO data.

The increase in world population and income, as well as the stepped-up use of agricultural products for material and energy uses, is causing a rise in demand for agricultural products. A diversification of people's food consumption (in developing countries but also in Germany) – which is desirable for health reasons – would further intensify the rise in demand for farmland, since one hectare of fruit trees, vegetables or pulses provides fewer calories than one hectare of cereals in most cases

(Herrero et al. 2017). Firstly, this underscores the fact that cutting the consumption of animal products in OECD countries, as well as reducing losses and waste, would not only be conducive to alleviating the environmental problems associated with processing and losses and waste, but would also help reduce the demand for agricultural produce. Such reduced demand could result in lower global food prices. This could contribute to improving the global food supply, both for the urban population and for those parts of the rural population that are dependent on food purchases. Secondly, in view of a further increase in global demand for agricultural products, de-intensification<sup>43</sup> in Germany and Europe could result in intensification and indirect land use change effects elsewhere in the world. This does not generally preclude de-intensification or extensification. On the contrary, they are necessary to a certain extent to achieve Germany's environmental targets. It shows, however, that in addition to local effects, global effects must also be considered. Germany is not an island, and sustainable food consumption and agriculture require a global view beyond Germany's borders.

## 4.2 Food consumption and health

The way people eat is deemed to be the key determinant of individual health status and well-being, alongside physical activity and tobacco and alcohol consumption (Li et al. 2018, RKI 2015)<sup>44</sup>. Health is thus an essential component of sustainable development, i.e. a development that makes it possible to meet basic needs in the long term (cf. Section 2). Both the conditions under which food is perceived, selected, prepared and consumed and the conditions under which food is produced can be such that people cannot adequately meet their basic needs. This expertise addresses the former under the health dimension, and the latter under the social dimension (Section 4.3).

The following Sections 4.2.1 and 4.2.2 describe how health-promoting food consumption can be defined and what the situation in Germany is like in terms of food consumption and health. Building on this, Section 4.2.3 is devoted to the question of whether and to what extent health-promoting food consumption is possible in households affected by poverty. Last but not least, a basic prerequisite for health-promoting food consumption is that the food consumed must be safe, i.e. free from residues that could pose a risk to health. This aspect is dealt with in Section 4.2.4. Section 4.2.5 summarises the problem analysis for the health dimension.

---

<sup>43</sup> Haber (1991, 2016) uses the term de-intensification instead of extensification in a context where the use of inputs in a farming system is reduced, but no change of farming system occurs (e.g. shift from conventional to organic farming).

<sup>44</sup> The WBAE is aware of the fact that high alcohol and tobacco consumption and low physical activity also increase the risk of disease. Li et al (2018) recently estimated that lifestyle factors (overweight, "unhealthy" diet, smoking, increased alcohol consumption, physical inactivity) can cause 50-year-old women and men to lose up to 12 to 14 years of their life expectancy. A well-researched analysis and discussion of the consumption of psychotropic stimulants such as alcohol and tobacco goes beyond the limits of this expertise (cf. WHO 2018). Only specific problem situations will therefore be examined below, such as alcohol during pregnancy (Section 4.2.2.2) and the replacement of soft drinks by alcoholic beverages (Section 8.6.2).

### 4.2.1 What are the characteristics of health-promoting food consumption?

Health-promoting food consumption can be achieved by implementing the ten rules of the German Nutrition Society (DGE)<sup>45</sup>. The rules are addressed at the population as a whole, without taking into account specifics such as age or gender. Key concern of the implementation of the ten rules is to prevent diseases and promote performance and well-being. In order to do justice to the diversity of people's preferences and cultural backgrounds, the DGE recommendations deliberately leave a wide scope. In short, they are as follows:<sup>46</sup>

- (1) Enjoy food diversity
- (2) Fruit and vegetables – take “5 a day”
- (3) Favour whole-grain foods
- (4) Complete the choice with animal-based foods
- (5) Choose health-promoting fats
- (6) Reduce sugar and salt intake
- (7) Water is the best choice
- (8) Careful preparation
- (9) Mindful eating and enjoyment
- (10) Watch your weight and stay active

The ten rules are based on the one hand on the D-A-CH reference values<sup>47</sup> for recommended nutrient intake and on the other hand on the evaluation of foods based on relevant meta-analyses (see text box 2 on “Dietary guidelines”).

#### **Text box 2:** Dietary guidelines

According to the WHO, dietary guidelines should be designed in such a way as to ensure vital metabolic, physical and mental functions in almost all healthy individuals in the population and to prevent health issues such as deficiency diseases.

The D-A-CH reference values for nutrient intake are divided into guidance values, recommendations and estimated values (see <https://www.dge.de/wissenschaft/referenzwerte/>). Guidance values are intended to provide orientation with respect to the desirable intake of energy and nutrients necessary for maintaining and promoting health. They apply, for example, to energy, carbohydrates, fat or fibre. Recommendations are made if there is an experimentally determined average requirement; this is added to two standard deviations or a coefficient of variation of 10 to 15%. Recommendations apply, for example, to protein, linoleic acid, vitamin C, thiamine, calcium or iron. Estimates are made when the average requirement cannot be identified with sufficient accuracy but must be derived, for example, from the consumption of healthy people eating an adequate diet. This applies for example to cooking salt (NaCl), linolenic acid, vitamin D, vitamin E, biotin and potassium.

<sup>45</sup> The DGE develops the food-consumption recommendations for Germany on behalf of the Federal Government, cf. Section 7.2.

<sup>46</sup> For a more detailed version of the ten DGE rules, see: <https://www.dge.de/index.php?id=52>.

<sup>47</sup> D-A-C-H stands for Germany, Austria and Switzerland. The reference values were jointly developed by the respective professional associations (see DGE et al. 2019).

Most countries have developed both nutrient-related and food-related recommendations. The latter take into account not only the nutrient level but also cultural customs, common consumption habits and the results of scientific studies (usually meta-analyses) on the effectiveness of the respective food in disease prevention. Dietary guidelines are often presented graphically, usually as a pyramid or plate model, and also include a description of the respective food quality and the desirable intake levels. A representation in form of a food pyramid was chosen in Germany. The dietary circle is based on this pyramid (cf. Fig. 4-5).

In Europe, neither the food-related nor the nutrient-related recommendations have been harmonised, although standardisation has been conducted by the European Food Safety Authority (EFSA) to establish such values. The EFSA has also published its own reference values for a desirable nutrient intake (EFSA 2017). However, most countries have retained the values established by the respective professional associations. The situation is similar with respect to food-related recommendations, which vary from country to country in Europe and mostly take greater account of national consumption patterns and typical foods of the country than is the case with scientific studies on nutrient recommendations.

The connection between health-promoting food consumption and the prevention of non-communicable diseases (NCDs: cancer, cardiovascular diseases, stroke and type 2 diabetes) is, as a rule, related to food-based dietary patterns. The evidence for the prevention of NCDs through health-promoting food consumption is derived from prospective observational studies and intervention studies. Two different approaches are pursued: the influence of the diet or food ingredients on bioindicators interpreted as a risk for the development of an NCD and the influence on the recording of a clinical endpoint (disease or death).

In Europe, dietary patterns based on the Mediterranean diet are favoured. This is because a diet rich in fruits, vegetables, wholemeal products and fish with, at the same time, a low intake of red and processed meat and sugar-sweetened beverages is deemed good in terms of its preventive effect. A higher consumption of nuts and seeds, vegetable oils, fermented milk products and coffee can further reinforce the protective effect (Schulze et al. 2018).

For a better understanding of health-promoting food consumption, the Healthy Eating Index (HEI) was developed in the USA, which forms the basis for the Dietary Guidelines for Americans 2015-2020 (HHS & USDA 2015, Reedy et al. 2018).<sup>48</sup> Desirable dietary patterns include not only the Mediterranean diet and HEI but also the so-called DASH diet and, more recently, the so-called Nordic Diet:

- **Healthy Eating Index (HEI):** The Healthy Eating Index was developed in 1995 and has been revised several times, most recently in 2015, and encompasses different categories with points awarded depending on the degree to which dietary recommendations are complied with. It covers the following categories: total fruits; whole fruits; total vegetables; greens and beans; whole grains; dairy; total protein foods; seafood and plant proteins; fatty acids; refined grains; sodium; and “empty calories”. This last category was split into saturated fatty acids and added

<sup>48</sup> The HEI comprises an index of 100 points in total. Currently, US-Americans achieve an average of 59 points (NCHS 2015; see also: <https://www.fns.usda.gov/resource/healthy-eating-index-hei>).

sugars in the 2015 revision. A total of 13 categories are thus assessed. Minor changes were also made to the classification of vegetables (Krebs-Smith et al. 2018, Täger et al. 2016).

- **Mediterranean Diet:** The Mediterranean Diet got its name because it is typical for southern European countries. However, there are several variations of this dietary pattern, with different foods being preferred in different quantities depending on the country. The common feature of all of them is that the diet includes 2 to 3 portions of vegetables, wholemeal products, 6 portions of fruit and 1 to 2 portions of dairy products daily. Olive oil is generally used (both for salads and for frying). It is recommended to eat fish 4 to 5 times a week, poultry, olives and legumes 3 to 4 times, and nuts and seeds 3 times. Potatoes, eggs and sweet desserts are limited to 3 to 4 times a week. 4 to 5 portions of red meat are allowed on a monthly basis and moderate consumption of white or red wine (Dontas et al. 2007). The American Heart Association criticises that, based on the amounts usually consumed, this type of diet involves an excessive intake of fat.<sup>49</sup> The Mediterranean diet is reported to provide special protection against cardiovascular diseases and to have a positive impact on life expectancy (Dinu et al. 2018). However, various studies classify the evidence of this connection as weak (Bonaccio et al. 2017, Rees et al. 2019).
- **Nordic Diet:** The Nordic Diet was first compiled in 2004 as a basis for recommendations by the northern European countries of Denmark, Sweden, Finland, Norway and Iceland. The focus is on only seven food groups. The Nordic Diet is characterised by plenty of fish, cabbage, rye bread, oat flakes and oat flour, apples/pears, berries and root vegetables. Rapeseed oil is recommended as the standard oil. Many studies have now been published on this dietary pattern too, suggesting its preventive effect against non-communicable diseases (Daneshzad et al. 2018, Uusitupa et al. 2013).
- **DASH diet (dietary approaches to stop hypertension):** The DASH diet was initially developed in 1995 by the National Institute of Health (USA) to reduce the high prevalence of high blood pressure and cardiovascular disease in the American population (Phillips et al. 2018, Soltani et al. 2018). This dietary pattern is characterised by a high consumption of fruit, vegetables, nuts, seeds and pulses. Red, processed and high-fat meat should be avoided, as should high-fat milk products, fast food and salted snacks (e.g. peanuts and salt sticks). This results in higher levels of potassium, magnesium and calcium as well as fibre. Products with high levels of saturated fatty acids or sugar (Steinberg et al. 2017) are also limited.

With regard to desirable dietary patterns, there is a great consistency regarding food groups – and this despite the fact that the dietary patterns presented take account of regional and cultural customs in the respective countries. Various meta-studies show predominantly positive effects; it is thus meaningful to derive dietary recommendations. Health effects include, for instance, the reduction of the relative risk of cardiovascular diseases, the reduced prevalence of diabetes mellitus

---

<sup>49</sup> Cf.: <https://www.heart.org/en/healthy-living/healthy-eating/eat-smart/nutrition-basics/mediterranean-diet>.

type 2 or the extension of life expectancy. Protective effects are also often identified with regard to various types of cancer.<sup>50</sup>

Thus, meta-analyses of 68 prospective cohort studies involving a total of 1,670,179 test subjects showed a relative risk reduction (see text box 3 “Absolute and relative risk” below) of 22% for cardiovascular diseases, of 16% for cancer, of 18% for diabetes mellitus type 2 and of 15% for neurodegenerative diseases if a high-quality diet such as the DASH diet is consumed. The diet reduced the relative risk of total mortality by 22% (Schwingshackl et al. 2018: 74). Another recent review arrives at comparable results and conclusions. Here too, a comparison between the different consumption patterns of a high-quality diet shows a lower mean relative risk of cardiovascular disease (Schulze et al. 2018). It is concluded from the systematic analyses of the Global Burden of Disease Study that every second to third premature death caused by cardiovascular diseases could be avoided by well-balanced and health-promoting food consumption (Meier et al. 2019).

The DGE dietary circle or the DGE food pyramid (Fig. 4-4) illustrates what long-term, health-promoting and in this sense more sustainable food consumption can look like in terms of the quantitative composition of food groups. A total of seven food groups are shown (“cereals, cereal products and potatoes”, “vegetables and salad”, “fruit”, “dairy and milk products”, “meat, sausage, fish, eggs”, “oils and fats”, “beverages”).

**Figure 4-4:** DGE dietary circle and three-dimensional DGE food pyramid



Source: © Deutsche Gesellschaft für Ernährung e. V., Bonn (German Nutrition Society).

The size of the circle segments illustrates the percentage which the food groups should make up in a wholesome diet. The basis for the presentation of the segment sizes are average values calculated on the basis of model menus for men and women of different age groups and different physical activity levels (if the reference values for nutrient intake are met) for one week. Consequently,

<sup>50</sup> However, some studies that derive physiological effects for one or the other dietary pattern have methodological limitations, so that a comparison of the pros and cons is not easy (Rees et al. 2019; cf. Section 5.3).

the quantity ratios indicated in the DGE dietary circle cannot be met on a daily basis; instead, the dietary circle shows an optimal distribution on average over one week (see DGE 2014, Jungvogel et al. 2016). Table 4-1 shows guidance values for the food quantities consumed by adults.

**Table 4-1:** Example of a selection of foods based on the DGE dietary circle

Foodstuffs	Guidance values for adults
Group 1: <b>Cereals, cereal products, potatoes</b>	daily: 4-6 slices (200-300 g) bread or 3-5 slices (150-250 g) bread and 50-60 g cereal flakes and 1 portion (200-250 g) potatoes (cooked) or 1 portion (200-250 g) noodles (cooked) or 1 portion (150-180 g) rice (cooked) Opt for products from whole grains
Group 2: <b>Vegetables and salad</b>	daily: At least 3 portions (400 g) of vegetables 300 g cooked vegetables and 100 g raw vegetables/salad or 200 g cooked vegetables and 200 g raw vegetables/salad
Group 3: <b>Fruit</b>	daily: At least 2 portions (250 g) of fruit
Group 4: <b>Milk and dairy products</b>	daily: 200-250 of low-fat milk and milk products and 2 slices (50-60 g) of low-fat cheese
Group 5: <b>Meat, sausages, fish and eggs</b>	weekly: 300-600 g of low-fat meat (prepared) and low-fat sausage, and 1 portion (80-150 g) of low-fat sea fish (prepared) and 1 portion (70 g) of high-fat sea fish (prepared) Up to 3 eggs (incl. processed egg)
Group 6: <b>Oils and fats</b>	daily: 10-15 g oil (e.g. rapeseed, walnut or soybean oil) 15-30 g margarine or butter
Group 7: <b>Beverages</b>	daily: around 1.5 litres preferably energy-free/low-energy beverages

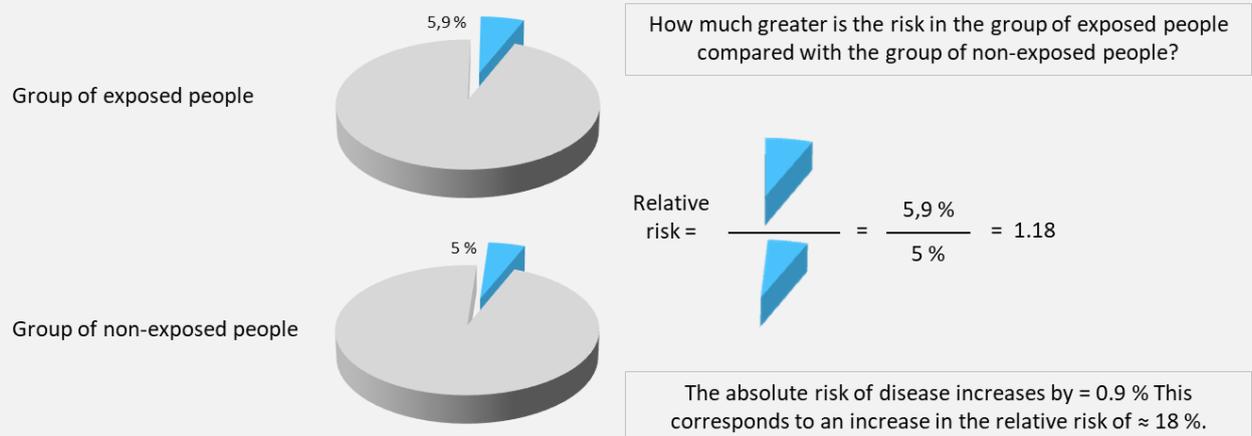
Source: Jungvogel et al. (2016: M477).

Analyses of existing studies on eating habits in Germany (Section 4.2.2) clearly show that our actual eating and drinking behaviour deviates from the DGE's dietary guidelines: on average, we consume too many calories, including overly high quantities of high-fat meat, milk products, fast food, sugar-sweetened foods and soft drinks. In contrast, the proportion of nutritionally valuable product groups such as fruit, vegetables and fibre-rich foods in our diet is too low for optimal disease prevention. Such a dietary pattern that is not very beneficial to health is also called the "Western Diet" in literature (cf. Cordain et al. 2005, Zinöcker & Lindseth 2018, Carbone et al. 2019, 2015).

**Text box 3:** Absolute and relative risk

Risk assessments in medical statistics and epidemiology can be presented as absolute and relative risks. The relative risk describes the factor by which the risk during exposure (i.e. when persons are exposed to a specific risk) differs from that during non-exposure, and thus relates the absolute risk of disease in one group (usually that of the exposed) to the absolute risk of the other group (usually that of the non-exposed), see also Fig. 4-5. In October 2015, for example, the WHO warned that the risk of developing colorectal cancer rose by 18% per 50 g daily consumption of processed meat (e.g. sausage) (WHO 2015a). The absolute risk of contracting colorectal cancer, which is the reference value in this example, is about 5%. Accordingly, a relative risk increase of 18% in this case means that the absolute risk increases by about one percentage point ( $5 \cdot 18 / 100 = 0.9 \approx 1\%$ ) from about 5% to 6% (Max Planck Institute for Human Development 2015, Gigerenzer et al. 2007).

**Figure 4-5: Absolute and relative risk of developing colorectal cancer due to the consumption of processed meat**



Sources: WHO (2015a) and Max-Planck-Institut für Bildungsforschung (2015); Fig.: WBAE presentation based on <https://www.statisticshowto.datasciencecentral.com/calculate-relative-risk/>.

## 4.2.2 Food-consumption and health situation in Germany

The food-consumption and health situation of the German population can be derived from various studies, which are conducted both as cross-sectional studies and as longitudinal studies. The intervals between the respective nationwide surveys are in some cases very long. One example: The National Food Consumption Survey (NVS) II was published in 2008 and the data were collected in 2006 and 2007. Pre-tests for the follow-up study (“Gern”) are currently underway; the surveys will not begin until 2020, and the first findings will not be available until 2022 at the earliest (RKI & MRI 2018). “Gern” will be more extensive than NVS II: In addition to health status (anthropometric as well as blood and urine parameters) and health behaviour, food consumption behaviour, food intake and nutritional knowledge will also be mapped. Medicinal products and food supplements as

well as the use of medical services, including the diseases that occur, are also identified. “Gern” is supplemented by an environment-specific module that examines stresses and strains in the domestic settings. The representative sample will comprise 12,500 persons aged between 18 and 79 years.

The study situation in Germany can be described as good for individual parameters such as anthropometric characteristics. On the other hand, there are gaps for other parameters such as nutrient intake, because they are not collected regularly and mostly only at greater intervals. Furthermore, individual age groups are under-represented or only small cohorts mapped. This is especially true regarding senior citizens, infants up to two years of age and children and adolescents from poor families. Table 4-2 provides an overview of the currently available studies on the food consumption and health situation in Germany.

**Table 4-2:** Overview of studies that allow conclusions to be drawn about the food-consumption and health situation of individual population groups in Germany

Study	Age group	implementing institutions	Study design	Focus
<b>Adults</b>				
NVS I (in future together with DEGS (see below) in extended form as Gern study)	14-80 years	MRI, 2008 (Continuation Gern: MRI together with RKI and in cooperation with UBA and BfR; results expected from 2022).	Cross-sectional study, representative, N = 20,000 (in future as Gern study with N = 12,500)	Anthropometric data, purchasing behaviour, food intake, inclusion of the federal states, age and gender, social class affiliation
Nemonite	18-79 years	MRI, 2016 (ongoing)	Longitudinal study, representative, N = 2,000	Food consumption, nutrient supply
NAKO health study	20-69 years	Network of German research institutions: Helmholtz, Leibniz Communities, Universities since 2014	Long-term population study, randomised, representative, N = 200,000	Health status, anthropometric data, blood and urine parameters, lifestyle, occupational and dietary considerations. Energy and nutrient intake
DEGS I, II	18-79 years	RKI, 2011, 2013	Cross-sectional study combined with longitudinal study, not representative, N = 7,800	Health status, anthropometric data, blood parameters, specific nutrient supply, fruit and vegetable consumption, socioeconomic status
Health monitoring	18-79 years	Destatis and RKI, every 5 years, last 2018	Longitudinal study, continuously updated, representative	Anthropometric data, diseases – incidence, health status, life expectancy
DGE nutrition reports	18-79 years	DGE, every 4 years, most recently in 2016	Calculations from agricultural statistical data	Food consumption, trend analyses by comparison with previous years

Source: WBAE presentation.

**Table 4-2:** Overview of studies that allow conclusions to be drawn about the food-consumption and health situation of individual population groups in Germany – **continuation**

Study	Age group	implementing institutions	Study design	Focus
<b>Adults</b>				
EPIC study European prospective Investigation into Cancer and Nutrition	35-65 years	23 study centres in 10 European countries, in Germany DIFE and Heidelberg	Longitudinal study, N = 520,000 in Europe, in Germany N = 53,000	Health status, anthropometric data, blood parameters, individual habits, food consumption habits
EHIS – European Health Interview Survey	18-79 years	Eurostat, every 5 years, most recently 2019, for Germany GEDA	Cross-sectional study, representative, N for Germany: > 20,000	Health status, health behaviour
<b>Youth and children</b>				
Kiesel	Infants from 6 months and toddlers up to 5 years old	BfR and RKI, 2017 (results 2019)	Cross-sectional study, results 2019, methods paper already available, N = 1,000	Anthropometric data, health status, food consumption, nutrient intake
School entrance examinations	6-7 years	Health offices of the Länder, annually	Cross-sectional study, complete survey, representative	Anthropometric data, health status, cognitive and motor skills
KIGGS – Basis (2008), KIGGS Wave 1 (2011) and Wave 2 (2018).	6-17 years	RKI	Cross-sectional and longitudinal study, representative, N = 20,000	Anthropometric data, state of health, special events such as allergies, intolerances, consumption of fruit and vegetables, beverage consumption, socioeconomic status
Donald study (Dortmund Nutritional and Anthropometric Longitudinally Designed)	3 months-18 years	Initially FKE, since 2012 University of Bonn	Longitudinal study (open cohort study), N = 1,500, new infants are added annually	Health status, growth, development, metabolism, food consumption habits
AdiMon	6-17 years	RKI, 2018	Set of indicators in connection with the KIGGS study	Identifying the factors influencing underweight, overweight and obesity.
Eskimo I (2008) and Eskimo II (2019)	6-17 years	RKI/University of Paderborn	Cross-sectional study – module of the KIGGS study, representative	Food consumption and nutrient supply, socio-economic status
HBSC study Health Behaviour in School Aged Children	11, 13, 15 years	WHO, Copenhagen Regional Office	Comparative analysis in the different countries of Europe	Anthropometric data, food consumption habits, pupils at 11, 13 and 15 years of age.
<b>Senior citizens</b>				
ErnSIPP	Senior citizens in need of nursing care	DGE, 2012	Cross-sectional study in three selected cities, not representative	State of health, illnesses, need for nursing care, food and nutrient intake

Source: WBAE presentation.

**Table 4-2:** Overview of studies that allow conclusions to be drawn about the food-consumption and health situation of individual population groups in Germany – **continuation**

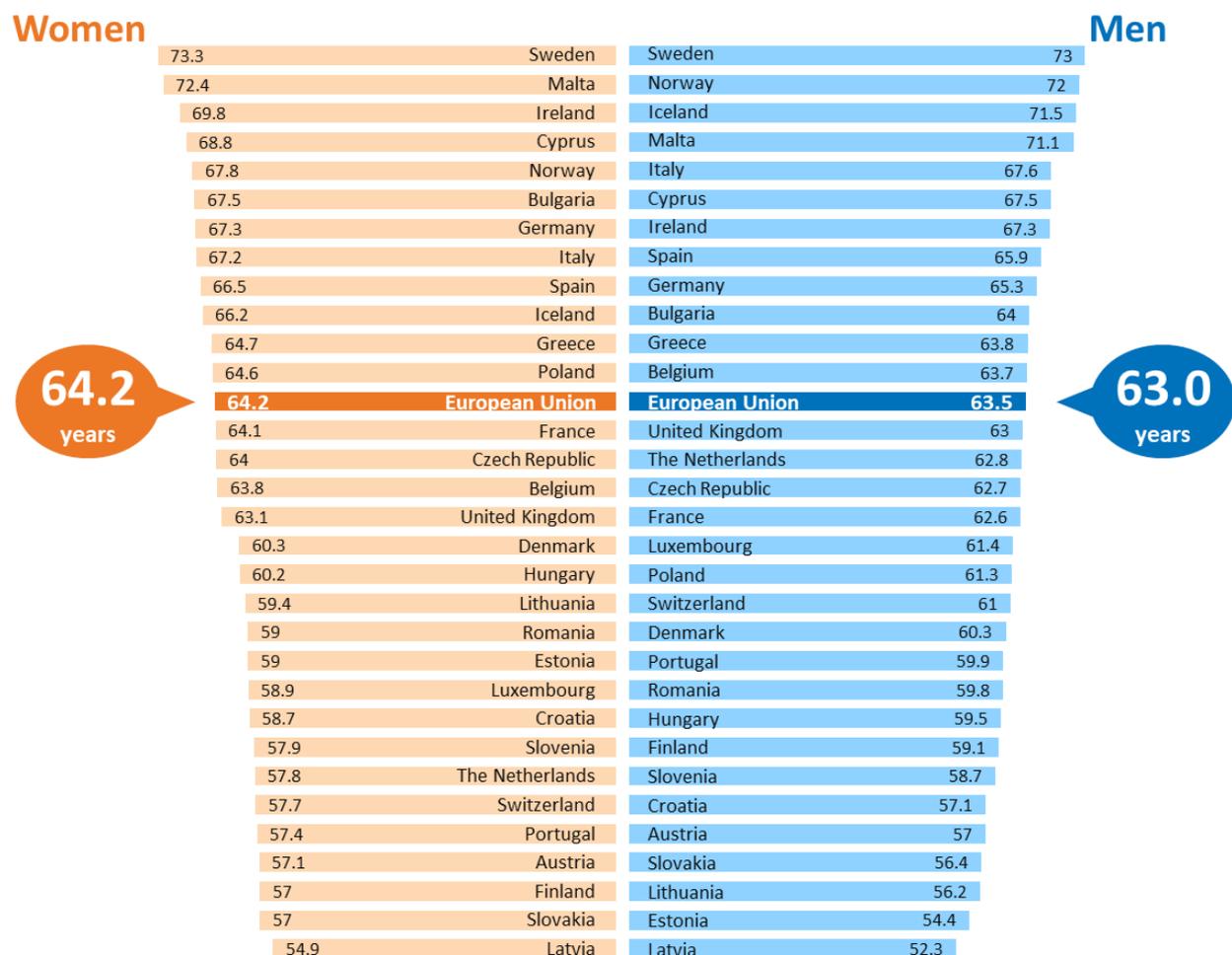
Study	Age group	Implementing institutions	Study design	Focus
<b>Senior citizens</b>				
Meals on wheels	Senior citizens who receive meals on wheels	DGE, 2012	Cross-sectional study, representative with regard to the structures of meal services	Provision of midday meals, satisfaction with the meals that are offered, state of health
Evaluation of the DGE quality standard for catering in in-patient senior citizens' homes	Senior citizens in in-patient facilities	DGE, 2016	Cross-sectional study, not representative	Meal provision in inpatient facilities, quality characteristics, dissemination of the DGE quality standard for catering
PROMISS	65–79 years	EU Commission, from 2019	Longitudinal study in selected countries of the EU, results will only be available in a few years' time	Prevalence of malnutrition
Health monitoring	65–79 years	Destatis and RKI, every 5 years, last 2018	Cross-sectional study, representative	As part of the health monitoring of adults, special evaluation

Source: WBAE presentation.

In the following, this (fragmented) study situation with regard to central nutrition-related health parameters and food consumption is presented. This is done for the different age groups: adults (Section 4.2.2.1), pregnant women and infants (Section 4.2.2.2), children and adolescents (Section 4.2.2.3) and senior citizens (Section 4.2.2.4).

#### 4.2.2.1 Adults

Life expectancy in Germany has changed only minimally in recent years: It is 83.2 years for newborn girls (based on the 2015/2017 mortality tables) and 78.4 years for newborn boys (Federal Statistical Office 2019a). By European standards Germany tends to rank in the middle: In France, Spain and Italy, for example, life expectancy for women and men is higher than in Germany (Eurostat 2019, cf. also Germany's moderate position in the Bloomberg Healthiest Country Index: Miller & Lu 2019 as well as Foreman et al. 2018). However, in terms of healthy, disability-free life years, Germany is in the top third in Europe with 67.3 years for women and 65.3 years for men (see Fig. 4-6).

**Figure 4-6:** Healthy life years at birth in the EU Member States (2016)

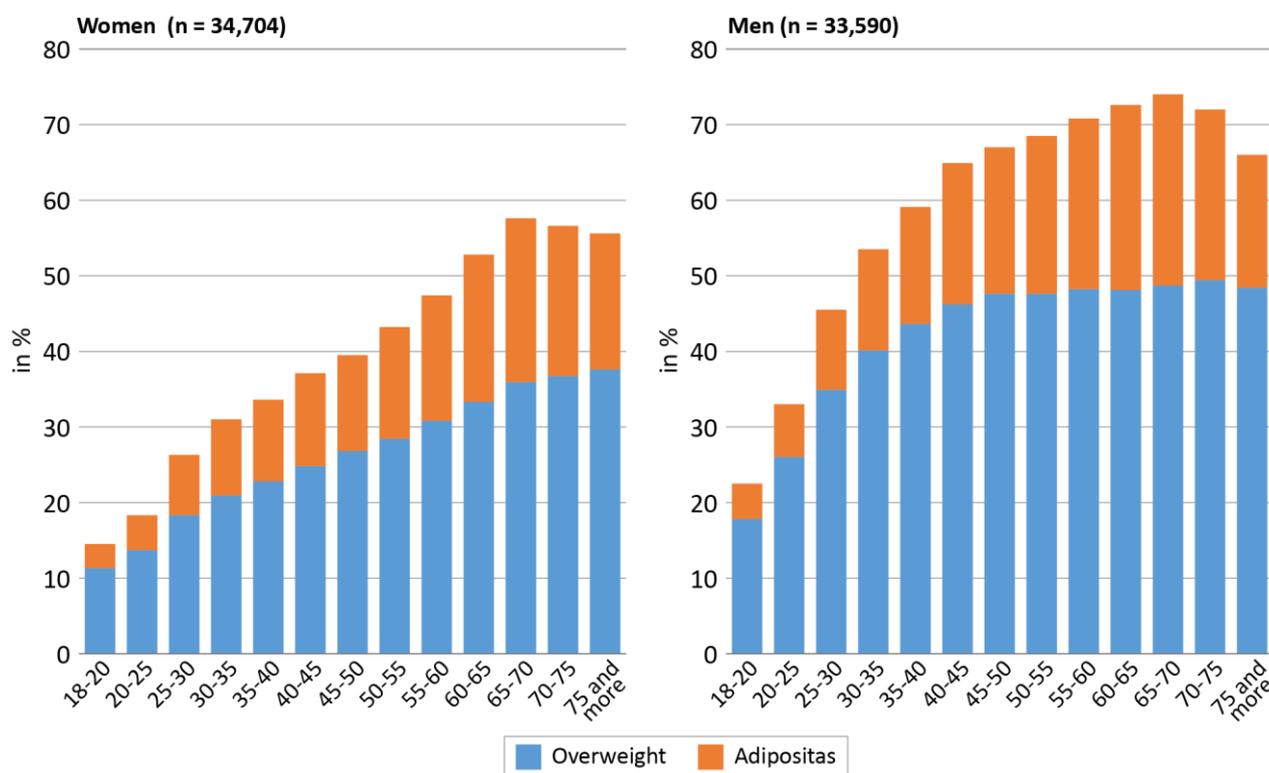
Note: Healthy life years = number of years that a person can expect to live without functional impairments/disabilities. Norway, Iceland and Switzerland: non-EU countries. For Iceland: data from 2015.

Source: Eurostat (2019), graphically adjusted.

The prevalence of overweight and obesity in Germany continued to rise in recent years, albeit only slightly. According to the evaluation of the micro-census (Federal Statistical Office 2018a), in 2017 an average of 52.7% of the entire adult population was overweight, 16.3% of them obese (men 62.1% overweight, 18.1% of them obese, women 43.1% overweight, 14.6% of them obese). There are typical differences in terms of advancing age and gender (see Fig. 4-7). It should be noted that the data of the Federal Statistical Office in the context of health monitoring are based on self-reporting by the persons involved. However, the data of the DEGS-1 study, which is based on objective measured values of 7,116 test subjects, also show comparable prevalences. According to these data, 67.1% of men are overweight, 23.3% of them obese, and 53.0% of women are overweight, 23.9% of them obese. On average, 4.5% of women and 0.5% of men are underweight. These results do not differ significantly from those of the self-reports in the health monitoring (Mensink et al. 2013a: 788).

The following figure shows the current prevalence of overweight and obesity in Germany broken down by different age groups.

**Figure 4-7:** Overweight and obesity in the female and male population by age groups



Source: Federal Statistical Office (2018a: 11), graphically adjusted.

An analysis of the DEGS-1 data by socioeconomic status shows that, for both women and men, the frequency of obesity decreases with increasing socio-economic status (SES)<sup>51</sup>. However, the correlations are significantly stronger for women than for men. The data also show that the higher the SES, the better the subjective assessment of health status. Sporting activity is also positively correlated with SES (Lampert et al. 2013: 817).

<sup>51</sup> In DEGS, the SES was calculated using an aggregated index of information on education, occupational status and net equivalent income. For the analyses based on SES, a distribution-based delimitation of three status groups is used: the low and high-status groups each comprise 20% and the middlestatus group 60% of the population (cf. Lampert et al. 2013: 815).

**Text box 4:** Indicators of increased body weight

When overweight or “obesity” is referred to, this is usually measured by the so-called Body Mass Index (BMI). The body mass index is calculated by dividing the body weight (in kilograms) by the square of the height (in metres).

According to the classification of the World Health Organisation, the BMI is classified as follows:

BMI (kg/m <sup>2</sup> )	Classification
< 18.5	underweight
18.5–24.9	normal weight
25–29.9	overweight
> 30	obese

Example: A woman who is 1.65 metres tall and weighs 65 kilograms has a BMI of just under 24; a man who is 1.80 metres tall and weighs 100 kilograms has a BMI of almost 31. According to the currently used classifications, the woman would therefore be of normal weight while the man would be severely overweight or “obese”.

There is agreement that the BMI is only a rough measure for assessing the health consequences of being overweight. The abdominal girth has informative value, as it describes the amount of visceral fat tissue. This, together with the hormones produced there, is partly responsible for the development of comorbidities. The determination of the abdominal girth is more complex and can be subject to various errors, so that the BMI determination is still frequently used.

The BMI is not a very specific measure, as it does not allow the body composition to be recorded (Chandrasekaran 2018, Borga et al. 2018). Consequently, people with large muscle mass can have a BMI between 25–30 and therefore be classified as overweight. The same applies to the fact that people become smaller with increasing age (> 65). If the BMI is related to the smaller body size, then these people have a higher BMI for the same weight compared to their younger selves. This is one reason why for the age > 65 the BMI values associated with the lowest mortality are between 25–28 for both men and women (Wojzischke et al. 2016).

In women, weight (pre-menopausal) can be significantly influenced by subcutaneous fatty tissue (e.g. hips), also known as lactation fat. This fatty tissue is metabolically inactive and poses no risk.

When it comes to morbidity and mortality, a strict distinction must be made between overweight (BMI 25–30) and obesity (BMI > 30): According to an extensive meta-analysis (Flegal et al. 2013), overweight does not result in increased mortality, while in the case of obesity it increases by 10 to 30% compared with normal weight.

Overweight does not necessarily result in illnesses. This is especially true when there are no comorbidities (concomitant diseases). In contrast, obesity significantly increases the risk of developing high blood pressure, of having a heart attack or stroke or of developing diabetes mellitus type 2 (Kivimäki et al. 2017). Many types of cancer, such as breast cancer and colon carcinoma, also occur more frequently in cases of obesity (Lauby-Secretan et al. 2016: 794 et seq.). By way of qualifying that, though, it should be added that overweight and obesity in senior citizens do not necessarily represent a risk of disease (see Section 4.2.2.4).

Compared with the prevalence of overweight and obesity, underweight<sup>52</sup> plays a minor role in Germany. A total of 0.8% of men and 3.3% of women are affected, although data from health monitoring show that the group of 18 to 25-year-olds has a significantly higher prevalence (Federal Statistical Office 2018a). The health consequences caused by underweight are often more serious than those of overweight. While the intake of micronutrients can be quite adequate for overweight people, this is not the case for underweight people. Here, in addition to the energy deficit that leads to underweight, there is always a deficit of individual micronutrients, depending on how far the intake falls short of the daily calorie requirement.

### Energy intake

Data from NVS II show a daily energy intake of 2,252 kcal for men and 1,683 kcal for women on average for the German population.<sup>53</sup> These average values differ only slightly between the socio-economic classes, but indicate clear differences as people grow older: Men (on average 2,366 kcal) and women (on average 1,733 kcal) have the highest daily energy intake between the ages of 35 and 51 (Krems et al. 2012: 53). Thus, even in this age group the existing reference values for energy intake are only slightly exceeded in adult men (reference value for a physical activity level – PAL of 1.4 of 2,300 kcal, age between 25 and 51 years), while in adult women (reference values of 1,800 kcal) they even fall slightly short of the guidance values (D-A-CH reference values for nutrient intake 2015). The average values for energy intake are only of limited significance and can result in the wrong conclusions, because in 48% of men and 38% of women alone the reference values for energy intake are exceeded (Krems 2012: 62). If the energy intake exceeds the output, the outcome is a positive energy balance which, over a longer period of time, leads to overweight.

### Nutrient intake

In addition to the overweight problem outlined above, specific nutrient deficits can be identified. These were identified in the DEGS Study 1 (year 2011, based on blood and urine analyses) and the DGE 2016 Nutrition Report (DGE 2016). The latter is based on a 24-hour recall of NVS II, with the evaluation having been conducted using the national nutrient database (Bundeslebensmittelschlüssel, BLS) version 3.02. The result shows that the median intake of most vitamins and minerals is within the range of the D-A-CH reference values (see also text box 2 “Dietary guidelines” in Section 4.2.1). The exceptions are vitamin D, folate, calcium and iodine. In women, the iron intake also falls short of the recommended intakes.

- **Vitamin D.** A total of 61.4% of women and 61.7% of men have serum concentrations that are below the level of  $\geq 50$  nmol/l for 25-hydroxy vitamin D, a level which is regarded as sufficient

---

<sup>52</sup> Senior citizens are deemed underweight already from a BMI < 20 (cf. Küpper 2010).

<sup>53</sup> On the basis of the Nemonit study, the same average energy intake (2,362 kcal daily) was established in adult men and a slightly increased energy intake (1,844 kcal daily) in adult women (Gose et al. 2016). Again, other data determined by the United Nations Food and Agriculture Organisation show, on average, significantly higher values for Germany in recent years: 2,990 to 3,150 kcal for men and 2,340 to 2,466 kcal for women ([www.fao.org/faostat/en/?country/79](http://www.fao.org/faostat/en/?country/79), accessed on 25.04.2019). However, these values are calculated on the basis of the agricultural statistics of the countries, while the data of the NVS and Nemonit study are derived from consumption protocols (usually 24 h recalls). Since these protocols require a considerable recall ability, underreporting can be assumed for both NVS II and Nemonit.

by the IOM (Institute of Medicine) (Rabenberg et al. 2015: 641). The deficits are particularly marked in winter when the skin's own production is lower than in the summer months due to less solar radiation.

- **Folate.** As a vitamin of the B group, folate is particularly important for cell division: Around 86% of the population are considered to have sufficient folate (DEGS Study 1). This result is slightly better than determined in the NVS II. However, given that there were only a few pregnant women included in the DEGS cohort, it is not possible to make any statements about the intake status of this population group, for whom folate is of particular importance with respect to preventing embryonic malformations. Based on the folate concentration of 400 ng/ml in the red blood cells, which is recommended by the WHO in order to prevent neural tube defects, 96% of the women of childbearing age studied did not have an adequate intake (Heseker 2016: 50).
- **Iodine.** As a component of the thyroid hormones, iodine is indispensable for numerous metabolic processes. An insufficient intake in adults can cause reduced performance, affective disorders and hypothyroidism. The comparison between the estimated iodine intake (based on the excretion rates in spontaneous urine) and the estimated average requirement (EAR) of the IOM of 95 µg/day showed that more than 30% of the study participants in DEGS ran a risk of insufficient iodine intake (Heseker 2016: 63). This must be borne in mind with a view to the recommended reduction in daily salt intake. The recommendations are barely able to be met using only iodised table salt.
- **Iron.** Men achieve the recommended iron intake, having an average of 11.8 mg/day. Women have on average significantly less, at 9.6 mg/day. Young women aged between 15 and 25 years, in particular, have only about half the recommended intake, with a median intake of 8.2 mg/day (in the age group 15 to < 19 years) and 8.6 mg/day (in the age group 19 to 25 years) respectively (Heseker 2012: 63).
- **Calcium.** Some of the population's calcium intake is still insufficient. Data from the Nemonit study show that the average intake is 897 mg/day for men and 809 mg/day for women. This represents practically no changes when compared with the findings of the NVS II. The recommended intake for adults is 1,000 mg/day (Gose et al. 2016).

Men have a higher intake of vitamins and minerals (with the exception of vitamin C) than women. This is because of the higher overall food consumption.

In contrast to vitamins and minerals, where less is consumed than desirable, sodium intake is too high for many consumers. Compared with the D-A-CH reference values of 1.5 g of sodium per day, this value was exceeded by 93% of men and 90% of women in the DEGS Study, in some cases significantly (DGE 2016: 55). It ultimately remains unclear what level of sodium intake represents a risk for cardiovascular disease. Nevertheless, the DGE has recommended not to exceed 6 g/day of cooking salt per person and per day<sup>54</sup>, as the correlation between a high salt intake and high blood pressure seems clear (Strohm et al. 2016).

---

<sup>54</sup> The WHO recommends an intake of less than 2 g of sodium per day.

## Food consumption

The average per capita food consumption is calculated based, inter alia, on agricultural statistics. While these statistics have some uncertainties, they do allow trend analyses over the past decade to be made. In addition, DEGS 1 provides partial information on food consumption by adults. The overall assessment for the major food groups is as follows:

- **Meat and meat products.** A characteristic feature of Germany is the high meat consumption. For some years now, there has been a more or less constant average annual per capita consumption of about 60 kg (Gedrich 2016: 34). Non-vegetarians consume an average of 88 g (women) and 138 g (men) of meat per day. The comparatively small quantities in this survey are due to the fact that only one food list was used and meat in compound foods such as lasagne, sauce Bolognese etc. was not able to be calculated. The proportion of vegetarians in the adult population is estimated to be 4.3%, with significantly more women than men choosing vegetarian diets (6.1% compared with 2.1%) (Mensink et al. 2016). While the consumption of pork has fallen somewhat in recent years, consumption of poultry has increased slightly.
- **Fish.** Fish consumption has declined in Germany, and is currently only around 14 kg/capita (Gedrich 2016). In other European countries, especially in the south and north, far more fish is consumed.<sup>55</sup> The consumption of fish contributes considerably to the intake of n-3 fatty acids, but also of selenium, vitamins A and D and high-quality protein, while at the same time fish has a low average fat content. The decline in fish consumption is therefore to be considered problematic from a nutritional point of view.
- **Milk and dairy products.** Milk and dairy products continue to play an important role in adult nutrition. Women consume on average 187 g per day, men 195 g (Gose et al. 2016: 1501). Cheese consumption especially has increased (Gedrich 2016: 32). BMEL data for 2018 show a per capita consumption of 50.6 kg of milk and dairy products, of which cheese accounted for 24.2 kg/capita and year.<sup>56</sup> On the one hand, we can take a positive view of this development, as it means that calcium, iodine and riboflavin are absorbed in desirable amounts. On the other hand, it is precisely the cheeses with a higher fat content that are a source of the overall excessive intake of saturated fatty acids
- **Fruit and vegetables.** In the case of foods of vegetable origin, the consumption of vegetables has increased, while the consumption of fruit (apples, pears, bananas and grapes) has decreased. The exception among fruits is berries. Overall, it is concluded from this trend that the intake of vitamins, especially carotene, vitamin C and folate, is set to improve even further. Nevertheless, only 15% of women and 7% of men achieve the desirable amounts of five portions of vegetables and fruit a day. On average, women consume 3.1 servings and men 2.4 servings of this food group. The proportion of women and men who consume at least 3 servings daily increases with socio-economic status (Mensink et al. 2013b: 781).

---

<sup>55</sup> See: <https://www.ednh.news/de/lebensmittelkonsum-in-der-eu/>.

<sup>56</sup> See: <https://www.bmel-statistik.de/ernaehrung-fischerei/versorgungsbilanzen/milch-und-milcherzeugnisse/>.

- **Cereals.** We also welcome the increase for cereals, with a rise being recorded in particular with regard to wholemeal cereals. Nevertheless, the market share of whole grain, which is rich in fibre, in all baked goods amounts to only just under 10% (Zentralverband des Deutschen Bäckerhandwerks 2017).
- **Beverages.** While the consumption of water (150 l/capita and year) has continued to increase in recent years, this does not apply to fruit and vegetable juices. For these, the consumption levels have fallen substantially and now amount to only 32 l/capita and year (Ernst et al. 2018). A slight decline was also recorded with respect to sugar-sweetened soft drinks, but the quantities are high overall at 120 l/capita and year, even by European standards (Heseker 2016: 37-39, Popkin & Hawkes 2016, cf. also Section 8.6.2).

In line with an EU Regulation, health behaviour in Europe is surveyed in the European Health Interview Survey (EHIS). Data for Germany are also available from EHIS (GEDA (Gesundheit in Deutschland Aktuell) as part of the RKI health monitoring). Selected indicators include the prevalence of obesity, daily fruit and vegetable intake, physical activity and smoking or excessive alcohol consumption at least once a month. An EU-wide comparison shows that the adult population in Germany is only in the lower third when it comes to fruit and vegetable intake. German men even have the lowest consumption among all Europeans. In contrast, Germans are above the European average for physical activity of at least 150 minutes/week, but this also holds true for alcohol consumption (Lange & Finger 2017: 3).

#### 4.2.2.2 Pregnant women and infants – “1,000-day window”

A sufficient and needs-based intake of nutrients during pregnancy and the first two years of a child's life is vital for survival as this so-called 1,000-day window sets the course for the child's later development and susceptibility to diseases. This concerns a multitude of essential micronutrients, e.g. iron, zinc, calcium, iodine, folic acid, vitamins A, D, B6, B12 and biotin (Christian & Stewart 2010). An insufficient intake of these micronutrients can result in an increased risk of physical and cognitive developmental disorders (Biesalski 2016).

**Consequences of malnutrition during pregnancy.** There are two causes that can lead to malnutrition of the growing child during pregnancy: A functional disorder of the placenta preventing important micronutrients and energy from being transported to the child in sufficient quantities, or malnutrition of the mother with similar consequences. We now have strong evidence indicating that food consumption during pregnancy that provides insufficient micronutrients can contribute to intrauterine developmental disorders, premature births and low birth weights (< 2,500 g) (Doyle et al. 2001, Wilson et al. 2007, Gernand et al. 2016). A too low birth weight can be associated with changes conducive to the development of non-communicable diseases in the child's later life (Singh et al. 2015). An intrauterine developmental disorder impairs the growth of the kidney, the pancreas and other organs and leads to changes in the configuration of important hormonal signalling pathways. Consequently, this can contribute to a heightened risk of high blood pressure

and diabetes. An insufficient energy intake signals to the developing child's organism, like a weather forecast, an environment characterised by deficiency. As a result, metabolic pathways are adjusted to higher levels of absorption and storage. If, contrary to this configuration, the child now consumes a high-energy diet, this would be conducive to the development of overweight and secondary diseases (Hanson & Gluckman 2014). A key indicator of poor nutrition in the first 1,000 days is a reduction or delay in length growth, which usually cannot be made up for after the end of the 2<sup>nd</sup> year of life (Piwoz et al. 2012). If growth in height is 2 standard deviations below the median (body length/age), we call this "stunting" (UNICEF et al. 2019, Development Initiatives 2018).

**Available data on nutrient intake among pregnant women.** No data are available from Germany on pregnant women's intake of micronutrients. While NVS II does contain a small group of pregnant women, these data have not yet been evaluated. If one bears in mind that the intake by young women, according to the data of NVS II, falls short of the recommendations for non-pregnant women for some micronutrients (vitamin D, vitamin E, iron, zinc, calcium, iodine), then the situation for pregnant and breastfeeding women is likely to be even more critical due to the additional requirement for various micronutrients in these cases. Furthermore, it can be assumed that the intake situation of pregnant women is related to their socio-economic status. Foods with a high micronutrient density are more expensive and pregnant women have a higher requirement. There are as yet no evaluations available on the provision of food to pregnant women in low income brackets, which means that the problem of malnutrition induced during pregnancy and the consequential damage to children from socio-economically worse-off families is not covered.

**Available data on nutrient intake among breastfeeding mothers.** The proportion of breastfed children is 87%, the average duration of breastfeeding is 8 months, with only every eighth child being exclusively breastfed for 6 months in line with WHO recommendations (RKI 2018a). For many micronutrients, the composition of breast milk depends on the micronutrient status of the mother. The transfer of micronutrients is therefore always at the expense of the maternal reserves. As long as the mother's micronutrient intake is adequate, the concentration of most vitamins in breast milk remains relatively constant. There are no data available that examine the food consumption of breastfeeding mothers in terms of the amount of micronutrients in breast milk. Similarly, there are no data on women who belong to risk groups due to multiple births or short birth intervals. Only small studies analysing fewer nutrients show here that the intake of vitamin A can become critical, for example (Schulz et al. 2007). Data on the provision of breastfed babies with critical micronutrients such as iron, zinc or vitamin D would be particularly important, as these micronutrients have a major influence on the physical and cognitive development alongside other micronutrients.

**Available data on fetal alcohol syndrome.** Alcohol consumption during pregnancy can cause physical malformations and damage to the central nervous system, which is associated with cognitive and behavioural disorders. This is called fetal alcohol syndrome (FAS) or alcohol embryopathy. The global prevalence of FAS in children and adolescents is 0.8%, with the highest prevalence in Europe (2%) and the lowest in the eastern Mediterranean region (0.01%) (Lange et al. 2017). In Germany,

0.6% of newborn babies (10,000) display FAS every year; if unreported cases (10,000–15,000) are added, this shows the dimension of this disorder.

**Available data on nutrient intake among small children.** Up to now there are very few data on the intake of nutrients among small children. A first study has found that the infants' (10 to 12 months of age) intake of vitamin D, iron and iodine fell short of the recommendations (Hilbig et al. 2015). In infants between the 13<sup>th</sup> and 36<sup>th</sup> month of life, the intake of vitamin D, folic acid, iron and iodine is well below the recommendations, while vitamin B1 and calcium intake are borderline.<sup>57</sup> The problem of inadequate intake is also confirmed by a recent study comprising children from Germany, the Netherlands and Great Britain (n = 325) between the 12<sup>th</sup> and 36<sup>th</sup> month of life, in which iron deficiency (ferritin < 12 µg/l) was described in 11.8% of cases and vitamin D deficiency (< 20 ng/ml) in 22.8% of cases (Akkermans et al. 2016). Further data on the nutrient intake of infants are expected within the framework of the Kiesel study (see Table 4-2). The study design is based on a sample of 1,000 participants. Food consumption is recorded on the basis of information provided by the parents or guardians. Statements on nutrient intake are made on this basis (Golsong et al. 2017).

**Available data on the prevalence of stunting and underweight.** The prevalence of stunting according to WHO criteria is estimated at 1.7% in children between 3 and 4 years of age in Germany (Schienkiewitz et al. 2018b: 65). In contrast, 3.7% of children in this age group are overweight and 0.1% obese. It should not be forgotten that malnutrition and overweight can occur together, especially in children (double burden). At the same time, studies from the USA and Europe suggest that the phenomenon of stunting occurs disproportionately in children from socio-economically worse-off families (Lloyd et al. 2018, Lewit & Kerrebrock 1997, for Germany: Baten & Böhm 2010) – which means that there is a need for action in terms of social inequality (cf. Section 4.2.3).

### 4.2.2.3 Children and adolescents

For childhood and adolescence (2 to 17 years) data are available from the KIGGS baseline study and the subsequent KIGGS wave 1 and 2 studies. In the baseline study, an average of 15% of the children and adolescents were overweight, 6.3% of whom were classified as obese (Kromeyer-Hauschild reference system, see Kurth & Schaffrath Rosario 2010). Recent studies show that these values have changed only slightly: A total of 15.4% of children and adolescents are classified as overweight (including obesity) and 5.5% of girls and 6.3% of boys are deemed obese. The findings of school entry medical check-ups from different German federal states also tend to indicate a

---

<sup>57</sup> The Netzwerk Gesund ins Leben (Network for a healthy start to life) recommends exclusive breastfeeding up to the start of supplementary feeding (from the 7<sup>th</sup> month of life) and continued breastfeeding also thereafter during the first year of life (<https://www.gesund-ins-leben.de/>). The Netzwerk Gesund ins Leben is located at the Federal Centre for Food and Nutrition (BZfE) and is part of the IN FORM National Action Plan – German national initiative to promote healthy diets and physical activity.

stagnation or slight drop in the prevalence rates (DGE 2016, RKI 2013). Similarly to what was already noted in the baseline study, the data of KIGGS wave 2 show that the prevalence of overweight and obesity increases with age. Another characteristic feature is the dependence on socio-economic status (SES).<sup>58</sup> Thus, girls and boys with low SES (measured by their parents' status) are about four times more likely to be affected by obesity than children and adolescents from families with higher SES. The prevalence of underweight is low – 0.5% – in the under-five age group as measured by the WHO reference system. Wasting (too little body weight in relation to height) affects 0.3% and stunting (too little body height in relation to age) an estimated 1.7%. There are no statistically significant differences between girls and boys (Schienkiewitz 2018a: 65 f.).

### Nutrient intake

With regard to the intake of nutrients by children and adolescents, only the data from the Eskimo I study published in 2008 are available. The data for the Eskimo II study have already been gathered, and partial results are currently being published on an ongoing basis. It is evident that the energy intake of children and adolescents corresponds to the guideline values of the D-A-CH reference values. The intake of most vitamins and minerals can be described as satisfactory. The intake of calcium and iodine is regarded critically, as is the intake of iron regarding girls from the age of 9 years. The vitamin D intake is too low in all age groups, with the folate intake also being too low (Heide et al. 2019, Mensink et al. 2017, 2019). For the age group of the under 6 year-olds the data are supplemented by the Kiesel study in cooperation with the BfR. The intervals between these studies are (too) long for the target group of children and adolescents.

### Food consumption

There is also little information available so far on food consumption by children and adolescents. Data on the consumption of fruit and vegetables as well as sugar-containing soft drinks can be gathered from the KIGSS wave 2 and the AdiMon study (RKI 2018b)<sup>59</sup>. These data also show a correlation between eating habits and socio-economic status.

- **Fruit and vegetables:** 93% of 3 to 6-year-olds consume one portion of vegetables or fruit per day. Yet, only 16% of this age group reach the recommendation of 5 portions.
- **Sugar-sweetened soft drinks:** The proportion of children and adolescents who drink sugar-sweetened soft drinks every day has decreased in recent years. One of the factors that seems to have had an effect here is that the supply of drinking water in schools and day-care centres has improved significantly (Mensink et al. 2018: 36). According to data from KIGGS wave 2, 13.7% of girls and 17.6% of boys (age group 3 to 17 years) drink sugar-sweetened soft drinks

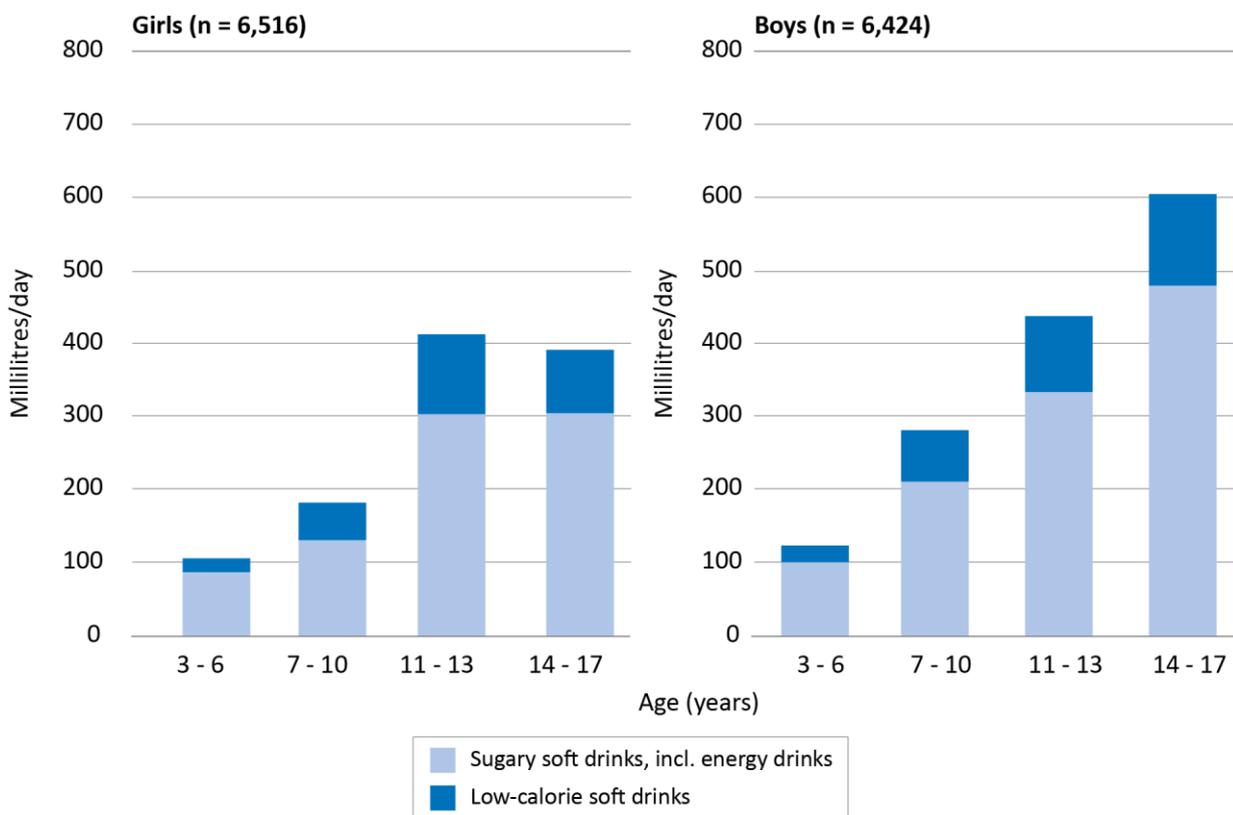
---

<sup>58</sup> The net income of the parents, their levels of education and their employment were surveyed. These three categories were assigned a scale from 1 to a maximum of 7 points. The sum of the three categories indicates the socio-economic status. Low: 3–8 points, medium 9–14 points and high 15–21 points.

<sup>59</sup> The AdiMon study is based on data of the KIGGS waves (see Table 4-2). It studies, inter alia, the factors influencing overweight and obesity in childhood. The monitoring encompasses the prevalence of obesity in different age groups and differentiates between girls and boys; it asks about physical activity and sports, television viewing times, consumption of sugar-sweetened soft drinks and water, consumption of fruit and vegetables as well as chocolate and sugar confectionery among children. The study also looks at the life situation of the parents.

one to three times a day, 3.3% of girls and 4.7% of boys even four times or more often. The frequency of consumption increases with age and children and adolescents with a low socio-economic status drink these beverages more frequently than their peers with a higher socio-economic status (Mensink et al. 2018: 34 f.). Figure 4-8 shows the quantities of sugar-sweetened soft drinks that girls and boys drink on average every day (Mensink et al. 2018: 35).

**Figure 4-8:** Consumption of sugar-sweetened soft drinks by girls and boys



Source: Mensink et al. (2018: 35), graphically adjusted.

The health status and food-consumption behaviour of school children aged 11, 13 and 15 years were investigated in the HBSC study (WHO 2016a). The last survey was conducted in 2013/2014. The findings on fruit, vegetable and soft drink consumption are largely confirmed (HBSC-Studienverbund 2015a, b). Furthermore, it is shown that only 57% of girls and 65% of boys have breakfast every day on school days, whereas 27% of girls and 23% of boys do not have breakfast on any school day. The proportion of those who never have breakfast on school days is particularly high among girls (39%) and boys (33%) where both parents have a migrant background and among girls (35%) and boys (27%) with low family wealth (HBSC-Studienverbund 2015c).<sup>60</sup>

<sup>60</sup> In the HBSC study, poverty is measured as an index derived from the items of family affluence, such as computers, cars, a room of one's own or holidays. The index is referred to as the "Family Affluence Scale" and follows the concept of material deprivation (cf. Section 4.2.3).

#### 4.2.2.4 Senior citizens

A characteristic feature of the population group of over 65-year-olds is their heterogeneous living and health situation. As they grow older, health impairments and diseases occur, so that malnutrition, for example, can push the problem of overweight into the background (Schultz et al. 2016). Nevertheless, even in this age group the prevalence of overweight and obesity is still at a high level, although a closer look at the various age groups from 75 years onwards shows a slight decline in comparison with previous years (Federal Statistical Office 2018a). However, overweight and obesity are no longer regarded as problematic in old age as they were in younger years.

The available data on the situation of the currently around 13 million senior citizens in Germany is not very satisfactory. Meta-analyses and systematic reviews of the catering situation of the elderly are only available from abroad. Furthermore, there are no good, validated instruments that measure the quality of life in old age. These are important because restrictions in mobility and the burden of disease, for example, do not necessarily automatically result in less quality of life in old age. The timelines of many studies are too short and prognoses about the course of disease are subject to great uncertainty. The only country where data is regularly collected is the USA, where the “Older Americans Act Nutrition Assistance Program” is continuously evaluated.

Although, since 1993, an expertise on senior citizens has been commissioned in every legislative period by the responsible Federal Ministry for Family Affairs, Senior Citizens, Women and Youth, there is little knowledge about the nutritional situation of elderly people in their own households. Even the German Ageing Survey – DEAS (last published in 2014) of the German Centre of Gerontology, which appears at regular intervals, provides data on the health situation in general, but does not specifically address the factor of food and nutrition. Even the reports on long-term nursing care issued by the Federal Statistical Office do not permit any meaningful statements to be made. Some data are only available from the hospital sector, since senior citizens are treated here increasingly frequently, with their nutritional status being determined at the beginning of their stay in hospital, although this is only done in specific cases and not yet generally (Löser 2010, Pirlich et al. 2006).

Information on the nutritional situation of older people can currently be drawn from two studies of the 2012 12<sup>th</sup> DGE Nutrition Report. On the one hand, the special situation of older women in need of nursing care who still live in their own households was studied (ErnSipp study, Volkert et al. 2012), on the other hand, the provision of “meals on wheels” for older people was examined (Arens-Azevedo & Wollmann 2012).

The study on the nutritional situation of senior citizens in need of long-term care (ErnSipp) involved 353 persons, 67.3% of whom were women. In addition to the body mass index, the survey also recorded data on the general state of health, the levels of care and the need for assistance with respect to nutritional intake. In addition, food consumption and energy and nutrient intake were determined. The characteristic feature here was that 63% of the men and 58.4% of the women did

not reach the guideline values for energy intake. However, this is probably due to underreporting, because most of the study participants were found to be overweight. The intake of dietary fibre and water fell short of the recommended guidance values. In addition, the intake of vitamin C, vitamin E, folate, calcium and vitamin D was too low. However, their intakes were higher than those of people of the same age in nursing homes. For proteins and fat, the recommendations and the guidance values were usually exceeded. One striking feature is that nutritional screening by family doctors is not common and by no means every person in need of long-term care receives meals via “meals on wheels” (Arens-Azevedo & Wollmann 2012). Moreover, the ErnSipp study found that 3.2% of men and 1.8% of women had a BMI of below 18.5 and thus manifest malnutrition (Volkert et al. 2012). It should be added that in older women a BMI of below 20 is already defined as underweight and the person is accordingly classified as a patient at risk (Colb 2014: 37).

The study on “meals on wheels” focused first and foremost on the service provision structures and the corresponding range of meals on offer. Nationwide, 2,500 providers were identified, with 300,000 to 325,000 seniors using the service. 844 meals-on-wheels services took part in the survey. The meals are mainly provided in the form of deep-frozen menus, which are heated by regional meal-on-wheels services on the ground and delivered warm to the senior citizens. There is a wide range on offer: senior citizens can choose from several menus. Vegetarian dishes and different portion sizes are common, but consistency-adapted food and specific diets can also be delivered. Only a small proportion (9.6%) of the meals-on-wheels services questioned included salad or raw vegetables on a daily basis; it was more common to have these 3 to 4 or 1 to 2 times a week. Desserts, on the other hand, are provided daily by 50.9% of the meals-on-wheels services. In most cases, additional services are available, such as beverage deliveries or assistance in completing applications and dealing with authorities. The older customers are very satisfied with the range of meals on offer; only very rarely do they make critical comments or suggestions for improvement (Arens-Azevedo & Wollmann 2012).

The delivery of one midday meal a day is an important contribution to the care of older people. However, it is up to the senior citizens or their environment to decide how the other meals are procured and what quality they are. Furthermore, social components are missing: meals are mostly eaten alone at home. There has been little systematic research so far into the impact of the social de-structuring of meals. The reasons for the trend towards eating alone include demographic developments in a number of countries and this is in some cases associated with a considerably increased risk of obesity and a metabolic syndrome (Kim et al. 2018, Tani et al. 2015). It is also unclear whether and to what extent meals are actually consumed.

The seventh expertise on the elderly from 2016, with its focus on “Care and co-responsibility in the municipality – building and securing viable communities”, at least picks up on the correlation between health and diet at one point. It concludes that a balanced diet must be an essential component of a prevention policy in old age. Mention is also made of the “Fit in Old Age” project launched in the context of IN FORM, in which the German National Association of Senior Citizens’ Organisations, (Bundesarbeitsgemeinschaft der Senioren – BAGSO), the consumer advice centres of the

federal states and the DGE are involved. In addition, reference is made to the quality standards published by the DGE for catering in inpatient facilities for the elderly and for the offer of “meals on wheels”. These initiatives make it possible to influence a balanced diet in old age (German Bundestag 2016c).

This position is buttressed by the adoption of the Prevention Act and the convening of the National Prevention Conference. Objectives of prevention policy for older people were subsequently formulated in the Federal Framework Recommendations of the National Prevention Conference. The Federal Centre for Health Education (BZgA) was charged with the implementation of these goals. At the same time, the health insurance funds are also called upon to advise their policyholders accordingly. In addition, nutritional screening is to be carried out in inpatient facilities in order to identify nutritional deficits at an early stage (National Prevention Conference 2018: 33).

The BZgA now operates a platform that older people can access to obtain information on various topics related to their everyday lives.<sup>61</sup> Under the categories “Promoting Vitality and Health”, “Eating and Digestion” and “Preventing and Treating Diseases”, older people can find tips for their daily diets, usually combined with offers for physical exercise and sport. The information draws on materials from the Federal Centre for Food and Nutrition (BZfE), the DGE and other professional associations such as the German Obesity Society. However, concrete support regarding catering, for example through midday meals or the offer of “meals on wheels”, is not discussed here.

All in all, the structures for an adequate provision of desirable foods for older people are no longer in place everywhere. Rural areas in which shopping structures are dissolving because there is no longer such a tight network of retail outlets are probably particularly problematic for shopping and the daily preparation of meals if no car is available (Neu 2014). In this case, the elderly are largely dependent on the help provided by relatives or neighbours. On account of missing or inadequate supply structures, more and more municipalities are establishing a system of “carers”, reminiscent of former structures of “community nurses”. The “carers” should be able to organise domestic services as required or provide help in procuring foodstuffs and meals. Persons who carry out this task work mostly as volunteers or for a small expense allowance.<sup>62</sup>

The BMEL has also recently (2018) launched a nutrition initiative for senior citizens.<sup>63</sup> Measures include, among others, the setting up of networking bodies for senior nutrition in all federal states and the “Im Alter IN FORM – Gesunde Ernährung, mehr Bewegung, aktive Teilnahme in Kommunen fördern”<sup>64</sup> project (IN FORM in old age – Promoting a healthy diet and more physical activity, active

---

<sup>61</sup> [www.gesund-aktiv-aelter-werden.de/gesundheitsthemen](http://www.gesund-aktiv-aelter-werden.de/gesundheitsthemen).

<sup>62</sup> In 2017, for example, the city of Hamburg introduced the “Hamburg home visit” for senior citizens in two districts. For this purpose, a specialist department was established at the Health and Consumer Protection Authority. All persons will receive a corresponding offer from their 80<sup>th</sup> birthday onwards. Due to the consistently high demand – over 33% of the senior citizens contacted have requested the home visits – the programme will be extended to cover all districts of Hamburg this year. The visiting staff will undergo a brief preliminary training and receive a fee of 100 EUR per visit (70 EUR for subsequent visits).

<sup>63</sup> See: [https://www.bmel.de/DE/Ernaehrung/GesundeErnaehrung/ErnaehrungimAlter/\\_Texte/Aktionsprogramm\\_Senior.html](https://www.bmel.de/DE/Ernaehrung/GesundeErnaehrung/ErnaehrungimAlter/_Texte/Aktionsprogramm_Senior.html).

<sup>64</sup> See: <https://www.im-alter-inform.de/>.

participation in municipalities), which is carried out by BAGSO and funded with EUR 1.65 million in federal funds. In addition, BAGSO has now developed a concept of mobile midday meals. These are usually offered by committed laypeople and allow older people to come to a nearby meeting place in order to have an inexpensive lunch. The midday meal services are run by non-profit organisations, by cities and municipalities or by associations. The midday meal services “On wheels to meals” (*auf Rädern zum Essen*) are intended to address the problems of immobility affecting elderly people and at the same time – in contrast to “meals on wheels” – to make it possible to eat a meal together with others.

### Particular problem of malnutrition in old age

As people get older, the risk of multiple illnesses (multimorbidity) increases and with it the risk of an insufficient intake of energy and nutrients. While the calorie requirement decreases, the nutrient requirements remain relatively constant, so that the quality of food consumed becomes even more important (Volkert 2015). According to EU estimates, more than 20 million older people are currently affected by malnutrition; with the proportions in the Member States ranging from 13.5 to 29.7% of people aged over 65 ([www.promiss-vu.eu](http://www.promiss-vu.eu)). Current data from nutritionDay show that 23% of residents in German nursing homes are classified as underweight; their average age was 87. The EU average prevalence was higher, at 29% of residents (Volkert et al. 2019: V6). The problem of malnutrition is particularly hard to tackle, as this is described as a vicious circle: if malnutrition is diagnosed, this means that the immune system is weakened and there is an increased risk of further disease which may result in a need for medication and a loss of appetite. This cycle is difficult to break without specific nutritional intervention. The prevention of malnutrition in old age is therefore a top priority.

Malnutrition is closely linked to the need for long-term care. For the year 2017, the Federal Statistical Office reported 3.4 million people in need of long-term care, the majority of whom were women. Around a quarter of the people in need of long-term care (776,000 older than 65 years) are cared for in the 14,500 inpatient facilities currently available; the majority (2.59 million) are cared for at home, 1.76 million by relatives alone, the rest (0.83 million) receive assistance from outpatient care services (Federal Statistical Office 2018a). A high prevalence of malnutrition can be assumed, especially in inpatient facilities for care of the elderly, since this is where the average age and the proportion of those with a high level of care are highest.<sup>65</sup>

Systematic reviews from longitudinal studies have identified primarily loss of appetite, frequent medicine consumption, loss of will to live, but also diseases such as dementia, Parkinson’s disease, chewing and swallowing difficulties and frailty as risk factors for malnutrition in old age (Favaro-Moreira et al. 2016). The period when older people are discharged after a hospital stay is considered particularly critical. In some cases, special support must be offered to the elderly in their own households to ensure a balanced diet (Rasmussen et al. 2018, Schultz et al. 2016, Volkert et al. 2019, De van der Schueren et al. 2016). It has been shown that malnutrition can be effectively

---

<sup>65</sup> The average age at the facilities providing inpatient nursing care for the elderly is 85 years. 16% receive the highest level of nursing care (ibid.).

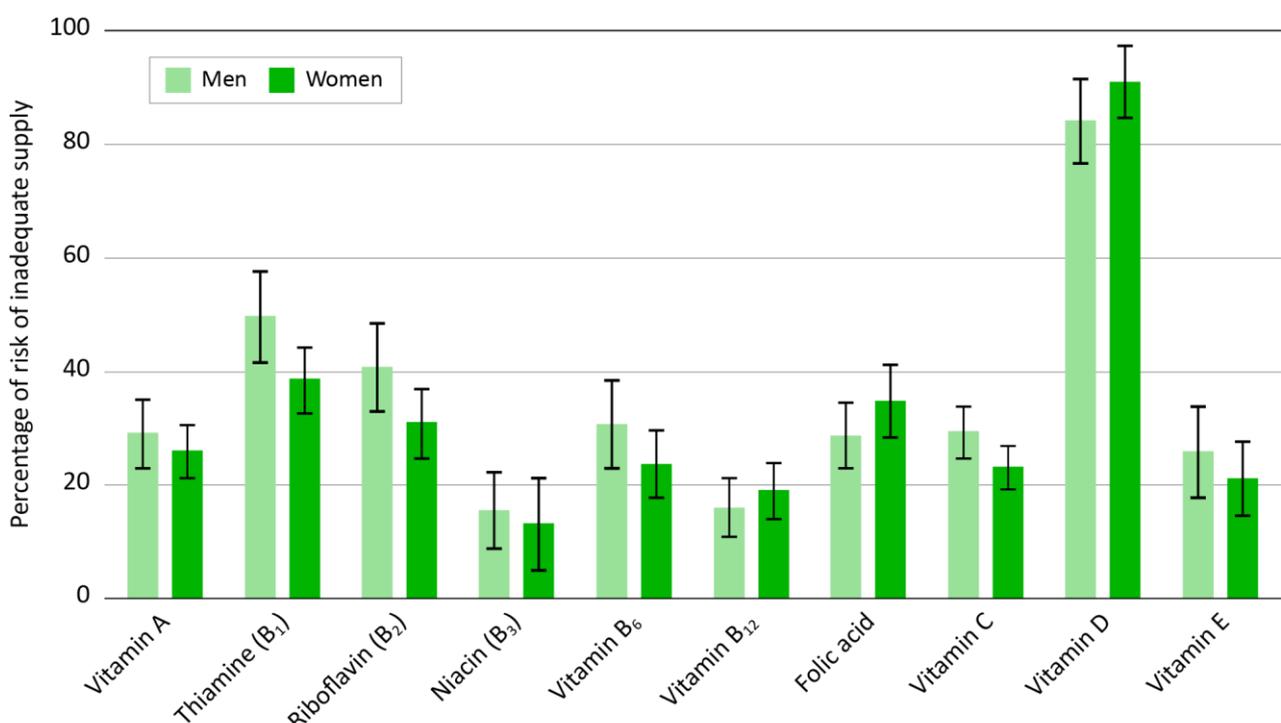
prevented in inpatient facilities if the nursing staff are specifically sensitised and trained for this (Fernandez-Barres et al. 2017).

Malnutrition in old age restricts the quality of life, increases health costs and the risk of premature death. Insufficient protein intake plays a special role in this regard (Coelho-Junior et al. 2018: 1334). In addition to a lack of physical activity, an overly low protein intake can also cause sarcopenia (Robinson et al. 2018: 1121). In sarcopenia, both muscle mass and muscle function decrease with age (DGG 2017, Volkert et al. 2011). Sarcopenia thus has a major influence on mobility in old age, which hampers access to food and can in turn promote malnutrition (Cederholm 2014: 3173). In addition, dementia-related illnesses increase with age and can lead to a significantly increased energy demand that cannot be easily met. Weight loss occurs gradually and is often noticed too late, so that older people have suffered from malnutrition for a long time (Volkert et al. 2015). According to estimates of the Federal Statistical Office, 1.7 million people are already suffering from dementia today. Here, too, it is assumed that the likelihood of contracting dementia increases with increasing age and that this number is therefore set to rise in the coming years.

Meta-analyses conclude that the intake of individual micronutrients is critical for the elderly (ter Borg et al. 2015, Biesalski & Tinz 2018).

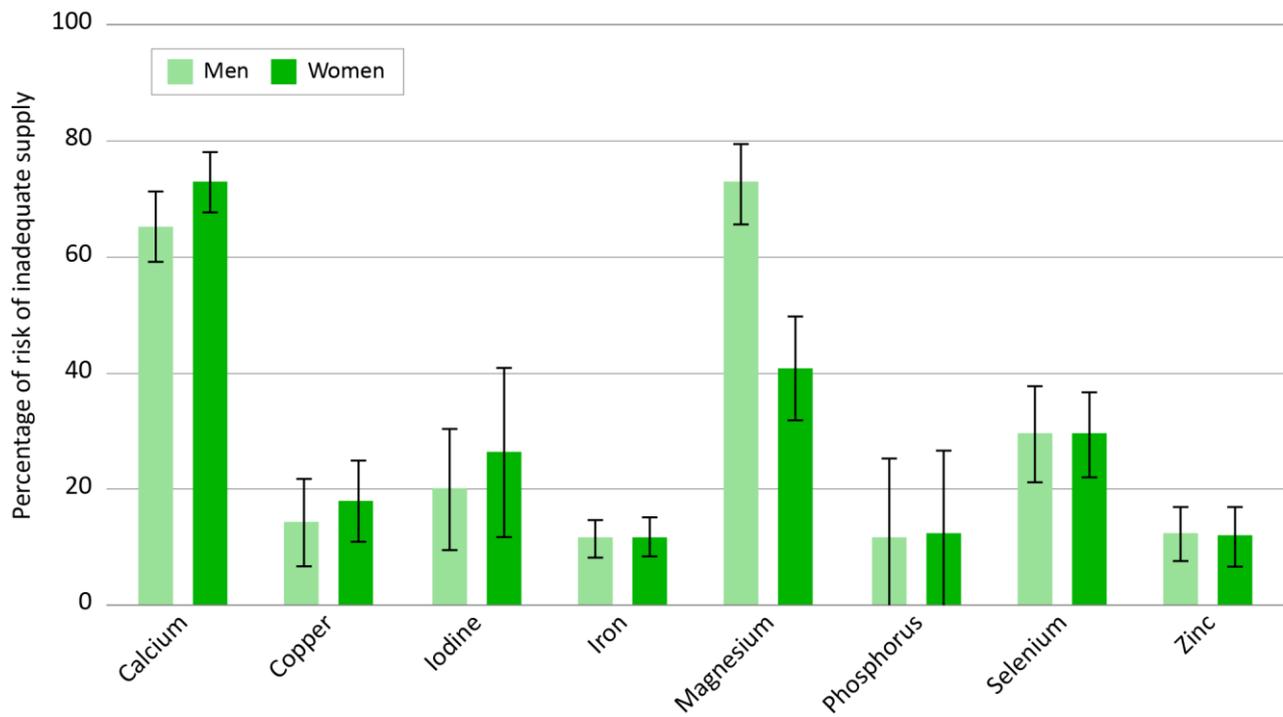
Figure 4-9 shows the percentage of older women over 65 years of age who fall short of the EAR and thus by definition have an increased risk of deficiency disease (ter Borg et al. 2015). This applies not only to vitamins but also to minerals (Fig. 4-10).

**Figure 4-9:** Percentage of risk of inadequate vitamin intake in older people (meta-analysis, n = 37 studies, OECD countries)



Source: ter Borg et al. (2015: 1200), graphically adjusted.

**Figure 4-10:** Percentage of older people at risk of inadequate mineral intake (meta-analysis, n = 37, OECD countries)



Source: ter Borg et al. (2015: 1201), graphically adjusted.

US studies especially point out that low income can be a major cause of malnutrition in old age (Strickhouser et al. 2014, Eggersdorfer et al. 2018).

### 4.2.3 Health-promoting food consumption in households affected by poverty?

In prosperous countries like Germany, poverty and poverty-related experiences of deficiencies are subject to controversial and polarised discussion.<sup>66</sup> With regard to food consumption, the question is whether and to what extent it is possible for people living in poverty to have a health-promoting, i.e. needs-based across their lifetimes, diet and whether there is, within Germany, food poverty<sup>67</sup>, i.e. poverty-related malnutrition or even hunger<sup>68</sup>, and associated limited socio-cultural participation. Investigating the factual situation is difficult due to lack of data. It begins with the question how poverty is measured and how many people in Germany are affected.

#### Poverty in Germany: How is it measured, who is affected and how many people are affected?

Poverty describes a life situation that is characterised by limited access to goods and a lack of opportunities for fulfilment and participation. In a prosperous country like Germany, poverty is usually defined in a relative sense, i.e. with reference to the given societal standard of living and its benchmarks. In this light, the German Federal Government's 1<sup>st</sup> Report on Poverty and Wealth already referred to a decision of the Council of Ministers of the European Communities of 1984 according to which persons are considered poor if their "resources (material, cultural and social) are so limited as to exclude them from the minimum acceptable way of life in the Member States in which they live" (BMAS 2017a: 98, European Council 1985: 2). In the EU countries, this lack of (self-)realisation and participation chances is measured based on the disposable income. A person whose income is less than 60% of the national median of the net equivalent income<sup>69</sup> is considered at risk of poverty.

---

<sup>66</sup> For further information on the poverty discourse in Germany see Hradil (2015, 2010).

<sup>67</sup> The German term "Ernährungsarmut" (food poverty) was coined by Feichtinger (1995) with reference to the concept of material and social deprivation. Material food poverty is characterised by a lack of (socially accepted) food per se or by a lack of means to buy food. Social food poverty, on the other hand, refers to limited chances of participation with regard to the communal aspects of food and nutrition. Income-related, material food poverty in most cases goes hand in hand with social food poverty. In the international discourse, the discussion on food poverty is reflected by the reference to the concepts of food security/insecurity. Food security exists when all people, at all times, have physical, social and economic access to sufficient, safe and nutritious food that meets their dietary needs and food preferences for an active and healthy life (World Food Summit 1996).

<sup>68</sup> Hunger is a subjective sensation that is caused if the calorie intake falls below an individual's caloric need or, in other words, is caused by an insufficient supply of energy. If the energy supply is insufficient over a longer period of time, we speak of chronic hunger. Malnutrition, on the other hand, is characterised by an insufficient supply of nutrients. If the energy requirement is met or even exceeded but the supply of nutrients is insufficient, we also speak of hidden hunger (cf. Chapter 4.1).

<sup>69</sup> See also the glossary in the Federal Government's current Report on Poverty and Wealth (BMAS 2017a: 604 f.): The net equivalent income is a net income weighted according to the size of the household and the age of its members. The generally used new scale of the Organisation for Economic Co-Operation and Development (OECD) assigns a value of 1.0 to the main earner, of 0.5 to each additional household member aged 14 and over and of 0.3 to each person under the age of 14. A couple with two children under the age of 14 and a disposable income of € 4,500 per month would therefore have an equivalent income of € 2,142.86.  $(4,500 / (1.0 + 0.5 + 2 * 0.3) = 2,142.86)$ . The economic performance of a single person with an income of € 2,142.86 would be considered equivalent to this household.

According to the German Federal Government's 5<sup>th</sup> Report on Poverty and Wealth, this applied to approx. 16% of the population in 2015, i.e. about 13 million people (BMAS 2017a: 549 ff.).<sup>70</sup> Although the average disposable household income increased by approx. 15% between 1991 and 2015, the increase in the lower income groups was disproportionately low or – in the case of the lowest income decile – non-existent. In the long-term trend, the at-risk-of-poverty rate in Germany, as in most other industrialised countries, is on the rise (Grabka & Goebel 2018, BMAS 2017a). The risk of poverty is particularly high for people in unemployment or marginal employment, single parents, low-skilled persons and people from a migrant background (BMAS 2017a). Households with children that, measured by the professional status and educational background of the adult household members, can be classified as being in the lower social strata, are also clearly disproportionately at risk of poverty (Stuth et al. 2018: 19 ff.). In 2015, about 2.5 million children and adolescents in Germany, i.e. almost every fifth person under the age of 18, lived in poor households (BMAS 2017a: 553).

In contrast to the measurement of poverty based on the at-risk-of-poverty threshold, people are considered "actually poor" in the broad public discussion if they are not able to attain the constitutionally guaranteed sociocultural subsistence minimum by their own efforts and are thus entitled to state-financed basic income support. This includes persons capable of work and persons not capable of work who are in need of support under Book II of the Social Code (SGB II, basic income support for jobseekers or "Hartz IV"), people in need of assistance under Book XII of the Social Code (SGB XII, esp. basic income support in old age and in the event of reduced earning capacity) and recipients of basic benefits under the Asylum Seekers Benefits Act. All in all, almost 8 million people, i.e. 9.7% of the population, received basic income support in 2017. It should be added that there is likely to be a high number of unknown poverty cases, i.e. people living below the socio-cultural minimum subsistence level but not applying for benefits for reasons of shame, lack of knowledge or lack of possibilities. A particularly high number of unknown cases (68%) is assumed among the population group of over 65-year-olds; according to estimates, about two thirds of the seniors entitled to support do not apply for benefits under Book II or Book XII of the Social Code (Becker 2012).

The largest group receiving such benefits are the approx. 6 million recipients of basic income support for jobseekers under Book II of the Social Code, including about 2 million children and adolescents (as of December 2017, Statistics of the Federal Employment Agency 2018). The number of children receiving support under Book II of the Social Code has risen substantially: whereas the rate of children and adolescents in claimants' households entitled to benefits under Book II of the Social Code was 12.8% in December 2012, it rose to 14.2% by the end of 2017. Almost half of them live in single-parent households (ibid.). Most of these children and adolescents (57% of the 7-to-15-year olds) receive benefits for a period of over three years (Bertelsmann Stiftung 2016: 5). This

---

<sup>70</sup> The data on the at-risk-of-poverty rate vary as a result of different data sources: based on micro-census data, the at-risk-of-poverty rate was 15.7% (2015), based on data of the German Socio-Economic Panel (SOEP) 15.8% (2014) and based on the data of the European Union Statistics on Income and Living Conditions (EU-SILC) 16.7% (also 2014). The sample survey of income and expenditure conducted every five years by the Federal Statistical Office also shows an at-risk-of-poverty rate of 16.7% for the year 2013 (see BMAS 2017a: 549 ff.).

reflects the continuous increase in long-term unemployment since 2010 and thus a “hardening of long-term unemployment” (Statistics of the Federal Employment Agency 2019a: 7).

### **What is the disposable income of poor households in Germany?**

A net household income of 60% of the median income amounts to a little more than € 1,000 per month for a single person household, with the exact amount varying depending on the underlying data set (see BMAS 2017a: 551 ff.). The standard needs rates of basic income support, which are statistically determined and annually adjusted on the basis of the sample survey of income and expenditure conducted every five years<sup>71</sup>, apply to the 6 million recipients of basic income support for jobseekers under Book II of the Social Code. These rates are shown in Table 4-3 for the year 2019, together with the respective standard amount for food and non-alcoholic beverages.

The amount of basic income support is supplemented by the accommodation and heating costs.<sup>72</sup> These standard needs are borne by the municipalities; the municipalities cover the actual expenses, insofar as these are appropriate (see § 22 SGB II and also BMAS 2018: 91 f.). The level of the basic income support benefits including the accommodation and heating costs can be taken from the Federal Government’s 12<sup>th</sup> Minimum Subsistence Report (Deutscher Bundestag 2018a). In 2019, the three elements of basic income support for a single person household, i.e. the standard rate for current expenditure (€ 424 /month, category 1) and the costs for accommodation (€ 289/month) and heating (€ 51/month) amounted to a total of € 764/month (cf. Deutscher Bundestag 2018a: 9).<sup>73</sup>

---

<sup>71</sup> See Act on determining standard needs in accordance with Section 28 of the Twelfth Book of Social Code (Regelbedarfs-Ermittlungsgesetz, RBEG).

<sup>72</sup> This is supplemented by expenses for children, adolescents and young adults for education and participation and, if appropriate, by extra allowances for additional needs in special circumstances in life (e.g. single parents, disability). In the area of food consumption, this particularly applies to the additional needs of pregnant women and additional needs in respect of medically prescribed diets that are necessarily more expensive. In the case of e.g. AIDS, cancer, renal insufficiency or coeliac disease, it is possible to apply for extra allowances amounting to 10% to 20% of the standard rates shown in Table 4-3.

<sup>73</sup> For an overview of the standard needs rate calculations, also for other household types, for the year 2018 and for information on applications for extra allowances for pregnant women, single parents or people with disabilities please refer to BMAS (2018: 101 ff.).

**Table 4-3:** Standard needs rates of basic income support for the year 2019

Standard needs category	Total standard needs per month	Percentage for food and non-alcoholic beverages per month	Percentage for food and non-alcoholic beverages per day
Single/Single parent (standard needs cat. 1)	€ 424	€ 147.81	€ 4.86
Adult partners in claimant's households (standard needs cat. 2)	€ 382	€ 133.17	€ 4.38
Adults under the age of 25 without own household (standard needs cat. 3)	€ 339	€ 118.18	€ 3.89
Adolescents 14-17 years old (standard needs cat. 4)	€ 322	€ 151.57	€ 4.98
Children 6-13 years old (standard needs cat. 5)	€ 302	€ 122.01	€ 4.01
Children 0-5 years old (standard needs cat. 6)	€ 245	€ 85.87	€ 2.82

Source: Calculations of the coordination office for unionised groups of persons in unemployment (Koordinierungsstelle gewerkschaftlicher Arbeitslosengruppen, [www.erwerbslos.de](http://www.erwerbslos.de)) based on the Act on determining standard needs (RBEG), cf. <https://www.erwerbslos.de/a-info/39-aktuelle-ausgabe/675-mini-existenzminimum> (as of 04.08.2019).

### Is it possible to maintain a healthy diet with such limited income resources?

Whether and to what extent it is possible, with such a limited budget, to engage in sociocultural participation and, above all, to have a sufficient, needs-based diet that is health-promoting in the long term, is the subject of often very polarised and superficial discussions. On the one hand, there are theoretical calculations illustrating the strategies which can be used to have a health-promoting diet based on the respective budget (e.g. Thießen & Fischer 2008). On the other hand, it is often indicated by charities, poverty researchers and nutritionists that such theoretically derived budget calculations lack practical relevance (e.g. von Normann 2008). The apparent contradiction between the two positions can be explained if we a) remind ourselves of the limited significance of the poverty indicator "income" and b) look at the specific problem situations of a life in poverty:

- a) although income is the main factor regarding the living conditions and the chances to participate in society, income resources always only manifest themselves in a specific household context. Information on the disposable income therefore does not necessarily provide information on the standard of living that is actually achieved. The standard of living is dependent on further monetary resources (e.g. assets) to bridge temporary shortages of income and on the duration of the income poverty. In addition, non-monetary resources (e.g. social net-

works), other structural conditions (e.g. regionally differentiated price levels) and the efficient use of resources as a result of individual household skills (e.g. cooking), as well as the existence of specific needs (e.g. in the case of illness) also play a decisive role. Depending on these resources, health-promoting food consumption is therefore – at least theoretically – possible, even with very limited income resources.

- b) However, socio-epidemiological and poverty research findings have clearly shown that the above-mentioned supporting resources (e.g. social networks, assets, household skills) are often limited in households with longer-lasting income poverty. Specific needs, on the other hand, are disproportionately prevalent in this group (e.g. the disproportionately high support quotas under Book II of the Social Code for severely disabled persons; Statistik der Bundesagentur für Arbeit 2019b). In addition, studies confirm what people living in poverty have repeatedly reported in qualitative studies: dealing with a low income and the related material deprivation costs time and cognitive attention and has been proven to lead to chronic stress in the long term (Noble et al. 2015, Evans & English 2003, Evans & Schamberg 2009). These conditions and context factors can make it much more difficult to implement the above-mentioned budget calculations. In addition, the price of more nutritional food represents a considerable financial restriction on poor households. The increased costs of a health-promoting diet are a key factor for the link between monetary resources and food consumption: foodstuffs with a high nutritional value, such as fruit and vegetables, fish or lean meat, are on average (per 100 kcal) more expensive than energy-dense foods high in added sugar or fat and are therefore much more difficult to finance for low-income households (see text box 5 „(Additional) costs of a health-promoting diet”).

But if it is not possible to derive direct conclusions from income itself regarding the actual consumption options and chances to participate in society, it would make sense to record (more) directly the life situations in poverty and their impact, e.g. by recording the actual expenses (e.g. Hörstermann 2016) or the achieved standard of living (e.g. Pfortner & Schmidt-Catran 2018).<sup>74</sup> However, this only happens to a very limited degree with regard to food consumption in Germany. Although the NVS II, DEGS or KIGGS studies (Table 4-2) provide major population studies, these are only carried out at rather large intervals and they mostly use mixed status indices based on income, education and occupation instead of an evaluation by income (for the second follow-up to the KIGGS study cf. Lampert et al. 2018a).<sup>75</sup> It is, therefore, only possible to a limited degree to draw conclusions about existing poverty situations and the related material living conditions, socio-cultural participation chances, nutritional and health-related attitudes and practices and the factors

---

<sup>74</sup> This differentiation follows the distinction, widespread in poverty research, between the indirect measurement of poverty (via ‘income’) and the direct measurement of poverty (via the material and immaterial assets such households have), cf. Andreß (2008). The EU and the German Federal Government have also extended their previous measurement of poverty beyond the original income indicator. The Federal Government’s current Report on Poverty and Wealth also uses a multi-dimensional material deprivation indicator (cf. BMAS 2017a: 573).

<sup>75</sup> In addition to this, scientists like Pfeiffer et al. (2015: 458) criticise the non-representative consideration of poor population groups in the NVS II study.

causing these (ibid.: 125, Lampert & Kroll 2009). The multi-dimensional problem situations of poor households are also often disregarded.

**Text box 5:** (Additional) costs of health-promoting food consumption

The question whether health-promoting food consumption entails higher costs has been dealt with by a series of studies conducted over the last two decades, most of them in the United States (e.g. Rehm et al. 2015) but some also in EU countries like France (Maillot et al. 2007), Spain (Lopez et al. 2009), Sweden (Rydén & Hagfors 2011) and the Netherlands (Waterlander et al. 2010). There is strong evidence that foods show an inverse relationship between energy density and nutrient density and that energy-dense but nutrient-poor food products are comparatively cheap. Choosing more nutritional foods is therefore often associated with higher costs per kcal (Darmon & Drewnowski 2015, Drewnowski 2018, cf. Chapter 7.5.2.1). A British study assessing 94 foods, for example, comes to the conclusion that a nutrient composition as suggested by the Healthy Eating Index costs GBP 7.50 per 1,000 kcal as opposed to only GBP 2.50 per 1,000 kcal for a nutrient composition identified as being less healthy (Jones et al. 2014). The price breakdown shows that, in particular, bread, rice, pasta, sugary drinks and some high-fat foods like French fries are found in the lower price segment. The results of the meta-analysis by Rao et al. (2013) of 27 studies conducted mostly in North America and Europe confirm these basic links and indicate additional average costs of one to two US dollars per adult per day for health-promoting food consumption.

Comparatively little research has been done on the connection between nutritional values and prices of individual foods and baskets of goods in Germany. But currently available studies confirm the additional costs of healthier food consumption and put them in relation to the standard basic income support applicable at the relevant time. Thiele (2014), for example, shows on the basis of panel data for 2011 from the German society for consumer research (Growth from Knowledge, GfK) that baskets of food with a low energy density and a higher content of vitamins and trace elements may imply up to 10% higher costs (in terms of the then applicable standard basic income support rate). Kersting and Clausen (2007) calculate the costs of an optimised diversified diet for children and young people and also put them in relation to the then applicable standard rates. The study comes to the conclusion that there is a discrepancy, increasing with age, between the then applicable standard rate for food and the actual expenses ranging from 18% for the 4-to-6-year-olds up to 44% for the 15-to-18-year-olds. This is primarily due to the high percentage of (comparatively expensive) fruit and vegetables (60% share of the costs for an optimised diversified diet). If we put the above-cited analyses from the United States (Rehm et al. 2015) and Great Britain (Jones et al. 2014) in relation to the situation in Germany, we must assume that this discrepancy between standard rates and actual requirements for health-promoting food consumption (e.g. in line with the DGE recommendations) continues up to adult age and therefore implies an increase, in some cases considerable, in the current standard rates for food across all groups receiving benefit. Precise requirement calculations that are realistically adjusted to the people's daily lives and their often low supporting resources are urgently required.

In a nutshell, it can be stated that we are currently in a situation in which there is strong evidence that the nutritional and health status is closely related to the socio-economic status and that material and structural factors (such as the available income) have a major influence (for Germany cf. Lampert et al. 2018b, 2016, Moor 2016, Fekete & Weyers 2016). But we know little about poor households' actual scale of material and social deprivation in Germany with regard to food consumption.

In countries such as the USA or Canada, the situation is completely different. These countries have in recent years established a standardised reporting format that is firmly focused on the nutrition-related and health-related impact of poverty. In the USA, for example, 45,000 households are examined every year in order to understand the above-mentioned links and be able to take the necessary countermeasures. The data form the basis of the Supplemental Nutrition Assistance Program (SNAP), the effects of which are examined on a regular basis (Carlson & Keith-Jennings 2018, Holben & Marshall 2017, Gundersen et al. 2018). Other countries such as Great Britain try to draw conclusions from secondary data about persons at risk of food poverty but find that specific surveys are needed to be able to take targeted policy measures (Ejebu et al. 2019: 82).

### **Do we have poverty-related malnutrition and hunger in Germany and what is the impact of this?**

As only limited data are available on the nutrition-related living conditions and deprivation of poor households in Germany, we will in the following refer not only to standardised deprivation indicators obtained in larger studies such as the European Quality of Life Survey (EQLS) but also to smaller, qualitative studies. The summarised findings in the field of food consumption show the following:

- (1) **There are many different ways for poor households to deal with material disadvantages – including deprivation and hunger.** Poor households deal with material disadvantages in many different ways. General coping strategies described in all areas of need include “permanent economising” and “compromises to quality and/or quantity” (cf. Laubstein et al. 2016, Eurofound 2017, Pfeiffer et al. 2016). In the area of food consumption, this manifests itself in a significantly limited choice of foods and meals (cf. Yildiz 2014, Mrotzek 2008, Kamensky 2004) and in a preference given to cheaper, more satiating foods over fresh products such as fruit and vegetables (cf. Klärner et al. 2015: 42). But in spite of the fact that analyses based on the Panel Labour Market and Social Security (PASS) show that approx. 97% of all people receiving support under Book II of the Social Code can afford a warm meal every day (Christoph 2016), restrictions in quality are to be expected. In the above-mentioned EQLS, 11% of German households in the lowest income quartile stated that they could not afford to pay for a wholesome meal every second day (Eurofound 2017). A total of 9% of German households in the lowest income quartile reported that they had gone without fresh fruit and vegetables in the previous two weeks (related to the date of the interview) for financial reasons and 31% of them stated that they had bought less meat or cheaper cuts of meat (Eurofound 2017). In addition to that, qualitative studies – like the Gießen study on the food consumption habits of poor households – point to financial constraints occurring more or less regularly (so-called “pull, stretch or rubber weeks”, cf. Lehmkuhler 2002: 216 ff.). During these financially difficult weeks, food consumption becomes very unbalanced, and food stocks, organisational talent or loans from friends are required. Some of the people affected even speak of hunger (ibid., see also Pfeiffer et al. 2016, 2015). These results are consistent with initial studies analysing the nutritional status of the people visiting the so-called Tafel

organisations (food banks)<sup>76</sup> which have become increasingly common in Germany: Every second food bank user of the 1,033 interviewed spoke of financial restraints with regard to health-promoting and nutritious food consumption, approximately 60% spoke of restraints with regard to the variety of food and meals they ate, almost one third had experienced hunger and every tenth food bank user interviewed reported that, due to a lack of financial means, they had been without food for at least one full day during the previous twelve months (Depa et al. 2018: 97).

- (2) **The material restrictions in poverty situations are accompanied by reduced socio-cultural participation and tend to lead to social isolation and health impairments.** In poverty situations, people only have limited access to typical daily routines in our society (e.g. club sports, excursions, holidays, joint restaurant visits; cf. Klärner & Knabe 2019). This can lead to reduced integration in social networks, to a lack of coping resources, often to social isolation and to a generally lower health status (cf. Krug et al. 2020). These interconnections are especially addressed in research activities focusing on the poverty of children and adolescents, mainly due to the well-documented psycho-social consequences (e.g. lower self-confidence, multiple behavioural disorders, loneliness, little experience of social appreciation) (cf. Laubstein et al. 2016, Klocke & Lampert 2005, Groos & Jehles 2015). Analyses based on the Panel Labour Market and Social Security (PASS) show the limited social and cultural participation in the field of food consumption linked to poverty situations in Germany: about one third of all people over the age of 15 receiving support under Book II of the Social Code cannot afford to treat friends to a meal once a month, and more than half of the recipients cannot finance a monthly visit to a restaurant (Christoph 2016, cf. also Eurofound 2017, Kamensky 2004). Moreover, it can be assumed that financing away-from-home meals in pre-schools and schools represents a considerable restriction to many families living in poverty and that this is a reason for the low application rate for financial support for school meals under the education and participation package (Bildung und Teilhabe, BuT) as this support currently only covers part of the total amount (cf. SOFI & IAW 2016). However, no studies have yet been conducted to investigate the related exclusion effects and their impact on children and adolescents.
- (3) **Permanent or repeatedly occurring material and social deprivation have a negative long-term impact on people's health.** Material and social deprivation in poverty situations leads to a significantly poorer state of health in the long run. For children in particular, poverty represents a manifest development risk with regard to later cognitive and physical impairment (cf. AWO-ISS longitudinal study: Holz et al. 2012 or analyses of school entrance medical

---

<sup>76</sup> Food banks collect unsellable food from donors and distribute it for a small amount of money to people in need. The first Tafel initiative in Germany dates back to the year 1993 and was specifically aimed at homeless people. According to Tafel Deutschland e.V.'s own assessments (2018), Germany had an estimated 942 food banks in 2018 which were used by approximately 1.5 million people – about one third of them children and adolescents, but also many senior citizens. The number of food banks and the amount of distributed food have steadily increased in recent years. In addition, the products and services offered have become more diversified (e.g. food banks for children, midday meals etc.). Food banks are therefore regarded as an established strategy to address poverty (Selke 2011) although they consider themselves a complementary institution that does not intend to relieve the state of its responsibility with regard to poverty and food waste.

examinations in the federal state of North Rhine-Westphalia: Groos & Jehles 2015). But poverty situations not only induce experiences of material deficiencies (e.g. malnutrition and hunger) but also psychological stress, in some cases severe, resulting from the permanent confrontation with deficiency-related problems (Noble et al. 2015, Mani et al. 2013, Shah et al. 2012, Haushofer & Fehr 2014). In addition, poverty has indirect effects through the behavioural patterns associated with poverty situations (unhealthy food consumption, smoking, less recourse to preventive health care). Poor households, especially households with “old” or “entrenched” poverty, experience exacerbated problems (cf. Lehmkuhler 2002 for the area of food consumption). While short periods of poverty can usually be compensated quite well, long-term poverty increasingly affects other areas of life (housing situation, educational opportunities). However, only a few studies have been conducted in Germany that explicitly address the deprivation experiences and consequences for people that have lived at or below the minimum subsistence level for a longer period of time.<sup>77</sup> In the area of food consumption, there are none.

**In light of the outlined problems, the following can be noted in summary:** Poverty has a negative effect on the opportunities to eat healthily and increases the risk of disease. In Germany, too, there is poverty-related malnutrition and sometimes hunger, as well as limited socio-cultural participation with regard to food consumption. This is accompanied by high individual and economic follow-up problems (and costs). Due to a lack of data, it is not precisely known how many people in Germany are affected by income-induced restrictions regarding access to a quantitatively and qualitatively adequate diet. Very rough FAO estimates are that 4.3% of the German population (FAO 2016: 37) are affected by food insecurity. With respect to society as a whole, the poverty phenomenon of malnutrition in Germany can thus be interpreted as a marginal problem; the vast majority of the population are food secure. However, the above-mentioned findings raise the central welfare-related question as to what level of basic income support, i.e. what sociocultural subsistence minimum we, as a comparatively rich society, want to afford. The above analysis shows that without additional supporting resources, the current basic income support is not sufficient to enable the households concerned to eat healthily. Consequently, in order to align public policy with the Sustainable Development Goals, it is necessary to review the bases and methods of calculation used to determine the standard needs rates (cf. Becker 2016a, Der Paritätische Gesamtverband 2018, Diakonie Deutschland 2016, nak 2018, Tobsch & Becker 2017). In light of the fact that people living in poverty have a significantly limited material scope of action, purely informative measures and general appeals to consume more sustainable food are less suitable instruments. This particularly applies to the social and ecological dimensions of sustainability as, from the poverty perspective, more sustainable food consumption often means first of all “better/healthier/more/more varied” and budgets are already too tight for that. Consumption taxes are typically regressive in their impact, i.e. they place a greater burden on low-income earners. A steep rise in excise taxes, especially on staple foods, thus also raises socio-political questions. Therefore, if the use of steering taxes is

---

<sup>77</sup> The above-mentioned AWO-ISS study on living conditions and opportunities in the lives of children and adolescents (cf. Holz et al. 2012) is one of the few exceptions.

increased, particular attention should be paid to the social equilibrium of the measure. For example, compensation is often proposed in the form of a personal tax refund or a tax refund differentiated according to household types, which is independent of income or falls as income increases (cf. Section 7.5.2.3). Moreover, in view of the fact that health-related habits tend to last lifelong, and in view of the special significance of (early) childhood burdens, there should be a greater focus on the living conditions of the over two million children and adolescents from particularly low-income households. With regard to food consumption, particularly suited measures include macrosocial, setting-based approaches which address the two most important living environments of these children and adolescents: their families and their schools / pre-schools. Last but not least, significantly improved data on the scope and the causes of (food) poverty are required.

#### 4.2.4 Food safety

Food must be safe and must not jeopardise consumers' health. In 2018, a total of 366,986 samples underwent official food control in Germany, and 13% of them were intercepted (BVL 2019a). Most of these interceptions (60%) were due to incorrect labelling or presentation, i.e. aspects which do not primarily affect the safety of these foods. 0.09% of the samples might have posed an actual risk to human health.<sup>78</sup> As sampling in Germany is risk-orientated, i.e. samples are primarily taken from food products likely to give a positive result, the actual share of foods hazardous to health is significantly lower.

The greatest food-borne health risk was posed by mycotoxins and contaminations with food infection and intoxication agents. These include, for example, listeria, toxigenic E.coli, campylobacter and salmonella. In addition, unauthorised or overdosed substances in food supplements, and foreign bodies such as glass particles, metal particles, pesticide residues or undeclared allergens, were also of significance.<sup>79</sup>

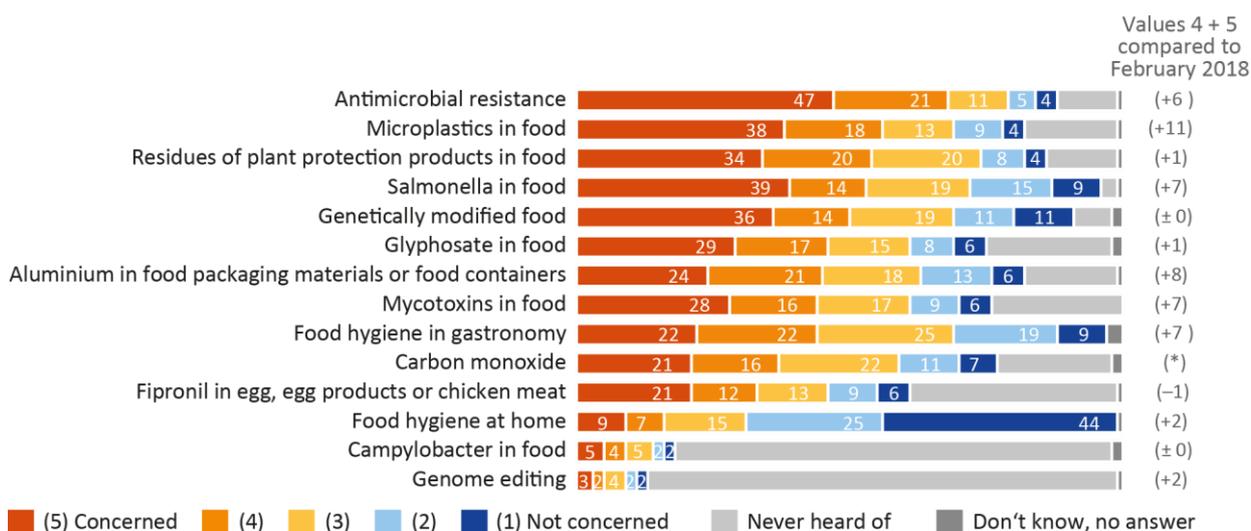
These findings are only partially consistent with the consumers' perception of risk. The 2019 BfR Consumer Monitor showed that, with regard to food safety, the people surveyed were mostly concerned about microplastics (63% of the respondents opted for the two highest scale categories) and residues of plant protection products, only then followed by mycotoxins (46%), glyphosate, salmonella and genetically modified food. Listeria and campylobacter in food, on the other hand, are only regarded as posing a very high or high risk by 19% and 13%, respectively, of the people surveyed (BfR 2019a). Microplastics are emerging contaminants and their data situation is still insufficient for scientifically sound risk assessment. Thus, there are no maximum permissible levels; food inspection authorities cannot, therefore, carry out controls to check compliance (EFSA CON-TAM Panel 2016).

---

<sup>78</sup> In 2018, Germany entered 320 notifications on food products into the European Rapid Alert System for Food and Feed (RASFF) (BVL 2019a, cf. also MLR (2018).

<sup>79</sup> The RASFF notifications from Germany on food products referred to mycotoxins (93), pathogenic micro-organisms (87), incorrect compositions (35) and foreign bodies (28), pesticide residues (21) and allergens (14). Other notifications concerned feeding stuffs and commodities (BVL 20219a).

**Figure 4-11:** Concern about 14 selected health and consumer topics (representative population survey, N = 1,016, August 2019)



Basis: 1.014; figures in percent (comparison with 02/2018 refers to "concerned" shares/scale values 4 + 5: percentage points);  
\*not surveyed in 02/2018

Source: BfR (2019a: 9).

Apart from acute health hazards, foods are intercepted if maximum levels are exceeded. The precautionary principle is applied when setting maximum levels. This means that exceeding a maximum level for a short time does usually not pose an acute health risk. Instead, a maximum level is set if (1) a health risk cannot be excluded in the case of long-term consumption, (2) an active substance has not (yet) been granted approval (in general or for a specific application, e.g. Fipronil for the raising of laying hens) or (3) the maximum level corresponds to the technically feasible standard (minimisation requirement under the ALARA principle = as low as reasonably achievable). This means that although maximum levels must not be exceeded, if they are it does usually not represent an acute health risk.<sup>80</sup>

The level of food safety in Germany can therefore be considered very high; this can primarily be attributed to an effective control system at all stages of the food chain (production/import, retail, official food control and inspection). This is, for example, shown by the fact that interceptions due to harmful substances detected by the functional, multi-level control system (e.g. pesticides, heavy metals or veterinary medicinal products) are clearly declining whereas interceptions due to foreign bodies, which are difficult to identify with analytical methods, are gaining in importance.

<sup>80</sup> Since 2015, the Federal Institute for Risk Assessment (BfR) has carried out a so-called Total Diet Study with more than 60,000 foods. It is aimed at determining the average concentrations of both health-promoting and potentially harmful substances in ready-to-eat foods. The results can be used for risk analysis purposes. The foods are prepared in the form in which they are typically prepared and then analysed with regard to approx. 300 ingredients. These include desired substances such as nutrients, but also heavy metals, pesticides, additives, dioxin, pharmaceutically active substances and substances that migrate from food packaging materials. The study is to be run for eight years and will also take into account the cumulative effects of the total daily diet. Away-from-home consumption is also part of this study (BfR 2019b).

But some general conditions may also pose a threat to food safety:

- (1) **Cuts in control activities.** Health risks from foods can be successfully reduced with the help of a functioning control system. Thus, there is the danger that measures which indirectly or directly lead to a reduction in control efforts (e.g. through cuts both in official inspections and private self-checks) may also lead to a reduction in food safety.
- (2) **Globalisation and complexity of commodity flows.** The risk that maximum levels are exceeded rises with the ongoing globalisation process in the production of and trade in foods and with the increased complexity of commodity flows. The requirements regarding quality management systems, quality assurance measures and statutory regulations in production/processing countries can sometimes differ greatly from the requirements applicable within the EU. Pesticides banned in the EU may be allowed in non-EU countries, for example. An insufficient separation in non-EU countries of products intended for the domestic market on the one hand and export markets on the other hand may therefore result in the maximum levels being exceeded when tested in the EU. In 2017, for example, 63% of the 3,924 notifications entered into the European rapid alert system (RASFF) related to products from non-EU countries (EU COM 2018a). The RASFF informs the member states (EU countries plus Switzerland, Iceland and Norway) about acute risks emanating from food, feed or commodities that were detected in one of the member states or prior to importation from a third country. Most notifications concern products from Brazil (372), followed by Turkey (316), China (313), Spain (232) and India (225).<sup>81</sup>
- (3) **Principle of targeted analysis.** In addition, it is currently only possible to detect contaminants and residues that are explicitly searched for (principle of targeted analysis). Unexpected contaminants/residues, i.e. substances which are not expected to be present in a food product and are thus not included in routine checks are not detected even if this would, in principle, be technically feasible. Harmful substances can therefore be overlooked for a lengthy period of time. These cases, in particular, often get a lot of public attention. Examples include Fipronil in eggs or EHEC in sprouts. The detection of unexpected contaminants ultimately requires the development and application of non-targeted analysis methods. But in spite of promising approaches, it is not yet possible to implement them technically for routine use.

Another problem is posed by risks which are generally not able to be assessed by conventional analysis methods. These contaminants and potential hazardous substances can thus be overlooked for a lengthy period of time. This includes, for instance, nanomaterials or microplastics. Although microplastics have probably been present in foods for a very long time, they were not detected in individual food products until a few years ago. In the vast majority of food products, the detection of microplastics is still impossible (EFSA CONTAM Panel 2016,

---

<sup>81</sup> The number of notifications per country depends on different influencing factors such as import volume, production of critical foods or local quality management systems, but also on the occurrence of individual events that sometimes lead to multiple entries. The distribution of the notifications entered in 2017 is given as an example. In 2018, the majority of notifications concerned products from Turkey (318), China (315), France (215) and the USA (202).

Ossmann et al. 2018). And the quantification of nanoplastics in food has not yet been satisfactorily resolved either (Lebensmittelchemische Gesellschaft 2018). Especially in the case of newly emerging contaminants, toxicity can only be assessed after the contaminants have been found and identified, and their risk can only be assessed after the contamination has been quantified.

- (4) **Internet trade in food products.** German enterprises offering food over the Internet must, just like conventional traders, register with the food inspection authority and are then subject to the same controls and inspections (BVL n.d.). But online trade also enables customers to import foodstuffs directly from non-registered and non-inspected enterprises abroad. In conventional trading, the importer must ensure that products imported from foreign countries comply with German legislation. In the case of direct imports, consumers have the formal role of importers so that the safety and legality of the products are therefore neither controlled nor ensured. In addition to that, manufacturers can in practice not be held legally responsible in the case of complaints. Prominent examples include plant-based food supplements offered as slimming aids over the Internet (BVL n.d., Rajcic de Rezende et al. 2019). These are, in fact, non-authorized medicinal products which can cause serious adverse reactions. This often also concerns food supplements for athletes, as these may also contain forbidden substances. Although such active substances can cause severe health problems, the products are available for direct import over the Internet (BVL n.d.).

### **Antimicrobial-resistant germs in food**

With regard to health and consumer topics, the people surveyed placed antimicrobial resistance top of their list of concerns, ahead of the food safety topics (cf. Fig. 4-11, 64% of the respondents opted for the two highest scale categories; BfR 2019a). The problem is indeed of major relevance and urgency as due to the large-scale use of antibiotics in human and animal medicine, antimicrobial-resistant germs are widespread and represent a direct and potentially life-threatening risk to human health (Antão & Wagner-Ahlf 2018). Although antimicrobial resistances are not primarily a food-safety topic, they are of high relevance for consumers and public health and we will therefore briefly go into the role food products themselves and food production systems play with regard to the spread of antibiotic resistances. Resistant pathogens primarily develop from the use of antibiotics in human and veterinary medicine and can then spread through direct contact, e.g. in hospitals or through the handling of animals. In addition to direct transmission, an important role is also played by direct spreading in the environment (soil, water).

Antimicrobial resistance occurs when bacteria are resistant to antimicrobial substances. Spontaneous mutations of the bacterial DNA or the acquisition of resistance genes from other bacteria, e.g. plasmids, cause changes in the genome and thus lead to different resistance mechanisms that may reduce or even neutralise the effect of antibiotics. Antibiotic-resistant bacteria, for example, can inhibit the absorption of the antibiotic by the cell, develop alternative metabolic pathways or directly inactivate the antibiotic through synthesised proteins. The use of antibiotics results in a selection of resistant bacteria as opposed to bacteria without resistance genes so that in the end

mostly bacteria with resistance properties will survive (Munita & Arias 2016, Davies & Davies 2010). If a pathogen is resistant to antibiotics, it can cause an infectious disease in a person which does not respond to treatment with the respective antibiotics. If no alternative antibiotics are available, which is a particular problem with multi-resistant germs, the course of the disease may become much more severe than it would be if able to be treated with antibiotics. This can be fatal in the case of immunocompromised individuals or lethal infectious diseases.

The estimated consumption of antibiotics in Germany is 700 to 800 tonnes every year in human medicine and approx. 1,200 tonnes in veterinary medicine (BVL 2016). The emergence of antimicrobial-resistant pathogens through antibiotic consumption in human medicine is very well documented and represents a major problem, especially in the inpatient sector (Antão & Wagner-Ahlf 2018, Bell et al. 2014). A similar link also exists between the use of antibiotics in veterinary medicine and the emergence of antimicrobial-resistant animal pathogens (Simoneit et al. 2015, ECDC et al. 2017). But as the emergence of resistances is dependent on the pathogen, the active substance and the animal species, and as the data situation with regard to the species-specific use of antibiotics is often insufficient, it is less easy to identify the correlation between the administration of antibiotics and the emergence of resistances in animals than in the field of human medicine (BVL 2016, Roth et al. 2019). The use of antibiotics in veterinary medicine and the related emergence of resistant bacteria may, in principle, also present a threat to human health (ECDC et al. 2017). The prerequisite for this is that the resistant animal pathogen is also able to cause infections in humans, i.e. if it is not animal-specific. There may also be a threat to human health if bacteria from animal production transmit their resistance properties to pathogens that are dangerous to humans. This means that not every antimicrobial-resistant germ poses a direct threat *per se*; it only does so if it is a pathogen.

There are different ways in which humans can come into contact with resistant pathogens which have emerged through the use of antibiotics in animal breeding (BfR 2015a, Tenhagen et al. 2018). The most likely way is the direct transfer from animals to humans. This primarily concerns people who are in direct contact with animals, i.e. farmers, veterinarians and slaughterhouse staff. If food-producing animals carry the resistant germs, transmission to humans through food is also possible (Larsen et al. 2016). This route of transmission primarily plays a role if the sanitary measures taken during slaughter, processing and preparation in households or catering facilities are insufficient (Simoneit et al. 2015). The third possible way of transmission is if resistant bacteria are transferred from animal housings into the environment through exhaust air or slurry and are then present in soil, water and air. How and to what extent transmission to humans can take place from there has not yet been sufficiently clarified. In principle, transmission to foods of plant origin, such as vegetables and salad vegetables, via soil and water is possible, however. This can pose a problem mainly because foods of plant origin, in contrast to those of animal origin, are often eaten raw so that pathogens are not killed before consumption. In the USA, it is currently even planned to apply common antibiotics used in human medicine on a large scale to plantations in Florida and California in order to combat a bacterial disease in citrus trees threatening all stands. It can be assumed that such measures will spur the emergence of resistant germs (McKenna 2019).

The hazardous potential of antimicrobial-resistant germs through foods cannot yet be ascertained reliably and is probably significantly lower than that through the use of antibiotics in human medicine or the direct contact between farm animals and humans. Nevertheless, taking preventive consumer protection aspects into account, it is important to reduce the spread of antibiotic-resistant germs in foods as much as possible through suitable measures at different levels (Roth et al. 2019). The development of resistances can primarily be reduced by cutting back the use of antibiotics in animal breeding to the therapeutically necessary level. If a resistance has developed, it is important to prevent the resistant germs from being able to escape from the animal stalls into the environment. Improved slaughter hygiene can reduce the possibility of resistant germs spreading to non-infected carcasses. This is particularly important with regard to the slaughtering of poultry (WBA 2015). If the resistant germs have already been transmitted to foodstuffs, an infection of consumers can, as with all other infectious agents, be minimised through good kitchen hygiene and, in the processing establishments, through strict compliance with good manufacturing practice requirements. The use of antibiotics in crop production should be completely avoided with the help of suitable preventive measures.

#### 4.2.5 Conclusions with regard to the health dimension

Life expectancy in Germany is high by global comparison, but is lagging behind several other European countries. The discussion on the food situation in Germany reveals: We eat too much and our diet is too imbalanced. About 48% of men and 38% of women in Germany consume more calories than recommended. And this 'too much' is often also too one-sided: We consume too many high-fat meat and dairy products<sup>82</sup>, too much fast food and too many sugar-sweetened foods and soft drinks while, at the same time, not consuming enough fruit, vegetables and high-fibre foodstuffs like wholemeal products and pulses. Compared with other EU countries, the adult population in Germany is only in the lower third when it comes to the consumption of fruit and vegetables, with German men even ranking last. According to most recent meta-analyses, a health-promoting diet such as the DASH diet (cf. Chapter 4.2.1 and 5.3) can reduce the relative risk of cardiovascular diseases, cancer and type 2 diabetes by 10-22% on average.

Socio-epidemiological research findings in recent decades have clearly shown: The lower the socio-economic position (especially the income), the less favourable – both in terms of quantity and quality – the dietary patterns and the higher the rates of obesity, morbidity and mortality. Poverty increases the risk of an inadequate diet and leads to limited socio-cultural participation or even social isolation. Without additional supporting resources, the current basic income support is not sufficient for realising health-promoting food consumption. Consequently, in order to align public policy with the Sustainable Development Goals, it is necessary to review the bases and methods of calculation used to determine the standard needs rates.

---

<sup>82</sup> The high average consumption of meat (approx. 60 kg) and dairy products (approx. 51 kg, of which approx. 24 kg cheese) per person and year makes a particular contribution to the excess consumption of energy from these higher-fat variants.

Greater focus should especially be placed on the living conditions of the over two million children and adolescents growing up in particularly low-income households. Because health and social impairments in childhood and adolescence have a decisive impact on future well-being and physical and mental health. With this in mind, measures to improve the opportunities for children, adolescents and their families to realise their full potential and participate in society are key elements of prevention policy. With regard to food consumption, particularly suited measures include macro-social, setting-based approaches which address the two most important living environments of children and adolescents: their families and their schools / pre-schools.

The nutritional and health situation of the German population can be derived from various studies (see Table 4-2). However, there are, in some cases, major shortcomings and gaps in the data situation and availability. The Advisory Board considers the often insufficiently up-to-date data situation, the fragmented reporting on the nutritional situation and the very limited assessment of the supply situation for specific population groups (senior citizens, pregnant women, infants, children and adolescents from low-income families) to be particularly problematic. There are, therefore, distinct limitations on the extent to which statements can be made on the specific conditions and consequences of food consumption in very limited income situations, but also on the situation of senior citizens. It is also the case that by no means all links between certain dietary patterns and health disorders are clear. This also particularly applies to the health situation in old age.

### 4.3 The social dimension of our food consumption

In this expertise, sustainability is understood as the permanent preservation of the possibility of satisfying basic needs. Both the conditions under which food is offered and consumed (Sections 3 and 4.2) and the conditions under which food is produced can be such that people cannot adequately meet their basic needs. Greater sustainability in food consumption thus also takes into account the conditions under which people produce and make food available. This will hereinafter be referred to as the social dimension of sustainable food consumption.<sup>83</sup>

In order to assess the social dimension of food consumption we first need to define which aspects this includes. This requires a different procedure from that, for example, used to assess the environmental dimension. The assessment of environmental impacts of food consumption can be based on the concept of planetary boundaries and also on national and international objectives and provisions such as EU environmental rules or international climate targets, which the German Government transposed into national regulations. A number of expertises published by the Scientific Advisory Board during recent years deal with environmental issues in agriculture (e.g. WBA et

---

<sup>83</sup> In this regard, it is important to highlight that health aspects are also part of these social aspects – when considered from the food consumer’s perspective. Social inequalities in the nutritional and health situation and especially the problem of food poverty are significant social problems (cf. Section 4.2.3). Given that health is of such vital importance in the policy field and problem area of food consumption, it is addressed in Section 4.2 of this expertise as a separate objective or dimension.

al. 2013, WBA & WBW 2016). With regard to animal welfare as another aspect of sustainable food consumption (cf. Section 2.4), this expertise can also build on a previous expertise (WBA 2015).

In view of this, the following Section will first of all discuss the key issues relating to the social dimension of food consumption (Section 4.3.1). Afterwards, different sources will be used to identify social aspects with respect to the production and manufacturing conditions of food, which the WBAE believes to be relevant in terms of more sustainable food consumption. Taking this as a basis, the social problems with regard to production (Section 4.3.3) and food trade (Section 4.3.4) will be described using available data.

### 4.3.1 Key issues

In the public debate, the term “social” is above all associated with two aspects which will in the following be referred to as “protection aspect” and “justice aspect”.

- (1) **Protection aspect:** In dealing with social issues, this aspect mainly focuses on personal protection from health problems and from getting into a situation where people are no longer able to satisfy their own basic needs due to unemployment or illness, for instance. This protection aspect is thus in line with the understanding of sustainable development as described in Section 2. In accordance with the principle of the welfare state, in Germany it is the government which is ultimately responsible for ensuring basic social protection – which is what the protection aspect aims at – in particular by defining standards of occupational safety and providing a corresponding social security system. With regard to foodstuffs produced in Germany, it should, in principle, not be necessary for consumers to make sure when purchasing a food product that all stakeholders along the value-added chain of said food product had basic social protection. However, this does not apply if there are gaps in implementation of social minimum standards as a result of the applicable social standards being undermined. In addition to that, the question arises as to whether consumers are able to ensure that these minimum social standards are met if the products were produced in countries where minimum social standards are not implemented at governmental level. The same also applies to minimum social standards with regard to foodstuff inputs such as feedstuffs imported from abroad. This aspect is dealt with in Section 4.
- (2) **Justice aspect:** This perspective goes beyond a basic minimum protection and postulates wider objectives, especially the alleviation of social inequality or the realisation of social justice. The justice aspect goes beyond the satisfaction of the basic needs. It picks up on SDG 8 “decent work and economic growth” and SDG 10 “reduced inequalities” (cf. Section 2.4), which are of particular relevance for the social dimension of a greater sustainability in food consumption. In the public debate, calls for the reduction of social inequality are linked to the concept of “fairness” – as seen in the demands for fair trade, for example. With regard to the justice aspect, the question arises as to which wider objectives are relevant in terms

of food consumption and how consumers can contribute to achieving these objectives, e.g. reducing social inequalities, through their purchasing decision.

### 4.3.2 Identifying social aspects using existing approaches to promote sustainability in the food system

In order to decide which criteria are relevant when assessing the social aspects of sustainable food consumption and given the different perspectives on the topic, it appears to make sense to first analyse which social criteria form part of already existing assessment systems. Janker and Mann (2018) analysed 87 existing assessment systems. Their analysis shows that there is no consensus on the meaning of the “social dimension” of sustainability in agricultural systems.

For the purpose of this expertise, six sustainability assessment systems were selected and used to identify criteria in order to assess the social dimension. Table 4-4 summarises these assessment systems as well as the grounds on which they were selected. The table is followed by a brief introduction of the assessment systems. Based upon this, Table 4-5 provides an overview of the social criteria.

#### 1) The International Labour Organization’s concept of decent work

The United Nations International Labour Organization (ILO) introduced their concept of “decent work” in 1999 (ILO 2019). The concept is also reflected in Sustainable Development Goal 8. Table 4-5 shows those elements of the ILO decent work agenda which are relevant for our expertise.<sup>84</sup>

Although the demand for decent work can be applied to the whole working population, the ILO criteria for decent work were mainly developed for wage and salary earners. Some of the criteria, such as those relating to the representation of employees’ interests (e.g. freedom of association and the right to collective bargaining), ultimately only apply to wage and salary earners. Self-employed persons generally face the challenge of being responsible for their own working conditions, at least formally. This problem will be discussed further on.

---

<sup>84</sup> Criteria which do not refer to the value-added chain of individual products, such as food products, but to the economy as a whole (e.g. national unemployment rate) were not included in the table.

**Table 4-4:** Selected sustainability assessment systems used as a basis to identify social criteria

Assessment system	Organisation	Justification for the selection
<b>1) Decent work</b>	International Labour Organisation (ILO)	Globally recognised concept, developed by the competent UN organisation; often used in agri-food related sustainability assessments
<b>2) SAFA</b> Sustainability Assessment of Food and Agriculture Systems	Food and Agriculture Organisation (FAO)	Globally recognised concept, developed by the competent UN organisation; often used in sustainability assessments
<b>3) Fairtrade</b>	Fairtrade Labelling Organisations International	Best-known label used to achieve social objectives in international food trade
<b>4) GlobalG.A.P. GRASP</b> Risk Assessment on Social Practice	GlobalG.A.P.: Good Agricultural Practice	GlobalG.A.P. is the certification standard for conventional food products that is used most frequently at international level. GRASP is an additional module developed, in particular, for social aspects in the global standard for Good Agricultural Practice
<b>5) COROS</b> Common Objectives and Requirements of Organic Standards	IFOAM: International Federation of Organic Agriculture Movements	Globally recognised guidelines for organic farming, developed by the International Federation of Organic Agriculture Movements
<b>6) DLG sustainability standard</b> ("Nachhaltigkeits-Standard")	German Agricultural Society DLG (Deutsche Landwirtschaftsgesellschaft)	Sustainability assessment system for agricultural holdings developed in Germany

Source: WBAE presentation.

## 2) Social criteria in the FAO Guidelines for Sustainability Assessment of Food and Agriculture Systems

Over several years, the Food and Agriculture Organization of the United Nations (FAO), together with a number of different stakeholders, developed guidelines for the assessment of the sustainability performance of food and agricultural systems which are known as SAFA (Sustainability Assessment of Food and Agriculture Systems) (cf. Section 5.2). According to the guidelines' description, this approach was developed in particular to assess the sustainability performance of the entire value-added chains of agricultural products (cf. FAO 2014: V).

The social criteria of the guidelines are listed in Table 4-5. Other sustainability assessment systems developed for the agricultural sector use similar types of criteria. The SMART (Sustainability Monitoring and Assessment Routine) assessment system is explicitly based on SAFA. The RISE system (Response-Inducing Sustainability Assessment) also includes similar criteria. But as far as the quality of life is concerned, the RISE system includes other criteria such as social relationships or individual freedoms and values as well (HAFL 2017: 9).

### 3) Social criteria in the Fairtrade label

Fairtrade<sup>85</sup> is a certification system which was primarily introduced for trading in products from developing countries. One particular aim is to ensure financial transfers to small-holder farmers by selling their products for above-market prices. In essence, a minimum price is guaranteed, which then applies when world market prices are particularly low, and an earmarked premium is paid to the producers. In addition to the social criteria, Fairtrade standards also include several environmental requirements, for example with respect to the use of pesticides and fertilisers, avoiding soil erosion, protecting biodiversity and, since 2019, also with respect to reducing GHG emissions and increasing carbon sequestration.

There are Fairtrade standards for small-scale farmers' cooperatives, plantation workers and contract farming. These standards essentially implement the ILO standards for decent work and explicitly make reference to the ILO core labour standards (Fairtrade 2019: 11, 35). The criteria which are explicitly relevant to the Fairtrade certification are given in Table 4-5.

With regard to wider social objectives in line with the justice aspect, the Fairtrade rules encompass the following aspects for small-scale farmers' cooperatives: promoting development potential (e.g. planning measures to encourage higher levels of member participation), democracy, participation and transparency as well as a general ban on discrimination (Fairtrade 2019). The standards for waged workers and the standards for contract farming also include additional social standards such as very detailed provisions on how to handle the Fairtrade Premium (Fairtrade 2011, 2014). As these provisions very specifically apply to Fairtrade they are not included in Table 4-5.

### 4) Social criteria in the GlobalG.A.P. System

The GlobalG.A.P. System also includes social criteria. G.A.P. stands for "Good Agricultural Practice". In its own description, the system is referred to as "the world's leading farm assurance program, translating consumer requirements into Good Agricultural Practice in a rapidly growing list of countries – currently more than 135".<sup>86</sup>

Unlike the Fairtrade label, for example, the GlobalG.A.P. System is limited to business-to-business communication and is not used for advertising aimed at consumers. Hence, it should be seen more as a risk management system of the retail sector. The system traditionally focuses more on food safety. For social matters in particular, an additional module was introduced for wage and salary earners: the "add-on module: Risk Assessment on Social Practice – Committed to Workers' Health, Safety and Welfare (GlobalG.A.P.-GRASP)". The module basically covers the ILO standards for decent work which are also part of the Fairtrade label. But in addition to that, it also includes further specific criteria applying to agricultural workers such as making sure that children of workers who live on agricultural holdings attend school.

---

<sup>85</sup> The spelling "Fair Trade" is also common.

<sup>86</sup> See [https://www.globalgap.org/uk\\_en/who-we-are/about-us/history/](https://www.globalgap.org/uk_en/who-we-are/about-us/history/).

## 5) Social criteria in the organic farming certifications

With regard to organic farming, the focus lies on the environmental dimension of sustainable development. That is why government requirements for the certification of organic produce usually do not include any social sustainability criteria. This also applies to the EU organic label. Private organic standards, in contrast, often include social criteria. The international umbrella organisation IFOAM developed common standards for organic certification which are known as COROS (Common Objectives and Requirements of Organic Standards). These standards also include a paragraph on “social justice.” The criteria mentioned in this paragraph largely reflect the ILO principles for decent work and also make explicit reference to the ILO (IFOAM 2014: 20).

## 6) Social criteria in the German Agricultural Society’s sustainability assessments

The aforementioned criteria were developed by international organisations. In Germany, the German Agricultural Society (DLG), which can be considered the leading expert association in the agriculture, agribusiness and the food sectors, developed criteria for the sustainability certification of agricultural holdings. Holdings can be certified by the DLG based upon these criteria. The criteria for assessing the social dimension are shown in Table 4-5. The DLG differentiates between criteria applying to staff and criteria applying to farm managers. The criteria for the employees include several aspects which are also part of the ILO criteria and the SAFA guidelines but not all of them.<sup>87</sup> Criteria with respect to staff representation, for example, are not included. With respect to farm managers, the DLG’s system also covers criteria which are not included in other systems. The DLG’s criteria include, for example, that farm managers themselves should take at least two weeks of holiday a year. The DLG certification also includes whether managers allow outsiders to gain insights into the farm (e.g. tours of the farm), are socially committed (e.g. party or association) or have settled the farm succession.

---

<sup>87</sup> The fact that specific criteria are not part of the DLG standards may, in part, be due to the fact that these aspects are regulated by law in Germany (e.g. no forced labour).

**Table 4-5: Social criteria in the six assessment systems selected**

Goals	Criteria/indicators	ILO Decent Work <sup>1)</sup>	FAO SAFA <sup>2)</sup>	Fairtrade <sup>3)</sup>	Global G.A.P. GRASP <sup>4)</sup>	IFOAM COROS <sup>5)</sup>	DLG <sup>6)</sup>
<b>Adequate livelihood</b>	Adequate remuneration	x	x	x			
	Stability and security of work	x			x		
	Employment of young people	x					
	Development of skills		x				x
<b>Labour rights/working conditions</b>	Legally compliant employment contracts		x	x	x		x
	No forced labour	x	x	x		x	
	No child labour	x	x	x	x	x	
	Freedom of assembly and negotiation	x	x	x	x	x	
	Decent working hours	x	x		x		x
	Reconciling working life and family life/Maternity	x			x		
	Old age security	x		x	x		
<b>Equal rights</b>	No discrimination/equal opportunities	x	x	x	x	x	
	Gender equality	x	x				
	Support of underprivileged groups		x				
<b>Safety and Health</b>	Safety at work	x	x	x	x		x
	Healthcare system		x		x		
	Public health		x				
<b>Cultural diversity</b>	Indigenous knowledge		x				
	Food sovereignty		x				
<b>Social aspects considering, in particular, farm managers</b>	Fair access to means of production		x				
	Holiday farm manager						x
	Social commitment						x
	Regulated farm succession						x
	Outsiders allowed to gain insights into the farm						x
<b>Social concerns of others</b>	Protection of suppliers' rights		x				

Source: WBAE presentation based on <sup>1)</sup> ILO (2019); <sup>2)</sup> FAO (2014); <sup>3)</sup> Fairtrade (2011, 2014, 2019); <sup>4)</sup> GlobalG.A.P. (2014); <sup>5)</sup> IFOAM (2014); <sup>6)</sup> Christen et al. (2013: 34).

**Text box 6:** In-depth concepts using the example of the Economy for the Common Good (ECG)

Table 4-5 includes social criteria which appeared to be of special relevance based on the reasons given in Table 4-4. However, it has to be taken into consideration that there are also detailed criteria which were developed in innovative approaches. An example is the certification under the ECG label, which is a concept based on Felber (2018) and can nowadays be considered as an (emerging) social movement. This concept also includes social criteria that apply to the owners of agricultural holdings. This is of particular relevance to the agricultural sector as it is mainly dominated by family-run farms. The ECG model provides for a certification of different types of enterprises through a peer review system or an external audit. A few agricultural enterprises have already been certified under this system. Similar to the concept of community-supported agriculture dealt with in Section 5.4, the reason for including the ECG system is not its significance with respect to agricultural practice (this is considered to be negligible) but because it represents an approach to implementing social aspects which are not remunerated by the market under market economy conditions.

The ECG concept includes three dimensions which can be categorised as social criteria: (1) human dignity; (2) solidarity and social justice; and (3) transparency and co-determination. The ECG model applies these criteria to five groups of stakeholders: suppliers; owners and financial service providers; employees; customers and other companies; and the social environment. The criteria for employees mainly correspond to the ILO criteria for decent work. But the ECG certification also encompasses social criteria which are not part of any of the systems referred to above such as the owners' ethical and social positions in relation to financial resources.

In respect of these social criteria, it has to be taken into account that they strongly focus on the role of employees working in agricultural holdings. No account was taken, with regard to the selected assessment systems, as to whether a holding caused social problems when purchasing land. One problem arising due to large-scale land acquisitions by investors in developing countries is the disregard of small-holder farmers' traditional land use rights. This problem is also referred to as "land grabbing". This issue will be discussed in detail in Section 4.3.4.1. Because of this problem, the Committee on World Food Security developed guidelines to protect farm holdings in developing countries from arbitrary land grabs.<sup>88</sup> Said guidelines also form part of the "Principles of Responsible Investment in Agriculture and Food Systems" which were adopted by the Committee on World Food Security in 2014.<sup>89</sup>

**In summary, it can be stated** that the different approaches to promoting sustainability in the agri-food sector include different aspects of the social dimension of sustainability. Across all different systems, securing minimum standards plays a major role as far as the working conditions are concerned. Most systems use the ILO Core Labour Standards as a basis. Furthermore, the systems differ in the extent to which they take social aspects into account with regard to trade relations between market partners – one example of this is Fairtrade. And last but not least, the approaches differ in the mechanisms they use for implementing social goals. The mechanisms range from providing an assessment framework (e.g. the FAO SAFA guidelines) for the use of labels (as is the

<sup>88</sup> See <http://www.fao.org/3/i2801e/i2801e.pdf>.

<sup>89</sup> See <http://www.fao.org/3/a-au866e.pdf>.

case with Fairtrade) or establishing additional certifications (e.g. GlobalG.A.P.-GRASP or Naturland Fair). In the following sections, we will deal with further mechanisms such as establishing an economic community consisting of consumers and producers (e.g. Alternative Food Networks, cf. Section 5.4) or making use of digital means (e.g. with apps or social media, cf. Section 8.10).

Given the aforementioned differentiation between the protection aspect and the justice aspect, it can be noted that most of the social criteria included in the assessment systems are part of the protection aspect. Thus, a broad range of protection requirements are met (e.g. accident insurance, maternity protection and protection of children and young people). The justice aspect is mainly represented in three types of criteria: (1) the criterion of decent remuneration and an adequate standard of living; (2) the criterion of freedom of association and collective bargaining which forms an essential precondition for negotiating fair payment; and (3) criteria for equal rights.<sup>90</sup> With regard to the situation of employed persons, the justice aspect plays a bigger role in the ILO Decent Work standards and the FAO SAFA guidelines as compared to Fairtrade. This is probably due to the fact that Fairtrade was mainly developed for independent smallholder family farms. IFOAM COROS, GlobalG.A.P.-GRASP and the criteria defined by the DLG largely cover the protection aspect; however, the justice aspect does not play a significant role.

In the following, we will use the criteria identified in this section as a basis to analyse social problems which arise during food production. As the basic reflections show, it is necessary to differentiate between food which was produced in Germany and imported food in order to assess the social problems in connection with food production.

### 4.3.3 Social problems in connection with food production in Germany

It seems useful to differentiate between three groups when assessing social problems with respect to food production:

- (1) self-employed farming entrepreneurial families which mainly manage family-run agricultural holdings;
- (2) wage and salary earners in the agricultural sector, although the social situation of seasonal workers must be considered separately;
- (3) wage and salary earners in other parts of the value-added chain for food. In respect of the last group, we will choose two exemplary groups which are repeatedly given as examples for employees facing problematic working conditions: employees working at slaughterhouses and in the restaurant and catering sector.

---

<sup>90</sup> Differentiated multi-dimensional concepts of basic needs (cf. ewa Max-Neef 1992) classify these criteria as a necessary contribution towards satisfying basic needs and not as (merely) farther reaching issues relating to justice.

In this section, the criteria identified in Section 4.3.2 will be used as a basis to analyse social problems which arise with food production in Germany.

### 4.3.3.1 Social situation of family farms

The social situation of family farms is significantly influenced by their income situation. In line with the criteria identified in Section 4.3.2., this section will also deal with the working conditions, social security and the social commitment of the manager of the holding as essential aspects of the social dimension of sustainability.

#### Income situation of agricultural holdings

In its statement on the CAP, the WBAE recently commented in detail on the income situation in the agricultural sector (WBAE 2018). One problem which became evident was that the data situation did not permit a comprehensive assessment to be made, in particular because the records of off-farm income are inadequate. In addition to the problem of data availability, it is a challenge to determine the income for different types of agricultural holdings in a comparable way. As farm income is often a major determinant of the social situation of (self-employed or employed) people working in the agricultural sector, we will elaborate on the data relating to the income situation and the respective methodology used for the calculating in the following. For the purpose of this expertise, we will use the agricultural farm income calculations of the Johann Heinrich von Thünen Institute (Federal Research Institute for Rural Areas, Forestry and Fisheries) as a basis.<sup>91</sup> These calculations are based on the indicators published by the BMEL in the Federal Government's Agricultural Policy Report. The Thünen Institute used the data available through the network of test farms run by the BMEL.

In order to assess the income situation in Germany, it has to be taken into account that the German agricultural sector is characterized by two types of holdings. In the former federal territory, most holdings are family farms. These farms are mostly run as sole proprietorships. In this expertise, they will be referred to as "family farms". In order to assess their social situation, it is useful to differentiate between full-time farms and part-time farms. In the new federal states, the majority of the production comes from large corporate farms which were created out of the former Agricultural Producer Cooperatives and state farms. About one half of the overall farmed agricultural area in eastern Germany is managed by legal persons. The data collected through the German network of test farms offers a first glimpse into the variety of farm structures which exist in the German agricultural sector (Table 4-6).<sup>92</sup>

---

<sup>91</sup> The WBAE would like to thank the working group at the Thünen Institute led by Hiltrud Nieberg and, in particular, Heiko Hansen for their contributions to this section.

<sup>92</sup> About one half of all legal persons within the network of test farms are registered cooperatives. Other legal forms include, amongst others, limited liability companies and private limited companies. See Agricultural Policy Report of the Federal Government (BMEL 2019b: 64).

**Table 4-6:** Structural data of agricultural holdings in the German network of test farms according to legal form and type of farming (2017/18)

	Small-scale and part-time farms	Full-time farms				Legal persons	Total
		Small	Medium-sized	Large	Total		
Share of holdings in %	25.5	17.9	27.9	26.8	72.6	1.9	100.0
Size of holding standard output (SO) in €1,000	51.9	76.7	169.3	515.6	274.3	2,245.6	255.8
Utilised agricultural area (UAA)	31.6	41.0	64.5	132.1	83.7	1,145.7	90.9
Man-work unit (MWU)	0.9	1.4	1.8	3.3	2.3	19.8	2.3

Source: BMEL (2019b: 27).

The following text box 7 shows how the income is calculated for each legal form. The calculations were made on the basis of the accounting results of the holdings in the network of test farms.

**Text box 7:** Calculation of income for family farms and legal persons in the Federal Government's Agricultural Policy Report (BMEL 2019c)

In the Federal Government's Agricultural Policy Report, the income of agricultural holdings is calculated as follows:

"Pursuant to Article 2 of the Agriculture Act (Landwirtschaftsgesetz– LwG), the BMEL annually presents the profitability of agricultural enterprises in Germany for the previous agricultural marketing year (MY) using the results of the test farm accounting. The test farm network uses a unified annual financial statement (BMEL annual financial statement), drawn up in accordance with tax and commercial regulations, to record the balance sheets and profit-and-loss accounts of agricultural sole proprietorships and partnerships. In the new federal states, legal persons (mostly agricultural cooperatives and incorporated companies) are also subject to evaluation.

Besides the incomes from agriculture, proceeds from other operating units such as farm shops, distilleries, biogas, contract services, tourism and maintenance of cultivated landscape, which are operated as subsidiary agricultural enterprise, are also taken into account. However, incomes from independent branches (e.g. energy generation) is usually not taken into account in the annual financial statement of the network of test farms. The network of test farms does not provide a qualitatively adequate evaluation of other types of income from independent non-agricultural commercial enterprises (such as accommodation and tourism), leasing or letting, capital assets, paid employment or pensions, for example. Apart from agricultural profits, other types of income – in particular from paid employment – are shown as part of the farm owners' overall income only in the case of part-time farms. (...)

The success of holdings with different percentages of unpaid workers (this particularly applies to holdings with different legal forms) is determined using "income" as a standard for success, which comprises "profits plus labour costs per worker" (BMEL 2019c: 58).

The following further comments on the calculation method used are taken from the methodological explanations of the Agricultural Policy Report (BMEL 2019c: 164):

“Profit/loss and annual surplus/deficit”

For sole proprietorships and partnerships, the profit/loss covers the payment for unremunerated work carried out by the agricultural enterprise and, if applicable, partner as well as unpaid family members, equity capital invested and entrepreneurial activities. It is available to be used for private withdrawals by the entrepreneur(s) (private taxes, cost of living, health insurance, old-age provision, settlement on retirement, compensation paid in satisfaction of the right of inheritance, private capital formation, etc.) and equity capital formation for the enterprise (net investments, debt repayment).

Pursuant to the Commercial Code (Handelsgesetzbuch – HGB), the respective terms used in the case of legal persons are “annual surplus/deficit”. As the work carried out is fully remunerated in agricultural enterprises with this legal form, the annual surplus/deficit only includes the remuneration for equity capital invested.

In the following, we will use the short form “profit or annual surplus”.

Profit / annual surplus before income and profit taxation

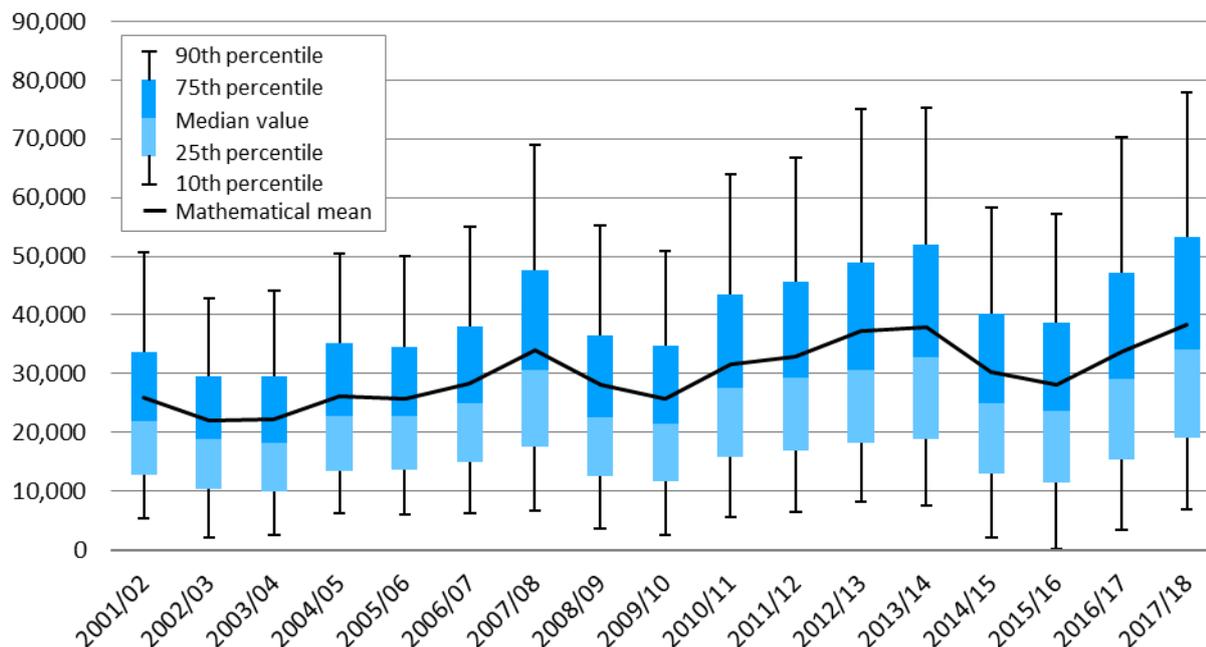
Profit or annual surplus plus taxes on income and profit

Profit / annual surplus before income and profit taxation plus labour costs

Profit or annual surplus before taxation plus labour costs for the workers of the enterprise – this indicator is used to compare the income situation across different legal forms.”

As can be seen from text box 7, the income data used for assessing the social situation of self-employed persons in the agricultural sector are only of limited significance. There are no data available on the household income of agricultural households in Germany. Furthermore, it must be noted that increasingly complex structures of and relations between agricultural enterprises are only to a limited degree taken into account in the official agricultural statistics which makes it even harder to determine the exact levels of income (see Forstner & Zavyalova 2017: 1).

Figure 4-12 shows the income development from agriculture over the course of time. The diagram covers full-time family farms as well as legal persons. The income is shown as “profits plus labour costs per worker”. Substantial fluctuations can be seen over the years. There is a slight upward trend. However, throughout the period in question the average income and also the median income are always under 40,000 euros per year and worker, even in the best years. The assessment of this value will be addressed in greater detail below. The diagram also shows that there is a considerable range in the income levels. In the 2017/18 marketing year, one quarter of the holdings made a profit of less than 20,000 euros per year and worker whereas another quarter earned more than 50,000 euros.

**Figure 4-12:** Income development in the German agricultural sector (2001-2018)

Note: The diagram shows the average profit plus labour costs per worker for all full-time farms (sole proprietorships and partnerships) and legal persons (see text box 7). As a measuring scale for the income distribution, the figure also shows the median value (black line in the diagram) and the 10th, 25th, 75th and 90th percentiles in addition to the often-used (arithmetic) mean. As a first step, the income is arranged in ascending order. The median value then divides the agricultural holdings into two groups of the same size, i.e. the number of holdings with a higher income corresponds to the number of holdings with a lower income. The 25th percentile (75th percentile) is the value at which 25% (75%) of the holdings have a lower income and 75% (25%) have a higher income. This applies to the 10th and the 90th percentile accordingly.

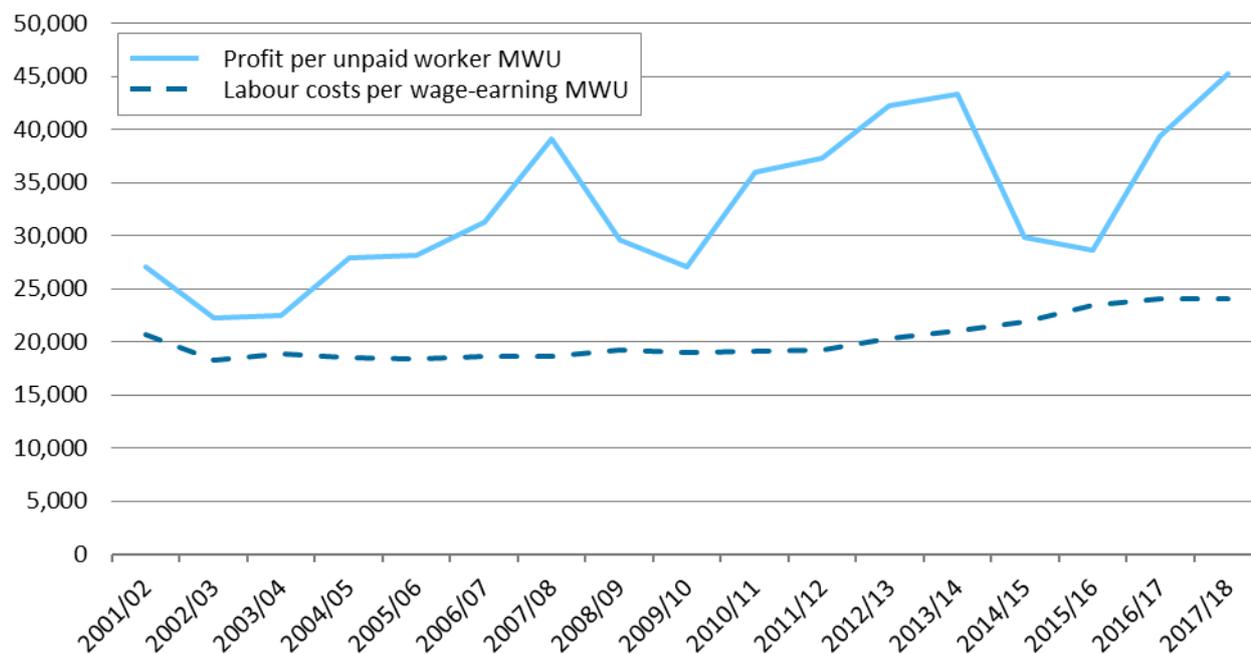
Source: Analysis by the Thünen Institute of Farm Economics based on the accounting results of the test farms (© Thünen Institute).

To calculate the income as shown in Figure 4-12, the income of all employees (wage and salary earners and family members working in the holding including farm managers) is taken into account and then the average income is calculated. In contrast, Figure 4-13 differentiates between the income of employed earners (measured as staff costs per paid worker) and the income of family members working on the farm (profits per unpaid worker). The diagram does not cover legal persons or small-scale and part-time farms. The diagram shows that family workers receive a considerably higher income than employed earners. However, this calculation does not contain any return on equity investments or give any regard to the farm managers' entrepreneurial activities.<sup>93</sup>

<sup>93</sup> In the Federal Government's Agricultural Policy Report (BMEL 2019c: 63), a supplement for farm managers of 7 euros per 1,000 euros turnover was used for "managerial or entrepreneurial tasks in agricultural holdings" in the agricultural comparative accounting to assess the situation in the agricultural sector pursuant to Article 4 of the Agriculture Act. The interest rate applied to the working capital was set at 3%. According to the comparative cost accounting for the year 2013/2014, agricultural incomes were slightly (0.6%) above the comparative figures. In all subsequent years, the agricultural incomes were below the comparative incomes. The largest discrepancy of -35.2% was found in the year 2015/16. In the year 2017/18, the discrepancy decreased to -3% (BMEL 2019c: 64).

In addition to that, non-agricultural income and income from other agricultural enterprises are not taken into account. With respect to family farms, the diagram also shows that the level of income for employed earners has slightly increased since 2011/2012 after years of stagnation. The minimum wage introduced in 2015 could be one factor that played a role in this increase over recent years.

**Figure 4-13:** Average profit per unpaid worker and labour costs per worker across all full-time farms



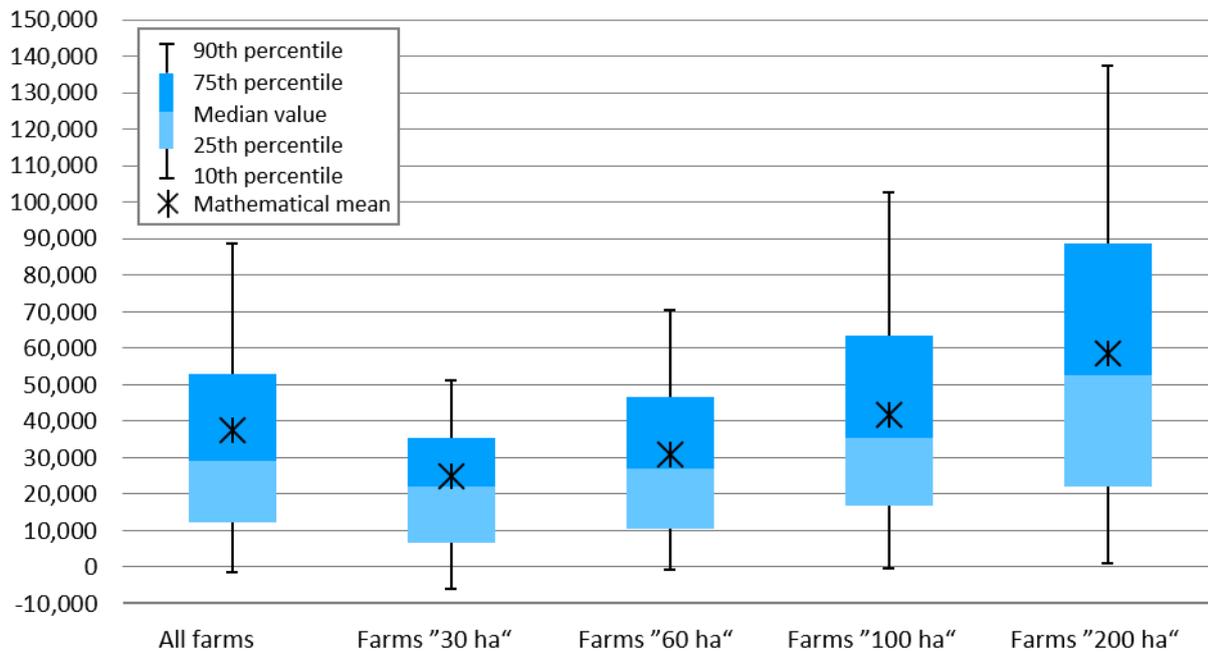
Note: The diagram covers sole proprietorships and partnerships run as full-time farms. Legal persons are not taken into account.

Source: Analysis by the Thünen Institute of Farm Economics based on the accounting results of the test farms (© Thünen Institute).

Figure 4-14 depicts the income situation according to the size of the farm. For this diagram, only family workers (i.e. unpaid workers) in full-time family farms were taken into account. For comparative purposes, we can use the average gross earning without special payments for full-time employees working in the producing industry as a reference, which amounted to 46,907 euros in 2017 (Federal Statistical Office 2018b: 388). On average, only holdings with an area of more than 200 ha have comparable incomes from their respective agricultural holdings as shown in Figure 4-14. The same applies to the median. This means that only in holdings with an area of over 200 ha do over 50% of unpaid workers in full-time farms receive the same income as an employee working in the producing industry.<sup>94</sup>

<sup>94</sup> But when making this comparison, it has to be taken into account that the income of employees and the income of self-employed persons are only comparable to a limited degree. Differences exist e.g. with respect to security in old age which is not taken into consideration when comparing the monthly income.

**Figure 4-14:** Profit of full-time farms per unpaid worker according to farm size (three-year average of marketing years 2015/16 until 2017/18)

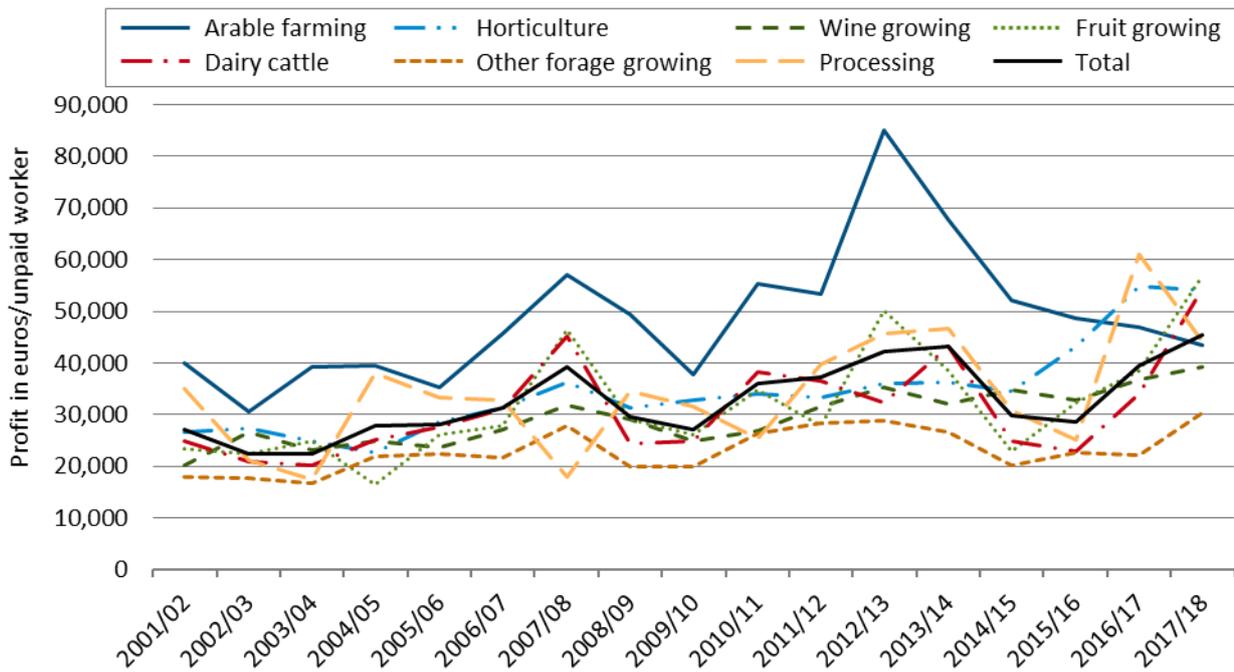


Note: The diagram covers sole proprietorships and partnerships run as farms. Legal persons are not taken into account. For comments regarding the graphical representation, see notes on Figure 4-12. The arithmetic mean is indicated with crosses.

Source: Analysis by the Thünen Institute of Farm Economics based on the accounting results of the test farms (© Thünen Institute).

Figure 4-15 shows the income development according to type of farming (type of agricultural production) from 2010 until 2018. Wide variations over the course of time and large differences across the types of farming can also be found in this context. Until 2014/2015, arable farms continually generated the highest incomes. However, this is not the case any more, as fruit farms, horticultural farms and processing enterprises have significantly increased their average income in recent years. Overall, Figures 4-12 to 4-15 show that the incomes from agriculture vary over the course of time and that there are huge differences among the farms which are due not only to the farm size but also, to a large degree, to the type of farming.

**Figure 4-15:** Profit per unpaid worker according to type of farm



Note: The diagram covers sole proprietorships and partnerships run as full-time farms. Legal persons are not taken into account.

Source: Analysis by the Thünen Institute of Farm Economics based on the accounting results of the test farms (© Thünen Institute).

When assessing the income situation it must be noted that a significant proportion of the income of agricultural holdings comes from direct EU payments (first pillar of the CAP), payments for agro-environmental measures (second pillar of the CAP) and further subsidies. They are listed in Table 4-7. As the table shows, family farms receive direct payments and subsidies which, on average, amount to around 40% of their income. For holdings which have the form of a legal person it is over 55% and for small-scale and part-time farms even 92%. But this does not mean that the agricultural incomes would decrease by that percentage in the medium and longer term if direct payments were to be discontinued because most of the direct payments are passed on to the land owners or used for agricultural inputs (WBAE 2018: 34 f.).

**Table 4-7:** Direct payments and subsidies per holding in the German network of test farms according to legal form and type of farming (2017/18, in euro)

	Small-scale and part-time farms	Full-time farms				Legal persons	In total
		Small	Medium-sized	Large	In total		
EU direct payments	10,130	12,514	19,025	37,003	24,056	299,519	25,838
Interest rate subsidies and capital grants	62	328	490	922	609	9,475	642
Refund on agricultural diesel	778	1,041	1,916	4,385	2,612	29,124	2,658
Compensatory allowance	834	1,255	1,481	1,201	1,322	14,906	1,461
Agri-environmental scheme payments	2,926	3,879	4,016	3,890	3,936	36,056	4,300
Other payments	485	815	1,529	2,577	1,740	48,018	2,315
<i>Payments in total in:</i>							
€ per holding	15,277	19,875	28,540	50,179	34,391	437,775	37,326
€ per UAA	484	484	442	380	411	382	410
€ per MWU	16,440	14,223	15,593	15,303	15,228	22,091	16,520
% of operating profits	18.2	16.4	11.7	7.8	9.5	13.8	10.8
Income (profits plus labour costs per worker) € per MWU	17,775	23,881	35,564	42,725	37,618	40,023	35,947
Share of income made up by total payments in %	92.5	59.6	43.8	35.8	40.5	55.2	46.0

Source: BMEL (2019b: 27).

How to assess the income situation depends on the perspective (see Section 4.3.1). When applying the protection aspect, the question arises as to whether the government should intervene in order to guarantee a basic minimum protection. As farmers are self-employed entrepreneurs with capital assets (such as soil, machinery, etc.), there is no justification for intervention to be deemed generally necessary, as explained by the WBAE (2018) in its statement on the CAP reform. The WBAE thus sees no justification for direct EU payments to be coupled to the amount of farmland for social reasons. Income transfers for which the protection aspect is used as justification would have to be oriented towards the level of neediness, which is to be determined case by case based on the household income, as is the standard procedure within social welfare systems.

In any case, consideration must be given to the fact that the agricultural incomes mentioned in the text are not the same as the actually available household incomes. In particular, income from diversification activities, some of which are economically important (e.g. the operation of biogas plants and photovoltaic systems, wind power) and also income from household members working

in non-agricultural sectors are not taken into account. Thus, there is a tendency to underestimate the actual income situation of many agricultural households (WBAE 2018: 30 et seq).

Furthermore, according to the regulatory principles of a social market economy, it is the entrepreneurs themselves who are primarily responsible for earning what they deem an appropriate income, especially as in Germany there are sufficient non-agricultural employment opportunities available to ensure one's livelihood (cf. WBAE 2018: 33 with citation of the relevant judgment by the European Court of Justice).<sup>95</sup> One particular problem regarding income support measures for entrepreneurs which exists relates to the fact that incentives may lead to misallocations in that unprofitable farms may be kept going in order to secure income.

Still, the numbers given before indicate that an immediate discontinuation of EU direct payments would result in significant social hardship for many farms in the short term. As respective adjustments, such as reduced land prices, will take time, the WBAE argued for a transitional period of up to 10 years in order to discontinue EU direct payments (WBAE 2018: III). In addition to that, a higher remuneration of services of public interest as suggested by the WBAE would create new income opportunities.

The wide range of income levels, including within the different farm-size and farm-type groups (Fig. 4-14), furthermore indicates that farms with a lower income level do, in principle, have opportunities to raise their level of income and thus improve their social situation. The income differences are in part due to factors which farmers cannot influence, such as natural conditions (soil points, precipitation level) or unfavourable market conditions lasting several years. But they are partly also based on factors for which the farm managers are responsible and can influence (e.g. good vocational training, further professional training, adapting innovations, making use of competition strategies, diversification). Agricultural advisory services can and should help farms with low incomes to make better use of their income potential and preserve their assets. Preserving assets can, in particular, also mean timely withdrawal or farm closure.

The protection aspect thus does not permit any necessity to be derived for general income support for all farmers by way of direct payments. General income support for all farmers is also not justified according to the justice aspect, especially when account is taken of the fact that social benefits granted by the government for other population groups are linked to the criterion of individual neediness. The fact that direct payments mostly go to the land owners – and the percentage usually increases the more land they own (see WBAE 2018: 30) – is extremely problematic when viewed from the aspect of justice and, in particular, given the fact that a major part of the land is owned by a small group of the population.

---

<sup>95</sup> In this respect, the original statement says: "A farm whose survival is in jeopardy may be needy. However, neediness as specified in Article 39 of the TFEU (Treaty on the Functioning of the European Union) does not exist insofar as (i) the farm closure does not jeopardise the societal function of agriculture, for instance land management; and (ii) sufficient non-agricultural employment opportunities are available (cf. settled ECJ case law since 5/67, Collection 1968, 127/147)." (WBAE 2018: 33).

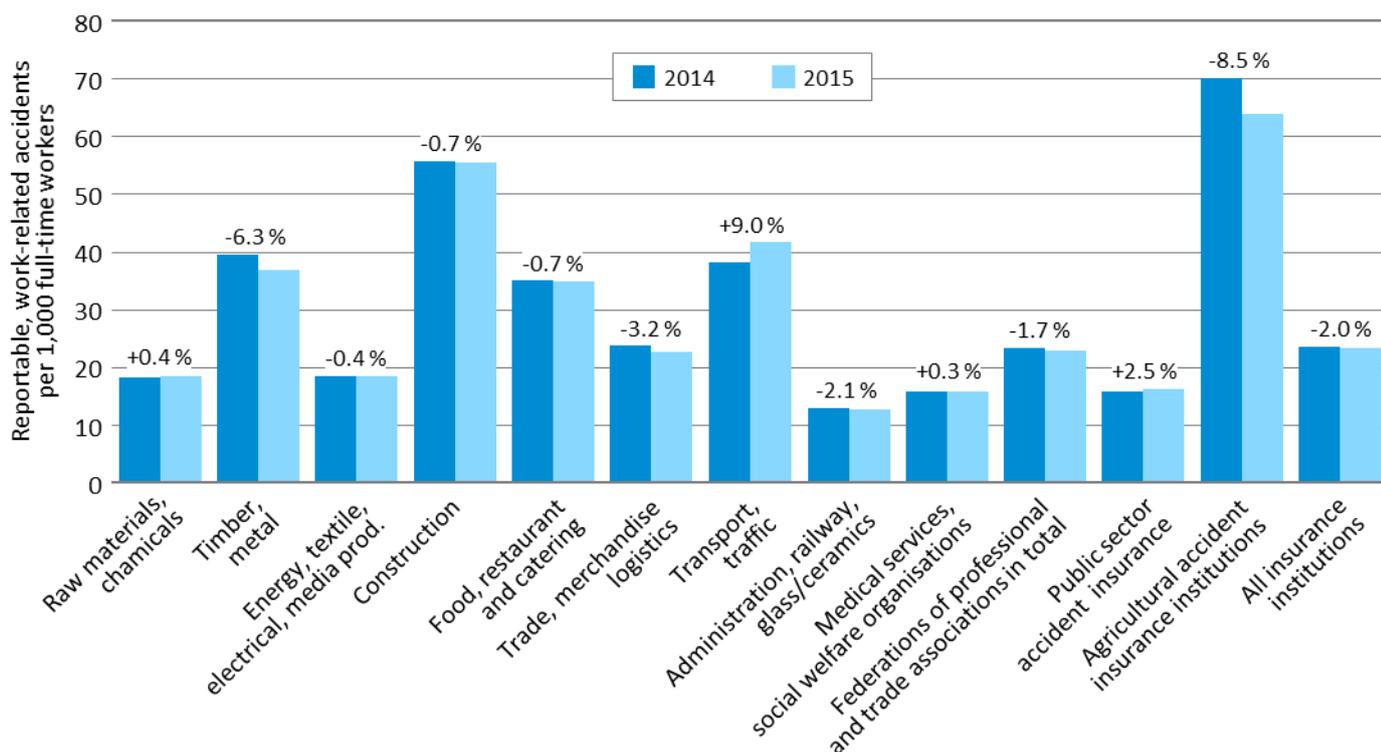
As regards the income situation of farmers, the farming profession and the public also demand “fair prices”, in particular for milk. But from the Advisory Board’s perspective, in a market-based system prices should primarily serve as scarcity indicators. As already elaborated in earlier expertises, the WBAE recognises that price formation can lead to results which are not socially compatible or desirable in terms of distribution policy. However, distribution goals should not be pursued by intervening in pricing processes but through distributional policy measures such as tax and social policies (WBA 2015: 160).

In this expertise, the WBAE therefore rejects state interventions in price formation for which the aim of ensuring “fair prices” is used as justification. Nevertheless, it is understandable that some farmers, and some consumers as well, consider the agricultural income level to be unfair and believe that consumers should pay higher prices. In respect of these consumers, it appears to be useful to use instruments which allow them to contribute to increasing the farmers’ income through their own purchasing decisions. Examples for this are given in Section 8 and include, amongst others, the label “Fair Milk” or the concept of community-supported agriculture (SoLaWi). Such instruments could, for example, support smaller holdings or holdings with special production methods in earning an adequate income and seem to be useful in particular for those consumers who prefer these holdings and have a critical view of structural change/farm size expansion.

### **Working conditions**

The working conditions in the agricultural sector have advantages and disadvantages compared with other sectors which can be subjectively perceived in different ways. Working outside, for example, which is a key element in the agricultural sector, can be seen as an advantage or as a disadvantage, depending on personal preferences. The same applies to working with animals. A challenge with regard to the working conditions is the fact that the work is linked to biological processes and thus there is only little flexibility e.g. in terms of when exactly a particular task needs to be carried out. This applies in particular to animal husbandry which requires work 365 days a year. Another challenge is preventing accidents at work. There is a particularly high accident risk in the agricultural sector due to the use of technology, the handling of animals and the huge variety of activities to be performed. Figure 4-16 shows that, compared with all other sectors, there is a clearly higher number of reportable, work-related accidents in the agricultural sector.

**Figure 4-16:** Reportable, work-related accidents in the agricultural sector compared with other sectors



Note: Reportable, work-related accidents per 1,000 full-time workers.

Source: Reusch et al. (2017: Chapter 3.1), graphically adjusted.

It is, in particular, up to the agricultural enterprises themselves to reduce the number of accidents at work. The government can contribute to improving occupational safety by adjusting the relevant training content as part of the vocational training. This strategy has already been implemented, as occupational safety instructions have been explicitly incorporated into training and into instructor aptitude examinations.<sup>96</sup> Furthermore, it is mandatory for farmers to be covered by the Landwirtschaftliche Unfallversicherung (LUV – agricultural accident insurance). As elaborated in the Federal Government’s Social Report, the LUV insurance is subsidised to a significant extent by the government. For the calendar years 2016 and 2017, the government subsidies for LUV were raised from 100 million euros to 178 million euros each year, resulting in the relief effect in terms of the accident insurance premiums being increased from 20% to around 36% (BMAS 2017b: 132). As in other sectors, legally binding accident prevention regulations (Health and Safety Requirements) are also in place for the agricultural sector.<sup>97</sup>

<sup>96</sup> See e.g. “Recommendations made by the main committee of the Federal Institute for Vocational Education and Training on a framework for trainer aptitude training”, p. 19 (<https://www.bibb.de/dokumente/pdf/HA135.pdf>).

<sup>97</sup> See: <https://www.svlf.de/gesetze-vorschriften-im-arbeitsschutz>.

## Risk

As self-employed family businesses, farmers face similar advantages and disadvantages to those of family businesses in other sectors. Advantages include self-determined work whereas the entrepreneurial risk can be considered a disadvantage. In its statement on the CAP (WBAE 2018: Section 2.6), the WBAE commented on the risk, which is higher in the agricultural sector than in other sectors. As pointed out in detail in its statement, the WBAE believes that risk management is mainly an entrepreneurial task. But consumers can contribute to the risk management e.g. by buying directly marketed products because farmers have more influence on pricing and can prevent excessive price volatilities via this marketing channel. The model of community-supported agriculture explained in Section 5.4 can also be viewed as an instrument through which farmers can share the risk.

## Social situation of women in agricultural family businesses

The social indicators mentioned in the ILO criteria are reconciliation of work and family life, gender equality and youth employment. It therefore appears appropriate to consider the role of women in the agricultural sector separately. Until the 1980s, rural sociologists conducted extensive research on both subjects.<sup>98</sup> Studies were recently conducted in Baden-Württemberg (Schanz et al. 2018) and in North Rhine-Westphalia (WLLV & RhLV 2016). Both of them are explorative studies which do not include statistically representative data. Nevertheless, these studies provide relevant indications on the situation of women in agricultural family businesses.

As regards equal participation, family farms often define equal participation in decision-making as a criterion. Several indications can be found in this regard in the study conducted in Baden-Württemberg. A majority of the women interviewed for this study stated that they participated in the making of all important decisions, that the management of the farm was split between them and their partners or that they independently managed a branch of production. Six per cent of all women interviewed were the sole managers. Around 10% of the interviewees stated that they worked at the agricultural holding without participating in decision-making with most of them aged 60 or over (Schanz et al. 2018: 61 et seq). These numbers indicate that women mostly participate in the family farm business. However, more extensive research and qualitative studies are necessary in order to evaluate this issue in greater depth.

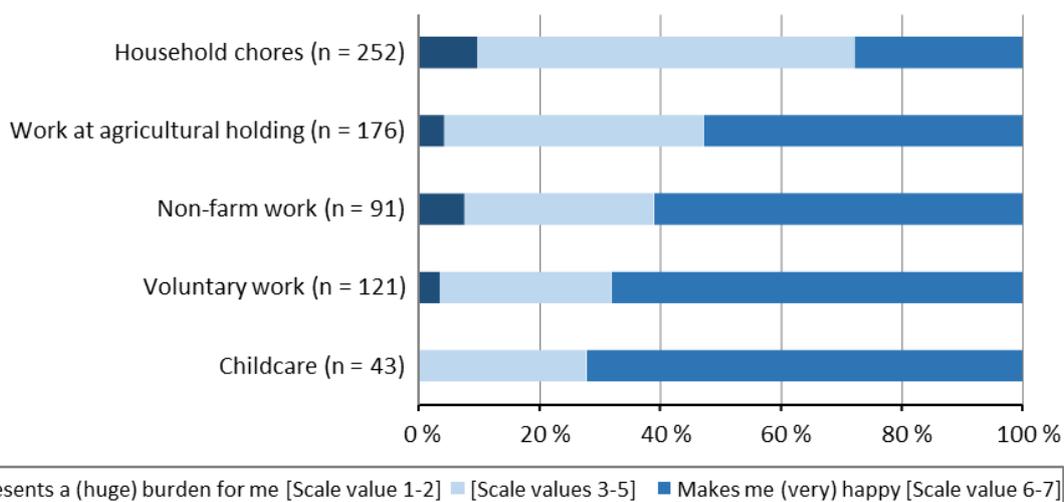
As expected, both studies show that managing the household mostly continues to be a task attributed to women. The authors of the study conducted in Baden-Württemberg came to the following conclusion: only about one in ten of the women interviewed stated that household tasks were distributed equally between them and their partners, every third partner “never” carried out household tasks. There are no indications for a generational change with respect to a more equal

---

<sup>98</sup> With respect to women farmers, see e.g. Inhetveen and Blasche (1983); Ulrich Planck conducted research in the field of rural youth from the 1950s until the 1980s (e.g. Planck 1970).

distribution of household tasks between men and women (Schanz et al. 2018: 13). The study conducted in North Rhine-Westphalia shows that women consider household tasks to be the least satisfying of all tasks (see Fig. 4-17).

**Figure 4-17:** Perceived burden regarding different tasks of women in family farms



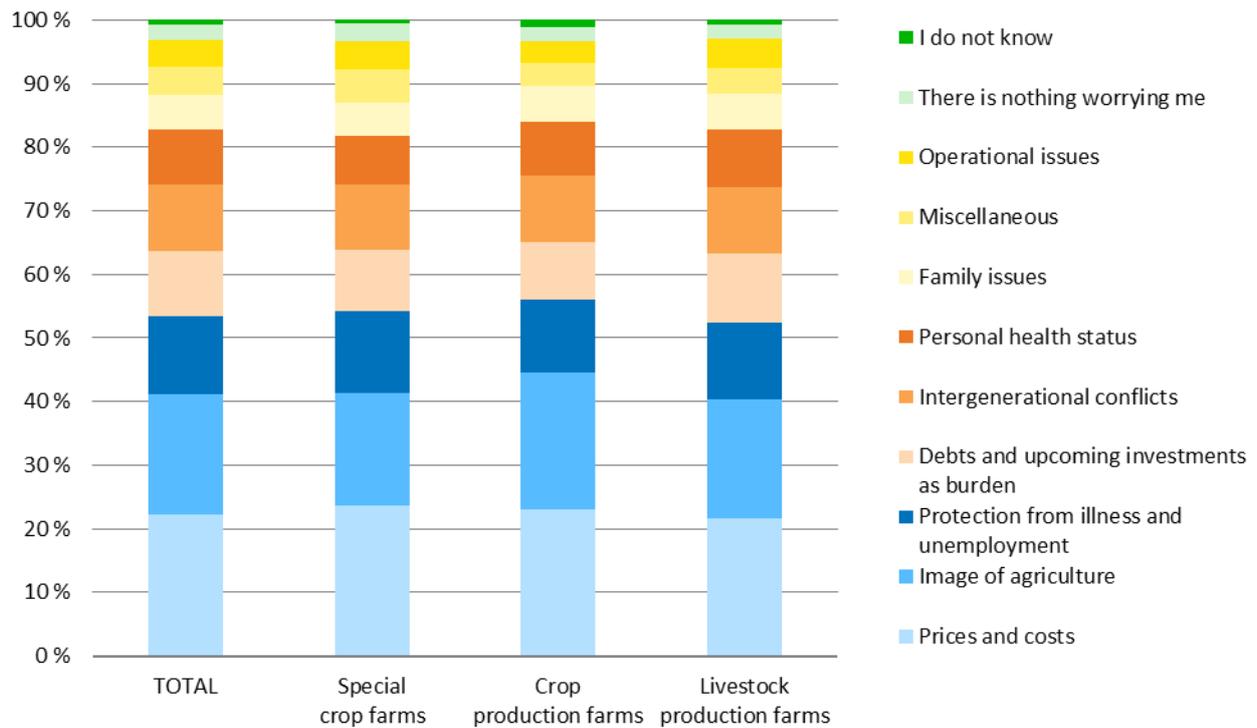
Note: Indicated in percent, rated using a Likert scale with 7 response categories from 1 = “represents a huge burden for me” to 7 = “makes me very happy”. The evaluation was made on the basis of interviews by phone. Replies of 258 women were evaluated in this study.

Source: WLLV & RhLV (2016: 39).

Both studies show that women in family farms, in some cases, also carry out non-agricultural tasks which cause a relatively high workload. However, the working hours of men and women working on family farms were not taken into account in either study, which would have been another important indicator in assessing the situation of family farms with respect to equal participation.

Figure 4-18 shows the results of the study conducted in Baden-Württemberg as regards the question: “Which worries do you personally experience in your everyday life?”. As the figure depicts, the workload is not one of the problems which women in family farms experience as a particular burden. The focus lies on economic factors (prices and costs). The image of agriculture is experienced as a burden to almost the same degree.

There is no comparable information available on how male family members in agricultural holdings perceive these problems. There definitely could be gender-based differences regarding the perceived stress factors. In any case, the findings indicate that the negative image of agriculture represents a social burden for family farms and deserves more attention.

**Figure 4-18:** Problems experienced as distress by women in the agricultural sector

Note: The results are taken from an online survey conducted among agricultural holdings in Baden-Württemberg. The study evaluated replies of 2,366 women. The figure illustrates the replies to the question: "Which worries do you personally experience in your everyday life?". It was possible to select multiple answers. 4,381 responses were selected in answer to this question.

Source: Schanz et al. (2018: 76).

Another aspect regarding the social situation of women in agriculture is social protection. There are particularities in family law which aim to maintain the agricultural farm. As a result of these rules, women who married into the family are entitled to a relatively small amount of assets in cases of divorce or deaths. However, there are hardly any studies on the impact of these rules on the situation of women in agriculture.<sup>99</sup>

Overall, the data situation with respect to the social situation of women in family farms and equality issues is extremely poor. There are no statistically significant findings either at federal state level

<sup>99</sup> An exception is the study "Until death do them part: A change in women farmers' old age security" published by Ludwig and Nolten (2006). But this study only analyses the legal situation and not the actual impact of this rule. According to the gender theory in literature, it is assumed that rules which put woman at disadvantage in case of divorce cause a dependency which has a negative impact on the role of women within families (cf. Sen 1990). However, with respect to the case at hand concerning rules to continue holdings the following applies: if gender justice was given in this respect, meaning that women had the same opportunities to own holdings as men, the problem that the person who married into the family is in a less favourable position in the case of divorce or deaths would continue to exist. However, it would no longer be a gender-related problem.

or at federal level.<sup>100</sup> Furthermore, no extensive qualitative studies on these topics have been conducted in recent years. There are no indicators of gender equality in the existing sustainability certification systems, e.g. the German Agricultural Society's "DLG-Nachhaltigkeitsstandard" sustainability standard or the organic farming certification systems. This is surprising considering that there is quite an intensive debate on gender equality at work in Germany.<sup>101</sup> Furthermore, the subject of gender equality in agricultural households has been intensively discussed in international literature. International organisations (World Bank, FAO, IFAD) working in the field of agricultural development also focus closely on this subject.<sup>102</sup>

### **Social security systems for farmers and their families**

Although, based on the principles of a social market economy, entrepreneurs are generally responsible for their own social security, the state assumes a far-reaching role when it comes to the social security of farmers. In the Federal Government's Social Report (BMAS 2017b: 131), this role is described as follows: "Social policy in the agricultural sector is, in financial terms, the most significant instrument of national agricultural policy and provides security for farming families in old age or in the case of accidents, illness, a need for long-term care or in the event of death. Furthermore, it contributes to preventing social hardships resulting from the structural change in the agricultural sector. Structural change in the agricultural sector is characterised by a significant decrease in the number of contributors and a simultaneously much slower decrease in the number of beneficiaries. In order to not overstress the contributors to this system, it is necessary that the Agricultural Social Security System LVS is co-financed by the whole of society on the basis of solidarity. (...). For 2017, funds totalling approximately 3.9 billion euros are envisaged for this purpose. The two biggest areas of expenditure are subsidies to the farmers' old age security scheme (AdL) and to the agricultural health and accident insurance scheme."

The role of the state with regard to the accident insurance scheme has already been discussed above. The farmers' old age security scheme (AdL) is subsidised to an even higher degree than the accident insurance scheme; 80% of the AdL expenditure is financed by state resources (BMAS 2017b: 131). Overall, Germany has a far-reaching, state-supported social security system for farmers.

One important aspect in the context of old age security comprises the assets which provide income, for example if the farm is let to successors or closed and transferred to a third party. Under inheritance and inheritance tax law, this is transferred to the exiting farmer or farm successor under favourable conditions.

---

<sup>100</sup> In spring 2019, a BMEL-funded study on the living and working conditions of women in agricultural holdings began (see <https://www.thuenen.de/de/infothek/studie-zur-lebens-und-arbeitssituation-von-frauen-in-der-landwirtschaft/>).

<sup>101</sup> Also, a large number of policy measures are in place to promote equality, see e.g. <https://www.bmfsfj.de/bmfsfj/themen/gleichstellung/frauen-und-arbeitswelt>.

<sup>102</sup> More than ten years ago, the World Bank, the FAO and the IFAD published a "Gender in Agriculture Sourcebook" which totalled over 700 pages (World Bank et al. 2008).

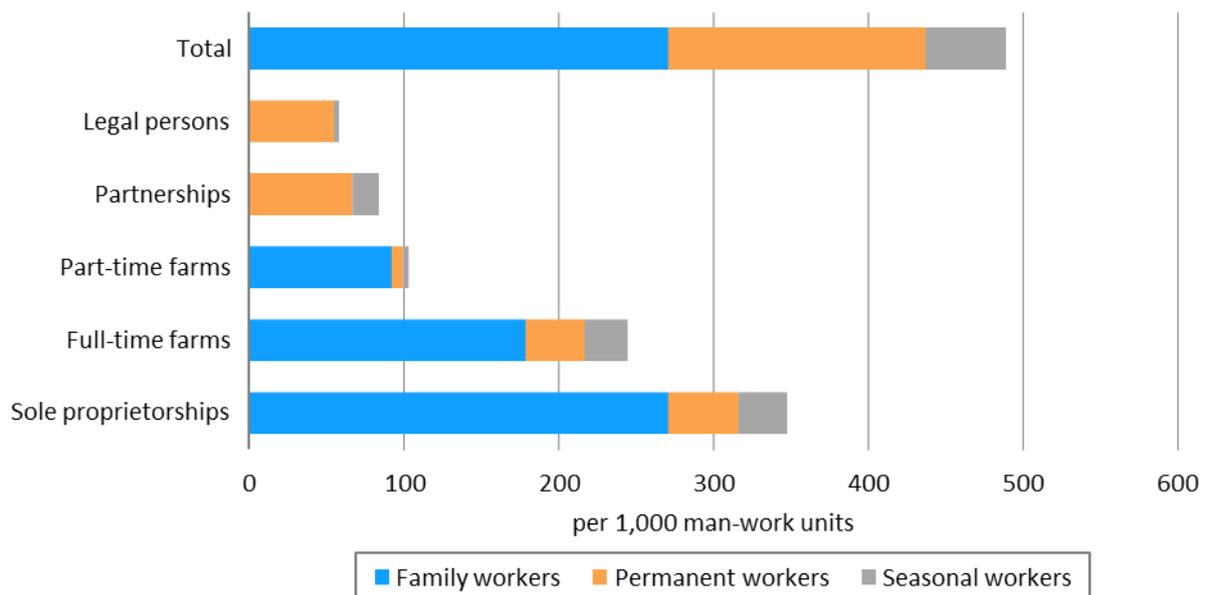
### 4.3.3.2 Social situation of employed earners in the agricultural sector

The majority of the social criteria identified in Section 4.3.2 were developed for employed earners. In the public debate, however, workers who are employed in the agricultural sector hardly play any role, as the public image is mostly that of a family-run farm on which mainly family members work. But, as will be explained further on, this image does not reflect reality.

#### Percentage of dependent employment in German agriculture

Figures on dependent employment in the German agricultural sector can be found in the statistical reports relating to the survey on the structure of agricultural holdings. Figures 4-19 and 4-20 depict the results of the 2016 survey on the structure of agricultural holdings. The number of workers is given in man-work units. As Figure 4-19 shows, around 45% of labour output in the German agricultural sector comes from external workers. 10% of them are seasonal workers. External workers are mainly found at plant production farms as can be seen in Figure 4-20. In comparison to family workers, the number of external workers is particularly high in horticultural farms.

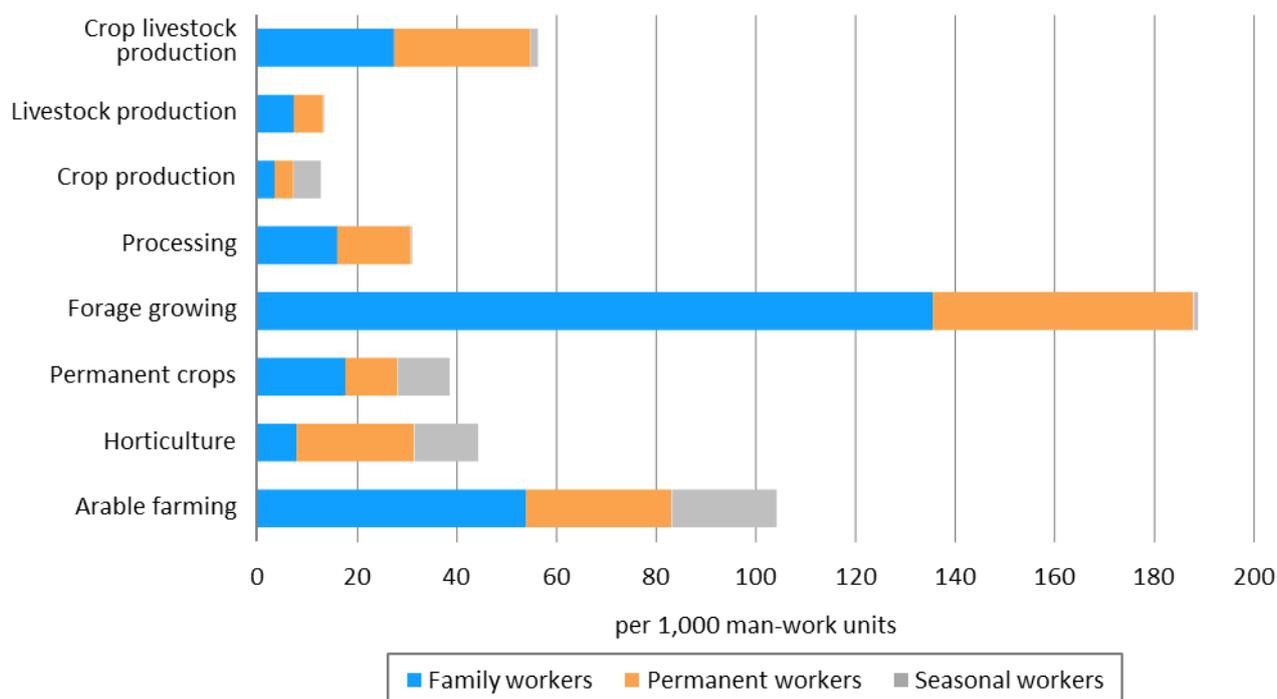
**Figure 4-19:** Family members and external workers in the agricultural sector (in 2016), per 1000 man-work units, broken down according to the legal structure



Note: The number of sole proprietorships was calculated by adding the number of full-time and part-time farms.

Source: WBAE figure based on Federal Statistical Office data (2017a).

**Figure 4-20:** Family members and external workers in the agricultural sector (in 2016), per 1000 man-work units, broken down according to the legal structure

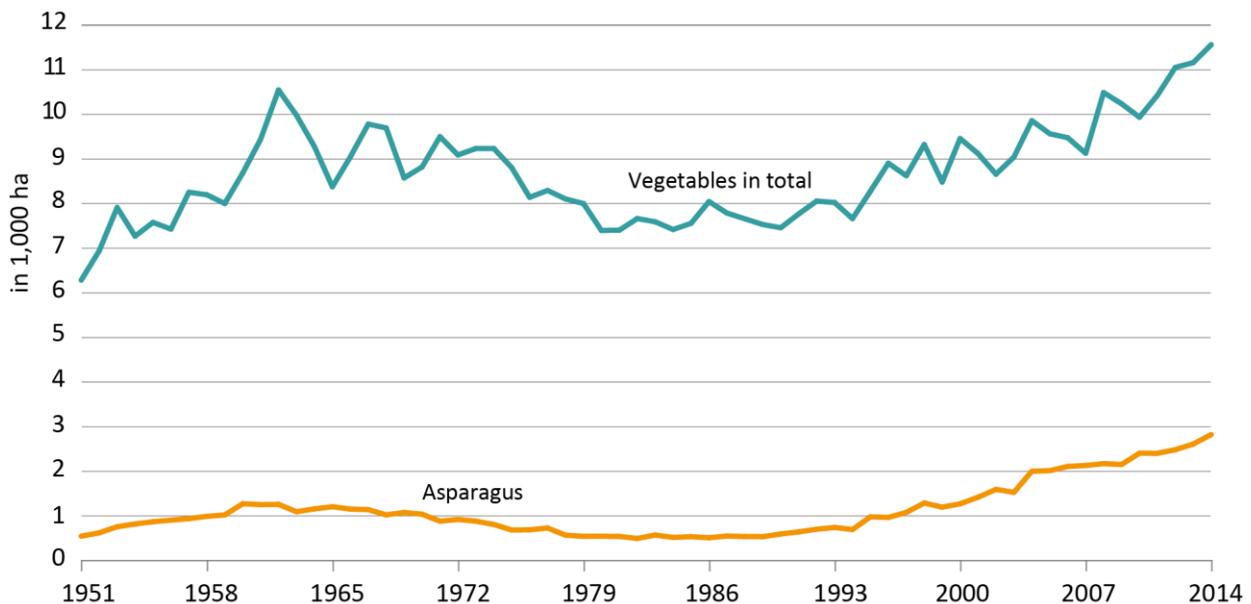


Source: WBAE figure based on Federal Statistical Office data (2017a).

However, the social situation of seasonal workers in the German agricultural sector is largely disregarded in the public debate.<sup>103</sup> The relatively high importance of seasonal workers in the German agricultural sector is also a result of the increasing cultivation of labour-intensive crops (e.g. asparagus). Figure 4-21 illustrates this using the example of Baden-Wuerttemberg. There are indications in literature suggesting that a lack of workers as a result of the economic development led to a decline in vegetable growing in the 1970s and that, because seasonal workers from Eastern Europe were available after the fall of the Berlin wall, the area for growing vegetables has started to increase again since then (Hartmann 2015: 18). As fruit and vegetables play a significant role in health-promoting food consumption, the social problems arising in connection with these crop species need to be examined more closely in this expertise.

<sup>103</sup> Due to media reports on scandals in connection with the employment of seasonal workers in southern European countries, the public impression appears to be that it is only in these countries that working conditions for seasonal workers are so poor. (See e.g. <https://www.daserste.de/information/wirtschaft-boerse/plusminus/sendung/ernte Helfer-italien-100.html>).

**Figure 4-21:** Development of cropping areas for vegetables in Baden-Württemberg from 1951 to 2014

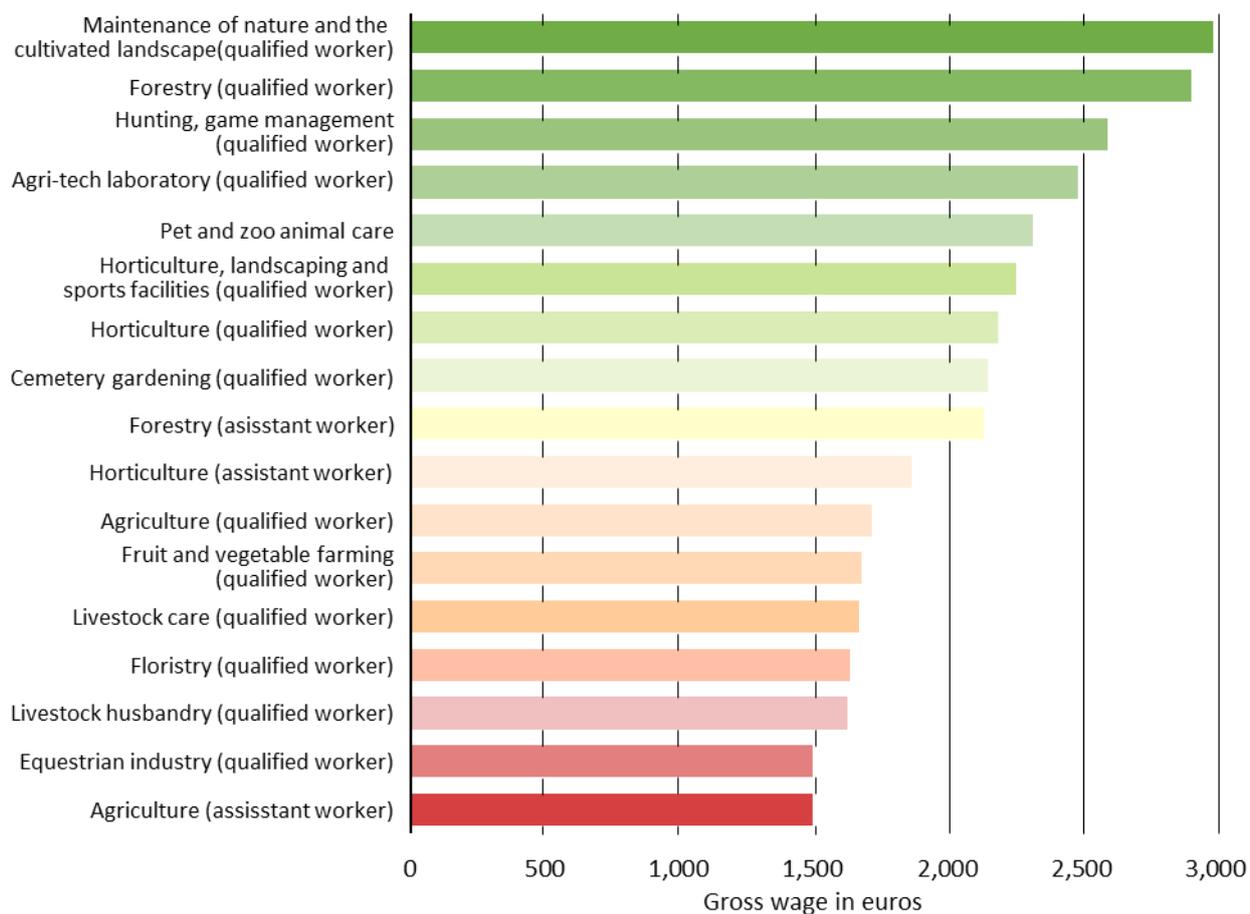


Source: Hartmann (2015: 18), graphically adjusted.

### Income situation of employed earners in the agricultural sector

Detailed data on the income of agricultural employees can be found in the survey on the structure of earnings which was conducted by the Federal Statistical Office in 2014 and published in 2016. Figure 4-22 shows the gross monthly wage of employees in the agricultural and forestry sector as well as in the horticultural sector according to the survey on the structure of earnings. To compare the income situation, the gross monthly wages of employees in the producing industry and the service sector are shown in Table 4-8. These figures show that the income level of qualified and unqualified employees in the agricultural sector is far below the indicated average wage levels. In 2014, the gross monthly wage of a qualified worker in the agricultural sector was around 1,700 euros whereas the average gross monthly wage was at around 2,630 euros per worker in the same year.<sup>104</sup> The wages in the field of animal husbandry are particularly low (see Table 4-8 for further comparative data).

<sup>104</sup> See <https://de.statista.com/statistik/daten/studie/164047/umfrage/jahresarbeitslohn-in-deutschland-seit-1960/>. This shows a gross annual wage of 31,600 euros per employee in Germany in 2014.

**Figure 4-22:** Gross monthly wages for different occupations in the agricultural sector

Note: The illustrated hourly wages are based on a detailed survey carried out by the Federal Statistical Office which was conducted in 2014 and published in 2016.

Source: <https://www.finanz-tools.de/arbeit/stundenlohn-vergleich-landwirtschaft-forstwirtschaft-tierwirtschaft-floristik-gartenbau>.

**Table 4-8:** Gross monthly wages of full-time employees in the producing industry and the service sector in 2017 (broken down according to qualification)

	Percentage (%)	Income (€)
Employees in leading positions	11.8	6,911
Expert staff	23.7	4,498
Skilled workers	45.1	3,132
Semi-skilled workers	13.6	2,562
Unskilled workers	5.7	2,156
Total	100.0	3,771

Source: Klemt & Lenz (2018: 168).

The unfavourable income situation of agricultural employees is also reflected in the low-income statistics. The Federal Statistical Office uses the ILO definition according to which the term low income is used for income levels corresponding to up to two thirds of the median income. In 2014, this threshold was at 10 euros per hour. As Table 4-9 shows, over half of the employees working in the agricultural, forestry and fisheries sectors belong to the low-income group. A higher number can only be found in the restaurant and catering sector.

**Table 4-9:** Low-income employees (in 2014) in percent

	Total	Regular workers	Atypical workers <sup>1)</sup>
Total	20.5	9.6	41.1
<i>Selected economic sectors</i>			
Restaurant and catering sector	66.8	49.8	76.2
Agriculture, forestry and fisheries	53.8	44.5	66.7
Arts, entertainment and recreation	43.2	22	57
Health and social work	16.2	9.8	25.5
Construction industry	10.9	6.3	29.9
Manufacturing industry	10.2	5.9	30.4

Note: Employees aged 15 to 64 years, not including trainees. Low-income threshold is set at two thirds of the median gross hourly wage (10.00 euros). <sup>1)</sup>Atypical workers include fixed-term workers, part-time workers, workers in marginal employment and temporary workers.

Source: Klemt & Lenz (2018: 175).

The low-income sector is connected to a high risk of poverty which also includes a high risk of poverty in old age. Therefore, the income situation of employed earners in the agricultural sector is clearly problematic when considered from a social perspective.

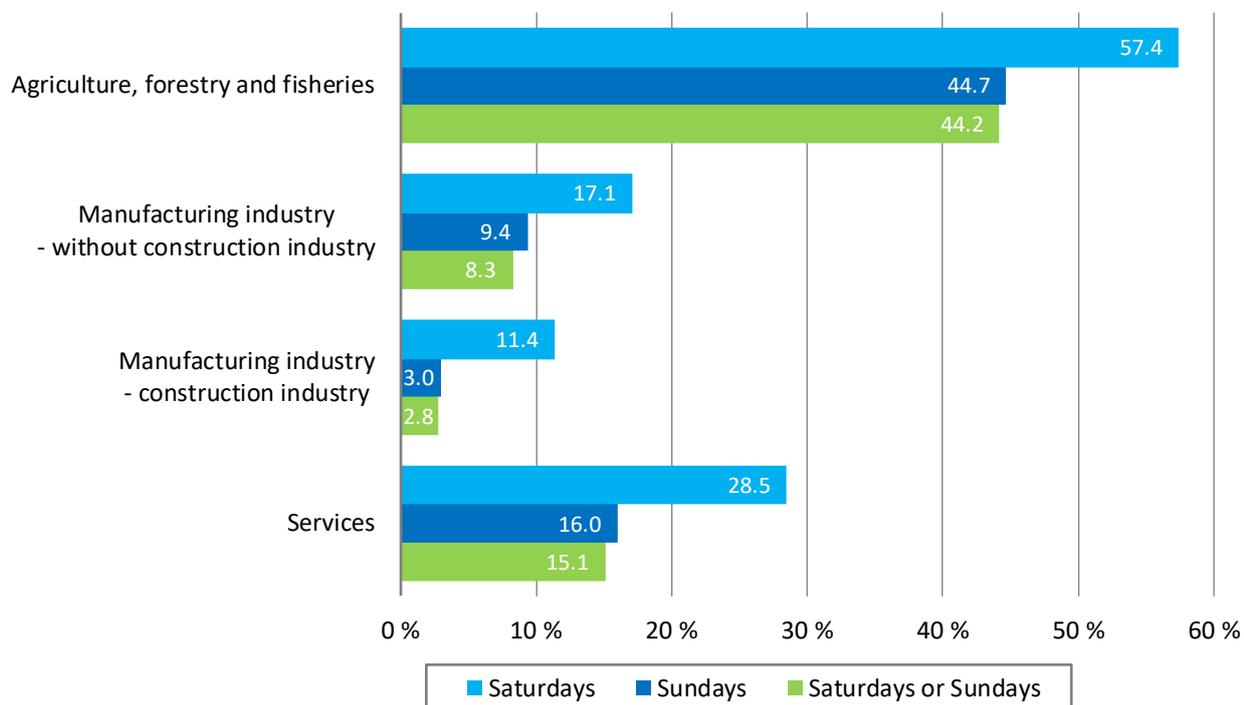
### Working conditions

The situation of agricultural entrepreneurs which was described above also applies to employed earners. Depending on individual preferences, the type of agricultural work and the circumstances linked to that (working outside, working with animals, living in rural areas) can be perceived as an advantage or a disadvantage. As employees choose their jobs on a voluntary basis and could also choose from jobs in other business sectors, it can be assumed that persons working in the agricultural sector prefer to carry out this kind of tasks and knowingly accept the challenges linked to these tasks.<sup>105</sup> But as they are employed earners, their working hours and working conditions are fixed according to agreements with their employers and they cannot choose their own working hours and conditions as self-employed persons can do. Compared with other business sectors, the working hours of agricultural employees can be classified as less favourable. As Figure 4-23 shows,

<sup>105</sup> A study conducted by Mußhoff et al. (2012: 1), which is based on an online survey, also points out these aspects. The authors found that agricultural employees saw many non-economic benefits in their work and were clearly more satisfied with their work than employees who worked in other sectors. However, these findings are not statistically representative.

there is no other business sector where so many employees also work on weekends. With regard to working conditions, there is also a comparatively high risk of accidents as was discussed above.

**Figure 4-23:** Employees working on Saturdays and Sundays, broken down according to business sectors (in 2016), in percent



Source: Klemt & Lenz (2018: 162), graphically adjusted.

### Situation of seasonal workers in the agricultural sector

From the social point of view, particular attention must be given to the situation of seasonal workers. As stated above, seasonal workers make up a high proportion of the employees at plant production farms. The majority of seasonal workers are temporary labour migrants from Eastern Europe (Holst et al. 2008). Problematic issues among this group of workers include the level of the wages paid, the working hours and the type of housing, which is usually organised by the company hiring the workers. A key measure for improving the income situation and working conditions that also applies to seasonal workers in the agricultural sector is the minimum wage, which was introduced by the Minimum Wage Act in January 2015. This Act provided for the possibility of defining different sectoral minimum wages in collective agreements concluded by trade unions and employers, which was applied in the agricultural sector. From 2015 until 2018, a collective minimum wage agreement applied to the agricultural and horticultural sectors. The sectoral minimum wage laid down in this collective agreement was lower than the statutory minimum wage. Since January 2019, however, the statutory minimum wage has also been applicable in the agricultural sector. Another important aspect for seasonal workers comprises the rules that lay down to what extent payments-in-kind, including food services, may be taken into account. Pursuant to the Posted

Workers Act, the employer is required to record the start, end and duration of an employee's daily working time.

Therefore, the overall working conditions should have significantly improved for seasonal workers. The effectiveness of these new rules, however, depends on good implementation. A study conducted by the Thuenen Institute at the end of 2015 found that the income of seasonal workers in the production sector had increased around 12% and around 11% in the marketing sector as a result of the introduction of the minimum wage (Garming 2016: 16). According to the study, it is furthermore to be expected that the number of seasonal workers will decline in the medium term due to the introduction of the minimum wage (Garming 2016: i).<sup>106</sup> However, this study is not based on statistically representative surveys. The study also only questioned farm managers and not the employees.

In 2017, the Minimum Wage Commission launched a study on the impact of the minimum wage on seasonal work which covered three sectors: agriculture and forestry; hotel and catering; and horticulture and landscape gardening (Späth et al. 2018). This study discusses in detail the methodological problems which exist in terms of analysing the impact of the minimum wage on seasonal work. The authors come to the conclusion that it is not possible to carry out a causal analysis of the minimum wage's impact on the income level and working conditions of seasonal workers in the aforementioned three sectors on the basis of the data available. But based on different data sources, it was possible for the authors to at least provide the following descriptive result: "Since the beginning of the respective period in 2012, the number of seasonal workers has significantly increased across all sectors analysed; however, the percentage of total employment made up by seasonal workers remained roughly the same. Scarcely any pronounced fluctuations have been detected since the minimum wage was introduced on 1 January 2015. But this does not automatically mean that the minimum wage could not have had any impact" (Späth et al. 2018: 3). The survey only covered the period up until 2016 and does not, therefore, include possible medium-term impacts. The authors furthermore came to the conclusion that it was not possible to make reliable statements regarding the minimum wage's impact on the income level of seasonal workers (Späth et al. 2018: 47).

No further scientific studies regarding the impact of the Minimum Wage Act on employed earners in the agricultural sector were identified at the time this expertise was drawn up. It therefore appears to be useful to consider two factors which have a major influence on possible impacts of the minimum wage: (1) the proportion of employees whose income is lower than the minimum wage and (2) the extent to which the enforcement of minimum wages is monitored. The second report by the Minimum Wage Commission (2018) includes figures for both determining factors.

---

<sup>106</sup> The wording of the study is: "In the medium term, it is expected that there will be a saving in labour input, which means that fewer seasonal workers will be employed and also permanent workers will be made redundant. To reduce labour input and increase labour productivity, some holdings plan to reduce the area for growing labour-intensive crops and to invest in mechanisation" (Garming 2016: i).

As Table 4-10 shows, the percentage of jobs in the agricultural sector with a minimum wage under 8.50 euros was at 36.3% and therefore in the upper range when compared with other sectors which collectively agreed on transitional arrangements to introduce the minimum wage. With 105,000 jobs, the absolute number of jobs in this category was furthermore higher than the number of corresponding jobs in other sectors with transitional arrangements. However, this number includes all kinds of employed earners and not just seasonal workers. However, the number indicates that the minimum wage rule should have had a positive impact on a great number of agricultural workers including seasonal workers.

**Table 4-10:** Number and proportion of jobs with a minimum wage under 8.50 euros in 2014 in sectors with transitional arrangements

Economic sector	Total number of jobs	Number of jobs with a minimum	
	in thousands	in thousands	in percent
Hairdressing and beauty salons	199	88	44.4
Washing and (dry-)cleaning	69	25	36.6
Farming, hunting, and related activities	288	105	36.3
Slaughtering and meat processing	172	33	19.2
Production of clothing	37	5	14.5
Production of textiles	77	10	12.7
Loan of staff	727	91	12.6
Horticulture and landscaping as well as provision of any other horticultural services	130	14	10.9
Forestry and logging	27	3	10.2

Note: The classification of the sectoral collective agreements does not exactly correspond to the economic sectors. The number of persons employed only represents a rough estimate.

Source: Minimum Wage Commission (2018: 46).

The percentage of companies which are subject to labour inspections by the customs authorities responsible for monitoring is one indicator of the extent to which the enforcement of minimum wages is being monitored.<sup>107</sup> In the agricultural sector, the percentage increased from 0.7% in 2014 to 1.2% in 2017. But compared with other sectors, the percentage is rather low. In 2017, 26.8% of companies in the construction sector were monitored and 15.7% of those in the hotel and restaurant sector (Minimum Wage Commission 2018: 69).

<sup>107</sup> At the customs authorities, the Financial Monitoring Unit for Illicit Employment (FKS) is responsible for the monitoring. Following the introduction of the minimum wage, the number of permanent posts at the FKS department was increased by 1,600 (see Minimum Wage Commission 2018: 68).

The “Initiative Faire Landwirtschaft”<sup>108</sup>, a civil society initiative for fair agriculture has analysed the implementation of the then newly introduced Act (Imig & Jahn 2016). In 2018, the Building, Agricultural and Environmental Trade Union (IG BAU), which represents agricultural employees, collaborated with the Peco Institute to publish a report on the “nationwide awareness-raising week for seasonal work in the agricultural sector” (Kuschel & Varelmann 2018). Based on a survey of seasonal workers, both reports identified the following typical violations: incorrect working time records, unpaid overtime, excessive working hours, costly accommodation and meals, poor accommodation and inadmissible wage deductions for working materials. As the surveys are not statistically representative, it is not possible to evaluate how common the problems identified are. In any case, the surveys can be said to be an indication that there is a need for continued action when it comes to implementing legislation on work protection in the agricultural sector.

### 4.3.3.3 Social situation in other areas of the agri-food sector

Low wages and unfavourable working conditions are not social problems that are restricted to agricultural production; they also exist in other areas of the agri-food sector. As Table 4-9 shows, the problem of low wages is even more serious in the restaurant and catering sector than in the agricultural sector. Furthermore, the working hours in the restaurant and catering sector are also unfavourable (evening and weekend work is required).

Another problematic area is the working conditions in the slaughter industry, on which the Advisory Board commented in its expertise on livestock farming (WBA 2015: Section 5.4.2) in 2015. In addition to low wages, the slaughter industry offers a rather unattractive working environment (handling carcasses), requires hard physical work and has a comparatively high risk of injury. A large number of foreign temporary workers are employed in this area as well.

For these areas of the agri-food sector, just as for the agricultural sector, the social situation of the employees should have improved after the minimum wage and further respective rules (see above) were introduced. The seasonal workers in the hotel and catering sector were included in the aforementioned study on the impact of the minimum wage on seasonal work which was launched by the Minimum Wage Commission (Späth et al. 2018). As already mentioned, the authors came to the conclusion that it was not possible to (1) identify a decrease in the number of seasonal workers employed as a result of the minimum wage introduction or (2) make conclusive statements regarding the minimum wage’s impact on the income level of seasonal workers based on the data available. The same applies to the hotel and catering sector (Späth et al. 2018: 47). As already discussed, the percentage of companies which were subject to labour inspections to ensure compliance with the Minimum Wage Act was significantly higher in this sector than in the agricultural sector (15.7% compared to 1.2% in 2017) (Minimum Wage Commission 2018: 69). Media reports indicate that

---

<sup>108</sup> The following organisations form part of the initiative: the Peco Institute, the “fair mobility” project of the German Trade Union Confederation (DGB), the European Migrant Workers Union (EVW), the Building, Agricultural and Environmental Workers’ Union (IG BAU) and the Alliance Against Human Trafficking for the Purpose of Labour Exploitation (BGMA).

the hotel and catering sector as well as slaughterhouses belong to the economic sectors which still face problems with regard to implementing the new legislation.<sup>109</sup>

But the meat industry, in particular, is undertaking special efforts to improve the employees' situation. In 2015, the sector made voluntary commitments to improve the working conditions. The German Bundestag enacted the Act on Safeguarding Labour Rights in the Meat Sector (GSA Fleisch) in 2017. This Act aims, in particular, to prevent slaughterhouses from evading their obligation to pay social security contributions by subcontracting other companies. However, the Act appears to have only little effect as there is only a low level of monitoring. As the Minimum Wage Commission's second report (2018: 69) shows, the percentage of companies subjected to inspections was at 0.4% in 2017, which is considerably lower even than in the agricultural sector. In 2015, it was 1.0%. In 2018, the Green Party "Die Grünen" submitted a minor interpellation regarding the working and income conditions in the slaughter industry. In its reply, the Federal Government confirmed that the number of labour inspections had been substantially reduced. This is surprising considering that there was no decrease in the number of violations, a fact which can be interpreted as an indication that inspections are necessary. The custodial sentences imposed for violations of the laws protecting employees increased from a period of 65 months in 2015 to 356 months in 2017 (Deutscher Bundestag 2018b). These figures indicate that, similar to the situation in the agricultural sector, there continues to be the need for action when it comes to implementing legislation.

#### 4.3.4 International trade and social problems

As a significant proportion of food is imported from abroad, this raises the question of how to incorporate the social dimension with regard to sustainable food consumption. This point is especially relevant for food imports from developing countries, as the social situation of people working in the agricultural sector there is often particularly precarious. However, among the public there is also a controversy on the extent to which exports of food produced in Germany or in the EU to developing countries may cause social problems in these countries, for example through these exports putting pressure on the local producer prices of small-holder farmers.

When looking at the trade flows it can be observed that, with regard to the market values, the EU developed from a region that imported farming and food products, with a relatively low trade deficit, to an export region with a relatively low trade surplus in the period from 2007 to 2017 (EU COM 2019a: 3). The most important European export goods are meat, milk, dairy products and cereals. The imported goods mainly include vegetable oils, feedstuffs, fruits, vegetables, coffee, cocoa and tea. Germany is the only EU Member State with a long-standing significant trade deficit

---

<sup>109</sup> See e.g. a report on employers using a variety of tricks to avoid paying the minimum wage ("Mit allen Tricks gegen den Mindestlohn") published in the newspaper *Süddeutsche Zeitung* on 7/6/2017 (<https://www.sueddeutsche.de/wirtschaft/gehaelter-mit-allen-tricks-gegen-den-mindestlohn-1.3537205>) or a report on the poor working conditions of employees at slaughterhouses ("Ausgebeutet auf dem Schlachthof") published in the newspaper *Süddeutsche Zeitung* on 1/6/2017 (<https://www.sueddeutsche.de/wirtschaft/fleischindustrie-ausgebeutet-auf-dem-schlachthof-1.3530747>).

in agricultural trade with non-EU countries, with tropical products, in particular, being imported, while the export of animal products plays a significant role (EU COM 2019b).

#### 4.3.4.1 Social problems in connection with food imports

With respect to European imports of food and feedstuffs (e.g. soy, cf. Section 5.2.4) from developing or emerging countries, there is the fundamental issue of the impact this may have on the food situation in these countries. In the public debate, there is a fear that growing export crops presents a danger to food security in developing countries, as it is assumed that local farmers will then produce less food to meet their domestic needs (De Schutter 2017). Furthermore, the import of food from developing countries may also create other social problems, for example when the products are purchased from value chains where the social criteria dealt with in Section 4.3.2 and, in particular, the decent work criteria, are not met. Also, the displacement of small-holder families resulting from the appropriation of large areas of land by investors for the purpose of export production is a social problem. In the public debate, the term “land grabbing” is used in this context. The various social problems will be discussed in detail below.

##### **Impact of trade on poverty and food consumption in developing countries**

As discussed in Section 4.1, global food security presents a major challenge. The agricultural production in developing countries is mainly carried out by smallholder farms. The FAO estimates that over 80% of all agricultural holdings worldwide farm on less than 2 hectares of land (Lowder et al. 2016: 23). Poverty is particularly widespread across these smallholder farms and although these farms produce food they often suffer from food insecurity due to low yields and greater yield-induced fluctuations (see Section 4.1).

Even though the issue of possible negative effects of food imported from developing countries is a topic of intensive public debate, scientific studies indicate that agricultural trade can have significant positive effects on developing countries. Martin and Laborde (2018) come to the conclusion that agricultural trade is of particular importance for developing countries and significantly contributes to combating starvation and poverty. Numerous other studies conducted based on aggregated country data as well as microdata show that the increasing number of agricultural imports and exports during the last decades have played a major role in improving the nutritional situation in developing countries (see e.g. von Braun & Díaz-Bonilla 2007, Anderson 2014). Countries which are more integrated into the international trading system were able to reduce poverty and hunger faster than countries which participate to a lesser degree in agricultural trade. Gödecke et al. (2018) have also found that the degree of self-sufficiency in terms of basic food commodities does not have any significant impact on hunger and malnutrition.

In many cases, growing export crops in developing countries essentially contributes to reducing poverty among smallholder farmers (Euler et al. 2017, van den Broeck & Maertens 2016, Chiputwa et al. 2015). This is mainly due to the fact that the growing of export crops results in a higher added

value than the growing of food crops for the local market. Higher incomes and the integration of small-holder farmers into international value chains often also result in far-reaching positive impacts on the level of income and employment in rural areas (von Braun & Díaz-Bonilla 2007). In addition to that, this often also results in positive spillover effects on local food production e.g. when innovations in the export sector can be transferred and used for the cultivation of crops for domestic food production.

Although the export of food and other agricultural products may have positive impacts on development, the working conditions within the value chains concerned still need to be examined from a social perspective. This will be discussed in the following.

### **Child labour, forced labour and dangerous working conditions**

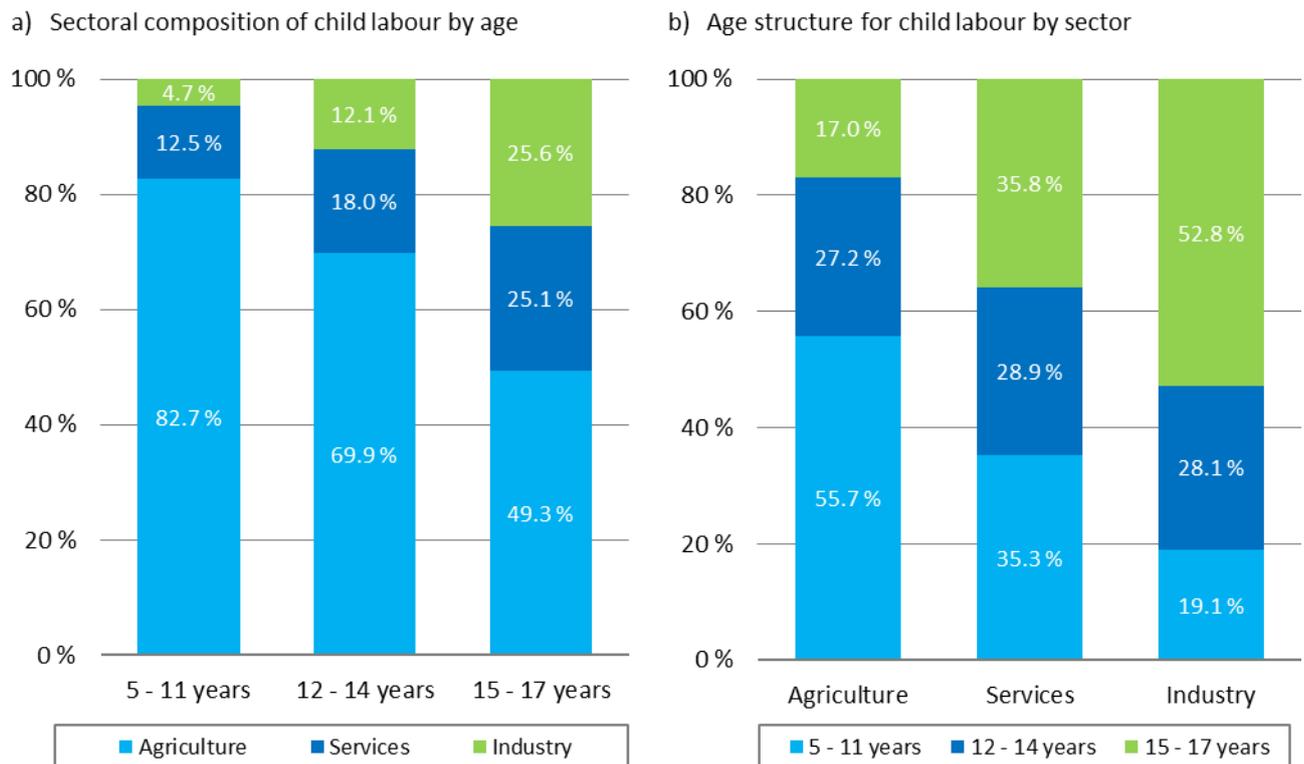
Child labour is widespread in the agricultural sector and, in particular, on family farms. However, not all kinds of activities carried out by children and young people in order to help on the farm or with the household chores are necessarily negative. According to the ILO, child labour is problematic when it consists of tasks which deprive children of their childhood, are detrimental to their potential and dignity and adversely affect their physical or mental health. Child labour is particularly problematic when it hinders or prevents children from attending school.<sup>110</sup>

As Figure 4-24 shows, there is significantly more child labour in the agricultural sector than in other economic sectors. A particularly high number of children working in the agricultural sector are in the age group of 5 to 11 year-olds. There are also regional differences. According to estimations for Africa, over 85% of the child labour performed was carried out in the agricultural sector (ILO 2017: 36). It is beyond doubt that the low level of mechanisation of farms in the African agricultural sector contributes to this problem.<sup>111</sup>

---

<sup>110</sup> See <https://www.ilo.org/ipec/facts/lang--en/index.htm>.

<sup>111</sup> The FAO estimates that, depending on the region, around 50% to 85% of farmed land in sub-Saharan Africa was managed using hand tool technology in 2005 and that the use of tractors has not increased significantly since then (FAO & AUC 2018: 6). A more recent case study from Zambia, in which the working hours of men, women and children from households with different mechanisation levels were analysed in great detail, shows that mechanisation through tractors can lead to a decrease in child labour (Daum et al. 2018).

**Figure 4-24:** Percentage distribution of child labour by sector and age groups

Source: ILO (2017: 41), graphically adjusted.

With regard to the subject of this expertise, the question arises as to what consequences these findings have for imports of agricultural products from developing countries. At this point, it seems reasonable to differentiate between short- and long-term objectives. In the long term, it is certainly advisable to aim to eliminate all forms of child labour from agricultural value chains for social reasons and to make sure that there is no child labour involved when importing agricultural products from developing countries. In the short term, however, it seems reasonable to initially end the worst forms of child labour. This includes situations where children are separated from their families and forced to carry out slave-like agricultural work. In the international debate, forced labour is also referred to as modern slavery (ILO 2017).

According to ILO estimations, around 25 million people are currently affected by modern slavery and approximately one quarter of them are children. In half of the cases where private actors are responsible for modern slavery, financial liabilities are the main cause for forced labour (ILO 2017: 5). According to estimations, the agricultural and fisheries sectors account for 11% of all cases of modern slavery (ILO 2017: 32). These numbers emphasise the urgent need to take action. As discussed in Section 4.3.2, preventing child labour and forced labour are core ILO labour standards and are therefore integral parts of certification systems such as Fairtrade. How effective Fairtrade and other labels with social objectives are in terms of improving working conditions will be discussed in Section 8.

Even employment in the agricultural sector which is not categorised as forced labour is often characterised by unfavourable working conditions. The problems that were already described for Germany, such as a high risk of accidents, are even more severe in developing countries due to insufficient training and a lack of legal regulations. Specific health problems also arise in connection with the use of chemical plant protection products and, in particular, when these products are used without applying protective measures. The FAO and the WHO have created extensive guidelines to assist developing countries in taking measures for safe handling and application of pesticides (FAO & WHO 2019). However, implementing these measures still poses a major challenge (see, among others, Karunamoorthi et al. 2012).

Already existing sustainability certificates, in particular Fairtrade and GlobalG.A.P., do, as explained in Section 4.3.2, cover the social dimension of working conditions in agricultural production, and use the ILO core labour standards as a basis for this purpose. One challenge is, however, the certification of small-holder farms, as this results in high transaction costs. When small-holder farmers market their export products via cooperatives, cooperatives can play a key role for certification and can also assist any members which struggle with the documentation requirements due to a low level of formal education (Birkenberg & Birner 2018). Fairtrade accordingly developed differentiated standards for small-scale producer organisations (Fairtrade 2019) and for hired labour (Fairtrade 2014). Yet it appears that there are some problems when it comes to implementation and monitoring and therefore not all employees along the Fairtrade value chains do actually benefit. A recently published study uses the example of the cocoa sector in Côte d'Ivoire to show that the Fairtrade certification improves the income and work situation of wage workers in cooperatives but does not have any positive effects on the situation of wage workers on small farms (Meemken et al. 2019).

**Text box 8:** Delisting of non-Fairtrade bananas at Lidl and withdrawal of the measure in 2018/2019

The Lidl initiative to only sell Fairtrade bananas demonstrates the opportunities and limits retailers face when it comes to further spreading fair trade labels. Lidl committed to only sell fairly traded bananas in autumn 2018 (Lidl 2018), which was effectively communicated in the media. The company started with a successive transition from bananas which were not certified by Fairtrade and which bore the Rainforest Alliance label, to Fairtrade bananas exclusively. As the organic bananas sold at Lidl were already certified by Fairtrade, the aim was that all bananas stocked should be from “fair trade” after completion of the switch. The decision to delist bananas that were not Fairtrade-certified (i.e. with the Rainforest Alliance certification) was withdrawn in May 2019 as Lidl lost market shares to other retailers. Since then (i.e. since summer 2019), Lidl sells three kinds of bananas in all of its stores: organic Fairtrade bananas, conventional Fairtrade bananas and conventional bananas which are not certified by Fairtrade but by Rainforest Alliance.

As Lidl stated in the media, withdrawing the delisting measure was a result of the customers not being willing to pay more. In spring 2019, when Lidl sold only Fairtrade bananas in around 40% of their stores, these bananas were at 1.19 euros. The comparative price for conventional bananas sold by their main competitor Aldi then was at 0.99 euros. Despite different price campaigns during which Lidl occasionally sold Fairtrade bananas at 0.99 euros and in individual cases even at 0.89 euros, Lidl lost market shares. During the campaigns, Aldi reduced their price for Fairtrade bananas from 1.69 euros to 1.39 euros (n.p. 2019) and was, in addition to that, able to occupy the entry-level price segment with their permanently low price of about usually 20 eurocents/kg less. Other competitors also offered special deals to gain market shares. Lidl, in its statements to justify the withdrawal of the delisting measure, criticised the fact that other food retailers unfortunately did not join in in delisting non-Fairtrade certified bananas.

Around 92,400 tons of bananas, which corresponds to approximately 10% of all bananas in Germany, were Fairtrade certified in 2018. This amount almost tripled in the period between 2013 and 2018 (Hielscher 2019, n.p. 2019a). The example of Fairtrade bananas illustrates the key role consumers play. Even for comparatively low-priced products such as bananas (with a price of around 1 euro per kg) certified with a relatively well-known label (cf. Sections. 7.5.2 and 8.9.2) and limited price increases of around 20%, some consumers are not willing to pay more for a Fairtrade certified product. It should be borne in mind here that the number of price-sensitive households among customers of discounters, such as Lidl, is higher than among customers of supermarkets such as Edeka and Rewe.

This example also shows that, in a highly competitive (oligopolitical) market, a label can only contribute to an industry-wide rise in social standards if all major competitors participate (as was successfully done in the context of the animal welfare issue of “battery eggs”). As anti-competitive agreements among retailers are not allowed under anti-cartel legislation, it is a risky decision to be taken by the pioneering companies which have to make trade-offs between the expected reputational gains and the possible market share losses.

In general, food retailing plays a very important role as far as fair-trade labels and sustainability marketing are concerned. The success of initiatives in the commercial sector ultimately depends on consumers’ willingness to pay and on the other competitors’ reaction. Bananas are the second most often sold Fairtrade product and are surpassed only by coffee; a total delisting therefore at least seemed to be a feasible possibility. For other imported food products it would currently not be possible to carry out a total delisting.

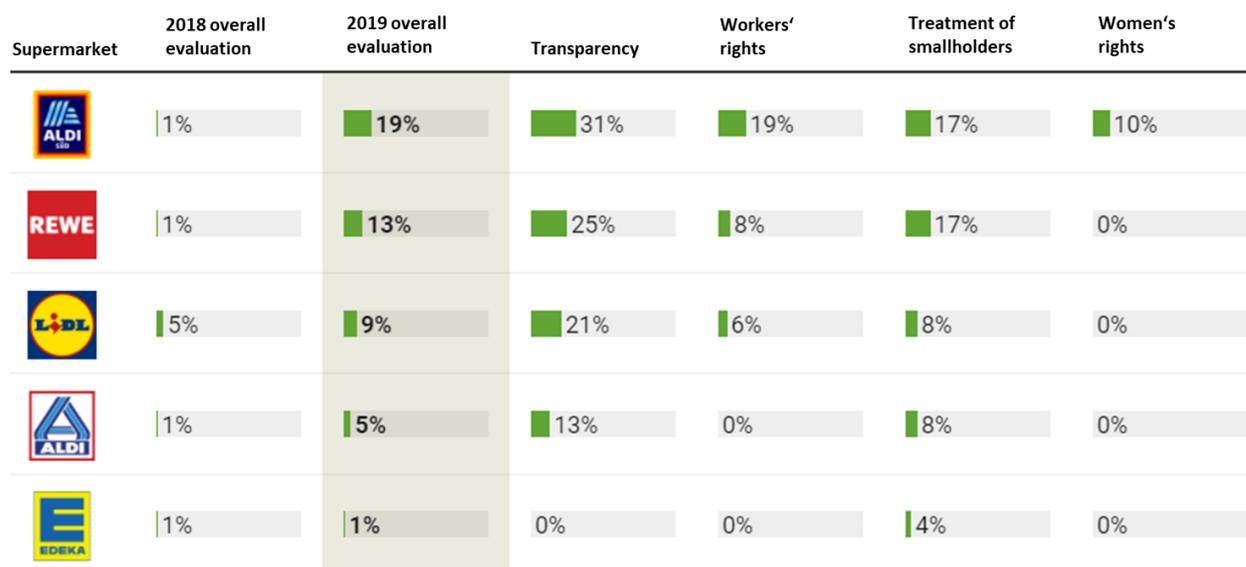
Another problem is the fact that the market share for Fairtrade products – which essentially only comprise a few products such as coffee and bananas – remains small, despite growing steadily over recent years.

As the use of the Fairtrade label is limited, the question arises as to how the food retail sector can ensure, through other measures, that the products offered by commercial companies are produced under decent working conditions. The GlobalG.A.P.-GRASP certification is one of the instruments available to commercial companies. However, there is still a major need for action in this regard (cf. Section 5.3.2). The non-governmental organisation Oxfam has been conducting a “supermarket analysis” on human rights violations in commercial food chains since 2018. In its analysis, Oxfam evaluates the business practices and activities of supermarket chains (for more information on the methodology used see Oxfam 2018). Measures to take into account the working conditions of employed earners, smallholder farmers and women working in the value chains are given a score ranging from 0% (no account taken) to 100% (taken into account on a large scale). The results for 2018 and 2019 are illustrated in Figure 4-25:

**Figure 4-25:** Oxfam analysis of business practices in the food retail sector with regard to social problems along the value chains

### Supermarket analysis

What is the situation in German supermarkets with regard to respecting human rights in their supply chains?



The figures are based on business practices and measures with regard to the supply chains published by the supermarkets. Reports on human rights violations in the supply chains of the companies can be found at: [www.business-humanrights.org/barcodes](http://www.business-humanrights.org/barcodes)

Note: For details on the method used see Oxfam (2018).

Source: Oxfam (2019), translated.

This analysis poses methodological problems as it is based on a qualitative assessment of the business practices and measures published by the companies. On the one hand, measures which the companies do not report are therefore not taken into consideration and, on the other hand, the fact that a business practice exists does not automatically mean that it is also effectively implemented. Nevertheless, the Oxfam campaign plays an important role in raising awareness among the consumers of the impact they as consumers can have on the social situation of the people working along these value chains through their purchasing decisions. In addition to that, the campaign creates incentives for the food retail sector to play a more active role in this field.

### **Negative social impacts caused by large-scale investments**

The appropriation of large areas of land in developing countries by private investors looks back on a very long history in terms of agriculture, in particular in the plantation sector. However, after the sharp rise in food prices in 2008, appropriation significantly increased. Contrary to the public perception, a large number of local investors from developing countries are also involved (Deininger & Byerlee 2011). According to the “Land Matrix”<sup>112</sup> monitoring platform, which has been working on setting up a global database for land appropriation since 2009, investors have acquired over 42 million ha in large-scale land acquisitions globally (more than 200 ha per transaction) since 2000, mainly through long-term lease contracts (for a period of 49 or 99 years). This also includes German investors which, according to Land Matrix (data from May 2019), have acquired 470,000 ha of land, of which 370,000 ha are in Africa.<sup>113</sup>

Despite the fact that land acquisition by investors can generally have positive impacts, e.g. by creating jobs or providing access to new value chains or technology transfer, this process often has negative social impacts. This applies, in particular, when small-holder farmers are displaced, as mentioned above. In the public debate, the term “land grabbing”<sup>114</sup> is commonly used to describe this. Socially problematic acquisitions mainly happen in countries where the property rights of farming families are not very well protected (Deininger & Byerlee 2011). Especially in Africa, this is a huge problem because traditional land law is prevalent and only few farming families are in possession of official ownership titles for their land. Davis et al. (2014) estimate that globally around 12 million people were potentially affected in a negative way by land investments between 2000 and 2014.

A number of different international initiatives have been introduced as a reaction to this issue, particularly by the Committee on World Food Security (CFS), which was fundamentally reformed following the food price crisis in 2008. The CFS strategies against large-scale acquisitions of land

---

<sup>112</sup> See <https://landmatrix.org/>.

<sup>113</sup> See <https://landmatrix.org/charts/web-of-transnational-deals/> (accessed on 8/5/2019).

<sup>114</sup> The International Land Coalition, which is an alliance of non-governmental organisations, defined land grabbing in the 2011 Tirana declaration as follows: acquisitions or concessions that are one or more of the following: in violation of human rights, particularly the equal rights of women; in disregard of social, economic and environmental impacts; not based on transparent contracts that specify clear and binding commitments about activities, employment and benefits sharing; not based on effective democratic planning, independent oversight and meaningful participation (see <http://www.landcoalition.org/about-us/aom2011/tirana-declaration>).

include, as mentioned above, the introduction of the Voluntary Guidelines on the Responsible Governance of Tenure of Land, Fisheries and Forests in the Context of National Food Security and of the Principles for Responsible Agricultural Investment that Respects Rights, Livelihoods and Resources (PRAI) (see BMZ 2012). As these are voluntary instruments, the challenge consists in implementing them. From the consumer perspective, the question arises whether a certification of food products (or other agricultural goods) can contribute to prevent negative impacts resulting from large-scale investments. The existing sustainability certification systems only take the social situation of people working in agricultural holdings operated by investors into consideration. They are not designed to deal with the issue of displacing people. It should be assessed whether the existing certification systems could be extended to cover this aspect e.g. by issuing certifications only for holdings which acquired their land in a socially acceptable way.

#### 4.3.4.2 Social problems in connection with exports to developing countries

Exports of food products from Germany and Europe to developing countries are also regarded critically by the public (AgrarBündnis 2018). There are concerns that these exports exercise downward pressure on the prices of the local markets and undermine the competitiveness of local farmers. Exports of poultry and dairy products to Africa, in particular, are repeatedly accused of destroying local markets and hindering farmers in finding a way out of poverty (Brot für die Welt 2017, Misereor 2017). Such examples contribute to the public perception of trading with developing countries being in part counterproductive with regard to the objectives of sustainable development. The complex impacts of food imports on consumers, producers and the natural environment are not always sufficiently taken into consideration. The public debate often also neglects the fact that exports of agricultural products from the EU to sub-Saharan Africa correspond to less than 7% of the exports to all non-EU countries (EU COM 2019b: 2). Finally, it should be pointed out that EU exports of agricultural products to developing countries are now no longer based on direct export subsidies but mainly on cost benefits resulting from production (Rudloff & Brüntrup 2018). The EU has not applied export subsidies since 2013.<sup>115</sup>

Studies conducted by the Agency for International Cooperation (GIZ – Deutsche Gesellschaft für Internationale Zusammenarbeit) show that the impacts of food exports have to be examined under different aspects as both positive and negative impacts may arise. The impacts strongly depend on the agricultural structure of the importing countries and their national trade policy (GIZ 2018a, b).

There may be a negative effect due to imports causing prices on local markets to drop, which in turn subjects domestic producers to additional competitive pressures. But domestic consumers also benefit from less expensive access to food products (e.g. dairy products, poultry). In particular in the urban areas of Africa, the demand for poultry and dairy products has been higher than the domestic supply in recent years (FAO 2015a). Because of the additional imports from Europe, price

---

<sup>115</sup> See [https://www.bmel.de/DE/Landwirtschaft/Markt-Handel-Export/\\_Texte/Agrarexport.html?nn=3714070&notFirst=true&docId=2510288](https://www.bmel.de/DE/Landwirtschaft/Markt-Handel-Export/_Texte/Agrarexport.html?nn=3714070&notFirst=true&docId=2510288) (last accessed on 23/12/2019).

increases were avoided. Affordable prices enable the poorer sections of the population to also have access to animal products, thereby improving protein and micronutrient provision. The majority of small-holder farmers do not produce poultry or milk on a commercial scale; the positive social impacts of the imports on the consumer side therefore more than compensate for the negative impacts on the producer side. However, this is not always the case – e.g. it would not be the case if many smallholder farmers participated in the commercial production of milk and poultry. Wherever it appears reasonable to support smallholder agriculture, in particular for these product groups, the respective countries should develop and implement appropriate support policies which could also include imposing temporary trading restrictions where necessary. However, the impacts on domestic consumers should not be ignored.

A positive example in this regard is Cameroon which is one of the few African countries that has imposed restrictions on the import of frozen poultry meat parts since 2005. At the same time, the country has supported the domestic poultry sector through support programmes funding, for example, hatcheries, feed manufacturers and veterinary services. In this way, domestic poultry production has become established, and has created more than 300,000 jobs in the production sector alone which has been a particular benefit to young people (GIZ 2018b: 9).

### 4.3.5 Conclusions regarding the social dimension

The food we consume not only fundamentally influences our individual health status (Section 4.2); it also has a social and environmental footprint due to the fact that other people have produced and processed these food products. One difference to the other sustainability dimensions consists in the fact that there is, regarding the social dimension, less agreement among the public, in academia and in political circles with respect to which aspects should be included, which objectives should be used as a basis for an evaluation and how current problems should be addressed in this regard. In other words, there is greater dispute over the normative reference framework.

For the normative reference framework, this section has distinguished between the protection aspect and the justice aspect: the protection aspect encompasses above all minimum social protection (protection from health impairments and from the inability to continue to satisfy basic needs) and consequently describes what is understood by sustainable development, as drawn up in Section 2, whereas the justice aspect encompasses more far-reaching objectives, in particular the reduction of social inequality and the realisation of social justice. The latter plays a key role in the public debate. It is therefore also dealt with in this Section. The global sustainable development goals (SDGs) include both aspects: SDG 8 “decent work and economic growth” and SDG 10 “reduced inequalities” (cf. Section 2.4).

When it comes to working conditions, securing minimum standards plays an essential role in the various assessment systems to promote sustainability in the field of agriculture and food (cf. Section 5.3.2). Most of these systems use the ILO core labour standards as a basis. In addition to that,

some of the assessment systems also take into account social aspects regarding the exchange relationships between market partners (e.g. Fairtrade). These approaches use different mechanisms for achieving the objectives, which range from providing a framework for assessment (such as the FAO SAFA Guidelines) to the use of labels (such as Fairtrade) or additional certifications (such as GlobalG.A.P.-GRASP or Naturland-Fair). Other mechanisms, such as establishing economic communities of consumers and producers (e.g. community-supported agriculture, cf. Section 5.4) or making use of digital options (such as apps and social media, cf. Section 8.10) will be discussed in the following sections. Most assessment systems focus on the protection aspect and, viewed overall, address a broad spectrum of protection needs (e.g. accident protection, maternity protection and protection of children and young people). The justice aspect is, in particular, reflected in three types of criteria: adequate remuneration and livelihood security, freedom of assembly and association as fundamental requirement to negotiate fair wages, and equality.

Although the social standards in Germany rank high in international comparison, social problems – which consumers may only be partially aware of – do exist in the agri-food sector. Today, around one half of the total farm labour force are employed earners with an income level that is well below the average income of employees with a comparable professional background working in other sectors. An above average proportion of employed earners in the agricultural sector faces a high risk of poverty. A large number of Eastern European seasonal workers are employed in the special crop farming sector; their wages also are comparatively low and they work in unfavourable conditions. Other agri-food sectors, in particular the meat sector and the restaurant and catering sector, are characterised by problematic working conditions. In light of this, it can be assumed that the Minimum Wage Act introduced in 2015 has improved the social situation of employees working in these sectors. However, the currently available studies which were identified for the purposes of this expertise do not provide any statistically representative findings on the impacts of the Minimum Wage Act on income levels or working hours in the agricultural sector, the meat sector or the restaurant and catering sector. There are also indications suggesting that problems with implementation exist across all three sectors. In addition to that, the intensity of controls is rather low in the agricultural and meat sectors when compared with other sectors.

The situation of family workers in the agricultural sector has to be viewed differently, as family holdings can, in principle, determine their own working conditions. There are huge differences in the income levels of agricultural holdings, depending on the type and size of the holding and on entrepreneurial skills. However, a necessity for government support can only be found in families which are actually in need of such support and are able to prove it. The government should provide assistance through the general social security systems where necessary. Means testing is not a part of agricultural policy and does not fall within the scope of agricultural-policy; it is instead a task for national social-policy. In the context of the Common Agricultural Policy, farm operators receive substantial financial contributions via direct payments, which are made on a fixed basis and completely independently of the respective income situation. Taking this into account, the WBAE continues (see WBAE 2018) to be of the opinion that fixed direct payments are not justifiable on the

grounds of providing income support, particularly considering that they are largely passed on to the land owners and therefore do not fulfil this purpose.

In conclusion, low wages and incomes in the agri-food sector contribute to the fact that consumers only have to spend a relatively small portion of their income on food products (9.4% in 2018, Federal Statistical Office 2019b: 24). The agricultural sector often complains about consumers not being willing to pay more for food products. It is in particular criticised that consumers make use of bargain offers at prices which obviously do not allow for producers to receive adequate remuneration.<sup>116</sup> But this kind of criticism neglects the fact that consumers currently have only very few possibilities to actually influence the social situation of farmers in Germany through their purchasing decisions. Even if consumers do not make use of low-priced offers, they cannot make sure that farmers or employees actually receive a higher income as higher prices could also only be the result of increased profit at other levels among the value chain. Furthermore, it must be taken into consideration that the proportion of money spent on food products is significantly above-average among low-income households and these household therefore have little potential to influence social conditions in the agricultural sector through their consumer decisions (cf. Section 4.2.3). In addition to that, consumers, as citizens entitled to vote and as part of the civil society, have the possibility of striving to bring about improved health and safety regulations for the German agricultural sector e.g. by engaging in political parties or trade unions and committing to the respective objectives. In this way, consumers are likely to have a broader impact than labels or approaches could possibly achieve.

International agricultural trade plays a central role for sustainable development. Due to different soil and climate conditions, agriculture offers different advantages for different forms of production across the globe: not every product can be efficiently produced in all climates. Trade can help in overcoming local food shortages and preventing over-exploitation of natural resources which is detrimental to the environment. However, more attention needs to be paid to the social dimension of trade. Sweeping trade barriers put in place on social grounds are not a suitable solution as trade has a huge potential to reduce poverty and ensure food security, in particular when high-quality products are exported. For the same reasons, it is not desirable that consumers generally only consume food products which were produced in their own country or boycott products from specific countries (cf. text box 11 “Boycotts of countries and sustainable consumption” in Section 5.3.2.2). What matters is reducing negative social impacts in international food trade as far as possible and supporting positive effects.

Sustainability certifications and labels can play a leading role in this regard (Byerlee et al. 2016, Chiputwa et al. 2015, see also Sections 7.5.3 and 8.9.2). The food retail sector can take measures, for example certifications along the value chains, to help prevent food products sold in Germany from having been produced in inhumane conditions, such as forced labour. If retail initiatives do

---

<sup>116</sup> A prominent example is the “Dear consumer” (“Lieber Verbraucher”) publication written by “Farmer Willi” (<https://www.bauerwilli.com/lieber-verbraucher/>).

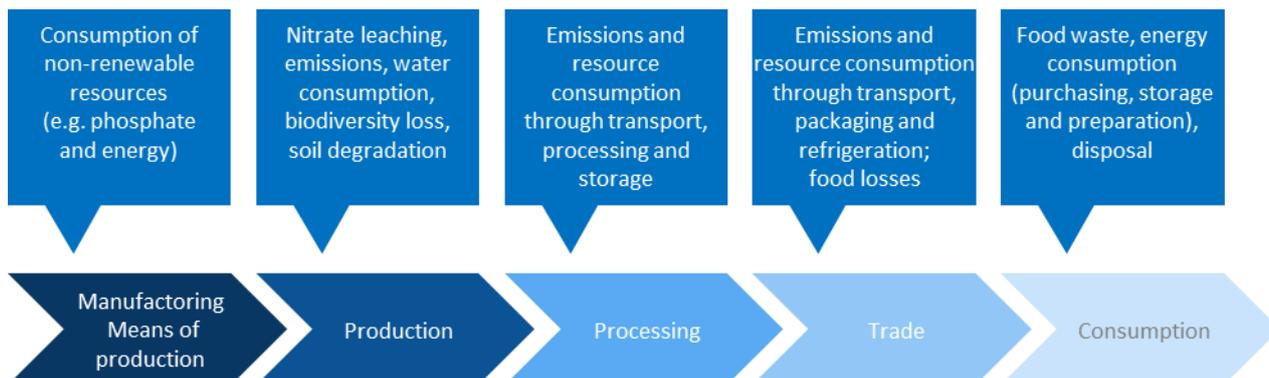
not result in respective measures being satisfactorily implemented, the introduction of legal obligations could be useful. With labels such as Fairtrade, consumers can also contribute to achieving more far-reaching social objectives. There is also still need for improvement in this regard, particularly as far as employed earners working in the agricultural sector in developing countries are concerned.

Furthermore, Germany can also contribute to improving the social situation of farmers and hired farm labour in developing countries by concluding international agreements and through developmental cooperation. In addition to that, Germany and Europe can promote the benefits of trade for developing countries by further reducing tariffs and other EU trade barriers for processed food products as well as agricultural commodities.

#### 4.4 Environmental effects of our diet

Food production is an integral part of the economic and socio-cultural system in which we live and work, and affects the environment in many different ways. Clean air and water, fertile soils, biodiversity and an agreeable climate are necessary preconditions for a healthy life. Numerous studies show that current food production and consumption impairs these life-sustaining resources in the long term.

Combined with a higher degree of processing of our food and the international division of labour driven by globalisation, recent decades have seen the emergence of increasingly differentiated, and in some cases global, value chains. The strain on the environment can be traced along these chains (see Fig. 4-26). The respective hotspots vary depending on the product. In the following, the different stages of the value chain are examined with respect to the key environmental effects, starting with agriculture, which in most cases accounts for the bulk of the environmental impact. For example, around 56% of greenhouse gas emissions in relation to the entire value chain (Meier 2014: 41) are generated in the agricultural upstream chain (16%) and during agricultural production (40%).

**Figure 4-26:** Main environmental impacts along the value chain

Source: WBAE illustration.

#### 4.4.1 Environmental effects of agricultural production – planetary boundaries

The food system is facing challenges on a global scale that result equally from the aim to provide sufficient food (cf. Section 4.1) and the aim to preserve livelihoods. Excessive water extraction (especially in regions of the world with a negative water balance), increasing water pollution, deforestation, conversion of ecologically valuable areas and the depletion of biodiversity are repercussions of the global food system as currently practised. Three key drivers will exacerbate these problems in the coming decades (FAO 2018a, Section 4.1):

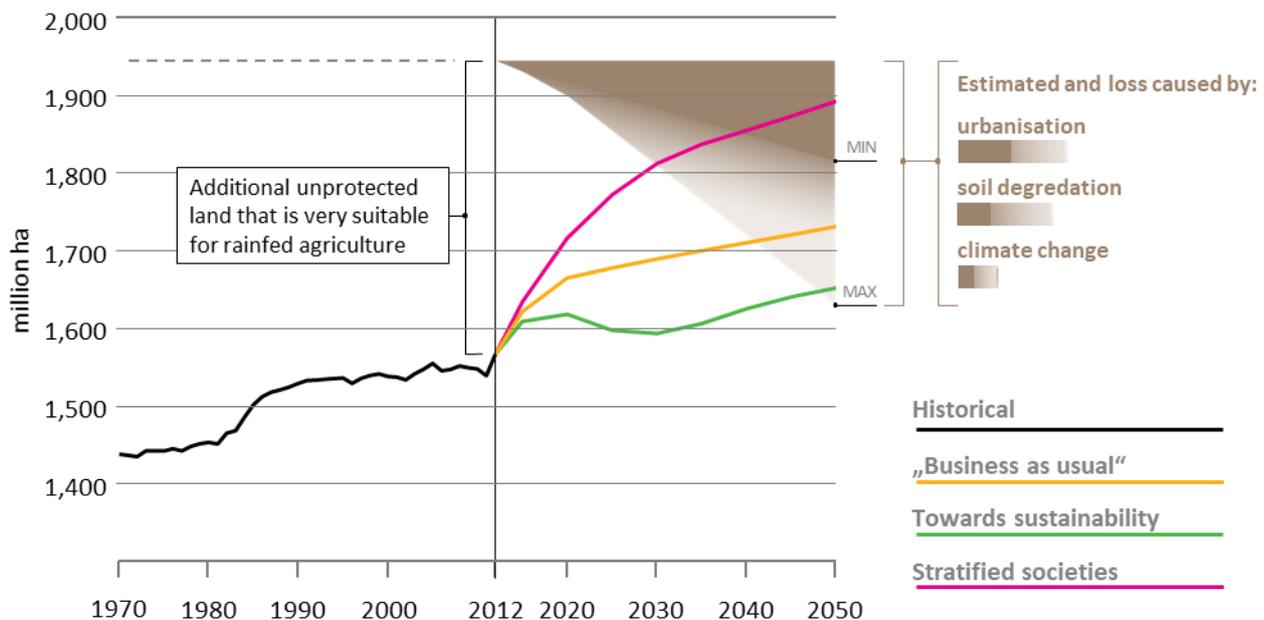
- (1) a world population that will continue to grow until at least the second half of the 21st century;
- (2) the increasing adaptation of developing countries to the consumption and dietary patterns of industrialised nations (especially increased consumption of fat, sugar and animal products);
- (3) limited productivity growth in crop production due to climate change effects, especially in countries with extremely high population growth (sub-Saharan Africa).

Several studies show that it will in principle also be possible to meet the global calorie requirements in terms of a needs-based diet (cf. Section 4.1) in 2050 (cf. Mauser et al. 2015, Davis et al. 2016, Alexander et al. 2017, Rööß et al. 2017). While the FAO (2018a), in its food projection, assumes markedly decreasing case numbers of undernutrition in different scenarios, the cohort of the world population characterised by overnutrition or obesity will increase considerably until 2050 and beyond, particularly in a “business as usual” scenario. The global challenges for the food system in the conflict between necessary additional production on the one hand and the increasing threat to the available farmland on the other are shown in Figure 4-27. At best and depending on the assumed scenario, the sustainability-aligned production and consumption of food would increase

the land requirements only slightly, while a “business as usual” scenario would require an expansion of land by more than 10% – with simultaneous loss of production areas due to urbanisation, land degradation and climate change. Although there is, in theory, available global potential for farmland expansion, this would also affect ecologically sensitive areas, especially in sub-Saharan Africa and Latin America (Bruinsma 2009) (previously protected rainforest and grassland biomes). The land available for the world’s food systems is thus limited, and both expansion and overuse of land are linked directly with a negative ecological impact.

This makes the global significance of the footprint produced by different dietary patterns evident. Owing to the relatively dominant role of global protein supply, this footprint is not always related to energy supply as a functional unit in the literature; instead, the functional unit selected is often protein supply. Clark and Tilman (2017), among others, analysed foods of different origins accordingly in a meta-analysis. According to this, the consumption of meat derived from ruminants causes by far the largest land footprint, but poultry meat is also linked to a land requirement that is increased by at least a factor of 2 compared to protein sources of plant origin. The high specific land requirements for beef are often qualified by arguing that beef is in most cases produced on non-arable grassland sites or on natural grassland worldwide and thus does not cause any competition for food on the field (Wilkinson 2009). At first glance, this argument appears plausible. However, the premise of the argument must be clearly qualified: today, a significant proportion of global beef production is based on arable feed and thus directly competes with the production of plant-based food. In addition, overgrazing, which takes place on a large scale across the globe (Bedunah & Angerer 2012, Ren et al. 2013), causes massive environmental damage in arid and semi-arid areas (degradation of soil carbon sinks, biodiversity loss, erosion, desertification, loss of farmland), as does, for instance, the use of drained peatlands for dairy and meat production (soil carbon depletion, eutrophication) in the northern hemisphere (Poyda et al. 2016). Finally, the development of the bioeconomy is increasingly providing opportunities to use grassland growth for energy purposes or for material production (Joseph et al. 2018).

**Figure 4-27:** Scenarios for global demand for farmland and estimated loss of farmland due to urbanisation, land degradation and climate change



Note: “Additional highly suitable and unprotected land” refers to land of the highest suitability level for rainfed agriculture and states the amount of this land that was available in the base year but that is currently not used. If you add this area to the area used for agriculture in 2012 (irrigated and rainfed) you obtain an estimate of the maximum potentially usable agricultural area (dashed line) under the irrigation conditions prevailing in 2012. If one wants to expand the agricultural area beyond this limit, this requires progressively increasing investments. The fading wedge shows the degree of potential land loss (dark brown: minimum, light brown: maximum). The values for land loss due to urbanisation (1.6 million to 3.3 million ha annually) and land degradation (between 1.0 million and 2.9 million ha annually) are taken from Lambin & Meyfroidt (2011); the loss due to climate change (0.5 million to 1.4 million ha annually) refers to the “representative concentration pathways” (RCP scenarios) -4.5 (min) and 8.5 (max) and these are based on FAO-IIASA GAEZ v4 (see <http://www.fao.org/nr/gaez/about-data-portal/en/>).

Source: FAO (2018a: 131).

From the perspective of the Earth’s environmental boundaries, it thus becomes clear that the main environmental problems arising from food production (climate change, biodiversity loss, nitrogen surpluses) are essentially caused by production and consumption patterns, notably in highly developed countries including China (Rockström et al. 2009). In particular, the consumption of high percentages of food of animal origin is problematic simply because, in addition to the increased area requirements ensuing from conversion losses in the food chain, these have far higher specific emissions than foods of vegetable origin. For example, of the 100 kg/ha of fertiliser nitrogen used for plant production, around 14% is actually consumed by humans, whereas this is only 0.5% for beef. Thus, the environmental impact of food consumption is always associated with the dietary patterns of different cultures around the globe. For example, while meat consumption in India is comparatively stable and low, developments in China since the 1990s have increasingly reflected those in industrialised nations, with all the resulting consequences (diet-related diseases, negative environmental impact).

In the long run, the increasing demand for land for agricultural production will have significant negative impacts on human well-being and thus on the development opportunities of future generations. This results in the call for sustainable intensification (Garnett & Godfray 2012, Pretty & Bharucha 2018). Globally, the challenge now is to increase food production while at the same time reducing environmental impacts. In this respect, the FAO formulates clear expectations regarding the global spatial distribution of these tasks: **Countries of the South** and those with a pronounced “yield gap”<sup>117</sup> of more than 50% should be placed in a position to **increase production sustainably**. This has already been achieved to some extent in the last 20 years, e.g. a global increase in wheat yields by 30% (USDA 2017).<sup>118</sup> In contrast, **highly developed countries** with a marginal “yield gap” of less than 20% and stagnating yields<sup>119</sup>, but which at the same time face considerable environmental problems, are primarily called upon to **intensify ecologically**, i.e. to maintain the high yield level while significantly reducing the ecological footprint (cf. van Wart et al. 2013). The aim here is therefore to increase eco-efficiency (Taube et al. 2014).

On most of its land, the agricultural sector produces food, i.e. products that are only substitutable to a limited degree. According to Rockström et al. (2009), the “**planetary boundaries**”, i.e. the Earth’s capacity limits in terms of available resources<sup>120</sup>, have been clearly exceeded in three areas in particular: climate change (GHG emissions), the nitrogen cycle (N surpluses) and biodiversity loss. Beyond that, mention should also be given to other pressing ecological problems faced by agriculture, such as wind and water erosion, pollutant and antibiotic inputs into the environment and a partial loss of key soil functions.

---

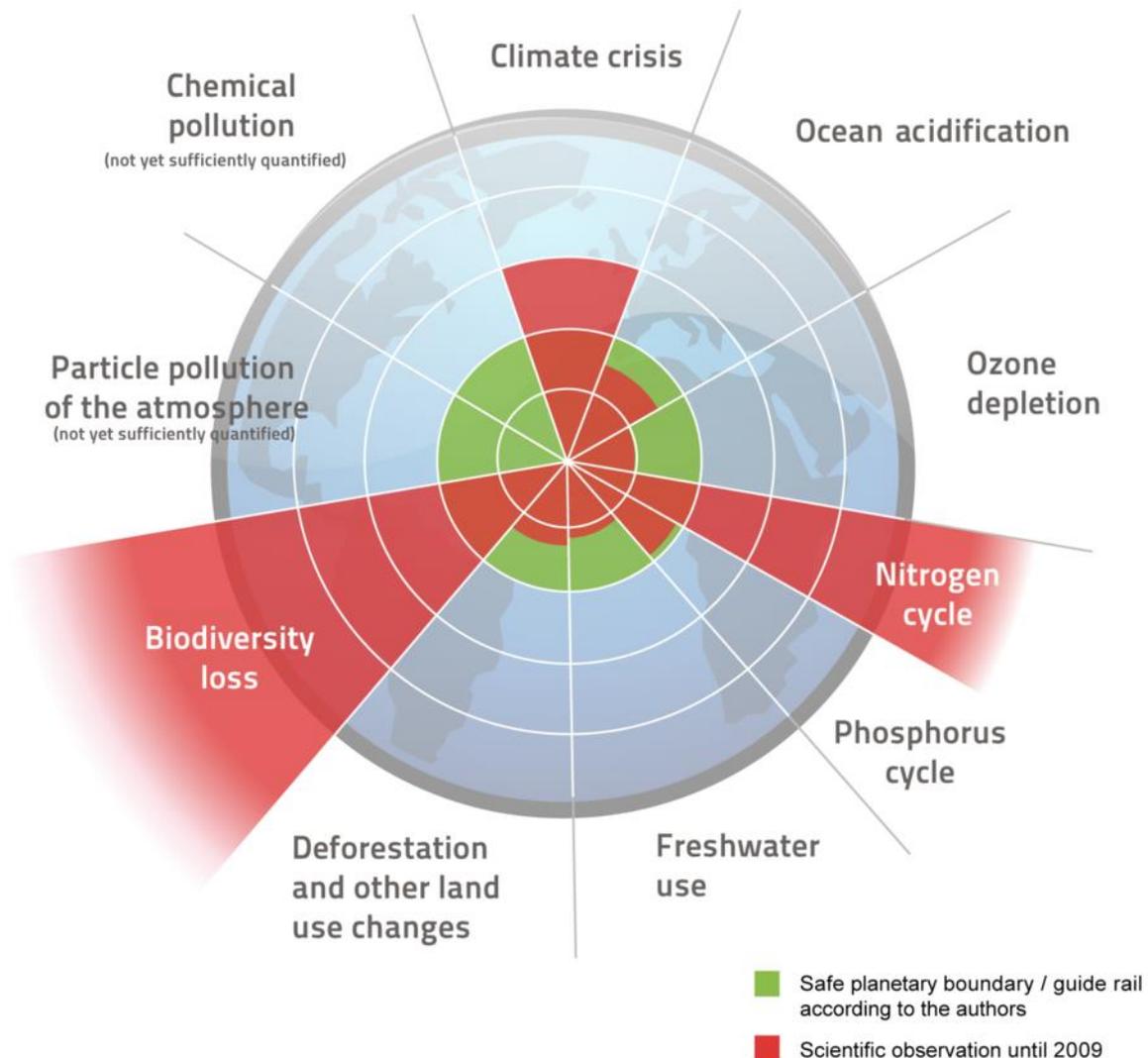
<sup>117</sup> This term refers to the ratio of achieved yields to yields that are agro-ecologically possible without irrigation.

<sup>118</sup> However, there is criticism of investors’ large-scale acquisition, in the southern hemisphere, of land that was previously used by smallholders, which is in some cases associated with this rise in productivity (cf. Section 4.3.4.1).

<sup>119</sup> Such locations are often characterised by high annual fluctuations in yields, for example the yields of winter wheat in Germany in the last 20 years (Federal Statistical Office 2019c).

<sup>120</sup> Although the concept of planetary boundaries seems to be descriptive, it is based on important normative decisions. The above-mentioned global boundaries cannot be found empirically in the world. What can be described are the effects that exceeding certain stress limits will have in the short and long term. The definition of global boundaries results from the description of such impacts combined with the value judgement that certain short-term and long-term impacts are unacceptable. The relation of planetary boundaries to the understanding of sustainable development as a permanent possibility to meet basic needs, as elaborated in Section 2, lies in the assumption that exceeding the planetary boundaries implies that people will not be able to permanently meet their basic needs today or in the future. In this sense, exceeding the planetary boundaries can be regarded as unsustainable development.

**Figure 4-28:** The key global environmental problems and their boundaries



Source: Felix Müller/Wikimedia Commons ([https://upload.wikimedia.org/wikipedia/commons/thumb/1/17/Planetary\\_Boundaries.png/993px-Planetary\\_Boundaries.png](https://upload.wikimedia.org/wikipedia/commons/thumb/1/17/Planetary_Boundaries.png/993px-Planetary_Boundaries.png)) according to Rockström et al. (2009).

The three subsections below will first outline the role of the food system with regard to the three major areas of the planetary boundaries mentioned above. This will be followed by a brief summary of other environmental problems.

#### 4.4.1.1 Crossing planetary boundaries I: Climate change (GHG emissions)

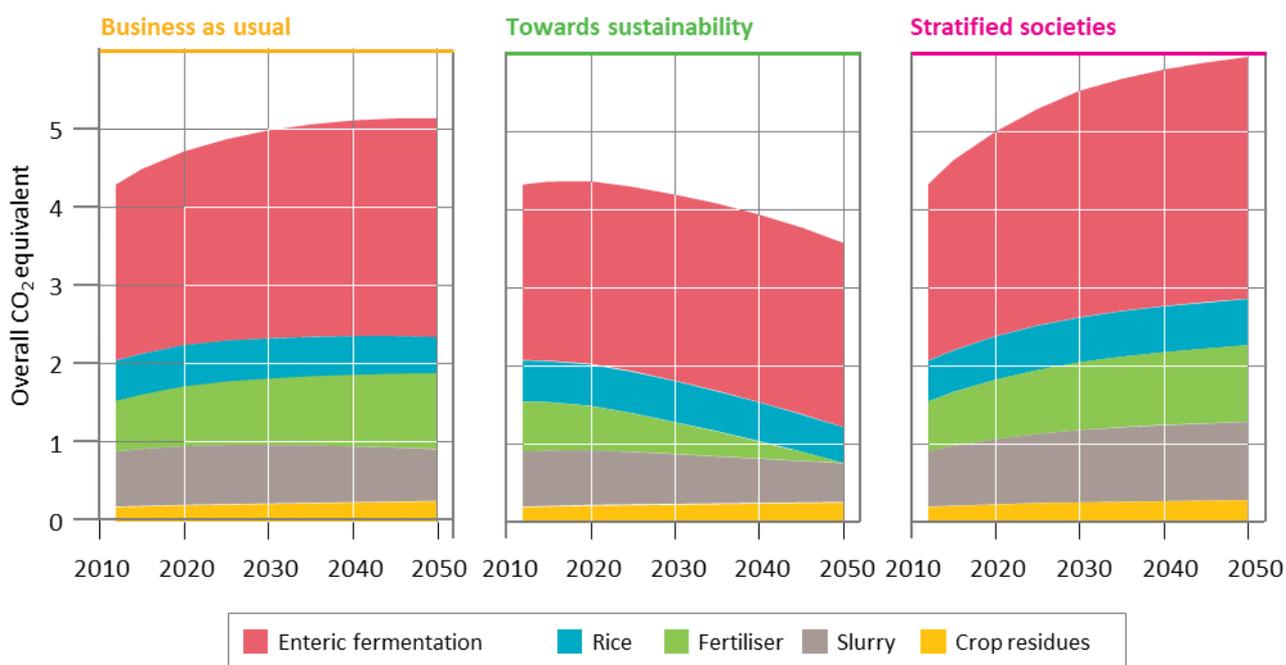
The agricultural and food production sectors are both perpetrators and victims of climate change. Globally, the agricultural sector (without land-use change) accounts for 12% of anthropogenic greenhouse gas emissions (IPCC 2019). In the context of international climate reporting, the agricultural sector is included in source group 3. In contrast to other sectors (energy, industry, etc.),

the agricultural sector does not emit CO<sub>2</sub> significantly, but chiefly nitrous oxide and methane. The agricultural sector directly accounts for 57% of global nitrous oxide emissions (N<sub>2</sub>O) and 47% of methane emissions (CH<sub>4</sub>). If these non-CO<sub>2</sub> GHG emissions, which are especially relevant for climate change, are aggregated, the specific global significance of livestock farming becomes clear, with a magnitude of 19% to 23% of global nitrous oxide and methane emissions (Reisinger & Clark 2018). These figures for the agricultural sector fail to take account of both emissions from land-use change (LUC) and land use (LU) and emissions from fossil energy consumption on agricultural holdings or emissions from upstream and downstream sectors (agrochemical, food industry, etc.) (Meier 2014). These emissions are allocated to other sectors. If the total complex of Agriculture, Forestry and Other Land Use (AFOLU) change is aggregated, it accounts for just under a quarter of global GHG emissions, at 10 to 12 Gt CO<sub>2</sub> eq/year (IPCC 2018). The same order of magnitude of 25 – 30% is also reported for the global food system (IPCC 2019, Food and Land Use Coalition 2019).

In Germany, agriculture, including emissions from arable land and grassland, accounted for 104 million t CO<sub>2</sub>-eq or 11% of the country's total GHG emissions in 2014 (WBAE & WBW 2016). If the GHG emissions generated by the food system are summarised across the value chain, they account for about 25% of total GHG emissions in Germany and about 30% globally (WBAE & WBW 2016).

Global CO<sub>2</sub> avoidance strategies in the field of food consumption have been presented by FAO (2018a) with a comparison of three scenarios (Fig. 4-29) – with the result that only an agricultural production system based on sustainability, together with a major reduction in methane (beef/dairy consumption) and nitrous oxide emissions (reduced N fertiliser use), should be able to achieve the combined targets of food security and climate change mitigation (< 2° target) by 2050.

**Figure 4-29:** Scenarios of future development of GHG emissions from global agriculture



Source: FAO (2018a: 139), graphically adjusted.

A marked decline in GHG emissions from agriculture in Germany could be achieved primarily by reducing the current **scale of livestock farming** (although the same level of consumption would result in a shift of emissions to other countries), by engaging in a dedicated **protection of peatlands** under agricultural use and by **increasing nitrogen efficiency** (WBAE & WBW 2016). Reducing the scale of livestock farming would also make it possible to reduce the intensity of agricultural land use of drained peatlands. In Germany, these currently provide a key feed base for dairy farming and cattle fattening, but at the same time constitute hotspots of GHG emissions (CO<sub>2</sub> sources). Compared with mineral soils, feed production on drained organogenic soils (bogs, fens) generates emissions that are higher by a factor of 8 to 20. The product-specific carbon footprint (PCF), i.e. the specific greenhouse gas emission per product unit during the product's entire life cycle, is therefore very high, especially for milk or dairy products and beef produced with such feed (Poyda et al. 2016). Yet these drained organogenic soils are as a rule also designated as FFH areas (Fauna-Flora-Habitat areas as defined in the Natura 2000 programme); they thus also provide biodiversity services. In their expertise on climate change mitigation, WBAE and WBW (2016) recommended a peatland protection strategy under which: (1) all peatland areas worthy of protection that are used for agricultural purposes should be provided with basic protection (good professional practice of agricultural peatland use); (2) on areas of higher conservation value, site-appropriate uses beyond the basic level of protection which prevent the degradation of the bogs and, where appropriate, promote biodiversity or water protection targets should be fostered; and (3) areas of highest conservation value should be withdrawn from agricultural use and rewetted.

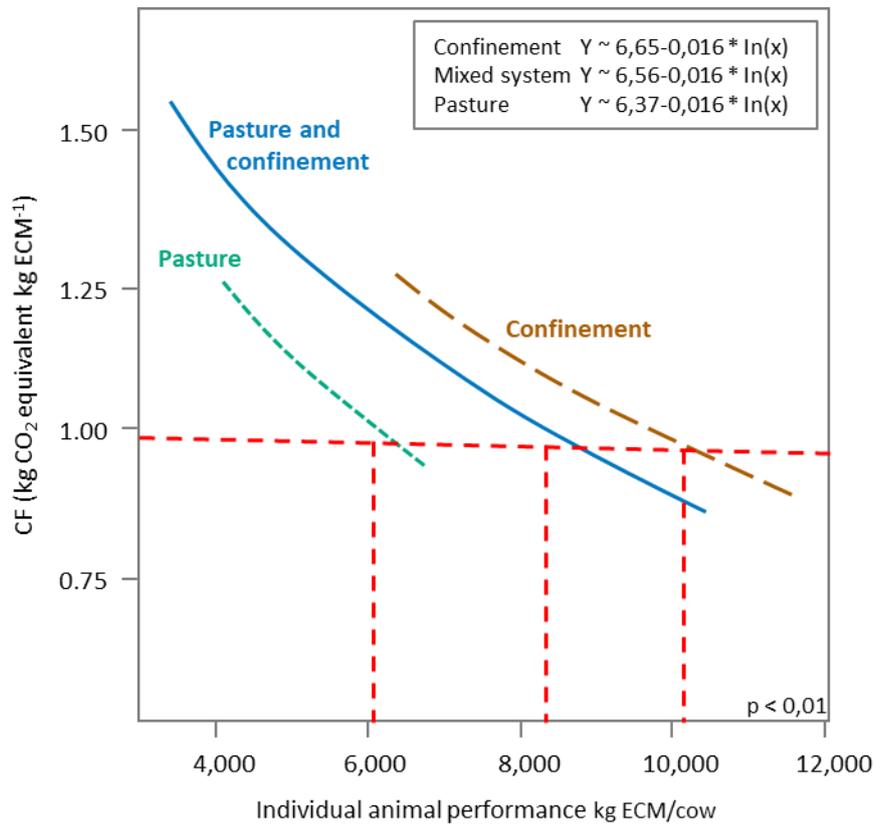
Given that climate change mitigation constitutes the protection of a global good and extensive moorlands are currently managed in a near-natural way (without drainage) in other EU countries, WBAE and WBW (2016) have also, in the context of a pilot project, recommended testing public tendering for climate change mitigation in the northern and north-eastern EU Member States. This could be financed in the post-2020 CAP through earmarked EU budget funds (WBAE 2019). It would thus be possible to contribute at European level to preventing the agricultural intensification of these still intact moorlands, which are mostly used marginally as extensive grassland.

Grassland areas on mineral soils, on the other hand, constitute a long-term carbon sink, with a C storage about 25% to 30% higher than arable land (Jacobs et al. 2018). These grassland areas, e.g. in the German low mountain ranges and in the alpine foothills, are to be regarded as "absolute grassland" (arable land use is not sustainable for ecological reasons such as soil erosion due to slope gradients and economic reasons). There, they do not cause competition over land use with the production of food from arable land (cf. Wilkinson 2009) and also fulfil additional ecosystem services (soil, erosion and water protection as well as the preservation of the biodiversity function). They should therefore continue to be used as permanent grassland. This presupposes utilisation options for the grassland growth. There are options in livestock farming but the options could also include energy recovery.

The example of “permanent grassland” in Germany makes it clear with reference to climate change mitigation that the problem situations and the solution concepts in terms of more sustainable food and feed production are complex.

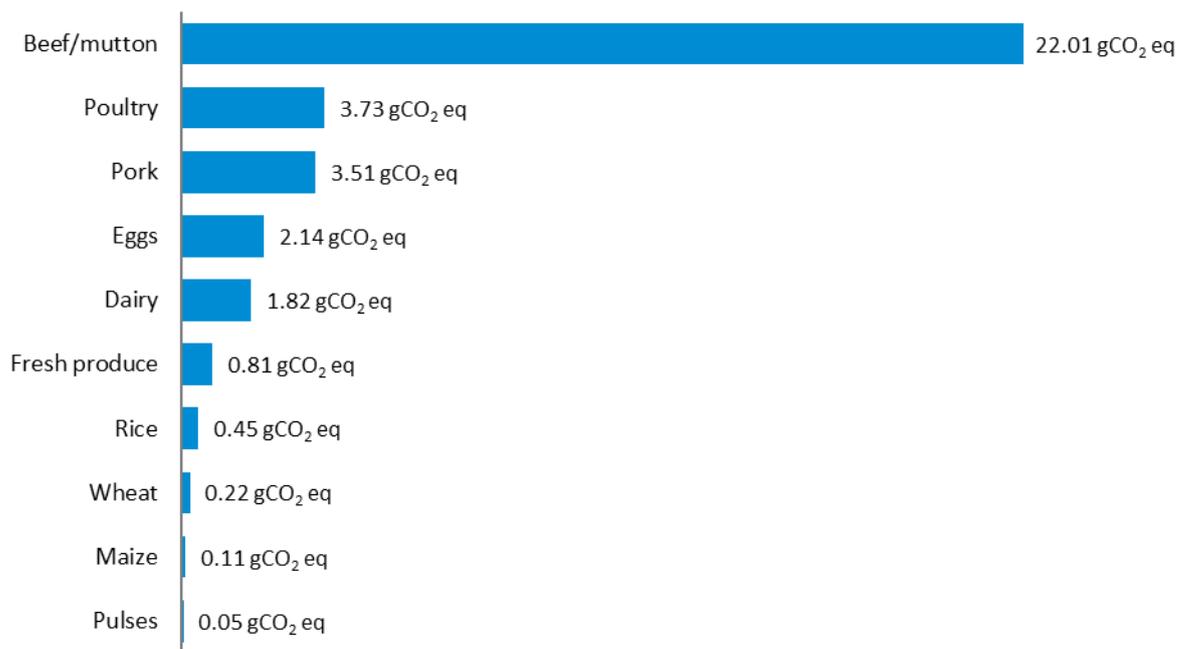
A differentiated approach is also essential with respect to recommendations on the optimal specific intensity. This can be explained using the example of milk production: it is frequently assumed that an increase in individual animal performance automatically means a decline in specific greenhouse gas emissions (e.g. the product carbon footprint (PCF) of milk). However, various analyses indicate that significantly different production systems can result in similarly low specific GHG emissions per kg of “energy-corrected milk” (ECM) under optimal management. In a comparative meta-analysis of the globally available literature on PCF milk, Lorenz et al. (2019) show that a comparably low product carbon footprint (PCF) can be realised both with a herd performance of 10,000 kg ECM per cow/year with year-round indoor housing and concentrated feed use and with 6,000 kg ECM per cow/year in a pasture milk production system (Fig. 4-30). The reason for the comparatively low emissions of milk from pasture farming lies in increased carbon storage on pastures compared with maize (indoor feeding), higher GHG emissions arising from the cultivation of concentrated feed (e.g. soy/rapeseed) in housing systems and significantly lower restocking rates in pasture systems (longer useful life/productive lifetime of cows). Moreover, in contrast to the housing system, the pasture systems usually exert additional positive effects in the areas of biodiversity, lower N surpluses per hectare of forage area and animal welfare, while the housing systems usually show a low nitrogen surplus per kilogram of ECM (Rotz et al. 2005). The global land area needed for foraging per kilogram of ECM is mostly similar in both systems (Taube et al. 2014).

**Figure 4-30:** GHG emissions per kilogram of energy-corrected milk yield (ECM) depending on system and performance



Source: Lorenz et al. (2019), graphically adjusted.

It remains undisputed that the greenhouse gas emissions of products of animal origin are several times higher than those of plant sources, in terms of both the energy units and the protein units (Fig. 4-31). Cutting the share of foods of animal origin in overall consumption at least to a level recommended by many professional societies of nutritional science (e.g. the DGE) would have positive climate change mitigation effects and thus constitutes a central lever for reducing negative climate impacts from the food sector.

**Figure 4-31:** GHG emissions per kilocalorie for different foods

Note: Shown are the (global) average GHG emissions per kilocalorie of food production broken down by food type, measured in grams of CO<sub>2</sub> eq per kilocalorie. The averages are based on a meta-analysis of studies on 742 agricultural systems (emissions included up to the farm gate) and over 90 individual food products (Clark & Tilman 2017).

Source: <https://ourworldindata.org/grapher/greenhouse-gas-emissions-per-kilocalorie-of-food-production> (last accessed: 20.12.2019), graphically adjusted.

#### 4.4.1.2 Crossing planetary boundaries II: Nitrogen cycle and excesses of reactive nitrogen compounds

“Too much of a good thing” is the title of a Nature article (Sutton et al. 2011) that succinctly describes the ambivalence of nitrogen use. On the one hand, according to Sutton et al. (2011), the use of nitrogen results in a multiplication of yields per hectare for cereals. Corresponding productivity gains in crop production over the last century have managed to reduce hunger in the world in the face of a growing world population (Section 4.1). On the other hand, frequent over-fertilisation and low N-utilisation efficiency in crop and especially livestock production, as well as the reactivity of N-compounds in the environment, have caused a sharp rise in environmental nitrogen pollution (the same applies to phosphorus). Bouwman et al. (2013) calculate an increase in global N surpluses from agricultural production starting from 20 million tonnes of reactive nitrogen/year in 1950 to 138 million tonnes in 2000. These N surpluses are to some extent accumulated in the soil or, after the end of the accumulation phase (in Germany’s arable soils since the 1990s (Nieder et al. 2010)), these N surpluses are largely transported to the environmental compartments of water and air, so that N surpluses largely exert their effects in near-natural ecosystems. With the exception of the process of complete denitrification of nitrate into elemental nitrogen, all other

reactive N-compounds in the environment are coupled with negative effects (ammonia and nitrous oxide via the air pathway, nitrate, ammonium and dissolved organic nitrogen via the water pathway). The dominant influence of agriculture in relation to all of the above compounds is undisputed (agriculture, on the other hand, contributes only marginally to nitrogen oxide emissions). Given that individual farmers do not include the external ecological and health costs caused by reactive nitrogen in their business management considerations, the optimal nitrogen fertilisation in economic terms is higher than the optimal one from a societal point of view. Analyses that quantify the scale of over-fertilisation from an economic perspective, as well as quantifying the associated macroeconomic costs, are necessarily subject to large uncertainties, since the evaluation of environmental goods (e.g. “non-eutrophic seas”) and effects on human health are based on numerous assumptions, and the estimation of the agronomic benefits of nitrogen fertilisation is also fraught with large uncertainties. Van Grinsven et al. (2013) state that the health and environmental costs of nitrogen fertilisation in the EU-27 in 2008 were within the range of 35 –230 billion euros per year and the agronomic benefits were in the order of 20 –80 billion euros per year. In contrast, according to Brink et al. (2011) and Sutton et al. (2011), the costs are within the range of 20 to 150 billion euros per year and the benefits are within the range of 20 to 80 billion euros per year (long-term, Brink et al. 2011) or 10 to 100 billion euros per year (Sutton et al. 2011). Van Grinsven et al. (2016) estimate the costs of environmental legislation to reduce nitrogen surpluses for the Dutch agricultural sector to be far lower than the benefits, especially for health, arising from the reduction of air pollutants via ammonia mitigation measures. The estimates indicate that the societal costs of nitrogen fertilisation in the EU are substantial and may far exceed the benefits, depending on the assessment of environmental and health effects. A significant reduction of nitrogen balances in the German agricultural sector is therefore not only urgently required to achieve the goals of the German Sustainability Strategy (see below), but also justified in economic terms.

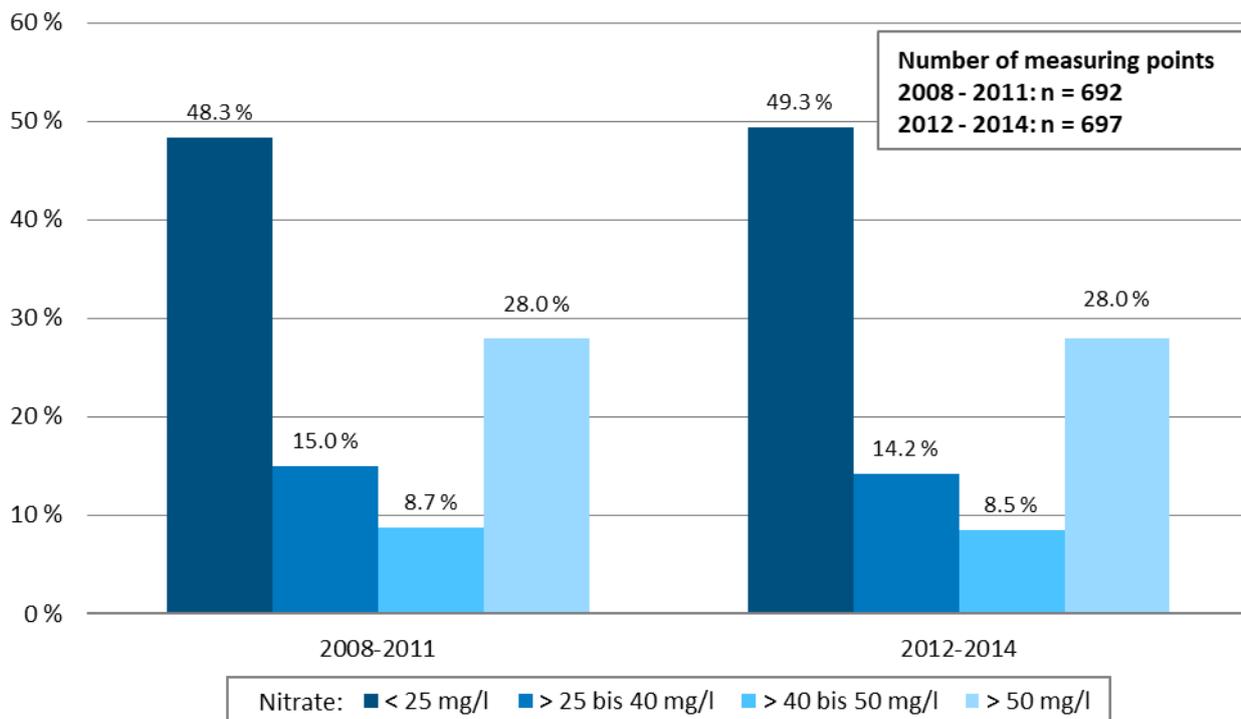
Sectoral nitrogen surpluses in German agriculture have decreased from 111 kg N/ha on average over the five-year period 1991 – 1995 to 94 kg N/ha in the period 2013 – 2017 (UBA 2019a). The target value of a maximum of 80 kg N/ha/year for the average of the years 2009 – 2011 from the German Government’s Sustainability Strategy of 2002 has never been reached. In the new edition of Germany’s Sustainability Strategy of 2016, the target for the reduction of the nitrogen surplus in the overall balance for Germany was set at an annual average of 70 kg N/ha agricultural land between 2028 and 2032. This target value was updated in the 2018 update of the strategy (Federal Government 2018: 53, Indicator 2.1a).

Around half of the sectoral nitrogen surpluses from German agriculture result from land use (the land-area balance) and half from livestock husbandry (the livestock housing balance). However, if the forage areas, which are included in land use (around 65% of agricultural land), are attributed to the livestock husbandry system as they should be, the share of animal husbandry is in the order of over 75% of the sectoral N surplus.

With regard to the loss pathways of these N surpluses, nitrate nitrogen plays a dominant role, accounting for around 40% of the total surplus via the leachate pathway. This nitrate pollution of

leachate has only been of greater relevance since the 1970s and reached a peak at the end of the 1980s, before the European Community, with the EC Nitrate Directive (Directive 91/676/EEC) in 1991, required the Member States to take action with the aim of “reducing water pollution caused or triggered by nitrates from agricultural sources and preventing further water pollution of this kind” (Art. 1). Pursuant to Article 10 of the Directive on the protection of waters against pollution caused by nitrates from agricultural sources (EC Nitrates Directive), Germany is obliged to submit a report on the implementation of the Nitrates Directive to the European Commission every four years. The report describes the status and development of water pollution for groundwater, surface waters and coastal waters.

**Groundwater** is Germany’s most important drinking water resource. The pollution of groundwater with nitrates is shown representatively for Germany on the basis of the so-called EUA monitoring network (European Emission Allowances) (BMUB & BMEL 2017). Nitrate levels in groundwater are recorded by the federal states for the reports on the status of groundwater in Germany that are submitted to the European Environment Agency. In addition, since the 1990s the federal states have been using the EU nitrate monitoring network (“pollution network”) to demonstrate the trends of nitrate pollution on farmland in order to document the reduction of agricultural inputs (and compliance with the EU Nitrates Directive) over time. This network of measuring points, which alone is relevant for the implementation of the Nitrates Directive, has been expanded to 697 measuring points over the past five years in order to ensure representativeness for the area of agricultural land use in Germany. The natural background levels for nitrate, i.e. the natural pre-existing pollution in groundwater, range between 0 and a maximum of 10 mg/l. Levels ranging between 10 and 25 mg/l are indicative of low to medium anthropogenic pollution. Concentrations between 25 and 50 mg/l indicate heavy groundwater pollution. Once the threshold value of 50 mg/l specified in the Groundwater Ordinance and the Surface Water Ordinance has been exceeded, the groundwater is in poor chemical condition. According to the Drinking Water Ordinance, this value is also the limit value for drinking water and should be complied with at all measuring points (Federal Statistical Office 2017b). The 2016 Nitrate Report shows the pollution of agricultural land in the years 2008 to 2014 (Fig. 4-32).

**Figure 4-32:** Development of nitrate levels in the new EU nitrate monitoring network

Source: UBA (2019b), graphically adjusted.

If one compares the last two reporting periods, marginal positive changes are evident, but overall no reduction in nitrate contamination of groundwater of agricultural soils can be detected nationwide in the new EU nitrate monitoring network either.

The Federal Environment Ministry summarises the development of **surface water pollution** in the 2016 Nitrate Report as follows (BMUB & BMEL 2017):

- at most measuring points for flowing waters, a slight to major decrease in nitrate concentrations is evident in the years 2011 to 2014 compared with the first survey period 1991 to 1994. The share of measuring points showing very high (IV) to elevated (III) contamination levels has fallen significantly since the mid-1990s. This is chiefly due to extensive investment in municipal and industrial wastewater treatment plants. Accordingly, the relative share of agriculture in the pollution has increased.
- Just under 74% of the measuring points in lakes in Germany had a nitrate-nitrogen level of below 1 mg/l in 2014. This share has by and large remained unchanged since the mid-1990s. Only approximately 12% of the values were in a moderate or bad condition. The trend over the years thus shows a clear improvement for lakes in Germany (ibid.).
- On the German Baltic Sea coast, nitrate concentrations at the measuring stations are highest near the coast and especially near the river mouths because of the high riverine nutrient inputs,

while they decrease towards the open sea. In the 2011 to 2014 period, the concentrations recorded were lower than in the 2007 to 2011 assessment period, but higher than in 2003 to 2007. The guidance values for total nitrogen are largely complied with at three of the measuring stations, while at the other four stations the value is exceeded, in some cases very significantly. The assessment of the eutrophication of the German Baltic coastal waters and the Baltic Sea is carried out in the context of the Helsinki Convention. For the 2007 to 2011 period, the entire open Baltic Sea was designated as eutrophic, and the near-coastal waters of the North Sea in the German Bight are also mostly not classified as being in a “good condition”.

To sum up, the situation of water bodies in Germany must be viewed in a differentiated manner: While rivers and lakes have seen a significant improvement, especially with respect to phosphate, chiefly due to the improved purification of municipal wastewater (point sources), both the situation with regard to groundwater under agricultural land use and the situation in coastal marine areas (largely due to nutrient loads via the rivers from diffuse sources of agriculture) are still insufficient in terms of the implementation of EU environmental standards, in spite of certain improvements. The European Commission is currently pursuing infringement proceedings against Germany for incomplete implementation of the Nitrates Directive. In February 2019, Germany promised the EU Commission a renewed revision of the fertiliser legislation amended in 2017 in order to implement the targets of the Nitrates Directive (BMEL 2019d) and presented further proposals to the EU Commission in September 2019 and most recently in February 2020 to adapt the Fertiliser Application Ordinance (BMEL 2019e). The Advisory Board still considers an improvement of the Fertiliser Ordinance amended in 2017 to be necessary as far as water protection is concerned (WBAE 2019: 5).

#### 4.4.1.3 Crossing planetary boundaries III: Biodiversity

Biodiversity comprises the diversity of ecosystems, of species and of the genetic diversity within these species (Art. 2 of the International Convention on Biological Diversity, UN 1992). This multi-dimensional diversity has an impact on the structures of ecosystems and the processes that take place within them, and thus on ecosystem functions and ultimately ecosystem services<sup>121</sup>, which ultimately benefit humans (Kehl 2014, Hansjürgens 2015, Elmqvist et al. 2010, Haines-Young & Potschin 2010). Ecosystems – and thus also living organisms as their constitutive elements – provide goods and services on which humans are crucially reliant and whose value can in part also be estimated economically (National Academy of Sciences Leopoldina et al. 2018: 7). Thus, Oré Barrios et al. (2017) estimate the economic value of beekeeping in Germany for the pollination service of agricultural crops at up to 1.6 billion euros annually. Many inconspicuous animal species and microorganisms are key for the functioning of an agro-ecosystem: control pests, recycling nutrients, and eating plants and seeds. Flower strips and hedgerows provide important habitats for these organisms. High biodiversity is necessary for the stability of such services. For instance, the more diverse an ecosystem is in terms of species, the lower the frequency of pathogens and parasites in

---

<sup>121</sup> The concept of ecosystem services has now gained major importance for biodiversity conservation policy (Hansjürgens 2015, Kehl 2014).

plants and animals (National Academy of Sciences Leopoldina et al. 2018: 7). Moreover, biodiversity contributes to the experiential and recreational value of landscapes, which is vital for human well-being. An increasing number of studies show links between biodiversity and psychological and physical health in humans (cf. National Academy of Sciences Leopoldina et al. 2018: 8).

Some time ago (2001 to 2005), the Millennium Ecosystem Assessment<sup>122</sup> and, more recently, the Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services (IPBES 2019) addressed biodiversity status and trends. These studies, which involved several thousand scientists, identified the main reasons for biodiversity loss. **Agricultural and forestry land uses are at the top of the list of causes of ongoing biodiversity loss**, both internationally and nationally (BMU 2018). This was not always the case – for centuries, agriculture was, in shaping landscapes, the guarantor for the biodiversity of these agricultural landscapes in Europe. Until the 1950s, these had been characterised by diverse habitat structures with extremely limited nutrient inputs of nitrogen and phosphorus.

The decline in animal and plant species over the last 50 years has been caused by an interplay of many factors (Kehl 2014). Even though the land-sealing construction of settlements and transport routes is frequently regarded as playing a major negative role in nature and landscape conservation, agricultural and forestry use in its entirety has a much greater impact on the biodiversity status. The individual field or forest cut is not the central problem here, but rather the accumulation of the multitude of interventions, emissions and changes in the plant population on agricultural and forestry areas, which together account for more than 80% of Germany's land area.<sup>123</sup>

The loss of habitats takes place primarily through landscape change. In Germany, the area covered by settlements and transport routes increased by an average of 58 ha/day between 2014 and 2017, which is thus well above the 30-hectare target for 2020 (UBA 2019c). The most direct form of influence in the 1950s to 1970s was the reclamation and conversion of natural land into arable land, grassland or forests through land consolidation and amelioration. Even if this was done decades ago for most areas, land consolidation and amelioration measures are still taking place on a significant scale. The development described above has been exacerbated over the past 15 years by the promotion of bioenergy, which in many cases has contributed to a narrowing of the production spectrum and a further scarcity of near-natural land. These developments have resulted in an increased dominance of crop rotations with few but high-yielding crops in arable farming (winter wheat, winter barley, rape) as well as an increasing cultivation of maize, especially in regions with intensive biogas production and livestock farming, often in permanent cultivation over many years. Due to a rise in farm units and cultivated areas, there is a change in farming practices in favour of arable crops covering large areas. Given that the land is harvested at the same time, birds and other wildlife can no longer find refuge. Last but not least, the phasing-out of the so-called compulsory set-aside under the EU's agricultural policy in 2008 was another mosaic stone in the causes

---

<sup>122</sup> See <https://www.millenniumassessment.org/en/index.html>.

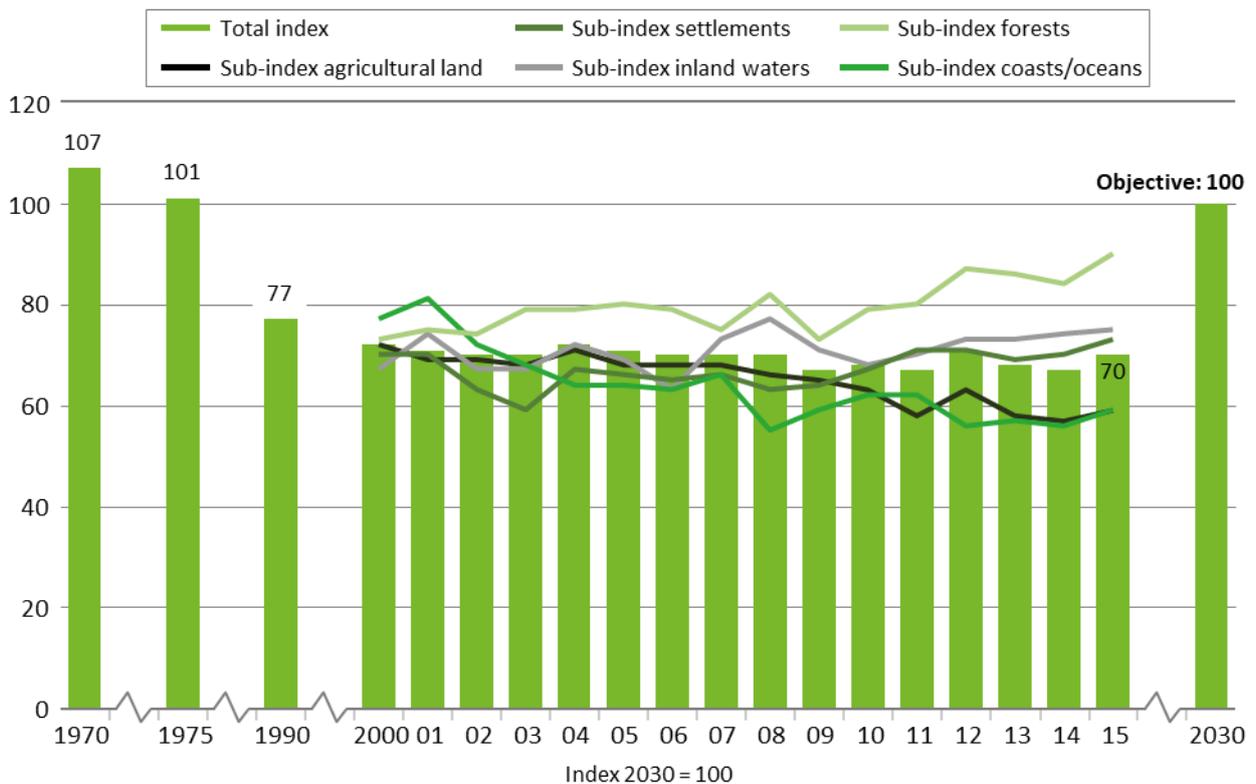
<sup>123</sup> In 2017, 50.9% of Germany's land area was used for agricultural purposes and 29.7% for forestry (Federal Statistical Office 2018c).

of the additional loss of important habitat structures in the landscape. The disappearance of rows of trees, hedges and field copses, cairns or loose stone walls, extensively managed margins and fallows caused a loss of structural diversity in the landscape and thus the loss of food, nesting sites and hiding places for birds, wild bees, spiders and other animals. The lack of size and connectivity of protected areas in the agricultural landscape (e.g. extensively managed grassland) promotes the decrease of insect populations or prevents recolonisation.

Biodiversity loss is not limited to areas outside protected areas, but also takes place within protected areas (National Academy of Sciences Leopoldina et al. 2018: 2). Contributing factors include the input of nutrients from fertilisation and pesticides from surrounding areas into protected areas, especially if there is a lack of buffer strips around protected areas.

Finally, the significant intensification of cultivation on farmland since the mid-20<sup>th</sup> century has had a negative impact on biodiversity. The intensive use of fertilisers and pesticides should be stressed. The widespread application of herbicides, fungicides and insecticides as well as high mineral and manure fertilisation on intensive grassland are deemed to be the causes of the decline of plant species and insects that rely on nutrient-poor soils. The sum of these causes has led to a situation where the decline in populations of target indicators of biodiversity in agricultural landscapes (e.g. farmland birds) is now much more pronounced than in non-agricultural landscapes (Fig. 4-33); the negative trend of this development is unbroken.

**Figure 4-33:** Biodiversity and landscape quality



Source: Federal Statistical Office (2018d: 106), graphically adjusted.

The loss and degradation of natural biotopes and so-called “high nature value” areas in the agricultural landscape is apparently continuing. Countermeasures such as the creation of a biotope network system by the federal states on 10% of the federal state area, as prescribed in the Federal Nature Conservation Act (BNatSchG), the government strategy on biological diversity and the establishment of the Natura 2000 network of protected areas (15.4% of the federal area) have so far not brought the hoped-for success. Efforts have also been made since the mid-1990s to increase biodiversity by implementing a series of agri-environmental measures. The efforts have hitherto not been sufficient to reverse the trend. In its expertise “Designing an effective agri-environmental-climate policy as part of the post-2020 EU Common Agricultural Policy”, the WBAE has therefore made proposals for a target-oriented agri-environmental policy within the CAP context (WBAE 2019).

#### 4.4.1.4 Other environmental impacts of primary agricultural production (soil protection)

The transgressions of planetary boundaries outlined above in the categories of climate, nitrogen and biodiversity are all closely linked to the soil factor. Soils are, among other things, carbon (climate change mitigation) and nutrient (N) reservoirs, and the importance of intact soils for biodiversity is only gradually emerging for researchers (“The Hidden Half of Nature”, Montgomery & Biklé 2015). Accordingly, soils have a variety of different characteristics, potentials and functions.

One of the natural soil functions mentioned in the Federal Soil Protection Act is the **habitat function** for humans, animals, plants and soil organisms. It includes all life on and in soils as well as its biological diversity and therefore goes beyond the traditional interpretation of soil as a site for plants. Soil animals and soil microorganisms are of vital importance for both soil formation and the maintenance of certain soil functions (Marahrens et al. 2015: 68). Due to their filtering and buffering capacity, soils can act as **sinks** for pollutants released into the environment, such as heavy metals or persistent organic compounds, and prevent them from entering groundwater or being taken up by plants. Pollutants are filtered out of the leachate and bound to the soil organic matter and clay minerals. The buffering neutralises acidifying inputs of sulphur and nitrogen compounds and thus prevents an acidification of soils. However, pollutants can only be accumulated and bound until the storage capacity of the soils is exhausted. If the filtering and buffering capacity of soils is exceeded, pollutants are mobilised and shifted into the groundwater or increasingly absorbed by plants, so that they can also enter the food chain (Marahrens et al. 2015: 19).

The overexploitation of soils, mostly in the form of overgrazing by livestock, plays a major role around the globe, especially in semi-arid and arid areas, resulting in rapidly increasing desertification processes and thus the loss of land that could be used for agricultural purposes (IPCC 2019). In contrast, the degradation and erosion processes of arable soils in these globally dominant arid regions have been reduced to a significant degree due to the almost global use of “no-till” practices (conservation tillage) since the mid-1980s and the related abandonment of the use of ploughs. However, such ploughless systems have to date often only worked in combination with the use of

total herbicides. The downside of such systems is increasingly often seen in the form of herbicide-resistant weeds in combination with increasing subsoil acidification (cf. Vieira et al. 2008). In the meantime, there are approaches worldwide that implement a more sustainable use of “no-till” practices, mostly based on an integrated use of land with perennial forage crops combined with cash crops (Integrated Crop Livestock Zero Tillage Systems, FAO 2007). Although these approaches have to date only gained limited importance overall, they have recently been debated more intensively, especially in relation to required certification systems for documenting sustainable soy cultivation in South America, e.g. in the form of the Round Table on Responsible Soy (Schouten et al. 2012).

In Germany, the first Soil Protection Act was enacted in Baden-Württemberg in 1991. This was followed in 1999 by the less ambitious Federal Soil Protection Act. At European level, there have so far been only declarations of intent (EU COM 2006) on soil protection. The United Nations integrated soil protection into the Desertification Convention by redefining the term “desertification” (Herrmann 2018). The FAO has recognised the importance of soil protection and organises annual meetings through the European Soil Partnership (ESP) and the Global Soil Partnership (GSP) for cooperation and joint further development of soil protection.

The question of the status of soils in Germany is not easy to answer – due to the lack of systematic monitoring. Although the latest comprehensive soil status survey carried out by the Thünen Institute (Jacobs et al. 2018) has estimated the amount of carbon stored in soils in high spatial resolution, there is still a lack of long time series. The Germany-wide inventory has shown, among other things, that the agricultural soils in Germany currently store 2.5 billion tonnes of carbon in the top metre. This is eleven times as much carbon as Germany emitted in CO<sub>2</sub> in 2016 (Jacobs et al. 2018). Even though there are hardly any comprehensive long-term data series available, it can be assumed that the soil carbon stocks and thus also the soil fertility on many sites has increased significantly over the past 50 years in Germany, in particular due to the doubling of the tillage depth from approx. 15 cm in the 1950s to approx. 30 cm by the 1990s and the related carbon input. The importance of the soil carbon pool, in addition to the role it plays for soil fertility and plant growth, is particularly relevant in connection with global climate change mitigation targets. The “4 per thousand” (“4 per 1,000” or “4 ‰”) initiative was presented by the French government during the international climate negotiations in Paris in December 2016 (COP21). It focuses on the sink function of soils for CO<sub>2</sub>: according to this, an additional storage of 4 ‰ more soil organic matter per year in all soils around the globe could (in theory) largely offset the current global, anthropogenic greenhouse gas emissions. The initiative is trying to raise the awareness of as many states as possible, as well as non-governmental organisations, companies and institutions, of the issue of “climate change mitigation and 4 ‰ through the storage of organic carbon in soils”. While it is likely that the potential of additional storage to the order of 4 parts per thousand is overestimated due to the time-limited effectiveness and reversibility of climate change mitigation effects in the agricultural sector (Jacobs et al. 2018, Chambers et al. 2016), this initiative has nevertheless turned attention towards the importance of soil functions and soil fertility for a globally sustainable land use and food system.

With respect to the specific relevance of food systems for carbon storage in soils, available data for Germany indicate that permanent grassland has a C storage capacity, which is about 25–30% higher than arable land (Jacobs et al. 2018, Reinsch et al. 2018). The conversion of arable land to grassland can be a sensible measure on sensitive sites (e.g. erosion exposure). The grassland growth can be used as animal feed or for energy generation. However, it is undisputed that soil fertility and thus a stable value of organic soil carbon can also be safeguarded by other management measures in crop rotations without forage crops. Maintaining soil fertility without livestock husbandry would thus theoretically be possible in principle in the moderately humid climate of Central Europe.

In the earth's arid regions, desertification through overexploitation plays a central role in the loss of soil functions and ultimately of agricultural land. In the humid areas of Central Europe, agricultural land use is also to blame for the loss of soil functions. Here, erosion processes (water and wind erosion) and soil compaction play a central role. Vehicles and machines in the agricultural and forestry sectors have become increasingly powerful in the past. The consequence of this is a steady increase in weight. In extreme cases, soils have to bear vehicle weights of up to 60 tonnes. In comparison, the Road Traffic Licensing Regulations (StVZO) for German roads only provide for an upper limit of 44 tonnes. A combine harvester can weigh up to 27 tonnes, a beet harvester for harvesting sugar beet up to 60 tonnes and harvest transportation can weigh up to 40 tonnes (Marahrens et al. 2015). Nationwide uniform measurement results on the scale and development of compaction are not available. Point measurements and structural examinations from the federal states allow the conclusion that, depending on the soil type, anthropogenically caused impairments due to compaction occur on around 10 to 20% of the arable land (Marahrens et al. 2015, Fleige et al. 2017). This applies equally to arable and grassland sites.

Soils play a major role in regions with intensive livestock farming because of their filtering function against inputs of veterinary medicinal products and antibiotics. Over 150 active pharmaceutical ingredients have so far been detected in the environment in Germany. Since some of the active ingredients are used both in humans and in domestic and farm animals, it is not always possible to distinguish which application the active ingredients found in the environment originate from. Veterinary medicinal products can have an impact on the natural environment, e.g. on plants and animals. Antibiotics, antiparasitics and hormonally active substances are particularly relevant to the environment. However, the risks are difficult to estimate due to the fact that current knowledge is fragmentary (Kemper et al. 2017 and Section 4.2.4).

#### 4.4.2 Environmental effects at the further stages of the food value chain including losses

For most foods, the environmental impacts of primary production far exceed those of processing, storage and transport. For some foods, however, the reverse is true. When it comes to the environmental assessment of food, therefore, the **entire life cycle of a product** must be considered,

ranging from the production of agricultural inputs (such as fertilisers) to the consumption of the food (including waste) (cf. Fig. 4-26 and Section 5.3.3). Since a complete presentation of the environmental effects in the value chain would go beyond the scope set here and the available data are limited, the interrelationships will be outlined chiefly in respect of climate relevance (which has been investigated to a greater extent). With respect to greenhouse gas emissions in Germany, the WBAE, together with the WBW (WBAE & WBW 2016), presented a rough estimate of the significance of various stages of the value chain in its expertise. According to this, transport and trade account for 14 million tonnes of CO<sub>2</sub> eq/year, processing for 21 million tonnes, and packaging for 18 million tonnes. In comparison, the agricultural sector accounts for 108 million tonnes (without land use effects, WBAE & WBW 2016: 29).

In addition to the GHG effects, the reduction of food losses is a central issue for the alleviation of environmental impacts in the value chain up to the consumers. In Germany, the total food waste volume in 2015 accounted for approx. 11.9 million t of fresh mass, with the agricultural sector accounting for 1.36 million t (12%), processing for 2.17 million t (18%), trade for 0.49 million t (4%), away-from-home catering for 1.69 million t (14%) and private households for 6.14 million t (52%) (Schmidt et al. 2019a). In 2019, the Federal Government pledged to lower (halve) these quantities in the national strategy to reduce food waste. This target is also included in other national and international agreements (incl. SDG 12.3).

The share of food waste that is in principle (theoretically) avoidable in Germany is estimated at around 50% (Schmidt et al. 2019a), whereby the avoidance potential in the value chain is estimated to be higher in percentage terms than that at the consumer level, although in absolute terms the latter accounts for the largest block (see Fig. 4-34). In recent decades, the losses that occurred in the agricultural sector and in the further processing and trade stages have fallen, at least in the industrialised countries, due to enhanced technologies, while the losses at the consumer level (section 4.4.3) have increased (Bovay & Zhang 2019).

In agriculture, many food losses<sup>124</sup> are deemed avoidable. In various studies for Germany, the average food losses from farm to fork are estimated at 20% and more, although for produce such as apples, where there is an adequate processing line for visually deviating products (here: juice), the losses are, at less than 5%, much lower than for many types of vegetables, which have losses of over 30%, as many of these products are rejected during sorting and processing and are often only channelled to inferior forms of utilisation (Meyer et al. 2018).

---

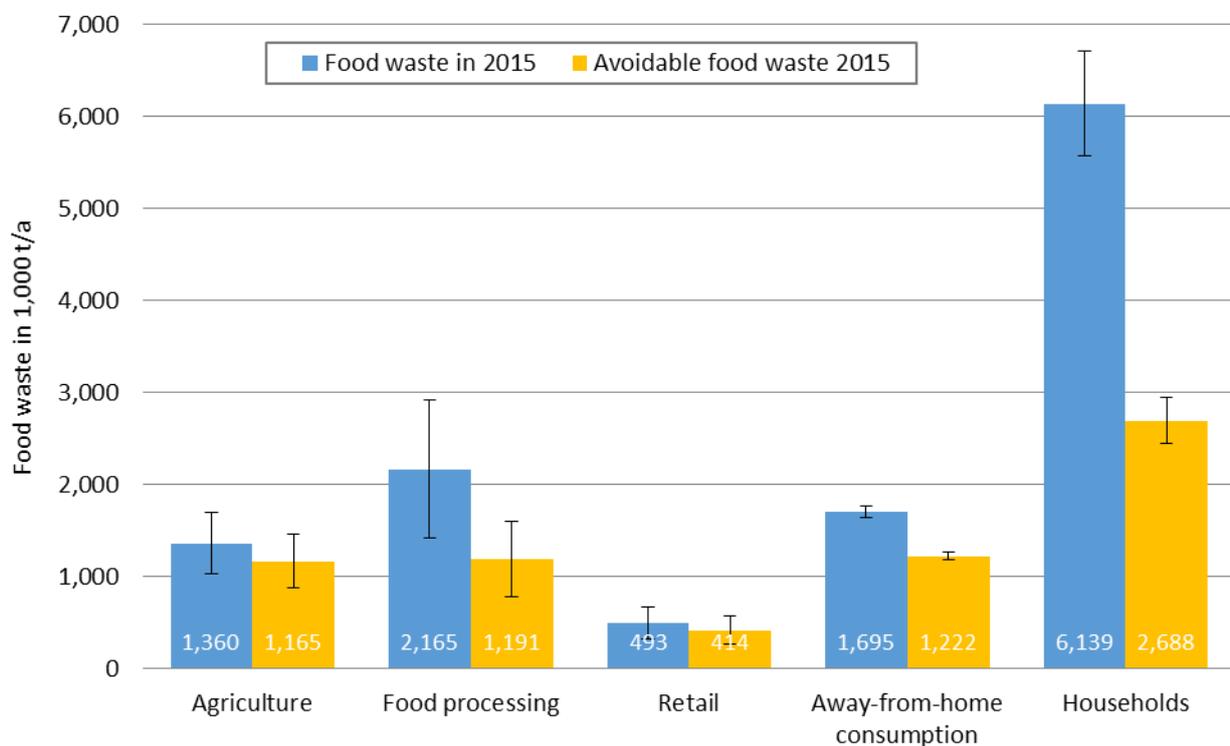
<sup>124</sup> The terms food losses and food waste are in some cases used synonymously in the literature; other authors, following FAO (2011), distinguish between food losses, meaning losses by the producers (along the value chain up to processing) and food waste, meaning the consumer-related fields (trade, away-from-home, consumers). In legal literature, food waste is defined as food losses that occur after harvesting and correspond to the waste concept, i.e. that actors want to or have to get rid of, whereby recycling as animal feed is excluded. In this expertise, the terms food losses and food waste are used synonymously for reasons of simplification.

The causes of high food losses in the agricultural sector differ but are often (partly) caused by requirements of the subsequent stages of the value chain. Important causes include (Meyer et al. 2018):

- increasing demands regarding the appearance of the products,
- non-lucrative marketing due to e.g. seasonally low prices at harvest peaks,
- safety margins on the part of the farmers in the volume they produce, in order to be able to definitely supply large-scale demanders in industry and trade in compliance with their contracts,
- problems caused by extreme weather events and
- diseases and pests.

Other causes of food losses in the value chain will be addressed in the following sections.

**Figure 4-34:** Food waste in Germany 2015 and share of avoidable losses (1,000 t/a)

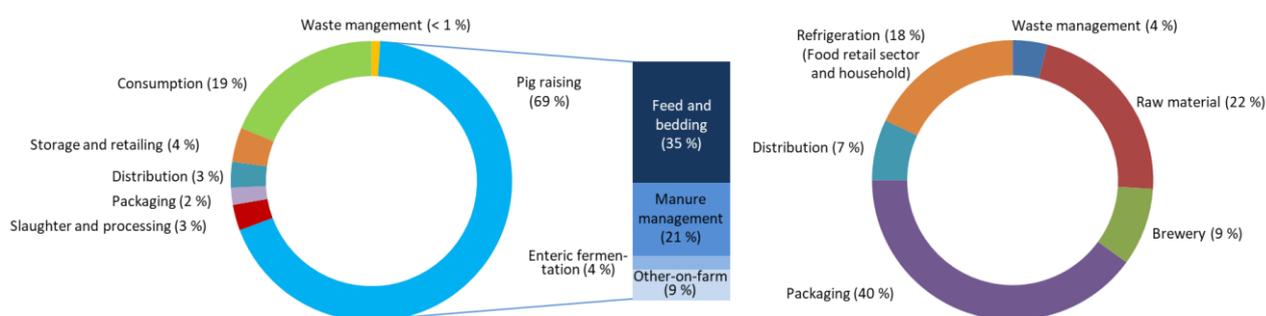


Source: Schmidt et al. (2019a: XIV), graphically adapted.

### 4.4.2.1 Processing

Food is processed to varying degrees, from simple separation, cleaning and packaging processes for fruit and vegetables to ready-made meals. Accordingly, the environmental effects of processing methods differ for different products. Figure 4-35 demonstrates this on the basis of the example of greenhouse gas emissions from pork on the one hand and beer on the other. In the case of pork, agricultural production including feed is chiefly responsible for the greenhouse gas impact; in the case of beer, it is production, packaging and the downstream stages.

**Figure 4-35:** Average greenhouse gas emissions of pig production compiled from various literature sources (left-hand side) and CO<sub>2</sub> balance of beer (right-hand side)

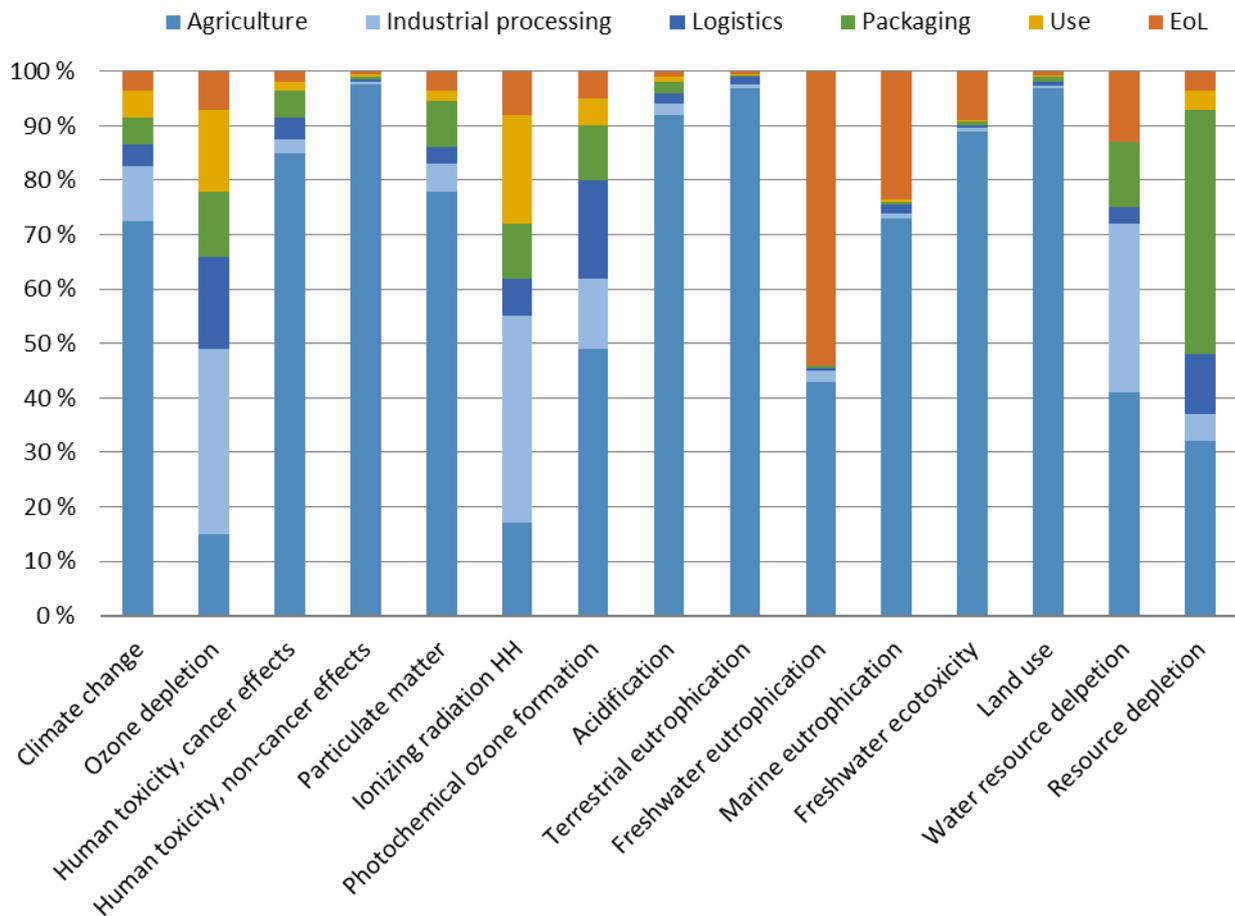


Source: Heller (2017b, c), translated and graphically adjusted.

All in all, the share of food processing (excluding the first processing stage, such as grinding, slaughtering, milk pasteurisation, etc., and without packaging and transport, see below) accounts for just under 3% of total greenhouse gas emissions along the value chain, according to calculations by Mohareb et al. (2018) based on a literature review (primarily with US data). Using different distinctions and related to a variety of environmental indicators, Notarnicola et al. (2017) calculate the environmental impacts of a food basket for an average household shown in Figure 4-36 and arrive at slightly higher GHG emissions for the food industry. In addition, ozone depletion and water consumption play a significant role as pollutants in the food industry (irradiation is of no importance in Germany).

Industrial food processing has advantages and disadvantages from an environmental policy perspective. In contrast to processing at home, additional process steps are often added, for instance to ensure the transportability and storability of the food. On the other hand, industrial manufacturing employs efficient production technologies and, similarly to the economic benefits of large production plants (economies of scale), to some extent also achieves so-called “ecologies of scale” (Schlich & Fleissner 2005) by reducing the energy input per product. Apart from the size of the production plant, the production technology also plays a key role (Jungbluth & Demmeler 2005). Overall, cooking at home usually involves higher energy use compared with industrial production, but packaging use will be lower when raw products are processed at home.

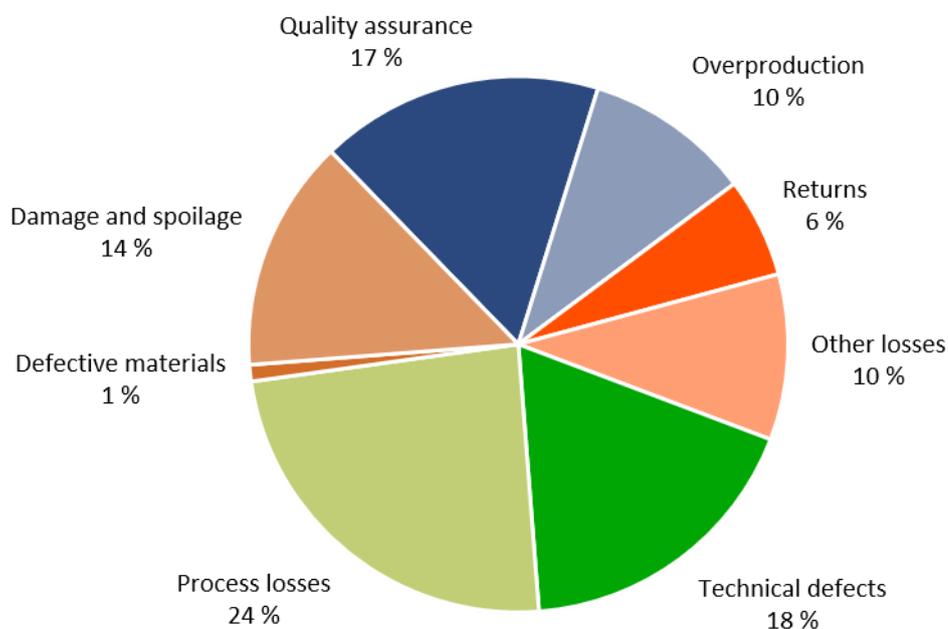
**Figure 4-36:** Environmental strain of a food basket – Relative contribution of the six life cycle stages to the effect of the whole basket



Source: Notarnicola et al. (2017: 761), graphically adjusted.

At around 2.2 million tonnes, the food industry records the highest **food losses** in the value chain; only at household level is there more waste (Schmidt et al. 2019a: 51). In addition to beverage production, the high losses in the production of bakery and pasta products is particularly striking at almost 700,000 tonnes (ibid.). In a – non-representative – survey among 100 food producers, the Thünen Institute identified the causes of food losses set out in Figure 4-37 (Schmidt et al. 2019a: 50). The authors see opportunities for reduction chiefly in the fields of process losses, damage/ spoilage, overproduction and retail returns.

**Figure 4-37:** Causes of waste generation in the food processing industry based on a company survey



Source: Schmidt et al. (2019a: 50), graphically adapted.

#### 4.4.2.2 Cooling

At the processing and retail stages, but also during transportation, the refrigeration of food causes a significant impact on the climate. Estimates from Great Britain state that refrigeration accounts for around 2.5% of the entire GHG emissions caused in the country (cf. Garnett 2011). These are caused on the one hand by the energy needed for stationary operation and logistics and on the other hand by the refrigerants (hydrofluorocarbon). However, the turnover of refrigerated food is higher in the UK than in Germany. Therefore these values can only to a limited extent be transferred to Germany.

If one compares the GHG emissions released by frozen products and corresponding fresh or self-prepared foods, taking into consideration the upstream chains, main processes (e.g. cultivation, processing, distribution, purchasing and preparation) and the downstream chains (e.g. disposal of waste, wastewater treatment), there is no significant difference in the overall GHG emissions, according to a joint study by the Öko-Institut and the Deutsches Tiefkühlinstitut (Öko-Institut & dti 2012). However, only finished products or elaborately packaged products (e.g. canned/jarred peas) were compared with the corresponding refrigerated goods; there was no comparison with unpackaged raw produce (e.g. loose peas), which have significantly lower GHG emissions (unless there are very high food losses due to spoilage). Yet, ultimately the findings of such comparisons heavily

depend on the assumptions made. Therefore, different studies can reveal sometimes quite significant differences (WBAE & WBW 2016).

Refrigeration and deep-freezing can therefore have a major impact on the environmental balance of food. However, for reasons of food safety and in order to avoid food losses, full compliance with the cold chain is key for perishable goods. The use of **energy-efficient equipment** (e.g. avoiding open freezers in the retail sector) offers a significant approach to reducing energy consumption, alongside the **optimisation of logistics chains**. Rising electricity prices in the context of climate policy constitute the central lever here to give enterprises incentives to innovate.

#### 4.4.2.3 Packaging

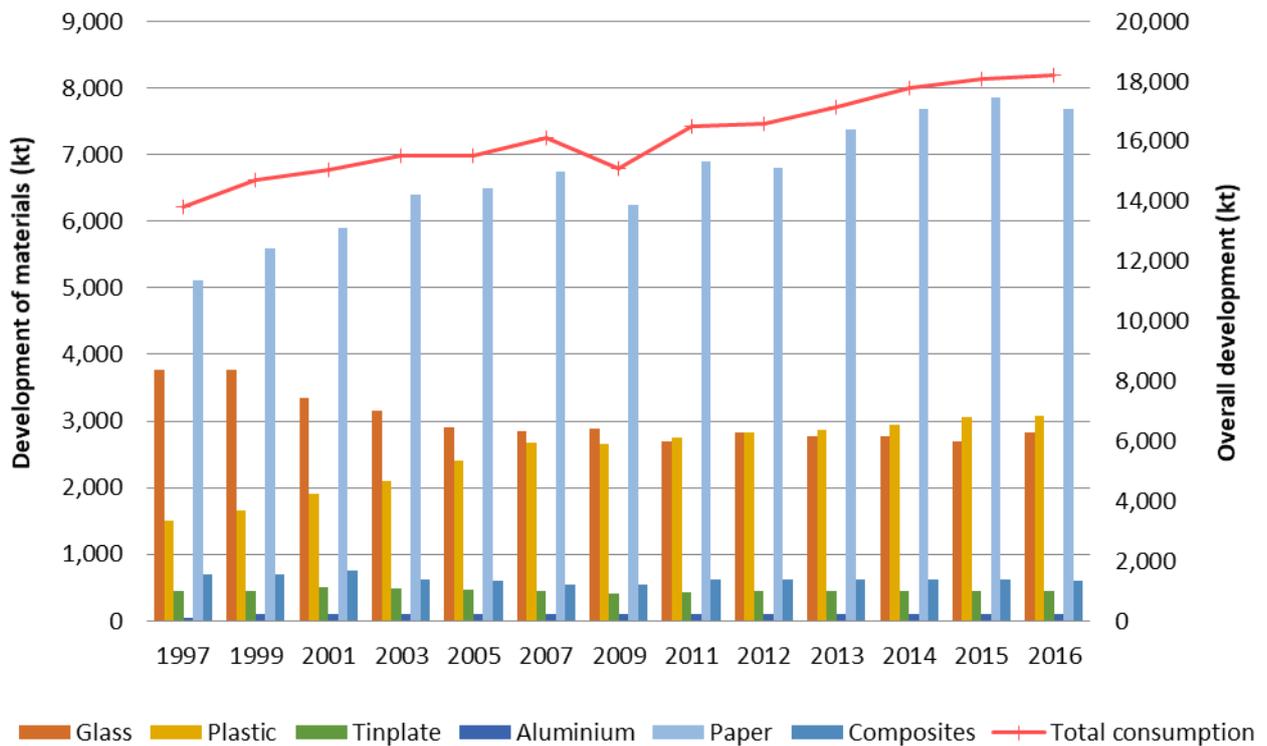
Packaging technology must on the one hand ensure the protection of foodstuffs and at the same time meet requirements such as low energy consumption, low material costs, social and ecological compatibility as well as provisions with regard to pollutants and disposal. Food is the only product group that is typically consumed several times a day by everyone. Food packaging therefore generates the largest volume of total packaging waste (Hunt 1990).

Food packaging can delay quality loss, extend shelf life and ensure food safety. In the process, packaging offers protection against external chemical, biological and physical influences. Glass and metals provide an almost absolute barrier against chemical and other environmental influences. Plastic packaging offers a wide range of barrier characteristics, but is, in general, more permeable than glass or metal. Biological protection provides a barrier against microorganisms, insects, rodents and other animals, thus preventing disease and spoilage. Biological barriers also maintain conditions to control senescence (ripening and ageing). Physical protection minimises changes in composition caused, for instance, by humidity, high temperatures or light. Furthermore, it must be taken into account that packaging makes it possible to convey information (WBAE & WBW 2016). Finally, packaging also fulfils a marketing function, given that food is nowadays predominantly sold in self-service systems and visibility on the shelves is central to sales success. There are therefore massive economic incentives to use eye-catching materials and material combinations (which renders recycling more difficult, Schweitzer et al. 2018) and in some cases also to use oversize packaging (“overpackaging”).

At 220.5 kg per capita (2016), **packaging waste** in Germany is particularly high compared with the EU average (167.3 kg), and the figure has also risen relatively continuously in recent years (1991: 192.3 kg) (UBA 2018a: 39).<sup>125</sup> Figure 4-38 shows this trend in relation to the total packaging waste generated in Germany between 1997 and 2016 (2016: peak of 18.16 million t).

---

<sup>125</sup> In 2015, food, beverages and pet food accounted for approx. 60.4% of the total packaging waste of private end consumers (UBA 2018b).

**Figure 4-38:** Development of packaging waste generated in Germany

Source: UBA (2018a: 40), graphically adjusted.

The different types of packaging have different environmental effects (Licciardello 2017). While aluminium and tinfoil are energy- and material-intensive, they can be recycled well. Glass is suitable for reuse and recycling, but is relatively heavy. Plastic composites are light and less energy-intensive, but difficult to recycle.

Currently, the discussion about the use of plastic and the resulting implications for humans and the environment is increasing. In addition to striking images of “garbage patches” in the oceans, the harmful effects of microplastics are being discussed. The release of microplastics during waste disposal is the second most important factor following the abrasion of tyres (Eisenhut 2018). While know-how of the environmental relevance of microplastics is still incomplete, it should be urgently advanced for precautionary reasons (EU COM 2019c).

**Trade-offs** need to be heeded when analysing the **environmental impact** of packaging: packaging plays a vital role in protecting food from damage and contamination and extends the shelf life of food in supermarkets and at home, potentially reducing food losses and their environmental impact. Due to the large amount of resources that are used for the production of food, efforts to reduce food waste through increased packaging can sometimes result in a curbing of the overall environmental impact, even when the environmental impact of additional packaging is taken into account. Varietal purity of packaging would facilitate recycling, but is to some extent difficult for

food safety reasons, and to some extent undesirable for marketing reasons (because using different materials opens up design options).

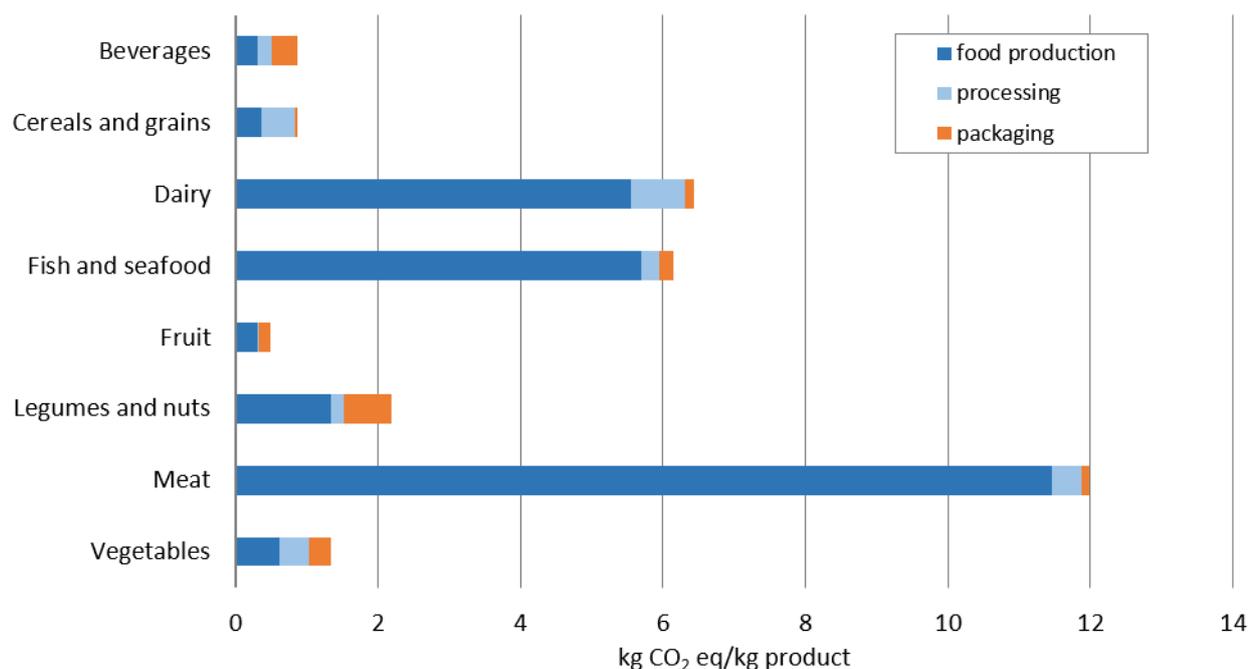
Due to these trade-offs, the overall ecological assessment of packaging must be related to the entire life cycle and all environmental goals (Wikström et al. 2014, Molina-Besch et al. 2019, cf. also Section 5.3). Figure 4-39 shows the GHG emissions of the three life cycle stages of agriculture (production), processing and packaging for various food products based on average values for different product groups. It is clear that packaging accounts for a major share of the overall impact in the case of beverages, while animal husbandry is responsible for virtually all GHG emissions in the case of meat (cf. Heller et al. 2019).

Likewise, there are still trade-offs between the recycling of packaging and precautionary consumer protection. Even though the toxicological assessment of mineral oil residues has not been completed, the available data indicate that a health risk from them cannot be ruled out. Packaging made of recycled paper and cardboard is regarded as the chief contaminant (for this and other sources of input: Bögli et al. 2017). As a result, recycled materials are at present being replaced by virgin paper for foodstuffs or additional packaging material is introduced as a barrier layer; the latter in turn makes recycling more difficult.

Packaging continues to be used to identify products at the tills. Organic products, for example, achieve a considerably higher sales price, but are visually indistinguishable from conventionally grown produce. Here, for example, the packaging is used by the checkout staff to recognise organic fruit and vegetables. Recently, there has been increased testing of alternative methods that are considerably less intensive in terms of material use (e.g. small stickers, laser engraving).

Packaging is also increasing because it opens up new product ranges or business segments. Products that are particularly **packaging-intensive** include, for instance, (online) ordering services in the hotel and restaurant industry and cooking box providers. Another example is pre-cut fruit and vegetables.

**Figure 4-39:** Average GHG emissions from production (agriculture), manufacturing and packaging for different food groups



Source: Heller (2017a: 1), graphically adapted.

With respect to reusable beverage packaging, the problem lies in the fact that it is increasingly individualised for **marketing reasons** (e.g. for beer), which renders reusable systems more difficult or less environmentally friendly, as the packaging has to be collected separately and transported further. Standardised, regional reusable systems are typically advantageous in ecological terms; individualised and widely transported beverages in reusable packaging are disadvantageous compared with most single-use variants (Kauertz et al. 2018).<sup>126</sup> The results of the conducted life cycle assessment, which comprises several environmental parameters, can be summarised as follows, inter alia: for juices and nectars, the 1-litre and 1.5-litre beverage cartons and the 1-litre glass returnable bottle deliver significant benefits compared with the 1-litre PET non-returnable bottles. Beverage cartons and returnable glass bottles (VdF pool bottles) are similar in terms of the benefits they provide. For fresh milk, the 1-litre beverage carton delivers overall benefits compared with the returnable glass bottle and the non-returnable PET bottle (Kauertz et al. 2018: 165 f.). The benefits of milk in cartons compared with returnable glass are due in particular to the long distances over which the remaining seven returnable dairies deliver their milk bottles, as well as to the low circulation rate caused by the declining market share of the returnable system (Kauertz et al. 2018).

<sup>126</sup> Study conducted by the Institute for Energy and Environmental Research (IFEU) on behalf of the Fachverband für Kartonverpackungen für flüssige Lebensmittel e. V. (Trade Association for Carton Packaging for Liquid Food) (FKN).

In conclusion: reusable can be better, but is not necessarily so; if reusable systems are used, then they should be regional and standardised. Beverages are heavy, so they should not be transported too far. Plastic is not fundamentally problematic. While these findings have been undisputed among experts for some time (IFEU 2010), they are obviously complex for consumers. At the same time, the marketing pressure on enterprises and the convenience preferences of some customers are obviously so great that significant progress has not been made. It does not seem to make much sense to conduct the same packaging debates for many decades and thus absorb social attention and motivation.

In retrospect, the dual system of packaging collection (“yellow bin/yellow sack”) introduced in Germany (early on) in the early 1990s has certainly resulted in ecological improvements, as shown by a cost-benefit analysis carried out by the Rheinisch-Westfälisches Institut für Wirtschaftsforschung in Essen shows (Rothgang et al. 2017). In the 2000s, system efficiency was considerably improved by the increasing use of automatic separation and sorting systems. The Packaging Ordinance has also introduced quotas for material recycling, which have stimulated the recycling market. Currently, the bulk of food packaging (plastic, tinsplate and aluminium) is collected separately and around 40% is recycled<sup>127</sup>; the rest is essentially used for energy. The recycling of packaging is generally a case of down-cycling, i.e. lower-quality products are created from the recycling. A particular problem with packaging that is not recycled in Germany is waste exports to developing and emerging countries, where malpractices exist (mismanaged waste, Jambeck et al. 2015). Another problem with the current dual system is that the incentives to reduce or avoid packaging have, in general, remained relatively low.

The legislator has responded to these limits of the dual system by enacting the amendment to the packaging law, the so-called Packaging Act<sup>128</sup>, which came into force on 1 January 2019. The central aim of the amendment is to close gaps regarding participation in one of the various recycling systems (dual systems). In addition, the requirements for recycling quotas in respect of packaging are increasing, with the mandatory deposit also being expanded. Finally, an obligation to make licence fees incorporate ecological aspects has been introduced (Section 21). This is designed to provide economic incentives for enterprises to use materials and material combinations that can in practice actually be recycled to a high percentage. In addition, it is intended that enterprises should use as many recyclates and renewable resources as possible in their packaging. How these economic incentives are set is left to the various recovery systems in Germany. They are required to report to the UBA on this annually. In 2022, the success of the various systems will be evaluated for the first time. In the medium term, this will increase the pressure to develop packaging that is advantageous in ecological terms. To this end, companies should take a look at the entire packaging chain ranging from raw material extraction to recycling by means of a life cycle assessment in order to develop more eco-friendly packaging (cf. Section 5.3). To date, progress in this field has been slow, as packaging tends to become even more complex as a result of technological development and

---

<sup>127</sup> Of this 40%, another 30% is lost in the recycling process (Rothgang et al. 2017), so that ultimately 28% is actually recycled.

<sup>128</sup> Cf. Act on the Further Development of the Household Separate Collection of Waste Containing Recyclable Materials. 5 July 2017. Federal Law Gazette 45 ([https://dejure.org/BGBl/2017/BGBl.\\_I\\_S.\\_2234](https://dejure.org/BGBl/2017/BGBl._I_S._2234)).

marketing requirements (Kreibe et al. 2017). There is still a lack of **recycling-oriented design**, despite a decades-long discussion; this implies that there are too few economic incentives. Moreover, it is to some extent a collective action problem because individual companies cannot change existing recycling structures.

Overall, the following can be noted for the topic of packaging:

- food packaging in general and plastic packaging in particular are a “long-running issue” in the environmental debate (“jute instead of plastic”). The issue has recently gained renewed importance in social discourse (“zero-waste shops”, microplastics). Nonetheless, and contrary to parts of the public discourse, food packaging is not a central hot-spot of environmental pollution in Germany. Yet packaging issues are symbolic of the environmental protection debate and they are conducive to symbolic politics.<sup>129</sup>
- Despite many years of discussion and political efforts, no overall reduction in the volume of packaging has been achieved – on the contrary: in the last 20 years, the total volume of packaging in Germany has increased by almost 30%, and the amount of plastic packaging has doubled (see Fig. 4-38).
- The establishment of the dual system of waste disposal enabled major progress to be made in material recycling. Around 40% of the packaging collected by the dual systems in Germany is now recycled. As a rule, however, these are low-quality recyclates.<sup>130</sup>
- The conventional environmental policy hierarchy of targets in § 6 of the Closed Substance Cycle Waste Management Act (KrWG)<sup>131</sup> which prioritises “packaging avoidance over reuse over recycling over recovery over disposal” is too general. There are many different trade-offs which require a differentiated approach. Dispensing with packaging can, but does not have to be, beneficial from an overall ecological perspective.
- However, such a differentiated overall ecological analysis (life cycle assessment, cf. Section 5.3.3) must then also be carried out. There are, at present, surprisingly few ecological analyses in this regard; for many questions there are none at all, or only outdated life cycle assessments on the various types of packaging and fields of application (Detzel et al. 2016). Without corresponding data, the reference to trade-offs can be part of an environmental resistance strategy (“doing nothing”).

---

<sup>129</sup> In 2011, 9.65 million tonnes of plastic were used domestically in Germany, of which the amount used for plastic bags was 68,000 tonnes (=0.71%) or 0.83 kg per inhabitant. In relation to the polyethylene used for packaging purposes, the percentage is 6.1% (UBA 2013). The UBA (ibid.: 5) assesses the discussion as follows: “Life cycle assessments show no clear advantages for either paper bags or bags made of biodegradable plastics. (...). In the overall view of the environmental effects of plastic articles, the contribution of plastic bags to life cycle assessment impact categories is relatively minor due to the small total quantity.”

<sup>130</sup> Globally, about 8.3 billion tonnes of plastic have been produced since its invention, of which about 9% has been recycled, 12% incinerated, 30% is still in use, and the rest has been moved to landfills and the environment (Geyer et al. 2017).

<sup>131</sup> Act to Promote Closed Substance Cycle Waste Management and to Ensure Environmentally Sound Management of Waste (Closed Substance Cycle Waste Management Act – KrWG) of 24.02.2012 (<https://www.gesetze-im-internet.de/krwg/>).

- The WBAE therefore believes that it is imperative to carry out corresponding analyses, i.e. to present comprehensive life cycle assessments of the various forms of packaging and purposes of use, precisely because intuitive estimates are not helpful in view of the complexity of the trade-offs (cf. Section 5.3.3 and Detzel et al. 2016).
- The ecological compatibility of different forms of packaging is currently only communicated to consumers in general terms, if at all, e.g. in flyers or on the internet, which has not resulted in transparency. There is a lack of clear communication on the product.
- An example of packaging avoidance without trade-offs is the replacement of packaged drinking water with tap water. In Germany, around 11.5 billion litres of mineral water were consumed in 2018, corresponding to 147.7 litres per capita (VDM 2019).
- The increased use of economic incentives for eco-friendly packaging design (e.g. recycling-oriented design) initiated by the amendment of the Packaging Act makes sense – but whether the financial incentive is sufficient and whether it will help overcome the problems related to the implementation of the necessary collective solutions (industry solutions) seems questionable.
- Germany is far from a circular economy: “For the relevant types of plastics, the market for secondary plastics comprises an estimated 5% of the market for primary plastics” (Rothgang et al. 2017: 14).

#### 4.4.2.4 Logistics

The transport of foodstuffs is an integral part of the modern food system. Due to a growing global division of labour, but also on account of increasing specialisation within value chains, transport performance, measured in tonne kilometres, has developed disproportionately vis-à-vis the gross domestic product. It is often concluded from this that the globalisation of the agri-food markets contributes significantly to the climate impact of food because of the resulting transport of goods.

However, meta-analyses of existing life cycle assessments (see Section 5.3) for food suggest, with a few exceptions (e.g. air transport), that the transport of most foodstuffs is not a dominant influencing variable on their product-specific GHG emissions (Niles et al. 2018). The percentage of emissions from transportation across all food groups is estimated to be around 3–8% of total food system emissions (Taylor 2000, Wiegmann et al. 2005, Meier 2014). Yet the results do not suggest simply ignoring food transportation, but rather underline the need to take account of the specific life cycle of food and, based on this, to focus mitigation strategies on phases and processes with the greatest impact.

Thus, the **choice of transport** can have a significantly **stronger influence on GHG emissions** than the transport distance. GHG emissions in grams per tonne kilometre amount to 20 g for freight trains, 32 g for inland waterway vessels, 104 g for trucks and 1,444 g for aircraft (UBA 2018c: 145). Thus, air transportation of foodstuffs has a high ecological impact. At the same time, global air transport is heavily subsidised as a result of some tax exemptions (paraffin tax and VAT). The means

of transport is therefore key in order to assess environmental impacts. The distance alone, the so-called “**food miles**”, on the other hand, is **rather misleading** as an indicator for the environmental impact of foodstuffs (see also van Passel 2013). Studies show that, for instance, ship transport has only a limited impact on the total climate footprint, even with long transport distances and in spite of other ecological problems (e.g. use of heavy oil). The share that transport accounts for in the total emissions of a product also depends greatly on the level of the corresponding total emissions. For instance, the transport share is significantly higher for fresh vegetables, where GHG emissions from production are relatively low, than for processed products with high emissions from agricultural production and processing (see e.g. Reinhardt et al. 2009). For vegetables that are delivered by air, the share of GHG emissions from transport can exceed 90% of total emissions. In absolute values, the GHG emissions from the transportation for most food produce are usually less than 0.5 kg CO<sub>2</sub> eq per 1 kg of product, while the relative share is usually in the order of 5 to 20% (Heller 2017d).

Overall, it is evident that while local foodstuffs can have social, economic and ethical benefits (cf. Section 5.4), they are not necessarily the preferred option for reducing energy consumption and GHGs (Niles et al. 2018). There are several reasons for this: as set out in Section 4.4.2.1, trade-offs between rising transport emissions on the one hand and economies of scale in processing that also contribute to energy savings (so-called ecologies of scale) on the other hand are possible. If the agricultural sector in Germany is not particularly efficient by international standards for certain products (such as soy), then regional products will, all in all, tend to cause more greenhouse gas emissions despite transport reductions. If transport is carried out by eco-friendly means, then transport distances are as a rule not decisive for the greenhouse gas balance (Edwards-Jones 2010, van Passel 2013).

The above explanations and the current scientific discussion are strongly influenced by the focus on climate change and greenhouse gases. However, the impact of transport on the environment affects a multitude of other environmental parameters: air quality, noise, water quality, soil quality, biodiversity and land use. Road vehicles, ship engines, locomotives and aircraft are the source of pollution in the form of gas and particulate emissions that impair air quality and harm human health (UBA 2012, Becker 2016b). Air pollutants and particulate matter are associated with cancer and with cardiovascular, respiratory and neurological diseases. Noise affects the quality of life and impacts human health by increasing the risk of cardiovascular diseases. The removal and sealing of the top layers of land for the construction of roads, or the reduction of the quality of surface layers for port and airport developments have caused a significant loss of fertile and productive soils. Soil contamination can be caused by the use of toxic substances in the transport industry. Fuel and oil spills from motor vehicles wash up on roadsides and migrate into the soil. Tyre wear is a major contributor to the microplastics problem (Bertling et al. 2018). Only some of these and other strains are taken into consideration in existing product life cycle assessments. The **impact of transport is therefore underestimated when focusing on greenhouse gas balances** (cf. Section 5.3).

#### 4.4.2.5 Retail sector

Food retailing is a decisive link in supplying consumers with food. In addition to handling the direct sales processes (transactions), it pools the supply of foodstuffs, both by bringing together the volumes necessary for a shopping area and by putting together an attractive range of goods that meets the changing demand of consumers. Through its storage function, time differences between production and consumption can be bridged. Moreover, spatial differences are overcome through logistical processes. Trading companies are transaction specialists (Picot 1986). If these functions are shaped in an efficient manner, the environmental impact resulting from food can be considerably reduced, so that consumers can make their purchases with relatively little effort and benefits are created by combining logistics and storage processes.

The food retail sector exerts a direct influence on ecological parameters through the construction areas for distribution centres and shops. It also consumes energy for lighting and temperature regulation. Even though the percentage made up by food retailing in the overall environmental impact of food is rather small (Weber & Matthews 2008), it is worthwhile to take a look at whether and to what extent there are options for mitigating the environmental impact in retailing. Surprisingly, there are only a few studies on this issue, and they cannot be easily transferred to other countries. Even though the number of food retailing branches has decreased in Germany (in ten years from 50,500 to around 37,700 in 2017, IFH 2018), sales areas (HDE 2019) and refrigerated counters<sup>132</sup> have increased. Electricity costs in food retailing branches average 1.5% of sales. There are indications that around 45% of electricity is used by the refrigerated counters, an area where savings potential can still be expected (Atzberger et al. 2015).

The food retail sector has an indirect impact on ecological parameters through its choice of locations, which influences consumer transport behaviour. In particular, however, the food retailing companies play a vital role in sustainability in the value chains because they act in a way as “**leading companies**” due to their **market power**. They exert a decisive influence on the ecological and social implications of the food system by setting their requirements for suppliers (e.g. for private labels) (cf. also Section 4.3.4.1). Therefore, many call for food retailing to engage even more strongly in the design of its value chains (“ecological gatekeeper”, Schulze et al. 2019). Due to the high degree of concentration, the food retail sector is in a relatively strong negotiating position and basically dictates the requirements for packaging and services. As part of its procurement policy, the food retailers influence the organisation of storage and logistics. Increasingly, they also set sustainability requirements for the agri-food industry (e.g. by stipulating their own residue levels for pesticides and their own animal welfare standards). Beyond that, trade also exerts an influence on the scale of food losses through its quality requirements, portioning and the organisations of the supply chains. This point has recently been the subject of intense debate, including requirements for external appearance (and thus the definition of unsaleable goods) and the use of goods that are no longer marketable.

---

<sup>132</sup> See: <https://www.wlw.de/de/inside-business/branchen-insights/lebensmittel/convenience-food>.

Owing to the strict requirements of the retail sector regarding the external appearance of the goods, high losses can occur, especially in the case of fruit and vegetables (Runge & Lang 2016, Noleppa & Carlsburg 2015). Rejects are not even harvested or are discarded immediately after harvest. The share of primary production that is lost in the fruit and vegetable sector due to external quality deficiencies is estimated at around 20% for the industrialised countries of Europe, Russia, North America and Oceania; in the case of potatoes, this share can be twice as high (Priefer & Jörissen 2012, Meyer et al. 2018). Given that the losses would be edible at the time of their disposal or recycling without any health-related restrictions, they are “avoidable losses”.

Fruit and vegetables have to meet international marketing standards in order to find their way into the supermarkets. The standards for fresh fruit and vegetables, which are legally valid in Europe, were issued by the European Commission – partly at the request of the retail sector – and apply in every Member State. They are designed to simplify the cooperation between actors in the value chain and to safeguard the quality of the products. The so-called specific marketing standards (SMS), which were valid until 2009 for all 36 fruit and vegetable varieties traded in the EU, contained precise specifications on quality characteristics, sizing, tolerances, presentation, class grading and labelling. In 2009, specific marketing standards were abolished for 26 types of fruit and vegetables. Since then, these products have been subject to a General Marketing Standard (GMS), which is less stringent and only requires minimum quality characteristics and minimum ripeness criteria as well as an indication of the product origin.

However, the ten remaining SMS cover the fruit and vegetable varieties with the highest turnover (apples, citrus fruits, kiwis, lettuces, peaches and nectarines, pears, strawberries, peppers, grapes and tomatoes) and thus 75% of the EU trade value. When abolishing the 26 specific marketing standards, policy-makers did not take into account the power position of the food retail sector, because the food retail companies and thus the upstream stages in the value chain have now simply replaced the former EU requirements with the almost congruent UNECE (United Nations Economic Commission for Europe) standards or imposed their own, even more stringent quality requirements on producers. A study commissioned by the European Commission comes to the conclusion that the effect of the abolition of the 26 CSRs has been “small to negligible” and that food losses have not decreased (Frieling et al. 2013).

Other approaches pursued by the retail sector to reduce food waste encompass better coordination of logistics between manufacturers and retailers, including new planning systems; approx. 28% of food disposed of in retail is due to expiry of the best-before dates (Schmidt et al. 2019a: 52). Fewer promotional campaigns with high stock levels and greater acceptance of sold-out items (the so-called out-of-stock situation) also contribute to this objective. Other measures could comprise voluntary industry agreements, awareness-raising campaigns and the development of packaging to prolong product life (Filimonau & Gherbin 2017, Teller et al. 2018). Further options for retailing lie in the greater discounting of goods shortly before the best-before date has expired (in future increasingly by means of electronic labels). In their function as trademark manufacturers,

retailers could also act by extending the best-before date as well as through more demand-based packaging sizes.

Another matter connected with food losses concerns the handling of goods that are no longer saleable but that are still fit for consumption. 56% of the food disposed of in retailing is rejected due to defects (Schmidt et al. 2019a: 52). Retailers pass some of these foodstuffs on to so-called food banks (cf. [www.tafel.de/](http://www.tafel.de/)), while others go into recycling and disposal channels. Therefore, there is quite a lot of debate on issues such as the legalisation of containerisation<sup>133</sup>, an obligation to give usable food to charitable organisations (as in France) or stronger state support for food banks so that the food banks can pass on more products. Another option lies in communication measures to market visually deficient products, as is now also offered by some German retailing companies, based on the Swiss role model<sup>134</sup>. Finally, innovative business models are emerging such as “toogoodtogo”,<sup>135</sup> which offers unsold food (also from the hotel and restaurant industry, see below) at a reduced price to consumers via an app.

Overall, the special role that concentrated food retailing plays as the actor with the strongest economic position in the food chain is relatively undisputed. Yet, a systematic measurement of the environmental impact that ensues from the gatekeeper position of the food retail sector is hardly possible. However, there are rankings for specific subjects that compare the commitment of different retail companies to certain sustainability topics (cf. also Section 8.13). For food policy, the gatekeeper function of retailing gives rise to opportunities for the involvement of private sector initiatives and voluntary self-restrictions (cf. also Section 8.12).

#### 4.4.2.6 Away-from-Home Catering

After food retailing, away-from-home catering plays a key role in the economy, with a turnover of around 80.6 billion euros in 2018, accounting for a good 28% of total food sales (BVE 2019). Away-from-home catering includes individual catering with restaurants, hotels and, for instance, snack bars (fast food). Another segment is event catering for sports and cultural events. The third segment is community catering (preschools, schools, universities, workplaces, retirement homes, hospitals). Overall, it is assumed that away-from-home catering will continue to increase (Göbel et al. 2017).

The environmental impact of away-from-home catering is comparatively poorly studied, which can partly be attributed to the heterogeneous sectoral structure and to the many small-scale players.

---

<sup>133</sup> Containerisation refers to the taking away of foodstuffs from waste containers. The term “dumpster diving” is also used synonymously.

<sup>134</sup> The Coop Group has been offering “uniquely shaped” vegetables and fruit under its own brand Ünique since 2013, e.g. three-legged carrots and crooked cucumbers, cf. <https://www.coop.ch/de/labels/unique.html>, Edeka, Netto, Aldi and Rewe have or had corresponding products in their assortment as “Wunderlinge” and “Krumme Dinger”.

<sup>135</sup> <https://toogoodtogo.de/de>.

Another barrier to reducing the environmental impact of away-from-home catering is that consumers are less aware of sustainability issues than they are when shopping for their own households. Due to the delegation of preparation to the hotel and restaurant industry, the different consumption situation in the hotel and restaurant industry (enjoyment, relaxation), but also owing to the lack of information on menus, sustainability tends to be less embedded in the minds of customers (Rogge et al. 2009). Central aspects for enhanced environmental protection lie in:

- Compiling and marketing menus with a small ecological footprint (fewer animal products, seasonal, etc.)
- Reduction of food losses
- Eco-friendly storage, preparation and disposal of food; and
- Environmental friendliness of logistics, including packaging for fast food and delivery services

The greening of meals through appropriate menu planning and prominent marketing for eco-friendly meals (nudging) is currently being discussed chiefly for communal catering, as this is where the state can exert the most direct influence (Bucher et al. 2016). Special initiatives are also currently unfolding in some large cities as part of Sustainability Cities initiatives. Similar to the situation regarding final consumers, the **composition of the meals** is the central lever for reducing the environmental impact (see Section 5.3.3 and Engelmann et al. 2018).

In terms of **food waste**, away-from-home catering accounts for 1.69 million tonnes, or around 14% of the total in Germany. According to current knowledge, about 35% of foodstuffs from out-of-home consumption end up in waste (Jepsen et al. 2016). A high savings potential is assumed, estimated at 30% to 50% of the current waste volume (Dräger de Teran 2019: 8), other estimates estimate the theoretically avoidable percentage even higher (Schmidt et al. 2019a). When reducing waste, the entire process chain must be taken into consideration, ranging from purchasing, interim storage and preparation to serving and consumption. The know-how and behaviour of employees in terms of meal planning and work processes exert a decisive influence, and modern technologies can support waste prevention strategies. These include software solutions where the results of waste volumes and volume matches are assessed and fed directly into meal planning as part of the procurement and ordering software. As avoiding food waste can result in business advantages for enterprises and there are many small businesses in the hotel and restaurant industry, various free tools<sup>136</sup> have now been developed that, on the one hand, enable the continuous recording of quantities and types of waste and, on the other hand, show suitable measures to significantly reduce waste quantities in catering. In some cases, specific guides have also been published for fields such as school catering (Waskow & Blumenthal 2018).

---

<sup>136</sup> For example, the waste analysis tool of United against waste e. V. – Moneytor, the Leanpath-software tool, the ResourceManager-food-software tool, Küchenmonitor – an online portal of the VZ NRW and the ReFoWas research project, the guide to reducing food waste from iSuN at the FH Münster and the Federal Environment Agency's guide to avoiding food waste in catering.

Compared with individual catering, companies in the hotel and restaurant industry and communal catering can use more efficient technologies. And yet, the extent to which energy-saving equipment is actually employed has not been studied.

However, the benefits of professional kitchen technologies may be offset in some areas by more elaborate packaging. This applies to the fast food catering industry; more recently, (online) delivery services, where the type of transportation is also highly relevant (bicycle, e-bike or car), have also gained in importance.

In general, there has been little analysis of the environmental impact of away-from-home catering. Beyond the specific field of avoiding food waste, sustainability has not been embedded in the mission statement of away-from-home catering companies. Exceptions include, for example, large caterers which often operate internationally. In addition, public attention focuses on the large fast food providers such as McDonalds and Burger King due to their predominantly less health-promoting menus with a high meat content and elaborate packaging. The publicly known brand suppliers are therefore comparatively active in sustainability management. In the other segments of the market, there is a lack of specifics, such as figures for energy and water consumption and suitable training modules for employees and strategies to promote motivating communication with customers.

#### 4.4.3 Environmental effects at consumer level

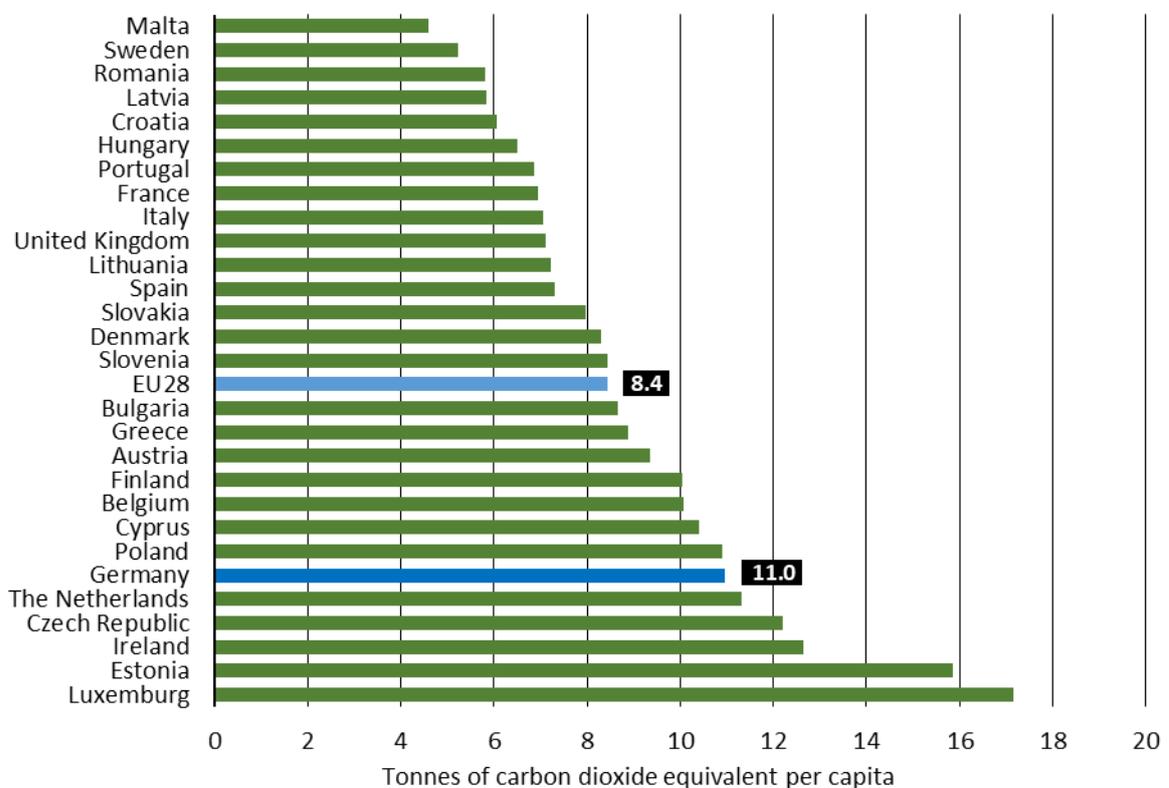
The vast majority of food production is intended for human consumption (an exception is e.g. pet food; see text box 9 “Environmental impacts of pets”). From a consumption perspective, all environmental problems caused by a food product along the entire value chain – ranging from agricultural production including the upstream sector to processing, transport, retailing and the end consumer – are therefore ultimately influenced by consumer decisions. A substantial percentage of emissions are also generated in households themselves and by large-scale consumers through storage (refrigeration, freezing), preparation (cooking, heating, washing up, etc.) and disposal. However, consumers cannot directly influence most of the environmental effects in the value chain.

This section sets out the consumption-related environmental effects on the basis of the corresponding **greenhouse gas emissions**. These make up an important part of the consumption-related environmental effects; moreover, no clear analyses are available for many other environmental effects (cf. Section 5.3). First of all, a look at the percentage of the total environmental impact of consumption that is made up by food: this can be roughly estimated on the basis of greenhouse gas emissions. The GHG emissions generated in Germany, calculated on the basis of the territorial

principle of the GHG reporting system, amount to approximately 11 tonnes per person (UBA 2019d). Germany is thus significantly above the EU average in terms of climate impact per capita.<sup>137</sup>

Food-related GHG emissions are reported at varying levels in different analyses. In its expertise on climate change (WBAE & WBW 2016), the WBAE, with reference to extensive analyses by Meier (2014), estimates the GHG emissions of food consumed in Germany, irrespective of whether this food was produced in Germany or abroad, at 2.3 tonnes/year per person (see Fig. 4.4-16). Eberle and Fels (2015) put the food-related GHG emissions including procurement, preparation and disposal (cradle-to-grave) at 2.7 tonnes (85% generated by consumption in private households, 15% by away-from-home catering). Using other definitions, the Federal Environment Agency arrives at a lower value for food-related GHG emissions (UBA 2019e). Key factors of environmentally-aware consumption (Bilharz 2010, Backhaus et al. 2012, Wynes & Nicholas 2017) include the living space per capita as well as heating and insulation standards, the number and duration of journeys by air, car avoidance, car type, number of cars, but also the level of consumption of animal products. Nutrition is undeniably an essential field of action for sustainable consumption.

**Figure 4-40:** Per capita emissions of greenhouse gases in the EU 2017



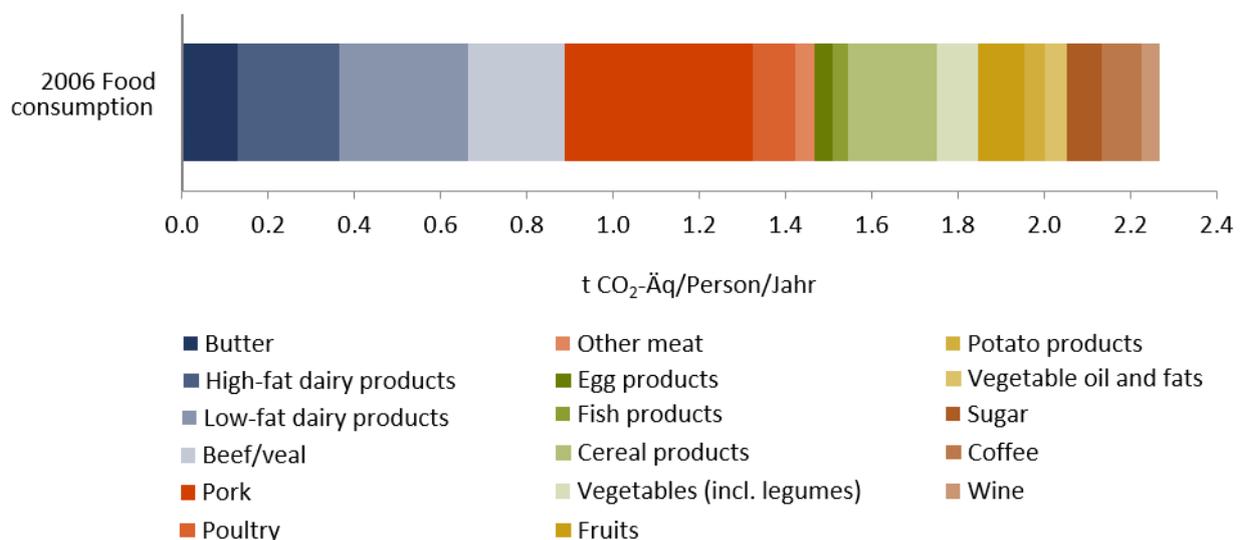
Source: UBA (2019d) based on data from the European Environment Agency, graphically adjusted.

<sup>137</sup> Per capita emissions can be calculated as a source balance (based on production emissions, as here) or as a consumption balance, calculated directly from consumption. The latter emissions are more difficult to calculate, although the results probably do not vary very much, cf. Schächtele & Hertle (2007).

Studies show clear correlations between the environmental impact of a household and the household's income (Kleinhüchelkotten et al. 2016). Although wealthier people are often more environmentally aware, the actual environmental impact caused by them is significantly higher. This is due to factors such as a greater living space per capita, more long-distance travel, more cars, etc. The German Council of Economic Experts (2019: 85) balances the relationship between household income and climate impact as follows: "While a household in the lowest income decile emitted an average of 7.0 tonnes of CO<sub>2</sub> in 2013, a household in the fifth income decile emitted almost twice that amount of CO<sub>2</sub>. In the top decile, the figure is almost three times as high." This correlation does not exist for food, where GHG emissions are actually slightly lower in richer households. The amount of food a household buys is no longer a status factor today.

With respect to the various foodstuffs, animal products prove to be key drivers due to processing losses on the one hand and due to their high share in methane and nitrous oxide emissions on the other (Willet et al. 2019, WBAE & WBW 2016).

**Figure 4-41:** Greenhouse gas emissions broken down by food consumed in Germany (2006) in t CO<sub>2</sub> eq per person/year



Source: WBAE & WBW (2016: 37) based on Meier (2014), graphically adjusted.

Given the targets agreed under international law to reduce GHG emissions, considerations on reducing GHG emissions from food are unavoidable. Options consumers have to reduce their environmental impact start from the following points (Gruber et al. 2016):

- (1) Composition of the shopping basket, i.e. purchasing food with a small ecological footprint (low climate impact, seasonal, little packaging etc.; incl. own cultivation).
- (2) Reduction of food losses or food waste in the household.
- (3) Eco-friendly storage, preparation and disposal of food.
- (4) Environmental friendliness of the shopping process itself, especially the route/travel to the shopping location.

**Re. (1) Composition of the shopping basket:** given that the consumption of foodstuffs cannot be reduced arbitrarily, there are major differences compared with the avoidance potential in other sectors. In the case of food, it is less a question of the amount that is consumed, even if a reduction in obesity would have a positive environmental impact and even if food losses should be reduced (see point 2 on the latter). What is imperative is a more environmentally aware choice of food by consumers, i.e. a shopping basket that is composed differently so that fewer negative environmental effects per food unit ensue, e.g. more legumes and fewer animal products. To this end, consumers need information on the overall environmental friendliness of food. However, which foods are particularly environmentally friendly is subject to controversy. Two different approaches can be found in the discussion:

- The eco-friendliness of food can be determined by the type of farming and thus by the issues raised above in Section 4.4.1. With respect to consumers, this discussion is dominated by the comparison between organic and conventional production, but also by issues such as the use of genetic engineering, glyphosate, etc. Section 5.2 presents these controversies and the measurement and evaluation problems linked to them in detail. This type of measurement focuses on agriculture and does not consider environmental friendliness at subsequent stages (e.g. packaging, transport, etc.).
- Alternatively, the eco-friendliness of food can also be assessed on a product-by-product basis by analysing the entire value chain (see Section 4.4.2), a process known as Life Cycle Assessment (LCA). While agriculture is included here, it is not covered in all facets. Important subjects such as biodiversity and land use are not included. The results of LCAs on food are set out in Section 5.3.3.

**Re. (2) Reduction of food losses or food waste:** the environmental effects of food also encompass the emissions associated with food that is not consumed (food waste). For the EU, the share of food waste along the entire value chains was estimated to be about 20% in 2011 or 2012 (Stenmarck et al. 2016, Caldeira et al. 2019). Here, a distinction is made between avoidable and

unavoidable food waste. Unavoidable food waste is usually defined as that which is usually removed during food preparation (e.g. banana peels, bones), while avoidable food waste is defined as that which is unreservedly edible at the time of its disposal or which would have been edible if it had been used in time (Kranert et al. 2012). According to Schmidt et al. (2019a), the annual volume of food losses in Germany totals 11.9 million tonnes of fresh mass, with private households accounting for 6.14 million tonnes, or around 52%.

Many studies on food waste have so far chiefly focused on recording the underlying material flows and asking how much waste is actually avoidable (Parfitt et al. 2010, FAO 2011b, Kranert et al. 2012). As a rule, this is a purely technical consideration that does not take economic aspects into consideration (see Koester 2012). Only a few studies convert these material flows into corresponding greenhouse gas emissions or other ecological parameters (e.g. FAO 2013, Heller & Keoleian 2014). The FAO (2013) calculated the so-called Food Waste Footprint for 2007 on the basis of a global waste volume amounting to 1.6 billion tonnes. According to this, 3.3 billion tonnes of CO<sub>2</sub> eq were emitted through food waste/loss along the entire value chain, i.e. during production (e.g. harvest and storage losses), processing and distribution of the corresponding foodstuffs, which corresponded to about 6.7% of global GHG emissions (WBAE & WBW 2016).<sup>138</sup>

On a different calculation basis than that used by Schmidt et al. (2019a) and using a conservative calculation, GfK (2017) has calculated there to be 4.4 million tonnes of food waste per year caused by households, which corresponds to a share of around 10% of the food purchased (or 109 kg per year or 300 g per day per household with an average of 2 people). In a rough calculation, this corresponds to a value of about 6 billion euros. The average German household thus throws food worth about 150 euros in the bin every year. This corresponds to about 5% of food expenditure (ibid.). According to the households' own estimates, almost 44% could have been avoided. Fresh fruit and vegetables account for the bulk (50%) of total food waste. These two food groups account for 64% of all unavoidable losses. Cooked food, bakery products and dairy products are other key commodity groups which have a high risk of spoilage. Per capita, both household size and age have an influence on the generation of food waste: while 1-person households generate the largest volumes, older people behave in a more resource-conserving manner.

The reduction of food waste by consumers offers major opportunities for reducing emissions, both in theory and in practice.<sup>139</sup> Unconsumed food constitutes a waste of all the emissions previously generated in producing and distributing it. Food losses (along the entire chain), for example, raise the carbon footprint of average American food consumption by 39%. Eberle and Fels (2015) analysed the environmental effects of German food consumption and food losses. Losses accounted for between 11% and 17% of the environmental effects exerted by food consumption; for away-

---

<sup>138</sup> In the SOFA (State of Food and Agriculture) Report 2019, the FAO (2019b) employs a new calculation method and estimates global food losses between harvest and retailing to be 14%. However, this figure does not yet include waste generated at the retailing and consumption levels.

<sup>139</sup> In a pilot study comprising 51 households, avoidable food losses were cut by more than 50% through coaching households and through self-documentation of waste via kitchen diaries (Leverenz et al. 2019).

from-home consumption they were even more relevant, at 28 to 33%, depending on the impact category.

The indication of the best-before date is considered, at consumer level, to be one (often overestimated) factor among others for food losses (Schmidt et al. 2018), since it is misinterpreted by many consumers. Therefore, a reform has been discussed for some time. The best-before date indicates until when the manufacturer guarantees the highest quality of the foodstuffs. If the original sealed packaging has been properly stored, the products can, in most cases, still be eaten for a certain time after the “expired best-before date”. After opening the packaging, oxygen, moisture and microorganisms can cause the food to spoil at an accelerated rate. To be on the safe side, e.g. with regard to product liability and product tests, manufacturers set the best-before date at a relatively early date. In retailing, an expired best-before date does not trigger a ban on sales. Nevertheless, it must be ensured that the goods are flawless. As soon as the best-before date is reached, the manufacturer is no longer liable; instead, the food business operators who place the goods on the market, usually the retailers, bear the responsibility. For this reason, and given that many customers regard “expired” goods as a sign of poorly maintained shelves, many retailers avoid offering these products. Alongside the best-before date, there is also the use-by date (“use by...”). This is prescribed for sensitive foods that perish particularly quickly – for example, minced meat or fresh fish. Therefore, these products must be consumed in good time before the use-by date has expired. After the use-by date has expired, food may no longer be sold and should not be eaten.

The food manufacturers provide information on the best-before date and use-by date on their own responsibility, taking into account the award criteria laid down in the Food Labelling Ordinance. It is prohibited to commercially market foods that are harmful to health, unsafe and misleadingly labelled. The abolition of the best-before date for long-life foods such as pasta, salt or rice would not pose any problems and could prevent premature disposal of the goods. The situation is somewhat different with respect to coffee and tea, which have a long shelf life but lose their aroma and quality over time. Therefore, the best-before date provides a certain guidance for consumers, but the printing of a production date could provide an alternative. The best-before date system could also be improved by setting uniform guidelines for calculating the best-before date. For instance, extending the best-before date by just one day for many products would prevent a significant amount of food loss without compromising consumer safety.

It is important to let consumers know the actual information content of the best-before date and to offer goods with an expired best-before date in supermarkets in order to enhance the image of these foods among consumers.<sup>140</sup> Consumers could also buy products with a short remaining best-before date more frequently, instead of specifically picking out the products “at the back of the shelves”. A higher acceptance of shelf gaps (sold-out products, e.g. baked goods) would also contribute to curtailing food losses (Teller et al. 2018). The high percentage of fruit and vegetables in

---

<sup>140</sup> Waste & Resources Action Programme (WRAP) in Great Britain (Reducing Food Waste by Extending Product Life, 2015).

household-related food losses points to the factors of purchase planning and, in particular, shopping frequency.

A considerable proportion (33.4%) of food waste is disposed of in residual waste, i.e. is not composted (GfK 2017). As there are considerable regional variations in Germany (the share is 46% in NRW, for example), this suggests potential with respect to the distribution of organic bins, the use of which differs at municipal level.

Overall, the issue of food losses has attracted attention in recent years, not least due to the BMEL's relatively successful campaign ("Too good for the bin"). The proportion of consumers who, in a targeted manner, buy less food as stocks so that they then have to throw away less has risen from 44% (2010, i.e. before the beginning of the campaign in 2012) to 51% (2016) (GfK 2017). Whether food losses have changed fundamentally cannot be reliably assessed due to a lack of data, even if GfK does find a correlation between awareness and behaviour in its data in the sense that consumers with a more marked awareness of the problem actually generate slightly lower waste volumes. However, the long-term rise in food waste at household level is not only a question of awareness (attitude), but also the outcome of rising prosperity and of food prices which are falling in relative terms (Bovay & Zhang 2019).

All in all, the database on the topic is not yet satisfactory, but is set to improve in the future, as the EU Member States will in future have to report on an annual basis on the development of food waste under the European Waste Framework Directive 2018/851 (see also the "National Strategy to Reduce Food Waste" adopted by the Federal Cabinet in 2019, BMEL 2019f).

**Re. (3) Eco-friendly storage, preparation and disposal of food:** within households, measures to manage energy consumption encompass the purchase and use of energy-efficient refrigerators, energy-saving measures in cooking and minimal use of the oven. Refrigeration and freezing account for 17%, cooking for 11% and washing up for 7% of household electricity consumption (co2online 2019). There are many options to cut this energy consumption, e.g. moving refrigerators to colder rooms, replacing outdated appliances with energy-saving ones, using kettles, etc.<sup>141</sup> It is possible that the introduction of smart metres in smart homes can result in a better awareness of energy consumption (Hargreaves et al. 2010).

**Re. (4) Environmental friendliness of the shopping process:** a car trip by consumers to the shopping location causes a perhaps surprisingly large contribution to greenhouse gas emissions, whereby the key factors comprise the vehicles' fuel efficiency, but especially the distance, the

---

<sup>141</sup> Scientific studies are available specifically on the trade-off regarding the replacement of old electrical household appliances. This trade-off is between the cut in energy consumption brought about by using a new appliance on the one hand and the resources used by buying a new appliance before it is really necessary, including the material input needed to manufacture this appliance (Kim et al. 2006). In recent years, due to the major strides made in energy consumption, the replacement of refrigeration appliances has mostly been ecologically beneficial after only a few years. In the future, this assessment could change due to decreasing energy-saving progress and with increasing use of renewable energy sources (Baxter 2019). Longevity will then become more important.

amount of food purchased per trip and the question as to whether shopping trips are combined with other tasks (Niles et al. 2018, Mohareb et al. 2018). Approximately 52% of the population has a grocery shop within a radius of one kilometre of their home (Neumeier 2014). Shopping trips for individual products are problematic. For instance, buying a kilogram of strawberries at a farm 5 kilometres away by car causes approximately 1 kg of CO<sub>2</sub>, while buying Spanish strawberries in a supermarket causes slightly more than 200 g of CO<sub>2</sub> for the transport of the berries by trucks (cf. Sections 5.3 and 5.4).

**Text box 9:** Environmental impacts of pets

When considering food consumption at the household level, one factor that is regularly ignored is that about 60% of German households have pets that also consume food. Their influence may be negligible in the case of small animals, but larger pets and companion animals such as cats, dogs and horses make a major contribution to the ecological footprint, especially as they are fed less and less with leftover food. A calculation for Switzerland (Annaheim et al. 2018) shows, for instance, that the total climate impact of a horse of about 2.4 t CO<sub>2</sub> per year (of which about 35% for horse feed) is roughly equivalent to the food consumption-related emissions of a human. A dog contributes about 950 kg of CO<sub>2</sub> per year, a cat 380 kg (rabbits 95 kg; birds 30 kg). Overall, the contribution of all pets to Swiss climate emissions is estimated at a good 1% (ibid.). For the USA, which has a high pet density (e.g. approx. 163 million dogs with a human population of around 320 million), Okin (2017) shows that the energy consumption attributable to dogs and cats corresponds to around 19% of human food consumption. In terms of the environmental indicators of land use, water, fossil fuels and biocides in the production of animal food, the combined percentage of these two domestic animal species totals 25–30% of human consumption. The authors encourage a societal discourse on the scale of pet ownership and whether smaller pets could also have the positive health and social effects associated with pets.

#### 4.4.4 Conclusions on the environmental dimension

Negative ecological effects occur in the food value chain (ranging from the production of agricultural inputs to agricultural production, processing and consumption), in particular in terms of biodiversity, surplus reactive nitrogen compounds and greenhouse gas emissions. The food sector bears key responsibility for the key environmental issue of biodiversity (IPBES 2019). The food sector is highly relevant for climate change – not least due to nitrous oxide and methane emissions – even in a highly industrialised country like Germany, and also represents a global priority (IPCC 2019).

The food sector has thus rightly been the focus of societal debate on the environment in recent years. At the same time, steering environmental effects on the supply side does not suffice (see Section 7). There is a danger, for instance, that if standards are raised, the negative environmental effects will merely be shifted abroad, as consumer demand will then be increasingly covered by imports. Measures on the supply side alone are therefore not sufficient to regulate the environmental problems of agriculture and should therefore be supplemented by measures on the demand side (see Section 6.2).

Changes in consumption are, for instance, key to achieving climate change mitigation goals. But food consumption represents an existential need. The focus of nutrition-related environmental protection and climate change mitigation is therefore on shifting consumption to more eco-friendly foods, i.e. foods that have been produced or transported in a more environmentally friendly way (e.g. without air transport), as well as to other product groups that exert less negative environmental effects (e.g. fewer animal products, more legumes instead). It is frequently hard for consumers to identify which foods are more environmentally friendly and for what reasons (see Sections 5, 7.6.3 and 8.9).

The preceding remarks have demonstrated that primary agricultural production is in many cases, but not always, the most ecologically relevant stage of the value chain. What matters is to look at the entire food chain.

**Regarding agricultural environmental pollution, it should be noted that:**

- Current global agricultural practices are contributing to the exceedance of important planetary boundaries, particularly as regards climate change, nitrogen surpluses, biodiversity loss and soil degradation.
- From a global perspective, more environmental protection in agriculture in most regions of the world cannot be achieved by reducing production: In view of the global scandal of more than 800 million starving people (with the number of overweight people being of a similar order of magnitude) and a growing world population, as highlighted in Section 4.1, it is much more important to increase food production while reducing environmental impacts. The central guideline here is that countries in the South and those with low yield levels should be placed in a position to increase production. Highly developed countries with major environmental problems, such as Germany, on the other hand, are primarily required to intensify in ecological terms, i.e. to maintain high yield levels, but to significantly lower the ecological footprint and thus increase eco-efficiency (Taube et al. 2014). Realistically, in some regions, a reduction in environmental impacts and an increase in biodiversity will only be achievable if production is reduced.
- The high contribution of farming to climate change, both globally and also in Germany, is essentially due to livestock husbandry (and related to this, nitrogen fertilisation) and therefore ultimately dependent on the dietary patterns of consumers. The argument that reducing livestock farming in Germany without changing consumption patterns would only shift the problem in the short run is basically correct. Yet the climate policy assessment depends, in the individual case, on whether or not production, if shifted abroad, can be carried out with lower GHG emissions. In the medium and long term, going without the previous scale of animal husbandry in a rich country would have a moral role model function for emerging and developing countries, but corresponding adaptation responses can hardly be estimated in quantitative terms.
- It is difficult to make general statements about which type of agricultural production is more climate-friendly. As demonstrated by the example of dairy cattle production systems, it is not true that intensive forms of production are always more climate-friendly – but neither is the

opposite. Against this backdrop, the contribution of organic farming is discussed in detail in Section 5.2.

**Biodiversity** is closely tied to regional and natural conditions. It is hardly possible to ascertain in general which measures make sense for Germany as a whole in order to increase biodiversity. The topic is very complex for a consumer-oriented policy. Thus, the WBAE regards biodiversity as an example of a policy field in which a differentiated influence on the supply side (i.e. agriculture) should take place. In this regard, the WBAE (2018, 2019) has developed detailed proposals in its opinions on the CAP. Consumers who want to contribute to biodiversity protection can do so by buying organic foods (see Section 5.2).

**With regard to the further stages of the value chain, it turns out that:**

- There are relevant trade-offs between measures at different stages of the value chain, e.g. between refrigeration, packaging avoidance and food waste. These trade-offs make an evaluation difficult. Section 5.3 therefore demonstrates that a life cycle assessment of food covering the entire product life cycle is required in order to gain transparency. This is also the basis for the call for a climate label (Sections 8.5 and 9), as the current complexity is incomprehensible for consumers.
- The role of (plastic) packaging and plastic bags for environmental protection and climate change mitigation is overestimated in societal debate. Due to their visibility, packaging issues are symbolic of the environmental protection debate and lend themselves to token politics. With the establishment of a dual waste disposal system, progress has been made in material recycling, but at the same time the amount of packaging has increased substantially. Dispensing with packaging can, but does not have to be, beneficial from an overall ecological perspective. There are trade-offs that require a life cycle assessment. By amending the Packaging Act, which took effect on 1.1.2019, the legislator has provided economic incentives for environmentally oriented packaging design (e.g. recycling-oriented design). Whether this will suffice and whether the implementation of the necessary collective solutions (industry solutions) will be achieved with the amendment, however, seems questionable. Germany is still far from being a circular economy. Another urgent starting point is the prevention of improper disposal via exports (mismanaged waste).
- Food retailers, like consumers, are chiefly responsible for reducing food losses. Food losses are an important issue of environmental protection. The central role of food retailing in environmental protection is not so much the environmental impact it creates, but its strong position of power in the value chain. The highly concentrated retail sector has significant opportunities to influence suppliers and customers in an environmentally-oriented manner through standards and purchasing decisions (see Section 8.13).

**Finally, the following conclusion can be drawn on the consumption side:**

- Key factors of environmentally aware consumption include the living space per capita, the number of journeys by air, the avoidance of car travel, the type and number of cars, heating and

insulation standards, but also the level of consumption of animal products. In the further course of the expertise, the reduction of the consumption of animal products will be addressed in greater detail (see Sections 5.3, 9.3). Food and nutrition policy is an important component of a comprehensive policy for sustainable lifestyles.

- Food from greenhouses heated with fossil energy sources has particularly high greenhouse gas emissions. Central components for cutting these emissions include climate-oriented taxation of fossil energy, the promotion of greenhouses powered by renewable energies and a mandatory climate label.
- As a general indicator, the role of food miles or regionality is overrated (see also Sections 5.3 and 5.4). However, air transport poses particular problems. The WBAE therefore proposes a global climate tax on freight air transport as a first-best option.<sup>142</sup> In addition, the proposed climate label should point out the issues caused by air freight for consumers. If this cannot be implemented, a mandatory “warning label” for consumers could also create transparency. The combination of regionality with seasonality makes sense, spatial proximity alone only to a limited extent (cf. Section 5.4).
- Food losses account for about 6.7% of global GHG emissions. A good half of food losses occur during the consumption phase, i.e. among consumers. Germany has set itself far-reaching reduction objectives in this field, but their implementation constitutes a considerable challenge (cf. Section 8.11).

## 4.5 Animal Welfare

In its expertise on socially acceptable animal husbandry (WBA 2015), the WBA identified the need for profound changes to livestock farming against the backdrop of major deficits, in particular regarding animal welfare, but also relating to environmental protection. In Germany, a large percentage of livestock are kept in conditions that lead to a considerable impairment of animal welfare, including for instance 15% of dairy cows with little space to move freely due to the use of tethers all year round as well as a high proportion of fattening pigs kept on fully-slatted floors. In its expertise (2015), the WBA listed a large number of animal protection problems in all areas of livestock husbandry, breeding, transport, and slaughter. In the case of many of these animal protection problems, this encompasses multi-factor harm, diseases or behavioural disorders regarding which the risks arise at several husbandry stages (e.g. breeding and production stages). In most cases approaches to improvements are necessarily complex. The management and handling by animal keepers has a significant impact on animal welfare. In practice, non-curative interventions are used for prevention purposes e.g. to prevent cannibalism or animal injuries caused by issues such as poor management and husbandry systems that do not conform to animal welfare requirements. And finally, the genotypes used have an impact on animal welfare. While desirable attributes regarding animal health and behaviour are becoming increasingly important in animal breeding, they

---

<sup>142</sup> This proposal, as it is outside the food sector and raises complex international issues, will not be taken up further below.

are to some extent characterised by low heritability and phenotypes that are difficult to assess, resulting in less progress in breeding. In practice, animal health and behaviour are often not yet considered as crucial as they should be.

The Advisory Board, however, calculated that a substantial improvement of animal welfare would cause significant costs to the tune of roughly 3–5 billion euros annually. This would result in an increase of approximately 13–23% of today's production costs. At the same time, further increasing efficiency of production, e.g. through growth in output (daily weight increase, milk yield etc.), may have a positive impact on both climate change mitigation (cf. WBAE & WBW 2016) and global food security (cf. Section 4.1). In Germany, however, an increase in efficiency will only be possible to a limited extent. In fact, extensification will be required in several areas.

Against this backdrop, more sustainable food consumption must take animal welfare into account: **focussing solely on efficiency at the expense of animal welfare** would drive an ever deeper wedge between parts of society and the agri-food industry. There is considerable evidence that the relationship between humans and animals is shifting profoundly in the wake of an ongoing social change: Roughly 61% of German households are pet owners. As a result, people often project the experiences gained from the relationship with their pet onto livestock farming (Vanhonacker & Verbeke 2014, McKendree et al. 2014). The fields of biology and ethology provide new insights into the emotional, cognitive and social abilities of animals. In addition, new information has emerged that the genetic material of animals is very similar to that of humans. Against this backdrop, our notion of good living conditions for farm animals is increasingly being shaped by human needs (empathy) and an intuitive understanding of animal welfare aside from scientific findings (i.a. Boogaard et al. 2011). The shift in the relationship between humans and animals presumably indicates a long-term trend rather than a temporary phenomenon as it is linked to deeply rooted positions on animal ethics which have come to be less anthropocentric (Hölker et al. 2019).

Livestock farming in Germany thus faces major challenges. Husbandry and management systems must be adapted to be in line with **scientifically robust** requirements for animal welfare that correspond to **society's moral concepts**.

More specifically, the WBA (2015) highlighted the following nine guidelines for sustainable animal husbandry that should be considered in the transition of livestock farming:

- (1) access of all livestock to different climate zones, preferably including outdoor climate;
- (2) provision of different functional areas with various floor coverings
- (3) provision of installations, substances and incentives for species-specific activities, feed intake and grooming activities;
- (4) provision of sufficient space;
- (5) a halt to amputations;

- (6) routine farm self-inspections based on animal-related animal welfare indicators;
- (7) significantly reduced (or optimised) use of medicinal products;
- (8) improved levels of education, knowledge and motivation of people working in the livestock sector; and
- (9) greater consideration of functional characteristics in breeding.

These guidelines must be defined in greater detail according to the animal species and the husbandry system. They also require a schedule for conversion and a funding strategy. This is the case because significantly higher standards could result in the problem merely being moved to other countries due to the considerable additional costs for animal welfare and the fact that especially pig and poultry husbandry can easily be shifted abroad. In principle, there are three options available in terms of funding (WBA 2015, competence network on livestock farming 2020):

- (1) higher consumer prices for products labelled as particularly animal-friendly;
- (2) levy models such as Germany's private-sector Animal Welfare Initiative or a meat duty ortax; and
- (3) the granting of state animal welfare premiums from the general state budget.

With the Animal Welfare Initiative's current budget of around € 130 million a year and national animal welfare payments under the second pillar of the CAP (Article 33 EAFRD regulation) of currently around € 34 million per annum, the **funds provided are not proportionate to the size of the challenge.**

In light of that, our food consumption habits play a decisive role: they can contribute to achieving more animal welfare through targeted demand for particularly animal-friendly products and the associated willingness to pay for them. At this point in time, however, there is a wide gap between the great importance attached to animal welfare from the perspective of citizens and the low consumer demand for foodstuffs produced in a particularly animal-friendly manner. Thus, products labelled as particularly animal-friendly account for only about 1% of meat sales, 2,5% of dairy sales and 27% of egg sales in Germany. Not only are these percentages lower than the preferences citizens expressed but also well below the potential of 10–30% for milk and meat, which consumer researchers consider to be an attainable share (e.g. Cicia & Colantuoni 2010, Weinrich et al. 2014, for an overview see Grethe 2017).

In its expert opinion (WBA 2015), the Advisory Board fully analysed the reasons for the consumer–citizen gap, which illustrates the discrepancy between the behaviour of people in their roles as citizens and as consumers (see also text box 13: Consumer–citizen gap in Section 6.2.3). In addition, the Advisory Board outlined possible solutions which include a profound transition of agricultural policy contributing to more animal welfare-oriented demand by consumers. Transparent, trustworthy and well-communicated labelling and a broad distribution of such labels on the market,

especially for meat and ready-made products, as well as on the away-from-home catering market are critical to promote demand for products produced in a particularly animal-friendly way. Given that the labelling system in Germany is as of today a rather unclear patchwork, the WBA proposed establishing and widely advertising a voluntary, multi-stage, state animal welfare label (WBA 2015). In 2016, it was announced that a voluntary state animal welfare label would be developed. However, it has not yet been implemented. A corresponding Act was submitted to the Federal German Parliament in spring 2020; however, as of yet this Act relates to pork alone. Criteria for other species are to follow. While the process towards a voluntary state animal welfare label is rather slow, there has been progress regarding market transparency due to the fact that large German food retailing enterprises have opted for a single, comprehensive husbandry labelling system for beef, pork and poultry meat (cf. Section 8).

## 4.6 Conclusion: The challenge of transformation

Key international organisations, such as the FAO, the WHO and the IPCC, are increasingly stressing the fact that promoting sustainability in food consumption represents a global challenge. The previous sections describe a number of issues that clearly show that Germany, too, needs to take action.

Germany shows a serious deficit and, above all, a substantial social imbalance pertaining to the **health impacts of food consumption**, i.e. malnutrition and poor diets. Poverty increases the risk of an inadequate diet. Women from low-income households tend to already show signs of poor nutrition during pregnancy, which may have long-term implications. Children from poor households are more likely to be obese. Socially disadvantaged children consume significantly higher amounts of sugary soft drinks. The cost of foodstuffs with a high nutritional value, such as fruit and vegetables, is on average higher compared with the cost of energy-dense foods high in added sugar or fat. The additional costs of a health-promoting diet are considerable. Without further financial assistance, the current basic social security is not sufficient for a health-promoting diet. Consequently, it is necessary to review the bases of calculation and methods used to determine the standard needs rates in order to align public policy with the SDGs. Moreover, measures to improve the opportunities for children, adolescents and their families to realise their full potential and participate in society are key to prevention. Suitable measures for the field of food consumption comprise macro-social, setting-based approaches<sup>143</sup> that address the two most important living environments of children and adolescents: their families and their schools/pre-schools.

---

<sup>143</sup> Behavioural prevention starts with an individual person or household and aims to induce behavioural regulation in individuals. Behavioural prevention approaches include measures to inform and educate people. In contrast, setting-based approaches cover communal catering facilities such as pre-schools, schools, universities, hospitals, senior-citizen institutions, and prisons. Setting-based approaches address specific institutions where a large number of people eat rather than being directed at an individual person (cf. Section 8).

With respect to the **social dimension**, a distinction must be drawn between the situation in Germany and the situation in international trade. In Germany, half of the farm labour force is employed. Wage levels are well below the average of employees in other industries with comparable qualifications. In agricultural holdings, there are significant differences in income, depending on the type of holding, the size of the holding and entrepreneurial skills. A substantial percentage of family workers on farms do not receive a salary for their work that is comparable with the average remuneration that others receive for comparable tasks in other industries in Germany. This is to be viewed critically. Nonetheless, only families that are de facto in need and are able to provide proof of such need are eligible for state support. There is currently very little that consumers can do in terms of their purchasing behaviour that has an actual impact on the social situation of farmers in Germany. Even by opting not to take advantage of low-priced offers, they cannot ensure that farmers or employees actually improve their income.

International agricultural trade plays a pivotal role in sustainable development. Yet the social dimension of trade has so far been largely neglected. General barriers to trade for social reasons or a purchasing behaviour focussing only on one's own country are, however, not appropriate solutions. It is rather the responsibility of the government and enterprises to ensure that all foodstuffs sold in Germany are produced under decent working conditions, free of degrading labour conditions such as forced labour. Moreover, labels such as Fairtrade can help consumers achieve wider social objectives, although there is still room for improvement, in particular pertaining to the situation of those employed in the agricultural sector. The broader impact of these labels is also quite limited, while additional costs for consumers are relatively high compared with the improvement.

The **environmental implications** of agriculture and food consumption are one of the reasons why planetary boundaries regarding the climate, nitrogen and biodiversity are being exceeded. Food consumption rich in food of animal origin is a particular problem, not least as these foodstuffs, as opposed to foodstuffs of plant origin, cause considerably higher specific emissions, which are due to conversion losses along the food chain, in addition to increased land use claims. The agricultural sector directly accounts for 57% of global nitrous oxide emissions and 47% of methane emissions. Agriculture, land usage, forest plantations, and land use change together account for 10–12 Gt of CO<sub>2</sub> eq per year, which is equivalent to just under one quarter of global GHG emissions. Both nationally and internationally, land use in the farming and forestry sectors ranks first among the causes of the persistent and serious loss of biodiversity. With regard to the entire lifecycle, the other phases of production, transport and trade, both individually and combined, account on average for less than half of the negative impact caused by agriculture. Nevertheless, there are major exceptions such as air transport of foodstuffs and energy-intensive packaging. Besides the consumption of animal products, the reduction of food losses plays a critical role at consumer level.

Finally, livestock husbandry in Germany faces enormous **challenges in terms of animal welfare**. In Germany, a large percentage of the livestock are kept in conditions that lead to a considerable impairment of animal welfare. In its expertise (2015), the WBA listed a large number of animal

protection problems in all areas of livestock husbandry, breeding, transport, and slaughter. Focusing solely on efficiency at the expense of animal welfare would drive an ever deeper wedge between parts of society and the agri-food industry.

Aside from the multi-dimensionality of the goals, the existence of partial trade-offs poses a particular challenge for food and nutrition policies. This can be illustrated by means of an important example: in terms of climate stewardship, the productivity of livestock farming is a top priority. Yet higher feed efficiency and thus rapid growth are relatively frequently linked to animal protection issues, e.g. unbalanced breeding focused solely on weight gain. Improved husbandry conditions and animal breeding for functional characteristics of relevance to animal protection can mitigate trade-offs to some extent. However, the Scientific Advisory Board on Agricultural Policy (WBA) also described the limitations of this approach in its expert opinion on sustainable animal husbandry (2015). From an animal welfare perspective, it would be necessary to “extensify” the current intensive production system of most farm animals. Likewise, there are also trade-offs within the environmental dimension between the sub-goals of protection of biodiversity and climate change mitigation. In this case as well, more biodiversity requires extensification measures, whereas climate change mitigation calls for means of (ecological) intensification. Another key trade-off is between animal welfare and biodiversity protection in Germany and Europe on the one hand and climate stewardship, biodiversity protection and food security on the global level on the other hand. On the German and European level, it is necessary to take measures to extensify in order to improve animal welfare and biodiversity protection, which result in lower yields.

A stable demand for agricultural products may thus lead to intensification of production in other regions of the world. In regions such as Africa, where production intensity is very low, intensification may even be environmentally beneficial. In other parts of the world, however, further intensification measures might be problematic in terms of nature conservation. The exploitation of primary forests or hitherto protected areas has particularly problematic indirect effects on land use. Moreover, extensification in Germany or the EU may result in a global upsurge in food prices, which has a negative impact on food security in emerging and developing countries.

A sustainable development of the food system therefore requires a combination of supply-side measures, including both agricultural de-intensification and ecological intensification, and consumer-side measures, in particular by reducing food losses and the consumption of animal products. In the ongoing political debate, these two sides of the coin are often set against each other or, when taken in isolation, reach their limits:

- Even now, the food system exceeds the planetary boundaries. If the globally emerging food consumption habits spread further (a “westernisation of diets”), while the world population continues to grow, technological progress, e.g. regarding plant and animal breeding, will have to be accelerated significantly. The latter, however, is currently hardly conceivable and is today already reaching limits regarding animal ethics.

- Solely focussing on individual (sustainable) changes in food consumption habits fails to recognise the strong cultural and individual habitualisation of food consumption and the risk of rebound effects (cf. Sections 3 and 7.6). Without any policy intervention, it seems highly unlikely that the global consumption of animal products can be reduced in the foreseeable future. OECD countries serve as role models in this respect. Yet there are only the first signs of a trend reversal in these countries as well.

It is crucial to note that for almost all of the issues described in Section 4 the time-scale is particularly long and the progress thus is very slow. In many cases, it is also hardly even perceptible, in particular when it comes to climate change and biodiversity. With respect to food consumption as well, there may be a time gap of up to several decades between consumption and many possible positive or negative health effects. Problems related to biodiversity are hardly ever as obvious to people as they are when it comes to the dramatic decline in insect populations and clean wind-screens. Animal welfare and the shifting relationship between humans and animals are the result of a gradual societal transformation.

In general, there is a multidimensional range of objectives including partial trade-offs. This is rendered even more difficult by considerable differences in the food consumption habits of people from different social groups. Moreover, different problems tend to particularly accumulate among low-income households. The initial situation is therefore quite complex and requires a particularly well thought-out food policy (cf. Sections 7 and 8). Food policy has in the past already been put to the test in view of related health issues. In the case of obesity, for instance, the trend, which has persisted over decades, has so far only flattened out. A reversal has not been achieved yet. The multidimensionality of the SDGs has broadened the overarching objective, necessitating a conceptual, budgetary and institutional development of food policy (cf. Sections 8 and 9). With respect to the latter, it is necessary to at least partially integrate hitherto institutionally separated policy areas, e.g. environmental and health policy with agri-food policy, and in part also with development policy. In Germany, this integration involves several ministries at the same time. Moreover, it covers all policy levels, from international institutions, which for instance take climate-related decisions, down to local institutions responsible for nature conservation issues (cf. Section 7).

A policy for promoting more sustainable food consumption consequently meets several of the criteria of the challenge that, in view of climate change, was described by the German Advisory Council on Global Change (WBGU 2011) as a “Great Transformation”, i.e. a profound, yet not fully predictable transition that will entail fundamental changes to the way we live.

## 5 Identification and measurement of sustainable food consumption

### 5.1 Conceptual and methodological challenges of assessing sustainability

To systematically pursue the aim of promoting sustainability in food consumption, decision makers (politicians, consumers, businesses) require a sort of “compass” that provides some orientation as well as permitting systematic monitoring (“Governing through Goals”, Kanie & Biermann 2017).

The past few decades have seen the development of a number of reference frameworks and measurement systems that can be applied to food consumption and each reflect environmental, economic, social and animal-welfare aspects of sustainable development in different ways. These reference frameworks and measurement systems in many instances draw on the prevalent social debate of their time – which, however, frequently focuses on certain subject areas and/or indicators as key characteristics of sustainable food consumption.

By way of example, Table 5-1 shows three different sets of recommendations for sustainable food consumption addressed to consumers: (1) recommendations made by the Federal Government’s Council for Sustainable Development (RNE) for a “sustainable shopping basket” (2) recommendations made by Tegut, as an example of a grocery store chain committed to sustainability, and (3) recommendations made by a popular website on which the WWF describes its position.

Of the sustainability dimensions discussed in this expertise, the RNE explicitly focuses on the environment and climate, while the WWF focuses on the environmental footprint. In addition to various environmental aspects, Tegut also mentions the social aspects of securing the income of farmers in the region and securing the livelihoods of producers in the poorer southern countries. Compared with what sustainable development and food consumption is taken to mean in this expertise, these examples have a very clear environmental emphasis, while health, social and animal-welfare aspects are each only addressed by individual recommendations, either explicitly (health aspects: DGE; social aspects: the fair trade concept; animal welfare: compliance with animal welfare requirements, better meat) or implicitly (organic products, MSC, Rainforest Alliance/UTZ concepts also comprise social standards, organic concepts also comprise animal welfare standards).

Consumers who now obtain information from the media thus receive the following recommendations as key indicators for sustainable food consumption: consume organic foods, eat less meat, buy fish from sustainable fisheries (confirmed, for example, by the MSC label), buy regional products. Other frequently listed aspects include GM-free foods, animal protection, seasonal products, fair trade products, reusable packaging, consumption of tap water, increased consumption of fruit and vegetables and decreased food wastage.

**Table 5-1:** Examples of recommendations for sustainable food consumption addressed to consumers

Federal Government's Council for Sustainable Development <sup>1)</sup>	Retail company Tegut <sup>2)</sup>	Online resources/WWF <sup>3)</sup>
Organic foods	Organic foods	The bio the better
Regional	Regional foods	Shopping radically regionally
Seasonal		Shopping seasonally
Less meat or go vegan		Eating vegetarian more frequently
GMO-free	GMO-free	
Stock-conserving fisheries (MSC)	Fish from stock-conserving origins	Fish is no vegetable (if fish, then MSC)
Proper storage/ Avoiding leftovers/ Avoiding food wastage		Don't throw out food
Fair foodstuffs (Fairtrade)	Fair trade	Grab 'em by the money (shopping with political awareness)
Eating healthy (Reference to DGE and 5-a-day)		Fruit for the world
Drinking tap water		Not drinking bottled water
Animal protection/animal welfare/explicit attention to type of housing when buying eggs		Eating better meat
Cooking at home		Smarter shopping
Using reusable systems		Single-use is not the way
Avoiding palm oil		
Rainforest Alliance/UTZ		

Sources: WBAE illustration based on <sup>1)</sup> RENN (2019) and <https://www.nachhaltiger-warenkorb.de/themenbereiche/essen-und-trinken/> (last accessed on 10 January 2020), <sup>2)</sup> Tegut (2015), <sup>3)</sup> Samson (n.d.).

These recommendations for sustainable food consumption addressed to consumers pose some major problems, however.

- Firstly, there is very little correspondence between them.
- In addition, the various recommendations are not prioritised but are simply listed with equal weighting. This makes it unclear what contribution each recommendation makes, whether it has a more symbolic character or whether it can make a relevant contribution.

- Some of the recommendations are scientifically controversial or have not (yet) been investigated and verified (sufficiently).

In the face of the complexity of the sustainability challenge, deviations between the recommendations made by different stakeholders are not surprising – but inconsistent and/or conflicting recommendations cannot be used to provide meaningful orientation to the actions of politics and consumers. Despite all measuring and assessment problems, it is important to make sure that the ideas on promoting sustainability in food consumption that are developed and communicated to society are sufficiently consistent. After all, the issue of sustainable food consumption is of interest for many, and many people would like to take action in this regard (Zander & Hamm 2010, Tobler et al. 2011, Hartmann & Siegrist 2017, Massey et al. 2018, BMEL 2019g).

Various assessment and measurement systems for sustainability have been proposed in social debate and in the scientific community. These include, in particular, (1) approaches for measuring the sustainability of various **agricultural production systems** (Section 5.2); and (2) approaches for assessing complex **dietary patterns, products and foodstuffs** (Section 5.3). Table 5-1 lists, by way of example, recommendations on sustainable food consumption made by three players which address different levels. While the recommendation to buy organic products refers to the agricultural production system, the recommendation to eat less meat or follow a vegan diet focuses on one type of food as well as a dietary pattern, or on certain products (e.g. meat products); this is one of the reasons – but certainly not the only one – for the inconsistency of the recommendations. In addition to the different viewpoints presented in Table 5-2, there is, finally, also the spatial dimension of food systems (global, national, regional) (Section 5.4), which is, however, less frequently investigated.

**Table 5-2:** Systems for measuring and assessing sustainability within the context of a sustainable diet

	<b>Agricultural production systems</b>	<b>Dietary patterns, products, foodstuffs</b>
<b>Focus of analysis</b>	Agriculture	Foodstuffs
<b>Object of analysis</b>	Comparison between alternative agricultural production methods or systems	Comparison between foodstuffs and certain combinations of foodstuffs (alternative dietary patterns)
<b>Indicator priority</b>	Protection of environment and resources, climate change mitigation, animal welfare; health and social issues are scarcely considered	Health, climate change mitigation; other indicators are scarcely considered

Source: WBAE illustration.

This section aims to analyse the various systems relevant to assessing the sustainability of food consumption in terms of the following aspects:

- What **methods** of sustainability assessment are suitable and/or necessary?
- What **information** do we have, what are the existing knowledge gaps and what need for research can be deduced from this?
- How can the transmission of information to economic operators, politicians and consumers be **improved**?
- What information and **conclusions** can be deduced from the results of the respective sustainability assessment and what recommendations can be derived from these conclusions regarding policy action to promote sustainability in food consumption?

The various fields (health, social, environmental and animal welfare aspects) present similar challenges, particularly with regard to the selection of suitable indicators for the measurement of each sustainability dimension and the aggregation (weighting) of the various indicators to an overall assessment.

## 5.2 Assessment of various farming systems

One way of assessing whether a food is sustainable is to scrutinise the farming system that was used to produce the product. For this purpose, different forms of farming will be defined (e.g. conventional or organic); this will be followed by a comparison of the **degree of sustainability of these farming systems**.

Farming in Germany has changed greatly over recent decades. Intensification, specialisation, larger holdings – these are just some of the keywords. Despite certain harmonisation, the field is still multifaceted, ranging from very small to very large holdings, from highly specialised to highly diversified holdings, from holdings which rear livestock to those that do not, from intensively to extensively managed holdings, and so on. The multitude of different types of land management reflect the large differences in the local natural conditions as well as the economic and historic settings, on the one hand, and the individual preferences of the land managers on the other. This begs the question whether any farming systems have evolved among this variety that can be identified as particularly sustainable.

During the 1990s – particularly against the backdrop of increasing environmental problems in agriculture (SRU 1985) – various assessment approaches were developed with the aspiration of examining and assessing agricultural holdings in terms of the consequences of agricultural production on the environment (cf. e.g. Eckert & Breitschuh 1994, Diepenbrock et al. 1997, Meyer-Aurich et al. 2000). Since sustainability means more than just environmental compatibility (cf. Section 2), and in order to take into consideration all pillars of sustainability, expanded approaches to measuring the sustainability of agriculture have been developed increasingly over the past two decades.

It is not easy, however, to assess and compare the sustainability of farming systems (cf. e.g. Christen & O'Halloran-Wietholtz 2002, Roesch et al. 2017) because numerous economic, social and environmental effects must be identified, assessed, weighted, and – in the case of trade-offs – weighed against each other. The challenge here is that the effects differ, for example depending on the location (climate, soil conditions) and the type of holding (management capacities).

In the following, we will firstly outline the various concepts for assessing the sustainability of agricultural holdings and production systems. Since organic farming, as a clearly delineated and legally defined farming system, plays a special role in the sustainability debate and is frequently named in the social debate as the most important sustainability indicator for foods, this system will subsequently be illustrated in more depth (Section 5.2.2). Building on this, we will then briefly consider the perspectives of additional (more) sustainable farming systems (Section 5.2.3) and some socially controversial farming system issues such as the use of genetic engineering or glyphosate (Section 5.2.4). Section 5.2.5 summarises these analyses.

### 5.2.1 Concepts for assessing the sustainability of agricultural holdings and production systems

There are nowadays a number of concepts for recording, assessing and controlling the sustainability of agricultural holdings and production systems.<sup>144</sup> These concepts differ – sometimes greatly – depending on their objectives and intended purpose, which must be taken into account when comparing them.

#### a) International guidelines for assessing sustainability

Within the scope of the “**Sustainable Agricultural Initiative**” (SAI Platform, <http://www.saiplatform.org/>), which was founded by internationally active food corporations and presently has 90 members, principles and practices of sustainable agriculture are developed and consolidated. The aim of the initiative is to support the development of sustainable agriculture globally. The guidelines developed are applied when procuring raw materials. Thus, during the past few years, companies such as Nestlé, Unilever and Ferrero have expanded their conditions of purchase to include sustainability requirements, for example when it comes to milk products. The sustainability processes thus initiated are used within the company and not communicated to product consumers.

In consultation with relevant stakeholders, the FAO has developed the **SAFA Guidelines** (sustainable assessment of food and agricultural systems)<sup>145</sup>. This sustainability assessment comprises the

---

<sup>144</sup> Besides the comprehensive concepts for assessing sustainability, additional concepts are frequently drawn upon in this context; however, these relate only to environmental issues (e.g. the Life Cycle Assessment Method SALCA, cf. Gaillard & Nemecek 2009), and will therefore not be discussed further here.

<sup>145</sup> <http://www.fao.org/nr/sustainability/sustainability-assessments-safa/en/>;  
[http://www.fao.org/fileadmin/templates/nr/sustainability\\_pathways/docs/SAFA\\_Guidelines\\_Final\\_122013.pdf](http://www.fao.org/fileadmin/templates/nr/sustainability_pathways/docs/SAFA_Guidelines_Final_122013.pdf).

dimensions “good governance”, “environmental integrity”, “economic resilience” and “social well-being” (cf. Section 4.3.2), each of which covers four to six topics. A total of 21 topics and 58 sub-topics are addressed. Objectives are outlined for each sub-topic and potential indicators suggested. Schultheiß et al. (2014) expect providers of sustainability assessments to base their services on the specifications of the SAFA Guidelines.

#### b) Concepts for assessing the sustainability of agricultural holdings with sustainability certifications

There are only two German-language assessment concepts that, in addition to the environmental aspect, also take into consideration the economic and social dimensions on the level of individual agricultural holdings, that have been developed sufficiently for practical application, that are used on a number of holdings, and that include a certification (Zapf & Schultheiß 2013): these two assessment concepts are the Criteria System for Sustainable Agriculture (“Kriteriensystem nachhaltige Landwirtschaft”, KSNL) and the German Agricultural Society’s sustainability standard (“DLG-Nachhaltigkeitsstandard”). These concepts are being further developed as part of an ongoing learning and adaptation process. This is reflected, for example, by the fact that they are being and/or have been expanded to include modules for assessing animal welfare.

- The **KSNL criteria system for sustainable agriculture** was developed by the Thuringian State Institution for Agriculture in collaboration with scientists and advisers. At the heart of the document are 34 criteria from the three pillars of economy, environment and social welfare (Breitschuh et al. 2008) and currently 20 criteria for assessing animal welfare in dairy cattle farming. If all assessment criteria are at least within the permissible tolerances, then a holding is deemed sustainable and receives a sustainability certification. According to Zapf and Schultheiß (2013), by 2013 a total of approximately 120 sustainability assessments had been conducted using KSNL, and the environmental module concerning criteria for environmentally sound land management (“Kriterien umweltverträglicher Landbewirtschaftung”, KUL) had been applied to 450 holdings.
- In collaboration with the German Federal Environmental Foundation (DBU), the **German Agricultural Society’s sustainability certification “Sustainable agriculture fit for the future”** (“Nachhaltige Landwirtschaft zukunftsfähig”) was developed by the German Agricultural Society (DLG), the Technical University of Munich (TUM), Martin Luther University Halle-Wittenberg and the Institut für Nachhaltige Landwirtschaft Halle/Saale e. V. association with support from the German Federal Environmental Foundation (Christen et al. 2013). The environmental assessment embedded in this concept is based to a large extent on the REPRO model, which was originally developed for balancing agricultural material cycles at the level of individual holdings by Martin Luther University Halle-Wittenberg (Hülsbergen 2003). Overall, the concept assesses a holding on the basis of 22 criteria from the three pillars of economy, environment and social welfare (cf. Section 4.3.2). According to the list on the assessment concept’s website, a total of 35 holdings in Germany have received the certification to date.<sup>146</sup>

---

<sup>146</sup> [http://www.nachhaltige-landwirtschaft.info/zertifizierte\\_betriebe.html](http://www.nachhaltige-landwirtschaft.info/zertifizierte_betriebe.html).

**b) Concepts for assessing the sustainability of agricultural holdings without sustainability certifications**

- The **RISE** assessment tool (Response-Inducing Sustainability Evaluation) was developed for global application at Bern University of Applied Sciences – School of Agricultural, Forest and Food Sciences (HAFL) in Switzerland. Using 46 indicators, compiled into ten topic-related values, agricultural holdings are assessed in a holistic manner. To date, approximately 3,500 assessments have been conducted in 57 countries worldwide (cf. Grenz 2017).<sup>147</sup>
- The **SMART** concept (Sustainability Monitoring and Assessment RouTine) was developed by the Research Institute of Organic Agriculture (FiBL) in Switzerland, based on the FAO's SAFA Guidelines (see above). The assessment concept is based on a large catalogue of indicators (currently more than 300), which are used to judge the degree to which each of the 58 sustainability goals (condensed into 21 topics) defined in the SAFA Guidelines (Schader et al. 2016) has been achieved.<sup>148</sup>
- The **Dairy Sustainability Tool** was developed as a basic tool for dairy farms and dairy plants by the Thünen Institute of Farm Economics in collaboration with the Projektbüro Land und Markt project office and representatives from the dairy industry. It currently comprises a little over 80 criteria from the fields of economy, environment, social issues and animal welfare (cf. Flint et al. 2016). The Dairy Sustainability Tool is not used to conduct a conclusive sustainability assessment for each dairy farm; instead, the aim of the concept is to identify strengths and weaknesses, reveal potentials for development, and thus encourage optimisation, for example through criteria benchmarks at farm/plant level. By spring 2020, more than 7,000 dairy farmers had completed the sustainability survey.<sup>149</sup> Similar approaches from the dairy industry also exist in other European countries, the US, Australia and New Zealand. They differ, however, in their focuses as well as in the depth and breadth of their criteria.

Common to all concepts outlined here is the fact that they are based on existing documentation at agricultural holdings on the one hand, and on information measured or estimated by the operators on the other.

In addition to these extensive assessment concepts, there are also a number of **certifications** which, although they have also “jumped on the sustainability bandwagon”, only consider certain aspects of sustainability (e.g. the fair trade concept, UTZ, Rainforest Alliance) or individual products

---

<sup>147</sup> The working group on holding assessment systems at the Association for Technology and Structures in Agriculture (KTBL) compared and assessed the KSNL, DLG and RISE sustainability assessment concepts (cf. Zapf et al. 2009).

<sup>148</sup> The SMART system has not yet been developed into a classic certification system with a neutral standard and independent certification. However, the Swiss Aldi subsidiary Hofer is testing the use of a sustainability label based on a voluntary assessment. The FiBL research institution uses the SMART approach to compare the “Zurück zum Ursprung” (“Back to the origins”) organic private label with corresponding conventional products, cf. <https://www.zurueckzumursprung.at/nachhaltigkeit/>.

<sup>149</sup> A nationwide test run has been funded by the BMEL since 2017 as part of a three-year pilot phase conducted by the QM-Milch national quality management scheme for milk, the Thünen Institute and the Projektbüro Land und Markt project office. A total of 34 dairy plants took part in the pilot phase. Cf. also <https://www.qm-milch.de/nachhaltigkeit>.

(sustainable soya/RTRS, sustainable palm oil/RSPO). These concepts focus on specific aspects rather than addressing an overall sustainability assessment. With regard to the agricultural production system, the concepts frequently address avoiding deforestation and include rules on the long-term preservation of soil fertility, the avoidance of erosion and the use of plant protection products.

The benefits of the comprehensive sustainability assessments/checks outlined above primarily consist in the fact that operators – in addition to the well-established operational assessments – gain supplementary economic parameters and in-depth insights into the environmental, social and animal-welfare situation of their holding. Sustainability strengths and weaknesses in different areas of the holding are made transparent. Farmers are thus sensitised to processes in their holdings that are not set up optimally. This raises their awareness of sustainability and triggers change. The processes concerned are frequently those that, out of tradition or habit, are more or less routine and are therefore not given much reflection. It is particularly improvements in the environmental dimension of such aspects that frequently go hand in hand with an improvement of the economic dimension. These concepts are primarily advisory tools intended to help farmers make long-term improvements to their operations in terms of sustainability criteria. The results can additionally be used in the communication with buyers and social groups.

The sustainability assessments/checks undoubtedly have great potential for contributing to operational improvements. Whether and to what extent the use of these assessment concepts actually improves the sustainability of holdings has not yet been investigated as this is not an easy task: one notorious challenge is that changes often do not occur until years later. Since these assessment concepts have not yet been in use for very long and only a small number of holdings have so far adopted them,<sup>150</sup> the changes thus induced are so far negligible when considering the entire sector. A wide adoption of these concepts can likely only be expected if politics, for example in the context of the CAP, or the receiving sectors in the context of their procurement policy call for the adoption of such systems by suppliers or provide the relevant incentives.

As described before, the concepts outlined have their justification when it comes to long-term improvements of agricultural production systems in terms of sustainability criteria. They reach their **limits** however, when it comes to the consumer point of view:

- there is not one sole technically substantiated and socially accepted measurement and assessment system; instead, there are many concepts jumping on the sustainability bandwagon and therefore causing confusion.
- It is not possible to (justiciably) verify some of the criteria with a reasonable level of effort.
- The aggregation of highly varied aspects such as biodiversity and the income of employees is methodologically controversial.

---

<sup>150</sup> Against the backdrop of funding being provided in some federal states for participation in sustainability assessments by KSNL, DLG and RISE within the scope of programmes for rural development support (ELER), the low demand for these concepts is slightly puzzling. Farmers do not seem to see any use in them.

- Frequently, the assessment concepts are too complex for consumers and therefore difficult to communicate.
- The assessment concepts do not permit any conclusions to be made regarding the overall sustainability of a foodstuff along the entire value chain.

It is hardly surprising, therefore, that these extensive assessment concepts are currently not being used as a labelling system addressing consumers.

In summary, it can be concluded that the assessment systems presented have potential above all for gradually leading to more sustainable agriculture. Clearly **definable farming systems** have **not developed** from these systems and are therefore not represented on the market. Due to the lack of verifiable requirements, the “integrated farming” approach, which is considered to be somewhere in-between conventional and organic farming and is also viewed as an established technical practice in well-managed conventional holdings (Spiller & Nitzko 2019), has also failed to establish itself on the market. Integrated cultivation as a production system has been a binding requirement throughout the EU since 2014 and therefore no longer represents a distinguishable system (Lefebvre et al. 2015).

Organic farming is in a different situation: it is regulated by law and has been presented and advertised as especially sustainable in the public debate as well as by retailers for many years. The comparative ease with which the standards can be controlled and communicated is particularly beneficial for marketing. By way of example, the almost complete avoidance of synthetic fertilisers and plant protection products is easier to control as well as easier to communicate than a partial limitation of the use of these inputs, although – from a scientific point of view – it is perfectly possible to use these inputs sustainably. In particular, organic farming speaks to consumers’ inclination towards naturalness, which is widespread in society, by excluding certain technologies (cf. text box 10: “Consumer preferences for naturalness and their significance for sustainability policies” in Section 5.2.3).

## 5.2.2 Sustainability potentials of organic farming

Organic farming has a long tradition as its origins go back far into last century. But it was not until the late 1970s that a global private standard for organic farming was created by the International Federation of Organic Agriculture Movements (IFOAM – Organics International) and the guidelines that this federation issued (Schmid 2007). The justification of this standard is not primarily science-based; instead, it mainly reflects the consensus among the organic associations active worldwide.

In order to protect consumers from deceptions and to prevent unfair trading practices, **organic farming has been regulated by law in the EU** since the early 1990s.<sup>151</sup> These EU regulations comprise rules on (a) how organic produce and foods must be produced and manufactured and how they may be labelled; (b) how the control system accompanying the entire production process and retail must work; and (c) the circumstances under which organic produce from third countries may be imported into the EU.<sup>152</sup> These rules have been adapted several times. In 2018, the EU adopted a new basic regulation on organic production and labelling of organic products (Regulation 2018/848). It will apply from 1 January 2021, replacing the current basic regulation (834/2007) and its implementing provisions (889/2008 and 1235/2008). The guidelines of German organic farming associations (Bioland, Naturland, Demeter, Biopark, Gää, Ecovin etc.) in some cases go beyond the EU regulations on organic farming. This applies not only to organic standards: some of these private organic farming associations have also set social standards (cf. e.g. Bioland e. V. 2019, IFOAM n.d.).

At its core, the objective of organic farming<sup>153</sup> is to establish a largely closed nutrient cycle on holdings (feed and nutrients should largely originate at the holding itself), to conserve/increase soil fertility and to keep animals in a manner especially conducive to their welfare (cf. IFOAM Organics International n.d.). Organic farming is mainly associated with the avoidance of synthetically produced chemicals as production resources, but, in its self-conception, it stands for more, namely the use of ecological regulatory mechanisms. There is a focus on the following management measures: no plant protection using synthetically produced chemicals, with beneficial organisms and mechanical weed control being used instead; avoidance of readily soluble mineral and synthetically produced fertilisers, with organic fertilisers such as manure and compost being used instead; green manuring using leguminous crops, varied crop rotation systems using catch crops, avoidance of genetically modified plants and organisms, humus management, maximum livestock densities according to area, feeding livestock primarily with feed produced on the same holding, more space allowance for livestock and additional measures for welfare-oriented animal keeping. There are additional regulations beyond agricultural production, namely in the production and processing of foodstuffs.

Conventional farming is usually drawn upon as a reference in order to determine the sustainability potentials of organic farming. While organic farming is explicitly defined by law, such a definition does not exist for conventional agriculture. The term “conventional agriculture” includes any type of farming that does not correspond to the principles of organic farming, i.e. any type of farming

---

<sup>151</sup> The earliest regulation, Council Regulation (EEC) No. 2092/91, came into force in 1991 and encompassed only the production, marketing and control of plant products. It was based on private-law standards of European growers' associations. Organic livestock farming was integrated into the European regulatory framework through Regulation (EU) No. 1804/1999, which entered into force in 1999. Both regulations were replaced by Regulation (EC) No 834/2007, which is currently in force.

<sup>152</sup> In Germany, the Organic Farming Act pools some enforcement duties in organic farming, which, according to the BMEL, improves the efficiency of the implementation of these EU regulations on organic farming ([www.bmel.de](http://www.bmel.de)).

<sup>153</sup> According to the current EU regulation, one of the aims of organic farming is to establish a sustainable management system for agriculture (Art. 3).

that uses synthetically produced chemicals as fertilisers and/or plant protection products or genetically modified seed. Aside from this automatic categorisation according to the principle of elimination, **conventional agriculture is not defined and includes farming systems of varying intensity.** The legal separation into organic and conventional systems suggests an unambiguity that does not exist in reality. This makes comparing systems difficult, as will be shown in the following.

### 5.2.2.1 Challenges of comparing organic farming with conventional farming

In the public debate on farming systems, organic farming is often associated with attributes such as small-scale and family-based, while conventional farming is associated with large-scale holdings and industrial organisation. This simplifying polarisation does not, however, reflect the actual variety in conventional and organic farming. There are small and very large holdings in both farming systems, and both farming systems include holdings run for subsidiary income and holdings run as the main source of income. Depending on the local, economic and historic conditions, many different forms of farming have developed in both farming systems, and these are continuing to develop rapidly. Thus, besides holdings that are managed very intensively, using a large amount of agricultural input products and tight crop cycles, there are also extensively farmed conventional holdings with varied crop cycles or extensive grassland use by suckler cows. Organic farming systems also have varying intensity levels, although they vary less strongly than in conventional farming. In addition to highly complex, varied organic holdings, there are also intensively managed organic holdings, for instance in the field of vegetable production, where organic fertilisers originate from outside of the holding and where weeds have just as little chance of growing as on conventional holdings (only without “chemicals” being used). Intensive and extensive management methods have developed in both farming methods. This means that the environmental impact of the two systems – depending on the environmental indicator, location and type of holding – can differ strongly, and may also amount to approximately the same overall. This makes comparing systems difficult. For example, extensively managed conventional holdings can achieve an environmental performance comparable to organically farmed holdings. Due to the variety of locations and management concepts, there will be some overlap for all indicators. For a comparison of systems, the systematic selection of reference holdings is therefore all the more important.

The lack of a systematic approach to selecting the comparative pairs/groups entails a high risk of “comparing apples with oranges”, assessing one or the other way of farming to be better or worse than it actually is, and ultimately drawing incorrect conclusions. How much the assessment results regarding the comparison of farming systems depend on the selected location and production systems is illustrated by Taube et al. (2006), for example. This also means that empiric results cannot be generalised when there are only few observations and that generalisations should only be considered once results for various different locations and production constellations have been obtained.

Generally, system comparisons should be drawn up in such a way that organic and conventional production systems are representative and comparable. An appropriate approach to such a comparison includes the following aspects:

- Factors that are largely independent from production practices should be the same or as similar as possible in the pairs/groups that are compared. Locational factors such as the regional situation, soil quality, climate, market distance etc. can be viewed as **system-independent**. Depending on the issue being investigated, approaches often also draw upon the size of a holding and the farm type (type of company), although in certain constellations it is critically examined whether these are indeed system-independent (cf. Offermann & Nieberg 2000).
- The systems investigated should differ – in a way that is representative for the relevant location – in terms of the factors that are **characteristic** of the relevant farming system, such as crop rotation systems, livestock density, soil preparation, fertilisation and plant protection measures, and animal nutrition etc.
- Due to the holistic aspirations of organic farming, comparisons of cultivation systems should consider the entire **crop sequence**.
- Converting farming operations to an organic system is a dynamic process that takes several years; many effects of the conversion only become evident after several years. This is why the organic farms included in the comparative analyses should have converted to organic farming **several years** (ideally at least five years) before the analysis.

Based on studies of the N leaching of organic and conventional farming, Kusche et al. (2019: 75 ff.) show clearly that the **methodological quality** of these studies varies considerably in some cases. An overall consideration of these studies consequently reveals large variation in the results. When the quality of the studies (extent of comparability of farming systems) is taken into consideration, this large variation in results can be reduced considerably.

Higher-quality studies show a relatively uniform outcome with small variations in results. Taking into account the quality of a study is therefore crucial for the informative value of meta-analyses and to avoid distortions.<sup>154</sup> Unfortunately, comparative studies do not always indicate whether the quality criteria listed above have been complied with, which means that the results of such studies must be interpreted with appropriate caution.

---

<sup>154</sup> According to Kusche et al. (2019: 78), when it comes to biometric analyses (particularly if there is not a great number of studies), it is important to assess the results of individual studies in terms of their suitability from an agronomical point of view in order to ensure that the data taken into account are interpreted appropriately. The quality of the study can be taken into account by means of the following methods: (1) exclusion of methodologically weak studies, determined by previously defined minimum methodological standards; (2) weighting of studies of differing methodological quality; (3) taking into account the methodological quality as a moderator variable.

This consideration of the methodological challenges is followed by an assessment of the extent to which organic farming can contribute to various sustainable development goals, such as food security, environmental and climate effects, health and income.

### 5.2.2.2 Contribution of organic farming to food security

In late 2015, the United Nations General Assembly adopted 17 objectives for a sustainable future (Sustainable Development Goals, SDGs) within the scope of the 2030 Agenda for Sustainable Development. The aim of goal 2, “Zero Hunger”, is to “end hunger, achieve food security and improved nutrition, and promote sustainable agriculture” by 2030 (UN 2015, cf. Section 2.4). In concrete terms, the aspiration is, inter alia, to double agricultural productivity and the income of small food producers, guarantee sustainable food production systems, introduce resilient agricultural practices that contribute to conserving ecosystems, boost the capability to adapt to climate change, and gradually improve soil quality by 2030.

The role of organic farming in food security has been discussed intensively for several years (Badgley et al. 2007, Erb et al. 2016, Muller et al. 2017, Seufert & Ramankutty 2017, Meemken & Qaim 2018a, Kirchmann 2019). At the heart of this debate are primarily the **differences in yield** between organic and conventional farming. There are a large number of individual studies<sup>155</sup> as well as several review studies that try to assess and summarise the various individual results. An early review study by Badgley et al. (2007) came to the conclusion that organically farmed yields were, on average, higher than those conventionally farmed. Although Badgley et al. (2007) found lower yields in organic farms in industrialised countries, they claimed that these were overcompensated by significantly higher organic production yields in developing countries. This study conducted by Badgley et al. (2007) was later heavily criticised for methodological deficiencies and wrong assumptions (Cassman 2007, Connor 2008).

Three meta-analyses have been published since 2012 that use transparent and qualified methods for their summary assessments (Seufert et al. 2012, de Ponti et al. 2012, Ponisio et al. 2015). The main results of these three meta-analyses are summarised in Table 5-3. On average, the yields in organic farming systems are 19–25% lower compared with conventional farming. The yield gaps differ according to the various crop species. They tend to be lower for leguminous crops and fruit cultivation than for cereals, vegetables and root and tuber crops. Systematic regional differences in the yield gaps – e.g. between temperate regions and tropical climates – were not found in these meta-analyses, but the number of original studies from developing countries is low. Several of the original studies are based on experiments conducted over many years. The meta-analyses did not find any clear indication that the yield gaps increase or decrease over the course of time. Based on the dataset used by Ponisio et al. (2015), Knapp and van der Heijden (2018) discovered that the

---

<sup>155</sup> According to Meemken and Qaim (2018a), however, there are surprisingly few studies in the literature that soundly consider and remove disruptive factors (distorting factors that have nothing to do with the farming system itself, such as soil quality, climate etc.) based on data from agricultural practice.

relative yield stability is significantly lower in organic production systems. For Germany, it can be shown that organically farmed permanent pasture areas with relatively low yield gaps have a lower yield stability when compared with conventional systems, which can be attributed primarily to the higher environmental sensitivity of legume-based systems compared with systems based on mineral fertilisers (Trott et al. 2004). On the other hand, assessments of regional variety trials in the federal states revealed hardly any differences between organic and conventional farming for winter wheat in northern Germany. No studies were found on the issue of yield stability over the entire crop cycle. Due to the higher diversity in organic holdings, however, a case can be made for higher stability at holding level.

**Table 5-3:** Yield differences between organic and conventional farming (results of global meta-analyses)

Type of crop	Seufert et al. (2012)	de Ponti et al. (2012)	Hollands et al. (2015)
Cereals	-26 %	-21 %	-22 %
Root/tuber crops	Not evaluated	-26 %	-29 %
Oil seeds	-11 %	-26 %	-12 %
Legumes	-10 %	-12 %	-15 %
Fruit trees	-3 %	-28 %	-8 %
Vegetables	-33 %	-20 %	-13 %
Total	-25 %	-20 %	-19 %

Source: Meemken & Qaim (2018a: 44).

Based on data from 2014 from over 10,000 US organic holdings (compared with data from 83,000 conventional holdings), Kniss et al. (2016) come to the conclusion that (a) the yield of organic production is on average 80% of conventional production yield (i.e. there is a yield gap of 20%) and (b) the yield gaps between the crop species (vegetables: 23–62%, wheat: 34%, oats: 20%, grass–lucerne mix: 0% lower yields of organic farming than in conventional farming), and in some cases between the locations within one crop species, vary greatly. Analyses of accounting information from 2003–2016 in Austria (1,706 conventional holdings and 494 organic holdings in 2016) showed that the average yields of organic cereals were 35% lower than those of cereals from conventional production, and organic root crops produced 27–49% lower yields (Brückler et al. 2017). In addition, statistically significant differences were detected in the yield gaps between climatically different agricultural areas. For example, the yield gap for important arable crops such as soft wheat or maize was significantly lower in dry areas than in areas that were wet or sometimes dry.

Finally, it must be noted that the **yield gaps** differ not only between **crop species** and **locations**, but also between the different **production systems**. For example, according to the results obtained by Hülsbergen (2015), the yield gap of an average crop cycle in organic cash-crop farms (without livestock) is the largest at more than 50% because 10–20% of the area is not exploited through

livestock (green manuring). Taube et al. (2006) come to a similar conclusion. Such production systems do not, however, correspond to the ideal of organic farming. A considerable yield increase could, in this case, be achieved by integrating livestock farming.

According to assessments by Niggli (2015), the largest potential for improvement in the productivity of organic farming is in vastly increased research and development within the system of organic farming. It must be noted here that organic farming also profits from general agricultural research (agricultural technology, breeding etc.). To what extent the exclusion of certain new breeding techniques (e.g. genome editing) from organic farming could affect the development of yield gaps cannot be reliably estimated yet.

In order to produce the same amount of food and other agricultural products through organic farming as through conventional methods, arable land would have to be expanded considerably. The yield gaps of 19–25% observed during field experiments (Tab. 5-3) would mean an additional 23–33% of land would be required (cf. Muller et al. 2017). Larger yield gaps would further increase the additional land needed.<sup>156</sup> Although a further expansion of agricultural land is generally possible in some regions, this scenario is associated with increased ecological costs if all other conditions remain the same, since converting this amount of fallow land and other natural areas would involve additional biodiversity losses and greenhouse gas emissions. The cultivation of such land can also involve particularly high costs.

One option for feeding the world's population using smaller production volumes would be to **change global dietary patterns**, i.e. in particular lowering the consumption of animal products. Indeed, simulation studies show that organic farming could feed the growing global population without any expansion of arable land if everyone considerably reduced their meat consumption (Erb et al. 2016, Muller et al. 2017). For example, in their model calculations, Muller et al. (2017) come to the conclusion that 60% of agriculture worldwide could be converted to organic farming without any considerable expansion of arable land if food losses were reduced by 50% and the area cultivated for feed production were also reduced by 50% – with a corresponding decrease in animal production (by roughly a third).

This “theoretical” scenario of a globally meat-reduced diet was self-critically examined by the authors and is not recommended for everyone from a nutritional and physiological point of view. Particularly in poorer developing countries, the consumption of animal products contributes considerably to an improved supply of micronutrients. Besides, it is hardly politically possible to implement a global vegetarian or vegan diet in the short or medium term. Sharply limiting or completely eliminating livestock farming on a global scale would also raise the question of where the organic fertiliser necessary for organic farming should come from. However, these arguments should not distract from the fact that, particularly in industrialised countries and in some emerging

---

<sup>156</sup> For example, a yield gap of one third would result in a 50% increase in arable land needed (cf. Kirchmann 2019).

countries, reducing the consumption of animal products is a crucial approach to a sustainable development – irrespective of whether these animals are farmed organically or conventionally.

Against the backdrop of the fact that certified organic farming currently amounts to only 1.4% of the agricultural land used worldwide (Willer & Lernoud 2019), a complete conversion to organic farming – which some model calculations are based on – will remain a theoretical scenario for the foreseeable future.<sup>157</sup> In many European countries, however, where on the one hand conventional farming produces very high yields but is frequently associated with negative external effects, and, on the other, organic farming is increasing steadily, the question arises as to what the **acceptable maximum proportion** of organic farming is and what potential yield gap we are prepared to accept in order to avoid the negative environmental effects associated with high conventional yields (cf. Wilbois & Schmidt 2019).

Currently, the primary objective should be to determine where, how and to what extent organic production methods can contribute to feeding the world. If, for example, small farmers in developing countries can achieve higher prices by exporting organically farmed products, then this can contribute to an improved nutritional status due to the associated higher incomes. Therefore, the question is for how many tonnes higher prices could be achieved and how many organically farmed hectares would be necessary for this. Even if a sustainable intensification<sup>158</sup> of production is at the heart of many suggestions for improving the world's state of nutrition (cf. The Montpellier Panel 2013), organic farming could in some regions be a suitable approach – possibly as a “transition technology”: this is the case when small farmers do not have the financial means to buy fertiliser but can achieve higher yields by learning organic farming methods.<sup>159</sup> In this case, however, organic farming is a potential first step on the way towards a sustainable intensification. Currently, small-scale organic farms in developing countries can be found almost exclusively in the field of export crops such as coffee, cocoa or bananas. Organic farming plays next to no role in producing locally consumed food in developing countries, mainly because the demand for certified organic and therefore expensive foods is low among poorer population groups (Meemken & Qaim 2018a).

---

<sup>157</sup> It must furthermore be taken into account that the fight against hunger cannot be won solely by increasing food production (UN 2015). Hunger has primary causes other than the lack of global food availability. These primarily include poverty, wars and conflicts, extreme weather events and insufficient infrastructures.

<sup>158</sup> This is one way in which agricultural production can achieve yield increases without having negative effects on the environment and without requiring additional arable land (The Royal Society London 2009).

<sup>159</sup> “In drought-affected areas and under subsistence conditions, conversion to organic farming may well improve yields where the soils have been degraded over time, providing that a sufficient supply of manure and compost is available at the local level, as well as access to extension services.” (The Montpellier Panel 2013).

### 5.2.2.3 Contribution of organic farming to environmental protection, climate change mitigation and animal welfare

Agriculture has manifold consequences on the environment. Despite some progress, major effort is still necessary to reduce the negative external effects of agriculture. This can be effected in various ways. This section will address the contribution that organic farming can make.

Comparative studies on the **merits and environmental impact** of conventional and organic farming systems in Germany have been conducted in large numbers over the past 25 years. In a recent publication based on an extensive analysis of scientific studies, Sanders and Heß (2019) assessed the benefits of organic farming in temperate climatic zones for the areas of water protection, soil fertility, biodiversity, climate change mitigation, climate change adaptation, resource efficiency and animal welfare. The analysed results originate from studies of agricultural holdings, model analyses, life cycle assessments and especially field experiments. Taking into consideration a range of selection criteria<sup>160</sup> and after assessing their quality, a total of 528 comparative studies featuring 2,816 individual comparisons were assessed quantitatively. The study comes to the conclusion that, across all indicators considered, organic farming exhibited advantages over conventional farming in terms of environmental and resource conservation in 58% of comparative pairs; no difference was detected in 28% of the comparative pairs; and the conventional method was more advantageous in 14% of cases. In their study, Sanders and Heß (2019) revealed positive contributions particularly in the areas of water protection, soil fertility, biodiversity, climate change adaptation and resource efficiency.

The study by Sanders and Heß (2019) compared the environmental effects of organic and conventional methods primarily in terms of area. The question whether an area-based or a yield-based comparison is more suitable will be discussed in more detail below, after a summary of the main results of the Sanders and Heß study (2019). The following results were obtained by the area-based comparison:

- **Water protection:** Organic farming has great potential for protecting ground and surface water. In 71% of the comparisons, the organic method showed clear advantages compared with the conventional method in terms of the leaching of critical substance groups (nitrogen, plant protection products). Organic farming reduced nitrogen leaching by an average of 28% (median value). In terms of potential phosphorous input into water bodies, the two farming systems were assessed to be comparable. However, the data situation is relatively poor (mainly due to a lack of comparative studies on phosphorous removal by erosion).
- **Soil (fertility):** Soil fertility is a highly complex parameter. The present study aggregates aspects of soil fertility both in the soil category and in the categories of climate change adaptation

---

<sup>160</sup> The geographic area of the studies comprised the temperate climatic zones. The comparative studies investigated at least one comparative pair of one organic and one conventional holding. The conversion of the organic areas had happened at least two years previously. The studies were published between January 1990 and March 2017. They were published either in German or in English.

(proportion of organically bound carbon in the soil, i.e. soil organic carbon, SOC, and aggregate stability) and climate change mitigation (SOC content, stock and storage). Organic farming has considerable advantages in terms of some selected aspects of soil fertility, for example through longer crop cycles, organic fertiliser and the increased cultivation of catch crops. The abundance of earthworms (number of individuals/m<sup>2</sup>) and volume of biomass was 78% and 94% greater on average (median values) on organically farmed land. Neither of the two farming systems was advantageous regarding other parameters (plant-available phosphorus in the topsoil, soil acidity).

- **Biodiversity:** Firstly, it must be emphasised that the structure of a landscape has a considerable influence on species diversity, particularly when it comes to the fauna. Comparisons between different land use systems must therefore be conducted within the same landscape. The results of the assessments lead to the conclusion that organically farmed land usually boasts a larger diversity of species. Thus, 86% (flora) and 49% (fauna) of the comparative pairs exhibit considerable advantages arising from organic farming. The average number of species on organically farmed land was higher by 95% for field flora, 61% in the soil seed bank, 21% in field margins, 35% for farmland birds and 23% for insect pollinators.
- **Climate change mitigation:** The studies included in the analysis showed that organic farming overall produced fewer greenhouse gas emissions when the effects were measured by area (per hectare). Although nitrous oxide and other greenhouse gases are emitted when organic fertilisers are used, the lower nitrogen input means that less nitrous oxide is emitted by organic farming. The analysis revealed that higher contents of soil organic matter is measured under organic farming conditions – albeit with very high variance – and that carbon sequestration is on average 10% higher (additional 256 kg C/hectare/year). However, these positive effects occur in only 50% of the studies analysed, while 35% of the studies show no difference between organic and conventional farming, and 15% found the opposite result. Due to the wide spread of the data, which means that other known factors such as the type of crop cycle and fertilisation may have considerable influence, the authors rightly remain conservative, stating only that the results “suggest” that organic farming contributes to climate change mitigation. Taking into consideration nitrous oxide emissions, which are lower by 24% on average, organic farming results in a calculated average advantage of 1,082 kg of CO<sub>2</sub> equivalents per hectare per year. However, the lower plant-based and animal-based yields relativise this result (see below).
- **Climate change adaptation:** Compared with conventional farming, organic farming exhibits comparable or better values for important topsoil characteristics that contribute to erosion prevention and flood control. This includes a higher aggregate stability and significantly higher infiltration. In this context, the clover and alfalfa cultivation in organic farming is of major significance.
- **Energy input:** Organic farming is characterised by significantly lower nitrogen and energy inputs. The lower energy consumption of organic farming can mainly be put down to the non-use of mineral fertilisers, as the production of mineral nitrogen fertiliser is a very energy-intensive process.

- **Animal welfare:** There are few comparative studies, and these concern mainly individual effects and dairy cows. In terms of animal health, the studies analysed resulted in no clear picture across all farmed species and production types. Management practices seem to be more decisive than the distinction between organic and conventional farming. In terms of animal behaviour and emotional state, the small number of existing studies reveal advantages of organic livestock farming. Reasons include larger space allowances and the prescribed access to open spaces, e.g. grazing areas.

Overall, the results show that organic farming can contribute to environmental improvement – primarily at locations where organic farming can reduce several environmental stresses simultaneously.<sup>161</sup> It is thus not surprising that water suppliers in some areas of Germany (e.g. municipal waterworks in Munich, Leipzig and Dortmund) are encouraging conventional holdings to convert to organic farming (some with additional incentive payments).

What has also become clear, however, is that organic farming is not always better in and of itself. As described in section 5.2.2.1, there are always some organic farming methods that do not achieve better values, for example due to regional conditions. According to Taube et al. (2005), land use systems should be assessed, specifically taking into account both the region and the type of holding as this has a considerable influence on the results. An extensive analysis of a total of 32 holdings (16 organic and 16 conventional) conducted as part of the COMPASS study (Kelm et al. 2007) showed that half of organically farmed holdings with a focus on arable farming (< 0.4 LSU/ha) in high-yield locations in northern Germany exhibited critically low N balances, which may indicate a loss of soil carbon and therefore soil fertility when farming is continued in this way over many years. In contrast, in dairy cattle/fodder production, only the organically farmed holdings fulfilled the legal requirements of the Fertiliser Application Ordinance from 2007, while the N balances of all conventional holdings were well above 60 kg N/ha/year. To promote organic farming, Taube et al. (2005: 174) therefore advocate the development of concepts for designated areas or focus areas – similarly to those found in nature conservation concepts – based on scientific evidence specific to the region and respective holding.<sup>162</sup>

A comprehensive environmental assessment of organic farming cannot, however, be undertaken in a solely **area-based** manner (per hectare) but must also take into account **land use efficiency** (yields). Since organic farming, on average, produces lower yields and for this reason alone requires more area for the same production volume (cf. Section 5.2.2.2), it is expedient to also compare environmental and climate effects in a yield-based manner (i.e. per product unit). This is why comparative sustainability studies such as the ones published by Seufert and Ramankutty (2017) and Meemken and Qaim (2018a) usually determine the environmental impact of organic farming per hectare as well as per tonne of yield. As is to be expected, some of the environmental benefits of

---

<sup>161</sup> To solve environmental problems caused by agriculture in Germany without delay, it is insufficient to simply expand organic farming gradually. Considerable improvements in conventional farming are required. This is where the government is called upon to implement the necessary measures.

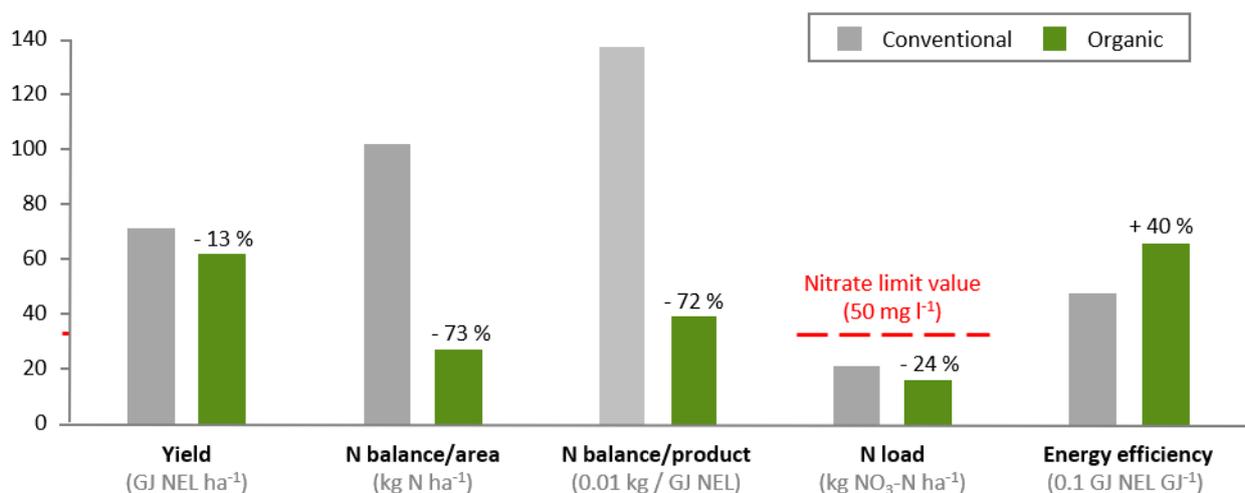
<sup>162</sup> The result could be funding schemes differentiated according to regions and types of holdings.

organic farming are relativised when comparisons are based on yield. One problem with yield-based comparisons, however, is that the information on the environmental impact and the yield potentials of organic and conventional farming methods frequently originate from different sources.<sup>163</sup> Interlinking these data must therefore be done with great care and the accuracy of the results should not be overestimated.

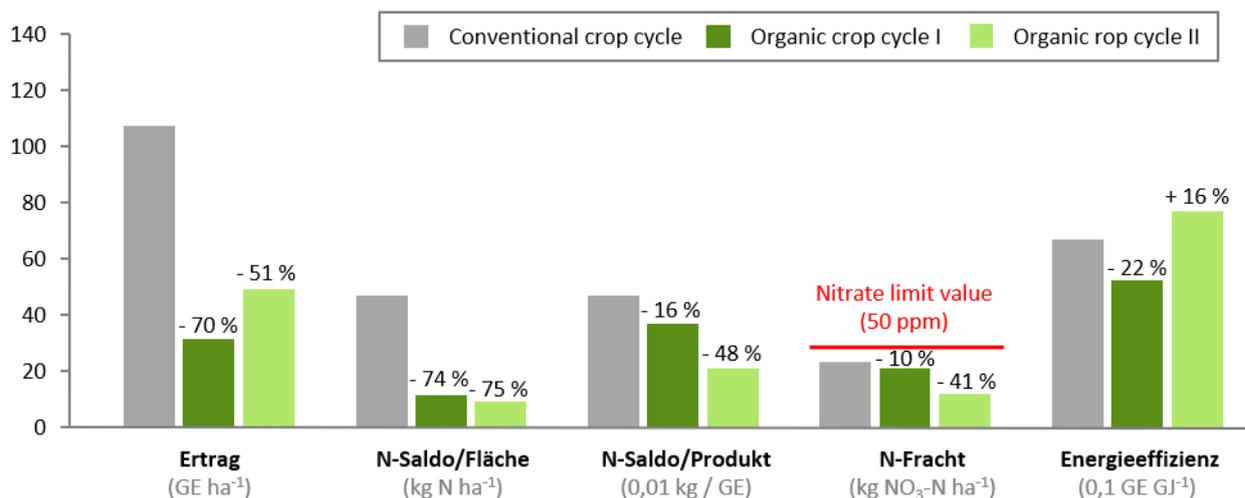
The investigations by Taube et al. (2005, 2006) revealed that the nitrogen balances per hectare are considerably lower in organic holdings. When considered per product unit, they correspond more closely to those of cash-crop farms, and in terms of energy efficiency, conventional cash-crop farms with high yield performances can come out on top (Fig. 5-1).

---

<sup>163</sup> This is due to the fact that many studies address only one of these aspects, i.e. yield and environmental impact are not considered simultaneously.

**Figure 5-1:** Effects of a conversion on the intensities of organic farming**a) Forage cropping on sandy soils (field valuation index < 30)****Notes:**

Location: Karkendamm test farm  
 System: Forage production (clover grass – maize – tritiale)  
 Conventional: 150 kg N ha<sup>-1</sup> from mineral fertilizer + 78 kg N<sub>tot</sub> ha<sup>-1</sup> from cattle slurry + N-Fix  
 Organic: 78 kg N<sub>tot</sub> ha<sup>-1</sup> from cattle slurry + N-Fix

**b) Cash-crop-oriented on high-quality soil (field valuation index > 45)****Notes:**

Location: Lindhof test farm  
 Convent. crop cycle: sugar beets – winter wheat – winter rape – winter wheat  
 conventional mineral fertilisation and plant protection  
 Organic crop cycle I: Green manuring (mulched clover grass) – oats – grain pees – winter wheat/potatoes  
 Organic crop cycle II: Mixed clover grass (fodder) – oats – grain pees – winter wheat + ~50 kg/ha N<sub>org</sub> fertiliser

Source: WBAE illustration based on Taube et al. (2005, 2006).

The question of what reference unit should be drawn upon for an environmental assessment is viewed differently depending on the issue at hand, the questions posed and the initial situation.

- **Climate change mitigation:** Greenhouse gas emissions are a global problem that does not stop at national borders. According to current knowledge, it is irrelevant to climate change where in the world greenhouse gases are emitted. Assuming that consumption remains unchanged, the decline in production associated with organic farming could be counterbalanced by increasing production at other locations, which would lead to emissions at those locations, and these could vary greatly, depending on the land management intensity. This means that yield-based emissions are relevant for assessing greenhouse gas emissions. As was shown by various studies (WBA & WBW 2016, Treu et al. 2017, Biernat et al. 2020), present knowledge attests organic holdings no advantage in terms of the overall emissions per yield unit.<sup>164</sup> In its climate expertise, the Advisory Board already illustrated that organic farming cannot in principle be rated more climate-friendly than conventional farming (WBA & WBW 2016).
- **Nitrate pollution:** Reducing the nitrogen pollution in the water bodies of a region can sometimes only be achieved by reducing the use of nitrogen fertiliser in the region (e.g. by means of specific agri-environmental measures and/or organic farming). This would lead to decreased yields. With unchanged demand and all other conditions also remaining the same, it must be expected that more would be produced elsewhere, for example by intensifying production. Whether this intensification leads to negative environmental effects elsewhere is heavily dependent on the initial fertilisation levels and the curve of the production function in the respective region. The yield relationship is thus less clear here. Data on nitrate leaching per product unit in organic farming compared to conventional farming are inconsistent in the literature (Tuomisto et al. 2012, Mondelaers et al. 2009, Taube et al. 2005). An older study that used the CAPRI modelling system to investigate the sectoral impact of an expansion of organic farming to 20% of the agricultural area used for farming in the EU revealed that such an expansion would lead to a reduction in regional nitrogen balances in the EU by between 2 and 12 kg N per hectare, depending on the region (Offermann 2003).
- **Biodiversity:** Although organically farmed land generally has greater biodiversity per area unit (see above), this is relativised by the finding that the same production volume (same consumption) achieved through conventional farming would require less area for production, making more area available for nature conservation. A simple example illustrates this: if organic farming uses an area of 1 million hectares and has a yield gap of 30%, then with the same production volume, conventional farming would make an additional 300,000 ha available for nature conservation. This would then raise the question of whether 1 million hectares of organically farmed land brings about a higher or lower biodiversity value than 300,000 ha nature conservation area and 700,000 ha conventionally farmed land. There are no explicit studies or even estimations of this issue since it is heavily location-specific. Presumably, the optimum is a mixture of both – if only because this would considerably expand the variety of habitat structures.

---

<sup>164</sup> As the results from the German network of pilot holdings revealed, the greenhouse gas emissions vary extremely between holdings, indicating a considerable improvement potential in both types of land management (Hülsbergen & Rahmann 2015).

In any case, a certain agricultural use/maintenance would be necessary in order to maintain the species inventory typical for traditional European landscapes, since this inventory is based on agricultural land use. Otherwise, forest vegetation would successively prevail. Under the current general conditions (i.e. without any special financial incentives), however, it is likely that without organic farming no new nature conservation areas would develop in Germany, with the land instead being used for conventional farming and therefore increasing the production volume. Assuming national consumption remains the same, this would in turn lead to additional exports. Vice versa, a further expansion of organic farming in Germany – at a steady level of consumption – would likely lead to additional imports from other regions of the world<sup>165</sup>, with potential environmental consequences. Negative environmental effects are particularly noteworthy whenever nature areas with high diversity values (rain forest, savannah areas etc.) are converted to farmland to compensate for the yield gap<sup>166</sup>. It must be noted that biodiversity is region-specific (Tuck et al. 2014) and is not substitutable on a global scale. It is not easy to assess whether and how a gain in biodiversity in one region (e.g. by means of conversion to organic farming) can offset a loss of biodiversity in another region (e.g. due to a conversion of nature areas). It depends on specific regional scarcities and ultimately on normative considerations.

In the discussion on potential relocation effects, which relativise the environmental effects of organic farming, the following aspects must ultimately be considered:

- The considerable agriculturally induced environmental problems in Germany in the fields of nutrient excesses and biodiversity losses (cf. Section 4.4.1) can only be solved locally – for example through organic farming or other forms of agricultural extensification. With today's technological state of the art, both approaches are associated with lower yields and may therefore cause relocation effects.
- Under otherwise unchanged conditions, the lower production volume of organic farming will lead to higher product prices, for example for cereals. Higher cereal prices lead to higher feed costs, and these will lead to higher prices, including for animal products. Depending on the price elasticity of demand, higher prices for animal products lead to a lower demand for such products. When fewer animal products are demanded, the relocation effect is, in turn, reduced.
- Due to the very complex interrelations and a lack of data<sup>167</sup>, it is currently not possible in a scientific way to conclude at what percentage of organic farming in Germany or Europe the

---

<sup>165</sup> To a certain extent, the yield gap in organically farmed areas could also be compensated by a further intensification of the conventionally farmed areas in Germany and Europe; however, due to the already high intensity levels here, this would be possible only to a limited extent and would lead to a number of additional environmental problems.

<sup>166</sup> Such leakage effects with possible loss of biodiversity in other regions of the world can of course not only result from the expansion of organic farming in Europe, but also from many other activities such as the import of vegetable oils from Southeast Asia or animal feed from South America.

<sup>167</sup> For example, in terms of how much area is currently fallow (e.g. in Russia) that could and would, in case of relevant price incentives, be (re-)cultivated in the short term without any large-scale negative environmental effects.

potential negative relocation effects outweigh the positive effects of reducing environmental problems in Germany and/or Europe.

Based on the available results, it can be concluded that **organic farming has clear advantages with regard to a number of sustainability criteria**. One **weakness of organic farming, however, is the low yields**. Due to these low yields, organic farming has **no systematic product-based advantages over conventional agriculture in terms of climate effects**. The results cannot be scaled freely, either. **The greater the share of organic farming, the greater the impact of the relocation effects**. This means that the constant further expansion of organic farming is an insufficient approach to reducing the environmental footprint of agriculture. In order to solve environmental problems caused by agriculture in Germany in the near future, considerable improvements are necessary in conventional agriculture. It should also be taken into account that it is conceivable to have farming systems that are in principle even more sustainable than organic farming, such as systems that have similarly positive environmental effects as organic farming but with higher yields and therefore higher land use efficiency. It has not yet been possible, however, to bring such alternatives together in the form of an alternative, internally consistent farming system positioned between the current conventional and organic intensities, to provide sufficient controls and hence sufficient credibility among consumers, and thus to establish them on the market (cf. Section 5.2.3). As a consequence, organic farming remains the **benchmark as society's control function on the path towards a greening of conventional systems** (Taube 2017).

#### 5.2.2.4 Contribution of organic farming to health-promoting food consumption

Consumers frequently prefer organic products mainly because they are viewed as healthier. However, there is no clear evidence that organic products are in fact healthier than conventionally grown food. Again, there is a multitude of studies that investigate different aspects of this and – as is to be expected – come to different conclusions. Review studies and meta-analyses come to the conclusion that no robust statements can be made on whether or not organic products systematically differ from conventional products in terms of their health effects (Dangour et al. 2010, Forman & Silverstein 2012, Baranski et al. 2017, Mie et al. 2017).<sup>168</sup>

In principle, organic products could differ from conventional products in that they may contain lower levels of undesirable substances or more nutrients and other health-promoting substances (cf. also Section 5.3).

---

<sup>168</sup> Such analyses are particularly challenging because organic products are primarily consumed by people who tend to lead healthier lifestyles anyway: “Suggestive evidence indicates that organic food consumption may reduce the risk of allergic disease and of overweight and obesity, but residual confounding is likely, as consumers of organic food tend to have healthier lifestyles overall.” (Mie et al. 2017: 15).

- Studies predominantly show that organic products contain lower residues of chemical plant protection products<sup>169</sup>; however, in the vast majority of cases in Europe, conventional products also remain below the acceptable limits<sup>170</sup>, so that according to current knowledge, they pose no significant health risks (Dangour et al. 2010, Baranski et al. 2014). In developing countries, where the acceptable limits are higher or are not complied with, this comparison may result in a different conclusion. There are, however, hardly any comparable studies from developing countries.
- According to Mie et al. (2017), the widespread use of antibiotics in conventional animal production is significant as it is viewed as a key factor in antibiotic resistance in society. Thanks to the limited use of antibiotics, organic farming is advantageous in this field.
- Most meta-analyses detect no difference between organic and conventional products when it comes to undesirable substances such as nitrate, heavy metals and mycotoxins.
- The situation is similar for health-promoting substances. Some studies show slightly higher levels of micronutrients and plant substances as well as lower levels of proteins and special amino acids in organic products. However, the differences are predominantly so small that no resulting health effects have yet been detected (Smith-Spangler et al. 2012, Baranski et al. 2017).

Special attention was paid to a study published in late 2018, which addresses the link between the consumption of organic food and the risk of developing cancer. A French team of researchers (Baudry et al. 2018) collected data from 68,946 volunteers (78% women, average age: 44.2 years) within the scope of the NutriNet-Santé cohort study. They came to the conclusion that a more frequent consumption of organically produced products is associated with a lower risk of developing cancer. This piece of news was taken up by specialist media as well as numerous newspapers and news programmes. Although the study comprises a large number of people, it has various methodological limitations.<sup>171</sup>

- The entire period of observation is relatively short at 4.56 years.
- Although the dietary patterns were recorded in a differentiated manner using 24 hour protocols (cf. Section 4.2 and 5.3), the level of organic products consumed was recorded in a rather general manner by asking the study participants once at the beginning of the study how often (predominantly, sometimes or never) they ate organic products, differentiated into 16 product groups. To what extent these general statements on consumption patterns reflect real behav-

---

<sup>169</sup> Two recent studies from the US have revealed that eating organic products can reduce exposure to some pesticides (Hyland et al. 2019, Curl et al. 2019).

<sup>170</sup> The findings of studies on residues from plant protection products in plant-based foods conducted by the Bavarian Health and Food Safety Agency (2017) show that in 88% of the investigated organically farmed foodstuffs no residues were detected, while 31% of conventional samples were free of residues. The rate of samples with residues above the acceptable limit amounted to 3%. For the year 2017, the Federal Office of Consumer Protection and Food Safety (BVL 2019b) came to the conclusion that 2.5% of the samples investigated (19,297 food samples) contained residues above the acceptable limits. In the case of organic products, this percentage amounted to 1.3%.

<sup>171</sup> For the fundamental methodological challenges of such studies, please refer to Section 5.3.

our has not been clarified (e.g. how accurately participants were able to identify organic products), and these general replies do not permit any quantitative information on the level of consumption. Instead, it is possible only to distinguish between persons who rarely or never eat organic products and those who sometimes or frequently eat organic products.

- The effects observed are partly based on very small case numbers. A total of 1,340 persons were diagnosed with newly developed cancer: 459 cases of breast cancer (34.3%), 180 cases of prostate cancer (13.4%), 135 cases of skin cancer (10.1%), 99 cases of colon cancer (7.4%), 47 cases of non-Hodgkin lymphoma (3.5%) and 15 cases of other lymphoma (1.1%). By way of example, there were 69 cases of postmenopausal breast cancer in the lower consumption quartile (no or rare consumption of organic products) and 50 cases in the upper consumption quartile (frequent consumption of organic products). The disease distribution and the result pattern can partly be explained by the fact that the majority of the sampling population were women and the case numbers were low.
- Overall, the observed effect of a 0.6% reduction of the absolute risk of developing cancers is low<sup>172</sup> and only concerns selected types of cancer. For example, although a reduction in the risk of postmenopausal breast cancer, non-Hodgkin lymphoma and lymphoma overall was found, this risk was not reduced for breast cancer overall, premenopausal breast cancer, prostate cancer or colon cancer.

This study, at the very least, is the first larger-scale study that addresses the issue of a link between preventive effects of consuming organic products and the risk of cancer. However, the team of researchers from Sorbonne University in Paris themselves conceded that the results of these correlations leave many questions unanswered and that it is definitely necessary to find a more valid basis for collecting data on food consumption.

Organic farming as a system refers not only to agriculture itself; it also includes rules on the further processing of foodstuffs. This further processing of organic foodstuffs prohibits the use of a number of additives and certain processing methods. Furthermore, some organic farmers' associations have stipulated additional regulations on the lowest possible processing depth and on gentle preparation. Organic farming throughout its history has had a multitude of connections to wholesome food consumption (Körber et al. 2012) and some of the producers and retailers endeavour to offer health-promoting products. What influence these stipulations and principles in the processing of food have on our health has not yet been comprehensively investigated. Cohort studies (Hoffmann & Spiller 2010) show that, overall, consumers of organic products eat healthier diets and have a better health status – primarily because they also have different dietary patterns (see Section 5.3) and exercise more. Whether the consumption of organic products plays an independent role in this has yet to be determined.

---

<sup>172</sup> The frequently reported overall effect of a 0.6% reduction in the absolute risk of developing cancer is based on a comparison of persons who were in the upper and lower quartile in terms of the consumption frequency of organic products (upper quartile: 16,962 persons, 269 new cases of cancer; lower quartile: 16,471 persons, 360 new cases of cancer;  $(360 * 100 / 16,471) - (269 * 100 / 16,962) = 2.19\% - 1.59\% = 0.6\%$ ); cf. also text box 3 "Absolute and relative risk" in Section 4.2.1.

### 5.2.2.5 Contribution of organic farming to the income situation of farmers

Numerous studies at the level of individual holdings have investigated the economic effects of organic farming by comparing the profits achieved per hectare or per holding by organic and conventional farmers. One meta-analysis summarises a multitude of economic results (Crowder & Reganold 2015). This meta-analysis – based mainly on data from the US and other industrialised countries – shows that the profits of organic farming are on average 22–35% higher than those of conventional farming. Although the yields of organic farming are lower, certified organic products obtain higher prices. Without these higher prices, organic farming would not be economically viable in most cases.

Analyses conducted by the German test farm survey over the past 18 years show that, with the exception of two years, the organic holdings achieved **significantly higher profits in some cases** (measured by profits plus labour costs per worker)<sup>173</sup> than their conventional reference holdings. However, this would not have been the case without **premiums encouraging organic farming** (Sanders 2019). In addition, the results exhibit large variance: In the financial year of 2017/2018, almost 26% of the organic holdings achieved profits that were more than twice as high as those of the conventional reference holdings. On the other hand, 15% of the organic holdings achieved a profit of less than half of that of the conventional reference holdings.

There are also some studies of developing countries that investigated the economic effects of organic farming on small farmers. These studies predominantly show that **small farmers can profit from an organic certification** (cf. e.g. Ayuya et al. 2015, Parvathi & Waibel 2016), and particularly so when they receive **intensive training** and are supported in accessing lucrative **export markets**. Without this type of support, small farmers are currently hardly able to profit from certified organic production (Meemken & Qaim 2018a). This also means that organic certifications in developing countries concentrate mainly on typical export products such as coffee, cocoa, tea and tropical fruit.

### 5.2.2.6 Other effects of organic farming

The guidelines of the German organic farmers' associations and of the international umbrella organisation IFOAM also contain **social standards** (cf. e.g. Bioland 2019, IFOAM Organics International n.d.), which implies that organic holdings also have a special focus on their social standards. Due to a lack of scientific investigations, the question of how organic farming should be assessed from a social point of view cannot, however, be answered in total. The following can only outline individual aspects:

---

<sup>173</sup> The indicator used in the analysis to assess the economic viability as a measure of success is profits plus labour costs per worker, which is also called "income". This permits holdings of various legal structures to be taken into account.

- Organic farms usually have **greater labour requirements**, for example due to more labour-intensive production activities, particularly in arable farming (mechanical weed control), more varied crop cycles and frequently a more varied operational structure (crop and livestock farming). According to a review study published by Offermann and Nieberg (2000), the extent of the increased labour requirements is heavily dependent on the type of holding and in Europe amounts to 10–20% in most cases. If this additional labour requirement is not covered by family members working on the farm, increases in conversions to organic farming therefore have the potential of creating new jobs in rural areas, which is of positive significance in regions with high rural unemployment rates. However, this effect is cancelled out when there is a shortage of labour.<sup>174</sup>
- Within the scope of the “**social farming**”<sup>175</sup> concept in Germany, agricultural holdings offer employment and integration for people with physical, mental or psychological disabilities as well as people who have committed crimes, suffer from addictions, or are classified as long-term unemployed. Due to the higher labour requirements, organic holdings are particularly suitable for this. This applies especially to organic holdings with a high proportion of vegetable crops and on-farm processing. These holdings require a lot of manual labour – which is work suitable for people who have no previous knowledge of agriculture or can, for various reasons, only undertake simple tasks. It is thus unsurprising that it is mostly organic holdings that are listed in the database of the German working group on social agriculture.<sup>176</sup>
- Primarily in countries where the use of plant protection products is not regulated and workers do not have access to protective equipment (e.g. special suits), conventional farming bears the risk of **damaging the health** of farm workers. The associated absences from work or even incapacity for work reduce the income and can considerably harm the social situation of the affected families.
- From a social point of view, the consumers’ side must also be considered. Eating organic products is associated with considerably higher costs if consumption patterns remain unchanged. Haubach and Held (2015) calculated a **70% increase in cost** for an average shopping basket.<sup>177</sup> Relative to overall private consumption, the changeover to organic products in the categories of food, drinks and tobacco products results in a 10% increase in costs.<sup>178</sup> Due to the higher prices, households that receive social assistance and low-income households can hardly afford

---

<sup>174</sup> This is why countries with lower labour costs are more competitive in organic farming compared with more capital-intensive production methods.

<sup>175</sup> See for example the website of the German working group on social agriculture (Deutsche Arbeitsgemeinschaft Soziale Landwirtschaft, DASoL): <http://www.soziale-landwirtschaft.de/startseite/>. The holdings search function (“Hofsuche” under “Suche”) lists more than 100 holdings.

<sup>176</sup> <http://www.soziale-landwirtschaft.de/suche/hofsuche/>.

<sup>177</sup> When switching from conventionally farmed brand products to organically farmed non-brand alternatives or organically farmed market-entry price brand products, the cost increase of an organic shopping basket amounts to only 5% (Haubach & Held 2015).

<sup>178</sup> Differentiated according to income classes: a switch to organic products causes a 14% increase in costs in relation to overall private consumption in the “poorest” net equivalent income decile, while these costs increase by 7% in the “richest” net equivalent income decile (Haubach & Held 2015).

organic products unless they make extreme changes to their dietary patterns and other food consumption habits (eating less meat and fish, cooking at home more etc.).<sup>179</sup>

Finally, the pioneering function of organic farming as a **trial field** must be mentioned. Organic farming views itself as a sustainability segment. Studies attest organic farmers greater motivation for sustainability on average (Sullivan et al. 1996, Franz et al. 2012, Naspetti et al. 2017). As a higher-price quality segment, organic farming is also under pressure to position itself as particularly environmentally friendly. Against this backdrop, the organic farming sector has time and time again initiated developments and given impetus (e.g. organic plant protection, mobile chicken coops, conservation of old breeds and varieties, innovative direct marketing such as vegetable boxes, community-supported agriculture, etc.) (see also Section 5.4).

### 5.2.2.7 Conclusion: assessment of organic and conventional farming systems

It is not easy to assess and compare the sustainability of farming systems because numerous economic, social and environmental effects must be identified, assessed, weighted, and – in the case of trade-offs – weighed up against each other. Added to this is the fact that these effects can vary greatly depending on the location and the farm manager's skills. There are currently various instruments for recording, assessing and controlling the sustainability of agricultural holdings and production systems (KSNL, DLG sustainable and future-proof agriculture programme "Nachhaltige Landwirtschaft zukunftsfähig", RISE, SMART, Dairy Sustainability Tool). These systems primarily have the potential to gradually make agriculture more sustainable. But they also reach their limits when it comes to the consumer perspective since they have not yet led to – and were not developed for – authentically definable systems.<sup>180</sup> It is thus unsurprising that these systems have not resulted in the development of any farming systems whose products are recognised by consumers as being especially sustainable.

Organic farming is a special case: it is regulated by law and has been presented and advertised as especially sustainable in the public debate as well as by retailers for many years. When it comes to the various sustainability aspects, an overview of all studies illustrates that organic farming has both weaknesses and strengths, and that these can vary depending on the location, type and management of the holding. The positive environmental effects in terms of many environmental goods is one clear strength of organic farming. This means that organic farming can contribute to reducing

---

<sup>179</sup> However, in her book entitled "Arm aber Bio!" ("Poor but organic!", <http://www.arm-aber-bio.de/das-buch/>), Rosa Wolff shows that it is possible to eat organic food on a budget. Yet this does not seem realistic for many low-income households, as the necessary (support) resources are not available or only available to a limited extent (cf. Section 4.2.3).

<sup>180</sup> Only in Switzerland has a small intermediate segment between organic and conventional agriculture become established, with an integrated production system and its own label (IP-SUISSE, cf. <https://www.ipsuisse.ch> and text box 25 "On the failure of a label for integrated farming" in Section 8.9.3); furthermore, there are multi-tiered labels in the field of animal welfare that constitute developments towards intermediate segments between organic and conventional agriculture.

the current political challenges relating to the environment and resources in Germany – particularly at locations where organic farming can reduce several environmental strains simultaneously. One clear weakness, however, is the lower yield: firstly, due to these low yields, organic farming has no systematic product-based advantages over conventional agriculture in terms of climate effects. Secondly, the low yields are problematic against the backdrop of a growing world population. In order to produce the same amount of food and other agricultural products through organic farming as using conventional methods, arable farming would have to be intensified in other regions and/or arable land would have to be expanded considerably. Although a further expansion of agricultural land is generally possible in some regions, this scenario is associated with increased ecological costs if all other conditions remain the same, since converting this amount of fallow land and other natural areas would involve additional biodiversity losses and greenhouse gas emissions. Due to the very complex interrelations and a lack of data, **it is currently not possible in a scientific way to conclude what percentage of organic farming in Germany or Europe would mean that these potential negative relocation effects weigh more heavily than the positive effects of reducing environmental problems in Germany and/or Europe.**

However, a further significant expansion of organic farming could be unproblematic if **food losses, the consumption of animal products and the land used for bioenergy crops were reduced**. What is also clear, however, is that the gradual expansion of organic farming in Germany should not be the major or only instrument for solving environmental problems caused by agriculture. **Significant adjustments to conventional agriculture are also necessary**. The large differences in the environmental and climatic effects, even within the two farming systems, indicate that both systems have considerable potential for improvement. In general, the search for sustainable forms of agriculture **should not be based too strongly on the classic system delimitations that are popular among the public; instead, this search should overcome traditional thought patterns and combine the best elements of the two different variants** (Meemken & Qaim 2018a). Sustainable systems must always be location-specific. There can be no one-size-fits-all approach. For this reason, Rööös et al. (2018) come to the conclusion that organic farming may have to re-examine certain fundamental principles in order to be a driving force for more sustainability in the food system.

There is no single answer to the question that is ultimately relevant to consumers – whether or not organic products belong in a sustainable shopping basket. Much of the evidence currently does suggest this. Organic products can contribute to a more sustainable shopping basket as long as the positive environmental effects of organic farming in combating major environmental problems in Germany outweigh the potential negative relocation effects. Since both farming systems continue to develop and the assessment depends heavily on the degree of expansion of organic farming as well as on other changes in the food system, this **positive assessment of organic products must be reviewed periodically** (e.g. once organic farming has expanded to the political objective of 20%).

### 5.2.3 Perspectives of (greater) sustainability in farming systems

Overall, the WBAE supports boosting organic farming and recommends the system as one element for promoting sustainability in food consumption – and does so all the more the greater the extent to which the consumption of organic products goes hand in hand with a reduction in the consumption of animal products and a reduction of food wastage. In the long term, however, as laid out above, the dichotomy between “organic” and “conventional” is not only simplistic but also insufficient. **Organic farming** is one specific form of sustainable agriculture with a special focus on a preference of naturalness. It has historically developed as a social movement outside of traditional agriculture (Radkau 2011) and, due to this exceptional position, it has managed to establish itself as **the only alternative system identifiable to consumers**. This distinctness has been reinforced since the 1990s through a (governmental) certification scheme. To a large extent, the success of organic farming is therefore an issue of communicability and control, i.e. of transaction costs. The relatively clear and easily controllable system criteria (“Avoidance of...”, cf. Section 5.2.2) are important advantages of organic farming in this regard. The view that organic farming is the more environmentally friendly system has become widely accepted in society in the past few years. Studies show that roughly 30% of German consumers have developed a preference for organic foods based on this, which has led to continuous market growth. As an example, the turnover achieved by organic foods rose from 8.2 billion euros in 2014 by almost 34% to 10.9 billion euros in 2018 (AMI 2019). But organic foods are considerably more expensive. For products for which the extra costs are particularly high, e.g. for meat (up to 189% according to Groß et al. 2019), the market share is only 1–2%.

**In principle, and when considered globally, farming systems that are more sustainable than organic farming as it is currently defined are conceivable and meaningful.** If such farming systems were certified and therefore became recognisable on the market, consumers could accomplish more with every euro that they are willing to spend on sustainably produced products. The possibility of certifying products is primarily important whenever it is intended to use the consumers’ willingness to pay higher prices for particularly environmentally friendly products in parts of the market to cover additional production costs. The certifiability of products is less significant when it comes to implementing basic environmental provisions that apply to the entire market as a standard and can therefore not serve as a means of differentiating products. Particular emphasis is placed on certifiability here because this expertise examines the consumers’ point of view.

In its expertise on policy strategy regarding food labelling, the WBA argued in favour of a multi-tier environmental categorisation of foodstuffs (WBA 2011). This is the general idea of the planned governmental animal welfare label, which provides for a three-tier assessment, and of the climate label proposed in this expertise. In contrast, other important aspects of the environmental dimension, including N leaching and effects on biodiversity, can less easily be expressed in a product-specific manner (cf. Section 5.2.2.3) and are only suitable for labels to a limited extent. The standardisation and certification of farming systems would permit consumers to place greater emphasis on these aspects in their purchasing decisions.

There are three main issues that would have to be solved in order to develop a label for farming systems with greater sustainability (cf. also Sections 8.9.3 and 9.9):

- (1) Sensible, **clearly delimited farming systems would have to be defined** that can compete with organic farming in terms of their environmental performance but achieve higher yields by, for example, using methods for reducing the necessary input products (e.g. reducing the use of plant protection products through new breeding technologies such as genome editing, robot use / smart farming).
- (2) The defined farming systems must be **certifiable**, i.e. valid and reliable inspections of holdings must be possible and the effort or expense required for these inspections must be acceptable, in order to make a reliable label feasible. It is to be expected that the transaction costs will be higher than those of organic farming (Beckmann et al. 2003).<sup>181</sup>
- (3) A sensible **transition** from the current dichotomy of “organic vs conventional” towards a more differentiated way of assessing the sustainability of farming systems must be identified, which simultaneously secures the acceptance of both farmers and consumers.

“Organic” should maintain its position as a sustainability signal for consumers, and particularly for those consumers whose **inclination towards naturalness** is especially pronounced (cf. text box 10). However, in terms of sustainable development, it is expedient to work on both developing the organic farming system and on **establishing intermediate forms** of systems that are also more sustainable (Janssen et al. 2009) but that are less oriented towards naturalness and make use of novel techniques for reducing the necessary input products.<sup>182</sup> In its statement on the post-2020 CAP (WBAE 2019), the WBAE acknowledged an ecopoints model as one possible approach to recording and officially rewarding ecosystem services within the scope of agricultural land-use. In the WBAE’s view, this approach can be further developed towards a certifiable farming standard and thus a (multi-tier) label. A label such as this could on the one hand help food processors and retailers in their purchasing policies, and on the other help consumers in their selection of foods (particularly unprocessed products such as apples, carrots etc. but also processed foods, which could for example be labelled with information such as “contains cereals from certified environmentally friendly production”) (cf. Sections 8.9.3 and 9.9). It is to be expected that the increasing digitalisation will facilitate the development of such systems.

---

<sup>181</sup> From the point of view of agricultural administration, organic farming as a whole-farm measure is an alternative that saves on transaction costs when compared with having a multitude of individual measures for achieving environmental objectives (Beckmann et al. 2003).

<sup>182</sup> This particularly concerns the use of technologies that are viewed by (some) consumers as unnatural and (therefore) particularly risky. In the current debate within the organic sector concerning new breeding technologies, it is becoming apparent that organic farming will not make use of certain technologies since there are market-related path dependencies resulting from the positioning adopted vis-à-vis consumers.

**Text box 10:** Consumer preferences for naturalness and their significance for sustainability policies

One difficult issue in sustainability policies is the significance and handling of consumers' preference for naturalness. It is undisputed that, in the various fields of sustainability, there is a strong inclination towards a high degree of naturalness of foods and the associated production processes (a comprehensive overview of this is given by Román et al. 2017, see also Section 3.1). Consumers judge a foodstuff's naturalness primarily by the way it was cultivated and produced (i.e. what technologies and ingredients were used) and by the properties of the end product.

This strong preference for naturalness is based to some extent on health concerns. Many consumers expect natural, gently processed foods to be healthier. In the case of livestock systems, those that are closest to nature are viewed as particularly animal-friendly. Organic foods are viewed as particularly natural and are therefore preferred (Hemmerling et al. 2016b). "Free from" labels as a sign of the lowest possible use of additives, processing aids and flavouring substances are increasingly used in successful marketing (Spiller & Zühlsdorf 2012, Asioli et al. 2017).

From a scientific point of view, this preference for naturalness is controversial:

- To some extent, naturalness or closeness to nature is interpreted as a sensible, easy-to-understand cue that helps consumers make their purchasing decision. For example, the wholefoods nutritional concept promotes a low degree of processing as one of the key indicators for identifying health-promoting foodstuffs (Körber et al. 2012, Mendonca et al. 2016). In its expertise on livestock farming (WBA 2015), the WBA also listed systems that are closer to nature (e.g. those that include free-range areas and various floor coverings) as a sensible objective for greater animal welfare. It is also easy for consumers to understand the rule of thumb that "natural livestock system = greater animal welfare".
- Other authors view the preference for naturalness as a specific perception distortion (Rozin 2006), i.e. a consistent assessment pattern (frame) that can also lead to erroneous judgements and that complicates technological solutions.
- There are even more sceptical views that strong preferences for naturalness are based on esoteric notions of holism and hostility towards science, which lead to socially dysfunctional tendencies (e.g. vaccine refusal).
- In contrast, other authors view preferences for naturalness as a sensible principle of cautiousness which, in case of doubt, prefers a more natural variant in light of the limits of our knowledge – e.g. in terms of nutritional science and technology assessments (Gleich et al. 2001).

In view of the intensity of the preference for naturalness in some parts of the consumer community, and particularly among the more involved target groups, and the fact that this cue is, at least to a degree, reasonable, sustainability policies should take these consumer preferences into account and strive for a more clearly differentiated analysis. Román et al. (2017) warn that simply dismissing these preferences for naturalness could potentially be problematic, since this would disregard the beliefs of many consumers.

## 5.2.4 Further issues of sustainable agriculture

In addition to the question of “organic vs conventional”, there are other issues of sustainable agriculture that are the subject of controversial debate in society. In particular, this relates to

- (1) the potentials and risks of green genetic engineering
- (2) the use of glyphosate in agriculture
- (3) the importing of soya from South America
- (4) the assessment of products from energy-intensive greenhouses and
- (5) husbandry conditions in livestock farming

**Re. (1) Genetic engineering and sustainability** In the past few years, much attention has been paid to the debate on green genetic engineering<sup>183</sup>. As outlined in Section 5, many sustainability recommendations advocate the avoidance of genetic engineering, and the use of genetically modified organisms (GMOs) in agriculture is widely rejected by society in Germany. In surveys, more than 80% of consumers regularly state that they reject the technology.

GMOs, as well as foods and feedstuffs consisting of GMOs, containing GMOs, or produced from GMOs, must be labelled in accordance with EU Regulation (EC) No 1830/2003. There are currently no GMOs approved for cultivation in Germany. GMO feedstuffs are imported in large volumes and used in livestock farming. Animal products that are produced using such feedstuffs do not have to be labelled as GMOs. However, increasing numbers of producers add “no GMOs” labels to their animal products (especially dairy products) in order to indicate that the animals were not fed with genetically modified feed crops.<sup>184</sup> There are also a multitude of additives and technical auxiliaries that are produced using white genetic engineering and that are used in Germany without any obligation for labelling.

GMO foodstuffs subject to labelling requirements have so far not been widely sold in Germany. Vice versa, the “No GMOs” labelling of animal products, particularly of milk and dairy products, has greatly increased in significance in the past few years. Many consumers fear great environmental and health risks through the use of GMOs, which is why products labelled as GMO-free are viewed as more sustainable and sometimes associated with aspects such as animal welfare and regionality. Many consumers obviously see the avoidance of GMOs as one key characteristic of sustainability.

---

<sup>183</sup> The term “green genetic engineering” refers to the use of genetic engineering methods in plant breeding. In contrast, “white genetic engineering” refers to the use of genetic engineering to modify micro-organisms, cell cultures or enzymes. Such micro-organisms, cell cultures and enzymes are frequently used in the production of foods. “Red genetic engineering” refers to genetic engineering in medical contexts.

<sup>184</sup> The use of white genetic engineering in feed additives, animal drugs and vaccines is not excluded by this label.

The WBAE will not further discuss the issue of genetic engineering in this expertise due to the following considerations:

- Scientific research has reached a broad consensus on the fact that GMOs should not be rated differently from conventionally bred plants in terms of risks to the environment and human health (German National Academy of Sciences Leopoldina et al. 2019). For roughly 25 years, GMOs have been cultivated and used in other parts of the world without incurring any negative environmental or health effects that can be ascribed specifically to the fact that the breeding methodology involves genetic engineering.
- The use of genetically modified herbicide-tolerant varieties in North and South America has led to large-scale uniform production that raises concerns from an ecological perspective and with regard to increasing resistances of weeds to herbicides. However, these problems are caused by the herbicide tolerance itself and are not directly connected to genetic modification. The large-scale use of conventionally bred herbicide-tolerant breeds would have led to the same problems.
- From an economic and social perspective, GMOs are frequently associated with high concentrations on the seed markets. However, the concentration can primarily be ascribed to the large and costly approval hurdles for GMOs as well as to excessively strong patents instead of genetic engineering itself.

Overall, there are important sustainability aspects associated with GMOs which require improved policies and regulation. However, the WBAE is convinced that the blanket categorisation of genetic engineering as unsustainable is unwarranted according to today's scientific knowledge.

This does not mean that consumers have no right to information on the use or non-use of GMOs. Consumers may decide that they do not want to consume GMOs for various reasons. These decisions have much to do with trust in a sector and its enterprises. Transparent labelling and legal provisions on a coexistence of different farming systems are therefore sensible (cf. WBA 2010).

The WBAE expects novel methods of genome editing to have the potential to contribute to sustainability in future. For example, genome editing can help make plants more resistant to diseases and pests, which would reduce the use of chemical plant protection products. A detailed assessment of new breeding techniques would, however, surpass the scope of this expertise. In view of current EU legislation, it is not to be expected that genetically modified or genome-edited plants will be cultivated in Germany or other European countries in the short or medium term. Globally, however, they will likely be cultivated to a larger degree, which may lead to problems in international competitiveness in the long term.

**Re. (2) Use of glyphosate in agriculture** Glyphosate, introduced by Monsanto in 1974 under the name "Roundup", is a broad-spectrum herbicide (also known as a "total herbicide"), which means that it kills all plants, with the exception of herbicide-resistant plants. Herbicide resistance (herbicide tolerance) is introduced into cultivated plants via genetic engineering methods. In weeds, it

can develop through spontaneous mutation and then spread through natural selection when herbicides are used on a large scale and over long periods of time. Glyphosate is used in agriculture for non-selective weed control, mainly as a pre-sowing treatment (shortly before or after crop sowing, usually in combination with no-plough soil tillage methods), as a pre-harvest treatment (shortly before the harvest, known as desiccation) and as a post-harvest treatment. This herbicide is used on 30–40% of German arable land (Wiese 2018). Cost benefits are often the reason for its use, but other economic effects (expenses for workers) also play a major role. Ploughing arable land is done for weed control, among other purposes. The use of glyphosate makes it possible – at least partly – to forgo ploughing (“no-plough soil tillage”). The avoidance of ploughing can minimise erosion in areas that are prone to erosion. Glyphosate also serves to terminate catch crops and weeds / inferior grasses against which selective herbicides have lost their efficacy.

From a farming perspective, glyphosate has specific advantages for certain purposes, but it can also be used on a large scale and to compensate for otherwise deficient weed control. Some aspects of post-harvest treatment, for example, replace using a grubber or other forms of conservation tillage. Pre-harvest treatments with glyphosate are viewed particularly critically. Desiccation (drying out) means that cultivated plants (which are not herbicide resistant) such as cereals, rapeseed or potatoes, are killed by means of glyphosate. The cultivated plants then dry out and can thus be more easily harvested and more efficiently processed. Weeds that would otherwise be included in the harvest and (in the case of cereals) increase the moisture content of the harvested produce, are also killed. The criticism in this case is that glyphosate is not used for weed control but with the sole aim of simplifying harvesting (Steinmann et al. 2018). This type of application is generally prohibited for large-scale use in Germany, but permitted for sections with high degrees of weed growth. This exemption rule is questionable and difficult to control.

Internationally, glyphosate in combination with no-plough soil tillage has created the conditions for unploughable areas to be converted into arable land. This was implemented on many millions of hectares, predominantly in the southern hemisphere. In Latin America as well as Australia, New Zealand and South Africa, the use of glyphosate is non-controversial, both among specialists and in society, and is therefore a standard procedure. In the dry regions of the world, which are additionally affected by climate change to a higher degree than the northern hemisphere, no-plough soil tillage is often the only way to obtain sufficiently high yields while conserving water and simultaneously binding carbon dioxide in the soil by forming humus. It is also undeniable, however, that these positive attributes of using glyphosate have in many cases been counteracted by oversimplified crop cycles and excessive use of inputs (Cuhra et al. 2016). Against this backdrop, countries such as Australia, the US or Brazil are increasingly discussing integrated crop livestock systems that are based on expanded crop cycles and also restrict the use of glyphosate to a only few crop species (cf. Russelle et al. 2007).

The social debate on glyphosate in Germany, which in 2019 led to the Federal Government banning this active substance as of 2024, is being conducted on various levels. On the one hand, it is about the intensity of the use of plant protection products in general, and on the other hand it is about

the toxicity of glyphosate. The connection between glyphosate and genetic engineering also plays a role.

- **Intensity** In the past twenty years, domestic sales of plant protection products have risen from 30,706 t (1997) to 34,583 t (2017), although the level has remained roughly constant in the last ten years (BVL 2018, not including gases to control storage pests). It has to be taken into consideration, however, that the specific eco-toxicity of the active substances, particularly in aquatic ecosystems, has likely risen by a multiple thereof over the same period of time (cf. Schäfer et al. 2019). According to assessments by a number of observers, including some from the agricultural sector itself (DLG 2017), there are considerable reduction potentials. The debate on the use of glyphosate, including those application options that do not serve weed control or only do so to a limited extent (such as desiccation), is simply a proxy for the discussion on these reduction potentials and a more curative-orientated application which has not yet been effectively implemented either by agricultural policy or by agriculture itself.
- **Toxicity** The toxicity of glyphosate is controversial, although there is little doubt that the active substance, compared with similar total herbicides and many individual active substances, degrades quickly and is comparatively less toxic.
- **Connection between glyphosate and genetic engineering** By combining glyphosate and crops that have a genetically engineered tolerance to this active substance (herbicide-tolerant crops), Monsanto has created the major global application pattern for genetic engineering in agriculture. This has led to opponents of genetic engineering exploiting the debate on a ban of glyphosate to protest against genetic engineering in general and Monsanto in particular.

The WBAE considers it paramount to have a debate on plant protection intensities and on some fields in which glyphosate is applied. At the same time, the WBAE acknowledges the potential of pre-sowing applications of glyphosate to make soil management more conservation-orientated. For this reason, the WBAE criticises the complete ban of glyphosate. Simultaneously, the WBAE believes that it is the responsibility of agricultural policy makers and agriculture to considerably reduce the use of plant protection products overall (Steinmann et al. 2018). The fact that consumers are providing impetus to avoid a particular plant protection product by conducting “glyphosate-free” advertising is an expression of a problematic agricultural policy that has not succeeded in reducing the overall use of plant protection products to the benefit of biodiversity and preventive consumer protection. The debate on glyphosate is thus to some degree a “proxy war”. Constructive agricultural policy should attempt to reduce such disputes.

**Re. (3) Soya from South America** The issue of animal feed production in South America and its role in German agriculture has been discussed intensely in the past few years, due to soya cultivation technologies (genetic engineering and use of glyphosate), monotonous and tight crop cycles (soya–maize–soya), tropical deforestation, the loss of land (rights) by traditional land users and indigenous peoples, and the role of international trade and transport over long distances. At the heart of this is the issue of the environmental impact of global agricultural trade and the importing of

commodities (feedstuffs, luxury products) mainly from southern countries. On the one hand, agricultural exports from southern countries cause welfare gains in those national economies; on the other hand, importing agricultural commodities such as soya products to the EU also means importing ecological footprints which must be attributed to the European processing industry and ultimately to the foodstuffs of animal origin produced here. For example, Germany imports the equivalent of roughly 20 kg nitrogen per hectare of agricultural land in Germany and a corresponding amount of phosphorus (2–3 kg P/ha) via the various categories of soya products alone. If the demand for animal products produced by using these feedstuffs and for these luxury commodities is taken as given, then the environmental assessment of such imports depends on the assessment of corresponding substitutes produced in Germany. For example, van Zanten et al. (2015) compare the environmental effects of substituting imported soybean meal by nationally produced rapeseed meal in Denmark's pig fattening industry. The comparison reveals that there are only very minor differences in terms of land take, greenhouse gas emissions and eutrophication potentials. Cerri et al. (2017) analysed the greenhouse gas emissions from soya-based biodiesel production in Mato Grosso (Brazil) and determined that these emissions are well below the EU-set greenhouse gas reference values for corresponding biodiesel made from EU rapeseed, even including expenditure for transport to Europe. Soya imports from South America thus do not necessarily cause higher greenhouse gas emissions than national alternatives. However, these analyses exhibit large variances depending on the location and the production system, which means that they are not suitable for making simplified statements. Currently, considerable public funds are being used to boost the cultivation of soya in Germany (roughly 1% of import volume in 2017); this has resulted in comparatively low-yield soya cultivation (approx. 3.5 t/ha) replacing high-yield wheat (8 t/ha) and grain maize (10 t/ha) cultivation and thus causing indirect land use change elsewhere in the world.

In view of these interconnections, it is the WBAE's view that it would be more expedient to a) significantly reduce the consumption of animal products and therefore the amount of land needed for food in Germany (cf. Section 9.3) and b) ensure that soya cultivation in South America is made more sustainable through certification systems such as the Round Table Responsible Soy concept (RTRS) as part of fair international trade. Such certification systems can contribute to considerably raising social and environmental standards in the agricultural sector of southern countries, including those standards concerning the responsible use of chemical plant protection products. However, these systems will only take effect if they are relatively widespread, otherwise they can be easily circumvented by selling certified products to some countries and the produce from non-sustainable cultivation forms to other countries (danger of "leakage effects", cf. Section 7.6.2). As long as this is not the case, Germany and the EU should increase the pressure on soya-cultivating countries on a political level and/or motivate them through incentives to make their cultivation systems more sustainable. Industry – in this case the large exporters and agricultural traders – can make major contributions in this regard, for example to deforestation-free supply chains.<sup>185</sup> The RTRS label is currently only rarely used and is relatively unknown among consumers. The current

---

<sup>185</sup> See for example the soya moratorium signed by Greenpeace, many producers and exporters from Brazil and global traders: it prohibits the trading, financing and purchasing of soya originating from rainforest areas that were deforested after July 2008. Due to a lack of transparency and its small-scale implementation, its efficacy is controversial (cf. Ermgassen et al. 2019).

impact of the RTRS can hardly be estimated due to the limited distribution and the consequent leakage issues (van der Ven et al. 2018) in spite of the fact that the standard does cover relevant points (Kusumaningtyas & van Gelder 2019). One important aim of the RTRS – namely stopping deforestation and the destruction of habitats – has not been reached to date (Gatti et al. 2019, van der Ven et al. 2018, Carlson et al. 2018).

The debate on the **sustainability of palm oil production** exhibits similar lines of argument as the soya production sustainability debate outlined above. This sector, too, suffers from a tense relation between economic development in the producing countries on the one hand and producing systems that are viewed as problematic in terms of western social and environmental standards on the other. Simple solutions such as general import bans are not helpful here, either. Oil palms yield more oil per hectare of land than any other cultivated plant, so that simply substituting palm oil with other plant oils would lead to additional land use change. Instead, comprehensive and verifiable sustainability efforts by agricultural trade and the processing industry are crucial, and they should be reinforced through political pressure. The Roundtable Sustainable Palmoil system (RSPO) faces criticism similar to the RTRS label (Ostfeld et al. 2019).

**Re. (4) Energy-intensive greenhouses / vegetable production systems** With regard to sustainability aspects, horticulture can be broken down into open-field, foil and greenhouse cultivation (the latter being heated using fossil energy sources). The plants are often cultivated in soil-free systems on rock wool and provided with lighting to increase photosynthesis. Heated greenhouses (especially those with artificial lighting) consume a lot of fossil energy and therefore make a relevant contribution to climate change. Vegetables grown in greenhouses heated with fossil energy cause 5–20 times more greenhouse gas emissions than vegetables grown in open fields or unheated greenhouses (WBAE & WBW 2016, Dias et al. 2017).

At the same time, however, production in heated greenhouses increases the variety of health-promoting vegetables on offer, increases off-season availability and thus contributes to sensible diversity in food consumption. Furthermore, open-field systems in southern European countries cause considerable problems due to the regional scarcity of water (Hess & Sutcliffe 2018, Frankowska et al. 2019), and in some cases social problems relating to workers (e.g. migrants, Salvia 2019; cf. Sections 5.3.2 and 5.3.3). Additional environmental issues relate to the very varied use of plant protection products in vegetable growing systems.

However, greenhouses heated with fossil energy are ultimately not sustainable due to climate change considerations, and a climate label would indicate this (cf. Section 9.6.4). The energy intensity of heated greenhouses must be re-assessed if the energy originates from renewable sources or waste heat. There are additional innovation opportunities in systems such as aquaponics, as a combination of aquaculture and vegetable production in closed systems (König et al. 2018). Additionally, a number of vertical farming systems are currently being developed, but these have found only occasional practical application and there is little reliable information on their environmental friendliness.

**Re. (5) Husbandry conditions and animal protection** Other sustainability assessment issues at the level of farming systems relate to animal protection. Current husbandry methods that are established in conventional farming are often contrasted with developments for the benefit of animal welfare, or the husbandry systems are differentiated according to categories such as indoor, outdoor-climate and free-range systems. From an animal protection point of view, the assessment is similar to the comparative work on organic livestock husbandry cited above: while the operational management is decisive for animal health, animal-welfare-orientated livestock systems offer animal-protection advantages by enabling animals to indulge in a variety of behavioural patterns, and thus also have sustainability advantages. In its 2015 expertise on the future of livestock farming, the WBA described the expansion of husbandry systems that permit the animals access to various climate zones, preferably an outdoor climate, and to various functional areas with different floor coverings as a major prospect for development. It is the WBAE's view that although trade-offs with other sustainable development goals exist, they are not sufficiently pronounced to generally oppose this direction of development. Therefore, with regard to animal-protection aspects, and despite some trade-offs, the consumption of products from such animal-welfare-orientated husbandry systems (e.g. pastoral farming, free-range farming, outdoor-climate stalls etc.) is an important element of sustainable food consumption.

### 5.2.5 Conclusion

German agriculture is a multifaceted field, ranging from very small to very large holdings, from highly specialised to highly diversified holdings, from holdings which rear livestock to those that do not, and from intensively to extensively managed holdings. From the consumers' point of view, this begs the question whether any farming systems have evolved in this variety which can be identified as particularly sustainable.

A variety of scientific concepts for assessing sustainability have been developed. These mainly have the potential for gradually improving agriculture with regard to sustainability in the long term. But they reach their limits when it comes to the consumers' point of view, so that these comprehensive assessment systems are not currently used for environmental labels.

Organic farming is a special case: it is regulated by law and has been presented and advertised as especially sustainable in the public debate as well as by retailers for many years. When considering the overall results of the studies, however, it becomes clear that organic farming is not a universal remedy. It has strengths and weaknesses in terms of the various sustainability aspects, which, in addition, can be extremely specific to the location and type of holding. One clear weakness is the lower yield, which is problematic against the backdrop of a growing world population. The positive environmental effects, relating to many environmental goods, is one clear strength of organic farming. Overall, the WBAE supports boosting organic farming and recommends the system as one element for promoting sustainability in food consumption – and does so all the more the greater the extent to which the consumption of organic products goes hand in hand with a reduction in

the consumption of animal products and a reduction of food wastage. In the long term, however, the dichotomy between “organic” and “conventional” is insufficient. After all, viewed globally, it is possible to conceive of farming systems that are more sustainable and have greater land-use efficiency than organic farming as it is currently defined. These must be developed and then made recognisable to consumers.

In addition to the consumption of organic products, many sustainability recommendations (cf. Section 5.1) advocate avoiding genetic engineering. A blanket, fundamental categorisation of genetic engineering as unsustainable is, however, unwarranted according to today’s scientific knowledge. The principal rejection of importing feedstuffs (e.g. soya) or using glyphosate is also too generalised. There are, however, justified points of criticism concerning certain production methods. When it comes to purchasing behaviour, it is currently hardly possible for consumers to act in a differentiated manner because there is a lack of pertinent information on the market.

As explained in detail in its expertise on livestock husbandry (WBA 2015), when it comes to livestock husbandry the WBAE advocates the expansion of husbandry systems that permit the animals access to various climate zones, preferably an outdoor climate, and to various functional areas with different floor coverings. With regard to animal-protection aspects and despite some trade-offs, the consumption of products from husbandry systems such as pastoral farming, free-range farming, outdoor-climate stalls etc. is an important element of sustainable food consumption. Due to the higher prices, this would also be accompanied by a desirable reduction in Germany’s high consumption of meat.

Vegetables grown in greenhouses heated with fossil energy cause 5–30 times more greenhouse gas emissions than vegetables grown in open fields or unheated greenhouses. At the same time, the constant availability of a wide variety of vegetables also contributes to a health-promoting diversity in food consumption. There are sustainability potentials in this area in seasonal consumption and innovative, energy-efficient production systems using renewable energy sources.

### 5.3 Assessment of dietary patterns and foodstuffs

Issues of greater sustainability in food consumption may relate to the entirety of food consumed by a person – a level which is referred to as a dietary pattern. Many decisions made by consumers during their daily lives ultimately take place in the grocery aisle, making the selection of products and foodstuffs a crucial everyday decision. This is why issues such as what dietary patterns and what foodstuffs are environmentally friendly or health-promoting and which of them fulfil higher social and animal-welfare requirements are key to promoting sustainability regarding dietary habits. The great interest in these topics shown by the media also indicates that consumers are asking themselves these exact questions.

The sustainability of a diet can be assessed on different levels as shown in Table 5-4. In the fields of economics, food and nutrition science and trade, various classification systems are used. From a consumer's point of view, however, these address comparable levels; they are therefore grouped together in this expertise in order to assess the four key sustainability aspects (health, social issues, environment, animal welfare). Thus, a "foodstuffs" group (nutrition science) more or less corresponds to a "product" group (trade, economy).

**Table 5-4:** Analysis levels for assessing the sustainability of food consumption using dietary patterns and the product-range structure of grocery retailers for products and foodstuffs

Analysis level	Examples
Dietary pattern (entirety of recommended/consumed foodstuffs)	Positive dietary recommendations, e.g. made by DGE, observed dietary patterns, or diets such as vegetarian or vegan diets (cf. Chapter 4.2)
Foodstuff groups/product groups	Meat, dairy products, fruits, vegetables, beverages
Article group	Cheese, yoghurt, curd cheese, mineral water, soft drinks, beer
Foodstuff/article	Full-fat curd cheese (40 %), low-fat curd cheese; pasture milk, Alpine milk (differentiated according to ingredients, processing method, means of transport etc.)
Brand	Specific products offered by different producers and retailers (manufacturers' brands/dealers' brands)

Source: WBAE illustration inspired by categorisations used in retail management (Möhlenbruch 1994) and nutrition science.

- On the level of **dietary patterns**, consumers, policy makers and retailers could, for example, pose the question whether a dietary pattern based on DGE recommendations is more conducive to good health, better for the environment and more respectful of animal welfare than a vegan diet.
- The recommendation to eat less meat, for example, pertains to the level of **foodstuff groups / product groups**. Policy makers as well as consumers might ask themselves, for example, which option is more climate-friendly: consuming meat or consuming protein from other sources such as legumes.
- The recommendation to drink tap water instead of bottled water, but also to prefer bottled water over sugar-sweetened drinks, relates to a slightly lower level, namely that of **article groups**. Consumers might also ask themselves whether there is a difference in terms of climate compatibility when it comes to eating either beef or poultry.

- The suggestion to prefer grass-fed milk over milk from cows kept in stables (which is not specially labelled) relates to the level of individual **articles/foodstuffs**. Another question consumers might ask themselves is whether milk with a fat content of 3.8% is healthier than milk with a 0.5% fat content.
- On the level of **brands**, policy makers and consumers might wonder whether meat from brand X conforms to higher animal welfare standards than meat from brand Y or whether the company behind brand A cares more about sustainability than the company behind brand B. For companies that advertise their commitment to sustainability, brands are the key reference point that distinguishes them from the competition, and consequently, most advertising addresses this level.

The explanations below show that all five levels have their merits. One brief example:

- Considering the dietary patterns level may be advantageous due to this reference level's closeness to reality and action: consumers typically combine foodstuffs in a specific way. For consumers, such dietary recommendations may thus be easier to understand than considerations on the level of several thousand individual products. For example, the "5 a day" campaign (fruit and vegetables) that has been established in many countries offers an easy-to-understand rule for health-promoting food consumption habits.
- Several sustainability arguments are in favour of a reduced overall meat consumption (dietary patterns / foodstuff groups / product groups)
- On the level of foodstuffs and articles, for example, there are significant differences in CO<sub>2</sub> footprints, depending on whether a fish originates from regional aquaculture/fisheries sector or was transported by air, for example.
- Finally, there are different brands for every foodstuff or article. In the case of strawberry yoghurt, for example, these may contain different amounts of sugar. Some brands nowadays do not add any sugar as part of health-oriented recipe changes, while other brands continue to add large amounts of sugar to otherwise comparable products.

Depending on the analysis level, the sustainability of food consumption can thus be assessed to differing extents and degrees of differentiation. Furthermore, consumers' dietary choices sometimes relate to all of these levels simultaneously. It is self-evident that the smaller the number of decisions taken on the superior levels, such as foodstuff groups / product groups, and the greater the number of decisions made on the level of the individual foodstuffs and articles, the greater the degree of differentiation and the need for information. As an example, German food control and inspection differentiates between 59 product groups.<sup>186</sup> On the level of individual brands, rough estimates indicate approximately 200,000 foodstuffs that consumers in Germany can choose between. A typical discounter offers roughly 1,500–2,000 products, a supermarket about 10,000–20,000, and a large superstore more than 50,000 foodstuffs.

---

<sup>186</sup> <https://www.lgl.bayern.de/lebensmittel/warengruppen/index.htm>.

In addition, a certain dilemma becomes apparent on the level of foodstuffs and products: the differences between foodstuffs as well as between different articles and brands are sometimes considerable. Precise sustainability information regarding these levels would therefore be very desirable. However, such recommendations are problematic on the level of foodstuffs, brands or articles. Firstly, such data are currently hardly available and many companies are not interested in providing them. Secondly, the required information volume is considerably larger than on the level of product groups or dietary patterns, and controlling this information in detail is complex in the political system as well as for consumers. The information dilemma in sustainability policy is therefore fundamental and can only be partially remedied by means of improved assessment and communication instruments (Spiller 1996). Consumers as well as policy makers require information that is sufficiently meaningful but also user friendly.

It is therefore impossible in the following sections, which are concerned with the measurements and assessments of food in terms of health, social, environmental and animal-welfare aspects, to systematically distinguish these different analysis levels: there are often no comparable data or studies, particularly at the lower levels. For example, nutritional studies investigate the health effects of food consumption on the level of dietary patterns (e.g. Mediterranean diet vs Western diet, cf. Sections 4.2.1 and 5.3.1.1) or on the level of various foodstuff groups and nutrients, but not on the level of foodstuffs, products or markets.

The sections below concern the various sustainability dimensions, beginning with a health assessment of dietary patterns and foodstuffs and, based on this, an environmental assessment. There are no sound assessment concepts for social aspects yet, so the section concerned with this topic is a bit shorter. The topic of animal welfare has already been comprehensively addressed elsewhere by the Board (WBA 2015), so a brief summary is presented here. Last but not least, recent years have seen attempts at assessing sustainability in an integrated, product-based manner. These will be discussed towards the end, but they still face major challenges in terms of assessing existing conflicting objectives.

### **5.3.1 Comparative assessment of health contributions**

#### **5.3.1.1 Methods of assessing health benefits**

The question of what makes a dietary pattern, foodstuff or product healthy is an important topic for society, which is therefore much discussed in public. Hardly any other issue is discussed so regularly or controversially in the media. The volume of research work is correspondingly large. And yet there is no easy answer to this question. Both the scientific community and the wider public repeatedly question the reliability of health recommendations on dietary patterns and food consumption habits as well as foodstuffs (“Is a low-carb diet healthier than being vegan?” or “Are we supposed to eat eggs now or not?”)

Assessments from a health point of view are obviously complex because it is ultimately the combination of all food consumed, i.e. the dietary pattern, that is decisive for the health effects of food consumption. Strictly speaking, there are no unhealthy foods (with the exception of perished or contaminated foods), there are only unhealthy dietary patterns. In this context, the dose really does make the poison: a single soft drink with a high sugar content does no harm – but many consumers drink these beverages regularly and intensively, which increases their probability of becoming obese (Ernst et al. 2018: 16). This is why dietary patterns and diets are a key approach for epidemiological research.

### **Operationalisation of dietary patterns and diets**

Issues of assessing the health benefits of food may relate to the entirety of food consumed by a person – the level referred to as dietary pattern.

The systematic analysis of **dietary patterns** makes it possible to derive values or indexes that take into account the health effects of each pattern. The analysis reveals whether a dietary pattern increases the likelihood of developing cardiovascular disease or type 2 diabetes mellitus, for example. The comparison of dietary patterns at different points in time can also help identify changes in the food consumption habits of a population. There are two different approaches to determining dietary patterns (Richter 2017):

- The **a priori approach** uses previously defined dietary patterns, usually based on prescriptive dietary recommendations that define desirable dietary patterns. A typical example of an a priori approach is the “healthy eating index” (HEI), which is the basis of the US American dietary recommendations for 2015–2020 (Reedy et al. 2018). It uses a scoring system with scores ranging from 0 to 100. The average American currently reaches a value of 59 points (NCHS 2015). Since other countries favour other dietary recommendations, an “EPIC HEI” was, for example, developed for the European EPIC study, and an “NVS-II-HEI” for the NVS II study, which is based on the DGE recommendations (cf. Section 4.2). Alongside the Healthy Eating Index, desirable dietary patterns also include the DASH diet, the Mediterranean diet and, more recently, the “Nordic diet” (ibid.).
- The **a posteriori approach** or explorative approach empirically derives the dietary pattern based on existing data and dietary surveys. As an example, each German consumes 60 kg of meat and meat products on average per year (Gedrich 2016: 34). In comparison with prescriptive dietary patterns such as the DGE standard, this value is far above the recommended intake level.

**Diets** are characterised by a combination of food consumption habits and motives, which means that they comprise not only a specific dietary pattern but also the multitude of reasons for which certain foodstuffs are selected. It is rare that only health-related issues contribute to this; instead, world views and ethical and religious convictions frequently also play a part. Examples include religious rules (e.g. kosher or halal food), which primarily regulate what foodstuffs may or may not be eaten and how animals must be slaughtered (e.g. ritual slaughter). Other examples are vegetarian or vegan diets, which are often influenced by animal ethics issues (Hölker et al. 2019). Diets can also follow general trends such as the paleo diet or gluten-free or lactose-free diets without there having to be any concrete medical indications. Diets may thus influence the entire eating behaviour or relate only to selected individual aspects, and represent a combination of attitude and behavioural characteristics.

While dietary patterns have become a key concept of nutritional epidemiology because they either define desirable nutrition (“What should we eat?”) or are based on empirical data (“What do we typically eat?”), diets are a part of lifestyles that may change over the course of a person’s lifetime. When it comes to diets, it is possible to ask a person about them without necessarily measuring the actual food consumption habits (e.g. “Are you a vegetarian?”), whereas dietary patterns are usually determined by recording dietary behaviour, i.e. the eating frequency and/or volume in a standardised manner (cf. Section 4.2).

### **Methods for assessing health benefits based on nutritional research**

In order to understand the assessments and recommendations presented below, including health-related labelling (Section 8.9.1), consideration must be given to the methods used in nutritional research. Like other empirical fields of research in the life and health sciences (e.g. medicine, pharmacology), nutritional science has a number of study designs and methods at its disposal.

- **Randomised controlled trials** Randomised controlled trials (RCTs) are the gold standard of health research. This study design involves dividing study participants into an intervention group and a control group in a randomised manner. This is done to ensure an even distribution of any other potential characteristics that might otherwise systematically influence the effect of the intervention. Additional blinding (i.e. not revealing which group a participant belongs to) prevents participants and researchers from developing expectations that might affect the results. In the field of nutritional science, this study design can only be implemented to a limited extent, however. Firstly, RCTs have ethical borders since there are limits to the extent to which study participants can be subjected to problematic nutrition. Control groups in intervention studies can normally be given a placebo that should be indistinguishable from the treatment, but this is usually not possible when it comes to nutritional studies. Another problem is the usually short duration of studies: many (negative) effects of nutrition only develop in the long term. The intended endpoints (e.g. life span, BMI) cannot be measured within such a short period of time. This is why other, less valid surrogate indicators are recorded. In addition, small sample sizes are frequent, which makes it more difficult to preclude other influencing factors

(confounders) and interactions between various influencing factors (interaction effects). In addition, interventions that affect food consumption habits can lead to systematic sampling effects, e.g. when subjects prematurely discontinue their participation (compliance problems).

- **Observational studies, e.g. prospective or retrospective cohort studies or case control studies**  
This is the study design most frequently used in nutritional science. Groups are either retrospectively or prospectively compared over time (e.g. persons affected by an illness compared with persons not affected by that illness). Prospective cohort studies meet the requirement of ensuring a clear temporal sequence between exposure and illness onset when recording the individual data. Their results therefore have better validity than those of other study designs such as case-control studies (retrospective comparison) or cross-sectional studies (concurrent comparison). Since the participants of cohort studies are not allocated to groups in a randomised manner, observable group differences cannot necessarily be attributed to differences in food consumption alone; instead they can also be due to the systematically distorted selection of participants. Furthermore, measurement problems can occur when recording food consumption habits. People are only partially able to remember their food consumption habits so that measurements of consumption patterns are often a limiting characteristic of observational studies. Another problem is the multitude of potential influencing factors (confounders) both within food consumption habits behaviour (thousands of products) and the multitude of accompanying factors (general health-related behaviour such as smoking, drinking, exercise, stress, socioeconomic status etc.). Interactions between various factors (interaction effects) are even harder to record<sup>187</sup>. Beyond this, dietary patterns can change over time. The high costs and long duration of prospective studies limits the number of studies conducted. Although cohort studies cannot prove causal connections between exposure and risk, they do provide important indications of potential causal connections. Prerequisites for this include consistent results, strong associations (strong effects), biologically plausible associations and a clear temporal sequence between exposure and illness onset (Schulze 2007: 271).
- **Laboratory studies aimed at finding physiological explanations** (particularly animal experiments, cell experiments and biochemical, genetic and physiological studies): the complexity of nutritional and physiological connections over many years in a human's life can only be represented to a limited extent, and the transfer of findings relating to short-lived experimental animals to humans is problematic. In humans, there are long periods of time between consumption and health effects (time lags).

---

<sup>187</sup> For example, unsaturated fatty acids, in contrast to saturated fatty acids, have various functions beyond metabolising energy. This is why a surrogate macronutrient used in an intervention (that may consist of carbohydrates, proteins, other fatty acids or of a combination since macronutrients primarily supply energy and are, in this capacity, interchangeable) can lead to weight changes/losses in participants, depending on genetics, epigenetics and lifestyle, and this, in turn, can influence the development of non-communicable diseases. This means that the effect is dependent not only on the selected surrogate macronutrient but also on the interactions with participants' characteristics.

- When assessing nutritional studies, the strongest type of evidence comprises **meta-analyses** and systematic papers<sup>188</sup>; however, the quality of these may vary, for example if studies are consolidated uncritically or overly sensationalist statements are derived (Barnard et al. 2017).<sup>189</sup>

Against the backdrop of these methodological challenges of nutrition science, it is difficult to identify or isolate these typically small effects. It is ultimately not one individual foodstuff that is behind nutritional problems, but usually whole dietary patterns. Added to this are individually different effects due to different genetic and epigenetic make-ups, as has been revealed by recent research on personalised nutrition (Drabsch et al. 2018).

The complexity of human nutrition is a major methodological challenge for nutritional science. However, scientific progress in this field is also fast-paced: there are, for example, growing numbers of meta-analyses for obtaining consensual estimates. Recently, there has been a greater focus on conducting cohort studies with large participant samples for the identification of small effects (cf. Section 4.2). In order to estimate the quality and effectiveness of measures and recommendations, it is therefore crucial to take into consideration the quality of the empirical evidence of the underlying scientific findings and the complexity of nutrition.

Conveying the current state of sound research on what makes a health-promoting diet is essential for informing policy makers, companies and the public. This is where the results obtained using the above-mentioned methods meet a media landscape that, due to the public's great interest, frequently covers the topic of "healthy foodstuffs". Media, however, have their own publication mechanisms which they use as a basis for addressing scientific findings. In communication science, these are analysed as part of the **news value** concept, which reveals why the news situation on health-promoting diets is fairly confusing nowadays:

- **Timeliness:** Media report on new developments. The ten rules of the German Nutrition Society (DGE) are frequently reported on when they are updated. After a short time, these recommendations no longer have a timeliness value. Media will then look for news and seize upon current

---

<sup>188</sup> One way of assessing the quality of research work is determining the strength of the evidence. The ranking of evidence according to its strength is the foundation of "evidence-based medicine", in which deriving guidelines for the diagnosis and therapy of illnesses requires logical and consistent study results. The classification is based on fundamental work conducted by Sackett et al. (1996), but is nowadays used globally by all scientific societies, the WHO and national public institutions in the healthcare sector. The DGE's guidelines on fat and carbohydrates are also based on this classification. There are usually four classifications (frequently with further differentiations). The meta-analysis of randomised, controlled studies is deemed to constitute the strongest degree of evidence, while expert opinions or clinical experience is regarded as providing the weakest evidence.

<sup>189</sup> The problems of such approaches are described using the example of saturated fats (Nettleton et al. 2018). For example, a number of meta-analyses have been published on the replacement of SFA with n-6 PUFA; all of these meta-analyses were based, more or less, on the same RCT studies. The partial replacement of SFA with PUFA led to a 27% reduction of cardiovascular events, but it had no influence on mortality (Hooper et al. 2015). The lack of effect on mortality can potentially be attributed to insufficient observation periods in the RCTs. A new analysis of these meta-analyses with differing combinations of groups comes to the conclusion that the partial replacement of SFA with PUFA reduces neither the risk of cardiovascular diseases (both overall and graduated according to severity) nor that of cardiovascular mortality (Hamley 2017).

research findings, even if they originate from single-case studies that may not yet be substantiated or have found very small effects.

- **Controversy:** Media prefer presenting controversial views because these are of particular interest to readers. This is why outsider positions are frequently seized upon, although it is difficult for journalists to correctly assess the competence of “nutrition experts”. Additionally, studies that question previous convictions are published particularly frequently (e.g.: “Eggs are good for us after all”). The audience is presented with a picture that is much more controversial than the actual canon of the scientific community – although the methodological challenges described above do mean that there are some important controversies among nutrition scientists.
- **Quantification:** Media like to report on figures, e.g. risk data. However, the sometimes selective presentation or the format of the information (e.g. relative risk increases (“50% risk increase) without details on the absolute risk (“increase from 2% to 3%); cf. Section 4.2.1) can quickly lead to misinterpretations and distorted risk perceptions (Gigerenzer et al. 2007, Renner & Schupp 2011).

These examples of news value factors (others include emotionalisation, personalisation, visualisation) in combination with the public’s great interest in healthy eating reveal why in the media, research findings often give the impression of nutritional science being a “science of contradiction”. On top of this is the increasing influence of the Internet and social media. Many “social influencers” are considerably more influential through their communication channels than specialist scientists or (semi-) public nutritional guidance.

### 5.3.1.2 Current knowledge on dietary patterns and health-promoting foodstuff groups

In terms of their long-term effects on the emergence of diseases, dietary patterns are assessed either under the positive aspect of disease prevention or under the negative aspect of the risk of developing non-communicable diseases. Phenotypic bioindicators such as obesity or biochemical bioindicators such as blood cholesterol as well as clinical endpoints (disease, death) can be associated with the dietary pattern and/or ingredients of a diet in order to define a foodstuff or dietary pattern as health-promoting (preventive) or unhealthy (risky).

The definition of health-promoting foodstuffs does not signify the absence of unhealthy components or vice versa. Those who eat a health-promoting diet will not per se become or remain healthy as a result. This requires a multitude of other factors (genetics, epigenetics, exercise, social status etc.) which influence our health. A health-promoting diet reduces the risk of developing diseases due to nutrition, i.e. due to the combination of foodstuffs. Those who eat unhealthy diets, in contrast, increase that risk. Just like unhealthy effects, health-promoting effects are associated with ingredients. This leads to a seemingly pragmatic approach: anything in a foodstuff that is not

unhealthy must be health-promoting, ergo reducing unhealthy elements in favour of healthy elements should promote health.

According to popular belief, what constitutes a health-promoting diet (cf. Section 4.2.1) is the already mentioned recommendation to eat a lot of fruit and vegetables as well as wholemeal products and little meat (especially highly processed meat products) combined with the recommendation to avoid sugar, salt and saturated fats. This means that foodstuffs with little sugar, salt and fats must be healthier.

In the following, we will examine the foodstuffs often mentioned in public as healthy as well as those in the foodstuff groups recommended by the DGE (cf. Section 4.2.1) with regard to their relevance for health.

Firstly, we will consider the three foodstuffs mentioned above:

- sugar
- salt (and iodine)
- fats and oils.

Subsequently, we will discuss foodstuff groups and associated diets that are integral to the public discussion and the DGE dietary guidelines. Here, we will examine

- meat and meat products
- the paleo and low-carb diets
- vegetarian and vegan diets
- fish
- cereals, cereal products and potatoes
- gluten-free and gluten-reduced diets
- legumes and nuts.

One aspect that is frequently assumed to be conducive to a balanced and health-promoting diet is preparing food and cooking meals at home (see also the recommendation to **cook at home** made by the Federal Government's Council for Sustainable Development, Table 5-1). This will be the last aspect to be considered.

## Sugar

No more than 10% of daily energy intake should be consumed in the form of sugar. This does not include the sugar contained in milk and dairy products. This recommendation is based on the observation that those who consume less than 10% sugar per day have less dental caries (Ernst et al.

2018, WHO 2017, Moynihan & Kelly 2014, COMA 1991, 1989). The British Scientific Advisory Committee on Nutrition (SACN) even recommends that the intake of free sugar should not exceed 5% of the overall energy intake.

When considering sugar, a distinction must be made between ‘free sugars’, i.e. mono- and disaccharides which are added by the manufacturer or the consumers, including sugar which is naturally contained in honey, syrup, fruit juices and fruit nectars, and naturally occurring sugars found in milk and dairy products (lactose) and in fruit, vegetables or potatoes (glucose and fructose), which are not subsumed under the term ‘free sugars’.

Assuming a total energy intake of 2,000 kcal per day, the recommendation to consume less than 10% of that daily energy intake in the form of free sugar corresponds to a maximum intake of 50 g of free sugar (Ernst et al. 2018). Compared to this recommendation, the sugar intake in Germany is currently much higher than the recommended relative energy proportion of 10%, especially among the younger age groups (Tab. 5-5).

**Table 5-5:** Estimated intake of free sugars as a percentage of the total energy intake among men and women according to the second national food consumption survey (NVS II)

	15 - 80 years	15 - 18 years	19 - 24 years
Women	13.9	17.8	18.5
Men	13.0	17.4	16.2

Source: Ernst et al. (2018: 9).

The consumption of fruit juices and nectars also contributes to the intake of free sugars. At 32 l per person per year, Germany is among the top consumers of these beverages in Europe (Ernst et al. 2018, wafg 2019, AIJN 2018). A consensus document recently published by the German Association for the Study of Obesity (DAG), the German Diabetes Society (DDG) and the German Nutrition Society (DGE) accordingly indicates that large amounts of sugar are ingested in Germany through the consumption of drinks alone (Ernst et al. 2018; cf. Section 4.2.2.1 and 8.6.2).

In this consensus document, these scientific societies state that the frequent intake of large amounts of sugar is associated, inter alia, with excess body weight and obesity, increased risks of numerous diseases associated with obesity such as type 2 diabetes mellitus and cardiovascular diseases as well as the development of dental caries (Ernst et al. 2018). The increased consumption of free sugars (particularly from sugar-sweetened drinks) contributes to the development of obesity, especially among children and adolescents. The effect of sugar-sweetened drinks on the development of obesity, especially in children and adolescents, is well documented. It is an indirect effect because it is the obesity caused by the positive energy balance that increases the risk of diabetes. Overall, the British Scientific Advisory Committee on Nutrition (SACN) in its extensive

scientific assessment comes to the conclusion that studies investigating cardiovascular risk factors and inflammatory conditions as well as markers and risk factors for type 2 diabetes have shown no effects of an increased sugar intake. Furthermore, there is no sufficient evidence to demonstrate a connection between individual sugars and sugar-sweetened foods and drinks on the one hand, and cardiometabolic reactions on the other hand (SACN 2015). This, however, only applies if the daily energy balance is not permanently exceeded through sugar intake. It is beyond doubt that reducing sugar intake contributes to reducing the overall energy intake.

### **Salt (and iodine)**

Reducing salt intake is generally viewed as positive since it means that the hypertensive effects of salt can be lessened. As a general preventive measure against hypertension and cardiovascular diseases, the WHO as well as a number of other national and international organisations recommend reducing salt consumption and to ingest no more than 5 g of salt per day. The DGE recommends not exceeding 6 g of salt per day. In Germany, the daily median salt intake is currently at 10 g among men and 8.4 g among women (Strohm et al. 2016: M147).

A summary assessment of several large-scale studies (63,559 hypertensive patients and 69,559 adults with normal blood pressure), however, only confirmed the long-standing finding that only those with hypertension can benefit from reducing their salt intake in terms of reducing blood pressure and the risk of cardiovascular diseases and mortality (Mozaffarian et al. 2014, Stamler et al. 2018; cf. Section 4.2). Since, however, it is not known how many persons in Germany are salt-sensitive (an estimated 15%), i.e. whose reaction to increased salt intake (> 5 g) is increased blood pressure, the recommendation to reduce salt consumption should be maintained as a general preventive measure.

Thanks to iodisation, however, salt is the most important source of iodine, particularly in countries such as Germany. According to the national food consumption survey II and the results of the DEGS study, the daily iodine intake in Germany is significantly below the recommendation (cf. Section 4.2.2.1). A lack of iodine, particularly during pregnancy or early childhood, is viewed as one of the major causes of disruptions in cognitive development (cf. Section 4.2.2.2 and Velasco et al. 2018). A review by Trumppff et al. (2013) suggests that the iodine intake among pregnant women is in some cases critical in various European countries, which can lead to subclinical or mild cognitive and late psychomotor development among infants and children. To what extent this also has an influence on cognitive function at older ages is subject to debate. However, according to recent studies, the proportion of iodised salt used in foodstuffs production is decreasing – in breach of legal provisions (Herrmann et al. 2018). The reasons for this development are unknown. It must be noted, however, that large companies more frequently use iodised salt, and usually do so across their entire range, while small and medium-sized enterprises use iodised salt less frequently. The aforementioned study found that iodised salt was not used in any of the investigated organic products in the bread and other baked goods category (Herrmann 2018: 105). Data from the Netherlands based on the Dutch National Food Consumption Survey 2007–2010 show that iodised salt makes up 43% of the population's average iodine intake, with baked goods making up a particularly

large proportion (van Rossum et al. 2011). To what extent the recommendation to reduce salt intake has an influence on a population's iodine intake has not been sufficiently investigated. Only data from the Netherlands show that a salt reduction by 50% would lead to an insufficient intake of iodine among 10% of the population, but among up to 35% of infants (Verkaik-Kloosterman et al. 2017). The recommendation to reduce salt intake should be communicated in combination with information on the problems of a lack of iodine.

### **Fats and oils**

Fats with a high proportion of saturated fatty acids (SFAs) are viewed as particularly unhealthy, and their intake should be limited to roughly a third of total fat intake in order to reduce the risk of coronary heart disease (CHD).

Considering the effects of SFAs in an isolated way does not reveal any increase in the risk of CHD with increasing SFA consumption. A meta-analysis of 16 prospective cohort studies on SFAs and the risk of CHD found no significant evidence that the content of SFAs in foodstuffs is linked with the risk of CHD (Siri-Tarino et al. 2010). Simply reducing SFA intake can therefore hardly be viewed as a measure for preventing CHD.

The recommendation to reduce the intake of SFAs thus falls short because only the combination of reducing SFA intake and increasing the intake of unsaturated fatty acids (UFAs) has the effect of reducing the risk of cardiovascular diseases and heart attacks (Nettleton et al. 2018). This was confirmed by way of example by a comprehensive meta-analysis which came to the conclusion that a diet that is rich in unsaturated fatty acids reduces the risk of cardiovascular diseases. However, this does not apply to a general low fat diet, for which no influence was detected on the morbidity or mortality (Billingsley et al. 2018). When 5% of SFAs were replaced by polyunsaturated fatty acids (PUFAs), the risk of CHD was reduced by 17–25% (Li et al. 2015, Mozaffarian et al. 2010).

### **Meat and meat products**

As illustrated in Section 4.2.2.1, Germany's average annual meat consumption of approximately 60 kg per person is significantly higher than recommended by nutritionists.

A pan-European study surveying the frequency of colorectal cancer and its causes (EPIC cohort) in more than 500,000 participants describes a connection between the consumption of red and processed meat and colorectal cancer (Norat et al. 2005). A daily consumption of more than 160 g of red meat, including red meat products, resulted in a significant increase in the risk of colorectal cancer. This risk increase is limited to groups in the highest quintile who mainly eat large amounts of processed meat products. The study cited above also showed a reverse connection between fish consumption (80 g/day vs 10 g/day) and colorectal cancer. The extent to which a diet comprising both fish and red meat changes the risk was not examined. These studies always concern associations, never causality, so that any risk assessment can only be made with reservations.

A meta-analysis (2011) of ten cohort studies revealed a 14% increase in the relative risk of colorectal cancer between the lowest and highest consumption (> 140 g/day) (Chan et al. 2011). However, the relative risk no longer changes at more than 140 g/day. This data basis recently led the International Agency for Research on Cancer (IARC) to classify red meat as probably carcinogenic (Bouvard et al. 2015).

A new assessment of the EPIC cohort (Rohrmann et al. 2013), however, comes to a more differentiated result when it comes to cancer risk and meat consumption. A daily consumption of more than 160 g of red meat and processed meat products reveals a mortality increase due to colorectal cancer as well as cardiovascular diseases compared to a consumption of 10–20 g per day. This higher mortality, however, only applies to processed meat products when the daily intake exceeds 50 g, and does not apply to meat. The lowest risk was presented by a daily consumption of meat products of 20 g. Two aspects become apparent: a reduced daily meat consumption, viewed in isolation, is not advantageous. Instead, it is the combination of consuming large amounts of processed meat products (> 20 g/day) with a poor lifestyle (smoking, alcohol, insufficient exercise, obesity) that induces the higher risk of colorectal cancer in the newly evaluated EPIC cohort.

Several meta-analyses have come to the conclusion that it is currently not possible to make a clear statement on whether reducing the consumption of red meat products alone can contribute to reducing the risk of cancer and cardiovascular disease (Alexander et al. 2015, Egeberg et al. 2013, Lippi et al. 2015, Carroll & Doherty 2019). For a multitude of reasons (genetics, microbiota, food processing techniques), the results of systematic reviews of the Japanese population (Pham et al. 2014) do not pertain to Europe. Processed meat products are the most likely candidate for increasing an individual's risk of colorectal cancer and possibly other forms of cancer of the gastrointestinal tract (Bouvard et al. 2015, IARC 2015). For this reason, it seems reasonable to point out the value of reducing the consumption of such meat products. Advising consumers that reducing the consumption of red meat and meat products can be effected through alternating between red meat and poultry or fish is perfectly compatible with a health-promoting diet (English et al. 2004). As the EPIC study has shown repeatedly, increasing the consumption of fish can reduce the risk of cancer in spite of high meat consumption. The significance of lifestyle in combination with the risk of cancer and meat consumption discussed above can best be shown by the example of vegetarians. Vegetarians, in comparison with omnivores, have a lower BMI, smoke less frequently and drink less alcohol (Key et al. 2009). There are also reliable indications that vegetarians do more physical exercise. It is these lifestyle factors more than the diet that explain why vegetarians suffer less frequently from non-communicable diseases.

### **Iron and iodine from meat and meat products**

As illustrated in Section 4.2.2, the supply of iron and iodine in Germany is critical. This applies particularly to women, pregnant women and infants.

According to the national nutrient database, meat and meat products have an iron content of 1–3 mg/100 g. Liver is an exception with considerably higher values (veal: 8 mg/100 g, beef: up to

10 mg/100 g, pork: up to 16 mg/100 g). Its bioavailability from meat and meat products is considerably higher than from plant sources. This applies particularly to cereal products, which, according to the second national food consumption survey (NVS II), represent the main source. The average iron content in bread (whole grain) is 2 mg, in vegetables 2 mg (leafy greens, cabbage) and up to 8 mg/100 g in legumes.

In foods of animal origin, up to 60% of the iron content is present in the divalent form (haem iron) and can easily be absorbed. Its bioavailability is 15–20%. In contrast, iron is usually present in plants in its trivalent form (non-haem iron). This form is insoluble in the alkaline environment of the small intestine and is therefore not absorbed. Its bioavailability is usually below 5%. In cereals in particular, the naturally occurring phytic acid strongly inhibits the bioavailability of iron.

As illustrated in Section 4.2.2, the iron intake calculated on the basis of foodstuffs is particularly critical in younger women. An insufficient amount of iron supplied by the mother can also lead to premature births and low birth weights. In both cases, iron storage is low and thus endangers the development of the child (Chaparro 2008). As part of a study conducted in Germany, 21% of the breastfed children investigated had an iron deficiency, and 6% suffered from iron-deficiency anaemia (Dube et al. 2010). Other authors have estimated the iron intake to be insufficient in 15% (m: 12–23 months), 18.5% (f: 12–23 months) and 12% (m/f: 24–25 months) among German children (Hilger et al. 2015).

### **The paleo and low-carb diets**

The currently trending “paleo diet” involves reducing the consumption of carbohydrates in favour of more meat (protein, fat). This paleo diet is also referred to as the “stone-age diet” and has a large following in the US in particular. The idea behind this dietary habit is that during evolution, the human digestive system has adapted to what humans have eaten for thousands of years. Since humanity spent the majority of its history as hunters and gatherers, the hypothesis is that the human digestive system is adapted to this type of food. The paleo diet therefore favours large amounts of vegetables and fruit as well as nuts and seeds. Processed foods are avoided. Meat and fish can be eaten, while plant-based fat and oils are controversial, with animal fats such as butter or lard being recommended. Cereals and legumes as well as sugar, milk products and sweeteners are avoided. The paleo diet is especially advertised to people who want to or need to lose weight as well as those suffering from certain diseases such as multiple sclerosis. Scientific studies on this diet are rare, and frequently such studies are conducted with comparatively small numbers of people. The health benefits of this diet are not clear. However, acceptance among those wanting to lose weight is reported to be high (Challa & Uppaluri 2019, Masharani et al. 2015, Obert et al. 2017).

Strictly speaking, the paleo diet is a slightly more specific form of the “low-carb” diet. The latter owes its success to the claim that it not only helps to lose weight, but that it also has a positive effect on insulin resistance and diabetes. Reducing the consumption of carbohydrates (by 10–40%) ensures that energy must be obtained from fat or protein in order to guarantee an even balance.

This is certainly an effective approach to short-term weight loss, but rather problematic in the long term.

### The vegetarian and vegan diets

Since meat and animal products contain ingredients that are important for human nutrition, the avoidance of such products can negatively affect human health. Vegetarianism is one of the most common diets in the world. By their own account, an average of 4.3% of Germany's population are vegetarian (cf. Section 4.2). Different vegetarian diets can be distinguished, however. These differ in terms of the foodstuffs that are avoided. Table 5-6 gives an overview of what nutrients are only ingested in low amounts in the different forms of vegetarianism.

**Table 5-6:** Vegetarian and vegan diets and critical nutrients

Diet	Foodstuffs avoided	Low intake
Semi-vegetarian	Meat and fish as well as end products based thereon are not avoided completely but their consumption is extremely reduced	-
Lacto-ovo-vegetarian	Meat and fish as well as end products based thereon	Iron, zinc, iodine, n-3 fatty acids
Lacto-vegetarian	Meat, fish and eggs as well as end products based thereon	Iron, zinc, iodine, n-3 fatty acids, vitamin A
Ovo-vegetarian	Meat, fish and milk as well as end products based thereon	Iron, zinc, iodine, calcium, n-3 fatty acids, vitamins A, B <sub>2</sub> and B <sub>12</sub>
Vegan	All animal-based foodstuffs	Iron, zinc, iodine, selenium, calcium, n-3 fatty acids, protein, energy, vitamins A, B <sub>2</sub> and B <sub>12</sub>

Source: Kersting et al. (2016).

Additionally, all forms of vegetarianism harbour the risk of a vitamin D deficiency. This, however, also applies to other diets and is usually not problematic since people under 65 can normally synthesise sufficient vitamin D from sunlight.

Nutrient deficiencies can also be avoided by the careful combination of foods in some of the vegetarian diet forms listed here. For example, the DGE views the ovo-lacto-vegetarian diet as suitable for long-term nutrition (Richter et al. 2016: M223). A similar stance is taken by the Italian Society of Human Nutrition (Agnoli et al. 2017). There are a whole host of studies that show the advantages of a mostly plant-based diet, particularly with regard to the reduction of cardiovascular diseases and colon carcinoma. These studies also stress that, in all cases, the foods consumed must be combined carefully in order to avoid nutrient deficiencies as shown in Table 5-6 (Satija et al. 2017, Williams & Patel 2017, Hemler & Hu 2019).

The vegan diet is viewed as problematic for pregnant and breast-feeding mothers, infants, children and adolescents since it leads to an insufficient supply of vitamin B<sub>12</sub>, calcium, iodine, iron, selenium and zinc. This risk of pre- and postnatal physical and cognitive developmental disorders in children must not be underestimated (Schürmann et al. 2017, Sebastiani et al. 2019, Biesalski 2013, Biesalski et al. 2016).

In general, vegans who do not belong to the vulnerable groups also depend on supplementing vitamin B<sub>12</sub> in order to avoid negative consequences. Furthermore, the mineral content and the value of the proteins<sup>190</sup> should also be considered when selecting foodstuffs.

A longitudinal study conducted in Germany over a period of 21 years that investigated diseases and mortality among 1,225 vegetarians and 679 healthy non-vegetarians came to the result that the mortality and cancer mortality did not differ between the two groups (Chang-Claude et al. 2005). Irrespective of meat avoidance, vegetarians are characterised by a generally health-promoting lifestyle (little alcohol, few smokers, lots of exercise). This – and not primarily the lack of meat consumption – explains the lower frequency of cardiovascular diseases among vegetarians. Although an analysis of the cancer incidence among vegetarians and non-vegetarians conducted as part of the British EPIC cohort revealed a lower overall cancer incidence among vegetarians, it also, surprisingly, detected a slightly higher incidence of colorectal cancer compared to meat eaters (relative risk: 1.49%) (Key et al. 2009).

In order to better understand the effects of vegetarian and vegan diets, a study is currently being conducted among children and adolescents aged 6–18 years. The results will be published as part of the 14th DGE Nutrition Report in 2020 ([www.dge.de](http://www.dge.de)).

## Fish

Sea fish provides a lot of iodine. Although milk and dairy products have become our main sources of iodine, sea fish continues to be highly relevant for a sufficient iodine intake. In addition to this, fish in general (i.e. freshwater and sea fish) provides high-value protein, vitamins A and D, and selenium. The n-3 fatty acid content is additionally notable in high-fat sea fish such as salmon, mackerel and herring, but also in freshwater fish such as carp and trout. Meta-analyses on the link between fish consumption and coronary heart disease show clear positive effects in terms of cardiovascular diseases. However, the differences between low-fat and high-fat fish was not clearly apparent (Boeing & Schwingshackl 2016: 290).

---

<sup>190</sup> The value of proteins depends on the respective amino acid pattern. There are essential and non-essential amino acids. Essential amino acids are amino acids that must be introduced to the body through food whereas non-essential amino acids can be synthesised by the body. The biological value of a protein signifies the proportion of endogenous protein that can be formed from 100 g of protein from food. The reference value of 100 is achieved by the protein contained in whole egg. Protein from foods of animal origin usually has a higher biological value than plant protein. Potato and soya protein are an exception.

### **Cereals, cereal products and potatoes**

The only one of these food groups for which a noteworthy number of studies has been conducted is wholemeal products. The majority of these showed that an increased consumption of wholemeal products correlates to a reduced risk of type II diabetes mellitus and cardiovascular disease (Aune et al. 2016, Zhang et al. 2018).

### **Gluten-free and gluten-reduced diets**

Food intolerances have also led to specific dietary trends. As an example, products that are “free from gluten” represent a growing segment on the food market. These are often also consumed by people who do not have a specific disease.

According to the KIGGS study, 0.3% of German adults and 0.9% of German children de facto suffer from gluten intolerance (coeliac disease) (Kratzer et al. 2013, Hesecker 2016).

Anyone following a gluten-free diet without the relevant medical indication increases their likelihood of nutritional deficiency. The choice of foods is generally limited and the products are expensive, often have fewer micronutrients than comparable products and, in some cases, their taste differs greatly from those that do contain gluten. Furthermore, there is frequently a lack of wholemeal products in a gluten-free diet, so that insufficient dietary fibre is consumed. In addition, gluten-free products contain insufficient quantities of vitamins B<sub>1</sub>, B<sub>2</sub> and B<sub>6</sub> as well as the minerals iron, magnesium and zinc. In some cases, the lack of carbohydrates is compensated by consuming too much fat (Martin et al. 2013).

Moreover, some of these foods contain harmful substances: in 2017, the Ökotest magazine tested various products and detected surprisingly high levels of arsenic in those containing rice (Ökotest 2017). A recently published review summarised the data of the heavy-metal contamination of a gluten-free diet (Wünsche et al. 2018). In addition to arsenic, the lead, cadmium and mercury levels were significantly increased in blood and urine. Back in 2015, the Federal Institute for Risk Assessment (BfR) warned of increased arsenic levels in rice and recommended avoiding products such as rice crackers and rice biscuits in children’s diets.<sup>191</sup>

### **Pulses**

With protein levels of 20% and more, pulses are important plant-based protein sources that also contain a wide range of minerals such as potassium, calcium, magnesium and iron. Soya beans additionally have a fat content of approximately 20%, with tofu coming in at 4–5%. It is suspected that they reduce the risk of coronary heart diseases, but not when it comes to diabetes mellitus or strokes (Boeing & Schwingshackl 2016: 293).

---

<sup>191</sup> BfR (2015b); in 2016, maximum admissible levels of arsenic were introduced in the EU.

## Nuts

A number of meta-analyses that have become available reveal convincing evidence that nuts and almonds reduce the risk of coronary heart disease. Despite a comparatively high fat content, the polyphenols and dietary fibre they contain and the favourable fatty acid pattern seem to have a positive effect (Boeing & Schwingshackl 2016: 300).

## Cooking at home

There are currently few scientific studies investigating how frequently Germans cook at home or their general cooking behaviour (Borrmann 2016). In a representative study from 2013, 69% of the 1,000 participants stated that they ate home-cooked food several times a week, and as many as 40% of the participants said they do so every day or exclusively (BMEL 2014). According to a representative study on the health of adults in Germany (DEGS1, 2008–2011; Borrmann & Mensink 2016, Borrmann 2016), 51% of German adults prepare their meals from fresh ingredients every day or almost every day. In total, 61% of women and only 40% of men prepare their meals themselves (almost) every day.

Overall, how much time people have at their disposal is an elementary factor for the frequency of cooking at home in German households: longer working hours are associated with a lower frequency of cooking at home (Borrmann & Mensink 2016). While among those with low or no working hours, 70% of women and 44% of men cook at home almost every day, among those who work full time, only 37% of women and 33% of men prepare their meals at home almost every day. When it comes to senior citizens, as many as 82% of women and 62% of men cook at home every day. Study participants with a migration background more frequently stated that they cook at home every day. In contrast, no association was found between cooking frequency and social status. Although the data do show a tendency across all age groups and among both men and women that those with a lower level of education more frequently cook every day or almost every day and those with intermediate or higher levels of education tend to do so less frequently, these differences are not statistically significant. A systematic review that summarised 38 observational studies on cooking behaviours in different countries identified gender, income status, cultural background and available time as key determinants of the frequency of cooking at home (Mills et al. 2017).

Reicks et al. (2018, 2014) summarised intervention studies designed to promote cooking at home conducted between 1980 and 2016 and showed that these studies generally had a positive effect on knowledge and skills as assessed by the participants themselves. Learning how to cook thus promotes knowledge concerning nutrition and food as well as the respective individual ability to act. For example, the evaluation of a four-week (free) nutrition and cooking programme entitled Food Sensations® for Adults conducted in Australia revealed that the 900 participants reported a significant improvement in planning meals and selecting and preparing food (Begley et al. 2019). However, to what extent interventions and programmes promoting cooking at home also intensify food competences or “food literacy” (cf. Section 8.10) in the long term has not yet been clarified due to the scant data base (Reicks et al. 2018).

It is often assumed that preparing and cooking food goes hand in hand with a well-balanced diet and the corresponding positive health effects. The findings in this regard are, however, based on a poor data situation: the number of available scientific studies is surprisingly small, and those that are available are often cross-sectional studies that frequently feature selective and small-sized samples and very varied measuring of nutrition and health parameters. In addition, the available reviews (e.g. Caraher & Lang 1999, Mills et al. 2017, Reicks et al. 2014, 2018) refer to small and inconsistent effects. Although individual investigations show a significant positive association between the frequency of cooking at home and dietary quality, the effects are usually small and permit no clear conclusions. The data of the UK National Diet and Nutrition Survey 2008–16, for example, show a significant – if weak – positive association between the proportion of energy intake from home-prepared food and dietary quality measured according to the DASH Index (cf. Section 4.2.1) (Astbury et al. 2019). In contrast, no positive association was detected between cooking behaviour and health-related parameters such as body weight. As an example, Méjean et al. (2018), who conducted one of the few prospective investigations with 12,851 participants from France and an observation period of five years, did not detect any systematic association between the frequency of and time spent on preparing food, on the one hand, and changes in body weight on the other hand. The German DEGS-1 data even revealed a positive association between cooking frequency and BMI: the higher the cooking frequency, the higher the BMI.<sup>192</sup> Cooking at home thus does not in general mean a healthier diet (Mills et al. 2017); what is important is the kind of food prepared and what the control group eats.

In contrast, various studies show that **commensality**, i.e. the practice of preparing and eating meals together, promotes psychological well-being, performance and especially social ties (cf. Section 3.3.4; Farmer et al. 2018, Mills et al. 2017, Reicks et al. 2018, Utter et al. 2016) and permits the development of important social learning spaces.

## Conclusion

As previously illustrated, food can be evaluated on different levels according to its contribution to a health-promoting diet:

- Dietary pattern
- Foodstuff group / product group
- Articles/foodstuffs
- Brand

The most important recommendations concern **dietary patterns**, and the assessments made by the various national scientific societies do not differ much. A healthy dietary pattern features considerably more foods of plant origin, e.g. vegetables, fruits, wholemeal products, pulses and nuts, as well as more fish and less red and processed meat, fewer sugar-sweetened foods and drinks,

---

<sup>192</sup> This observed positive association likely stems from a confounding effect between BMI and age since both BMI and cooking frequency increase with increasing age.

and fewer refined and heavily processed cereals than what is consumed by the average German today (cf. Chapter 4.2 and Mozaffarian 2016).

Persons following diets that aspire to be based mostly or completely on plant-based foods (vegan or almost completely vegan diets) should pay careful attention to how foods are combined in order to avoid nutritional deficiencies. This applies particularly to vulnerable groups such as young children, pregnant and breastfeeding women and elderly people. A general recommendation to limit or completely avoid the consumption of meat products should point out alternative sources of iodine and iron. Those following a vegan diet require vitamin B<sub>12</sub> supplements in any case.

Dietary patterns or diets that expressly avoid certain foodstuffs (e.g. gluten-free diets) are suitable for those who have health issues concerning these food components or foods. In cases where such intolerances are legitimately medically indicated, any potential risks are known and can be taken into account. In all other cases, this is a voluntary decision where known risks may be accepted or lesser known risks be involved and where the scientific data situation in terms of efficacy is sparse to non-existent. The situation is different for dietary patterns developed and tested on the basis of scientific findings. Examples of these include the DGE recommendations as well as the HEI and DASH diets (cf. Section 4.2).

Contrary to popular belief, the evidence that **certain food or product groups** have a positive or negative effect on non-communicable diseases must not be viewed as anything more than probable or possible – with the exception of the very well documented positive effects of wholemeal products on diabetes. This does not mean that recommendations to increase or reduce the consumption of such food groups should not be made. What it does mean is that such recommendations, in combination with a health-promoting lifestyle, represent an opportunity to improve one's health by combining certain foodstuffs, i.e. through a health-promoting dietary pattern.

**Table 5-7:** Correlation between the consumption of various food groups and important non-communicable diseases (direction of arrows), including the degree of evidence<sup>193</sup> (number of arrows)

Foodstuff/article groups	Cancers	Type II diabetes mellitus	Coronary heart disease	Stroke
Wholegrain cereals	↓↓	↓↓↓	↓↓	↓↓
Fruit and vegetables	↓↓	↓	↓↓	↓↓
Fermented dairy products	○	↓↓	○	↓
Red meat	↑↑	↑	○	↑↑
Meat products	↑↑	↑↑	↑↑	↑↑
Fish	○	○	↓↓	↓↓
Eggs	○	↑↑	○	–

Note: ○ no correlation to changed consumption, convincing evidence of a ↓↓↓ positive or ↑↑↑ inverse correlation, probable evidence of a ↓↓ positive or ↑↑ inverse correlation, possible evidence of a ↓ positive or ↑ inverse correlation, - evidence cannot be evaluated.

Source: Boeing & Schwingshackl (2016: 297).

Pulses and nuts are additional food groups likely to have positive health effects.

The key recommendations for a health-promoting diet are to reduce free sugar intake and to reduce salt consumption while taking into account iodine intake. The evaluation results of a multitude of other products would likely be of interest to both consumers and businesses. There are many discussions in the media concerning topics such as coffee and tea consumption, superfoods etc. In light of the –partly methodologically induced – uncertainties, it is the WBAE’s view that it is much more important to ensure a balanced and varied combination of foods, and therefore follow recommendations such as “Eat the rainbow!” or “Eat products with low energy densities”.

## 5.3.2 Comparative assessment of social effects

### 5.3.2.1 Methods for social assessments

The social dimension is a particular weakness regarding the sustainability assessment of foodstuffs since there is a general lack of reputable methodology and reliable data, even after more than 20 years of discussion (Smith & Barling 2014). The text and Table 4-4 contained in Section 4.3.2 summarise the most important approaches to assessing the social dimensions of the food sector. The concept of decent work as defined by the International Labour Organization (ILO), and the

<sup>193</sup> The degree of evidence describes the formal and content-related quality of scientific studies. It does not indicate the strength of the effect.

criteria for securing the minimum standards included in it, have become widely accepted. They include the following:

- Adequate earnings
- Stability and security of work
- Employment of young people
- No forced labour
- No child labour
- Freedom of association and freedom of negotiation
- Decent working hours
- Compatibility of work, family and personal life / maternity protection
- Old-age security
- No discrimination / equal opportunities
- Gender equality
- Safe work environment

Consumers, and also businesses active in stages of the value-added chain closer to consumption, are not usually able to discern whether these criteria are taken into consideration in the production of foodstuffs. Furthermore, there is no measurement concept that records the extent to which these protective criteria and other fairness criteria (cf. Section 4.3.1) are implemented, i.e. that permits any kind of quantitative assessment of social performance.

The few conceptual considerations concerning this issue aim to translate life cycle assessments (see Section 5.3.3.1 for more detail) to social aspects (Jørgensen et al. 2008). Although guidelines published by UNEP (2009) promoted the establishment of a social life cycle assessment, this development is still in its infancy (Finkbeiner et al. 2010, Henke & Theuvsen 2014). In a review, Kühnen and Hahn (2017) characterise the current state of research as inconsistent in terms of the indicators used, detect methodological gaps and criticise a lack of empirical data in almost all sectors. Despite the fact that some initial databases have been established (Benoît-Norris 2013), it is not currently possible to predict when a consumer-focused, summary assessment of the social dimension will be available.

This means that the discussion is dominated by individual topics, such as remuneration, child labour or slavery. There is no comprehensive assessment, for example in the form of a label for foodstuffs and products that gives an overall rating of the social conditions of production. Furthermore, there is often no distinction made between protective aspects (social minimum standards) and justice aspects (fairness, reducing social injustice)

### 5.3.2.2 Current knowledge on social problems associated with food and dietary patterns

Section 5.3.1.2 showed what foods and foodstuff groups are health-promoting or harmful to our health. Due to the conceptual deficits of assessing the social dimension, comparably clear distinctions concerning social effects cannot be made.

When it comes to **adhering to basic social minimum standards** (protective aspects, cf. Section 4.3.1), typical import products from emerging economies and developing countries are more “risky”. This applies particularly to regions that are in fragile situations due to conflicts or in which government structures are weak (“failed states”) or grave social injustices are abundant.

There have been attempts to rank countries in terms of their social performance (Gustafson et al. 2016). This, however, is not a useful criterion for consumers’ purchasing decisions. As shown in Section 4.3.4.1, the growing of export crops contributes considerably to reducing poverty in developing countries so that those working in food cultivation and production in the poorest countries would not be helped if consumers were to generally avoid products from these countries (cf. Text Box 11 “Country boycotts and sustainable consumption”).

There are also indications that protective minimum labour standards are violated in the production and processing of foodstuffs in Germany and Europe, for example in the field of seasonal workers and especially in the employment of migrants (cf. Section 4.3.3.2). However, knowledge of what countries in the EU have the largest social deficits in food supply chains is limited. This is why, for example, it would not be expedient to avoid fruits and vegetables from Italy or Spain in general due to the fact that, in some regions in these countries, migrants work as day labourers under problematic conditions.

**Text box 11:** Country boycotts and sustainable consumption

One feasible selection principle for sustainable consumption could be to avoid buying foodstuffs from certain countries. For example, during Apartheid, consumers from many countries boycotted products from South Africa. In the same way, with a view to the social dimension, consumers today might consider whether to buy or avoid products from countries with a high level of child labour or slavery, with a high corruption index, or where land grabbing is a common phenomenon. With regard to the environmental dimension, consumers might consider avoiding products from countries where the tropical rainforest is not sufficiently protected (e.g. Brazil is currently being discussed frequently).

From the WBAE's point of view, such country boycotts should be limited to exceptional cases such as Apartheid. During Apartheid, discrimination was structurally anchored within the system throughout the country, whereas in many other cases, problems such as child labour, slavery or the clearing of old growth forests is not symptomatic of the entire country. In cases where heterogeneous conditions exist, a country boycott, i.e. a boycott of all products from a certain country, is not a targeted approach. Furthermore, such boycotts are usually likely to most strongly affect the poorest farmers in a country, potentially leading to undesirable social consequences. Finally, there are few comprehensive studies concerning many problems such as child labour and rainforest destruction that permit the extent of the problems in different countries to be estimated. Consumers' perception of problems, on the other hand, is often characterised strongly by current debates in the media and does not always correspond to the actual extent of the problem.

Against this backdrop, it is the WBAE's view that a product's origin in a certain country is not suitable as a sustainability indicator for consumers except in special cases. A general avoidance of import products from developing countries would be even less target-oriented due to the considerable positive effects of agricultural trade in these countries.

Assuming that the country of origin in general is not a meaningful indicator of the social compatibility of production, could the product level be used as a starting point? What products are most frequently implicated in child labour, forced labour or non-compliance with basic protective labour standards? As shown in Section 4.3.3, there is frequently evidence of social problems among seasonal workers in the labour-intensive harvesting of fruit and vegetables (Caruso 2017) and in fishing activities (Stringer et al. 2016, Nakamura et al. 2018a). The working conditions in some other areas of the food system are also sometimes problematic, for example in some slaughtering establishments and the hospitality industry in Germany (cf. Section 4.3.3). What product groups are concerned and what producers have particular deficits, however, is currently not identifiable for consumers. Since the same foodstuff can be produced under very different social conditions, no blanket recommendations for or against the consumption of certain foods or food groups, or for or against certain dietary patterns can be identified from the problematic issues discussed in Section 4.3.

The fact that compliance with minimum social standards such as the ILO criteria is not guaranteed globally is a dissatisfying situation. Repeated reports of such malpractices contribute to acceptance problems of global trade. In the WBAE's view, consumers should not, however, bear the responsibility of ensuring compliance with minimum social standards. Instead, it is the responsibility of governments, supranational organisations and companies in the value adding chain to increase the transparency of these problems (cf. Section 8.9.2).

Although there are indications that consumers would be willing to pay extra for foodstuffs produced without exploitation of the workers (Drichoutis et al. 2017, CEval GmbH 2018), compliance with minimum social standards should not be an advertising point; instead, from a consumer point of view, it should be a matter of course. In Germany, advertising may not feature self-evident, implicit facts since such practices are problematic with regard to competition regulations (in accordance with Section 3(3) of the Act against Unfair Competition in conjunction with no. 10 of the Annex). Since the reality is that these standards are violated considerably in international trade, some labels do use the avoidance of child and slave labour as an advertising point (including the German government's "Green Button" for textiles, cf. Section 8.9.2).

In order to boost the transparency of social conditions, NGOs have recently begun comparing trading companies in terms of their commitment to social conditions in their supply chains (cf. Section 4.3). For example, Oxfam published its second comparative test relating to leading European trading companies in 2019 (Oxfam Deutschland 2019, cf. Fig. 4.3-14 in Section 4). The four leading German trading companies were given very low grades for these criteria in the first two assessment rounds (with slight improvements in 2019). The two highest-ranked companies in Oxfam's assessment were British traders Tesco and Sainsbury's. No robust statement can be made on the validity or reliability of these assessments (cf. Section 4.3). It is difficult for external parties with no access to company documentation to reliably assess the social practices of a trading company sometimes dealing with more than 100,000 products.

The US federal state of California goes a bit further: in 2010 the California Legislature passed the "Transparency in Supply Chains Act" (Senate Bill 657). The act requires large retail and manufacturing firms with a turnover of more than \$ 100 million to disclose the way in which they implement certain management measures to combat human trafficking and slavery as well as for the protection of basic human rights standards in their supply chains, – for example through supplier verifications and audits or certification systems – and whether they include pertinent provisions in purchasing contracts, develop internal management standards and improve their employees' training (Pickles & Zhu 2013). The UK introduced a similar law in 2015 (UK Modern Slavery Act 2015, Section 54). A study on the effects of the California Act showed that this disclosure obligation initially led to share price drops among publicly traded companies, i.e. that it was viewed as effective by the capital market, but also that disclosure obligations ultimately led to responses that appeared to be more symbolic than substantive in nature and that their effects remained fairly limited if left unsubstantiated (e.g. by additional legal obligations) (Birkey et al. 2018). In the UK, there is a lack of clear requirements and meaningful penalties in cases where the Modern Slavery Act is violated, which limits its effectiveness (Voss et al. 2019). In a manner similar to the supermarket ranking conducted by Oxfam, the legal disclosure obligations in the UK and California are aimed at creating social pressure but are unhelpful for consumers doing their shopping.

There is currently also a debate on compulsory supply chain legislation in Germany. Similarly to comparable initiatives, for example in France and the Netherlands, such supply chain legislation should impose on companies compulsory measures aimed at preventing violations of human rights

by suppliers. In addition, the option of holding companies liable for violations of human rights by their suppliers is also being discussed (Huyse & Verbrugge 2018, <https://lieferkettengesetz.de>). Although such arrangements have potential in value-adding chains with a high degree of traceability, such as fruit and vegetables, they would be more difficult to implement on international commodities markets with low degrees of traceability, such as cereals. Furthermore, whenever individual countries implement such provisions, this poses the additional problem that international companies could avoid compliance by relocating their company seat. However, there are ultimately few other options to ensure minimum social standards in global value-adding chains than international political pressure and pressure by the purchasing companies.

While the protection perspective requires compliance with minimum social standards, the **fairness perspective** postulates social objectives going beyond such minimum protection. In the WBAE's view, ensuring compliance with minimum social standards is the responsibility of governments, not of consumers. In contrast, it is meaningful to denote compliance with higher social standards, going beyond minimum standards, by means of a social label in order to permit companies to secure higher prices for these products.

From the consumers' perspective, the fairtrade label is the only sufficiently known label that permits conclusions to be drawn on socially acceptable production and that is aimed at contributing to fair distribution (see Section 8.9.2 on the label's validity).<sup>194</sup> The GLOBALG.A.P. GRASP certification system, in contrast, comprises some social aspects but – for sensible reasons – is not labelled for consumers; instead, it is meant to be a risk instrument for stakeholders along the value chain (cf. Section 4.3). Additional labelling systems such as UTZ, Rainforest Alliance and – since recently – the MSC label also include some social criteria. The recently merged labels UTZ and Rainforest Alliance achieve high market shares but appear to lead to only small effects (cf. Section 8.9.2). The MSC label for sustainable fishing, which is widespread in Germany, recently added some minimum social criteria (prohibition of child labour and slavery) to its standards (MSC 2019). It is as yet unclear how (successfully) this prohibition will be implemented.<sup>195</sup>

These insights suggest that it may be promising to develop additional food-labelling systems that include social criteria; after all, there are indications that consumers are willing to pay extra for labelled foodstuffs produced by workers who receive fair remuneration and migrants who are not exploited (Drichoutis et al. 2017, CEval GmbH 2018). There are also strong correlations between different sustainability motives: consumers who are interested in a health-promoting diet are usually also concerned about environmental protection and animal welfare as well as decent social conditions and vice versa (Hemmerling et al. 2015, Andorfer & Liebe 2012). Accordingly, advertis-

---

<sup>194</sup> The Fairtrade label comprises both protective criteria and fairness aspects (cf. Section 4.3.2).

<sup>195</sup> Section 8.9.2 presents the various labels for social production standards in detail, including in terms of their effects. For the most important label, the Fairtrade label, positive effects can be detected mainly for the participating small-scale farmers in developing countries. Both the product range and market share are limited, and employees are not involved in the development of such systems. UTZ and Rainforest Alliance, which recently merged, achieve smaller effects but reach more operators. However, they are less well known to consumers (cf. Section 8.9.2).

ing claims on the German market frequently combine criteria of fairness, environmental protection, animal-welfare and others, without the basis of these claims necessarily being transparent or verifiable in all cases.<sup>196</sup>

Overall, the WBAE believes there is considerable need for action in the area of minimum social standards in the agri-food sector. In order to secure minimum social standards, political initiatives are currently directed towards regulatory law intended to obligate companies to influence compliance with such standards through their purchasing decisions. Policy makers themselves also bear responsibility to further develop minimum social standards by means of international agreements.

The situation is different regarding the fairness aspect: In the face of the global heterogeneity of living and working conditions, combined with trade-policy and trade-law regulations, there is a need for conceptual work on developing comprehensive assessment and labelling approaches. If consumers are asked to make a substantial contribution through their purchasing decisions, then such labels are needed to identify fairness in national and international value-adding chains. The existing Fairtrade label is an important approach, but its impact on fairness is limited for several reasons:

- it is only assigned to countries of the global South although there are also deficits elsewhere, for example in the EU,
- it is de facto limited to relatively few product groups,
- it is currently not used by many producers and importers, and
- it supports small-scale farmers above all, while the effects on workers on plantations vary and this group is unlikely to profit (cf. Section 8.9.2).

### 5.3.3 Comparative assessment of environmental compatibility

Similarly to the health assessment of foodstuffs discussed at the beginning of this section, environmental compatibility can also be assessed on different levels:

- Dietary pattern
- Foodstuff group / product group
- Article group
- Article
- Brand

---

<sup>196</sup> See, for example, the Fair-Bio association of organic producers who, however, envisage a certain degree of neutral certification cf. <https://www.fairbio.bio>.

Consumers who wish to eat in an environmentally friendly fashion are often faced with the challenge of identifying comparatively environmentally friendly products in a supermarket with tens of thousands of foodstuffs in order to leave the smallest possible overall ecological footprint. In the face of the multi-faceted nature of the available product range and the complexity of the underlying production processes, it is immediately apparent that this task is difficult and that clear information is needed.

The following sections will first give an overview of the available methods of measuring environmental compatibility before then briefly outlining the current state of knowledge. This will reveal that relatively reliable scientific assessments are available for major environmental issues but also that there are limits on the degree to which individual articles can be assessed.

### 5.3.3.1 Overview of the life cycle assessment method

In comparison with the health assessment in Section 5.3.1, an environmental assessment (such as the assessments of social aspects and of animal welfare) must be conducted differently because the environment is a “**process**”. This means that in order to assess the environmental compatibility of a product, all steps relating to the production process, consumption and disposal/recycling must be considered. The analysis of an end product is not meaningful on its own.

This is why, in the international debate, the life cycle assessment approach (LCA, also known as life cycle analysis) has established itself as a comparative environmental assessment method (Brodt et al. 2013, Foster et al. 2006, Del Borghi et al. 2014, Fritsche & Eberle 2009, Wognum et al. 2011). This approach attempts to systematically record and rate the largest possible number of environmental effects produced by different functionally equivalent products or product groups along the entire production process (the product life cycle).

Information on the sustainability of foodstuffs is needed for manufacturers to improve their products, for consumers to be able to make informed decisions and for governments to design their food policies. Within the scope of environmental management systems, the use of LCAs enables companies to analyse the production process with regard to potential environmental stresses and to identify hotspots. This forms the basis for continuous improvement processes in companies. In this case, the LCA refers to concrete procurement, production and marketing processes, and it can be tailored to the decisions that need to be taken in a company, and it can be simplified if necessary.

The situation is different if the LCA is used as a basis for political decisions or for labelling products for consumers. The ISO 14020 standard lays down well-established rules in this regard. One particular requirement is that the use of eco-labelling (see Section 7.5.2) takes into consideration **all relevant aspects of the life cycle of a product**, from cradle to grave, in order to ensure fair comparison. Product-based eco-labels must be correct, verifiable and relevant, and they must not be misleading.

In the face of the large product variety and increasing division of labour in the food sector, an LCA requires a multitude of data from various production stages and from different regions. These indicators must reflect the key determining factors that contribute to a foodstuff's environmental impact. In this context, the reliability of the data plays a major role. To permit a robust comparison to be made between different products, it is also necessary to make assumptions. Although the past few years have seen great methodological improvements and better data availability, meta-analyses show that there are still gaps and that it has not so far been possible to satisfactorily resolve the integration of social and economic indicators of sustainability, in particular, (see Section 5.3.5 for more on this) or an overall assessment method (evaluation/interpretation).

All foodstuffs follow a path through space and time, from production to consumption or disposal. During each phase of a foodstuff's life cycle, resources are used as inputs (e.g. land, raw materials) and outputs are yielded – some intentionally (e.g. the relevant foodstuff) and others unintentionally (e.g. greenhouse gases). Utilising resources and generating outputs in turn influence socially important environmental dimensions such as biodiversity, resource consumption and climate change. The LCA is the key method to systematically record and assess these environment-related processes in a product-based manner. Ideally, the assessment considers (1) all relevant potential detrimental effects (and positive effects, if applicable) on the environmental media of soil, air and water, as well as all material flows associated with the system being considered, and (2) all phases of the production and processing of consumables and durables, from production to consumption and disposal. Only an overall assessment minimises the risk of disregarding parts of the supply chain or shifting the problem to a different stage of the value-adding chain or to other problem areas. One current example of the problems that partial solutions pose is the attempt to avoid plastic wrapping for fruit and vegetables, which may, however, lead to spoilage since the shelf-life of a plastic-wrapped cucumber, for example, is roughly twice as long as that of an unwrapped cucumber (no author, 2019b). It is thus not clear a priori which of these options is more environmentally favourable. Only an extensive comparison of the two alternatives by means of an LCA would reveal the more environmentally friendly option and help identify improvement potential.

Principles and rules for conducting LCAs are stipulated by the ISO standards 14040:2006 and 14044:2006 which have also been integrated into the German collection of standards (DIN EN ISO 14040, DIN EN ISO 14044). According to these, LCAs comprise four elements: (1) definition of the goal and scope of the LCA, (2) the life cycle inventory analysis (LCI) phase, (3) the life cycle impact assessment (LCIA) phase, and (4) the life cycle interpretation phase. In contrast to an LCA, the carbon footprint (CO<sub>2</sub> equivalent emissions) and the water footprint of a product each only take into account one environmental dimension. This means that they permit conclusions to be drawn only on a product's contribution to the greenhouse effect or on water consumption, respectively. The calculation methods and the life-cycle-spanning perspective, however, are similar to the method of an LCA.

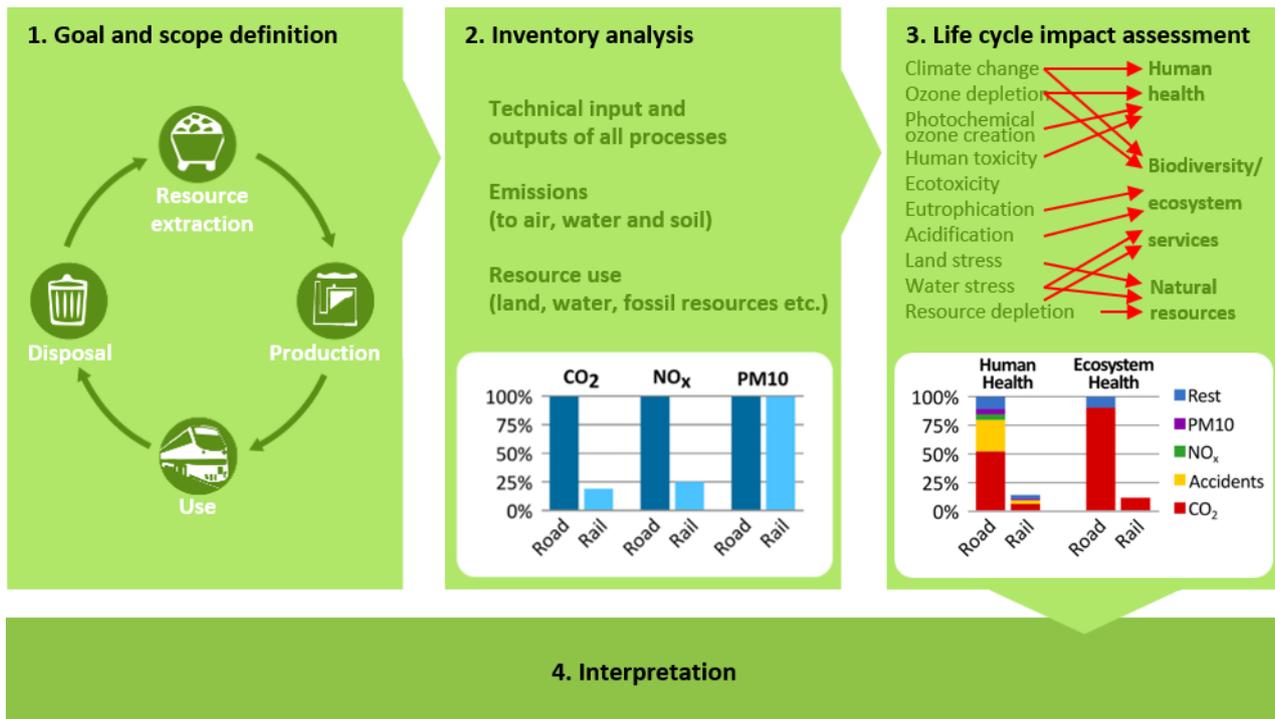
The work steps undertaken in the creation of an LCA are illustrated in Figure 5-2. Phase 1 defines the system limits. The following questions need to be answered for this purpose: What stages of a

product's life cycle are considered (e.g. the production of equipment for the processing of foodstuffs)? What inputs and outputs must be taken into account (e.g. indirect land-use effects)? What geographical sites are taken into consideration? Ideally, all phases involved in the production and consumption of a product should be considered. Furthermore, the product unit to which the effects refer must be determined – e.g. to 1 kg of a product or to 100 kcal. This means defining the functional unit. The aim is to compare functionally equivalent, substitutive variants.

The effects – e.g. the amount of CO<sub>2</sub> equivalents (CO<sub>2</sub> eq) emitted during the delivery of this functional unit – are expressed as a ratio, e.g. 0.5 kg CO<sub>2</sub> eq/kg product. The output can also be converted and expressed as the CO<sub>2</sub> equivalent per average or recommended portion. LCAs for foodstuffs are usually based on weight as the functional unit (e.g. 1 kg pork), and sometimes on nutritional units (e.g. the environmental impact of the production of 100 g protein from a foodstuff). The selection of the functional unit influences the comparison of foodstuffs. For example, eggs usually have a smaller carbon footprint than poultry meat if the functional unit is 1 kg of the product (egg or poultry meat). If it is 1 kg of protein instead, the carbon footprint of the two foodstuffs is more similar since eggs only contain roughly 12% protein compared to poultry meat with 20% protein. The selection of the functional unit should match the purpose of the LCA study. If, for example, the aim is to compare different ways of producing pork based on different feedstuffs, then 1 kg of pork at the farm gate could be a relevant functional unit. For a study that compares various ways of securing the protein in our nutrition (e.g. via meat, fish, dairy products, pulses etc.) the functional unit of 1 kg of protein would be more meaningful. Since foods are rarely bought solely on the basis of one individual nutrient, the functional unit of 1 kg is usually more relevant to consumers and will therefore be used in the following.<sup>197</sup>

---

<sup>197</sup> In research on LCAs, there is a lively discussion about the appropriate functional unit of comparison for food. Besides mass/volume (kg/l), energy units (calories/joule), individual nutrients (such as protein), nutrient combinations and also area units and economic quantities (prices) are proposed. Ultimately, the choice of the unit of comparison is to be determined from the consumption side, i.e. it is about substitutes. In the case of food consumption, however, the question of substitutes is not always easy to determine. For many choices, such as butter versus margarine or comparing different types of burger patties, most consumers will be concerned with the unit of measure, except for some athletes aiming to maximise protein. Even for poorer countries, the goal of maximising calorie intake plays a decreasing role. Although nutrient restrictions must be taken into account in the overall selection of foods, the comparison of individual nutrients is typically not a criterion for consumers when selecting items. In the overall view, therefore, the WBAE considers the reference to quantity (kg) to be more appropriate.

**Figure 5-2:** Work steps necessary to generate an LCA

Source: FCRN (2015: Chapter 2.1.1), graphically adjusted.

Phase 2 comprises an inventory analysis of all inputs and outputs (e.g. resource consumption and emissions) occurring at all stages of producing and/or consuming a functional unit within the system limits. Inputs include energy as well as land or water use; outputs include products and waste that leave the system during each phase. The data used for this purpose may be source data that are specific to one producer or brand. More frequently, generic data from existing databases are used which contain average effects that may differ greatly from the concrete situation. It is clear that the more specific the data the more accurate the results. LCAs that are based on generic data only permit articles to be compared in a general manner, e.g. comparing different packaging options (paper bag versus plastic bag) or products (butter versus margarine). Although such studies are complex, they do appear fundamentally feasible. Comparative LCAs between different product variants, e.g. different brands of butter, are considerably more data-intensive. Instead of using the average environmental impact of milk production for the assessment, such a comparison requires data on the specific farming methods and dairy technologies of the holdings supplying the dairy plant at which the relevant butter is produced. These data are not openly available; instead they require extensive data acquisition in the holdings.

If a company produces a number of different products, then the environmental impact must be attributed to these products in accordance with the cause. Attributing inputs and emissions to different products is crucial and does not necessarily result from the process itself but is often based on assumptions and stipulations. As an example, dairy farms produce meat as well as milk (male calves, dairy cows that are slaughtered). A part of the total emissions must therefore also be

attributed to this meat production. Different studies use different approaches for this. Just like cost accounting, assessing product life cycles requires attributional rules and cut-off criteria (i.e. which side processes are negligible) to be stipulated. The totality of these product or product-group-based rules for an LCA are the “product category rules”. Extensive standardisation work has been conducted on this issue in the past few years (e.g. within the scope of the international EDP System, <https://www.environdec.com>) to allow for improved comparability of data.

Phase 3 of an LCA summarises the overall emissions and the resource consumption of all life cycle phases according to their impact in terms of environmental effects and environmental categories and converted into common effect units.

Examples of impact categories include climate change, eutrophication potential, water use and land use. The results are ideally shown for each individual impact category or illustrated according to the separate phases of the life cycle of the product. For example, the water used for the production of 1 kg of bread can be illustrated for the entire life cycle or for each stage (e.g. agriculture, production etc.). Intermediate indicators show the effects in terms of specific environmental issues. What effects these have on humans and on the ecosystem can also be modelled. Such results are then illustrated using so-called final indicators, which refer to more general issues such as human health, biodiversity and ecosystem services. Final indicators are less numerous than intermediate indicators and can therefore be interpreted more easily. Calculating them, however, is fraught with larger uncertainties because frequently, several intermediate indicators contribute to their impact. For example, ozone depletion and increasing photochemical smog can make negative contributions to human health while excessive land and water use stress ecosystem services. The modelling of final indicators thus permits the actual environmental impact of producing a product or of a service to be communicated in an aggregated form. Due to the complexity of modelling and evaluating final effects, most LCA studies focus on one or a small number of selected intermediate indicators, in many recent cases on the greenhouse effect.

In order to determine the robustness of the results with respect to the assumptions and variables used in the calculations, phase 4 consists of a sensitivity analysis. Following this, conclusions are drawn and recommendations derived. Examples include suggesting alternative forms of packaging or identifying hotspots (stages during the life cycle of a product at which the greatest problems occur). Ideally, in addition to this, it is possible to make comprehensive and comparative evaluations of the environmental impact of the product investigated.

Overall, this description illustrates the immense complexity and the leeway regarding the decisions to be made when generating LCAs. Thanks to standardisations and considerable international research efforts, however, the methodological foundations and data are constantly improving. Particular advances have been made with partial LCAs, which focus on selected problem dimensions such as greenhouse gases, land use or water consumption. This simplifies the overall evaluation. Inconsistencies have been reduced through **standardisations** such as PAS 2050 (developed for the

analysis of CO<sub>2</sub> footprints). **Comparisons between the results – including on an international scale – are thus becoming increasingly reliable.**

**Agriculture**, however, presents a **particular challenge** because defining system limits and acquiring data is difficult due to the diversity of holdings and the heterogeneity of primary production. There is a large variety of production methods, management practices and processing steps as well as a multitude of smaller holdings which can only be represented and modelled with a great deal of effort. Even direct emissions are usually difficult to measure. Consider, for example, measuring the emissions from an industrial stack and measuring the emissions from one hectare of agricultural land. This is why they are usually modelled rather than measured – a step that involves uncertainties. In addition, emissions from agriculture vary depending on geographic location, production method, temperature, soil, precipitation pattern etc. This is why generic data are often used, which then decreases the accuracy of the results. The fact that soil can function both as a source of, and a sink for greenhouse gases adds to the complexity. Furthermore, ascertaining emissions from animals (and their manure) is difficult due to the large number of variables (including different races and genetics, the quantification of methane emissions from enteric fermentation, different feeds and production systems, effects of different ways of treating manure). Overall, on the level of agriculture, it is thus more complex to use generic data in order to generate values that are specific to a holding or brand.

Besides this, LCAs also take into account indirect land-use effects. How can, for example, the emissions from the deforestation of an area be attributed to the product that is cultivated there when it is the totality of agricultural production that contributes to deforestation? Indirect land-use effects are therefore often disregarded for good reasons in the comparative analysis of different foodstuffs, but they should be taken into account when comparing agricultural systems (cf. Section 5.2 above for details).

Some causes of this variability have to do with the monitoring periods selected for a study. Over a year, different results will occur for a foodstuff, depending on the season. This variability can be attributed to different storage periods as well as additional energy input in the production and preparation of foodstuffs (including the associated food losses). One example is apples; their climate footprint increases when they are cooled for a long time.

Overall, the scientific literature on LCAs for foodstuffs and food groups has increased more than tenfold between 2000 and 2015, and the number of publications is still increasing rapidly. There are thus numerous LCAs, at least on the level of typical products (i.e. on the basis of industry averages), as well as a number of meta-analyses. These publications permit some fundamental methodological delimitations to be derived:

- **Inconsistencies and non-transparency in methodological decisions** (e.g. on functional units and system delimitations) make comparisons of different studies more difficult.

- In spite of great efforts, there is still only a **limited amount of data available to evaluate different products and production methods**. So far, it is hardly possible to depict geographic, climatic and location-specific characteristics. Current data that are available in LCA databases for foodstuffs are usually not provided with spatial and temporal resolution (Hauschild et al. 2013).
- There still remain **knowledge gaps in the estimations of individual impact categories**. This has had the effect that they have received insufficient consideration. The current life cycle assessment method is thus incomplete and results in insufficient evaluations of some aspects that are decisive for long-term sustainable food production, such as soil quality, soil fertility, erosion and reduced ecosystem services through intensification and loss of biodiversity. The criticism is that although resource consumption is comprehensively taken into account in such LCA studies, changes on the landscape level (e.g. biodiversity) are often not considered. Effects such as those on biodiversity are thus usually considered outside the catalogue of impact categories.
- Finally, there is still a lack of **standardisation of final (comparative) evaluation and interpretation**. Concerning the issue of weighting various kinds of environmental dimensions, there are some evaluation concepts available; among these, the Swiss Ecological Scarcity Method, which involves the attempt to evaluate different environmental dimensions in terms of their scarcity as estimated by society (legal limit values, political environmental quality objectives etc.), has gained some currency but is not generally accepted (Frischknecht & Büsler Knöpfel 2013, Nemecek et al. 2016).

In spite of these limitations, LCAs are currently conceptually the most convincing instrument to analyse important environmental impacts on the product level, and especially those that are due to material and energy flows. LCAs in general permit a holistic understanding of the effects of foodstuffs along all stages of their life cycle. They help to identify practices with great environmental impact and to find approaches for improving processes. They additionally highlight conflicting objectives and contribute to finding compromises and innovative solutions in case of multiple objectives.

If, however, we want LCAs to be useful for politicians and consumers, for example for product labelling, then methodological development and standardisation are crucially important. Current environmental product declaration programmes are not subject to any detailed requirements or directives in terms of illustrating the variability of LCA results. Instead, they require data that are “representative” or that have been calculated as average values or weighted average values. This can lead to the erroneous evaluation of products on the market if they are considerably better or poorer than the average. The challenge facing researchers and practitioners lies in illustrating relevant variability in the results of LCA studies without having to provide a large range of data. In the medium term, more company-specific data needs to be generated.

Building on the basic principles of life cycle assessments, the European Commission in 2013 therefore presented guidelines on modelling a product’s environmental footprint, the **Product Environmental Footprint (PEF) Guide** (EU KOM 2013). PEF is a multi-criteria method for the life-cycle-

based modelling and evaluation of the environmental impact of products and services through the associated material and energy flows as well as the associated emissions and waste streams. This method adopts the “comparability over flexibility” approach, i.e. its purpose is to standardise existing methods of life-cycle-based product evaluation methods. This guide is currently being tested in an extensive pilot phase which began in late 2013 with 25 PEF pilot projects. The aim of the pilot phase is to create product-group-specific rules (Product Environmental Footprint Category Rules – PEFCRs).

The EU Commission justified its initiative with a number of hindrances that currently prevent an increased and faster distribution of environmentally friendly products and business practices on the EU’s internal market. For example, the EU Commission viewed it as evident that

- there is no common understanding in the EU on what constitutes a “green product” or “green business”,
- the multitude of national and private initiatives leads to the uncontrolled proliferation of different methods,
- producing companies face unacceptable effort and high costs if forced to calculate the environmental impact of their products using a number of different methods, and
- consumers are growing increasingly insecure when faced by inconsistent environmental information on products – particularly due to the exploding number of sustainability labels.

The PEF Guide was developed by the Joint Research Centre – Institute for Environment and Sustainability Ispra (JRC-IES) and is intended to serve users as a guide and/or a standard for conducting comparable studies. A direct comparison between the results of different life cycle assessments within one product group is currently not possible. What is more, it takes a relatively large amount of time and effort to create a complete life cycle assessment, particularly if it includes comparative statements (such as “Product A is more environmentally friendly than Product B”); this presents great challenges especially to small and medium-sized enterprises.

Target groups for the application of an environmental footprint include producers, farmers and traders in the food and non-food sectors, and small and medium-sized enterprises in particular. Finkbeiner (2014), along with Galatola and Pant (2014), offer a comprehensive discourse on the situation regarding PEF and life cycle assessments according to ISO standards.

The WBAE is in support of the EU’s objective of establishing a uniform and simple(r) life-cycle-based environmental evaluation method for products and making it accessible to more users. Developing product category rules makes sense, as they take into account the specific characteristics of a product group. It is to be expected that this will simplify the creation of environmental assessments in practice and therefore facilitate the comparison of assessments of different users. Overall, this could lead to a wider use of LCAs, which would, in turn, improve the data basis for companies, policy makers and consumers. The practical application of the method during the pilot phase

has revealed further challenges. The greatest of these is the frequent lack of data availability. In the WBAE's view, **one of the most important tasks of politics** is to place special emphasis on **addressing the problem of data availability**. There are several possibilities to do so:

- Politics should expend financial resources in order to gather or purchase generic datasets and make them available to users.
- Politics should provide incentives for companies to gather the necessary data, and subsequently investigate corresponding legal options.

Last but not least, it is important to further develop the application of the methodology as a means of communication with consumers (e.g. in the form of a product label; cf. Sections 7 and 8). In the face of the growing "jungle" of unclear sustainability labels, as well as environmental label systems that are trustworthy but not well-established on the market (e.g. the Blue Angel, EU ecolabels, the Austrian Ecolabel and the Nordic Swan Ecolabel), there is considerable need for development (cf. Section 8). Communicating the results is of high market relevance, which means it is crucial to involve a neutral party that is independent of industry.

**Conclusion:** LCA studies are currently useful for internal company use but they are rarely utilised. They are so far not very suitable for external communication or, in particular, for comparative statements for politics and consumers. For this purpose, the existing methodological challenges would first need to be solved. Uncertainties in terms of data bases and open design decisions in LCAs lead to an inherent uncertainty regarding results, which is especially pronounced in agricultural products.

Without LCAs, however, no reliable statements can be made on the advantages of different food-stuffs, types of packaging or dietary patterns. In reality, these assessments are increasingly focusing on greenhouse gas balances (see below), which are comparatively simple to undertake and which use a standardised aggregation via greenhouse gas equivalents. This is a first step. Focusing too strongly on greenhouse gases, however, is counterproductive in the long term since other important environmental dimensions then systematically attract insufficient attention. Due to potential conflicts of objectives, greenhouse gas (GHG) balances on their own are often not a good proxy for other environmental effects.

In the face of the more than 20 years of developing LCA methods (see UBA 1999 as a milestone for Germany) it is the WBAE's estimate that without a much stronger political framework for method application – and given the costs and the lack of commitment to transparency of many actors – no breakthrough is to be expected. **Much stronger incentives and, if necessary, obligations for using the instrument** must be created (cf. Section 9.6.4).

### 5.3.3.2 Current knowledge on environmental effects associated with food and dietary patterns

It is important for consumers, companies and society as a whole to know what the key environmental control factors are. So far, this knowledge is not very widespread in society, as is revealed by Table 5-8 below, which is based on a Germany-wide representative survey conducted in September 2019. Out of seven different climate-protection measures, the respondents were asked to select the one that they thought was the most effective. The survey results show that there is no general consensus with regard to a priority measure. The largest proportion of respondents (22%) selected the avoidance of plastic bags as the most efficient measure – a measure that is de facto insignificant for climate protection (Bilstein 2019). The contribution of preferring regional and seasonal foodstuffs (selected by 15%) is also overestimated (cf. Shi et al. 2018) as will be shown below.

**Table 5-8:** Efficiency of measures for climate protection as perceived by consumers

“Which of the following personal actions has the strongest impact on reducing the CO <sub>2</sub> footprint of an average German?”	
No more plastic bags	22 %
One flight less per year	18 %
Modern heating and insulation	16 %
Regional and seasonal food	15 %
Fuel-efficient driving	14 %
No more meat consumption	10 %
Switching off standby modes	5 %

Note: Representative survey of 1,500 Germans aged 18+ conducted in September 2019. Respondents were able to select one out of the seven measures. The percentages indicate the proportion of respondents who selected each measure.

Source: Bilstein (2019).

Recent years have seen a relatively large number of LCAs investigating various dietary habits and foodstuff groups (e.g. Taylor 2000, Clune et al. 2017, Willett et al. 2019). Many of the existing studies, however, refer only to **GHG emissions** because they are easily measurable and better databases are available. The following will therefore firstly present an overview of the results for the CO<sub>2</sub> footprint of food groups. Although greenhouse-gas footprints only comprise part of a foodstuff’s environmental stress, they are usually more meaningful than other partial approaches, such as the “food miles” concept or the water footprint: food miles do not take into account the differences between means of transport and water footprints usually neglect regional availability (overall, water in Germany is not scarce). At the same time, it would be advantageous if a larger number of comprehensive LCAs were available since there are conflicts of objectives between different environmental indicators (Willett et al. 2019).

Table 5-9 gives an overview of the average (median) GHG emissions of various product groups frequently consumed in Germany, based on a meta-review conducted by Clune et al. (2017). It also shows standard deviations which reveal, on the one hand, that there are considerable deviations between the different studies (see the example of crustaceans) and, on the other hand, that the ranking of various foodstuffs in terms of their climate impact is relatively unambiguous and that the number of studies behind these summary values is already relatively large.

**Table 5-9:** Greenhouse gas emissions of different product groups, consumption of these product groups in Germany (2013) and absolute greenhouse gas burden of these product groups

Food group	Product-based values (median value/standard deviation)		Consumption in Germany	GHG emissions from consumption in Germany
	GHG in kg CO <sub>2</sub> -eq/kg	Number of LCA studies	kg/capita/year	kg CO <sub>2</sub> -eq/capita/year
Vegetables	0.37±0.39 <sup>1</sup>	33	92.91	34.4
Fruits	0.42±0.32 <sup>1</sup>	77	88.46 <sup>2</sup>	37.2
Cereals	0.50±0.22	31	107.76 <sup>3</sup>	53.9
Pulses	0.51±0.45	16	0.73	0.4
Nuts	1.20±0.93	7	6.69	8.0
Rice	2.55±1.29	12	3.34	8.5
Fish	3.49±3.62	47	11.16 <sup>5</sup>	38.9
Shrimps	7.8±12.37	7	0.82	6.4
Eggs	3.46±1.21	19	12.2	42.2
Chicken	3.65±1.72	29	17.75 <sup>6</sup>	64.8
Pork	5.77±1.63	38	51.81	298.9
Lamb	25.58±0.32	22	0.73 <sup>7</sup>	18.7
Milk	1.29±0.58	77	62.73 <sup>4</sup>	80.9
Butter	9.25±7.37	4	5.16	47.7
Cream	5.64±1.62	3	6.32	35.6
Cheese	8.55±2.07	22	21.69	185.4
Beef	26.61±12.47	49	13.16	350.2

Note: GHG data are LCA values from Clune et al. (2017) and comprise the emissions from agriculture up to retail. Consumption data for Germany in 2013 according to FAOSTAT (2016), in the case of meat: data for meat consumption; <sup>1</sup>) GHG emissions of fruit and vegetables are values for field cropping without heated greenhouses; <sup>2</sup>) excluding grapes used for wine production; <sup>3</sup>) excluding rice and barley used for beer production; <sup>4</sup>) including milk and milk products but excluding butter, cheese and cream; <sup>5</sup>) encompasses pelagic, sea, freshwater and ground fish species; <sup>6</sup>) poultry meat including chicken, turkey, goose and duck; <sup>7</sup>) encompasses sheep meat and goat meat.

Source: Lemken (2019).

The values presented in Table 5-9 take into account studies from a variety of countries. This means that there may be differences with regard to German or Central European production. However, there are currently insufficient studies to create a comparative overview based only on LCAs of German growing conditions. The values would be higher for vegetables because Table 5-9 considers field cropping only. The GHG emissions of products from greenhouses heated with fossil energy are more than five times higher (cf. Section 5.2.4). Thanks to the high production efficiency, the GHG emissions caused by livestock farming in Germany would be at the lower end of the range indicated by the standard deviation values.<sup>198</sup>

The climate relevance of products originating from ruminant animals – both meat and dairy products – is striking: their GHG emissions per kilogramme are particularly high. Pigs have a slightly lower feed conversion ratio than poultry and are therefore attributed higher emissions. For fish and crustaceans, the results vary considerably between different species and production methods (particularly between wild-caught and aquaculture animals). Furthermore, the summary assessment presented here is too unrefined – especially since the “fish” group encompasses much more diverse organisms than the “mammal” group, which would never be summarised in the same manner in this type of analysis. The GHG emissions of fish production are, however, lower in most cases than those of vertebrate animals produced on land.

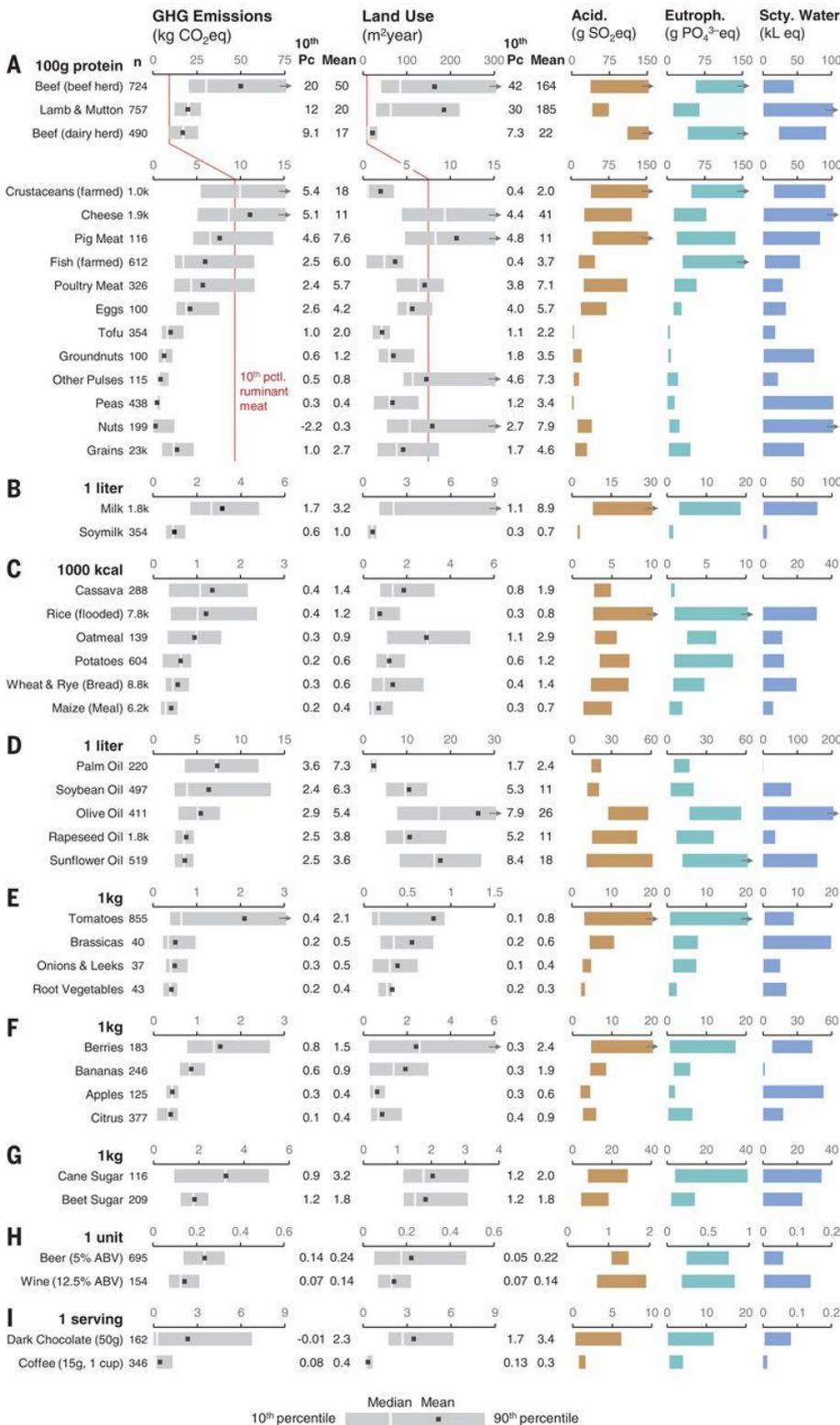
Figure 5-3 below shows the results of a comprehensive meta-study which, **in addition to greenhouse gases**, analyses the **land use, acidification, eutrophication** and **water use** of various food groups. In contrast to most other analyses, the values in this figure do not simply refer to kilogrammes but instead to relevant units of reference that the authors deemed meaningful, for example to 100 g of protein when it comes to animal products and to portion sizes for luxury goods. Where available, Figure 5-3 shows average values (median, mean) and ranges. For example, the contribution of fruit and vegetables to climatic pressure is relatively low. However, the production requires comparatively large amounts of water, which leads to problems in arid regions. Furthermore, considerable amounts of nitrate leach into the groundwater in regions that heavily rely on vegetable crops. Figure 5-3 further illustrates that in a number of cases (e.g. milk compared with soya milk), the other environmental indicators tend towards the same direction as the greenhouse gas balances. In some cases, however, the assessment of the other environmental indicators differs significantly from that of the greenhouse gas balances (e.g. olive oil compared with palm and soybean oil). What is remarkable in the case of palm oil is that due to the frequent conversion of rain forests or peatlands, it is a product with high GHG emissions while, at the same time, the figure clearly illustrates its generally high land efficiency. This contravenes an overall environmental assessment, necessitating a concluding interpretation (weighting). Finally, the ranges (i.e. the bars

---

<sup>198</sup> As an example, the two slaughtering companies Tönnies and Westfleisch indicate values of 3.3 kg and 3.2 kg for pork in their own GHG calculations (<https://toennies.de/verantwortung/nachhaltigkeitsthemen/klimaschutz-in-der-tierhaltung/>; <https://www.westfleisch.de/presse/archiv-pressemitteilungen/01022010-erster-co2-fussabdruck-fuerschweinefleischproduktion/>). Values of this scale are also found in the review conducted by McAuliffe et al. (2016) and in Reckmann et al. (2013) as well as Reckmann and Krieter (2015) for Germany, although the balances usually end at the farm gate and are therefore incomplete.

shown in the figure) also clearly reveal the large discrepancies between different ways of producing the same product; this also indicates possibilities for reducing emissions.

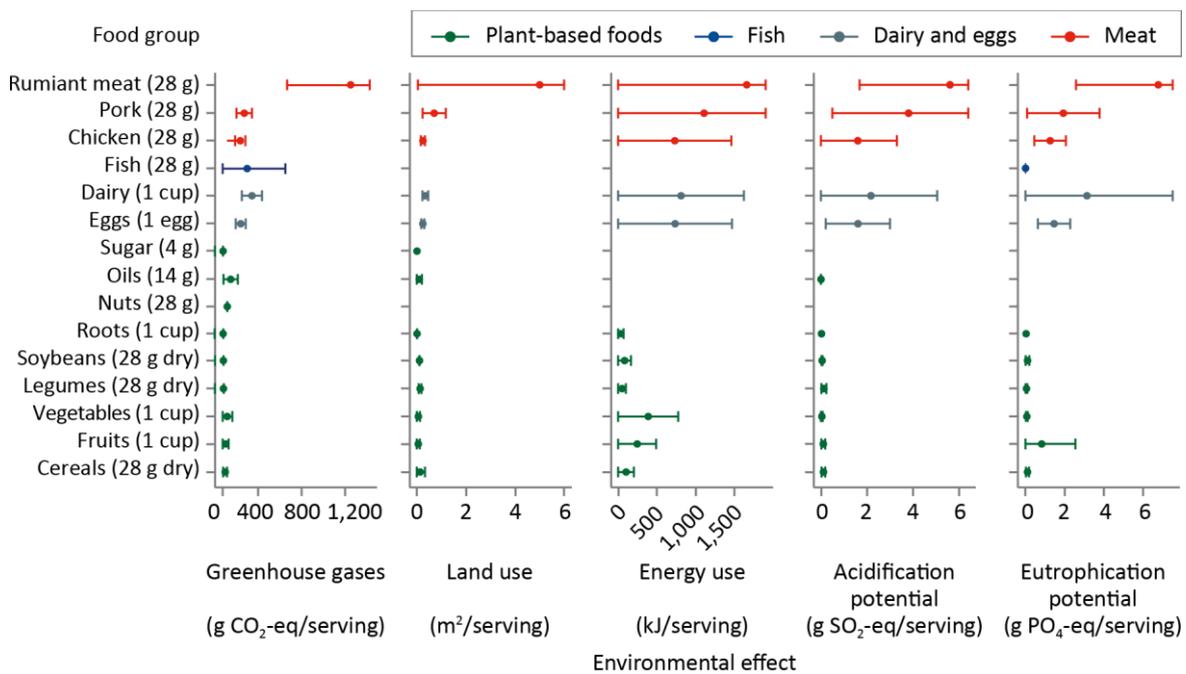
**Figure 5-3:** Selected environmental effects of different food groups (I)



Source: Poore & Nemecek (2018: 398).

Figure 5-4 uses similar indicators (energy instead of water) in relation to the relevant quantity unit to illustrate key environmental stresses caused by different food groups (Willett et al. 2019). The reference unit in this case is the recommended daily intake as suggested by the EAT-Lancet Commission. This way of presenting data also clearly illustrates the **disproportional environmental impact of animal products**. This result of environmental research is now widely accepted in the scientific community (Tilman & Clark 2014, Aleksandrowicz et al. 2016, Poore & Nemecek 2018, Springman et al. 2018, Bingli et al. 2019). From an environmental point of view, reducing the consumption of foodstuffs of animal origin in general and the consumption of products of ruminant animal origin in particular (beef and sheep meat, milk and dairy products, especially also cheese) must clearly be recommended (Searchinger et al. 2019).

**Figure 5-4:** Selected environmental effects of different food groups (II)



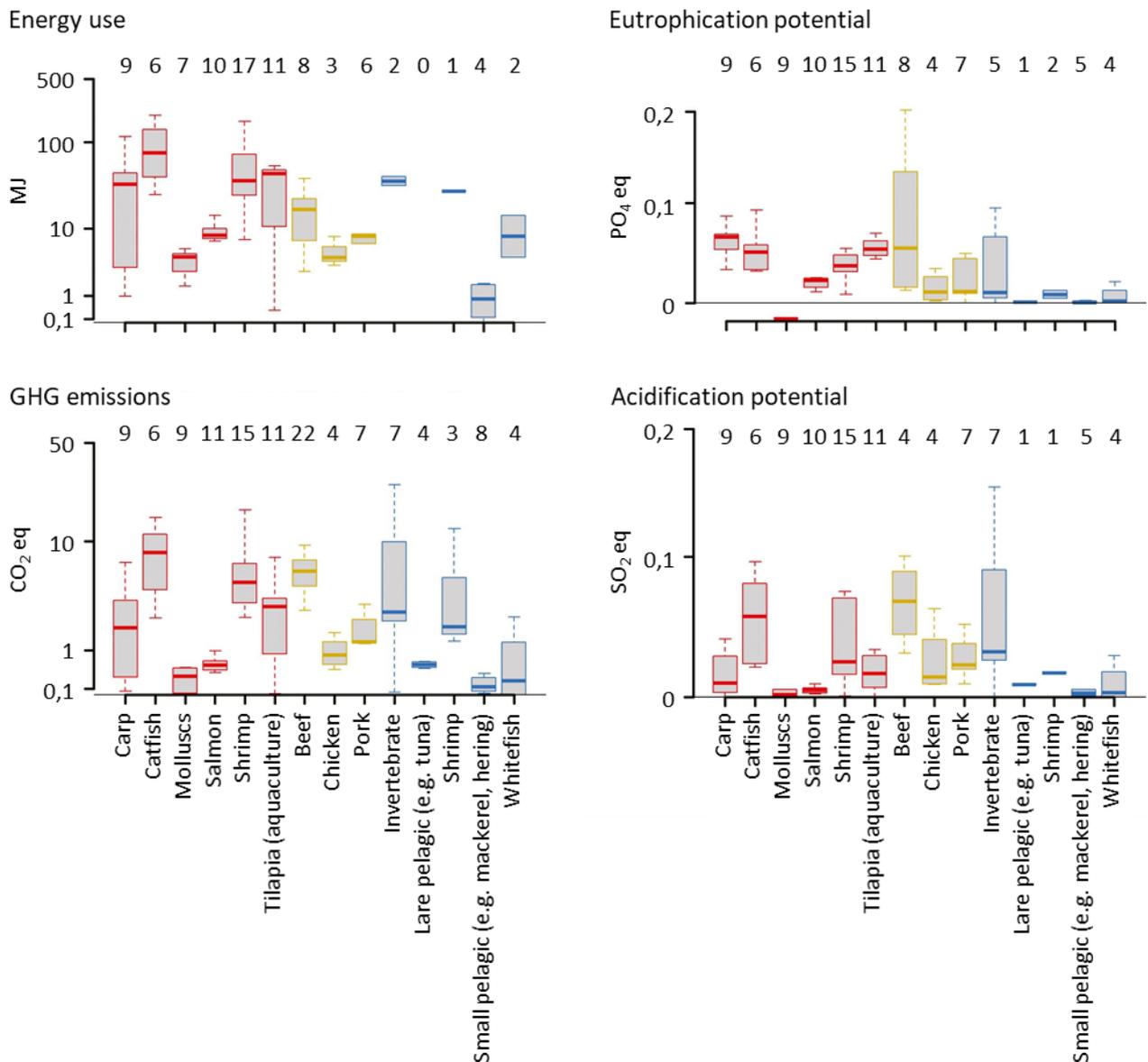
Source: Willett et al. (2019: 25).

The environmental effects illustrated in Figure 5-4 refer to food groups; i.e. vegetables are assigned an average value. Although standard deviations are presented, the ranges of different vegetables and the associated variety of production methods and means of transport is not always clear. At this aggregation level, the results can help consumers establish a dietary pattern. At the same time, such aggregated summaries – particularly of fish and crustaceans – and the sometimes extremely high standard deviation (see above) complicate the extrapolation of detailed recommendations for action.

Figure 5-5 shows the results of a different meta-study (Hilborn et al. 2018), in which the various species of fish and crustaceans from different fishing and production methods are listed separately and compared with animals produced on land in terms of the parameters of energy expenditure,

GHG emissions, and potential for acidification and overfertilisation. For fish, the results are especially varied, depending on the production and/or fishing method and fish species (Clark et al. 2019a). The figure shows clearly that this variance is still high even if a more detailed breakdown is used. Salmon, molluscs, and small and large pelagic fish almost always have smaller environmental effects than chickens and mammals. If, therefore, protein of animal origin is indispensable, then selected fishery products are preferable – especially compared with mammal products – in order to reduce the environmental footprint.

**Figure 5-5:** Selected environmental effects of various groups of foodstuffs of animal origin

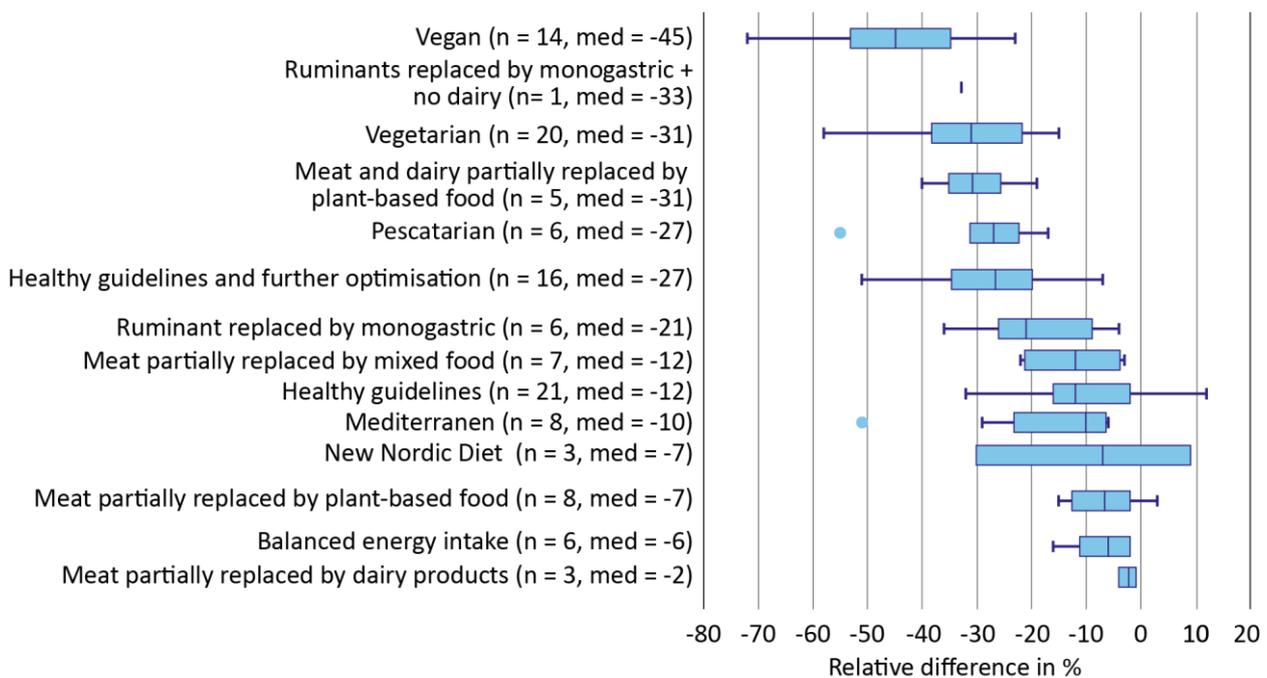


Note: Energy used (MJ), greenhouse gas emissions (CO<sub>2</sub>-eq), eutrophication potential (PO<sub>4</sub>-eq), acidification potential (SO<sub>2</sub>-eq) associated with different production methods per 40 g of protein produced. Aquaculture production methods are represented in red, livestock in yellow, and capture fisheries in blue. The thick horizontal line in the box represents the median impact; the box encompasses the interquartile range (IQR), i.e. the range in which the middle 50% of the data are located; and the “whiskers” extend to include all data within 1.5 times the IQR. Outlier data points are not shown. Numbers above each box represent the number of studies included in each product category.

Source: Hilborn et al. (2018: 331).

Figure 5-6 shows the result of a review which collated the GHG reductions that would result from a shift in **dietary patterns** away from today's typical pattern (the average dietary pattern / Western diet as determined by several publications) and towards various other patterns that the review also lists as health-promoting dietary patterns<sup>199</sup>. The authors summarise their key message by stating that reductions in greenhouse-gas emissions were generally proportional to the magnitude of animal-based food restriction (Aleksandrowicz et al. 2016). Springmann et al. (2018), however, report that the differences between a vegan and a flexitarian diet (the latter featuring roughly one quarter of the current consumption level of animal products) are small with regard to important environmental indicators (GHG emissions, area under cultivation, fresh water, nitrogen, phosphorus).

**Figure 5-6:** GHG emissions of various dietary patterns compared with current average dietary patterns



Note: GHG emissions are shown as kilogrammes of CO<sub>2</sub> equivalents per capita per year. The thick horizontal line in the box represents the median impact; the box encompasses the interquartile range (IQR), i.e. the range in which the middle 50% of the data are located; and the "whiskers" extend to include all data within 1.5 times the IQR. Outliers are shown as dots; n = number of studies, med = median value.

Source: Aleksandrowicz et al. (2016: 6), graphically adjusted.

Our dietary patterns therefore play a considerable role in environmental protection. With their work investigating the situation in the US, Heller et al. (2018) demonstrate astonishingly large discrepancies between individual households. Ranked by diet-related GHG emissions, the emissions for the top quintile amount to 7.9 times those of the bottom quintile. Chen et al. (2019) applied a different methodology to Switzerland, showing that the GHG emissions of a very meat-oriented diet (i.e. meat consumption twice as high as the current average meat consumption) are roughly

<sup>199</sup> See Section 5.3.1.2 for details on the WBAE's cautious to critical view of vegan diets due to health aspects.

11 times as high as those of a vegan diet. The incorporated land area of a meat-oriented diet is approximately 70% larger than that of a diet following the recommendations of the Swiss Society for Nutrition.

In addition to these recommendations on the level of dietary patterns and food groups, the next step then involves providing information on the level of individual foodstuffs (articles). A particularly well-differentiated overview of this issue was published by Clune et al. (2017). Compiling the results for the various foodstuffs in categories results in the following ranking for GHG emissions (Table 5-10).

**Table 5-10:** GHG emissions of foodstuffs (figures based on an international review)

GHG emissions (groups)	Foodstuffs in this category
Very low (< 0.5 kg CO <sub>2</sub> -eq/kg)	Onions, celery, potatoes, carrots, zucchini/squash, cucumbers, beetroot, squashes, cantaloupes, beans <sup>1</sup> , lemons and limes, mushrooms, guavas, apples, swedes, pears, quinces, watermelons, dates, oranges, kiwis, cauliflowers, grapes, oats, rye, peas, cherries, almond and coconut milk, peaches, nectarines, figs, barley, apricots, chestnuts, mandarins, tomatoes, corn, fennel, artichokes, chickpeas, soya
Low (0.5 – < 1.0 kg CO <sub>2</sub> -eq/kg)	Pineapples, melons, grapefruits and pomelo, tomatoes: passive greenhouse, wheat, spinach, garlic, strawberries, broccoli, olives, sweet peppers/chili peppers, soya milk, chickpeas, asparagus, peanuts, raspberries, currants and gooseberries, sesame seed, ginger, cranberries/blueberries, hazelnuts, ground nuts
Medium (1.0 – < 2.0 kg CO <sub>2</sub> -eq/kg)	Lentils, sweet peppers: passive or heated greenhouse, quinoa, milk, avocados, yoghurt, aubergines, sunflower seeds, cashew nuts, melons: passive greenhouse, walnuts, pistachios, almonds, strawberries: heated greenhouse, zucchini: heated greenhouse, small shoaling fish (mackerel, herring, sardines), Alaska pollack, carp <sup>2</sup>
High (2.0 – < 5.0 kg CO <sub>2</sub> -eq/kg)	Rapeseed and mustard seeds, (pickled) cucumbers: heated greenhouse, tomatoes: heated greenhouse, rice, duck, eggs, seabass, haddock, salmon <sup>2</sup> , cod, tuna <sup>2</sup> , trout, buffalo's milk, chicken, lettuce: heated greenhouse, rabbit
Very high (≥ 5.0 kg CO <sub>2</sub> -eq/kg)	cream, pork: global average, invertebrate seafood species (bivalve molluscs <sup>2</sup> , shrimps, scampi, octopus), turkey, cheese, butter, hake <sup>2</sup> , anglerfish, swordfish, sole, lamb: global average, beef: global average, buffalo

Note: The list has been restricted to major foodstuffs consumed in Germany. <sup>1</sup>) Beans are not clearly categorised in Clune et al. (2017) so this figure is an average value. <sup>2</sup>) Hilborn et al. (2018) assign a higher category to carp, a lower category to tuna, salmon and hake, and mussels are placed two categories lower.

Source: WBAE illustration based on Clune et al. (2017), partly modified.

From such overviews, consumers could deduce important insights with regard to their personal GHG balance – this would particularly be the case if these data were available for Germany when consumers are grocery shopping (e.g. as a label or an app, cf. Sections 8.9 and 8.10). It becomes clear that there are considerable disparities even within the generally recommendable categories, for example between different kinds of fruit or vegetables. In contrast, it is unclear how much GHG

balances differ depending on the type of production, means of transport and other influencing factors in sectors downstream from agriculture, such as packaging. This matter is addressed in the overview of various food groups shown below.

**Fruit and vegetables:** For fruit and vegetables, the following conclusions can be drawn (Müller-Lindenlauf et al. 2013, Eggenberger & Jungbluth 2015, UBA 2012):

- The potential for GHG savings is usually greater in the vegetable product categories than in the fruit categories.
- The greatest negative factor is transportation via aeroplane. Consumers wishing to reduce their carbon footprint should avoid air-freight products to the greatest possible extent. Take for example air-freight asparagus from South America: it causes almost ten times the GHG emissions of asparagus (in jars) transported by ship.
- Products that are frequently transported by aeroplane include asparagus, papaya and avocado. Per kilogramme, air-freight asparagus, papaya and avocado cause roughly twice the GHG emissions caused by pork.
- Another highly relevant factor is heated greenhouses – with variations depending on the way that the energy is generated. As an example, a tomato imported from southern Spain via lorry in May only causes roughly a tenth of the GHG emissions that a tomato causes if it is produced in a Central European greenhouse heated with fossil energy around the same time of the year.
- Seasonal<sup>200</sup> fruit and vegetables usually cause the lowest GHG emissions.
- Importing vegetables cultivated in other European countries in unheated greenhouses frequently has a smaller impact than the local cultivation of vegetables in heated greenhouses – and this also applies if the emissions caused by transporting the imported vegetables are included in the calculation.
- Correspondingly, local or regional cultivation is not always better, but in combination with “seasonal” as an indicator, it can be useful. When fruit and vegetables are in season in Germany, then products from nearby are usually better with regard to their climate balance than those transported by lorry or ship. In this case, the distance is also relevant, i.e. a long lorry transport from southern Europe significantly influences the GHG balance of fruit and vegetables.

---

<sup>200</sup> Fruit and vegetables grown outdoors are ripe at a certain time of the year in a certain climatic zone. Viewed globally, there are many products that are cultivated in different regions of the Earth where they become ripe at different times due to the different climatic conditions. For example, in Central Europe, strawberries are in season from May to July and grapes in September/October. In contrast, in the southern hemisphere, where both products are also cultivated (e.g. in Chile or Argentina), strawberries are in season during their early summer and grapes in their autumn. The term “seasonal” therefore always refers to a certain area. This area may, however, be larger than what is labelled as “region” and “regional” in retail. For example, strawberries sold in Germany in June may originate from the region (i.e. from an area no more than 100 km away or from the respective federal state) or from Italy or Spain (and therefore from the area of Central Europe). The terms “seasonal” and “regional” are commonly used in such a way that the term “seasonal products” always refers to products that are also “regional”. “Regional” products, however, are not necessarily also “seasonal” as they may also be cultivated in heated greenhouses.

- Despite factors such as storage (e.g. in a controlled atmosphere and/or cooled storage), fruit and vegetables from regional production frequently – but not always – do slightly better than imports from overseas, even if the latter are not transported by aeroplanes but by ship. In general, however, the differences are not enormous and storage is generally not a hotspot of GHG emissions.
- Another relevant polluting factor can be freezing. In comparison to loose fruit and vegetables, freezing generates higher GHG emissions; in comparison to other substitutes (e.g. canned fruits/vegetables), this is not always the case.
- Another relevant factor is the proportion of articles that perish along the value-adding chain, although this factor is currently not evident for consumers.
- The influence on the GHG balance of different types of packaging is quite small. Loose goods in reusable transport containers that are not additionally wrapped by consumers are advantageous unless this practice results in increased spoilage.
- The selection of shopping location – ranging from direct marketers to discount shops – has not been investigated sufficiently. The balance depends on factors such as the spoilage quota at each shopping location and, on the consumer side, on the distance that consumers must travel to shop and on the means of transport that they use for this purpose.

**Fish:** Similarly to fruit and vegetables, fish is recommendable from a health perspective<sup>201</sup>, while the environmental impact of sea fishing and aquaculture production is hotly debated. With regard to the GHG footprint, fish and other animals eaten as seafood have the advantage over terrestrial vertebrates that they are cold-blooded, so that they – unlike terrestrial vertebrates – do not need to spend considerable amounts of their energy to maintain their body temperature. The energy efficiency of their body growth is thus high and indeed comparable to that of insects, which do not yet play any role on the European market as a source of climate-friendly animal protein. If fish or aquatic invertebrates are grouped together, the data on GHG emissions are spread so wide that they are hardly usable, because these groups consist of organisms that differ greatly in terms of physiology and the way they are caught and/or produced. The factors determining GHG emissions must therefore be considered more closely.

- In **marine wild-catch fishing**, fuel consumption as a proxy for the type of fishing device has the greatest impact (Parker & Tyedmers 2015). Purse-seines<sup>202</sup> are highly efficient and cause the lowest GHG emissions per unit of mass of caught fish. This fishing method is used primarily for small shoaling fish such as mackerel, sardines, anchovies and herring as well as large shoaling fish such as tuna. Pelagic trawl nets (i.e. nets that do not touch the seabed), which are also used for catching small shoaling fish, require slightly more energy input. Due to the low catch per unit effort, passive catching devices, such as traps, gill nets or drift nets (used for almost all

---

<sup>201</sup> Cf. BfR (2004) for details on problematic mercury intake associated with high consumption of certain fish species, particularly for pregnant women and infants.

<sup>202</sup> Nets that are placed around a shoal of fish and then drawn together at the bottom with a type of drawstring to prevent the fish from escaping.

types of fish) are ranked lower than the average despite the extremely low fuel consumption. Bottom trawling (and particularly the heavy beam trawls<sup>203</sup> used to catch flatfish) and fine-meshed nets for catching shrimp require large energy inputs. The diesel consumption varies between 71 l per tonne of fish using purse-seining and 2,827 l per tonne of sole using beam trawling (Parker & Tyedmers 2015). In contrast, the size of the fishing vessels and therefore their classification as high-sea or coastal fishing vessels as well as the distance to the fishing location play a smaller role. Further aspects that can have a considerable impact on GHG emissions are the level of by-catch discards in certain types of fishery (Vázquez-Rowe et al. 2012) – because these catch percentages increase the specific fuel consumption of landings – and potential leakages in the cooling system of high-sea fishing vessels (Iribarren et al. 2011). Although discarding by-catch is mostly prohibited these days, these regulations are apparently ignored to a large extent. Certain cooling agents have GHG effects many times larger than that of CO<sub>2</sub>, so that leakages dramatically boost GHG emissions in LCAs. The use of such cooling agents has been prohibited worldwide since 2015, and this type of cooling agent must be replaced in existing systems by early 2020. For future assessments, such leakages will thus only play a role from an energetic point of view.

- A major factor in **aquacultures** is the production of feedstuffs (Hilborn et al. 2018). Apex predator species usually require feed that is produced in an energy-intensive way, for example from wild-caught marine animals. There are, however, differences between species in terms of feed conversion (e.g. it is fairly high for salmonids) and developments in feeding practices are moving towards replacing fishmeal and fish oil with plant-based components. What type of aquaculture is employed also plays a significant role: Extensive pond farming methods (e.g. for carp breeding) or net cage systems in open water (which are prevalent in Norwegian salmon aquacultures), for example, are more climate-friendly than recirculating aquaculture systems on land if the latter are run on a conventional energy mix. However, these various production methods have converse effects on other environmental parameters: Recirculating aquaculture systems have particularly low levels of water consumption and nutrient discharge. In addition, recirculating aquaculture systems do not pose the problem of “escapees”, i.e. the accidental release of breeding animals into the wild, where they may negatively impact wild populations (e.g. of salmon) due to their faster growth. Shrimp breeding in the tropics frequently means that mangrove forests, which are of major significance to coastal protection and biodiversity, are converted – which is not a problem posed by recirculating aquaculture systems or net cage systems in open water.
- In the case of wild-caught animals and aquaculture products, **transport** may play another major role in terms of GHG emissions. As is the case for other products, transport via aeroplane is particularly climate-damaging. However, products that reach the German market via aeroplane are almost exclusively exotic or very highly priced fishery products (approx. 20,000 t compared to 1,100,000 t of nationally consumed fish, i.e. 1.8%; FIZ 2018) For many years, the four most important species (groups) on the German market have been Alaska pollack, salmon, tuna and herring, making up 60% of consumption. These are almost exclusively transported to Germany

---

<sup>203</sup> Trawl nets that touch the seabed mostly used for catching flatfish.

via fishing vessels (herring), via refrigerated or frozen containers on ocean-going vessels (Alaska pollack, tuna, salmon), or via lorries from production and landing sites in other European countries (herring, salmon). No other species has a market share of more than 10%, and many of these (cod, plaice, carp) are produced or landed within Germany. Liu et al (2016a) showed that sea transport over 16,000 km (e.g. from the North-East Pacific, which is a fishing zone for Alaska pollack) produces roughly the same amount of CO<sub>2</sub> as a lorry transport over 500 km. Air freight, in contrast, multiplies the GHG emissions and exceeds the emissions caused by the actual production or fishing activity by a long way. The refrigeration of easily perishable fishery products also contributes to the climate impact, but only to a minor degree. Overall, regional production is advantageous, but the transport of fishery products – at least for German fish consumption – plays no major role, even if most of the fish originates from overseas.

- Finally, **packaging** can play a relevant role for the overall impact. By way of example, in the case of canned tuna, the packaging (tinplate, aluminium) has a considerable negative impact on GHG emissions, especially if it is not recycled (Avadí et al. 2015, Almeida et al. 2015). A similar situation applies to canned fruit and vegetables.

In addition to the CO<sub>2</sub> footprint, there are **other, sometimes more significant factors** that must be considered in order to determine the environmental impact. These also differ between **wild-catch fishing and aquaculture production**.

For **wild-catch fishing**, the primary aspect is overfishing: wild populations can only be exploited to a certain limit in order for fishing to remain sustainable, and production cannot simply be increased according to rising demand. Since 2002, there has been an internationally binding target for this limit, the maximum sustainable yield (MSY; UN 1982, 2002). Achieving the MSY requires healthy populations in a healthy marine environment (Mace 2001). Overfished populations should recover in order to be able to produce the MSY – in this case, the catch levels from marine wild populations that have constantly been at roughly 90 million tonnes for many years (FAO 2018b, not including considerable illegal, unreported or unregulated fishing, Agnew et al. 2009, Pauly & Zeller 2016) could even be increased.

Currently, roughly one third of the world's commercially used populations are in a poor condition, i.e. overfished, collapsed or recovering; 60% are being used optimally according to the MSY; only 7% retain some development potential and are therefore "underfished" (FAO 2018). More fish could only be caught from these 7% or from the 33% of stocks currently in poor condition if they were to fully recover. After a phase of global overfishing, more effective fisheries management and improved implementation of regulations such as fishing quota have brought – sometimes considerable – progress in preventing overfishing (defined as fishing pressure that leads to a decrease in yield beyond the long-term maximum sustainable yield) and in the recovery of previously overfished populations (e.g. in the US, Norway or Australia). In the EU's Atlantic waters, the proportion of overfished populations (according to the MSY) has decreased from more than 90% in 2004 to roughly 40% in 2018 (STECF 2018). At the same time, some regions in the world (including the Mediterranean Sea; STECF 2018) still have considerable need for governance and there is currently no sight of a change of course on a global scale. Considerable increases in fishing activities, which

are desirable from a nutritional point of view, can thus only be achieved by increasing aquaculture production.<sup>204</sup>

It is not easy for consumers to know which wild-catch fisheries are sustainable. Besides the condition of the population, different fishing practices have considerable influence on the assessment of the environmental impact, for example with regard to changes to ecological communities on the seabed (high when bottom trawls are used) or undesirable by-catch (high when trawl nets or long-lines are used) as well as marine mammals and seabirds (high when gill or drift nets are used). Fish consumers who do not wish to become experts in marine ecology can make use of guidelines published by environmental organisations, such as the WWF's Sustainable Seafood Guides (WWF 2018). These do, however, have the disadvantage that they need to generalise heavily in order to be useful to consumers while shopping and that they are frequently out of date (the newest Greenpeace fish shopping guide is three years old). An alternative is to pay attention to sustainability labels. The oldest and most distinguished by far on the market is the Marine Stewardship Council (MSC) label, which was developed more than 20 years ago by the then largest fish processor Unilever and the environmental organisation WWF. This label's aim is to secure minimum standards, which means that it does not go far beyond legal regulations and industry practices (Ponte 2012, Bush et al. 2013, cf. Section 8.9.4).

The suitability of the MSC label as a sign of sustainable fishery is controversial in literature (Gutierrez et al. 2012, Opitz et al. 2016, McIlveen et al. 2019, Travaille et al. 2019).

For the most part, positive effects are observed, but a clear assessment of the overall impact is currently hardly possible and verification at sea difficult.<sup>205</sup>

---

<sup>204</sup> According to the FAO (2018b), global aquaculture production may exceed wild-catch fishing for the first time in 2020.

<sup>205</sup> The WWF, who founded the MSC system in 1997 together with the enterprise Unilever, still recommends the MSC label in spite of all criticism, stating that despite the undeniable need for reform, the MSC label is still the fastest guidance available to consumers wishing to buy fish. The organisation's view is that it is better to buy certified fish than uncertified fish. (<https://www.wwf.de/themen-projekte/meere-kuesten/fischerei/nachhaltige-fischerei/der-marine-steward-ship-council-msc/>, last accessed on: 21 February 2020). The WWF also demands better controls. The ASC, which is a similar concept for fish from aquaculture, is also recommended by the WWF (cf. <https://www.wwf.de/aktiv-werden/tipps-fuer-den-alltag/vernuenftig-einkaufen/einkaufsratgeber-fisch/>).

An increase in fish consumption – which is desirable from a health perspective – can be realised through fish from **aquaculture**.<sup>206</sup> The aquaculture sector in Germany is currently weak (market share of 3.3%, and only half of it for fish) and in international comparison very small-scale but at a high level in terms of technology and expertise (DAFA 2014). Its production is primarily destined for the regional market but even there –despite favourable market conditions – it only meets a fraction of the demand and is heavily regulated. It consists of different segments which must be considered separately in terms of their environmental assessment:

- Fish kept in **ponds**, such as carp, (which currently make up 0.6% of overall consumption) are usually extensively produced via natural production and additional feeding of cereals. This means that they have a small environmental footprint. Tank and recirculating aquaculture systems usually have a higher energy demand (Biermann & Geist 2018) but can have advantages over ponds in terms of local water protection (Samuel-Fitwi et al. 2013). Trout (market share of 7.1%), which are kept in ponds or tanks, are usually produced in an intensive manner, but thanks to their extremely high feed conversion ratio and high slaughter yield, they have a high environmental efficiency. The low consumption level of freshwater fish in Germany is currently partly due to the market (acceptance problems of certain fish species such as bream and roach among consumers, insufficient marketing) and partly due to resistance, for example from a nature conservation perspective, against an expansion, particularly of freshwater aquaculture.
- **Open fish aquaculture systems at sea (net cages)** are uncommon in Germany and hardly expandable under current legal conditions; on a global scale, however, they are a growth sector. Production conditions, for example the use of pharmaceuticals, are hotly debated. There are great regional differences in this field as well (WWF 2018): despite media reports to the contrary, salmon aquaculture in Norway and fish breeding in Europe in general use relatively small amounts of pharmaceuticals.

**Nuts:** Nuts represent another foodstuff group that has recently become more widely discussed as an element of a health-promoting and more plant-oriented diet. Clune et al. (2017) assigned the group of nuts (shell fruits such as walnuts, hazelnuts, cashew nuts, almonds etc.) average GHG emissions of 1.2 kg CO<sub>2</sub> eq/kg. Volpe et al. (2015) give slightly lower values and show that the type of packaging often has considerable influence on the overall balance. On the whole, nuts do relatively well in terms of climate aspects. However, there is criticism of the environmental compatibility of production methods in some southern regions (use of large amounts of plant protection products, high water consumption in regions with low water availability; Grant & Hicks 2018).

---

<sup>206</sup> Freshwater fisheries (capture fisheries in lakes and rivers, e.g. for pikeperch) currently play next to no role in Germany: these only supply 0.4% (4,000 t) of national fish consumption. The productivity of freshwater fish populations is already suffering from the consequences of climate change (high summer temperatures, water scarcity, reduced flow rates) and it is therefore unlikely that freshwater fishing can be increased significantly (Basen 2016, Basen & Ros 2018). In addition, leisure and line fishing, which after all accounts for roughly 20% of the German national fish yield, attracts hardly any interest in respect of food consumption (Cooke et al. 2018).

Despite some knowledge gaps, some key results concerning the environmental compatibility of different foodstuff categories and dietary patterns can finally be deduced:

- In general, **animal products** are associated with **particularly high impacts** in comparison with other foodstuff groups due to the high emissions of livestock farming. Vegan, vegetarian and flexitarian dietary patterns perform significantly better.
- **Air transport** contributes relevant levels of environmental impact, as the WBAE already indicated in its expertise on climate protection (WBAE & WBW 2016). According to this expertise, roughly 52,000 t of food are flown directly to Germany every year, with fish making up the largest proportion, followed by fruit and vegetables (mango, papaya, pineapple) and meat. The emissions caused by air-freight foodstuffs brought to Germany are estimated to amount to roughly 1.2 million tonnes of CO<sub>2</sub> per year (Havers 2008). These flights correspond to less than 1% of the transport volume of foodstuffs but the associated emissions amount to roughly 16% of all transport-related emissions (Havers 2008). By avoiding air transport, a considerable amount of GHG could be conserved, and the impact on the availability of foodstuffs would be fairly small.
- **Heated greenhouses** are very energy-intensive. The impact here depends on the energy carriers used, the use of energy-saving technologies and the time of year.
- There are clear environmental and economic advantages to **tap water consumption** (compared with buying bottled mineral water), even if the tap water is processed further at home (Garfii et al. 2016).
- Depending on the distance travelled and the number of trips, **grocery shopping by car** can have considerable influence on the environmental impact of a household. Walking or riding a bike to go grocery shopping is a relevant contribution to environmental protection (Heller 2017d).
- Reducing **food wastage and food waste** could ensure considerable environmental improvements provided that progress in this field is not overcompensated at other points (e.g. through more elaborate packaging or more frequent shopping trips). Losses with regard to animal products are particularly relevant (Eberle & Fels 2016) due to the associated environmental impact, while losses of fruit and vegetables are relevant due to their sheer volume.
- The available LCAs on product assessments fail to document important specific characteristics of agriculture, particularly **biodiversity and (indirect) land use changes**. This is why an overall assessment requires consideration to be given to levels such as that of farming systems – discussed in Section 5.2.
- Some species of fish – both wild-caught (Alaska pollack, herring) and aquaculture (salmon) – that are important for the German market in terms of volume do fairly well in comparison with meat, provided they are transported by sea or land, as is usually the case. However, depending on the fishing method and mode of transport, the **variance** is high and individual product groups (such as shrimps) do not do much better than ruminant meat. When it comes to canned fish (e.g. tuna), the packaging is a key impact factor that can exacerbate the environmental impact.

- The LCAs concerned with GHG emissions do not take into account the major problem faced by the living resources of the seas, namely **overfishing**. A complex assessment of each fish species, fishing method and region is necessary here, and it is currently hardly feasible for consumers to make an informed choice. Sustainability labels such as the widespread MSC label can help, but this label's standards do not include GHG emissions and its control system is controversial. The number of landings from sea fisheries has been stagnating globally for many years and could not be increased by more than 20% globally, even if sustainable management techniques were employed consistently. The additional demand would have to be satisfied by increasing aquaculture production, which has large potentials on a global scale, but these are regionally limited. Unless they are run on renewable energy sources, recirculating aquaculture systems emit large amounts of GHGs.

The recommendations for action listed here represent an attempt of providing a rough overview. In everyday life, however, they are only helpful and implementable for consumers to a limited extent in terms of making a decision to buy product A or B. **Often, necessary and decision-relevant information is lacking** – e.g. facts such as which products are transported by aeroplane, which products originate from a heated greenhouse, how wild fish is caught, how aquaculture fish is produced, what influence the type of packaging has, and many more.

### 5.3.4 Comparative animal welfare assessment

#### 5.3.4.1 Overview of the methods of assessing animal welfare

In its expertise on livestock farming (WBA 2015), the WBA commented in detail on measuring concepts and indicators for animal welfare. The section below will therefore only give a summary overview.

**Animal welfare indicators** can be assigned to both the input and the output side. On the input side, attention is often focused on the level of husbandry systems (access to outdoor climate, type of stall, space per animal etc.). Other indicators concern the quality of management including the animals' healthcare and nutrition as well as the genetic stock used. The output/result side concerns the resulting animal health (including the prevention of animal suffering) and other animal-related indicators such as expressing the natural range of behaviour, behavioural abnormalities, the relationship between humans and animals and experiencing positive emotions.

Traditionally, the animal husbandry systems (and particularly the resources available to the animals) are at the centre of the discussion, historically influenced by debates concerning battery caging of laying hens, which have strongly characterised the discussion on animal welfare in agriculture since the 1960s. Recently, a number of publications have shown that the competences and efforts of animal carers (the management) have an equally large influence on the output indicators.

In combination with the EU's comprehensive Welfare Quality project (Blokhus et al. 2010), a paradigm shift was initiated a few years ago by prescribing the inclusion of additional indicators on the output/animal side in the assessment of animal welfare. Some of the animal-oriented output indicators are comparatively easy to gather or are already available, such as diagnostic data from slaughtering establishments or mortality rates, although problems are still associated with the standardisation of post-mortem data collection in particular. Other data, such as lamenesses, can only be gathered at the holdings themselves and require the assessor to have a certain expertise. In future, electronic data collection options may help.

Faced with these implementation problems, animal welfare indicators are currently still primarily governed by minimum requirements for the keeping of animals (space, daylight etc). This also corresponds to society's intuitive grasp of animal welfare, which corresponds relatively well with scientific insights on animal welfare indicators in many areas (Spiller & Knierim 2015). What is more, the opportunity to indulge in species-specific behaviour is primarily determined by the availability of relevant resources so that some key issues of husbandry methods should continue to be included in the target figures.

In its 2015 expertise, the WBA compiled elements of a particularly animal-welfare-oriented type of husbandry – summarised below – which have since been discussed intensively by the scientific community (Table 5-11).

**Table 5-11:** Guidelines for viable animal husbandry from the animal protection angle

Guidelines for animal welfare	Societal view	Scientific justification	Trade-offs
<b>Husbandry</b>			
(1) Access of all livestock to different climate zones (preferably an outdoor climate or, for dairy cattle, pasture where possible)	<ul style="list-style-type: none"> <li>• Society views access to outdoor climate as an essential component of animal welfare (“natural living frame”)</li> <li>• Emotional rejection of housing animals exclusively indoors</li> <li>• Livestock husbandry regains visibility in society, making attitudes less dependent on media and scandals</li> </ul>	<ul style="list-style-type: none"> <li>• Increases the animals’ choices</li> <li>• Access to outdoors areas/climate offers diverse stimuli, better air quality and unfiltered daylight and stimulates the immune system</li> <li>• Outdoor access permits a larger number of species-specific behavioural patterns</li> <li>• Permits animals to avoid one another and socially withdraw</li> <li>• Increases the animals’ chances to experience positive emotions</li> </ul>	<ul style="list-style-type: none"> <li>• Environmental conservation, animal health</li> <li>• Increased production costs</li> <li>• Increased demands on management skills</li> <li>• Can make obtaining building permits harder</li> </ul>
(2) Provision of different functional areas with various floor coverings	<ul style="list-style-type: none"> <li>• Studies show that society strongly prefers animal husbandry systems with unslatted, natural floor coverings (e.g. using straw as litter)</li> </ul>	<ul style="list-style-type: none"> <li>• Reduced risk of foot/h hoof problems</li> <li>• Reduced risk of injury and increased comfort when lying down</li> <li>• Safe movement and increased activity behaviours</li> <li>• Increases the animals’ choices</li> </ul>	<ul style="list-style-type: none"> <li>• When litter is used: environmental protection, animal health</li> <li>• Increased production costs</li> <li>• Increased demands on management skills</li> </ul>
(3) Provision of installations, substances and stimuli for species-specific activities, feed intake and grooming activities	<ul style="list-style-type: none"> <li>• Recognition of animals as intelligent beings (mainly from the perspective of pet owners)</li> </ul>	<ul style="list-style-type: none"> <li>• Increases the animals’ chances to experience positive emotions</li> <li>• Reduced risk of behavioural abnormalities</li> </ul>	<ul style="list-style-type: none"> <li>• Increased production costs</li> <li>• Increased demands on management skills</li> </ul>
(4) Provision of sufficient space and infrastructure, no permanent tie stalls	<ul style="list-style-type: none"> <li>• In qualitative interviews, space and movement as basic requirements are frequently cited as key demands placed on animal husbandry</li> </ul>	<ul style="list-style-type: none"> <li>• Reduced risk of aggression and injuries</li> <li>• Permits animals to avoid one another and socially withdraw as well as to carry out other species-specific behavioural patterns (e.g. movement)</li> <li>• Increased resting comfort</li> <li>• Increases the animals’ choices</li> <li>• Improves the animals’ general condition</li> <li>• Increases the animals’ chances to experience positive emotions</li> </ul>	<ul style="list-style-type: none"> <li>• Potential increase of gaseous emissions</li> <li>• Increased production costs</li> <li>• Increased demands on management skills</li> </ul>
<b>Operational management</b>			
(5) A halt to amputations performed to adapt animals to husbandry systems; other interventions with pain elimination	<ul style="list-style-type: none"> <li>• Most consumers who are aware of the practice reject amputations performed solely to adapt animals to husbandry conditions</li> </ul>	<ul style="list-style-type: none"> <li>• Necessary pre-emptive amputations are an indicator of poor conditions and/or methods</li> <li>• Some amputations influence an animal’s species-specific behaviour</li> <li>• There is evidence of the painfulness of such procedures</li> </ul>	<ul style="list-style-type: none"> <li>• Potential increase of gaseous emissions</li> <li>• Increased production costs</li> <li>• Increased demands on management skills</li> </ul>

Source: WBA (2015: 285 f.).

**Table 5-11:** Guidelines for viable animal husbandry from the animal protection angle – continuation

Guidelines for animal welfare	Societal view	Scientific justification	Trade-offs
<b>Operational management</b>			
(6) Setting up of a system of in-farm controls with legally enshrined target figures (use of medicinal products and animal health, animal behaviour) and the mandatory drawing up of animal health plans	<ul style="list-style-type: none"> <li>• Basis of political governance</li> <li>• Reinforcement of the scientific component within the livestock debate</li> </ul>	<ul style="list-style-type: none"> <li>• Identification of optimisation potential</li> <li>• Permits performance-based/animal-based remuneration concepts</li> <li>• Leads to the continuous improvement of husbandry conditions and to the continuing education of farmers</li> </ul>	<ul style="list-style-type: none"> <li>• Increased monitoring effort and hence higher production costs</li> <li>• Increased demands on management skills</li> </ul>
(7) Limited use of medicinal products	<ul style="list-style-type: none"> <li>• Use of antibiotics is a high-priority animal welfare problem</li> <li>• Strong link between altruistic and egotistical purchasing decisions</li> <li>• Consumers closely associate untreated/healthy animals with healthy foodstuffs</li> </ul>	<ul style="list-style-type: none"> <li>• Guidelines for farmers in order to avoid husbandry errors and the lack of expertise and animal observation/care being “compensated” by excessive use of medicinal products</li> </ul>	<ul style="list-style-type: none"> <li>• Insufficient use of medicinal products can lead to animal welfare problems</li> <li>• Increased demands on management skills</li> </ul>
(8) High level of education, expertise and motivation of people working in the animal sector	<ul style="list-style-type: none"> <li>• Facilitates communication with society</li> </ul>	<ul style="list-style-type: none"> <li>• Continuing education is the basis of optimised management</li> <li>• Strong correlation between the level of education and the quality of animal husbandry and care</li> </ul>	
<b>Breeding</b>			
(9) Major and broad consideration of functional characteristics in breeding	<ul style="list-style-type: none"> <li>• Societal scepticism towards the substantial performance advances in animal breeding (interference with nature, extreme conformations that cause suffering)</li> </ul>	<ul style="list-style-type: none"> <li>• This strong focus on performance parameters (e.g. egg yield, weight gain, milk yield) in animal breeding has resulted in animals that are highly sensitive to health-related and behavioural problems that farmers can only deal with to a limited extent</li> <li>• Opportunity to reduce the use of medicinal products</li> <li>• High complementarity between animal health and economic viability, particularly when it comes to long-lived animals (cows, sows)</li> </ul>	<ul style="list-style-type: none"> <li>• Frequent and relatively stark conflicts of interests with economic viability</li> </ul>

Source: WBA (2015: 285 f.).

These **guidelines** designate important objectives and key features oriented towards a stronger focus on animal welfare in livestock keeping, which can serve as a basis for product assessments, although at their core, they address the level of agricultural systems (cf. Section 5.2).

In its 2015 expertise, the WBA did not address the **animal welfare of fish**. After lengthy discussions, scientific research today views it as relatively certain that fish have a capacity for sentience as well as suffering (Sneddon et al. 2014, Rose et al. 2014, Martin & Gerlai 2018), albeit to a more limited extent than mammals. A majority within society also ascribe fish a moral status and call for animal welfare requirements, but also to a lesser extent (Kupsala et al. 2013, Riepe & Arlinghaus 2014). Correspondingly, animal welfare is a target for fish as well.

When it comes to assessing animal welfare, a distinction must be made between fish from aquaculture and fish that are not kept by humans but merely caught. For aquaculture fish, indicators to assess the welfare of the animals are ultimately comparable to those used regarding livestock husbandry. Indicators that relate to husbandry conditions, management, animal health, animal behaviour, slaughter etc. are adapted to fish husbandry. In terms of husbandry conditions, for example, water quality plays a key role (VDFE 2016). For fish that are not kept but merely caught, animal welfare assessments focus on catching and killing methods. Additionally, the protection of habitats, i.e. of the (marine) ecosystems in which the fish live, are taken into consideration (Diggles et al. 2011).

#### 5.3.4.2 Current state of knowledge regarding the animal welfare standards of products

In its livestock expertise, the WBA identified the largest animal welfare problems as existing in respect of intensively kept pigs, poultry and beef cattle and only to a lesser extent dairy cows, since the proportion of loose housing systems has continuously increased, which has satisfied a number of basic needs (WBA 2015). In addition, there are growing numbers of attempts on the market to stabilise pastoral stockfarming using appropriate tagging. This means that from an animal welfare point of view, it is advantageous to consume animal proteins in the form of milk, dairy products and extensively farmed beef. When it comes to beef, it is noteworthy that intensive cattle fattening also has considerable animal welfare deficits. Whether beef comes from dairy cows, from intensive fattening operations or from grass-fed cattle is currently not clearly discernible to consumers.

At the given level of consumption of animal products, a dietary pattern that includes a comparatively higher proportion of dairy products should be favoured from an animal welfare point of view. However, the most advantageous option for increasing animal welfare would be to **decrease the consumption of animal products overall**, for two reasons:

- The first line of reasoning – focusing exclusively on the objective of animal welfare – is that there is an argument to be made that despite some improvements, many husbandry conditions

are insufficient in terms of animal welfare and are, to a certain extent, associated with suffering, so that avoiding animal products is the most effective form of animal protection. According to recent studies, roughly 20% of the German population currently have a generally critical view of meat and dairy consumption for ethical reasons (Hölker et al. 2019). Ethical positions are the strongest driver for avoiding animal products (Ruby 2012, Janssen et al. 2016). Roughly 5% of the population eat vegetarian or vegan diets.<sup>207</sup> For these people, proper animal protection means non-consumption.

- The second line of reasoning is based on the key concept of “less and better” developed by the WBA in its livestock expertise (2015), i.e. decreased overall consumption of animal products, but opting for better quality when animal products are consumed (animal welfare, sensory qualities), on the grounds that there are considerable additional costs associated with animal welfare. Due to higher prices, higher animal protection standards lead to decreased average consumption. A decreased consumption of animal products also permits households with a limited food budget to consume animal-friendly products and is additionally also associated with health advantages for most consumers.

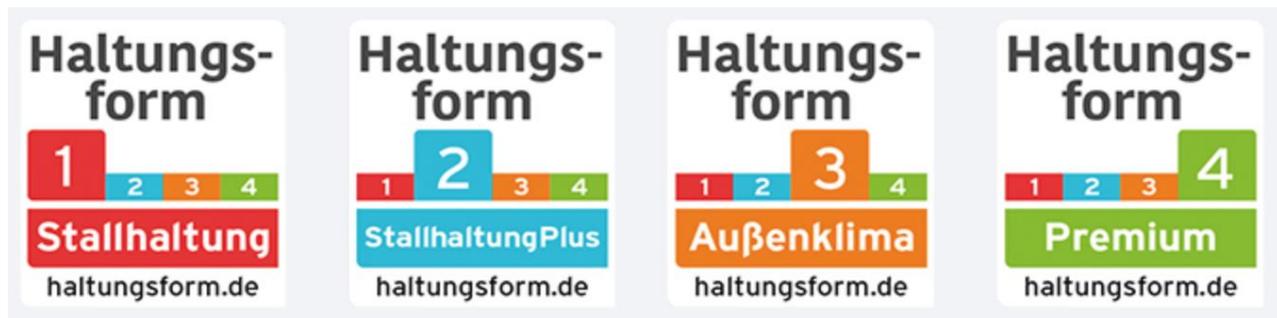
On the level of individual products, various **animal welfare labels** have been introduced in the past few years. Currently, these assessment and labelling concepts are based mainly on the husbandry system indicator. Well-known examples include grass-fed milk, caged vs cage-free vs free-range vs mobile-pastured eggs, outdoor climate stalls etc. The long-lasting social debate concerning the caging of laying hens was particularly defining in this field.

A label newly introduced in the German food retail sector also focuses on the husbandry system: in the form of a “husbandry compass”, the various husbandry types are indicated through a number code and a brief description in a manner similar to the labelling of eggs. A distinction is made between the legal standard (1), an improved husbandry system (2), various types of outdoor climate stalls (3) and premium husbandry forms (4). The latter comprise organic production and comparable husbandry types.

In contrast to this husbandry-system label introduced by large retailers, a governmental animal welfare label currently being developed is set to cover various animal welfare criteria in a more comprehensive manner, i.e. include animal health and behavioural parameters, and also genetics, which is sensible from a scientific point of view (WBA 2015).

---

<sup>207</sup> See text box 13 “Consumer–citizen gap” in Section 6.2.3 for a discussion of the difference between the 20% of the population that are critical of meat and dairy consumption, on the one hand, and the 5% of the population who are vegetarians and vegans, on the other hand.

**Figure 5-7:** Husbandry-system label introduced by German grocery retailers

Source: Initiative Tierwohl (2019).

In comparison with the situation just a few years ago and the other sustainability fields discussed above, it appears likely that animal welfare labelling will become embedded in a relatively wide section of the market (cf. also Section 8.9.4). On the product level, consumers likely have a better information basis in this area than for the other sustainability dimensions – even if there are still substantial discussions on the validity of the various animal welfare indicators.

Furthermore, animal-welfare-oriented livestock husbandry can also contribute to workers' job satisfaction in agriculture – and vice versa (Daigle & Ridge 2018). Many animal welfare measures require greater manpower allocation and better qualified workers. There are thus **synergies between animal welfare and social objectives**.

The above remarks refer to livestock in agriculture. There is less information available on the market concerning the welfare of fish. The well-established MSC label does not directly comment on fish welfare. Indirectly, however, it includes the protection of mammals, reptiles and birds as well as the reduction of by-catch. Fish welfare is more directly addressed by aquaculture labels. For example, the Aquaculture Stewardship Council (ASC) label addresses aspects such as low mortality rates, high water quality and rules on treating sick animals. There are also rules for organic fish production, for example on feed and water quality, stocking density and an environment providing for their behavioural needs (cf. Commission Regulation (EC) No 710/2009). Similarly to agricultural livestock, there is an intensified discussion on suitable indicators of fish welfare, including behavioural aspects (Martins et al. 2012, Noble et al. 2018), but these are not yet reflected in the labels to any noteworthy extent.

### 5.3.5 Integrative consideration of all four perspectives

“Sustainable food consumption” cannot be ensured simply by selecting “sustainably produced foodstuffs”. Instead, the amount and composition of the foodstuffs consumed must be taken into consideration systematically. Foodstuffs with a small “environmental footprint” are not automatically also health-promoting, as the example of sugar shows. The inverse also applies, as the examples of vegetables from heated greenhouses and air-freight fruit illustrate. Health-promoting foodstuffs can have an extremely large carbon footprint and/or be produced under socially problematic conditions. The animal welfare target is often independent of the other three sustainability dimensions. Exceptions include the moderate correlation between antibiotics use and intensive animal husbandry systems, as well as efficiency advantages due to performance-driven breeding which can lead to animal welfare issues.

These examples indicate that the relation between the four sustainability dimensions considered in this expertise is not clear. **The various dimensions can therefore not simply be aggregated into an overall sustainability assessment.** In order to do so, society (politics) would need to indicate what significance should be attached to the different dimensions, i.e. health issues, social affairs, environmental protection and animal welfare, in comparison with each other.

The approaches available so far that are intended to integrate different sustainability indicators are therefore more modest and attempt to consolidate two dimensions in one matrix as a start.<sup>208</sup>

A matrix was proposed by van Dooren et al. (2017), for example, that incorporates **GHG emissions** (for environmental assessments) and the **relative nutrient density** (as a health indicator). In concrete terms, they analysed 403 foodstuffs that are frequently consumed in the Netherlands and calculated the “Sustainable Nutrient-Rich Foods” (SNRF) index, which incorporates the nutrient density (determined by means of six different macronutrients<sup>209</sup>) relative to the appropriate recommended daily intake and to the (metabolic) energy intake. The lower the value of the SNRF index of a foodstuff, the poorer is its nutrient profile relative to its energy density (= relatively large amounts of salt, added sugar, saturated fatty acids; relatively small amounts of plant-based protein, dietary fibre, essential fatty acids). Figure 5-8 plots the SNRF index as a function of the

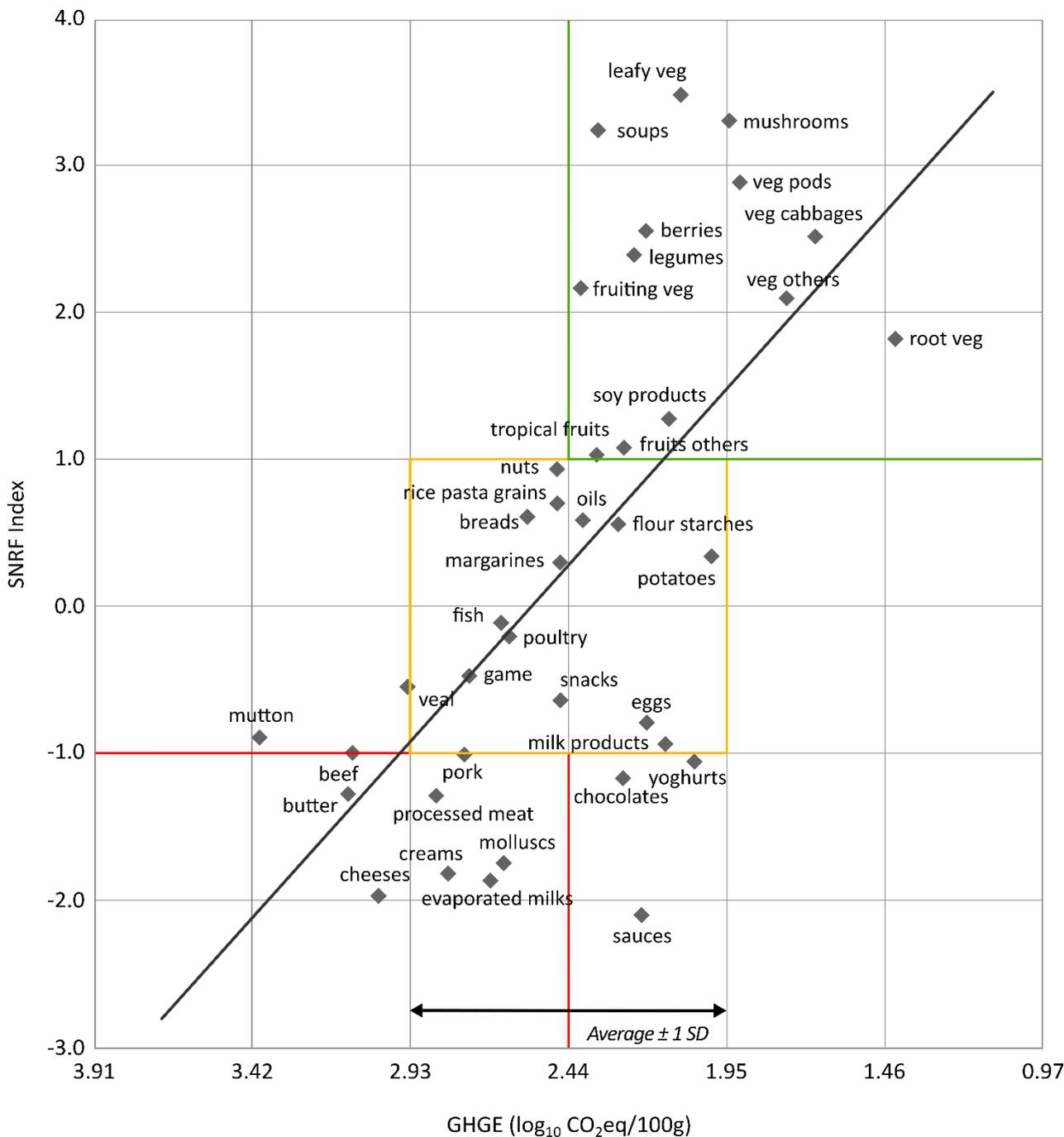
---

<sup>208</sup> Tools have recently been developed for companies that enable a relatively comprehensive assessment, such as SusDISH from the University of Halle-Wittenberg (<http://www.nutrition-impacts.org/index.php/sustainability-accounting-susdish>), the Menu Sustainability Index from the Zurich University of Applied Sciences (Müller et al. 2018), the Nutritional Footprint from the Wuppertal Institute for Climate, Environment and Energy GmbH (Lukas et al. 2014) and the web-based Nahgast calculator (<https://www.nahgast.de/rechner/>) from the BMBF joint project Nahgast, which takes into account e.g. ecological, social, health and economic indicators (Speck et al. 2017).

<sup>209</sup> The study distinguishes three favourable macronutrients that are beneficial from a health perspective and are therefore recommended for consumption (plant-based protein, dietary fibre, essential fatty acids) and three unfavourable macronutrients that, from a health perspective, should be limited (salt, added sugar, saturated fatty acids). The calculation formula is based on various assumptions – such as a desirable average daily intake of 50 g protein – which are decisive for the results. For this reason, these calculations can only provide a rough guideline.

GHG emissions of 39 different foodstuffs, revealing that the SNRF index proposed by van Dooren et al. (2017) and the GHG emissions value correlate systematically ( $R^2 = 0.38$ ).

**Figure 5-8:** Relation between the relative nutrient density (SNRF index) and GHG emissions of 39 foodstuffs



Source: Van Dooren et al. (2017: 395).

Based on the results of the relative nutrient density (SNRF index) and GHG emissions, three different product groups can be defined (cf. Figure 5-8):

- red group (SNRF index less than -1.0; GHG emissions more than 2.44): negative nutrient profile and high climate impact (e.g. beef, cheese, molluscs).
- orange group (SNRF index between -1.0 and 1.0; GHG emissions 2.44 +/- 1 standard deviation): average nutrient profile and moderate climate impact (e.g. poultry, fish, oils).
- green group (SNRF index more than 1.0; GHG emissions less than 2.44): positive nutrient profile and small climate impact (e.g. vegetables, fruit, mushrooms, legumes, soy products)

This integrative consideration can give consumers an overall but rather rough guide. For instance, no distinction is made between foodstuffs within one group, for example between different fish species or different production methods (e.g. vegetable production from heated or unheated greenhouses).

The work published by Rose et al. (2019a) indicates a similar tendency: in the publication, US households were compared in terms of the **GHG emissions** of the foodstuffs consumed and set in relation to the **Healthy Eating Index** (HEI) (1st and 5th quintile), revealing that households with a lower GHG impact also had a more favourable HEI. However, the correlation in Rose et al. (2019a) is not as strong as that in van Dooren et al. (2017) because, for example, households with lower GHG emissions may consume fewer vegetables.

An even more generalised summary assessment conducted by the Italian company Barilla was relatively thoroughly discussed: it combined the well-established approach of a health-based food pyramid with an environmental pyramid, showing that the two assessment dimensions frequently lead to similar categorisations (Ruini et al. 2015). Only for products containing large amounts of sugar, such as cake, does the categorisation diverge considerably. Fruit and vegetables would have to be considered preferable both from a health and an environmental point of view. This integrative consideration is intuitive but very rough if, for example, different species of fish are not distinguished (cf. also the representation in Clark et al. 2019a).

The Food Climate Research Network's attempt to categorise certain **dietary patterns** in terms of their **health and environmental impact** (FCRN 2015) is similarly intuitive (Figure 5-9). The upper right-hand quadrant describes a dietary pattern that is desirable from a health and an environmental point of view. It is characterised by a high proportion of legumes and wholegrain products, the consumption of seasonal high-yield fruit and vegetables, a small proportion of animal products, the occasional consumption of certified fish as well as the prevention of food wastage, among others. The FCRN demarcates three globally prevalent dietary patterns and assigns them to certain world regions (developing, emerging and industrialised countries) and/or income groups (rich and poor people).

**Figure 5-9:** Four-quadrant matrix for the concise categorisation of dietary patterns according to health and environmental impact for country groups, adapted from FCRN (2015)



Source: FCRN (2015: Section 9.4.4), graphically adjusted.

The FCRN thus shows that the transformation challenges in the field of nutrition are very varied, depending on the region and on people's income. In a comparatively rich country such as Germany, the majority of the population is located in the bottom two quadrants (however cf. Section 4.2.3). For these people, one major control factor for a health-promoting diet with a globally acceptable environmental impact on the level of dietary patterns is reducing the consumption of animal products in favour of, for example, legumes, more wholegrain products, vegetables and nuts (top right-hand quadrant).

Finally, there are approaches that build on the assessments of foodstuffs and dietary patterns above, attempting to deduce detailed dietary recommendations in terms of key foodstuff groups. Particular attention has recently been given to the proposal by the **EAT-Lancet Commission**, which incorporated nutritional and environmental research results (Willett et al. 2019, cf. Table 5-12 and

Figure 5-10). It shows that the currently recommended daily intakes basically correspond to the recommendations made by the DGE (cf. DGE 2014); however, the recommended meat consumption is only roughly one quarter of the amount currently consumed in Germany. At 360 kg, the amount of milk equivalents (IFCN 2018)<sup>210</sup> consumed per person and year in Germany is also four times higher than the amount recommended by the EAT-Lancet Commission.

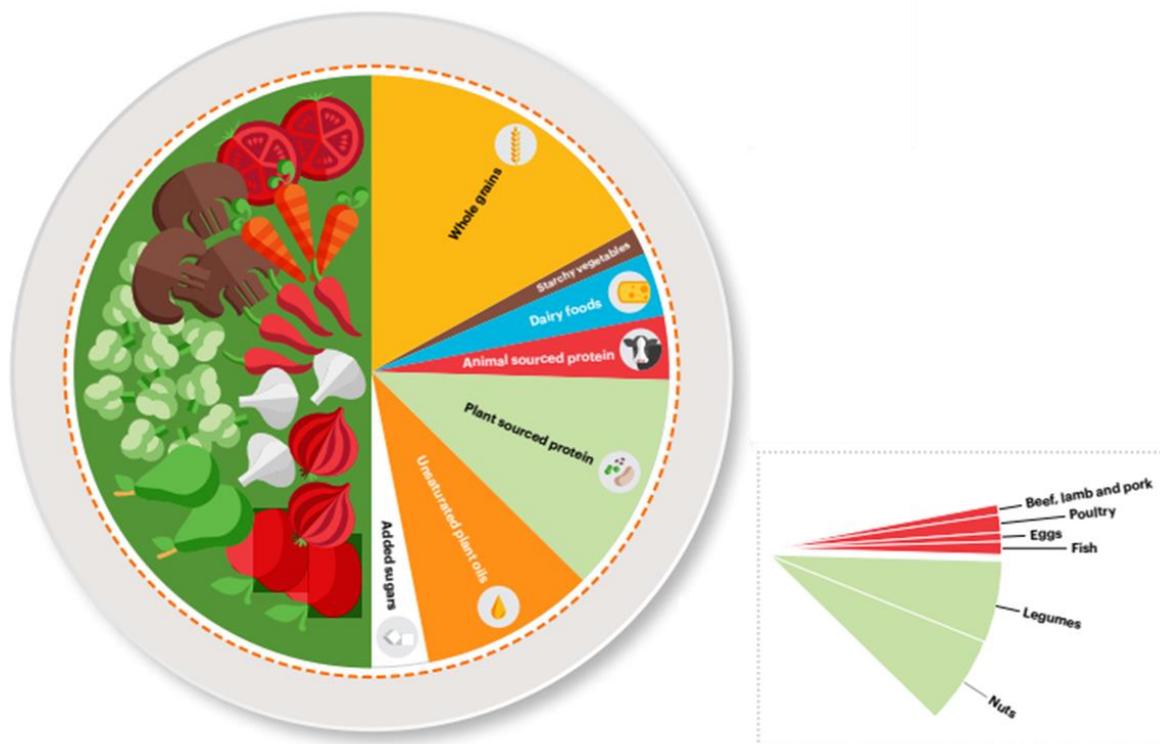
**Table 5-12:** Recommended amounts of food for achieving a health-promoting and environmentally sustainable diet (recommendations according to the EAT-Lancet Commission)

Foodstuffs	Grams per day	Range of variation
Cereals (rice, wheat, maize etc.)	232	max. 60 % energy
Potatoes	50	max. 100 g/day
Vegetables	300	200-600 g/day
Fruits	200	100-300 g/day
Milk/dairy products	250	max. 500 g/day
Animal protein, of which		
Beef, lamb	7	max. 14 g/day
Pork	7	max. 14 g/day
Poultry	29	max. 0-58 g/day
Eggs	13	max. 25 g/day
Fish	28	max. 100 g/day
Legumes, of which		
beans, lentils, peas	50	max. 100 g/day
Soya	25	max. 50 g/day
Peanuts	25	max. 75 g/day
Nuts	25	Not specified
Fats (unsaturated)	40	20-80 g/day
Sugar (all types)	31	max. 31 g/day

Source: Willett et al. (2019: 5).

<sup>210</sup> The unit of milk equivalents makes it possible to compare the amount of milk used to make a number of different dairy products; e.g. roughly 10 kg of milk are needed to produce 1 kg of hard cheese.

**Figure 5-10:** The recommended composition of meals for achieving a healthier and more environmentally sustainable diet (recommendations according to the EAT-Lancet Commission)



Source: EAT-Lancet Commission (2019: 9).

Some key statements can be deduced from this integrative assessment of the environmental and health dimensions:

- Although the approaches vary greatly in terms of methodology, the basic conclusion is the same: the dietary patterns recommended by various scientific societies from a nutritionist point of view (presented in Section 5.3.1: Healthy Eating Index, DASH diet, Mediterranean Diet, Nordic Diet) also do much better in environmental terms **overall** than the current dominant dietary patterns (Rose et al. 2019b). It would therefore be **environmentally advantageous to eat more healthily**.
- There are **partial conflicts of interests** between nutrition and environment: due to the efficiency of agricultural production, energy-dense starchy and sugary products only cause low GHG emissions (Drewnowski et al. 2015, Boehm et al. 2018). Sea fish is recommended by nutrition science but the world's oceans are already at their capacity limits. Increasing deep-sea fishing would only be environmentally meaningful to a very limited extent.
- For most environmental indicators, strategies for **increasing the proportion of fruit and vegetables consumed while decreasing the consumption of animal products** lead to considerable improvements; however, conflicts of interests may arise in the areas of water and land use,

and fruit and vegetable production can lead to high levels of nutrient leaching (Springmann et al. 2018).

While some work has already been published concerning the integrative analysis of environment and health, with important indications for sustainable dietary patterns and projects to be funded, there is still a lack of approaches that permit social issues and animal welfare to be taken into consideration.

Another limit of the studies currently available is the narrow focus on the greenhouse-gas footprint, meaning that other important environmental indicators are often disregarded. For the foreseeable future, there will be no way of using one summary indicator to communicate to consumers all of the sustainability dimensions on which this expertise is based.

### 5.3.6 Conclusion

Section 5.3 gives an overview of the options for assessing various foodstuffs, foodstuff groups and dietary patterns in terms of the sustainability dimensions of health, social issues, environmental protection and animal welfare. The approaches for measurements and assessments are at different stages of development in terms of the different dimensions.

- In nutrition science, the methodological challenge is to identify what are typically small effects.<sup>211</sup> Nutrition-related problems are usually not due to one single foodstuff; instead they usually concern entire dietary patterns. Additionally, different amounts and combinations of foodstuffs can have different effects, with different genetic dispositions also playing a role. Consumers face the additional problem that although the media – given the great interest shown by society – report abundantly on “healthy foods”, they usually seize upon scientific results based on their own publication mechanisms. This means that sometimes, only fragments of the scientific debate are communicated, and particular emphasis is given to contradictions. This makes it more difficult for consumers to assess the factual situation and adapt their actions accordingly.
- The social dimension is a particular weakness of the sustainability assessment of foodstuffs because there is a general lack of reliable data and no accepted methodology. At the heart of the debate are the Fairtrade label, with its focus on producer prices, and the ILO catalogue, which although relatively widely accepted has the problem that consumers cannot see whether a product complies with it.

---

<sup>211</sup> In other fields, for example in medicinal treatments, the range of variance in the sizes of effects is also small. For example, Leucht et al. (2012) assessed 94 meta-analyses and found a median effect of SMD = 0.37 for the 48 drugs and 20 medical diseases investigated, and of SMD = 0.41 for the 16 drugs included for eight psychiatric disorders. However, the impact effects are more easily isolated in this field than in the case of complex dietary patterns.

- In terms of assessing the environmental compatibility of foodstuffs, life cycle assessments are a conceptually convincing approach as these instruments attempt to illustrate all major environmental indicators along the entire value-adding chain. There are, however, four general problems regarding the practical application of LCAs for foodstuffs. These problems concern: 1) The inclusion of agriculture, with its multitude of stakeholders, spatially differentiated effects, and indirect land use changes. 2) There are insufficient differentiated standard data for agricultural processes. 3) There is a lack of methodological conventions when it comes to dealing with product specifics, e.g. the question as to what proportion of the environmental effects should be attributed to each product when assessing complementary products such as milk/beef 4) A consensus is needed on how different environmental dimensions can ultimately be made comparable (commensurable, cf. Section 2.7) These aspects have the effect that many stakeholders tend to increasingly concentrate on greenhouse gas balances (carbon footprints) – which is only one relevant environmental effect – because the methodology is more standardised in this field.
- There is a general consensus on the basic indicators of animal welfare, but not on their weighting. Many approaches in practice focus on the husbandry system, while scientific research is relatively unanimous in advocating a more comprehensive set of indicators that also consider animal health, animal behaviour, management and genetics.

In the face of these deficits that exist on the level of the individual dimensions, it is obvious that an integrative assessment – as is actually necessary – remains difficult. However, a growing number of studies show that the dietary patterns recommended for health reasons by various scientific societies (Healthy Eating Index, DASH diet, Mediterranean Diet, Nordic Diet) are for the most part also better for the environment than today's dominant dietary patterns (Rose et al. 2019b). It would therefore be environmentally advantageous to eat more healthily. However, some conflicts of interests also exist: for example, due to the efficiency of agricultural production, energy-dense starchy and sugary products – the consumption of which should be limited from a health perspective – only cause low GHG emissions (Drewnowski et al. 2015, Boehm et al. 2018). While some work has already been published concerning the integrative analysis of environment and health, which provide important indications for promoting sustainability in dietary patterns and regarding products that should be promoted, there is still a lack of approaches that also include social issues and animal welfare. Another **limit of the studies currently available is the narrow focus on the greenhouse-gas footprint.**

## 5.4 Community-supported agriculture, food co-ops, regional and direct marketing: assessment of “alternative food networks”

In order to increase the sustainability of our food, do we potentially need completely different food systems – different forms of agri-food production that are characterised by a close exchange with consumers? Current approaches such as community-supported agriculture, food co-ops, regional marketing and direct marketing are regarded and/or described in literature as alternative food systems. Are such systems pioneering a different food culture? Do they promote or lead to a greater appreciation of foodstuffs among their participants? Can this contribute to solving the great sustainability challenges? These and similar questions are at the core of a **social movement** that is being discussed in the pertinent literature under the terms of **alternative food networks/movement** (hereinafter abbreviated to **AFNs**)<sup>212</sup>. In scientific concepts, the discussion of such approaches usually takes place outside the classical agricultural and nutritional sciences.

The starting point is the term “**food system**”<sup>213</sup>, i.e. the entirety of all value-adding chains for foodstuffs, including their consumption in a previously defined area (e.g. a nation, a region) (HLPE 2014, Ericksen 2008, Schader et al. 2014, Jörissen et al. 2014). This term has recently gained more attention in classical agricultural and nutritional sciences (De Schutter 2017).

A comprehensive analysis of food systems can provide a useful framework for the investigation of links between societal needs, the associated natural and scientific processes for the fulfilment of needs and the resulting environmental consequences. However, such an analysis requires a deep understanding of the links between agricultural production methods, processing and marketing activities, and consumption behaviour and food consumption habits. Few attempts have been made so far to conduct comprehensive assessments of food systems (Allen et al. 2014, Esnouf et al. 2013, Marsden & Morley 2014, IOM & NRC 2015). In a way, this expertise can be viewed as an attempt to analyse the German food system and to ascertain what contribution politics can make to rendering this system more sustainable.

---

<sup>212</sup> German-language literature uses the English term “alternative food networks” while the German translation (“alternative Ernährungssysteme”) as an umbrella term is hardly used at all. This is why the English term is also used in the German original of this expertise.

<sup>213</sup> The FAO defines the term “food system” as follows: “A food system gathers all the elements (environment, people, inputs, processes, infrastructures, institutions, etc.) and activities that relate to the production, processing, distribution, preparation and consumption of food, and the outputs of these activities, including socio-economic and environmental outcomes” (HLPE 2014: 29).

The term AFN subsumes a multitude of production and marketing systems that can vary considerably.<sup>214</sup> According to Renting (2003), it describes regional production and (direct) marketing systems, organic farming<sup>215</sup>, community-supported agriculture<sup>216</sup>, food co-ops<sup>217</sup>, as well as fair trade systems. In recent times, additional concepts have been developed, e.g. urban gardening, communal gardens and (communal) food councils<sup>218</sup>.

According to Forssell and Lankoski (2015), what all these alternative food networks have in common is that they are primarily interested in sustainable development (instead of profit) and are defined by one or more of the following characteristics:

- a) Increased requirements for products and production processes, particularly – but not exclusively – in terms of **environmental compatibility and “naturalness”**
- b) **Short distances** between producers and consumers by focusing on regional products and short value-adding chains; in comparison to conventional systems, this means that information on products, production processes, producers and production location is usually more readily available in AFNs
- c) **New forms of marketing and business (operator) models**

Forssell and Lankoski (2015) note that not all holdings, groups or networks that view themselves as AFNs or are designated as such in literature fulfil all these characteristics to the same intensity. For example, an organic holding that retails its produce on the wholesale market fulfils only the first criterion while a conventional holding with direct marketing fulfils only the second criterion and a community-supported holding that does not make additional purchases fulfils all three criteria. This shows that the term AFN is under-conceptualised in scientific literature (Tregear 2011) and currently has little definition power.<sup>219</sup>

---

<sup>214</sup> The reality is that AFNs are part of the overarching food system but they deliberately set themselves apart from it by establishing separate value-adding chains in niches. Overall, this means that AFNs are less complex.

<sup>215</sup> In contrast to Section 5.2.2, in which the environmental impact of organic farming as a production system is discussed, it is here discussed as a form of AFN, i.e. as a deliberate societal counter-movement that is separate from “conventional” stakeholders.

<sup>216</sup> Defined as an association of agricultural or horticultural undertakings with a group of private households. Based on the estimated annual costs of agricultural production, this group pledges to prepay a (usually monthly) sum to the community-supported undertaking. In return, the clients receive the entire harvest as well as processed products such as bread, cheese etc. if the undertaking produces these (source: website of a German network for community-supported undertakings, “Netzwerk solidarische Landwirtschaft” <https://www.solidarische-landwirtschaft.org/das-konzept/>). A membership in a community-supported undertaking permits consumers to contribute to a higher income for producers and to share the entrepreneurial risk with them through their purchasing decision (cf. Section 4.3.3.1).

<sup>217</sup> Food co-ops are food-purchasing communities. Co-ops are usually set up by people who wish to purchase organic food-stuffs together in larger quantities on the wholesale market in order to achieve comparatively low prices.

<sup>218</sup> “Food councils” are associations on the town or municipality level made up of citizens, activists, local politicians and regional agriculture and business enterprises. The collaboration aims to ensure that the local food system contributes to urban development, improves citizens’ quality of life and is environmentally compatible. Cf. <http://ernaehrungsraete.de>.

<sup>219</sup> Forssell and Lankoski (2015) expressly mention that the question of what criteria a holding, group or network must fulfil in order to be viewed as a “real” AFN is a matter of controversial debate in literature. It is not, however, their intention to define AFNs; instead, they investigate which of the characteristics listed above have what potential for positive effects in terms of the various dimensions of sustainability.

This section will discuss whether and to what extent it is true that AFNs make positive contributions to certain (environmental, regional and/or alternative) production and retail structures – which is the aspiration of the public and parts of the scientific literature investigating AFNs. Due to the lack of definition and broad nature of the term AFN, this discussion can only refer to the major cause–effect interconnections that have been postulated. The question would be to what extent the characteristics listed above (a to c) have the potential to have a positive effect on the various sustainability dimensions. This section comprises a discussion of this issue in terms of the four sustainability dimensions discussed in this expertise.

**When it comes to the sustainability dimension of health**, many consumers believe in the following assumptions:

- a) Foodstuffs that are “natural” (unprocessed, free from additives) are “healthier” (cf. text box 10 “Consumer preferences for naturalness and their significance for sustainability policies” in Section 5.2.3)
- b) Production methods such as organic farming, which avoid the use of chemical plant protection products, hormones and to a large degree antibiotics, have positive health effects for producers and consumers (cf. Section 5.2.2.4)
- c) Foodstuffs that are only transported over short distances are fresher and therefore “healthier” (Born & Purcell 2006)

For the most part, however, these assumptions are incorrect (Edwards-Jones 2010). One exception comprises specific positive effects of short transports (i.e. criterion c): firstly, it is true that foodstuffs that are transported only for a short time<sup>220</sup> and in a cooled environment (ibid.) are fresher and may therefore exhibit a higher sensory quality and/or better taste. Secondly, it is also true that foodstuffs that are transported to consumers quickly permit certain business sectors (fruit, vegetables) to market varieties that have short shelf lives but excellent taste (e.g. tomatoes, Born & Purcell 2006). In the past, the sensory aspect was often neglected in vegetable production and breeding in favour of high yields (Hemmerling et al. 2016a). The most well-known example is the infamous watery-tasting tomatoes ascribed to production in Dutch greenhouses. There is a partial conflict of interests between yield and taste intensity. In light of this, some alternative suppliers have begun to reactivate old varieties as well as to offer unusual varieties. It is currently being investigated whether some of these may also contain more secondary plant ingredients. However, particularly large Dutch breeders and producers have put in a lot of development work in the past few years and improved the sensory quality of their products.

---

<sup>220</sup> The decisive factor here is the duration of the transport, not the distance. This means that foodstuffs that are transported over a long distance within a short period of time can be very fresh while the freshness of foodstuffs transported over short distances may suffer if their transportation to consumers nonetheless takes a relatively long time (e.g. due to inefficient logistics) (cf. Born & Purcell 2006).

**With regard to the sustainability dimensions of environment and animal welfare**, additional requirements for products and production processes are one aspect that has positive effects. Most AFNs operate according to the requirements of organic farming (Forsell & Lankoski 2015), which – as discussed in Section 5.2.2 – can have positive effects on the environment although this is not always the case. Another aspect is that small physical distances between production location / producers on the one hand and consumers on the other are associated with a reduction in food miles (compared with the status quo of food production outside AFNs). This is associated with positive environmental effects in literature (Forsell & Lankoski 2015). However, a reduction of food miles does not necessarily lead to a reduction in negative environmental effects: the means of transport (cf. Section 4.4.2.4) and the combination with seasonality are more decisive than the distance. Furthermore, such assessments disregard the fact that a reduction in the transport of foodstuffs conducted by producers and traders can involve additional mileage travelled by consumers. This is the case, for example, if consumers drive to “their farm” in the country every weekend in order to buy eggs or vegetables there. Such a car drive for the purchasing of individual products causes more negative environmental effects than would be caused by transporting the products to a central location to be sold or dispensed (cf. Section 4.4.3). Furthermore, ecologies of scale are likely to be exploited to a greater extent outside AFNs (cf. Section 4.4.2).

Closed nutrient cycles and added diversity in agriculture and landscapes are viewed as another potentially positive environmental effect of regional value-added chains (e.g. Wunder 2018). The argument here is that the consumption of regional products “automatically” implies the consumption of seasonal products and that this can have a positive effect on the GHG emissions of food. This conclusion is only valid, however, if regional products are not produced in greenhouses that are heated with fossil fuels – the heating of greenhouses thus makes it possible to circumvent the supposed automatism of “regional equals seasonal”. At the same time, such heating mechanisms are associated with high (product-based) GHG emissions (cf. Section 5.2.4).<sup>221</sup>

The link between animal welfare and regionality is not clear in many points, either. Regional production and slaughtering structures, however, do permit shorter animal transports – an aspect that is contained in many animal-protection labels. Studies have shown that long-duration animal transport is indeed a relevant animal-welfare factor, especially if stress factors such as a lack of water or feed, or high temperatures are added to this (Nielsen et al. 2011). However, the insights are not clear: it is likely that the quality of transport is more decisive (Rioja-Lang et al. 2019). Regional structures in combination with more visible livestock husbandry may, however, improve consumers’ understanding of animal keeping and promote a greater appreciation of animal-welfare products. There is no clear documentary evidence of this, however.

---

<sup>221</sup> The heating of greenhouses is not limited by the EU Regulation on Organic Farming but some organic farming associations do limit this practice further. For example, Bioland e. V. only permits greenhouses to be protected from frost in winter but not to be heated beyond that. There are exceptions for the cultivation of seedling plants such as potted herbs (Bioland e. V. 2019).

Furthermore, AFN holdings are usually quite small. Smaller holdings are usually viewed as preferable by society (cf. HBS et al. 2019: 21), and they are attributed positive environmental and animal-welfare effects compared with larger holdings (cf. Nowack et al. 2019). However, the assumption that smaller farms generally yield greater environmental and animal-welfare services of general interest per hectare of agricultural area or per animal is not supported by evidence (cf. Wuepper et al. 2020, Meyer-Hamme et al. 2016, Taube 2016, von Meyer-Höfer 2016, Ren et al. 2019, WBA 2015).

Overall, the positive environmental effects of AFNs are thus less clear than might be assumed from public debate.<sup>222</sup> The positive environmental effects become clearer if the consumption of products from AFNs is combined with a change in consumption patterns or contributes to such patterns; this is the case if consumers, for example, consume fewer animal products, or if they really do rely more heavily on seasonal products and on meat from better husbandry conditions, or if mutually reinforcing processes between producers and consumers develop. Whether and/or to what extent participation in AFNs contributes to such effects is discussed below under the heading “indirect effects of AFNs”.

**In terms of the sustainability dimension of social aspects,** it is believed that AFNs, through short value-adding chains, permit a large proportion of value creation to remain with the (primary) producers and that the great availability of information on products and production processes enables producers to obtain higher prices (Renting 2003). Furthermore, AFNs such as community-supported farms pass some of the economic risks on to the consumers, thus unburdening (the usually small) producers.<sup>223</sup> Many publications presuppose that increasing the value added by regional primary producers (and/or reducing these producers’ economic risks) is one of the objectives of sustainable development; however, it is not possible to justify this view based solely on an understanding of sustainable development that focuses on satisfying basic needs (cf. Section 2) – this requires additional reasons.

One aspect in favour of boosting regional value creation in rural areas is equitable distribution:<sup>224</sup> particularly in structurally disadvantaged rural areas, regional value creation can contribute to a convergence of living standards with those in structurally advantaged regions (conurbations). Corresponding policy objectives can be found on a national level in the Federal Government’s core

---

<sup>222</sup> With regard to GHG emissions cf. e.g. Edwards-Jones (2010).

<sup>223</sup> Community-supported farms are financed by a number of private households: at the beginning of a year, a monthly contribution is stipulated to bear the costs of the agricultural holding; in return, these households receive the holding’s harvest. The contribution is independent of whether the harvest ends up being good or poor. The risk of a poor harvest and/or crop failures is thus transferred from the producer to private households. It is not clear, however, whether consumers are really willing to remain members of a community-supported farm during/after a poor harvest. If members leave during/after a poor harvest, then the purported risk redistribution does not work (Feagan & Henderson 2009, Hinrichs 2000). It would also need to be investigated what long-term effects such an institutional arrangement – where farmers are paid irrespective of crop volumes – has, particularly against the backdrop of the considerable information asymmetries between producers and consumers.

<sup>224</sup> Compare these arguments to the discussion of the role of the fairness aspect in terms of the social dimension of agriculture in Sections 4.3.1 and 4.3.5.

principles for a nationwide funding system for structurally weak areas, in the Federal Government's demographic strategy and in the results presented by the committee for equitable living conditions; on an international level, such objectives are reflected in SDG 11a<sup>225</sup> as well as in UN-Habitat's activities on boosting urban–rural links.<sup>226</sup> However, it must be assumed that AFNs are primarily found in the richer outer regions of cities and not in peripheral, structurally weak regions. Furthermore, studies have shown that even producers in AFNs do not always earn appropriate incomes.<sup>227</sup> This can be due, for example, to the fact that direct marketing is personnel-intensive and that part of the costs of direct marketing – or even their entirety – correspond to the additional profits generated by AFNs (Jarosz 2008, Ilbery & Maye 2005, Milestad et al. 2010). Additionally, the distribution costs are often high in AFNs; for example when organic produce is marketed via individual and/or wholesale organic retailers and a total markup of roughly 70–80% is added – in comparison to discount stores, which operate at less than 20% (Spiller 2001).

From a social point of view, AFNs are criticised because the greater value creation for producers is in tension with calls for (low) food prices that would also allow low-income households to consume adequate quantities of high-quality food. With this in mind, the introduction of organic foods into the product range of discount stores has also been described as a democratisation of organic consumption (Spiller 2006). Based on this expertise, the WBAE views the objective of high-quality food for all (cf. Section 9.5) as an important sub-goal of a more sustainable nutrition system; however, it does not consider low food prices a suitable means of achieving this goal if said low prices come at the expense of sustainability in other dimensions. There is, however, obviously tension in this regard.

In addition to the direct effects of AFNs on health, environment and social aspects, the **indirect effects** on consumers participating in AFNs play an important role in assessing the contribution of AFNs to a more sustainable food system. These indirect effects include the increase in knowledge and awareness regarding sustainability-relevant effects of food production and consumption, a (resulting) change in attitude and appreciation of food, and ultimately modifications to eating habits and general consumption practices (Forssell & Lankoski 2015, Kropp & Stinner 2018, Wunder 2018). Forssell and Lankoski assume that these processes increase sustainability-boosting values and attitudes. As shown in Section 4.2, health-related effects of nutrition are not primarily dependent on how the products consumed are produced but on how much and what is eaten. Similarly, potential positive effects on the environment are particularly able to be realised when consumers simultaneously change their diets, i.e. consume fewer animal products or more seasonal products

---

<sup>225</sup> “Support positive economic, social and environmental links between urban, peri-urban and rural areas by strengthening national and regional development planning” cf. <https://www.un.org/Depts/german/gv-70/band1/ar70001.pdf>.

<sup>226</sup> Cf.: <https://unhabitat.org/books/implementing-the-new-urban-agenda-by-strengthening-urban-rural-linkages/>, <http://www.fao.org/urban-food-actions/knowledge-products/resources-detail/en/c/1144736/>.

<sup>227</sup> E.g. Brown and Miller (2008) concerning community-supported agriculture. A bachelor's thesis from 2015 also came to the conclusion that the remuneration of work was comparatively low on the community-supported farms that were investigated (Anschütz 2015).

(see above). Thus, if participation in AFNs indirectly affects how much and what consumers eat, then this participation is likely to have positive effects on health and the environment.

However, literature also shows that AFNs appeal primarily to consumers whose awareness of the negative effects associated with food production and consumption is already keen and whose willingness to change is already great – this could be viewed as a kind of self-selection bias, i.e. a form of self-reinforcing confirmation between producers and consumers (e.g. through producers and consumers experiencing self-efficacy). Thus, Hanson et al. (2019), for example, argue that in order to motivate low-income earners to participate in community-supported agriculture, their awareness of seasonality must be raised and their skills in handling fruit and vegetables improved. Thus, knowledge and skills in handling food are not viewed as a *result* but (also) as a *prerequisite* for participation in community-supported agriculture. In their empirical investigation of the situation in Germany, Kropp and Stinner (2018: 40) found that these initiatives usually appeal to an already well-educated, environmentally sensitised population group that is also active in other areas of civil society.

Indirect effects are also discussed in respect of the producers: In sustainability research, which is concerned with the far-reaching modification of systems (transformation), the role of outsiders to the sector developing innovations in market niches is discussed as an important element of sectoral transformation (“Sustainability Transitions”) (Geels 2004). Niche pioneers put (radical) innovations to the test, which – if successful – are then adopted by larger suppliers (the “regime”). According to the concepts of transformation research, these niche–regime interactions represent a major opportunity for breaking up unsustainable, solidified structures. Such outsiders to the sector are frequently necessary to break up blocked markets or path dependencies (Köhler et al. 2019). Transformation research assumes that sustainability innovations endanger the current business models of leading providers and therefore initially meet with rejection (see e.g. the energy transition and conventional electricity providers). It is therefore usually sustainability-motivated outsiders who first come up with new concepts, such as meat substitutes, urban gardening or community-supported agriculture. Meat substitutes are a good example of this path: The product ideas introduced to organic stores by small-scale companies years ago are now being taken up globally by large-scale enterprises and venture capital providers.

This does raise the question, however, whether such upscaling is easily possible in the case of AFNs. Among other aspects, AFNs are characterised by the small distance between producers and consumers, which is frequently (but not always: cf. e.g. fair trade) expressed through the more-or-less direct contact between these two groups (cf. characteristic b above). Such direct contact is only possible in small systems that do not comprise too many people. For this reason, it is not possible to randomly expand an existing AFN: it would then lose one of its major characteristics, i.e. the small distance. Against this backdrop, there is an intensive debate in organic farming concerning the “**conventionalisation**” of the sector (Best 2008, Darnhofer et al. 2010, Seidel et al. 2019). This means that the success of organic products on the market has led to the utilisation of structures and behavioural patterns that also characterise the conventional market:

- agricultural holdings are increasingly characterised by growth and specialisation; this is particularly hotly debated in organic laying hen husbandry, for example;
- many pioneering organic processing operations have been bought up; and
- the selective marketing system in which the large growers associations Bioland and Demeter used to only supply specialised organic stores has since been abandoned in favour of initially also supplying supermarkets and subsequently also discount stores.

On the one hand, this process permits agricultural holdings and producers to grow and benefit from the associated size advantages; these have contributed to the fast growth of the proportion of organic production in agriculture and in the sales of foods as well as to more cost-efficient production. On the other hand, this process is associated with a loss of traditional values as part of the “conventionalisation” concept (Best 2008).<sup>228</sup> Seidel et al. (2019) empirically investigated whether, over the course of time, organic farms in Germany became less consistent in following the principles of organic farming. They found weak evidence of conventionalisation as defined above.

Theoretically, the upscaling of AFNs could also be realised by increasing the frequency of individual small AFNs. This, however, requires there to be a sufficient number of people who are not only willing to participate in an AFN but are also sufficiently motivated to (co-) found an AFN themselves. The “take-over process” caused by large-scale enterprises as described in transformation research is more likely, however: in a market-based system, lucrative niches do not remain obscure for long, attracting capital-strong suppliers that attempt to propagate adapted (i.e. scalable) versions of pioneering ideas. One recent example of this is community gardens and urban gardening turning into mini greenhouses for indoor use at home and for supermarkets wishing to demonstrate exceptional freshness to their customers (Jürkenbeck et al. 2019). Through such processes, however, at least two of the characteristics of AFNs described above are lost: the primary motivation of sustainable development (instead of profits) and alternative marketing models. Potential positive effects of AFNs on health and the environment are brought about primarily through indirect effects, i.e. because participation in AFNs affects how much and what AFN consumers eat. Needless to say, the loss of the two characteristics, particularly of the primary motivation of sustainable development, negatively affects these indirect effects and therefore the potential of AFNs to contribute to increased health and more positive environmental effects.

---

<sup>228</sup> In his empirical investigation, Best (2008) found evidence that latecomers to organic farming are more strongly motivated by profit and that their environmental awareness is less strong than that of organic pioneers.

**Conclusion:** The discussion shows that many sustainability effects attributed to AFNs are not clear, particularly concerning the health and environment dimensions. Correspondingly, simple system-based recommendations for action such as “regional is first choice” (cf. Table 5-1 on dietary recommendations in Section 5.1) are problematic due to their general nature (Born & Purcell 2006). What the discussion does show, however, is that AFNs can contribute to a more sustainable food system both on the consumer side and on the producer side.

Sustainability research has presented a body of evidence supporting the assumption that the values, motivations and attitudes of stakeholders (producers and consumers) play an important role in the development of innovations (Kropp & Stinner 2018). The close interaction in AFNs does mean, however, that more prerequisites must be fulfilled both by producers and by consumers than is the case in the traditional food system, which is primarily characterised by a division of labour and specialisation. AFNs thus appeal only to certain groups of producers and consumers.

Politics should support AFNs as innovations<sup>229</sup> but keep in mind that useful sustainability innovations like AFNs will change their character if upscaled.

---

<sup>229</sup> An overview of existing funding measures is available at: [https://www.solidarische-landwirtschaft.org/fileadmin/media/solidarische-landwirtschaft.org/pdf/Veranstaltungen/Pr%C3%A4sentationen\\_fachtag/2017-01-24\\_SOLAWI.pdf](https://www.solidarische-landwirtschaft.org/fileadmin/media/solidarische-landwirtschaft.org/pdf/Veranstaltungen/Pr%C3%A4sentationen_fachtag/2017-01-24_SOLAWI.pdf).

## 5.5 Conclusion

Consumers are faced with a multitude of – often disparate – recommendations on how to eat more sustainably. In order to be able to systematically pursue the goal of greater sustainability in food consumption, decision-makers (politicians, consumers, entrepreneurs) need some kind of “compass” which both provides guidance and also permits systematic monitoring.

In science and society, the question of what constitutes a sustainable food system is discussed in relation to **different reference and assessment systems**. As illustrated in the introduction to Section 5, sustainability recommendations in effect draw on all of these levels. Some recommendations are concerned with consuming either more or less of a certain foodstuff or a food group (e.g. eating less meat). Other recommendations, which are socially well-established, refer to the consumption of certain product variants and therefore address the level of the farming system issues discussed in Sections 5.2 and 5.4 (e.g. eating more organic products). Furthermore, there are also recommendations for undertaking additional behavioural changes in the field of nutrition (e.g. avoiding food wastage). These different assessment levels address the relevant aspects of sustainable nutrition. For consumers, however, it is hard to identify and understand

- which of the many recommendations are clearly supported by scientific evidence,
- which of the useful recommendations supported by scientific evidence address particularly effective issues and which only make small contributions to sustainable nutrition, and
- whether a recommendation has a positive effect on all sustainability dimensions or whether there are conflicts of interests and/or differing degrees to which targets are met, which would make it necessary to weight targets.

Policies to promote sustainability in food consumption require an assessment of all sustainability dimensions, i.e. of the Big Four, and particularly the identification of conflicts of interests; this is, however, complex in terms of both methodology and content. It must be taken into consideration, however, that the existing assessment systems in the different sustainability areas are at different stages of development and that any statements derived have varying degrees of certainty:

- nutrition science has significantly advanced the methodological set of tools in the past few years. This enables sufficiently certain statements to be made on the level of food groups and some important foodstuffs in spite of the complexity of multi-causal issues, the long-term causal relations and the methodological limits.
- There are currently no methodologically reliable and valid attempts at summarising the social dimension of foodstuff production. This area is dominated by the Fairtrade label, with its focus on producer prices, and the ILO catalogue, which – although relatively widely accepted – has not yet been developed further into an assessment model.
- Environmental science has developed an accepted measurement technique in the form of life cycle assessments, but this needs significant further standardisation and, in order to improve

implementability, better data stocks. While CO<sub>2</sub> equivalents are an accepted weighting instrument for climatic impact, meaning that the calculation/quantification of CO<sub>2</sub> footprints is increasingly practicable and that climate balances are now available for many food groups, the aggregation of other environmental parameters is suffering from the lack of an accepted standardisation method. It is also difficult to include small-scale agriculture (i.e. a large number of the holdings) and its varied regional effects.

- There are a number of pragmatic assessment methods for the issue of animal welfare – originating from attempts to create a labelling system – which still need further development but generally appear capable of reaching consensus.

Against this backdrop, it is clear that the attempts outlined in this Section to achieve an integrated assessment of farming systems, foodstuffs and dietary patterns across all sustainability dimensions still have some weaknesses. Policy concepts for sustainable eating also face the task of deriving a **manageable number of recommendations for action** from the results outlined here. This is not easy due to uncertainties regarding assessment and conflicts of interests. For each recommendation, there are at least a few individual counter-examples and/or limitations relating to certain dimensions, spheres of action or (individual) situations. In a media landscape fixated on news, this leads to controversial reporting (e.g. low fat vs low carb, avocados as a meat substitute) that does not provide any useful orientation to consumers.

If consumers are to play a role in promoting sustainability in food consumption – and Section 6 below discusses why this is sensible and necessary – then they require **sound and manageable information**. Against this backdrop and based on Sections 3–5 of this expertise, the WBAE attempts to assess the widespread dietary recommendations listed in Table 5-1 in terms of whether they have positive (or negative) effects on the Big Four and how pronounced these effects are. During the course of this, in the WBAE's view, it becomes apparent that despite all limitations, a number of important recommendations can be made – but also that the recommendations for sustainable eating dominating the public debate are sometimes too general and sometimes not useful for all four sustainability dimensions.

Tables 5-13 to 5-15 shown below therefore draw upon the widespread recommendations introduced in Section 5.1 (cf. Table 5-1)<sup>230</sup> and – in a greatly simplified manner – summarise the assessments according to the current state of knowledge.<sup>231</sup> This results in a qualitative assessment of the dominant causal relations (Does a recommended action have a positive or negative effect on the relevant sustainability dimension?) and the strength of the effect (How great is the effect on the relevant sustainability dimension?).

- **Estimation of causal relations:** The causal relation between the recommended actions (rows) and the sustainability dimensions (columns) is estimated and gradated in a very simplified manner. A **green circle** symbolises that the dominant causal relation is positive (e.g. consuming fewer animal products has a positive effect on the environmental dimension, cf. Table 5-13), a **red circle** means that the dominant causal relation is negative, and a **red-and-green circle** indicates that there is no dominant causal relation, i.e. that there are both positive and negative effects, which in turn means that there are conflicts of interests within a sustainability dimension. For example, nuts usually exhibit low GHG emissions but, in arid regions, the high water consumption caused by nut cultivation is problematic. When it comes to the recommendation to consume more nuts, there are therefore conflicts of interests in terms of the environmental dimension relating to climate and water consumption (cf. Table 5-13). A **question mark** symbolises that, in the WBAE's view, there is insufficient evidence for a clear causal relation, with

---

<sup>230</sup> In comparison to the recommendations listed in Table 5-1, the following differentiations were made: 1) The recommendation to eat less meat or go vegan is differentiated in Table 5-13 into "less meat and fewer meat products" and "less milk and fewer dairy products". 2) The recommendation to "eat healthily", which refers to recommendations such as those made by the DGE (cf. Section 4.2.1) is differentiated in Table 5-13 into "more fruit and vegetables", "more fish", "more nuts" and "more pulses". 3) The recommendation to prefer seasonal products is made in combination with the recommendation to prefer regional products by the Council for Sustainable Development and the WWF ("seasonal and regional"/"regional and seasonal") and is therefore described in Table 5-14 in the sense of seasonal and regional products, i.e. products from Germany and neighbouring countries. 4) The recommendation "no GMOs" by the Council for Sustainable Development and Tegut refers to the BMEL's "GMO-free" label (cf: [https://www.bmel.de/DE/Ernaehrung/Kennzeichnung/FreiwilligeKennzeichnung/\\_Texte/OhneGentechnikKennzeichnungHG\\_Informationen.html](https://www.bmel.de/DE/Ernaehrung/Kennzeichnung/FreiwilligeKennzeichnung/_Texte/OhneGentechnikKennzeichnungHG_Informationen.html)). The recommendation "no genetic engineering in agriculture" listed in Table 5-14 additionally refers to the genetic engineering of animals in its assessment (referring to animal welfare). 5) The recommendation to "take animal-welfare aspects into account" refers to eggs in the case of the Council for Sustainable Development and to meat in the case of the WWF. In Table 5-14, this recommendation refers to all animal products. 6) The recommendations to "cook at home" made by the Council for Sustainable Development and "shop smartly" made by the WWF comprise a conglomerate of sometimes heterogeneous aspects referring to the purchasing, selection and preparation of foodstuffs. Purchasing and selecting foodstuffs are already addressed by other recommendations (e.g. "regional products"). The recommendation to "cook at home and eat together (commensality)" listed in Table 5-15 therefore focuses on food preparation and additionally includes joint meals (commensality; cf. also Section 3.3.4).

<sup>231</sup> This also concerns the discussion and assessment of the price effects of some of the recommendations for action: the consumption of fair-trade or organic products, for example, usually leads to higher expenses for foodstuffs. This is why, from the perspective of low-income population groups, the recommendation to buy more organic or fair-trade products must be viewed as negative in relation to the social sustainability dimension. In view of existing income restrictions, the recommendation to eat sufficient amounts of healthier and more varied foods is emphasised for this group, as demonstrated in Section 4.2.3. For people not affected by income poverty, higher food expenses are not necessarily negative from a social point of view. In contrast, they can even be viewed as a positive influence since they could lead to more conscious handling and possibly even greater appreciation of foodstuffs (see Section 7.5.2 on the steering effects of price incentives). Recommendations which, when implemented, lead to higher expenses for foodstuffs are not assessed in terms of the social dimension in Tables 5-13 to 5-15 below. Price effects are only indicated if it can be assumed that adapting consumption to comply with the relevant recommendation for action would lead to clearly discernible savings. In the WBAE's view, this also fully applies to the two recommendations to "avoid food wastage" and "drink tap water" (Table 5-15).

the background colour of the question mark indicating a potential tendency. For example, the 2019 update of the MSC standard included the prohibition of child and slave labour in this label. However, it is as yet unclear how (successfully) this prohibition is actually implemented (designated with a question mark, cf. Table 5-14). If the prohibition is implemented (successfully), then the effects of selecting MSC products is positive in terms of the social dimension (green circle as a background of the question mark, cf. Table 5-14). **“No interaction”** indicates that an action is not relevant, i.e. has no effects on that particular sustainability dimension. For example, the consumption of Fairtrade-labelled products (cf. Table 5-14) has no effect on animal welfare since the Fairtrade label is not assigned to animal products, with the exception of honey.

- **Estimation of the strength of the effect:** Any qualitative estimation of the strength of effects, i.e. of the extent to which a recommended action contributes to achieving the relevant target dimension, is conducted in three gradations: small, medium and large, symbolised by the size of the circles.

Table 5-13 firstly focuses on the group of recommendations addressed at the level of foodstuffs and food groups.

**Reducing the consumption of animal products** can be recommended more clearly from the point of view of environmental protection, climate stewardship and animal welfare than it can from a health perspective. Globally viable food consumption would halve the consumption of meat and dairy products in Germany – or reduce it even further (Röös et al. 2017, Willett et al. 2019). From an environmental point of view, vegetarian and vegan diets would be preferable due to processing losses. If a large part (majority) of the German population – i.e. a lot more than the current 1% of the population – were to follow vegan diets, however, this could be detrimental to biodiversity and the grassland sites that are key to nature conservation. From a health perspective, those following a vegetarian diet need to pay careful attention to how foods are combined in order to avoid nutritional deficiencies – and those following a vegan diet even more so. This applies particularly to vulnerable groups such as young children, pregnant and breastfeeding women and elderly people. Alternative sources of iodine and iron must be factored in. Those following a vegan diet require vitamin B12 supplements in any case and should ensure regular medical attention. What can be recommended, however, is a heavily plant-oriented dietary pattern. It must be stressed that, according to the WBAE’s assessment, the current environmental politics discussion is too focused on meat and meat products. In light of the significant greenhouse gas emissions of dairy farms, the discussion should include dairy products and cheese. For example, the health-based recommendation to consume fermented milk products (cf. Section 4.2) must be questioned from a climate-policy perspective. This reveals conflicts of interest. Overall, the WBAE recommends including milk and dairy products in the environmentally based recommendation to reduce the consumption of animal products.

**More fruit and vegetables** from a health perspective, this recommendation must clearly be viewed as positive, but from an environmental point of view has to be considered in a more differentiated manner. Vegetables grown in greenhouses heated with fossil energy cause 5–30 times the greenhouse gas emissions that vegetables grown in open fields or unheated greenhouses do. At the same time, the constant availability of a wide variety of vegetables also contributes to a health-promoting diversity in food consumption. Sustainability potentials in this area are present in seasonal consumption and innovative, energy-efficient production systems using renewable energy sources.

In addition to the recommendations that are usually at the forefront of discussions, there are further, primarily health-motivated, recommendations that refer to the consumption of certain food-stuffs, for example consuming **more fish, nuts or pulses** (cf. Section 4.2.1 and Table 5-13). The effects of such consumption changes are unclear with regard to the social dimension. From an environmental perspective, the assessment of the recommendation to consume more fish must be differentiated: marine fishery and various forms of aquaculture must be distinguished. Salmon, as well as small and large shoaling fish, almost universally have smaller climate impacts than meat; in aquaculture, extensive pond farming and open-water net cage systems are more climate-compatible than on-shore recirculating systems. However, the latter do better in terms of water emissions. The differences between the production forms are large, and the data situation quite unclear. The consumption of sea fish is already reaching global capacity limits. Increasing the consumption of nuts has both advantages and disadvantages from an environmental point of view. In contrast, an increased consumption of pulses has positive effects on the environmental dimension.

**Table 5-13:** A summarised and heavily simplified assessment of socially widespread recommendations for action that recommend eating either more or fewer products from a certain food group in the interests of more sustainable food consumption

Recommendation for action	Qualitative estimation of the dominant effect and effect strength in terms of the four sustainability dimensions			
	Health	Social Aspects	Environment	Animal Welfare
Fewer animal products: Meat and meat products	 Generally meaningful, particularly red meat and meat products (sausage).  (cf. Sections 4.2 and 5.3.1, Table 5-6)	 Poor evidence base and small effects due to global markets, indications of problematic working conditions, large economic relevance for agriculture.  (cf. Sections 4.3 and 5.3.2)	 Very large climate impact with differences between animal species, reduction of nutrient flows advantageous, (in the case of ruminants, however, the nature conservation advantages of grazing and pastoral farming should be maintained).  (cf. Sections 4.4 and 5.3.3)	 No effect on the husbandry conditions under which meat is produced. However, many animals are kept under problematic conditions. Keeping fewer animals is therefore expected to result in less animal suffering and permits a strategic reorientation of the sector towards greater animal welfare ("less and better").  (cf. Section 5.3.4)
Fewer animal products: milk and dairy products	 Generally meaningful; if following a vegan diet, nutrient supply must be managed and critical nutrients supplemented.  (cf. Sections 4.2 and 5.3.1, Table 5-6)	 Poor evidence base; indications of problematic working conditions (slaughtering), large economic relevance for agriculture.  (cf. Sections 4.3 and 5.3.2)	 Very high climate impact; however, it is important to maintain environmental protection advantages of pasture farming and grazing.  (cf. Sections 4.4 and 5.3.3)	 No effect on the husbandry conditions under which meat is produced. However, dairy cattle are frequently kept under problematic husbandry conditions. Keeping fewer dairy cattle is therefore expected to result in less animal suffering and permits a strategic reorientation of the sector towards greater animal welfare ("less and better").  (cf. Section 5.3.4)
More fruit and vegetables	 Increased consumption of fruit and vegetables is, generally speaking, very beneficial for health reasons.  (cf. Sections 4.2 and 5.3.1)	 Overall unclear and little evidence; on the one hand: higher demand for workers and higher agricultural incomes for speciality crops, on the other hand: sometimes indications of problematic working conditions.  (cf. Sections 4.3 and 5.3.2)	 Comparatively low climate change impact but water-intensive; danger of nitrate leaching; it is important to reduce the use of energy-intensive greenhouses heated with fossil fuels and to reduce the consumption of goods carried by air.  (cf. Sections 5.3.3 and 5.2.4)	Not relevant

Note: green circle = positive interaction; red circle = negative interaction; red-and-green circle = no dominant effect direction; ? = lack of evidence; rough differentiation of three effect strengths (small, medium, large) symbolised by the size of the circles.

Source: WBAE illustration.

**Table 5-13:** A summarised and heavily simplified assessment of socially widespread recommendations for action that recommend eating either more or fewer products from a certain food group in the interests of more sustainable food consumption – **continued**

Recommendation for action	Qualitative estimation of the dominant effect and effect strength in terms of the four sustainability dimensions			
	Health	Social Aspects	Environment	Animal Welfare
More fish	 From a health perspective generally to be recommended because fish is a high-quality source of protein and provides n-3 fatty acids, vitamin A and D and simultaneously has a low fat content.  (cf. Sections 4.2 and 5.3.1)	 Indications of problematic working conditions in some marine fisheries.  (cf. Section 4.3)	 Differentiation to be made: Fishing of salmon and shoaling fish usually has lower environmental impact than meat but global capacity of sea fish is almost exhausted. In aquaculture, extensive pond farming and net cage systems in open water are more climate-friendly than recirculation systems on land; however the latter do better in terms of water emissions.  (cf. Section 5.3.3.2)	 The fact that fish have a capacity for suffering is increasingly recognised by the scientific community. Consuming more fish potentially means more animal suffering in certain types of aquaculture as well as due to the killing of fish (aquaculture and sea fish).  (cf. Section 5.3.4)
More nuts	 From a health perspective generally to be recommended due to the comparatively high proportion of polyphenols and fibre as well as a favourable fatty acid pattern.  (cf. Sections 4.2 and 5.3.1)	 Working conditions are insufficiently investigated, some indications of problematic areas but also export opportunities for developing countries.  (cf. Section 4.3)	 Nuts usually cause low to medium GHG emissions, but there are problematic production methods in some growing areas (high water consumption in arid areas)  (cf. Section 5.3.3)	Not relevant
More legumes	 From a health perspective to be recommended since legumes are important sources of plant protein and contain a wide range of minerals such as potassium, calcium, magnesium and iron.  (cf. Sections 4.2 and 5.3.1)	 Working conditions are insufficiently investigated and likely to be very varied, depending on type and growing area; in case of soya for human consumption: some problematic working conditions and land displacements in connection with soya cultivation in South America.  (cf. Section 5.2.4)	 Comparatively low GHG emissions, nitrogen fixing, improvement in crop rotation; in case of soya for human consumption: problematic, monotonous crop cycles (soya - maize - soya) in parts of South America.  (cf. Sections 5.2.4 and 5.3.3.2)	Not relevant

Note: green circle = positive interaction; red circle = negative interaction; red-and-green circle = no dominant effect direction; ? = lack of evidence; rough differentiation of three effect strengths (small, medium, large) symbolised by the size of the circles.

Source: WBAE illustration.

The recommendations summarised in Table 5-14 below concern product variants and therefore usually production types (farming systems).

**Organic products** The societal discussion on sustainable food, along with the sustainability goals set by the Federal Government and many of the federal states, are dominated by boosting organic farming. This is manifested in the recommendation to prefer organically farmed products over products from conventional farming systems. The WBAE views organic farming in a differentiated manner: when it comes to the various sustainability aspects, an overview of all studies illustrates that organic farming has considerable strengths as well as weaknesses, and that these can vary depending on the location and the type of the holding. One clear strength of organic farming is the positive environmental effects (relating to certain environmental goods such as lower nutrient and pesticide leaching, and biodiversity). One clear weakness is the lower yield – against the backdrop of a growing world population and the problems of land use changes, this is problematic. Due to these low yields, organic farming to a large degree has no systematic product-based advantages over conventional agriculture in terms of climate effects. Overall, the WBAE recommends organic farming as one element of greater sustainability in food consumption – and even more so the more the consumption of organic products goes hand in hand with a reduction in the consumption of animal products and a reduction of food losses. This positive assessment of organic products must regularly be reviewed with regard to whether a further growth of organic farming may eventually cause the negative environmental effects to outweigh the positive effects (e.g. through indirect land use effects). Such a review could be conducted, for example, once organic farming has reached the political target of 20%.

In the long term, however, the dichotomy between “organic” and “conventional” is not expedient. Farming systems that are more sustainable than organic farming as it is currently defined are generally conceivable, particularly with a global perspective. These must be developed politically and then made identifiable to consumers. In the meantime, there are a number of reasons why organic products belong in a sustainable shopping basket.

**Regional and seasonal consumption** Many other recommendations, the implementation of which the public would view as a contribution to more environmentally compatible food consumption, are assessed in a more differentiated manner by the WBAE. This particularly concerns regionality. Regional foodstuffs are frequently viewed as more environmentally compatible by the public due to the short transport distances. This advantage is only clear, however, in comparison to air-freight transport and to very long lorry transports. In many cases, the efficiency advantage of large-scale production plants compensates the transport advantages of regional produce. Regional seasonal vegetables (e.g. from open-air farming) are environmentally friendly, while regional vegetables from greenhouses heated with fossil energy perform poorly compared with open-air produce from the Mediterranean area. Thus, regionality may be environmentally preferable but this is not necessarily always the case. If regional production is based on lower yields, then potential indirect land-use effects must be anticipated as well. Correspondingly, simple system-based recommendations for action such as “regional is first choice” are problematic due to their generalised nature.

This applies all the more because regionality causes a clear halo effect: many consumers (sometimes incorrectly) view regional products as not only environmentally favourable but also as more sustainable. However, as Table 5-14 illustrates, the effects of the consumption of regional seasonal products in respect of the other sustainability dimensions are unclear. In terms of the environmental dimension, products that are both seasonal and regional do have clear advantages.

A large share of “alternative food networks” (AFNs) also focus on regionality; these networks include producers and consumers that interact in the form of community-supported agriculture or food co-ops. In contrast to the criterion of regionality, the aspiration of AFNs refers to the entire value-adding chain. As is the case for regionality, the positive effects on the environment of AFNs are less clear than societal debate would suggest. The discussion does show, however, that AFNs can contribute to a more sustainable diet both on the consumption and on the production side due to direct and indirect effects. AFNs introduce innovation impetus to a market that has been characterised by a heavy price orientation for decades. Similarly to what was described for organic farming, such niches are important – not least in order to break up blocked sectors and path dependencies on the production side and to boost the sustainability of lifestyles on the consumer side.

**GMO-free** In addition to the consumption of organic products, many sustainability recommendations (cf. Section 5.1) also advocate avoiding genetic engineering. A blanket, fundamental categorisation of genetic engineering as unsustainable is, however, unwarranted according to today’s scientific knowledge. The principal rejection or limitation of importing feedstuffs (e.g. **soya**) or using **glyphosate** is also too generalised. In contrast, the WBAE views the criticism of certain production methods that use genetic engineering and glyphosate in a non-sustainable manner as clearly justified (cf. Section 5.2.4). It is currently hardly possible for consumers to reflect this degree of differentiation in their purchasing behaviour because there is a general lack of pertinent information on the market. In addition, due to leakage effects, relevant certification systems (RTRS, RSPO for **palm oil**) are only effective to a limited extent and virtually unknown to consumers (Section 5.2.4).

**Rainforest Alliance** The recently merged certification systems UTZ and Rainforest Alliance achieve high market shares similar to those of MSC for sea fish but appear to only lead to small positive effects on the environmental and social dimensions. The data stock is uncertain due to the small number of existing studies. These labels are little-known among consumers.

**Table 5-14:** A summarised and heavily simplified assessment of socially widespread recommendations for action that recommend preferring certain product variants, the production of which is viewed as more sustainable

Recommendation for action	Qualitative estimation of the dominant effect and effect strength in terms of the four sustainability dimensions			
	Health	Social Aspects	Environment	Animal Welfare
Organic products	<p style="text-align: center;">?</p> <p>Organically farmed products are not systematically “better” from a health perspective but there are usually lower pesticide residues and there are indications of increased micronutrient contents.</p> <p style="text-align: center;">(cf. Section 5.2.2.4)</p>	<p style="text-align: center;">●</p> <p>Generally slightly higher incomes in the organic sector. Less pesticide exposure of workers. Higher labour requirements, which has a positive effect in areas with high rural unemployment. Potential for integration of people with disabilities (socially responsible agriculture). Additional social criteria for private standards.</p> <p style="text-align: center;">(cf. Sections 4.3, 5.2.2.5, 5.2.2.6 and 5.4)</p>	<p style="text-align: center;">●●●</p> <p>Many positive environmental effects on the land, but due to lower yields per hectare not systematically better on a product basis. If the market share increases considerably, then negative land-use changes abroad will ensue unless diets change at the same time. Farming systems that are more sustainable than organic farming are conceivable and meaningful.</p> <p style="text-align: center;">(cf. Section 5.2.2.3)</p>	<p style="text-align: center;">●●●</p> <p>Husbandry conditions in organic farms promote animal behaviour and emotional well-being (exception: micro-farms with exemption rules, e.g. tethering); animal health not consistently better.</p> <p style="text-align: center;">(cf. Section 5.2.2.3)</p>
Regional products	<p style="text-align: center;">?</p> <p>Regional product origin is not an indicator for health; however, in the case of lettuces and vegetables, short value-creation chains permit a high degree of freshness.</p> <p style="text-align: center;">(cf. Section 5.4)</p>	<p style="text-align: center;">?</p> <p>Potential for increased value creation in the region; whether this is desirable from a national economy perspective remains controversial. Loss of positive effects of trade if the market share were to increase significantly; indirect effects through added appreciation of foods and food production possible but unclear.</p> <p style="text-align: center;">(cf. Section 5.4)</p>	<p style="text-align: center;">?</p> <p>Regional product origin is not a good environmental indicator; greenhouses heated with fossil energy cause high GHG emissions. Lower GHG emissions if regional and seasonal are combined; when shopping and in case of regional delivery, attention must be paid to the efficiency and capacity use of the means of transport. If regional yields are lower, then a significant increase in the market share can cause negative land-use effects.</p> <p style="text-align: center;">(cf. Sections 5.3.3.2 and 5.4)</p>	<p style="text-align: center;">?</p> <p>Regional rearing and slaughtering permit shorter animal transports; if regionally produced animal products are offered, these usually originate from housing types with higher animal welfare requirements, possibly leading to consumers’ greater appreciation of animal welfare (products).</p> <p style="text-align: center;">(cf. Section 5.4)</p>
Seasonal, local products (from Germany and neighbouring countries)	<p style="text-align: center;">?</p> <p>Unclear; consistently purchasing seasonal products limits the variety that is beneficial in winter but may indirectly – through increased appreciation – increase the variety of products consumed in summer.</p> <p style="text-align: center;">(cf. Section 5.2.4)</p>	<p style="text-align: center;">?</p> <p>Indirect effects through greater appreciation of foods possible but unclear.</p> <p style="text-align: center;">(cf. Section 5.4)</p>	<p style="text-align: center;">●</p> <p>When fruit and vegetables are in season in Germany, then products from nearby are usually better than those transported by lorry or ship. In this case, the distance is also relevant, i.e. a long lorry transport from southern Europe significantly influences the GHG balance of fruit and vegetables.</p> <p style="text-align: center;">(cf. Sections 5.3.3.2 and 5.4)</p>	<p style="text-align: center;">●</p> <p>Not relevant</p>

Note: green circle = positive interaction; red circle = negative interaction; red-and-green circle = no dominant effect direction; ? = lack of evidence; rough differentiation of three effect strengths (small, medium, large) symbolised by the size of the circles.

Source: WBAE illustration.

**Table 5-14:** A summarised and heavily simplified assessment of socially widespread recommendations for action that recommend preferring certain product variants, the production of which is viewed as more sustainable – **continued**

Recommendation for action	Qualitative estimation of the dominant effect and effect strength in terms of the four sustainability dimensions			
	Health	Social Aspects	Environment	Animal Welfare
No genetic engineering in agriculture	To date, no scientific evidence of health risks posed by GMOs, but also no GMOs with health advantages available.  (cf. Section 5.2.4)	 Effects are potentially multifaceted (changing procurement sources regarding seeds, economic advantages, dependencies) and unclear. Avoidance of GMOs within the EU presents a danger to competitiveness in the long term.  (cf. Section 5.2.4)	 No known direct negative environmental effects; Efficiency increases and resistance breeding permit environmental benefits but in some cases, non-sustainable production methods are promoted.  (cf. Section 5.2.4)	 Depending on breeding objectives, genetic engineering can lead to increased or decreased animal welfare; traditional genetic methods in animal breeding show little success; the use of novel methods is much more complex in animals than it is in plants. (cf. Section 5.2.4)
Rainforest Alliance/UTZ	 Whether pesticide residues can be reduced to a level that is relevant for health has not been investigated. (cf. Section 8.9.2)	 Uncertain data basis; small positive effects per tonne, if any, with large market share.  (cf. Sections 5.2.3 and 8.9.4)	 Uncertain data basis; small positive effects per tonne, if any, with large market share.  (cf. Sections 5.2.3 and 8.9.2)	Not relevant (only plant-based products are labelled)
MSC label (fish)	Not relevant	 Since the 2019 revision, the standard now includes the prohibition of child labour and slavery; implementation still open. (cf. Section 5.3.2)	 Clear assessment of the overall impact is currently impossible; small positive effects per tonne, if any, with large market share. (cf. Section 5.3.3)	 Animal Welfare of marine fish to be achieved through ecosystem conservation; data basis uncertain. (cf. Section 5.3.4)
Fairtrade label	Not relevant	 Primarily positive effects on the participating small-scale farmers; clear assessment of effects on plantation labourers impossible; signalling effect on retail sector. (cf. Sections 4.3.4 and 5.3.2)	 The Fairtrade label comprises some environmental standards but little research has been conducted into its effects.  (cf. Sections 4.3.2 and 8.9.2)	Not relevant (animal products are not labelled, except for honey)
Animal Welfare consideration	Not relevant  (cf. Section 5.3.4.2)	 Increased animal welfare has positive effects on workers' job satisfaction in animal husbandry; higher animal-welfare standards require more labour-intensive animal care, which creates employment opportunities; this has a positive effect in areas with high rural unemployment. (cf. Section 5.3.4.2)	 Extensive pasture grazing leads to environmental protection advantages, but can be contrary to climate stewardship goals; open stalls are currently being investigated scientifically.  (cf. Sections 5.2.2.3 and 5.2.4)	 Increased demand for animal-welfare products promotes a transition in animal husbandry.  (cf. Sections 4.5, 5.2.4 and 5.3.4)

Note: green circle = positive interaction; red circle = negative interaction; red-and-green circle = no dominant effect direction; ? = lack of evidence; rough differentiation of three effect strengths (small, medium, large) symbolised by the size of the circles.

Source: WBAE illustration.

**MSC label** The international Marine Stewardship Council (MSC) label has attained widespread distribution for labelling sustainable fishing; it aims to secure minimum standards and therefore does not go far beyond legal regulations and sector practices. For the most part, positive effects are observed, but the suitability of the MSC label as a sign of environmentally compatible, stock-conserving fishery is a matter of controversial debate in literature and is hard to verify – partly due to the fact that it takes place on the high seas. The effects of the social criteria (the MSC recently added minimum social standards to the certification) cannot be evaluated yet.

**Fairtrade label** In the food trade, the Fairtrade label is the only sufficiently well-known label that permits consumers to make conclusions on socially acceptable production. Studies have shown the positive effects of the Fairtrade label on small-scale farmers in developing countries but not generally for employed farm workers on these small farms. The Fairtrade label also includes some environmental standards that were expanded in 2019. Studies on the environmental effects of this standard have indicated some positive effects (cf. Section 8.9.2). The Fairtrade label disproportionately labels luxury foods and confectionery, which can cause negative health halo effects in terms of how these products' effects on health are estimated (cf. Section 3).

**Animal welfare** As explained in detail in the WBAE's expertise on livestock husbandry (WBA 2015), when it comes to livestock farming, the WBAE advocates the expansion of livestock systems to allow the animals access to various climate zones, preferably an outdoor climate, and to various functional areas with different floor coverings as well as sufficient space and enrichment activities. With regard to animal-protection aspects and despite some conflicts of objectives, the consumption of products from more extensive livestock systems such as pastoral farming, free-range farming, outdoor-climate stalls etc. is an important element of sustainable food consumption. The WBAE sees the greatest animal welfare problems among intensively kept pigs, poultry and beef cattle and only to a lesser extent among dairy cows. This means that from an animal welfare point of view, it is advantageous to consume animal proteins in the form of milk, dairy products and extensively farmed beef. The climate-protection perspective, however, reveals one of the greatest conflicts of interests in this field: the higher feed conversion ratio is an argument for the consumption of fish, poultry and pork products. This conflict, however, can be solved by a reduced overall consumption of animal proteins. There is currently a considerable dynamic in Germany in the labelling of various products, with the private sector introducing a label established by the Initiative Tierwohl (Animal Welfare Initiative), German grocery retailers launching a label denoting type of husbandry, the German Animal Welfare Association having developed an animal welfare label, and the government planning to introduce a State animal-welfare label.

In contrast to the previous conclusions, which referred to certain products, Table 5-15 below addresses more general behavioural changes.

**Table 5-15:** A summarised and heavily simplified assessment of socially widespread recommendations for action for more sustainable food consumption that advise further behavioural changes beyond consumption decisions

Recommendation for action	Qualitative estimation of the dominant effect and effect strength in terms of the four sustainability dimensions			
	Health	Social Aspects	Environment	Animal Welfare
Avoiding food wastage	<p>No hygiene risks if handled appropriately.</p> <p>(cf. Sections 4.4.2 and 4.4.3)</p>	<p>Consumers save money; supplying food banks reduces food poverty.</p> <p>(cf. Section 4.4.2)</p>	<p>Large effect on all environmental objectives possible.</p> <p>(cf. Section 4.4.2)</p>	<p>No effect on the husbandry conditions under which meat is produced; however, if fewer animal products are discarded, fewer animals need to be kept, and keeping fewer animals likely results in less animal suffering.</p> <p>(cf. Section 4.4.2)</p>
Drinking tap water	<p>Positive if substitute for calorie-dense beverages.</p> <p>(cf. Section 4.2.1)</p>	<p>Consumers save money.</p> <p>(cf. Section 8.6.2)</p>	<p>Almost complete avoidance of environmental effects caused by production, transport, consumers, packaging and disposal in comparison to other beverages.</p> <p>(cf. Sections 4.4.2.3 and 5.3.3.2)</p>	<p>Not relevant</p>
Using reusable systems (beverages)	<p>Not relevant</p>	<p>Not relevant</p>	<p>Beneficial if coupled with regionality; negative if transport paths are long.</p> <p>(cf. Section 4.4.3.2)</p>	<p>Not relevant</p>
Cooking at home and eating together (commensality)	<p>Inconsistent and small effects; mostly insufficient data situation: cooking at home or learning to do so promotes knowledge and action skills in terms of food and food processing; small positive/inconsistent effect on nutritional quality; no effect on body weight. The cook-and-serve system in communal catering facilities has the highest nutrition-physiological value.</p> <p>(cf. Sections 3.3.4, 5.3.1.2, 7.5.1, 8.2 and 8.8)</p>	<p>Commensality (e.g. in families, at preschools and schools, at the workplace) and the associated temporal structure of meals promotes social cohesion and relations as well as psychological health; it also creates important social learning spaces, for example discussing and learning about food-related norms and values.</p> <p>(cf. Sections 3.1.4, 3.3.4, 7.5.1 and 8.2)</p>	<p>Insufficient data situation. Cooking at home can have positive effects if shopping, preparation and processing are consistently oriented towards environmental criteria. In spite of increased packaging and transportation, industrial catering operations are more environmentally sound than private households because there is less spoilage and the preparation uses less energy.</p> <p>(cf. Section 4.4.2.1)</p>	<p>Insufficiently investigated. Empirically determined correlation: consumers pay less attention to animal welfare when purchasing highly processed products and in away-from-home catering because the relation to the animal is less perceptible.</p> <p>(cf. text box “Consumer–citizen gap” in Section 6.2.3)</p>

Note: green circle = positive interaction; red circle = negative interaction; red-and-green circle = no dominant effect direction; ? = lack of evidence; rough differentiation of three effect strengths (small, medium, large) symbolised by the size of the circles.

Source: WBAE illustration.

**Avoiding food wastage** The reduction of food waste is a measure that has a clearly positive effect on three dimensions. Food consumption that involves fewer food losses is cheaper for consumers, can be combined with supplying food banks and therefore makes a contribution to low-income households, conserves resources and may prevent animals from being killed unnecessarily. As long as it does not lead to the consumption of perished foodstuffs, it does not involve any conflicts of interests with health aspects either. The effect strength of this recommendation is potentially high since around half of all food losses are considered avoidable. There are, however, a multitude of implementation problems because the necessary behavioural changes are difficult to address (cf. Section 8).

**Drinking tap water** Another behavioural change with exclusively positive effects, i.e. a “no-regret measure” is the increased consumption of tap water and other home-prepared drinks with resource-conserving ingredients (water aromatised at home, e.g. using lime or ginger, herbal and fruit teas). The effect strength is limited but since it is a no-regret measure, there is much to be said in favour of supporting this approach. The substitution of sugar-sweetened drinks with (tap) water can only have positive health effects, is extremely cheap for consumers and reduces the environmental footprint of drink consumption.

**Using reusable systems** In contrast, the relevance of re-usable packaging for drinks is quite unclear. Re-usable packaging for drinks is only recommendable under specific conditions, namely when the system is based on a standardised type of bottle that is used by many suppliers and when the distribution is implemented regionally. In the same way, a general rejection of plastic packaging is not sound: glass is not generally more advantageous and an across-the-board “plastic bashing” does not make sense.

**Cooking at home and eating together (commensality)** Cooking at home (or learning to do so) can boost knowledge on selecting, preparing and consuming foodstuffs and on the sustainability value of these foodstuffs, as well as increase the corresponding ability to act (cf. Section 5.3.1.2). It is often assumed that preparing and cooking food at home equals a well-balanced diet with the associated positive health effects. The findings on this issue, however, are characterised by a currently poor data situation and the available review studies refer to small and even inconsistent effects. Cooking at home does not necessarily mean that a food is healthier and more sustainable. On the other hand, various scientific studies have indeed shown that cooking for or with a community and eating together (commensality) can increase psychological well-being, performance and above all social ties, creating important social learning spaces (cf. Sections 3.3.4, 5.3.1.2 and 8.8). Particularly in preschools, schools and senior-citizen institutions, this “social potential” of communal catering is currently not being exploited fully due to the lack or unattractiveness of eating and cooking environments (cf. Sections 4.2.2.4, 7.5.1 and 8.2). From an environmental point of view, commercial kitchens are usually advantageous in the preparation of food, but only if the food is

then not packaged and transported at great effort. Furthermore, cooking at home can have a positive effect on animal welfare since the connection with the animals is more easily recognised while cooking compared with using more highly processed products or eating out.

**By way of summary it can be said:**

- It is striking that all of the various recommendations concerning **health** each only make small contributions (i.e. the green circles are small). To sum it up: there is no “superfood”. The evidence that certain foodstuffs or food groups have a positive or negative effect on certain non-communicable diseases is weak. In contrast, the key health recommendation refers to dietary patterns. A well-balanced combination of foodstuffs is one of the most important components of preventive health protection. There are a number of different recommended dietary patterns (recommendations by the German Nutrition Society (Deutsche Gesellschaft für Ernährung – DGE), the Healthy Eating Index, the DASH diet, the Mediterranean diet, cf. Section 4.2), which consumers can use as guidance. Which of these dietary patterns the consumers then decide to follow is a matter of personal preference. All of the dietary patterns listed have in common that, compared with our current diets, they feature more plant-based foodstuffs and fish as well as less red and processed meat, fewer sugar-sweetened foods and drinks and smaller amounts of refined or heavily processed cereals. Overall, such dietary patterns also contribute to improving the environmental and climate compatibility of our food. This is one of the key results of the latest sustainability research: overall, the aspects of health, environmental protection and animal welfare complement each other in the field of nutrition.
- The first two Tables (5-13 and 5-14) in particular reveal the **lack of conceptualisation of the social dimension** and the associated poor data and information situation (question marks in the tables): The social footprint generated by a food along the value-added chain is at present only insufficiently recorded and therefore not identifiable to consumers. On a global level, but frequently also on the EU or even national level, it is unclear whether minimum social standards and/or basic ILO criteria are complied with. Compliance with these criteria should be ensured by the government. Of the labelling systems listed in Table 5-14 (organic, non-GMO, UTZ, MSC, Fairtrade), only the organic and Fairtrade labels are recommendable in terms of sound and positive social effects. The WBAE believes that the greatest medium-to-long-term potential for positive social effects relating to greater sustainability in food consumption, social participation and “social cohesion” here in Germany lies in cooking and eating together (commensality). This applies particularly to the increasingly important communal catering in preschools, schools, hospitals and senior citizens’ institutions (cf. Sections 7.5.1, 8.2, 9.2 and 9.8).
- **Environmentally compatible nutrition** depends mainly on the consumption of animal products. Preventing food losses is a second hotspot. Organic produce must also be mentioned here, at least insofar as the positive environmental effects are not offset elsewhere through distribution effects. These issues are accepted fact in the scientific community. However, Sections 3 and 4 also investigated how strongly our eating behaviour is shaped by habit and our food environment. In addition, our current system involves various behavioural incentives that pull in the opposite direction (e.g. price incentives). A significant reduction in the consumption

of meat and dairy products as well as a completely different handling of foodstuffs in order to prevent losses is therefore not easy to implement. A political change of course in terms of counterproductive behavioural incentives (e.g. increased taxation for animal products) as well as teaching more sustainable dietary patterns within the scope of preschool and school catering can thus make an important contribution to actually implementing the theoretically available improvement potential.

- An **animal-welfare-oriented diet** is absolutely dependent on the selection of products with higher animal-welfare standards, including organic produce, a reduced consumption of animal products and the prevention of food losses. For the latter, however, meat and dairy products are not the primary causes, so that the effect is not that strong. If animal products were primarily replaced with more vegetables and legumes, this would result in significant synergies with health goals. However, the transformation of the agri-food sector to “less and better” poses a considerable social and economic challenge to the sector.

The implementation of the various (categories of) recommendations by consumers entails several political prerequisites: consuming larger or smaller amounts of certain foodstuffs as well as avoiding food losses is easier when prices and other incentives point in the right direction. Selecting product variants which are produced to higher social, environmental and animal-welfare standards is only possible if they are labelled accordingly. Ultimately, food consumption is shaped largely by habit, and this is why it is so important to teach sustainable dietary patterns in preschools and schools. Politics for more sustainable food consumption can therefore not be based on one single measure but requires a differentiated mix of tools (cf. Section 7-9). Prior to discussing how politics can meaningfully support and demand a more sustainable food system, however, the question must be raised as to whether it is even within the sphere of responsibility of politics to interfere with individual and collective eating behaviour. This issue is addressed in Section 6 below.

## 6 Legitimation of a food and nutrition policy?

Government interventions in the food system and specifically in the food consumption habits of consumers is a controversial issue in Germany. Some introductory examples from the area of food, drink and tobacco may attest to this:

- The Alliance 90/The Greens' manifesto for the 2013 Bundestag elections contained the declaration that “offers of vegetarian and vegan dishes and a ‘veggie day’ should become the standard” (Bündnis 90/Die Grünen 2013: 64). This demand met with a great deal of indignation in politics and the media, where the proposal was interpreted in discussions using terms such as “prohibition republic” or “educational dictatorship” (Janssen 2013). The uproar in the media shows that in Germany even relatively weak interventions in individuals' food consumption are regarded as illegitimate by parts of society. Until today, the “veggie day disaster” has shaped the perception of many politicians who think that governance interventions in food consumption choices are unpopular among citizens.
- Germany is the only EU country where outdoor advertising for tobacco has not yet been prohibited, despite the fact that a ban has been stipulated by EU law. Overall, Germany is rather lagging behind with regard to anti-tobacco politics; many atypical advertising measures (so-called below-the-line marketing such as events or sponsoring) continue to be permissible. Germany ranks lowest in Europe on the Tobacco Control Scale published by the Association of European Cancer Leagues (Joossens et al. 2020).
- Regarding food consumption, the British campaign website entitled “nannystateindex.org”, on which several authors argue against food policy interventions, evaluates Germany as the country with the least government interventions. Scandinavian countries such as Finland and Sweden, but also Great Britain and France, use a significantly higher number of instruments, which are also more interventionist (see text box 16 in Section 6.5 on the systematisation of food policy instruments according to their depth of intervention).

Against this backdrop, this Section will discuss five arguments that are repeatedly used against increased public governance in the area of food consumption. The arguments are as follows:

- It is fundamentally illegitimate for the government to intervene in the decisions of individuals with the aim or intention of making food consumption more sustainable (Section 6.1).
- There is no need for demand-oriented governance, since demand-oriented governance instruments are less target-oriented and effective than supply-side instruments (Section 6.2).
- In Germany, the concept of consumer sovereignty applies – i.e. consumers who decide autonomously – and autonomous consumers need only adequate information in order to change their individual food consumption habits (Section 6.3).
- Up to now, the government or other actors have not intervened in consumption or nutritional decisions (Section 6.4); food and nutrition policy therefore represents a restriction of the scope within which consumers have so far been free to decide.

- The population fundamentally rejects any interference in individual decisions in the area of food consumption and interventions would have to take place against the will of those affected (Section 6.5).

## 6.1 Policies may interfere in the freedom of individuals in order to protect others from harm

The argument that it is fundamentally illegitimate for the government to intervene in the decisions of individuals with the objective or the intention of making food consumption more sustainable is expressed from the perspective of political philosophy, from an economic perspective and from a legal perspective. In the following, these three perspectives are discussed one after the other.

### 6.1.1 The perspective of political philosophy

The argument that the government should interfere as little as possible in food consumption habits and that – where influence or intervention cannot be avoided – these measures should at least not pursue a specific food policy goal can fundamentally be ascribed to the **liberal principle of neutrality**: According to political liberalism, a state is an association of free and equal individuals; consequently, it must not dictate to its members a particular conception of what a good life is but must take a neutral stance on different notions of what is good (Celikates & Gosepath 2013, Rawls 1988).

However, this liberal requirement of neutrality is complemented by a second principle, the so-called **principle of harm** (see Wall 2012, Fragnière 2014 regarding the relation between the two principles). According to the principle of harm, the liberal state may only interfere in the freedom of individuals if this intervention aims to protect third parties from harm (Wall 2012, Brink 2016, Mill 2008 [1859]). A classic example of an encroachment on the personal freedom of consumption to protect others from harm is the smoking ban in public spaces for the protection of non-smokers.

This expertise is based on the assumption that food consumption is to be considered more sustainable than current food consumption habits if it satisfies the individual's own nutritional needs in such a way that it jeopardises the ability of other people, both those living today and those in the future, to satisfy their needs *less* than current food consumption habits (Section 2). So if the government interferes in the freedom of individuals with the objective of promoting sustainability in food consumption, it does so to improve the opportunities of people living today and in the future to satisfy their needs and, in this spirit, to protect them from harm.

Climate change mitigation can serve as an example here. Climate warming caused by greenhouse gas emissions jeopardises the livelihoods of the people living today and in the future. In its expertise on climate stewardship, the Scientific Advisory Board on Agricultural Policy, Food and Consumer Health Protection, together with the Scientific Advisory Board on Forest Policy, highlighted

the great relevance of the food sector (WBAE & WBW 2016). Food consumption and the upstream stages of the agri-food sector account for about 25% of greenhouse gas emissions (WBAE & WBW 2016). Compliance with international climate policy commitments and nationally defined targets cannot be achieved without involving the food sector in climate-stewardship policies. In order to achieve a reduction in greenhouse gas emissions, decreasing the consumption of animal products plays a major role (Meier 2013, Springmann et al. 2016). Against this background, measures to reduce particularly CO<sub>2</sub>-intensive consumption patterns (such as abolishing the reduction of the VAT rate on products of animal origin, cf. Sections 8 and 9) can be understood as measures to protect people from harm.

The principle of harm therefore limits the principle of neutrality. It is, therefore, not possible to use the perspective of political liberalism to provide general justification for the assertion that the government must *not* interfere in the freedom of individuals with a view to promoting a more sustainable diet. Instead, from the perspective of political philosophy, everyone should enjoy the greatest possible freedom that is compatible with the freedom of all others (Rawls 1973).

### 6.1.2 The economic perspective

From an economic perspective, the government may also interfere in the food consumption habits of individuals if these habits have negative effects on others which the individual had not given appropriate consideration to when making his / her decision. In economics, such negative effects are called **consumption externalities**. Negative consumption externalities are, on the one hand, negative environmental impacts of food consumption that put the livelihoods of the people living in the present and future at risk. On the other hand, the high economic costs of food consumption that is hazardous to health are also for the main part external effects, because the costs caused by an individual who is eating unhealthily and falls ill for this reason are not borne by that person alone. Instead, some of these costs are assumed by the social community through compulsory health insurance. The individual thus causes costs for others (cf. text box 12 below).

From the perspective of consumer sovereignty (cf. Section 6.3), it could be argued that there is a right to unhealthy behaviour as an expression of the general freedom of action according to Art. 2 (1) German Basic Law.<sup>232</sup> The argument can be relativised if a certain behaviour causes great negative economic net effects, placing a significant strain on the community. The Federal Constitutional Court legitimised, for instance, the obligation to wear a helmet and the obligation to wear a seat-belt by citing high economic costs as an argument. Here too, the right to self-harm conflicted with the government's duty to protect. The decisive argument was that the violation of the obligation to wear a seatbelt takes place in public spaces, thereby causing consequential damage in the form of costs to the national economy. Ultimately, it comes down to trade-offs: the obligation to wear

---

<sup>232</sup> "Every person shall have the right to free development of his personality insofar as he does not violate the rights of others or offend against the constitutional order or the moral law." (Art. 2 (1) German Basic Law).

a helmet or a seatbelt constitutes a comparatively mild encroachment on the decision-making autonomy of citizens and has at the same time been proven to have clear protective effects. However, motorcycling per se or risky sports are not prohibited.

**Text box 12:** The economic costs of unhealthy food consumption

According to an assessment by the OECD (2019b), Germany has outstanding secondary and tertiary prevention (i.e. public health care system)<sup>1)</sup> but is lagging behind when it comes to primary prevention, i.e. the encouragement of health-promoting lifestyles and behaviours. Germany ranks among the fifth biggest budget holders for secondary and tertiary prevention, both in relation to the GDP (11.2%) and also per person (5,986 USD), and there is an above-average, demand-adjusted rate of visits to the doctor. However, unhealthy habits are widespread: with regard to balanced and health-promoting food consumption, Germany is well below the OECD average, while overweight and obesity are above the OECD average (OECD 2019b).

Despite outstanding methodological issues (cf. Tremmel et al., 2017), there is a general consensus in the literature that the consequential economic damage of current food consumption is high. For instance, obesity causes very high healthcare costs, especially if it occurs in childhood or adolescence (Sonntag et al. 2016). Yates et al. (2016) have determined annual direct medical costs of approximately 300 euros for every person affected by class I obesity, more than 800 euros for every person affected by class II obesity and more than 1,800 euros for every person affected by class III obesity. Other authors have also determined disproportionately rising costs of severe overweight (Colao et al. 2017). Particular emphasis is put on the rising number of type 2 diabetes cases. According to a current forecast by the Robert Koch Institute (RKI) and the German Diabetes Center (DDZ) (Tönnies et al. 2019), the number of people affected is expected to increase from 6.9 million to 10.7–12.3 million in the period from 2015 to 2040, which corresponds to an increase of 54–77% in the number of type 2 diabetes cases in Germany. The reasons for this rise in numbers lie in the development of new diseases, the overall increasing life expectancy and the decreasing mortality in people that have fallen ill. The last two above-mentioned factors result in the persons affected surviving longer, which increases the number of people affected at any one time. In a global study, Bommer et al. (2017) estimate the costs caused by diabetes to amount to 1.8% of the global economic output.

The economic costs due to obesity are even significantly higher when indirect costs due to lower labour productivity and an earlier retirement age are taken into account. Effertz et al. (2016) put the direct annual costs of obesity for Germany at about 29.39 billion euros and the indirect costs at 33.65 billion euros, using a broad definition (and therefore arriving at higher costs than those stated in the previous Section) and including costs of insurance and employers. According to OECD calculations (2019a), this amounts to approximately 7.9% of total healthcare costs in Germany.

The calculation of the total healthcare costs accounted for by obesity is based on several assumptions, and the damage costs vary accordingly, since the direct treatment costs for obesity represent only a part of the total costs. In a review on the economic costs of obesity, Tremmel et al. (2017) refer to the considerable methodological differences and deviating results of the studies available internationally. Thus, consideration of causalities for secondary diseases such as diabetes mellitus requires assumptions to be made which are usually multifactorial in nature, so that it is then necessary to calculate the proportion that is attributable to one specific cause. For example, 42.5% of diabetes is assumed to be caused by obesity (Knoll 2010: 66). Another important point relates to the opportunity costs incurred by incapacity for work, invalidity and mortality. For instance, these calculations typically include lost years of employment but do not include the years of life that are lost once the official retirement age has been reached. Sometimes it is even argued in the literature that, in the event of premature death, cost reductions due to avoided pension costs must be offset against the economic health costs. The

argument is: since people suffering from obesity die earlier, they relieve the burden on contributors accordingly (Tovey 2017). This argument, which is rarely put forward, ignores the objective of economic activities (welfare). From the WBAE's point of view, any years of life that are lost should be registered as costs. In addition to that, respective studies usually do not take the losses in quality of life into consideration (disability adjusted life years). This can make a major difference between different calculations (Mehta & Myrskylä 2017). Recent studies show that a year of life saved is worth five times their annual income to people (about 170,000 euros, Schlander et al. 2017).

Against the backdrop of high economic costs, studies generally calculate a significantly positive net effect of prevention measures in the healthcare system (median cost–benefit ratio= 8.3; Masters 2017, see also Owen et al. 2012, OECD 2019a, b). This usually also applies to measures aimed at reducing malnutrition. Yet, the state of research is unsatisfactory in this field (Alouki et al. 2016, Roberson et al. 2014). In particular, not all interventions aiming at weight reduction are effective, which then inevitably leads to unfavourable cost-benefit ratios. All in all, however, it is not least the international perspective (OECD 2019a, b) that provides a strong argument for increasing health-related prevention measures, also for cost reasons. The OECD (2019a) calculates, for instance, a gross domestic product growth of 0.5% if the calorie content in energy-dense foods were to be reduced by 20%. Similar considerations on the benefits of prevention could be made for environmental protection and climate change mitigation, but they are more uncertain due to the complexity of the impact assessments, even though there are many indications that it will be economically disadvantageous if it is not possible to limit the global temperature increase to below 2°C (IPCC 2018).

Note: <sup>1)</sup> Primary prevention begins before a disease occurs. Secondary prevention is aimed at the early diagnosis of (already existing, but not yet detected) illnesses, tertiary prevention is aimed at hindering the progression of an already manifest illness and the prevention of the onset of complications.

### 6.1.3 The legal perspective

The issue of the legitimacy of food policy, previously discussed from the perspective of political philosophy and economics, leads – from a legal point of view – to the question of whether the state may intervene in individual consumer decisions and, if so, why and to what extent. The state is constitutionally bound by international agreements, human rights and the German Basic Law to ensure that its citizens' food consumption is health-promoting. Therefore, food policy is a mandatory government task. However, this does not mean that the government itself needs to assume this task. In a market-based system, this task rests with the market. However, the government, by virtue of its duty to ensure this constitutional aim is met, must ensure that the healthy food consumption of citizens is not jeopardised as a result of market failure. At the same time, the government also needs to respect the citizens' autonomy, which to a certain extent also includes the freedom to harm oneself.

Instruments of the state which are voluntary from the point of view of the companies or have a recommendatory nature from the point of view of the citizens are legally unproblematic. In contrast to that, mandatory measures taken by the state that interfere with the fundamental rights of the citizens (Art. 2 (1) German Basic Law) and of enterprises (Art. 12 and 14 German Basic Law: fundamental professional and property rights) require a constitutional justification that is based on the respective provisions that limit the affected fundamental rights. In this regard, this primarily

affects the fundamental rights of companies which are forced, for example, to participate in a labelling system. From the point of view of citizens, increased taxes for certain types of food may be of constitutional relevance. However, the only relevant benchmark is the general freedom to act according to Art. 2 (1) German Basic Law. This freedom, however, sets only minor limits regarding interventions.

What is decisive is whether the government intervention protects constitutionally relevant public interests<sup>233</sup> and fundamental rights of third parties. The protection of health as a public interest and the individual citizen's right to health may be taken into consideration here. Food-policy measures can also advance the constitutionally enshrined state goals of environmental protection and animal welfare. Ultimately, consumer protection as an unwritten constitutional value may also play a role. Whether such an encroachment, serving to protect these constitutional values, is justified must be examined in each individual case by means of a proportionality review. These evaluations regularly focus on assessing whether the food-policy measure is necessary. It is only necessary if it is the mildest of all other equally effective means to achieve the constitutional objective. For example, mandatory government instruments will be measured by whether the target can also be achieved through voluntary government instruments (cf. e.g. Section 7.6.2 on the limits of voluntary product labelling).

It is in general legally questionable whether negative external effects in the form of high economic costs caused by food consumption hazardous to health can constitute a sufficient public interest in order to justify an intervention in fundamental rights. Firstly, it would be difficult to demonstrate that such high costs can primarily be traced back to consumption decisions (cf. text box 12 in Section 6.1.2). Secondly, the proof that there are no less drastic means of reducing costs requires high justification efforts. Of greater promise is the justification regarding negative ecological effects of consumer behaviour and regarding animal welfare, since reference can be made here to the constitutionally enshrined state goals of environmental conservation and animal welfare. Likewise, certain food-policy measures are essential for citizens to be able to make independent decisions regarding their own consumption patterns and thus contribute to consumer protection (cf. Section 6.3). In conclusion, it can thus be stated that **mandatory measures by the government to protect constitutionally protected state interests are generally possible under constitutional law.**

Insofar as a market failure, i.e. actions by private actors, has a considerable adverse effect on those spheres of activity for citizens – such as health or consumer protection – that are protected under the fundamental rights, then the right of the state may translate into an obligation to act. If, due

---

<sup>233</sup> The importance of public interest results primarily from the position the interest has within the hierarchy of norms. Of major importance are the interests that are expressly protected by the constitution, such as state goals (environmental conservation and animal welfare) or the areas of protection enshrined in the fundamental rights. Besides these, there are unwritten constitutional values such as consumer protection. Beyond that, public interests can simply be justified by law. Here, the legislator has an assessment prerogative. Whether the legislator defines, for instance, the promotion of small and medium-sized enterprises as a public interest is the legislator's decision, which is, for the most part, subject to political expediency.

to a market failure, the citizens are significantly prevented from exercising their freedom, the state must not simply stand by and watch. Due to the protective function of fundamental rights, it must issue regulations.

## 6.2 Supply-oriented versus demand-oriented policies: the necessity of a mix of instruments for the promotion of sustainable food consumption

Even if one were to assume that it is fundamentally permissible for the government to intervene in the actions of individuals with the intention of making food consumption more sustainable, one may nevertheless be of the opinion that such interventions are *not necessary*. An argument for this is that demand-side governance, i.e. political measures aiming to change consumers' behaviour, is less target-oriented and effective than supply-side measures. The argument is that the latter, i.e. political measures that would intervene in the actions of product suppliers (companies), would tackle the problem at its root and would be less bureaucratic, since the number of supplying companies is lower than the number of consumers. In contrast to this, this expertise advocates a mix of demand-side and supply-side instruments. The reasons for this are explained below. First, the argument against a demand-side policy will be briefly explained, followed by a critical discussion of this argument.

### 6.2.1 Environmental economic arguments for supply-side policies

The classical paradigm of environmental economics is based on the **internalisation of external costs** by means of the state, per unit of a negative external effect (e.g. per emission unit), levying an additional tax equating to the external costs.<sup>234</sup> One example of a so-called **Pigovian tax** such as this would be the CO<sub>2</sub> tax. From the perspective of environmental economics, economic instruments are generally considered to be preferable to other political instruments, in particular regulatory instruments. The reason for this is that, inter alia, economic interests (besides taxes this also applies to tradable certificates, e.g. emission rights and Pigovian subsidies) intervene less in individuals' freedom than regulatory ones and that the reduction or prevention of negative environmental effects is economically efficient. The price mechanism continues to apply, which leads to increased action by those actors with the lowest abatement costs. The economic incentives, previously targeted at the over-exploitation of a resource, are corrected in a targeted manner.

From the traditional perspective of environmental economics, a relevant tax should also be directed at the source of the external effect as much as possible. Since negative environmental effects are, for the main part, caused during the production of goods, this translates into taxing the supply side. On that note, from the environmental economics perspective, **supply-side measures**

---

<sup>234</sup> Similarly, positive external effects can be internalised by a subsidy.

**are preferable** compared with demand-side instruments. Insofar as such supply-side measures raise the production costs of a commodity and these additional costs are passed on to consumers via product prices, supply-side measures also affect the consumers. Therefore, the argument in favour of supply-side measures is *not* that nothing will change for the consumers but that taxation – as close to the source as possible – will allocate the costs, which would otherwise be externalised, to the causer of these costs, and that taxing production (e.g. energy producers) covers all downstream sectors. In addition to that, there are considerably fewer producers than consumers; therefore, taxing the supply side involves less administrative effort.

From this point of view, a tax on energy for heated greenhouses, for example, would be preferable to a ban on heating greenhouses (as is already the case in some organic farming associations); at the same time, a tax would also be more efficient than the introduction of a warning label for vegetables from heated greenhouses (or a positive label for cultivation in the open). The WBAE also believes that a CO<sub>2</sub> tax or tradable CO<sub>2</sub> emission certificates for climate stewardship are essential policy tools (WBAE & WBW 2016).

### 6.2.2 Limitations of supply-side economic governance instruments

For a policy on promoting more sustainability in food consumption, however, this conventional environmental economic solution is, for several reasons, limited and insufficient on its own.

A tax (and also emissions trading) necessitates a **target that can be measured with sufficient precision at reasonable cost** – this restricts the climate and environmental protection policy options of supply-side taxes. Climate change mitigation can serve as an example here. CO<sub>2</sub> emissions are readily measurable, and a CO<sub>2</sub> tax would involve relatively little effort in administrative terms, as it could be applied at the level of energy producers. However, a CO<sub>2</sub> tax would only address part of the climate-relevant greenhouse gases. The greenhouse gases nitrous oxide and methane would not be covered by a CO<sub>2</sub> tax. A nitrogen tax would be a form of taxation that would address the source of the problem of nitrous oxide emissions.

Possibilities for recording nitrous oxide (and also methane) emissions are currently limited. Around 80% of nitrous oxide emissions in Germany come from the agricultural sector (UBA 2019f), and here first and foremost from fertilisation. There are major differences between different holdings, particularly with regard to fertiliser intensity and application techniques; both are difficult to record, also because location parameters and weather exert an influence on nitrous oxide emissions. Therefore, the WBAE has not advocated a nitrogen tax in the past, but instead regulatory instruments in fertiliser law (WBA et al. 2013) and suggested demand-side measures aimed at lowering the consumption of animal products (WBAE & WBW 2016, cf. Section 9.3).

A tax requires a **uniform target value at national or international level**. Biodiversity losses constitute another example of negative environmental effects that are difficult to address by taxation.

The problem here lies not only in measuring where and how much biodiversity is lost. In addition to this, the various biodiversity losses (e.g. farmland birds, insects, plants; rare vs. less rare species; species that occur in Germany at the edge of their natural range vs. species for which Germany has a special importance) would have to be reduced to a common denominator in order to be able to tax them. Taxation is, in general, difficult for environmental effects whose valuation depends on spatial references. Alongside biodiversity, these include for instance water consumption at the large-scale level, which needs to be assessed differently in regions where water is scarce compared with regions where sufficient water is available, as well as indirect land use effects associated with (agricultural) land use. Governance of these environmental areas therefore usually takes the form of regulatory instruments and funding policies.

A tax is only permissible in cases where **it is also acceptable to have only a gradual improvement in the situation**. There is a social consensus that some negative effects caused by the production of goods should be avoided at all costs. These include child labour, labour under slavlike conditions or forced labour and violations of basic animal welfare requirements. The social consensus is that these should be completely avoided. A tax that merely aims to reduce such circumstances cannot guarantee this. Here, too, regulatory law is the first choice.

Certain problems arise on the consumption side and not on the supply side. Environmental problems linked to food consumption largely arise during the production of food. In contrast, diet-related health problems result from the consumption of food. Thus, negative health consequences arising from excessive sugar consumption have little to do with the production of sugar. With regard to health problems, therefore, the environmental economic argument that it is efficient to address problems at source does not lend support to the idea of taxing the supply side.

In a liberalised market, levying taxes to internalise external effects is only effective if these taxes apply internationally. In a globalised, liberalised market, regulatory and economic instruments applied to the supply side both worsen the competitive position of domestic producers if they are only applied at national level, as compliance with standards or the payment of taxes causes costs which international producers do not have to bear. As a result, nationally manufactured products become more expensive by international standards and sales of these domestic products drop. At the same time, there is a rise in imports of products that may have been produced under worse conditions, so that from a global perspective, this may mean that there are similar negative effects to previously, with the only difference being that these occur in other countries. Policy measures targeting consumption, on the other hand, have the advantage that they address sustainability problems without modifying international competitiveness. The Advisory Board has already worked out in various expertises (WBA 2015, WBAE & WBW 2016) that controlling the supply side can only partially cut the external costs of food consumption in an open economy and that new approaches must be developed for governance of the demand side.

The situation would only be different if supply-side policy measures did not result in cost increases, but instead there was a reduction in negative effects due to an increase in efficiency. In this case,

these measures would not be at the expense of competitiveness. The FAO, for instance, argues in this direction with respect to its policy proposals for reducing greenhouse gas emissions from livestock farming. To this end, it proposes measures to intensify and increase productivity in livestock farming through improved breeding and better health management. These offer significant opportunities for win-win situations on a global scale (FAO 2017), but they reach technical limits in the already very intensive livestock farming system in Germany and are at least partially in conflict with the targets of animal welfare (WBA 2015: Section 4.5). There is certainly a reservoir of win-win sustainability measures, i.e. measures that not only contribute to more sustainability but are also profitable for companies at the same time, and there is much to be said for expanding the circle of such measures as far as possible by promoting innovation. However, a policy that relies exclusively on such win-win solutions is, in the view of the Advisory Board, far too limited for Germany in view of the problematic situations outlined in Section 4.

**Dealing with scientific uncertainty.** Supply-side policies also pose a problem in the case of scientific uncertainty or ideologically justified preferences: if it is clear that preferences for certain characteristics are ideologically justified, the state should not exercise control on the supply side. One example is freedom from genetic engineering, for which there are clear preferences in the German population, but which at the same time, in the view of the Advisory Board, does not deliver clear sustainability benefits (cf. Section 5.2.4). Soft demand-side instruments, such as labels, are politically advantageous here, because consumers can decide for themselves whether and how much this characteristic is worth to them and it is then only consumers with a corresponding preference who (have to) pay additional prices.

### 6.2.3 Limitations of demand-side policy instruments

Given the limitations of supply-side economic governance instruments, the WBAE believes that what is needed is a mix of instruments that comprises both economic instruments and also other types of instruments, e.g. regulatory instruments. The WBAE also believes that it is sensible and necessary to include demand-side instruments such as consumption taxes, information campaigns, labels, education and nudging (Creutzig et al. 2018). However, these instruments also have limitations.

First, demand-oriented policy instruments are questioned from a **normative perspective**:

- **Non-negotiable minimum standards.** As described earlier in relation to the limits on the taxation of externalities, there is a social consensus to the effect that certain negative impacts caused by the production of goods should be avoided at all costs (e.g. child labour, labour under slavish conditions or forced labour, violations of basic animal welfare requirements). This argument does not support either taxation or, for example, using labels to indicate the violation of such standards. Compliance with such minimum standards should not be left to consumer demand, but should be regulated by law.

- Consumption taxes or nudging are regarded by many consumers, especially in Germany, as an (inadmissible) **intervention in individual decision-making autonomy** and may then encounter problems of acceptance (Section 6.5).
- **Specific problems of altruistic behaviour.** Many consumers fail to see why they should pay more money to comply with certain standards (e.g. animal welfare standards) if there is no guarantee that everybody else will do the same. The rationale behind this is the view that one's own (purchasing) behaviour can make little or no difference. These people see it as the task of politics to raise standards in general. They are only prepared to pay more for products produced to higher standards if everyone else does / has to do the same.

Secondly, implementing such instruments makes **high demands** of the legislator in terms of **knowledge and information**:

- Demand-side policy measures such as nudging are implemented in the various sub-markets with their different respective conditions (e.g. retailing, food service industry, communal catering) and therefore require the legislator to have a profound knowledge of markets and demand behaviour. This is not always available.
- Sustainability labels sometimes require a great deal of information, the acquisition of which involves high costs. The data do not always meet necessary validity standards. In many cases, standard/average data are used, which do not necessarily mirror the concrete real situation.

A third aspect concerns the **effectiveness of demand-side policies**: demand-side policies that are voluntary in nature have to reach a significant proportion of consumers in order to be effective. In view of the fact that there is so much information in today's world and that consumer behaviour is often based on habits (cf. Section 3), this is not an easy task. In international trade law and in the EU, it is not easy to implement binding demand-side policies, such as mandatory labels, at national level. The so-called consumer–citizen gap, i.e. the discrepancy between the wishes and attitudes of citizens established in surveys on the one hand and actual purchasing behaviour on the other (see text box 13 below), is often used to justify the ineffectiveness of demand-side measures, especially labels.

**Text box 13:** Consumer–citizen gap

The term consumer–citizen gap describes an actual or perceived inconsistency between what people (as citizens) express (for instance in surveys, elections or through memberships in NGOs) and their actions while shopping (as consumers). The starting point is thus the difference between consumers' expressed convictions and their actions. While the population expresses a generally positive attitude towards, for instance, more animal welfare, organic production or pastoral grazing, the actual market share of these products is comparably low. For example, the actual market share for organically produced foods amounts to about 5%, but the percentage of consumers who think that organic products are beneficial and important is approximately 30–50% of the population (BÖLW 2019). Related terms include attitude–behaviour gap, intention–behaviour gap and value–action gap.

In fact, surveys and observations of purchasing behaviour are focused on different things: attitudes characterise the desires and long-term behavioural disposition of people. They typically only influence behaviour to a certain extent (often, studies indicate influencing strengths of 20 to 50%). People have different attitudes that can prompt them to behave in different ways. It is, for instance, possible that animal welfare is important to a person, which might predispose them to spend more on products produced in compliance with higher animal welfare standards, while at the same time this person may be of the opinion that it is important not to spend too much on food in order to have more money for their children's education (e.g. for children's books or music lessons).

Beyond these fundamental differences in attitudes and behaviour, consumer research has identified several reasons why attitudes collected in surveys and actual purchasing behaviour may differ:

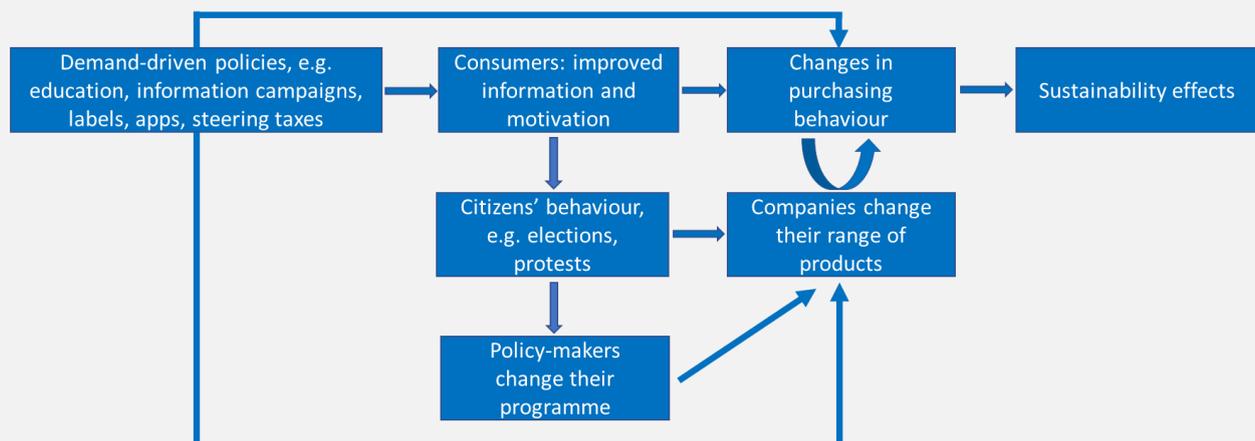
- **Poor behavioural control** can lead to people choosing the less sustainable alternative (e.g. convenience products) where more sustainable food consumption involves more effort (e.g. more time for shopping and processing regional or seasonal fruit and vegetables), or following a more sustainable diet only where this behaviour is comparatively easy or inexpensive for themselves (e.g. separating waste; low-cost hypothesis, see Diekmann & Preisendörfer 1998).
- **Feelings of powerlessness** (perceived consumer effectiveness), i.e. the perception that one's own consumption behaviour will not improve the overall situation.
- **Social desirability.** People occasionally give answers in surveys that they think are expected in their social environment. The extent of this interviewing effect is disputed; it occurs more in face-to-face interviews than in written or online surveys and depends on the topic.
- **Supply gaps and additional prices.** For many sustainability characteristics, there was and is only a limited supply of products, e.g. due to path dependencies. Moreover, due to certain niche problems, but also due to skimming price strategies of businesses, very large price differences can occur, which curtail the circle of potential buyers.
- **Lack of trust in labels.** Due to the absence of legal regulations, certain sustainability terms (such as animal welfare or species-appropriate) are not protected and can therefore be used relatively indiscriminately in marketing. This makes marketing more difficult for ambitious suppliers and results in a loss of trust among consumers. Furthermore, some traditional suppliers, if they also offer sustainability products, appear less credible to consumers interested in sustainability, who typically tend to be rather critical.

- **Rationalisation and displacement effects.** Certain aspects of production, such as the slaughtering of animals in meat production, create cognitive dissonance and are therefore rationalised or suppressed by some consumers (Bastian et al. 2011). As a result, (certain) animal welfare concerns (such as those related to the slaughtering process) are seen as less serious (meat paradox, Loughnan et al. 2010). In the case of more highly processed products, consumers are less likely to make the connection to the animal and its husbandry, so that less attention is typically paid to animal welfare in the case of sausages or ready-to-eat meals.
- **Negative correlation between certain sustainability preferences and consumption intensity.** The example of animal welfare preferences illustrates this phenomenon particularly well: vegans and vegetarians demonstrably have particularly high preferences for animal welfare, but do not consume meat and therefore cannot express their preferences on the market. Consumers who eat plenty of meat, on the other hand, often have a comparatively low awareness of animal welfare (Cordts et al. 2013). The latter therefore has a disproportionately strong influence on market demand.

Other researchers regard changes in consumers' values as providing a sufficient foundation for social change or at least view consumers a driving force for sustainable development (Bilharz et al. 2011). It is also stressed that demand-side policy measures greatly contribute to informing the population and thereby promote sustainability policies overall (text box 14).

**Text box 14:** Informational impact of demand-side policy instruments

Demand-side policies, e.g. education, information campaigns, steering taxes, apps and labelling that inform consumers and promote social debate, can have positive side-effects beyond their direct impact on demand (the upper impact pathways in Figure 6-1). Sustainability policy depends on support from society; in a democracy, politicians want to be re-elected. If they are to support a certain policy, citizens must therefore understand the background to the problem and the cause-effect relationships, at least in the broad sense. An example: if, as is currently the case, many people are unaware of the contribution of ruminants to climate change, measures aimed at reducing the consumption of dairy products will hardly be accepted. A climate label on foodstuffs can then have an important and also educational effect on consumers. At the same time, consumers signal the direction of market development to suppliers by (at least to some degree) modifying their purchasing behaviour (e.g. buying milk substitutes). Consumer actions send political signals (cf. Fig. 6-1). In addition, labels or information campaigns (such as the BMEL “Too good for the bin” campaign) also indirectly trigger market trends. Companies want to and need to pick up on trends in good time and can be encouraged by labels and campaigns to rethink their strategies. In many cases, the management cannot easily differentiate between short-term trending issues and long-term changes in values and mindsets (Spiller 2001). The extensive debate in society therefore influences management and investors; if successful, this discussion is in turn reinforced by new marketing concepts. Dynamic developments can occur when, for example, important gatekeepers such as large retailing companies take up issues and put pressure on suppliers (see the case of the delisting of battery-cage eggs by all major German food retailers). This in turn can encourage policy-makers to take regulatory measures. However, the discussion about specific sustainable consumer behaviour also motivates civil society to further address the issue, e.g. through demonstrations. Demand-driven policies thus have an overall effect that clearly goes beyond the direct purchasing decision.

**Figure 6-1:** Direct and indirect effects of demand-driven policies

Source: WBAE illustration based on Bullock & van der Ven (2020: 7).

In this expertise, the WBAE takes a differentiated position which derives the need for an extensive, target-oriented policy mix from the possibilities and limitations of a number of different types of instruments (economic instruments, regulatory law, other instruments) as well as from the possibilities and limitations of both supply-side and demand-side policies. There are many indications that supply-side and demand-side policies complement and promote each other in modern economies. The mix of supply-side and demand-side policies must be differentiated depending on the problem area.

### 6.3 Limits of consumer sovereignty – or: should we as consumers sometimes protect ourselves from ourselves?

While the external costs described in Section 6.2.1 are largely accepted as a legitimization argument in economic theory, the question of the extent to which consumers should be protected from their own misconduct is disputed (Frieden 2013). The concept of consumer sovereignty is regularly invoked as an argument against food policy interventions. According to this model, consumers are free to choose what they want to consume (freedom of choice).

In economic theory, the **concept of consumer sovereignty** is based on the premises of the neoclassical market model with its axioms of complete market transparency, infinitely fast responsiveness, complete competition, but especially also given, stable and uninfluenceable preferences of consumers who act rationally (“homo economicus”). These premises are obviously unrealistic. The position of Milton Friedman (1953) therefore received a great deal of attention: In a well-known contribution, he assumes that the neoclassical market model leads to practically meaningful results in spite of these idealised premises, because it makes sense for economics to act “as if” the market functioned in this way or “as if” the actors acted in a perfectly rational manner, because such a simplified model would ultimately result in a clear directionally stable outcome as a consequence. Friedman argues that (partial) market failure does occur, but the less the state intervenes, the better the market operates. In case of doubt, the market is at any rate more efficient than state control, where there is a risk of policy failure. This position, which has prevailed in economics for a long time, has lost support since the start of the millennium due to new research, including experimental psychological (behavioural economics) research (see below and Section 3).

A weakened form of the concept of consumer sovereignty is the **information paradigm of consumer policy** (Oehler & Wendt 2016). According to this paradigm, consumers are basically rational and informed and make decisions on their own responsibility. Yet, according to this model, they lack relevant information in some areas. This would have to be provided by consumer protection agencies or the state. The information paradigm continues to view consumers as market-controlling actors, but at the same time allows or demands the state to play an active role in the form of consumer education. This information paradigm of consumer policy is now widely accepted, and basic dietary information and education measures are not controversial.

In the 1970s, legal consumer protection was increasingly embedded in consumer policy alongside consumer information and consumer education. The Act regulating the law on general terms and conditions (AGB Act), which was incorporated into the German Civil Code (BGB) in 2002, was based, for example, on the assumption that there are situations in the market in which consumers cannot realistically take note of the information “in the small print”, so that they must be protected from any surprising clauses in this regard. In the case of food, a parallel case is the requirement to provide certain key information on the front of the packaging. The United Nations Consumer Bill of Rights explicitly guarantees the right to safety and protection of health. In this regard, the **concept of consumers in need of protection** emerged in German jurisprudence in the 1960s and 1970s.<sup>235</sup>

In contrast, when the European Internal Market was established in the 1990s, the European Court of Justice initially based its case law on the **concept of the basically informed (attentive, reasonable) consumer**<sup>236</sup> who can be expected to also take note or at least potentially take note of information on the back of packaging (cf. Federation of German Industries (BDI) 2014). However, more recently it has emerged that, in view of new psychological and behavioural economic findings, the ECJ decisions take greater note of the real (very limited) information behaviour of consumers. Thus, for example, the ECJ calls for eye-catching advertising statements on the packaging to convey an accurate impression (without looking at the “small print”). For example, the ECJ ruled that it is not admissible to display raspberries on a raspberry-flavoured tea packaging, thus suggesting that the tea contains raspberries if this is not the case and this is correctly recognisable in the list of ingredients on the back.<sup>237</sup> In line with the latest findings of behavioural sciences, case law is thus moving (again) more in the direction of the concept of **consumers in need of protection**. Disciplines such as marketing and psychology have provided a wide range of evidence that demand can be changed and moulded by the supply side, which is presented in greater detail in Section 3. The studies explained there show ever more clearly the weaknesses and influenceability of consumers, especially in the area of food consumption.

The former Scientific Advisory Board on Consumer and Food Policies of the Federal Ministry of Food and Agriculture (BMEL) has taken up this research work and further specified **the concept of consumers in need of protection** (Micklitz et al. 2010). According to this, consumers can find themselves in **different roles** depending on the product group, interest and situation:

- The **trusting consumers** who want to be able to trust policy-makers and market actors and who do not want, or are not able to take more than the barest minimum care about the qualities of the products and the implications of their consumption decisions. In a complex market society, consumers are overwhelmed as far as most goods segments are concerned and need an environment in which they can trust in a minimum level of protection.

---

<sup>235</sup> Federal Court of Justice (BGH), ruling of 23.01.1959 – I ZR 14/58, GRUR 1959, 365, 366 – English lavender.

<sup>236</sup> ECJ, ruling of 16.07.1998 – C-210/96, Slg. 1998, I-4657.

<sup>237</sup> ECJ, ruling of 04.06.2015, Az. C-195/14, Federation of German Consumer Organisations/Teekanne; Federal Court of Justice, ruling of 02.12.2015, ref.: I ZR 45/13.

- The **vulnerable consumers** who have limited problem-solving capabilities (sometimes only situationally) and tend to be overwhelmed. On the one hand, there are certain consumer groups that are generally particularly vulnerable (e.g. children) and should therefore be specifically supported or protected. On the other hand, in certain situations, e.g. due to acute, specific time pressures, we are all unable to deal with the range of goods in greater detail (cf. Section 3).
- **Responsible consumers** who want to be informed and take responsibility for themselves and their environment. This group is particularly motivated to reflect on their consumption behaviour, but needs information to guide their actions. While many consumers are experts in certain product groups, they are not familiar with others. Most responsible consumers are not scientific experts, but rely on key information and transparency, which they also have to trust.

All three roles, in which we find ourselves in different situations, lead to demands on the state to support or protect us as consumers. In respect of food policy, nutritional information and ingredient lists make a key contribution to nutritional knowledge and are indispensable for allergy sufferers and consumers who have to avoid certain ingredients for health reasons (e.g. people with coeliac disease). However, such detailed information is hardly effective for vulnerable consumers who want to eat more healthily or more sustainably. A food policy that essentially focuses on information tools does not sufficiently help vulnerable consumers. For instance, the concentration of nutritional policy problems in households of lower social strata is clearly visible; problematic behaviour patterns are often already present in children (Sections 3 and 4.2). Beyond this, nutritional problems such as obesity occur in all social strata (cf. Section 4.2), and we all end up in the role of vulnerable consumer in certain situations.

Based on the insight that food and nutrition policy should not be limited to information, research has increasingly proposed more far-reaching instruments in recent years. **Nudging** is the paradigm for this. Nudging is intended to “nudge” human behaviour in a certain direction without prohibiting options or modifying economic incentives (Thaler & Sunstein 2008). This is done, for instance, by favourable placement of health-promoting foodstuffs or by changing the default option (Hanks et al. 2012). Nudging works through stimuli that change the decision-making situation for consumers with regard to the desired food policy targets and suggest certain options.

A fundamental discussion about paternalism has developed around the issue of nudging in the recent consumer policy debate. While some authors, with reference to the limits of conventional information policy just outlined, call for more interventionist instruments, others, with reference to food consumption, argue that a liberal social order should also allow consumers to take risks for themselves if they rate the gain from a certain conduct (e.g. eating problematic foods that taste good) more highly than the risk of long-term negative consequences associated with this behaviour. It is a social consensus in Germany that citizens in a free society should be able to take risks, even if this causes economic costs (e.g. strains on health insurance companies). For instance, this manifests itself in the fact that the state does not prohibit many high-risk activities (e.g. high-risk sports) or does not promote the “privatisation” of risks through appropriate insurance arrangements. It is a question of weighing up how far the state intervenes here, e.g. by making helmets

compulsory for motorcyclists, but allowing motorcycling itself (although there are clearly lower-risk types of mobility). From a legal perspective, society also has to accept negative consequences of socially adequate behaviour to a certain degree through the “common burden principle”.

This discussion follows up on the above-mentioned ideas about different consumer models. Advocates of the homo oeconomicus model postulate that consumers very consciously take certain risks because, for instance, they are aware of the potential consequences of alcohol consumption, but nevertheless decide to drink alcohol.

Advocates of the concept of consumers in need of protection refer especially to vulnerable groups in society, e.g. children and adolescents. As far as smoking is concerned, for example, the international community has consistently decided to allow smoking, but to largely protect vulnerable consumers such as children and adolescents from being influenced and to prohibit them from buying the products. There are also age limits on alcohol. These paternalistic restrictions on freedom of consumption do not always meet with the approval of all those concerned.

In recent behavioural science research, the **target group for consumer protection** is **extended** beyond the group of consumers who are relatively easily recognisable as vulnerable, such as children. On the one hand, as the example of smoking shows, there are also consumers who would like to stop or curb a certain behaviour, but do not succeed in doing so. In the case of smoking, specifically, this is (also) due to the fact that it is an addictive behaviour. This legitimises further anti-tobacco policy measures, e.g. an increase in risk perception through warning messages or a reduction in the willingness to buy through high steering taxes. These measures are intended to protect consumers from starting to consume tobacco or to support them in quitting and thus protecting them from harm. Consumers may value such protective measures, which limit their freedom of choice, as a form of self-commitment. In fact, a methodologically comprehensive study shows that the subjectively perceived life satisfaction of former smokers increased on average because of tax increases (Gruber & Mullainathan 2002). Consumer preferences are not always stable in such cases, i.e. consumers might adapt to new (price) relations, quit smoking and then appreciate their new habits after a transitional period. Such an inconsistency of preferences in terms of time is not envisaged in traditional economics, but is relevant for many sustainability issues (Sunstein 2017).

Obviously, similar processes exist regarding food consumption habits, as shown by the numerous but often failed attempts of consumers to improve their food consumption habits for health benefits and/or weight loss. Research shows evidence of low impulse control for certain types of foodstuffs (Hoch et al. 2015, cf. Section 3). Economists also speak of “temptation goods”, products that we enjoy at the moment of consumption, but find difficult to stop consuming and always regret later on (Banerjee & Mullainathan 2010, Evans & Popova 2014). This provides legitimacy for state intervention in consumer behaviour.

On the other hand, many consumers overestimate their control over their actions (illusion of control, cf. Section 3). In reality, many dietary patterns are habitual and without explicit cognitive control (“mindless eating”, Wansink & Sobal 2007). The anchor effect, for instance, is well-known; it

affects the perception of package sizes in respect of eating. The available size exerts an influence on the assessment of “normal” portion sizes with a proven effect on calorie intake (Ello-Martin et al. 2005, Hollands et al. 2015). The optimistic bias concerns the problem that many consumers see their own health behaviour in too positive a light (Sproesser et al. 2015). Finally, there is a tendency towards a distorted view of future, long-term and sensually imperceptible risks (hyperbolic discounting, Frieden 2013, cf. Section 3) and towards an underestimation of “controllable”, behaviour-dependent risks (Harris et al. 2008, Renner & Schupp, 2011). Such distortions of perception and decision-making can also be used as arguments for the permissibility or even necessity of state support for consumers.<sup>238</sup>

All in all, four policy constellations can be identified (Wertenbroch 2017):

- (1) **Protection of vulnerable consumers**, e.g. those who cannot adequately assess risks, such as children.
- (2) **Protection of those customers who are struggling with their own behaviour and are looking for support**; a classic example here would be Odysseus, who is tied to the mast in order to resist the sirens.
- (3) **Protection of consumers who are subject to particularly pronounced illusions of control** and distortions of perception and decision-making and who therefore find it particularly hard to implement their preferences for a health-promoting diet in the given, less than fair environment.
- (4) **Consumers who consciously opt for unhealthy eating habits** and thus consciously accept health risks in favour of current preferences.

The WBAE takes the view that the protection of particularly vulnerable target groups (children or very elderly senior citizens, group (1)) should be indisputable. Here, relatively far-reaching interventions such as subsidies or advertising bans may be necessary in order to realise effective protection. Intervention in the consumption behaviour of group (4), on the other hand, is only legitimate if external effects or high economic costs justify it.

The share of consumers who have consciously and fundamentally chosen an unhealthy eating habit (group 4) is probably quite small. Accordingly, the WBAE rejects approaches to a stronger individualisation of the consequential costs (e.g. through financial incentives in the health system) (text box 15).

---

<sup>238</sup> The more recent economic discussion often speaks of libertarian or “soft” paternalism, cf. e.g. Kirchgässner (2014).

**Text box 15:** Individualisation of dietary responsibility through financial incentives in the health system?

In order to provide incentives to reduce the economic implications of malnutrition, it is sometimes proposed to differentiate health insurance contributions. In principle, it is possible for the state to allow statutory health insurance funds and private health insurers to levy differentiated contributions or refuse payments for certain types of behaviour. A well-known example is Section 52 of the German Social Code, Book V (SGB V), according to which insured persons who have caused an illness through non-induced aesthetic surgery, tattooing or piercing must contribute to the treatment costs to an appropriate amount and sickness benefits can be denied. Such patients must take recreational leave for the duration of the treatment. Such an approach would, in principle, also be conceivable for high-risk sports or malnutrition. In the opinion of the WBAE, however, this is indefensible due to the complex causality of food consumption problems. Malnutrition is a multifactorial problem that is influenced by the food environment just as much as by genetic factors, epigenetic factors, social situation, stress, family influences and traumatic life events (Harding et al. 2014, see also Sections 3 and 4.2). The prevailing tendency in social debates to attribute malnutrition to individual weakness of will fails to recognise the complexity of the causes. Sociological research (Barlösius 2014) demonstrates, for example, that it is not least the negative impact cycles of weight gain and social stigmatisation that aggravate the problem of obesity. Against this backdrop, financial incentives in the health insurance system (e.g. premium refunds for slim or surcharges for obese insured persons) are, according to the WBAE, both factually incorrect and discriminatory (and beyond that possibly even counterproductive).

Some data suggest that most consumers tend to belong to the groups of constellations 2 and 3 in many areas of food consumption. In a review, Santos et al. (2017) have determined that 61% of Europeans made a special effort to reduce or at least maintain their weight in the previous year (see also Section 3). A study commissioned by Nestlé summarises the results of a representative survey as follows: “85% of Germans today eat differently than they would like. They would like to eat more healthily, more balanced and more regularly, and cook for themselves more often. Establishing a different eating style in everyday life is therefore an important socio-political task.” (Nestlé Deutschland AG 2009).

From the Council’s perspective, such statements confirm the need for a conscious political design of appropriate food environments that are attuned to our human perceptual and decision-making options and behavioural patterns and make it easier for consumers to realise their own objectives regarding food consumption. The WBAE also describes such food environments as fair because they take into account the limited possibilities or capacities of consumers to autonomously decide at all times in the tight schedules of their everyday lives what, how much, when, where and with whom they eat or when they suppress corresponding behavioural impulses (cf. Section 3).

Ultimately, the legitimacy of a certain depth of intervention in food-policy measures remains a process of weighing up pros and cons, in which the preferences of customers and the acceptable negative consequences of socially appropriate forms of behaviour must be taken into consideration just as much as the protection of vulnerable subgroups, economic costs and negative external effects (e.g. environmental protection and climate stewardship).

## 6.4 Influence on consumption by other actors – restrictions on marketing

Consumers do not take decisions in a neutral space, but in a highly competitive market for food that is influenced by suppliers' marketing. Preferences are therefore possibly distorted. It can therefore be legitimate for the state to set up market trade conditions in such a way that consumers are protected from problematic influences when companies offer their products. In addition, the state provides compensatory measures to improve market transparency. Two case groups can thus be distinguished:

- (1) Ensuring a sufficient level of market transparency (e.g. through labelling requirements).
- (2) Protection against misleading marketing measures (e.g. through banning illegal promotion activities)

Measures taken by the state to increase the **transparency of the market** focus on credence attributes of the respective product that are difficult to identify and that consequently result in information asymmetries. The term credence attribute refers to those aspects of the product that consumers cannot verify either before or after the purchase. These include essential sustainability properties of products such as health promotion, environmental protection, animal welfare and social conditions associated with the production. The lack of verifiability causes an **information asymmetry** which may in some cases be substantial. While producers can – at least – partially<sup>239</sup> assess the advantages and disadvantages of their products, consumers as lay persons at the end of the value adding chain have no way of identifying the environmental compatibility of a product or its manufacturing conditions just by looking at it.

The discussion about sustainability is typically centred on properties that refer to non-visible ingredients (e.g. nutrients) or the manufacturing process (e.g. animal welfare) and that cannot be seen by simply looking at the product. The importance of such **credence attributes** has therefore increased considerably in the course of the sustainability discussion. This situation raises problems not just for consumers but also for suppliers. If they offer a product with a particular high quality regarding certain credence attribute (e.g. a product that was produced in a particularly environmentally and socially compatible manner) but are not able to communicate this quality, there is a danger that consumers will, in case of doubt, buy the most inexpensive item ("adverse selection", negative quality spiral). The cheapest rather than the highest quality products will then prevail on the market, and suppliers that are particularly aggressive in disseminating misleading information may also prevail.

Without government intervention, markets with credence attributes therefore function only to a limited degree. A high degree of information asymmetry requires neutral labelling schemes and, if

---

<sup>239</sup> This applies in particular to the processing operation. Many food manufacturers/food processing plants, however, often do not know how the raw materials have been produced at the respective agricultural holdings.

necessary, also further regulatory interventions in order to cope with negative quality developments (WBVE & WBA 2011). Experience gathered from the market shows, for instance, that key information on foods, such as the calorie content or the product composition, is not extensively implemented without government requirements (Sunstein 2017). Prior to the introduction of labelling requirements under EU law (e.g. nutritional information), there were only a few producers who voluntarily labelled their foods accordingly.

With the objective of increasing market transparency, the government has already established a great number of **food labelling regulations** in recent decades. Many of these labelling requirements were issued at EU level and have been combined in the Food Information Regulation (Regulation (EU) No 1169/2011). Mandatory information includes, inter alia:

- the name of the food;
- the list of ingredients including the quantity of certain ingredients;
- a nutritional declaration;
- any ingredients that may cause allergies;
- the net quantity;
- the date of minimum durability or the 'use-by' date;
- where necessary, specific instructions for storage and/use;
- the name and address of the food business operator;
- for some products, the country of origin or place of provenance;
- and indication of the alcohol content for beverages containing more than 1.2% by volume of alcohol.

Besides the Food Information Regulation, the **Health Claims Regulation** (Regulation (EC) No 1924/2006) specifically governs the area of health and nutritional claims made on foods. An advertisement containing health-related information is thus, in principle, only possible if this information has been scientifically checked for consistency and approved by the EFSA. Regarding nutrition claims (e.g. "low in sugar"), the Health Claims Regulation lays down specific admission requirements. More detailed provisions can be found in product-specific regulations, for example on dairy products and fruit juices. Apart from the health-related statutory labelling requirements, there are a few specific norms for the areas of environmental conservation, in particular the EU Regulation on Organic Farming.

The scope and precision of many claims and their placement on the product are the subject of intense discussion between the food industry and consumer associations (Spiller et al. 2014, Weinrich et al. 2015). There is some disagreement as to whether the extended labelling provisions are sufficiently clear and condensed so that consumers can reasonably easily assess the health and sustainability properties of food in their daily lives (cf. also Sections 7.6.2 and 8.5). In any event, it

is clear that in the past years the legislator has increasingly recognised that consumers need defined (protected) labelling as guidance when purchasing foods. In order for labels on foods to change the behaviour of consumers, consumers need to deal with the selection of food in a targeted manner. A major part of our purchasing decisions and nutritional decisions are based more on habit than on conscious thought. Labels are therefore a necessary but not sufficient requirement for consumers to eat more sustainably.

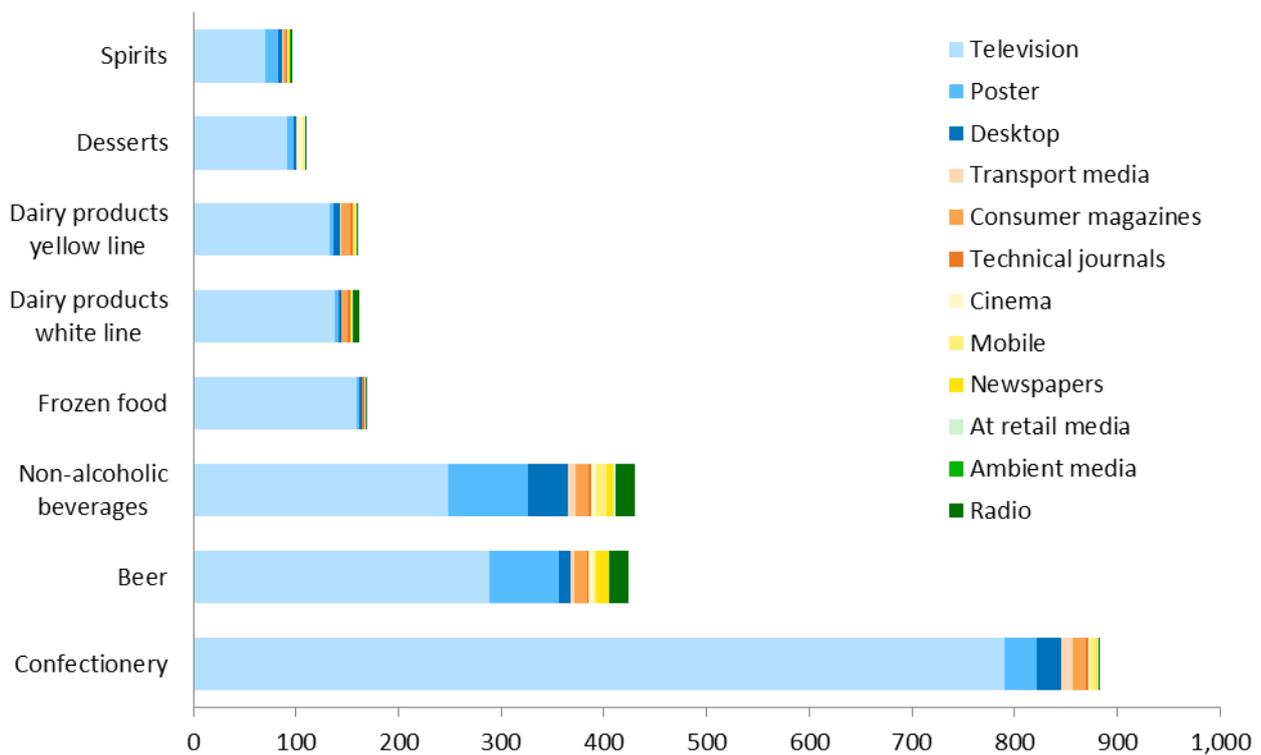
The fact that suppliers with great market power can influence food consumption habits is another reason why the government should intervene in the markets. Producers and retailers change preferences through **marketing** (product design, product placement, pricing, advertising etc.). Influencing the needs of customers may generally have a positive or negative impact on sustainability goals. Economically, marketing can also serve to spread sustainable innovations faster in the market. However, marketing can also direct preferences towards environmentally harmful or unhealthy variants. What product variants are promoted more strongly is therefore an empirical question.

An evaluation of spending on advertising shows that spending to advertise more highly processed products such as confectionery is many times higher than for unprocessed staple food (Figure 6-2).<sup>240</sup>

---

<sup>240</sup> In the US, only 4% of spending on advertising for food was on basic foodstuffs, i.e. non-processed or minimally processed staple food such as fruit, vegetables and meat (Okrent & Kumcu 2016).

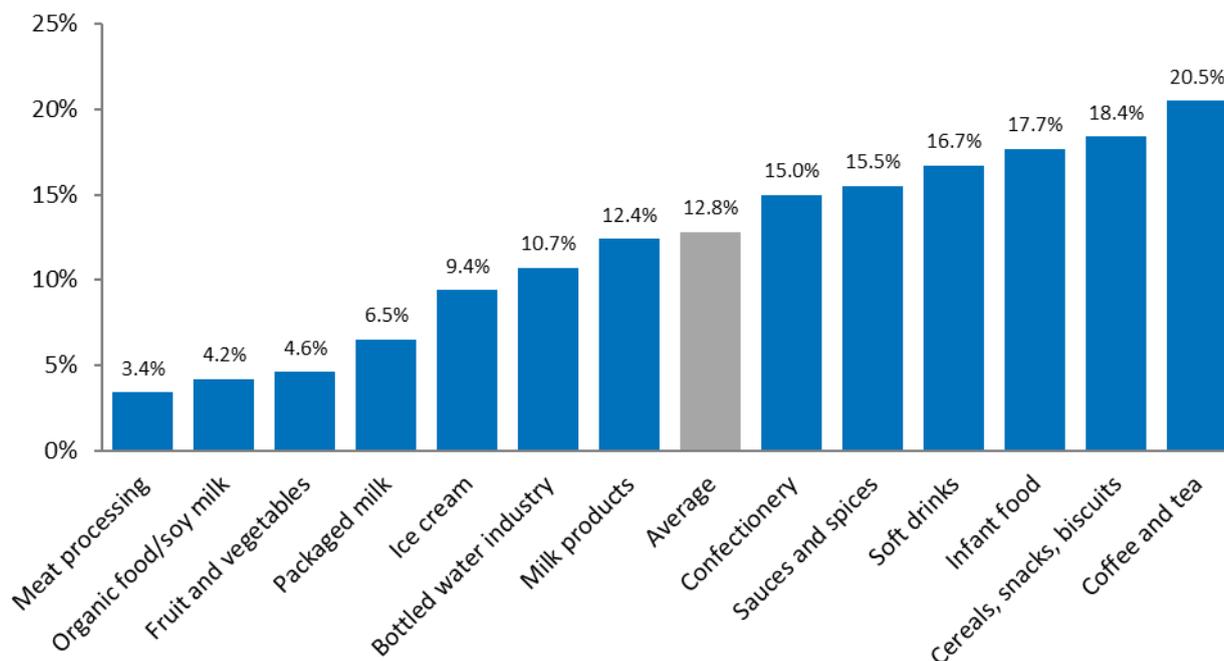
**Figure 6-2:** Gross spending on advertising by different food-industry sectors in Germany in 2017 (in million euro).



Note: Dairy products (white production line) = fresh, Dairy products (yellow production line) = cheese; Legend: Desktop = digital advertising content on websites, Transport media = advertising in public transport, Mobile = digital advertising for mobile devices, At retail media = advertising at shopping location, Ambient media = advertising in everyday life (pavements, pizza cartons etc.)

Source: WBAE illustration based on the Lebensmittelzeitung magazine of 07 September 2019, p. 44–45 (based on Nielsen data).

Alcoholic beverages, fast food and soft drinks are also heavily advertised (Harrison & Marske 2005). The reason for this is primarily to be found in the value-added potential of these products and the industry structure. Products such as confectionery are cheap to produce and have high profit margins, especially for branded goods (Fig. 6-3). While large national and international brand companies dominate here, fresh produce and low-processed products are mainly offered without brands. Data on the profitability of different food groups is provided by a JPMorgan study (2006), in which the corporate data of the 50 largest food business operators worldwide were compared (cf. Fig. 6-3). The study distinguishes three profitability groups: The lowest turnover (EBIT) is for unlabelled standard products (so-called commodities), especially fresh produce such as fruit, vegetables, milk and meat (staple foods, 3 to 6%). A second group (average profitability ranging between 9 and 12%) comprises more simply processed foods with mostly low brand strength, such as cheese or water. The highest profitability by far (over 15%) is found in the product groups of coffee/tea, baby food, cereals, snacks, soft drinks and sports drinks, confectionery, sauces and ready-to-eat meals. This is also where the strongest brands can be found.

**Figure 6-3:** Operating profit margin for different product groups in the global food industry

Source: JPMorgan (2006: 18), graphically adapted.

The low margins in commodity markets hardly allow for advertising expenditure. In contrast, highly processed products with low raw material costs allow for high profitability, which in turn makes high advertising expenditure attractive. Consumers are therefore much more motivated by advertising to buy product groups that tend to be “unhealthy”.

The **extent to which marketing influences preferences** is a subject of controversial debate. Extreme positions either assume that marketing measures have no influence on basic food consumption habits, but merely cause a shift in market shares between suppliers of the same products, or it is assumed that marketing has a comprehensive influence on food consumption habits. Both effects can generally be found in markets (Liu et al. 2015).

Conceptually, measuring the long-term effects of advertising on food consumption decisions is difficult because appropriate longitudinal data are rarely available and advertising effects fluctuate widely (Lewis & Rao 2015). A USDA study (Okrent & Kumcu 2016) shows different advertising elasticities for different food groups: According to this study, advertising for fast food and snacks has a particularly strong influence; a one per cent increase in advertising expenditure for fast food increases demand by 0.25%. For other product groups, the effects were weaker or not significant. An English study (Dubois et al. 2018) simulates the effect of an advertising ban on potato chips (as an example of junk food) on the basis of market data. The authors determine a decline in quantity of 15.2% if prices remain stable or of 9.7% under the realistic assumption that price competition

would then become tougher and prices would fall on average. Studies on tobacco marketing confirm that advertising restrictions reduce consumption, i.e. advertising measures have previously had a demand-increasing effect (Levy et al. 2013, see also Zheng et al. 2016 on the advertising effect for e-cigarettes).

Special attention is paid to influencing food consumption preferences through **marketing that targets children**. Estimates for the USA assume that children there are exposed to up to 40,000 TV commercials per year advertising foodstuffs, almost three quarters of which are for sweets, fast food and cereals (Chandon & Wansink 2012, cf. Section 3 “Exposure”). It is undisputed that younger children are particularly impressionable (vulnerable) as they have not yet developed any scepticism vis-à-vis marketing measures (see above). As a result of socialisation, they learn how to deal with attempts to influence them through advertising. However, adolescents are still particularly susceptible to social norms set by their peer group and corresponding influencing processes (e.g. through social media influencers) (cf. Section 3). The advertising effect is particularly strong here, not least because emotional and playful elements are often used (Boyland & Whalen 2015). In contrast, there is hardly any advertising aimed at children for “healthy” products, and when there is, the adverts often tend to be more informative, i.e. not really suited for children (Roose et al. 2018). Experiments have shown that children’s exposure to food advertising results in increased food consumption (Boyland et al. 2016, cf. Section 3).

The food industry also recognises the fundamental need to protect children. This is reflected, for example, in voluntary industry commitments to limit advertising aimed at children (on the low effectiveness see Effertz & Wilcke 2012). The scope of necessary marketing restrictions is the subject of heated debate (Harris et al. 2009, Lobstein et al. 2015, cf. Section 8.5).

In general, companies intervene in consumer preferences to a considerable extent. They do this through classic advertising, but increasingly also through other, less obvious communication measures such as sponsoring and event marketing, as well as online to an ever increasing extent (Boyland & Whalen 2015, He et al. 2017). The fact that these marketing efforts are focused to a very large degree on highly processed and rather unhealthy products is problematic.

Overall, it is evident that the state already intervenes in citizens’ decisions, i.e. in view of the systematically weaker position of consumers, it *nolens volens* provides a certain framework within which transactions take place. If the state has no choice but to influence consumption decisions, then it follows that state action steering consumer actions cannot be fundamentally illegitimate. The question is therefore not whether policy-makers want to shape food environments or not – even the omission of regulatory intervention results in a certain form of food environments.

If (food) policy cannot help but shape food environments, then it should do so consciously. The WBAE suggests aiming for so-called fair food environments, i.e. food environments that firstly are aligned with our human perception and decision-making options and behavioural patterns, and secondly are more health-promoting, socially, ecologically and animal welfare-friendly and thus

contribute to the preservation of the livelihoods of people living now and in the future. To this end, it is, *inter alia*, necessary to reduce factors in today's prevailing food environments that hamper sustainability in food consumption. The demands for defined (protected) labelling of credence attributes and for advertising restrictions address two concrete obstacles that today hinder consumers in realising their own nutrition-related goals. The WBAE takes the view that the high degree of information asymmetry regarding sustainability characteristics and the marked imbalance in marketing in favour of rather unhealthy product variants argue for more government intervention than has been the case to date (Sections 8 and 9).

## 6.5 Approval of food-policy interventions among the population

In order for food-policy interventions to be implemented in a democracy, they must not only be scientifically well-founded, they must also be accepted by the citizens (Effertz 2015). Even if interventions in the food consumption habits of citizens are considered legitimate on the basis of the arguments mentioned in the previous Sections, politicians may come to the conclusion that they should refrain from these measures due to presumed opposition from the addressees. The "Veggie Day disaster" of the Alliance 90/The Greens party in 2013, outlined in the introduction to this Section, is often interpreted as proof of the unpopularity of food-policy interventions.

The fact that the German population is particularly sceptical about food-policy interventions is explained in comparative cultural research by the specifically corporate orientation of the (West) German welfare state and the church tradition. In a high-profile contribution, Esping-Andersen (1990a, b) describes three types of welfare regimes: the liberal regime (e.g. Great Britain), the conservative regime (e.g. West Germany) and the social-democratic regime (primarily in Scandinavia). These **differed in terms of the respective mix of responsibilities attributed to the state, the market, civil society and/or the family** (Kjærnes 2003a, Richards et al. 2016).

In Scandinavia, public food policy is relatively well developed (e.g. free school meals in Finland) and should be seen in the context of the development of the Scandinavian welfare state. Access to health-promoting and diverse food featured on the political agenda as a socio-political issue as far back as the early 20<sup>th</sup> century and was taken up by the "National Nutrition Councils" responsible for nutrition-related issues from the 1930s onwards (Trübswasser & Branca 2009). The subject of nutrition was linked to the policy fields of health and social affairs at a very early stage. One of the main goals of food policy in Scandinavia (irrespective of the specific national form it took) was access to a health-promoting and nutritious diet for all population groups. In Sweden, Finland and Norway, nutritional issues are now the responsibility of the respective ministries of health and are understood as public health policies (Kjærnes 2003b).

In comparison, states with a corporatist orientation such as Germany and with a liberal orientation such as England have traditionally been more reluctant to intervene in individuals' consumption

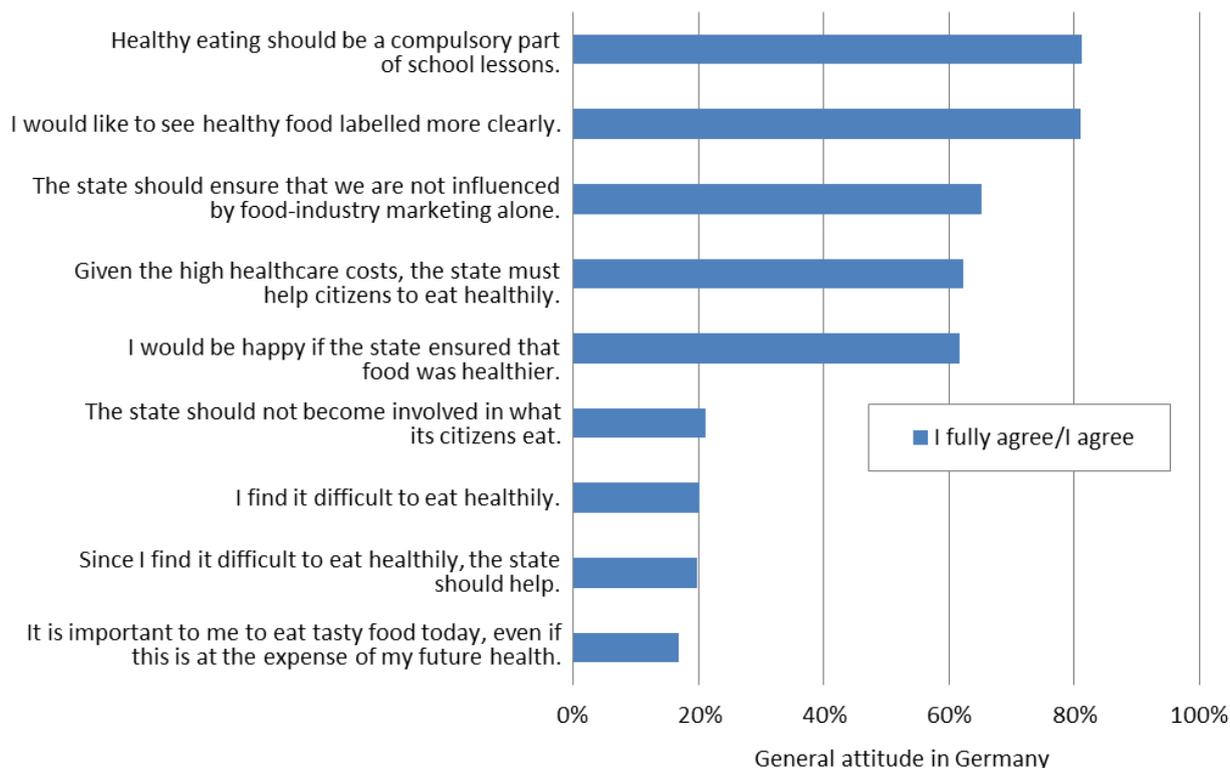
choices. For **corporatist welfare systems like West Germany**<sup>241</sup>, one characteristic is particularly noteworthy: the **emphasis on traditional family values**. Not least against the backdrop of the principle of subsidiarity developed by Catholic social doctrine, the welfare state is only supposed to intervene in families when family capacities are exhausted (Esping-Andersen 1990a). This tradition is reflected in West Germany, for example, in the long-standing scepticism towards state education in early childhood and the adherence to the traditional role model of women who give up their jobs (and cook meals) for their children. Interventions in the food consumption habits of citizens were therefore traditionally viewed with scepticism. Dietary deficits of children and adolescents are regarded as an educational problem.

This **culturally anchored scepticism** in West Germany (in contrast to East Germany) towards welfare state intervention in the family has, however, diminished in recent years as a result of **social modernisation**, as can be seen in the strong expansion of early childhood care facilities which are now almost completely state-funded. Recent empirical studies suggest that this change in societal values also applies to the area of food and nutrition and that here, too, the traditional attribution of responsibility to the family is moving slightly further into the background. However, the scientific evidence on this question of acceptance is limited, even though an increasing number of articles are being published which show that the population views state interventions positively (Lemken et al. 2018, Mata & Hertwig 2018). Figure 6-4 shows the results of a representative study commissioned by the Federation of German Consumer Organisations on selected attitudes on this subject (Zühlsdorf et al. 2018).

---

<sup>241</sup> In the GDR, a network of kindergarten crèches was established back in the 1950s, and school children often attended after-school day-care centres. The aim of these facilities was not only to enable both parents to work; the facilities also explicitly had an educational mandate assigned by the state. As a result of this tradition, the scepticism towards early childhood care outside the home and the focus on traditional role models is much less marked in today's eastern German states, the density of (all-day) crèches, nursery schools and schools as well as after-school day-care places and the accompanying offer of meals in crèches, nursery schools and schools is higher and utilised to a far greater extent than in the western German states.

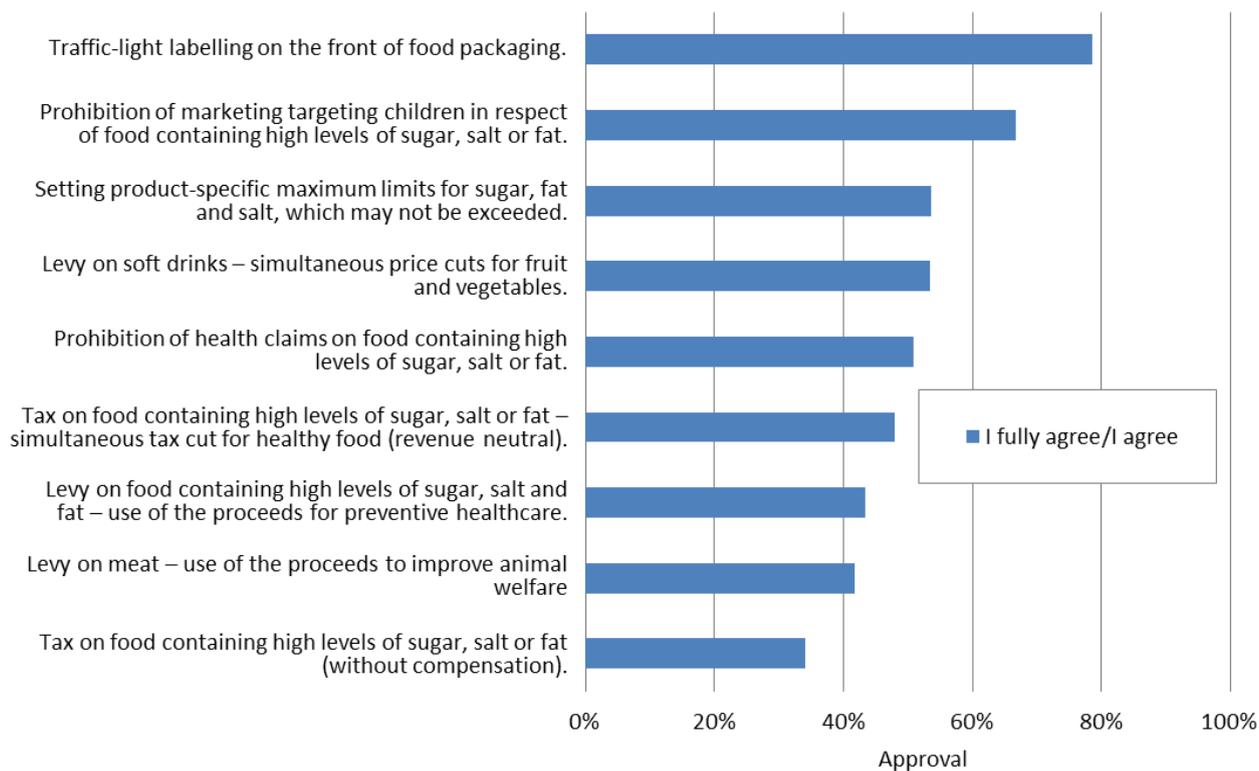
**Figure 6-4:** General attitude in Germany toward food policy



Note: Representative online survey among 1,035 consumers in November 2017. Five-tier Likert scale ranging from “fully agree” to “completely disagree”. Data expressed as a percentage of all answers.

Source: WBAE illustration based on Zühlsdorf et al. (2018: 20).

If one looks at individual instruments, information measures for health-promoting food consumption are typically supported, also in the form of more evaluative forms of labelling such as the food traffic light (Fig. 6-5).

**Figure 6-5:** Approval of food-policy instruments in Germany

Note: Representative online survey among 1,035 consumers in November 2017. Five-tier Likert scale ranging from “fully agree” to “completely disagree”. Exception: Attitudes towards the ban on child marketing are recorded on a nine-tier scale. Data expressed as a percentage of all answers.

Source: WBAE illustration based on Zühldorf et al. (2018: 20-27).

With regard to possible drivers influencing the approval of food-policy interventions, the state of research is as follows: Measures are more likely to be accepted if citizens assume that the environment is (also) to blame for the problems. Measures are more likely to be rejected if nutritional problems are seen as the result of individual misconduct (Aschemann-Witzel et al. 2016, Petrescu et al. 2016, Mata & Hertwig 2018). Likewise, approval usually increases when citizens themselves are affected by the initial problem (Aschemann-Witzel et al. 2016, Zühldorf et al. 2018). “If interventions are perceived as effective, they are more likely to be accepted” (Bos et al. 2015).

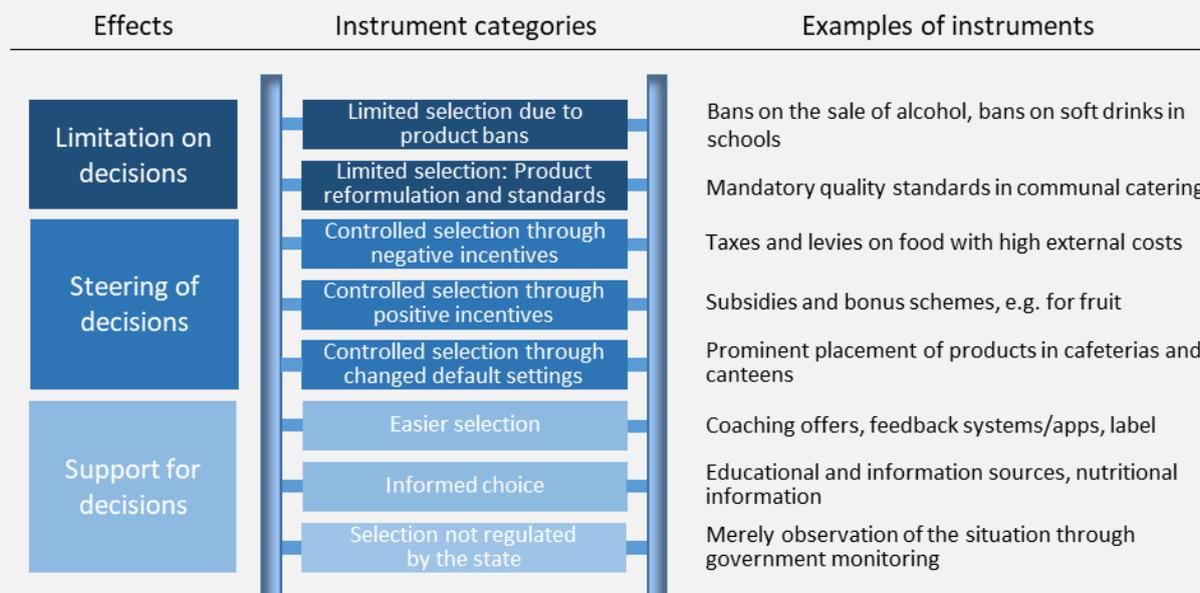
Approval tends to decrease with the **depth of the intervention in citizens’ decision-making autonomy** (see text box 16 below), with prohibitions being more readily accepted than taxes in some cases (Aschemann-Witzel et al. 2016, Lemken et al. 2018, Mata & Hertwig 2018). Nudging measures, e.g. a better placement of healthy or eco-friendly products or an elimination of sweets at supermarket checkout terminals, are mostly approved of (Petrescu et al. 2016, Reisch et al. 2017, Lemken et al. 2018). In contrast, taxes and advertising restrictions are viewed somewhat more sceptically. Small amounts of steering taxes are seen as rather ineffective for solving nutritional problems, which also contributes to the scepticism (Mata & Hertwig 2018). Using the tax

revenue for health and social policy objectives increases the acceptance of a food tax, as is the case with the soft drinks tax in the UK, which is to be used for school meals and school sports improvements. A similar increase in acceptance was established for the possible case of using a meat tax for animal welfare (Zühlsdorf et al. 2018).

**Text box 16:** Food-policy intervention ladder (“Nuffield ladder”)

In the literature, there are various attempts to systematise the different food-policy instruments. An approach is presented below that systematises them according to the intensity of the interventions in the market. The “ladder of food policy intervention” (“Nuffield ladder”) is a sequence of steps that ranks the instruments according to their increasing strength of influence on the personal choices of consumers (Jebb et al. 2013). Decision-supporting measures have the lowest intervention strength, while decision-restricting instruments limit choices or force changes in behaviour.

**Figure 6-6:** Food-policy intervention ladder



Source: WBAE illustration based on Nuffield Council on Bioethics (2007) and Jebb et al. (2013).

The **influence of the perceived fairness of a measure** is relatively large (Bos et al. 2015). Here lies the problem of tax increases if they primarily discourage low-income households from consuming certain products (cf. Section 7.6.3). It is obvious that citizens affected by tax increases respond more negatively than those not affected. General advertising bans tend to be viewed sceptically, whereas restrictions on advertising aimed at vulnerable target groups such as children are endorsed (Diepeveen et al. 2013, Effertz 2015 and Fig. 6-5). Older people and women, as well as people from larger cities, may be more supportive of food-policy interventions, but the outcome with respect to socio-demographics is inconclusive (Diepeveen et al. 2013, Lemken et al. 2018). Interestingly, prohibitions have higher levels of acceptance in some cases than taxes (Aschemann-

Witzel et al. 2016, Lemken et al. 2018, Mata & Hertwig 2018), possibly because citizens also assume that taxes are intended to generate financial revenue for the state and because prohibitions affect everyone, including wealthy citizens, and are thus perceived as fairer.

State interventions are seen more positively some time after their introduction than when they are first introduced; apparently people get used to them (“status quo bias”). An example of this is the clearly growing acceptance of the smoking ban in specific public spaces (e.g. workplaces, restaurants) in the years after the implementation (Fong et al. 2006).

Overall, the citizens’ approval of food-policy interventions is thus mixed. People tend to be subject to illusions of control, i.e. they typically assume that they can resist the “temptations” of a problematic food environment (cf. Section 3). Moreover, there is a relatively large optimistic bias (Sproesser et al. 2015): Most people assume in their self-perception that they eat a better diet than the average population. Nevertheless, the fact that a relatively high proportion of people also agree with stronger and fundamentally unpopular instruments such as steering taxes is an expression of an increasing awareness of the problem. It is not true to say that the population fundamentally rejects any interference with individual decisions in the area of food consumption and that any interventions must be taken against the will of those affected.

## 6.6 Conclusion

According to the WBAE, there is broad empirical evidence of a partial market failure in the food industry, which leads to sustainability deficits and specifically also to high economic burdens due to an increasing number of diet-related diseases. Due to these high economic costs and the associated individual burdens, the WBAE sees the need for stronger consumption-side governmental control than is currently the case. Measures focusing on the consumption side complement the classic regulatory and economic instruments that target the supply side; the latter reach their limits in open economies and in view of internationally divergent preferences.

The detailed analysis of the trade-off between consumer sovereignty and consumer protection makes it clear that the legitimacy of state intervention in the food consumption habits of consumers depends on the following factors:

- (1) the extent of external effects that are (partly) caused by food consumption habits,
- (2) the size of potential savings of economic costs through the reduction of diet-related illnesses caused (in part) by nutrition,
- (3) the intensity of the selective influence of marketing on consumer preferences in favour of more problematic foodstuffs,
- (4) the vulnerability of the respective consumer groups or, conversely, the degree to which citizens consciously choose unhealthy options,

- (5) the option of using target group-specific instruments to protect particularly vulnerable groups,
- (6) the attitudes of citizens (the target groups) towards government influence on their behaviour, as well as
- (7) the alternative availability of targeted measures on the supply side.

Moreover, the previous considerations show two things: Firstly, the reference framework by which the legitimacy of individual interventions must be gauged is not an ideal, intervention-free situation; instead, it consists of food environments characterised by a large number of interventions affecting consumption and eating habits. “Free” nutritional decisions are an illusion in this sense: what we consume and how we eat is always influenced by others (i.e. social influences, marketing) and other aspects (i.e. political, socio-cultural and material conditions). Some of these conditions are determined or at least influenced by government action, for example through information and labelling policies. However, the influence of economic actors in the context of corporate marketing is even more significant. Against this backdrop, **the question should not be whether it is at all permissible for the state to actively shape food environments**, i.e. the framework in which nutritional decisions take place; **instead, it should be what kind of influence citizens find socially desirable.**

Secondly, **arguments against certain interventions must be strong enough to outweigh the reasons for such an intervention**, i.e. the threat to the possibility of meeting the needs of people in the present and in the future. In essence, this is a matter of weighing up interests. Decisions must be made in particular about:

- a) The extent of food-policy interventions in consumer behaviour. The question is how great the interventions have to be in order to achieve the intended effects, and whether certain interventions interfere too much with individual freedom.
- b) The selection of appropriate, i.e. proportionate, instruments. This concerns the effectiveness and efficiency of instruments and their potential unintended side-effects. The question is which instruments achieve a certain objective with minimum restrictions on individual freedom of choice. Whether interventions in food-consumption activities should be permitted at all is then not a matter under discussion; instead, the question is what contexts make specific individual interventions, such as consumption taxes (Section 8.6), reasonable or necessary.



## 7 Governance of the food system

This section provides an analysis of the root causes of the problems identified in Section 4. The analysis will use the concept of “governance” which, for the purposes of the expertise, is used in the meaning of “control”.<sup>242</sup>

According to the widespread three-sector model (market, state, civil society), there are **three types of governing mechanisms**:

- (1) the **governing mechanism of the market** which is mainly based on competition between private companies as well as on their relationship with consumers which is established through the market;
- (2) the **governing mechanism of the state**, which can influence market activities through a range of different measures; and
- (3) the **governing mechanism of civil society**, i.e. organised social groups who have influence on the market and its stakeholders as well as on the state. According to the three-sector model, civil society associations are associations which do not represent the economic interests of their members but consist of citizens (not companies) and represent public or general interests, for example in relation to environment protection or social aspects.<sup>243</sup>

This expertise speaks of a “**governance problem**” if processes and interactions within or between the market, government or civil society result in existing potentials for making food consumption more sustainable not being fully exploited.<sup>244</sup> In order to identify these governance problems, the analytical framework described in the following section (Section 7.1) was developed. Said analytical framework is subsequently used to outline the organisations and stakeholders relevant to the governance of the food system (Section 7.2). In principle, the state can influence market activities through a large range of measures. However, the state cannot, in the interest of public welfare, overcome all forms of market failure by acting as a “benevolent dictator”. Government action is instead subject to the governing mechanisms of the political and administrative system in which citizens, their voting behaviour, political parties, stakeholder associations representing the economic sector, civil society associations and also science play a role. The interactions of all these

---

<sup>242</sup> The term “governance” stems from the Latin term *gubernare* (to govern). Nowadays, the English term governance is also widely used in the German-language literature in the field of economic and political sciences (cf. Benz et al. 2007).

<sup>243</sup> For a definition of civil society see Zimmer (2012). The stakeholder bodies of business enterprises often state that, besides economic interests, they also pursue further society-related environmental and social goals. As can be expected, these goals play a significant role in the organic food associations.

<sup>244</sup> In the literature on economics, governance problems of the market are referred to as “market failures”. Similarly, state governance problems may be referred to as “state failures” or “policy failures”. Problems relating to civil society are sometimes referred to as “community failures”. However, using the term market failure in a state or society-related context is problematic as a governing mechanism often does not “fail” completely; it is rather the case that there are problems related to variations in how far-reaching the different effects are. This expertise therefore uses the term “governance problem”.

stakeholders often do not result in overcoming the problems described in Section 4. The description of the state governance problems (Section 7.3) confirms the theory already mentioned in Section 6 that sustainability problems regarding food consumption cannot be solved by policy instruments targeted at producers alone. Policy measures targeting consumers are also required. With regard to these consumption-side policy measures, the description of the state governance problems highlights the significance of framing measures as well as the opportunities offered by formulating so-called policy packages. Governance problems also exist with respect to the innovation system (Section 7.4).

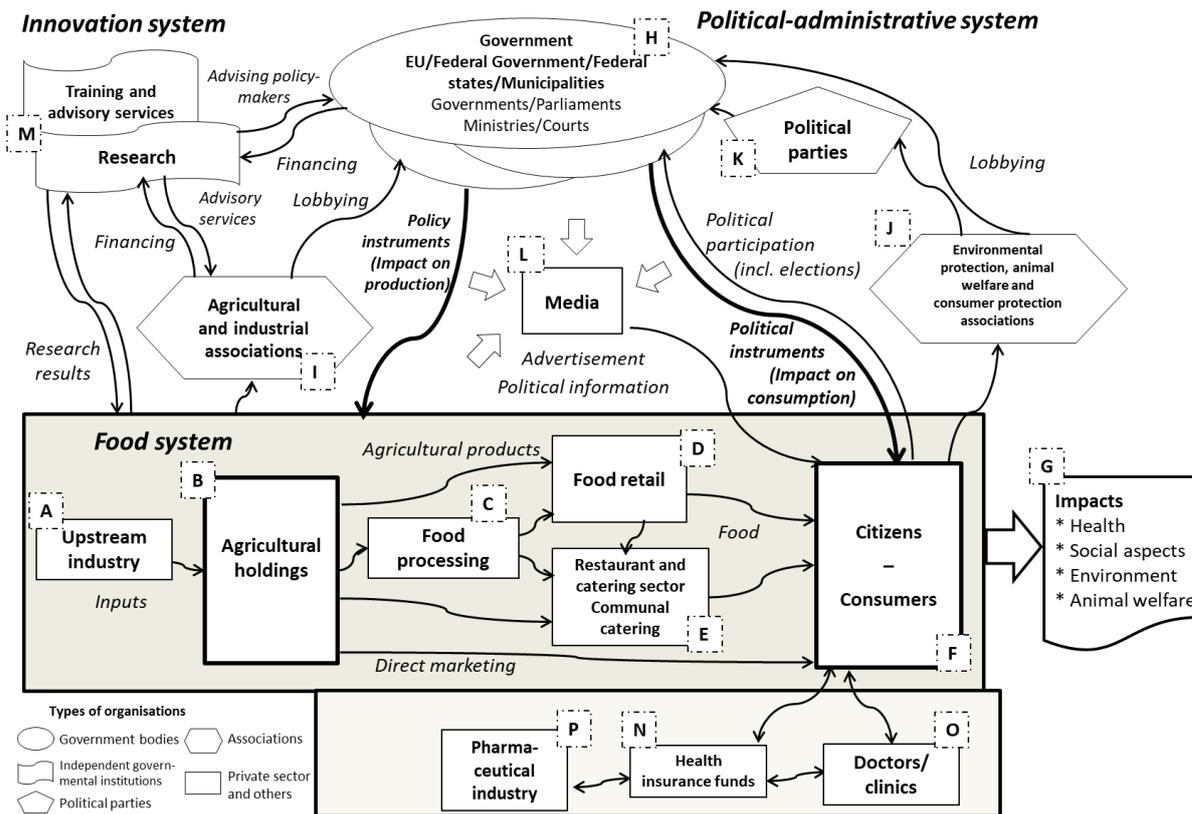
Besides these general governance problems, there are also far-reaching specific governance problems regarding implementation in central areas of food consumption and nutrition. Section 7.5 describes three policy elements in promoting more sustainable food consumption which address these specific governance problems and which the WBAE believes are to be recommended: Governance problems relating to the implementation of more sustainable catering in schools and preschools; to steering taxes; and to labelling.

## 7.1 Analytical framework

The analytical framework consists of five elements which are shown in Figure 7-1 and will be further elaborated in the following.

**Food system:** The “food system” is central to the analytical framework. As already mentioned in Section 5.4, a food system as defined by the FAO gathers “all the elements (environment, people, inputs, processes, infrastructures, institutions, etc.) and activities that relate to the production, processing, distribution, preparation and consumption of food, as well as the outputs of these activities, including socio-economic and environmental outcomes” (HLPE 2014: 29). In other words, the food system encompasses all food value chains, including consumption, as well as their socio-economic and environmental impacts. Boxes A-F in Figure 7-1 show the elements of the food system. As further explained below, value chains are mainly subject to the governing mechanism of the market. Due to the fact that this expertise deals with more sustainable consumption, consumers (Box F) are especially highlighted in this figure. Being citizens, they are, as described below, also part of the political and administrative system. Box G shows the food system’s impact in terms of health, social aspects, environment and animal welfare.

Figure 7-1: Governance of the food system – analytical framework



Note: For the sake of clarity, not all connections between the media and the relevant stakeholders were able to be depicted using single arrows. In Figure 7-1, we therefore used block arrows. Also, there are more connections between the different elements than the ones indicated by the arrows in the figure. Further elements are also conceivable. The figure only illustrates those aspects which are considered to be especially relevant for the purposes of this expertise.

Source: Birner (2019: 91), adjusted.

**Political and administrative system:** The second element of the analytical framework is the political and administrative system which is depicted in the upper half of the figure. This encompasses various governmental institutions (Box H) which can influence the food system by applying different policy instruments. Out of the three governing mechanisms described above, it is the governing mechanism of the state which applies to Box H. Governmental institutions, however, are also subject to the influences of the food system’s stakeholders. As shown above, the consumers themselves form a stakeholder group as they (as explained above) can, as citizens, have an influence, especially through elections or through participation in political parties (Box K) or civil society groups (Box J) which are subject to the governing mechanism of civil society (cf. Section 7.0). Another significant stakeholder group consists of business enterprises working at different value chain stages. They can influence political decision-making through lobbying activities (Box I).

**Innovation system:** Research and training in the area of agricultural and nutritional sciences have a major impact on the food system. In the analytical framework, they are therefore depicted as an individual element (Box M) under “innovation system”. Innovations, i.e. putting scientific findings into practice, can play a significant role in promoting more sustainability in food consumption. But the research institutions are also subject to economic, political and social influences which can cause governance problems as will be explained further on.

**Health care system:** As health aspects play an important role in this expertise, the health care system is also included in the analytical framework. However, the health care system will not be analysed in detail. The focus will instead be on elements which are of particular relevance in promoting more sustainability in food consumption. Health insurance funds are of special importance as, on the one hand, they have to bear a major portion of the health care costs linked to non-sustainable food consumption and, on the other hand, they can, in principle, influence food consumption habits, for example through their contribution structure or their expenditure for preventive measures. At the same time, health insurance funds are, to a relatively high degree, governed by the state.

**Media:** The media are depicted as an individual element (Box L) within the analytical framework because they play a key role for the communication between different stakeholders and consumers or citizens. They convey food advertisements, form a platform for political discussions on agricultural and food policy and are a significant channel via which findings in the field of agricultural and nutritional sciences can be passed on to consumers. In addition to that, associations from industry and civil society use the media as a means of political communication.

## 7.2 Organisations and stakeholders

In this section, the analytical framework described above is used to outline the most important organisations and stakeholders relevant to the governance of the food system.

### 7.2.1 Food system

The food system is mostly characterised by private sector organisations which are subject to the market’s governing mechanism<sup>245</sup>. In order to understand the different stakeholders’ importance, Figure 7-2 illustrates the production values<sup>246</sup> achieved in Germany’s food system. In the upstream sector (shown in Box A in Figure 7-1), the production value is at around 47 billion euros. More than

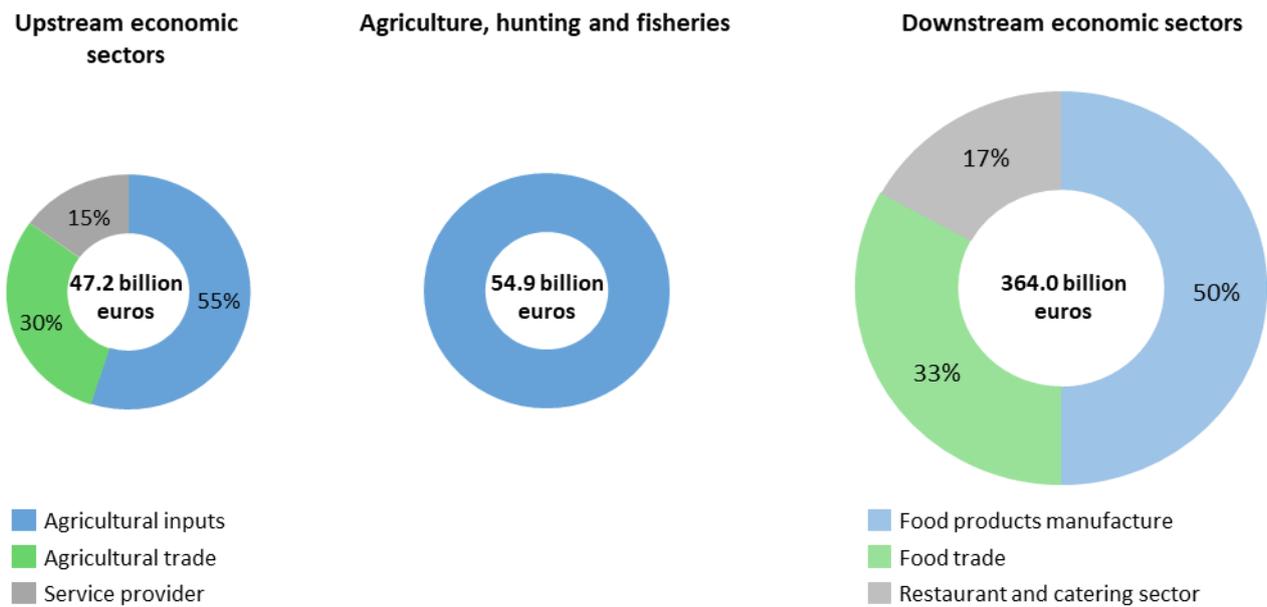
---

<sup>245</sup> However, the income situation of the agricultural holdings is subject to the EU’s Common Agricultural Policy (CAP) and thus strongly influenced by the government.

<sup>246</sup> The production value is the value of all goods and services generated by the respective companies within the relevant period of time (2017) including inputs (i.e. goods and services obtained from other companies).

half of this value is generated by companies which produce agricultural inputs (seeds, fertiliser, etc.). For agricultural production (Box B in Figure 7-1), the production value is roughly 55 billion euros and the gross value around 21 billion euros, which corresponds to around 0.7% of Germany’s total added value. The production value in the downstream sector, which includes a major part of the agricultural production value as input, is slightly more than 360 billion euros; over half of this amount is contributed by the food sector (Box C in Figure 7-1), a third is generated by food retailing (Box D in Figure 7-1) and the remainder by the restaurant and catering sector (Box E in Figure 7-1).

**Figure 7-2:** Production values in the food system in 2017



Source: DBV (2018: 9), slightly modified and graphically adjusted.

The upstream and downstream agricultural sectors are characterised by a high degree of market concentration. As further elaborated in the following, this is linked to the problem of market power which is one of the governance problems of the food system. Agricultural production itself continues to be characterised by a great number of family-run farms and, in Eastern Germany, by a considerable percentage of legal persons. For decades, the number of holdings has been declining by around 3% annually as part of the structural change.

### Upstream agricultural sector

The upstream agricultural sector is marked by an increasing degree of market concentration. In 1997, the four largest seed corporations held global market shares of 23%; by 2004, their market share had increased to 33% (World Bank 2007: 136). After the merger of Bayer and Monsanto, Syngenta and ChemChina as well as Dupont and Dow, market concentration increased further. However, the degree of market concentration varies significantly depending on the crop species and country, as a study which was recently conducted by the OECD (2018a) shows.

Table 7-1 depicts the largest four seed companies' market shares for different crops in Germany compared with those in the United Kingdom (GB) and the United States of America (USA). In this calculation, the value of seeds saved by the farmers themselves was also taken into account (OECD 2018a: 117 et seq.). This explains, at least to a certain extent, why the concentration level for those crop species whose seeds can be saved by the farmers themselves and whose gross value for the seed industry is hence lower – which here applies to wheat and barley, for example – than for other crop species.

**Table 7-1:** Market shares of the four largest seed manufacturing companies

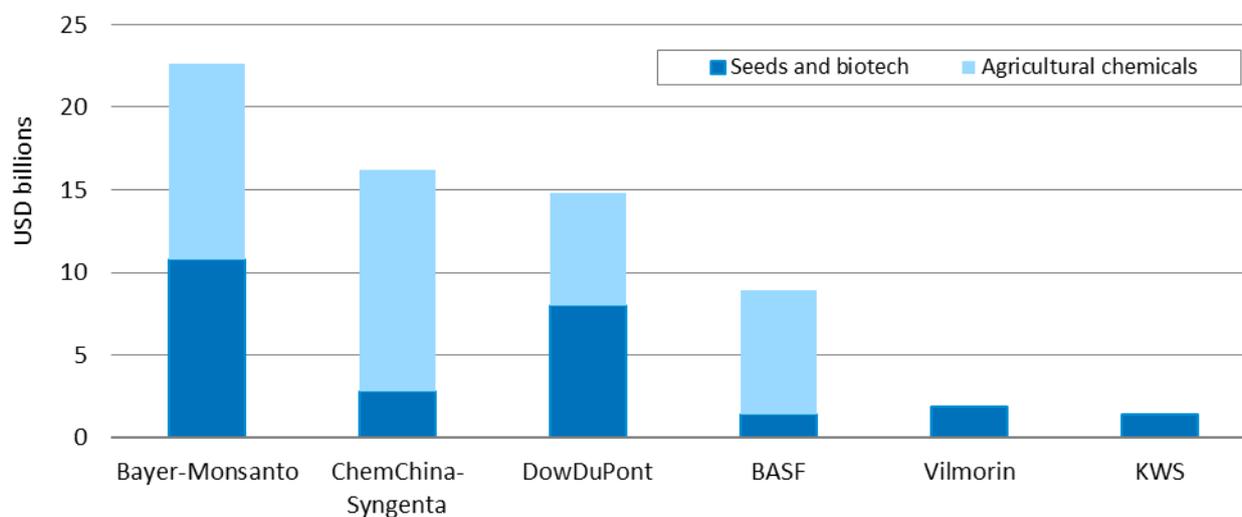
	Germany	GB	USA
Maize	66 %	85 %	82 %
Wheat & barley	44 %	77 %	not specified
Rape	74 %	66 %	not specified
Sugar beets	100 %	not specified	not specified
Potatoes	59 %	not specified	not specified
Soya	not specified	not specified	69 %

Note: The percentage given corresponds to the CR4 ratio which indicates the market share of the four largest companies. The market share refers to the sales value and not to the volume. In this calculation, the value of seeds saved by the farmers themselves was taken into account.

Source: OECD (2018a: 120-125).

Figure 7-3 shows the worldwide turnover of the leading companies for seed and biotechnology products (green genetic engineering) as well as for pesticides (agrochemicals) in absolute numbers; these amounts were calculated by the OECD as a part of their study. The amounts show that, following the mergers, four large corporations control the business with regard to the aforementioned products.

**Figure 7-3:** 2017 pro forma sales of leading firms after mergers and divestitures



Note: The term “pro-forma” refers to earnings figures which are calculated in a way that allows a company’s performance to be compared over different periods of time. Extraordinary cash flows, for example, are not taken into consideration.

Source: OECD (2018a: 57), graphically adjusted.

Market concentration has also increased in some areas of the upstream livestock production industry. Further details can be found in the WBA’s 2015 expertise on livestock husbandry (WBA 2015: Section 2.4). In the poultry farming sector, for example, 90% of all laying hens are now bred by only two groups of companies worldwide (WBA 2015: 36). A lower market concentration can be found in the animal feed industry (WBA 2015: 35). As regards livestock housing, there are hardly any data available. With respect to the production of robot milking systems, the market leaders Lely and DeLaval hold a global market share of more than 75%.<sup>247</sup>

### **Downstream sector: food industry, food retailing and away-from-home catering market**

The agricultural sector delivers its products to the food industry, partly via agricultural and livestock trade, and in some cases also delivers them directly to the food processing industry or away-from-home caterers. Roughly estimated, two thirds of the turnover can be attributed to retail food trade,

<sup>247</sup> See <https://www.marketwatch.com/press-release/global-milking-robots-market-report-2019---industry-research-report-by-manufactures-types-applications-and-market-dynamics-2019-04-16>.

including artisanal food production, and one third to the away-from-home catering market. These markets' structures differ significantly.

The food industry is a strongly polarized sector. In Germany, there are on the one hand 6,119 mainly small and medium-sized producers which in some cases operate only regionally (BVE 2019), and on the other a number of globally operating companies. The globally operating companies often own strong international brands (cf. Table 7-2).

**Table 7-2:** Leading food producers (worldwide, 2017)

Companies	Food retailing sales in USD billions (excl. excise taxes)	Company headquarters
Nestlé	91.2	Switzerland
Procter & Gamble	64.6	USA
Pepsico	63.5	USA
Unilever	60.5	Netherlands/UK
AB Inbev	56.4	Belgium
JBS	49.6	Brazil
Tyson Foods	38.3	USA
Coca-Cola	35.4	USA
L'Oréal	29.3	France
Philip Morris International	28.8	USA
Danone	27.8	France
Kraft Heinz	26.2	USA

Source: WBAE table based on <https://de.statista.com/statistik/daten/studie/265723/umfrage/erfolgreichste-fmcg-unternehmen-nach-leh-umsatz-weltweit/> (last accessed on: 19.12.2019).

The most important sub-sectors of the German food industry are the meat production sector with a turnover share of 23.7% and the dairy industry with a share of 15.1%, followed by the pastry sector (9.7%) and the confectionery/preserved baked goods/ice cream sectors (7.6%) (BVE 2019). This shows the enormous economic significance of animal products. The dairy industry and, above all, the meat industry are sectors which are – like the fruit and vegetable industry – characterised by the fact that the leading producers mainly offer store brands and mass-produced goods (e.g. dried milk products for further processing by international food corporations) destined for international trade; this means their actions are significantly price-driven in terms of competition.

Food retailing is highly concentrated at national level but still strongly competitive. Four groups of companies (Edeka, Rewe, Lidl/Kaufland and Aldi) account for approximately 70% of food retailing sales in Germany (Table 7-3). In addition, there are sellers offering a selected range of products: drugstore companies (dm, Rossmann, Müller), smaller regionally operating chain stores such as Globus or Bunting and retailers specialising in organic products like Dennree or Alnatura.<sup>248</sup>

<sup>248</sup> The turnover and market share figures vary among the different studies depending on the range of products included under food retailing.

**Table 7-3:** Overview of the four leading company groups of food retailing in Germany 2018

Companies	Retail sales 2018 in Germany in billions of Euros	Number of selling points (2017)	Turnover share for Germany in %
Edeka (Edeka, Netto)	53.9	13,646	26.2
Rewe Group (Rewe, Penny)	33.1	7,532	16.1
Schwarz group (Lidl, Kaufland)	32.3	3,879	15.7
Aldi (South, North)	24.7	4,140	12.0

Source: WBAE overview according to the BVE (2019) and data taken from the Lebensmittelzeitung magazine (<https://www.lebensmittelzeitung.net/handel/Ranking-Top-30-Lebensmittelhandel-Deutschland-2018-134606>) (total turnover 205.8 billion euros).

The concentration level of German food retailing has continuously increased over recent decades; this was mainly due to internal growth. Attempts to enter the market, even by huge international competitors such as the worldwide market leader Walmart, failed. Hence, the Federal Cartel Office and also the Monopolies Commission now presume that the four company groups Edeka, Rewe, Lidl/Kaufland and Aldi have a relatively strong buyer power (Federal Cartel Office 2014, Monopolies Commission 2012). Given the narrow margins and complex fresh food logistics, selling food online has so far only played a small role in Germany.

In comparison with food retailing, the away-from-home catering market is more divided. There are a few international providers (franchise systems) in the fast food sector, some canteen kitchens and frozen food delivery companies as well as a great number of small and micro businesses in the restaurant/catering and fast food sector. Online marketplaces such as Lieferando are playing an increasing role in the food-delivery sector.

## 7.2.2 Political and administrative system

As shown in Figure 7-1 and in accordance with the analytical framework applied here, the political and administrative system includes stakeholders who can exercise a controlling influence on the food system. These stakeholders consist of the executive, legislative and judicial government bodies as well as entities who influence the government bodies' actions: political parties, stakeholder associations from the economic sector, civil society associations and the media.

### 7.2.2.1 Government bodies

The government bodies dealing with the food system belong to vertically different levels (EU, Federal Government, federal states, municipalities) and, on a horizontal level, they consist of different ministries and authorities.

#### EU level

With its Common Agricultural Policy, the EU level plays a pivotal role in the agricultural sector; for the food and nutrition sector, however, this applies only to a limited extent. As executive body, the European Commission's Directorate-General for Agriculture and Rural Development (DG AGRI) is responsible for the agricultural sector. Food safety and food labelling matters lie within the competence of the Directorate-General for Health and Food Safety (DG SANTE). The Directorate-General for Environment (DG ENV) is responsible for all environmental matters. As matters relating to food and nutrition largely fall under the competence of the EU Member States, there is no Commission-established body which is responsible for such matters at EU level.

The European Food Safety Authority (EFSA) is responsible for risk assessment along food value chains. Furthermore, at EU level there is the "Platform for Action on Diet, Physical Activity and Health"<sup>249</sup> which encompasses the Guidelines drawn up by the EU "High Level Group on Nutrition and Physical Activity"<sup>250</sup>. The High Level Group is chaired by the European Commission and consists of representatives of the EU Member States and the EFTA States. Together with the EU's Platform for Action, the Group organises meetings in which representatives of the food sector also take part. In these joint meetings, they discuss topics such as the food sector's strategies to improve nutrition.<sup>251</sup>

As far as legislation is concerned, agricultural policy is part of the so-called ordinary legislative procedure in which the European Parliament and the Council (of Ministers) have equal decision-making powers and the Commission holds a strong position due to its right of proposal. There is a Committee on Agriculture and Rural Development (AGRI) which is part of the European Parliament. Food security and environment issues are dealt with by the Committee on the Environment, Public Health and Food Safety (ENVI). The European Parliament does not have a committee for health-related matters.<sup>252</sup> Furthermore, there is no specific committee dealing with matters relating to food and nutrition as, unlike the field of agricultural policy, this policy field is not communitised. In the judicial branch, however, the EU plays an important role as regards food and nutrition related issues because it makes decisions which have a far-reaching impact on the food and nutrition

---

<sup>249</sup> [https://ec.europa.eu/health/nutrition\\_physical\\_activity/platform\\_de](https://ec.europa.eu/health/nutrition_physical_activity/platform_de).

<sup>250</sup> [https://ec.europa.eu/health/nutrition\\_physical\\_activity/high\\_level\\_group\\_de](https://ec.europa.eu/health/nutrition_physical_activity/high_level_group_de).

<sup>251</sup> See e.g. [https://ec.europa.eu/health/sites/health/files/nutrition\\_physical\\_activity/docs/ev\\_20181026\\_co01\\_en.pdf](https://ec.europa.eu/health/sites/health/files/nutrition_physical_activity/docs/ev_20181026_co01_en.pdf).

<sup>252</sup> See list of committees (version of May 2019): <https://www.europarl.europa.eu/committees/de/parliamentary-committees.html>.

sector. Examples include rulings of the European Court of Justice (ECJ) on genome editing as well as on the labelling and advertising of foods.

### Federal level

**Federal ministries:** In Germany's federal system, the ministry responsible for agricultural matters is also responsible for food and nutrition-related matters (Federal Ministry of Food and Agriculture, BMEL) at federal level. In other European countries, in contrast, food and nutrition-related matters fall within the competency of the ministry of health (Trübswasser & Branca 2009) or the ministry dealing with both health and social affairs (Nowack 2017).

In principle, combining the fields of food, nutrition and agriculture within one ministry creates a good basis for taking into account the interactions between agricultural policy and food policy. This combination, however, also poses the challenge of providing food and nutrition-related matters with appropriate political attention and resources. Currently, the following BMEL Directorates mainly deal with food and nutrition-related matters: Directorate 21 (Food) belongs to Directorate-General 2 (Consumer Health Protection and Food Product Safety).<sup>253</sup> Directorate 31 is responsible for "Consumer Health Protection and Safety of the Food Chain" and is a part of Directorate-General 3 (Food Safety and Animal Health). Matters relating to the food sector are handled by Directorate 41 (Agricultural Markets and Food Industry) which belongs to Directorate-General 4 (Agricultural Markets, Food Industry and Exports). Questions on global food and nutrition issues are dealt with in Directorate 62 (International Cooperation and World Food Affairs) which is part of Directorate-General 6 (EU Affairs, International Cooperation and Fisheries). Another challenge to an integrated food policy is the fact that different Directorates are responsible for dealing with policy issues in this field.

**Coordination mechanisms between the ministries:** Besides the BMEL, there are other federal ministries which directly or indirectly deal with different aspects of food and nutrition: the Federal Ministry of Health (BMG); the Federal Ministry for the Environment, Nature Conservation and Nuclear Safety (BMU); the Federal Ministry of Labour and Social Affairs (BMAS); the Federal Ministry of Family Affairs, Senior Citizens, Women and Youth (BMFSFJ) and the Federal Ministry for Economic Cooperation and Development (BMZ). The rules of cooperation within one ministry and between the different ministries are laid down in the Joint Rules of Procedure of the Federal Ministries (GGO). Pursuant to the GGO, "the primarily responsible Ministry involves the other substantively concerned ministries. The GGO hence creates the obligation to involve other working units and – where other units are particularly concerned – to do so by way of co-signature."<sup>254</sup> In the case of cross-sectional tasks, it is also laid down in the GGO that "the consent of the competent federal ministries should be obtained" before a proposal for a new cabinet bill is presented

---

<sup>253</sup> See BMEL organisational chart (version of January 2020):

[https://www.bmel.de/SharedDocs/Downloads/Ministerium/Organisationsplan.pdf?\\_\\_blob=publicationFile](https://www.bmel.de/SharedDocs/Downloads/Ministerium/Organisationsplan.pdf?__blob=publicationFile).

<sup>254</sup> <https://www.bmi.bund.de/DE/themen/moderne-verwaltung/verwaltungsmodernisierung/geschaeftsordnung-bundesministerien/geschaeftsordnung-bundesministerien-node.html>.

(Sec. 22 (3)). All ministries have divisions shadowing the other ministries with the purpose of ensuring cooperation. At the BMEL, for example, there is a division shadowing the Federal Ministry of Health and one shadowing the Federal Chancellery, which all other ministries also have. It is also possible to establish an interministerial working group (IMAG) for the purpose of cooperation. Currently, there is an interministerial Working Group for Bioeconomy chaired by the BMEL. Hence, it would be possible to create an IMAG to promote sustainability in food consumption, which could then also be established as a permanent institution. As an alternative to that, one could assign a ministry with the task of developing an overall strategy to promote more sustainable food consumption.

**German Bundestag:** As the committees of the German Bundestag largely shadow the ministries' departments, food and nutrition-related matters fall within the remit of the Bundestag's Committee on Food and Agriculture. Apart from that, there are certain issues relating to food and nutrition which are dealt with by the Committees of the aforementioned ministries (health, environment, etc.).

**Authorities:** There are several other authorities which handle food and nutrition-related matters apart from the ministries. One of them is the Federal Agency for Agriculture and Food (BLE). Following the restructuring of the BLE in 2017, issues relating to food and nutrition now fall within the remit of the Federal Centre for Food and Nutrition (BZfE) which is a part of the BLE.<sup>255</sup> Out of the seven divisions of the BZfE, there is one dealing with sustainable consumption issues ("Food and Sustainable Consumption"). The BLE also houses the National Quality Centre for Healthy Nutrition in Schools and Preschools.<sup>256</sup> In terms of food safety, the Federal Office of Consumer Protection and Food Safety (BVL) and the Federal Institute for Risk Assessment (BfR) play a significant role. Further food and nutrition related research institutes within the BMEL's remit are mentioned in Section 7.2.3 (innovation system).

### Federal-state level

At the level of the federal states, the assignation of responsibilities for food and nutrition-related matters differ. This will be explained using the following two examples: Baden-Württemberg and Mecklenburg-Western Pomerania.

In **Baden-Württemberg**, the State Ministry of Rural Affairs and Consumer Protection (MLR) is responsible for food and nutrition-related matters as well as for agricultural matters. In Department 3 (Consumer Protection and Food), there is a division specialising in food and nutrition-related matters. Furthermore, there are other divisions dealing with issues concerning food and nutrition, e.g. food control or consumer policy.<sup>257</sup> In the State Parliament, there is a

---

<sup>255</sup> [https://www.ble.de/DE/BLE/Organisation/organisation\\_node.html](https://www.ble.de/DE/BLE/Organisation/organisation_node.html) (May 2019).

<sup>256</sup> <https://www.bzfe.de/inhalt/nationales-qualitaetszentrum-fuer-ernaehrung-in-kita-und-schule-nqz-30016.html>.

<sup>257</sup> <https://mlr.baden-wuerttemberg.de/fileadmin/redaktion/m-mlr/intern/dateien/PDFs/Organisationsplan.pdf>.

Committee on Rural Areas and Consumer Protection, corresponding to the MLR's remit, which is responsible for food and nutrition matters. Similar to the federal level, other state ministries and committees directly or indirectly deal with different aspects of more sustainable food consumption as well. In line with the principle of autonomy in cultural and educational affairs, matters relating to education are dealt with at the level of the federal states. This is relevant to food and nutrition because this means that educational measures for promoting more sustainable food consumption fall within the remit of the respective state ministry or committee of the state parliament. In the State of Baden-Württemberg this would be the State Ministry for Culture, Youth and Sport and the respective Committee of the State Parliament.

In addition to that, there are several different authorities that deal with food and nutrition-related issues at the level of the federal states. In Baden-Württemberg, there is the State Centre for Food and Nutrition which is part of the State Institute for Agriculture, Food and Rural Areas. The State Institute is designed to be an education and competence centre which supports the lower agricultural authorities at district level. Hence, the State Institute for Food mainly fulfils tasks relating to providing nutritional information and education as well as in the fields of catering in schools and preschools or communal catering.<sup>258</sup> Baden-Württemberg has set up an action programme with the title "Sustainable eating" as part of its sustainability strategy. Above all, the programme aims to optimise the quality of food when eating out.

In the State Ministry of Agriculture and Environment of **Mecklenburg-Western Pomerania** there is neither a department nor a division which has the term "nutrition" in its name. There is one division entrusted with "Monitoring of food, commodities and cosmetics".<sup>259</sup> In the State Ministry for Economic Affairs, Labour, and Health<sup>260</sup> and in the State Ministry for Social Affairs, Integration and Equality, there is no division which has the term "food" in its name. However, the State Ministry of Agriculture and Environment does actually deal with food and nutrition-related matters. For example, State Minister Backhaus announced a new nutrition strategy for the federal state in 2019.<sup>261</sup> Furthermore, "Nature & Nutrition" is one of the seven tabs on the internet portal of the State of Mecklenburg-Western Pomerania.<sup>262</sup> The State Minister for Social Affairs, Integration and Equality also promotes policy instruments related to food and nutrition. Since January 2015, for example, there has been the rule that "healthy and wholesome meals have to be an integral part

---

<sup>258</sup> <https://mlr.baden-wuerttemberg.de/de/unser-service/presse-und-oeffentlichkeitsarbeit/pressemitteilung/pid/eroeffnung-des-neu-gegruendeten-landeszentrums-fuer-ernaehrung-in-schwaebisch-gmuend/>.

<sup>259</sup> <https://www.regierung-mv.de/Landesregierung/Im/Ministerium/Organigramm/>.

<sup>260</sup> <https://www.regierung-mv.de/Landesregierung/wm/Das-Ministerium/Organigramm/>.

<sup>261</sup> <https://www.regierung-mv.de/Landesregierung/Im/Aktuell/?id=146674&processor=processor.sa.pressemitteilung>.

<sup>262</sup> <https://www.mecklenburg-vorpommern.de/startseite/>.

of the services offered by preschool facilities during their opening hours”.<sup>263</sup> The federal state also promotes regional networks in the food industry.<sup>264</sup>

The examples of these two federal states demonstrate that, at the federal state level, the field of food and nutrition is institutionalised to different degrees and in different ways and that the states implement a variety of initiatives in this field. Hence, the question arises as to how much exchange and cooperation there is between the Federal Government and the states; this will be elaborated in the following.

### **Coordination between the Federal Government and the federal states**

The Conference of Agriculture Ministers of the Federal Government and the Federal States (AMK) plays an important role in terms of coordination between the Federal Government and the states in the field of agriculture. In the framework of this Conference of Agricultural Ministers, there are various working groups at federal as well as at state level, e.g. the Working Group on Sustainable Rural Development or on Consumer Protection.<sup>265</sup> However, food and nutrition are not explicitly dealt with by any of these working groups. The minutes of the meetings held in recent years show that issues relating to food and nutrition only played a marginal role. In January 2019, for example, the implementation of the Act governing the security of food supplies and emergency food supplies<sup>266</sup> was part of the agenda.<sup>267</sup> A possibility to improve coordinated action between the Federal Government and the states as well as at state level, would be to establish a working group promoting sustainability in food consumption and consisting of members of the Federal Government and the states. A working group such as this could be an addition to other existing forms of cooperation such as the meetings currently held between the BMEL and the federal state experts in food and nutrition matters.

Another possibility would be an internet portal offering information on the various initiatives of the federal states. This would increase transparency and hence promote cooperation between the Federal Government and the states, as well as at state level. As far as catering in schools and preschools is concerned, there already is an institutionalised coordination mechanism among the networking centres for catering in schools and preschools established at state level and the National Quality Centre for Healthy Nutrition in Schools and Preschools based in Berlin (cf. Section 7.5.1). Strict limits apply to measures taken at federal level relating to catering in schools and preschools due to the division of competences as part of the federal system. This issue will be discussed in detail in Section 7.5.1.3.

---

<sup>263</sup> <https://www.regierung-mv.de/Landesregierung/sm/Familie/Kindertagesf%C3%B6rderung/Verpflegung/>.

<sup>264</sup> <https://www.mecklenburg-vorpommern.de/natur-ernaehrung/regionale-netzwerke-ernaehrung/>.

<sup>265</sup> <https://www.agrarministerkonferenz.de/Arbeitsgremien.html>.

<sup>266</sup> Act to ensure basic food supplies in a crisis of supply and precautionary measures for a supply crisis

<sup>267</sup> [https://www.agrarministerkonferenz.de/documents/ergebnisniederschrift-ack-berlin-17012019\\_1549007112.pdf](https://www.agrarministerkonferenz.de/documents/ergebnisniederschrift-ack-berlin-17012019_1549007112.pdf).

In principle, there is also the joint task instrument which is another mechanism for coordination between the Federal Government and the states. However, the German Basic Law (Art. 91a) so far only provides for two joint tasks, namely (1) the improvement of regional economic structure; and (2) the improvement of the agrarian structure and of coastal preservation. Pursuant to Article 91, there are further possible ways of cooperation between the Federal Government and the states. In the fields of science and research, for example, cooperation may be possible “on the basis of agreements in cases of supraregional importance” (German Basic Law, Art. 91b). Such rules could, in principle, also function as a model in the field of food policy. However, the German Basic Law would have to be amended to make this kind of cooperation possible.

### Municipal Level

Within Germany’s federal system, important tasks relating to food and nutrition also exist at municipal level. At this level, too, there are differences among the federal states: in the states with agricultural agencies, tasks relating to food and nutrition are dealt with at district level. In the states with chambers of agriculture, these chambers also have district offices. These district offices are generally also responsible for matters relating to food and nutrition, and implement state initiatives in this field. In Baden-Württemberg, for example, they are responsible for the federal state’s “Blickpunkt Ernährung” (Focus on Food and Nutrition) initiative and “Landesinitiative Bewusste Kinderernährung” (Health-conscious Food and Nutrition for Children) initiative.<sup>268</sup>

The municipal level is of special importance in the field of food and nutrition as the municipalities are responsible for catering in schools and preschools as well as for providing the infrastructures needed (cf. Section 7.5.1). The elected bodies of the district council, city council and local council also play a significant role as they, inter alia, decide on how much of the budget will be spent on what, for example on equipping preschools and schools.

Apart from catering in schools and preschools, there are a large number of other areas for promoting sustainability in food consumption at municipal level. An example is “KERNig” (Food systems at district level as the key to comprehensive and integrated sustainability governance), a transdisciplinary research project which is funded by the BMBF and was implemented in the cities of Leutkirch and Waldkirch in South Germany. One of the outcomes of this project was the development of guidelines for a “sustainable and healthy selection of food and beverages offered at parties, markets and festivals”.<sup>269</sup>

**Conclusion:** From the description of the situation it becomes clear that, within Germany’s federal system, responsibilities with respect to promoting more sustainable food consumption are, one the hand, distributed among different levels (EU, federal, state and district levels) and, on the other hand, are also dealt with by various departments which focus on different aspects of the food

---

<sup>268</sup> See e.g. <https://www.landkreis-esslingen.de/start/service/landwirtschaftsamt.html>.

<sup>269</sup> <https://www.nahhaft.de/kernig/>.

system. This offers the advantage of different stakeholders developing numerous initiatives, which is indeed evident. From a governance point of view, however, this creates the challenge of establishing a good level of coordination as well as the problem of a possible “diffusion of responsibility” meaning that possible or necessary measures are never taken because each stakeholder thinks it is the responsibility of another stakeholder to take the first step. The analysis shows that already existing coordination mechanisms, such as the interministerial working group or the Conference of Agriculture Ministers of the Federal Government and the Federal States, could be used to a larger extent in order to ensure a better coordination of food and nutrition-related topics. To promote a platform for exchange at municipal level, it could be assessed to what extent coordinating bodies, such as the convention of the local and city authorities of the federal states, could or should deal with food and nutrition-related topics. An important task which could be performed by means of expanded coordination between the Federal Government and the states, consists of evaluating the measures taken in the field of food and nutrition. To do so, uniform national standards for a high-quality assessment could be defined and the results of the assessment could be exchanged and jointly discussed in order to improve the impact of the employed instruments and funding in the field of food consumption.

### 7.2.2.2 Political parties

At all levels, political parties play a significant role in the process of building political will. The positions which the parties develop in their programmes relating to more sustainable food consumption at the different levels of government are hence of major importance for the governance of the food system. Table 7-4 shows the positions of the parties represented in the German Bundestag according to their programmes for the general elections of 2017. Tables 7-5 and 7-6 illustrate the positions of the parties which are relevant at federal level using the examples of the State of Baden-Württemberg and the State of Mecklenburg-Western Pomerania for the state elections of 2016. The data were collected based on the results of an automatic search of the party programmes for the keywords “food” and “nutrition”.

The data collection shows that the parties’ programmes attribute different levels of importance to the field of food and nutrition. At federal level, the CDU/CSU’s election programme does not contain any statements relating to food or nutrition whereas at state level the CDU mentions the nutritional education of children (Baden-Württemberg) and protecting children from advertisements (Mecklenburg-Western Pomerania) in its state election programmes. At the same time, the CDU emphasises in its election programme that it views human beings as “mature and informed consumers”. The parties SPD, Bündnis 90/Die Grünen and Die Linke make detailed demands relating to food and nutrition at federal and at state level. However, they focus on catering in schools and preschools. In addition to that, in its federal election programme, the SPD calls for the introduction of a food labelling system. The FDP’s federal election programme does not contain any statements on food or nutrition. According to the FDP’s state election programme for Baden-Württemberg, policymakers should have a high level of restraint when it comes to

influencing private lifestyles, with food and nutrition being explicitly mentioned, alongside family, clothing and housing, as being a part of private lifestyles. The AfD's election programme does not discuss the field of food and nutrition at all, either at federal level or for Mecklenburg-Western Pomerania; in Baden-Wuerttemberg they demand that nutrition classes be held as a preventive measure in the health sector (see Tables 7-4 to 7-6 and the citations taken from the respective programmes).

**Table 7-4:** Importance of food and nutrition in the 2017 general election programmes of the parties represented in the German Bundestag

Party	Importance of food, nutrition and diet in the programme	Essential demands
CDU/CSU	No section dealing exclusively with food, nutrition and diet	Topic of food, nutrition and diet not covered; role of food sector mentioned in connection with the agricultural sector
SPD	Section on "Responsible agriculture and a healthy diet"	Calls for understandable labelling such as the traffic-light nutritional labelling system, for ensuring that schools and preschools offer balanced meals, for making the German Nutrition Society's standards binding, for long-term support of networking units for school meals; and for expanding the National Quality Centre for Healthy Nutrition in Schools and Preschools
Bündnis 90/Die Grünen	Section on "Enabling consumers to make sustainable decisions"	Calls for a more varied diet in schools, preschools and cafeterias ("good vegetarian and vegan food should be offered on a daily basis"); for the expansion of school catering and for the improvement of schools meals through mandatory quality standards; for putting an end to aggressive marketing for unhealthy food that is aimed at children by introducing clear rules for advertisement; ("no PR promotions in preschools and schools")
Die Linke	Section on "For a sustainable agricultural sector and healthy food for everyone"	Calls for increased support for affordable organic foods in school and preschool meals. The section on education calls for preschool and school meals to be provided free of charge.
FDP	No section dealing exclusively with food, nutrition and diet	Topic of food, nutrition and diet not covered
AfD	No section dealing exclusively with food, nutrition and diet	Topic of food, nutrition and diet not covered

Source: WBAE table based on the parties' election programmes (CDU/CSU 2017, SPD 2017, Bündnis 90/Die Grünen 2017, Die Linke 2017, FDP 2017, AfD 2017).

**Table 7-5:** Importance of food and nutrition in the parties' state election programmes  
Example of Baden-Württemberg in 2016

Party	Importance of food, nutrition and diet in the programme	Essential demands
CDU	No section dealing exclusively with food, nutrition and diet	Call for health and nutrition-related education to become a part of early childhood education; nutrition and diet is referred to as element of promoting health.
SPD	Section on "Supporting a well-informed, healthy diet"	Calls for it to be made possible for everyone to follow a well-informed and healthy diet "irrespective of their level of education, origins or financial means" (however, specific measures to achieve this are not mentioned). Furthermore, the programme also calls for balanced meals in preschools and schools, for the promotion of programmes such as the School Fruit Scheme and for a well-informed diet for children as well as for the development of a guiding vision for catering in preschools and schools.
Bündnis 90/Die Grünen	Section on "Good diet: regional, organic, tasty"	This section calls for improved quality of away-from-home catering, model projects in order to increase consumption of regional and organic products, support of the network units for preschool and school meals, dietary education, school fruit scheme, Action Programme on "sustainable eating", and (organic) farms as places of learning.
Die Linke	No section dealing exclusively with food, nutrition and diet	The section on health calls for health-conscious behaviour to be promoted through specific gender and age-oriented offers (diet, exercise, sports). The section on agriculture calls for "regional autonomy as far as food is concerned as well as independence from the import of organically produced food". There is also a call for "awareness regarding a healthy diet to be promoted in educational institutions as well".
FDP/DVP	No section dealing exclusively with food, nutrition and diet	The topic of food, nutrition and diet is only mentioned in the section on "Trusting people – instead of patronising them". There it says that "Policymakers should exercise restraint in respect of exerting influence... particularly on people's private lifestyle – family, diet,...".
AfD	No section dealing exclusively with food, nutrition and diet	The topic of food, nutrition and diet is only mentioned once in the section on "Promoting preventive measures in the health sector". There it says that "Children should learn about the health risks of an unhealthy lifestyle in preschools and schools. In order to do so, the subjects of diet, preventive health care and sports should play a major role in the syllabus."

Source: WBAE table based on the parties' election programmes (CDU Baden-Württemberg n.d., SPD Baden-Württemberg n.d., Bündnis 90/Die Grünen Baden-Württemberg n.d., Die Linke n.d., FDP Baden-Württemberg 2015, AfD Baden-Württemberg n.d.).

**Table 7-6:** Importance of food and nutrition in the parties' state election programmes  
Example of Mecklenburg-Western Pomerania in 2016

Party	Importance of food, nutrition and diet in the programme	Essential demands
CDU	No section dealing exclusively with food, nutrition and diet	The food sector is mentioned in connection with agriculture. It is furthermore stated that "The CDU views human beings as mature and informed consumers. However, the CDU will actively support a ban on advertisements for unhealthy food that are directed solely at children."
SPD	No section dealing exclusively with food, nutrition and diet	The food sector is emphasised as being an important economic sector. "Healthy diet" is mentioned as one of several goals in the section on "Health and care"; however, specific measures are not stated.
Bündnis 90/Die Grünen	Section on "Good food – making environmentally and socially sustainable agriculture work for the future!"	The section calls for an annual federal state fund of 500,000 Euros to be established in order to help adjust the meals in schools and preschools to the DGE standards by 2020; for regional, sustainable products to be used; for the results of hygiene controls at preschools and schools with their own kitchens to be published annually; for support programmes for preschools and schools; for better use to be made of the European school milk and school fruit schemes for a healthy diet.
Die Linke	Section on "A wholesome diet for all pupils" in the paragraph on schools	The section calls for the School Act to be amended "in order to guarantee every pupil the right to have lunch and drink milk, irrespective of their age or school" and for the DGE standards to be complied with.
FDP/DVP	No section dealing exclusively with food, nutrition and diet	The food sector is mentioned in the section on economy and innovation; no statements on food, nutrition and diet.
AfD	No section dealing exclusively with food, nutrition and diet	The terms food, nutrition or diet are not mentioned in the election programme.

Source: WBAE table based on the parties' election programmes (CDU Mecklenburg-Vorpommern n.d., SPD Mecklenburg-Vorpommern n.d., Bündnis 90/Die Grünen Mecklenburg-Vorpommern n.d., Die Linke Mecklenburg-Vorpommern 2016, FDP Mecklenburg-Vorpommern n.d., AfD Mecklenburg-Vorpommern 2015).

**Conclusion:** Overall, the collected data show that there are different positions regarding the extent to which the government should pursue an active food policy across the political landscape. The political parties which prefer the government to play an active role mainly make suggestions relating to catering in schools and preschools. According to the parties which also take the environmental dimension of more sustainable food consumption into account (Bündnis 90/Die

Grünen and Die Linke), promoting and using organically produced food for catering in schools and preschools (and promoting organic farming in general) represents the appropriate means. The problem of food poverty is not mentioned in any of the election programmes. Die Linke, however, demands, in its state election programme for Baden-Württemberg, that schools and preschool meals should be provided free of charge. There are hardly any measures which aim to influence the food consumption habits of adults. A comprehensive food policy programme does not exist.

### 7.2.2.3 Associations

As shown in Figure 7-1, two groups of associations play a major role for the governance of the food system: industrial and agricultural stakeholder associations (Box I in Figure 7-1) and civil society associations dealing with environmental, animal and consumer protection (Box J in Figure 7-1). Furthermore, science-based associations, which may have an influence as they offer advice to policy-makers, are also important (e.g. German Nutrition Society (DGE), cf. Section 7.2.3). For reasons of space, only the most important associations from the different fields will be presented in the following. This list is not intended to be exhaustive. Section 7.3 will discuss the role these associations play within the political process.

#### Agricultural stakeholder associations

Most agricultural holdings are members of one of the 18 state farmers' unions (consisting of more than 300 district farmers' unions) and are hence organised through the **German Farmers' Association (DBV)**. The umbrella association comprises 18 state farmers' unions along with further members, including 46 associated members. Among these members, there are various interbranch organisations from all kinds of agricultural fields. This shows how well positioned and connected the DBV is. According to its own statement, around 90% of the 270,000 agricultural holdings are organised through the DBV.<sup>270</sup> The DBV's organisational chart shows that around 90 persons work at their federal office.<sup>271</sup> The DBV is known to be an extremely successful stakeholder which can be explained, amongst other things, by its high degree of organisation. However, the political science studies which empirically analysed the role of the DBV as a stakeholder were conducted in the 1980s and the 1990s (e.g. Ackermann 1977, 1982, Wolf 2001). More recent studies only make marginal reference to the DBV's role. The "*post-exceptionalism*" concept in agricultural policy, for example, suggests that agricultural stakeholder associations have lost influence in the course of liberalisation as they cannot argue that exceptional conditions ("*exceptionalism*"), due to which the sector is in need of special political protection, continue to apply to the agricultural sector to the same extent as they did before (Daugbjerg & Feindt 2017). Studies launched by civil society associations mainly deal with interconnections between the DBV and other stakeholder associations (see below).

<sup>270</sup> <https://www.bauernverband.de/> (siehe Webseiten in der Rubrik „Der Verband“).

<sup>271</sup> <https://media.repro-mayr.de/61/719861.pdf>.

The **German Agricultural Society (DLG)** is another important association through which farmers are organised. The DLG defines its own role as mainly consisting of promoting “progress in the industries of farming, agriculture and food by transferring knowledge, skills and technology”.<sup>272</sup> Therefore, the DLG will be further dealt with in the innovation system section (Section 7.2.3) although it also plays a role within the political system.

The interests of the farmers’ cooperatives in the new federal states, which were created out of the former Agricultural Producer Cooperatives (LPGs), are represented by the **Federation of Cooperatives – Federation of Regions**.<sup>273</sup> The **German Farmers’ Union (DBB)** describes itself as a “union representing the professional interest of family-run farms in the federal states of Eastern Germany. The union commits to promoting equal opportunities and social justice during the process of restructuring agriculture in Eastern Germany and disapproves of further agricultural industrialisation.”<sup>274</sup>

Apart from the DBV, there is the **German Small Farmers’ Association (AbL)** which also represents the farmers’ interest at federal level. The AbL consists of nine state associations.<sup>275</sup> In the association’s description, the AbL emphasizes the social aspect of agriculture as a central concern<sup>276</sup> and, as mentioned further on, plays an active role in the alliance “We’ve had enough!”.

Another politically active agricultural stakeholder association is the **Dairy Farmers’ Union (BDM)**.<sup>277</sup> The union’s main demand is that dairy farmers should be paid prices that cover their costs. The BDM furthermore supports the “fair milk” initiative. The websites of the AbL and the BDM do not state how many members the associations have.

The **German Association of Pig Farmers (ISN)** is another association with a focus on one animal species which (in contrast to the BDM) is linked more closely to the DBV. Above all, the ISN represents the interests of the larger, more market-oriented holdings in the north of Germany.

Organic farms are furthermore organised through **organic farmers’ associations**, with each of these having its own guideline. According to a list produced by the BLE (as of 2017)<sup>278</sup>, there are the following organic farmer’s associations: Biokreis, Bioland, Biopark, Demeter, Ecoland, Ecovin, Gäa,

---

<sup>272</sup> <https://www.dlg.org/de/ueber-uns/>.

<sup>273</sup> <https://www.genossenschaftsverband.de>.

<sup>274</sup> <https://www.bauernbund.de/index.php/mitglieder/uebersicht>.

<sup>275</sup> The AbL has representations in all federal states except for Berlin and Hamburg. Some state associations cover two or three federal states.

<sup>276</sup> “The AbL sees its key task in raising awareness of the social question as far as agriculture is concerned, in order to prevent points of view with an economic or ecological bias from failing to include the working people, meaning that social impacts would not be taken into consideration.” <https://www.abl-ev.de/ueber-uns/>.

<sup>277</sup> <http://bdm-verband.org/html/>. The AbL has representations in all federal states except for Berlin and Hamburg.

<sup>278</sup> <https://www.oekolandbau.de/verarbeitung/bio-zertifizierung/adressen/oeko-verbaende/>. There you will also find the links to the respective associations’ websites.

Naturland and Verbund Ökohöfe. The largest one of these associations is Bioland with more than 7,700 farmers, gardeners and vintners as well as over 1,000 partners from the production and retail sector such as bakeries, dairies, butchers, restaurants and catering services.<sup>279</sup> Demeter is the organic farmers' association with the longest history. About 1,600 agricultural holdings, roughly 300 Demeter producers, 100 on-farm producers and 140 contractual partners of the organic food and natural product wholesale market are organised through Demeter.<sup>280</sup>

On 1 October 2019, the **“Land schafft Verbindung” (Land connects) Facebook group** was created and, since then, it has become a new and strong movement supported by social media. So far, it has not been organised in the form of an association.<sup>281</sup> At this point in time, however, one cannot predict the group's further development. Therefore, the group was not analysed in this expertise.

The employees of the agricultural sector are represented by the **Building, Agricultural and Environmental Workers' Union (IG BAU)** which was created following the merger of the Building and Construction Union and the Horticulture, Agriculture and Forestry Union in 1996.<sup>282</sup>

### Stakeholder associations of the upstream and downstream agricultural sector

In the upstream agricultural sector, plant breeders are organised through the **German Plant Breeders Association (BDP)** which consists of 130 member companies.<sup>283</sup> The agrochemical industry is represented by the Industrial Association of Agriculture (IVA) which has 55 member companies from the sectors of crop protection, mineral fertilizers and biostimulants.<sup>284</sup> Agricultural trade is also organised through umbrella associations. The agricultural trading companies organised along cooperative lines are represented by the **German Raiffeisen Association (DRV)** which also represents cooperatives from the food processing sector.<sup>285</sup>

In the downstream sector, there are numerous interbranch organisations.<sup>286</sup> The **Food Federation Germany** (formerly Federation for Food Law and Food Science) is the umbrella association of the food industry. Associations and companies throughout the entire production chain, “from farm to fork”, i.e. the areas of agriculture, food processing, food retailers and the food service industry, are members of the Food Federation Germany. Private testing laboratories, law firms and a few individuals are also among the members of the federation. The Federation describes itself as “best point of contact for its stakeholders and the public throughout the broad range of issues pertaining

---

<sup>279</sup> <https://www.bioland.de/ueber-uns.html>.

<sup>280</sup> <https://www.demeter.de/organisation>.

<sup>281</sup> <https://landschafttverbindung.de/wer-sind-wir/>

<sup>282</sup> <https://www.igbau.de/Daten-und-Fakten-zur-Geschichte-der-IG-BAU.html>.

<sup>283</sup> [https://www.bdp-online.de/de/Ueber\\_uns/Mitglieder/](https://www.bdp-online.de/de/Ueber_uns/Mitglieder/).

<sup>284</sup> <https://www.iva.de/verband>.

<sup>285</sup> <https://www.raiffeisen.de/deutscher-raiffeisenverband-ev>.

<sup>286</sup> All associations which took part in the BMEL's round table discussion on the “reduction and innovation strategy for sugar, fats and salt in convenience products” are listed here.

to food". On its website, the Federation mentions 30 employees working at its head office.<sup>287</sup> The Federation furthermore states on its website: "Food Federation Germany functions as a partner with the political sectors and the public for what is an often heated and emotional debate; the federation relies in this respect on three principles: transparent communication, continued awareness-building measures on the basis of verifiable scientifically substantiated facts as well as an ongoing willingness to dialogue."<sup>288</sup>

Further important stakeholders from the field of agriculture are **stakeholder associations dealing with specific product categories**: the Grain, Milling and Starch Industry Association (VGMS) representing 575 companies,<sup>289</sup> the Sugar Industry Association (WVZ) consisting of around 27,000 beet growers and four sugar producing companies as well as four sugar importing and exporting companies,<sup>290</sup> the German Butchers' Association (DFV) consisting of 15 butchers' guild associations of the states,<sup>291</sup> the Umbrella Association of the German Bakery Trade (ZVDB) consisting of 16 guild associations at state level,<sup>292</sup> the Association of the German Dairy Industry (MIV) consisting of around 80 private, cooperative and international milk processing companies<sup>293</sup> as well as the Association for Non-alcoholic Beverages (wafg) representing all companies of the German market which produce or sell non-alcoholic beverages.<sup>294</sup> Food manufacturing companies are also represented by the German Confederation of Skilled Crafts (ZDH)<sup>295</sup> which, in its function as umbrella association, is responsible for the entire craft trade sector.

Food retailers are organised through the **German Food Retail Federation (BVLH)** which as a part of the German Trade Association (HDE) is responsible for the expert work in the area of food.<sup>296</sup> The BVLH is composed of state associations. Companies such as EDEKA or REWE are direct extraordinary members.

The restaurant and catering sector is also represented through interbranch organisations. These include for example the **German Hotels and Restaurants Association (DEHOGA)** which consists of 17 associations of the federal states and also has a specialist division dealing with the communal

---

<sup>287</sup> It is not explicitly stated how many employees in total work at the Federations' head office.

<sup>288</sup> <https://www.lebensmittelverband.de/de/verband/wir-ueber-uns>.

<sup>289</sup> <https://www.vgms.de/verband/struktur/>.

<sup>290</sup> <https://www.zuckerverbaende.de/wir-ueber-uns/wirtschaftliche-vereinigung-zucker.html>.

<sup>291</sup> <https://www.fleischerhandwerk.de/wir-ueber-uns/organisationsstruktur.html>.

<sup>292</sup> <https://www.baeckerhandwerk.de/baeckerhandwerk/struktur-organisationen/zentralverband/landesinnungsverbaende/>.

<sup>293</sup> <https://milchindustrie.de/ueber-uns/>.

<sup>294</sup> <https://www.wafg.de/ueber-uns/mitgliedschaft>. The website does not state the number of the association's members.

<sup>295</sup> <https://www.zdh.de/organisationen-des-handwerks/zdh/aufgaben/>.

<sup>296</sup> <https://www.bvlh.net/index.php?id=11>.

catering sector.<sup>297</sup> Furthermore, there is the **System Catering Federation (BdS)**<sup>298</sup> representing restaurant chains known as “fast food restaurant chains” such as McDonalds and Burger King.

The organic food sector has its own stakeholder association. The German umbrella association of agricultural producers, processors and retailers of organic food is the **Organic Food Industry Federation (BÖLW)** with 14 members including the organic farmers’ associations.<sup>299</sup> Further members of the BÖLW are the **German Association for Natural Food and Products (BNN)** through which the processors as well as the wholesalers and retailers of organic food are organised<sup>300</sup> and the **Association of Organic Food Producers (AÖL)** with around 100 members across Europe.<sup>301</sup>

Employees of the food industry are mainly represented by the **Food, Beverages and Catering Union (NGG)** covering the following areas: the hotel and restaurant industry, the pastry industry, the confectionery industry, the butchery trade, the bakery trade as well as the tobacco, sugar and meat industry.<sup>302</sup>

### **Interconnections between the stakeholder associations within the food system**

As was described before, the companies are thoroughly well organised in the different areas of the food system and, at federal level, they are represented by umbrella associations. This applies to conventional farming as well as to the organic farming sector. There are various strong interconnections between the different associations. These are partly based on organisational and formal structures (e.g. the German Raiffeisen Association is a member of the German Farmers’ Association) and partly due to the fact that certain individuals assume roles within several associations (personal interconnections). There are also organisations designed to function as networks for companies from different value creation areas. This includes the “Modern Agriculture Forum” which aims to influence the public opinion on agriculture.<sup>303</sup> The DBV and a large number of companies and associations of the upstream sector are members of the Forum. The DBV and companies of the upstream sector are also organised through the “Liaison Centre for Agriculture and Industry”. The Liaison Centre sees itself as a “link between industry and agriculture” and an “innovator, organiser and participant in discussions as far as important economic, social or ecological matters are concerned”.<sup>304</sup>

---

<sup>297</sup> <http://www.dehoga-bundesverband.de/ueber-uns/fachabteilungen/gemeinschaftsgastronomie/>.

<sup>298</sup> [https://www.bundesverband-systemgastronomie.de/de/Auftrag\\_des\\_BdS.html](https://www.bundesverband-systemgastronomie.de/de/Auftrag_des_BdS.html).

<sup>299</sup> <https://www.boelw.de/ueber-uns/mitglieder/>.

<sup>300</sup> <https://n-bnn.de/verband>.

<sup>301</sup> <https://www.aoel.org/struktur/>.

<sup>302</sup> <https://www.ngg.net/unsere-ngg/>.

<sup>303</sup> <https://www.forum-moderne-landwirtschaft.de/zusammen-mehr-erreichen>.

<sup>304</sup> <https://www.vli-agribusiness.de/mitglieder/mitgliederliste/>.

These interconnections have been criticised mainly by the environmental and consumer protection associations. In a study commissioned by the Nature and Biodiversity Conservation Union (NABU) and conducted by the Institute for Labour and Economy (iaw), a team of authors conducted a detailed network analysis of the organisational and personal interconnections at the DBV (iaw & NABU, 2019). According to the results of the study, there actually exist several links within the agribusiness. The DBV – together with the Modern Agriculture Forum, the Liaison Centre for Agriculture and Industry and the German Agricultural Society (DLG) (see below) – assumes a central role within these networks. The financial sector (which will not be analysed in this expertise) is also part of these interlinked networks. There is no comparable analysis of interconnections within the organic farming sector. Less well analysed are the interconnections within the agricultural downstream sector (food industry, retail, restaurant and catering sector) as well as between the agricultural downstream sector and the agricultural sector.

From a governance point of view, this poses the question of how to judge these interconnections. Civil society associations criticise the fact that, due to these interconnections, the stakeholder associations' influence on policy is disproportionately high and, compared to that, organisations and the civil society have only little impact (iaw & NABU 2019: 57). As explained below, a more differentiated assessment is needed at this point. The civil society associations dealing with agricultural, food and nutrition-related matters are nowadays also well connected and professionalised. Furthermore, the forming of networks is a general phenomenon which is not only limited to the agricultural sector, as research in the field of lobbying shows (May 2013, iaw & NABU 2019). These kinds of interconnections can also be found within the organic farming sector.<sup>305</sup>

In any event, as further elaborated in Section 7.3, the organisational structure is not the only decisive factor in terms of how successful lobbying is. In the fields of agriculture, food and nutrition, the “potential for outrage” and “framing” of a certain topic are particularly decisive in terms of how successful stakeholder associations are on the political stage. In policy fields with a high potential for outrage, e.g. green genetic engineering, environmental groups are in fact influential. However, in policy fields which are less suitable for publicity campaigns, such as the CAP or the Fertiliser Application Ordinance, the agricultural associations have the greatest influence (Greer 2017). Looking at the developments which have taken place over the recent decades, it can be seen that, with regard to the agricultural policy influencers, “a pluralisation has taken place. The still influential agricultural trade associations tend to have lost influence as environmental protection, animal welfare and consumer protection associations have gained importance” (Weingarten 2018: 56).

---

<sup>305</sup> For example, the chairman of the board of the Working Party on Organic Farming (AGÖL – umbrella organisation of organic farmers' associations) has, since 2002, been the chairman of the board of the Organic Food Industry Federation (BÖLW – umbrella organisation of producers', food processors' and retailers' associations in the field of organic food) and, since 2003, a board member of the Research Institute of Organic Agriculture (FiBL Germany), cf.: [https://www.boelw.de/fileadmin//user\\_upload/Dokumente/Vitas/Vita\\_Loewenstein.pdf](https://www.boelw.de/fileadmin//user_upload/Dokumente/Vitas/Vita_Loewenstein.pdf).

## Environmental civil society associations

As shown in Figure 7-1, environmental and consumer protection associations (Box J) play an important role regarding the governance of the food system. These kinds of civil society associations could, in principle, form a “counterpart” to stakeholder associations representing the economic sector. There are numerous active civil society associations promoting sustainability in food consumption: environmental protection associations dealing with environmental problems linked to agriculture, associations dealing with social aspects including global food security as well as associations dealing with issues relating to food and nutrition. For reasons of space, we can only mention selected organisations that play a key role due to their size and/or activities. The role of animal welfare associations was discussed in detail in the WBA’s expertise on livestock husbandry. Reference is made to the statements in said expertise (WBA 2015: Section 6).

With over 700,000 members and sponsors, the German **Nature and Biodiversity Conservation Union (NABU)** is the largest among the environmental protection associations in terms of the number of members.<sup>306</sup> It is divided into different branches at federal state level. On the websites of the state branches, there is plenty of information relating to action campaigns initiated by their members such as talks on more sustainable food consumption. The NABU has also developed an application which consumers can use to check labels and see “whether food products are ecologically recommendable or not”.<sup>307</sup> The NABU regularly issues political statements on agricultural issues such as the laws on fertiliser or the glyphosate problem.<sup>308</sup> Another important environmental protection association is the Friends of the Earth Germany (BUND) with around 620,000 members nationwide who are divided into approximately 2,000 active local and district groups as well as groups of young people. A further stakeholder to mention is the German League for Nature and Environment (DNR) which is an umbrella association consisting of 87 associations from the fields of nature conservation, animal welfare, environmental protection, outdoor sports as well as producer associations, foundations and institutes. Apart from coordination tasks, the League focuses on public relations and campaigns.<sup>309</sup> The BUND and the League for Nature and Environment regularly issue statements on environmentally relevant matters relating to agriculture as well as food consumption.

Another organisation which actively participates in agricultural as well as food consumption matters is the German branch of the international organisation **Greenpeace**. In Germany, Greenpeace has about 570,000 sponsoring members but only 40 members entitled to vote. The sponsoring members can elect 10 out of the 40 members entitled to vote or run as candidates

---

<sup>306</sup> <https://www.nabu.de/wir-ueber-uns/index.html>.

<sup>307</sup> <https://www.nabu.de/umwelt-und-ressourcen/oekologisch-leben/essen-und-trinken/bio-fair-regional/labels/16627.html>. On the website, the following is stated about the label check app: “The app represents the NABU’s opinion with a focus on the environment and nature”. The website does not indicate what basis the NABU uses to form its opinion.

<sup>308</sup> <https://www.nabu.de/natur-und-landschaft/landnutzung/landwirtschaft/pestizide/glyphosat.html>.

<sup>309</sup> <https://www.dnr.de/der-dnr/leitbild-und-aufgaben/>.

themselves. The organisation has over 200 permanently employed full-time workers (Greenpeace 2017: 2). In addition to that, Greenpeace has about 100 locally active groups. Greenpeace typically engages in high-publicity actions directed mainly at large corporations. In 2017, for example, Greenpeace focused on a campaign against Lidl which addressed husbandry conditions (Greenpeace 2017: 7–9). Greenpeace’s active role in the fight against green genetic engineering is known worldwide.

Another internationally active environmental protection association is the **World Wide Fund for Nature (WWF)**. The WWF is not a member organisation. In Germany, it is organised in the form of a foundation headed by two managing directors and an administrative board consisting of seven people.<sup>310</sup> The WWF also has projects related to agriculture as well as food consumption. To give one example, the WWF has established the “Towards culinary sustainability – Eating in Hesse” dialogue platform, which aims to promote “sustainable and resource-conserving away-from-home catering”.<sup>311</sup>

### **Civil society associations in the field of food consumption**

There are numerous civil society associations dealing with the topics of food consumption. These include associations engaging in food-related consumer protection in general as well as those committed to promoting certain types of diet.

The government-funded consumer protection associations (consumer organisations of the federal states) listed by the **Federation of German Consumer Organisations (vzbv)** are closely involved in food-related matters. The vzbv and the consumer organisations established, for example, the internet portal <https://www.lebensmittelklarheit.de/> which is funded by the BMEL and “aims to provide consumers – who feel they have been misled by the appearance of or advertisement for certain products – with general information on labels, answer their questions regarding specific products and create possibilities for discussion.” The vzbv is the central stakeholder association in terms of consumer policy related interests. It also engages in market monitoring, law enforcement and consumer advice and education services.

**Foodwatch** focuses more on campaigns. The organisation describes its mission as follows: “Foodwatch exposes food industry practices that are detrimental to the interests of consumers and fights for the consumers’ right to high quality, safe and honest food products.”<sup>312</sup> Foodwatch is a registered association and, like Greenpeace, it has various sponsoring members but only a small number of members entitled to vote. It has around 80 members entitled to vote and roughly

---

<sup>310</sup> See <https://www.wwf.de/ueber-uns/organisation/>. WWF Germany is one of the 33 national organisations that form the international WWF Network.

<sup>311</sup> <https://www.wwf.de/themen-projekte/landwirtschaft/ernaehrung-konsum/>.

<sup>312</sup> <https://www.foodwatch.org/de/ueber-uns/>.

38,000 sponsoring members.<sup>313</sup> Foodwatch employs 17 employees (full-time equivalent). Foodwatch's strategies include publishing newsletters and reports and organising campaigns to sign petitions.

One of the organisations promoting certain types of diet is **SlowFood Germany**, for instance. The association states that it promotes food products which are "good, clean and fair". It defines "good" as "flavoursome, nourishing, fresh, healthy, recognisable to educated, well-trained senses and satisfying"; "clean" as "produced in a way that does not harm the earth's natural resources, the ecosystems or the environment and does not cause damage to human beings, nature or animals"; "fair" as "pursuing social justice from the stage of production until the stages of retail and consumption [...]".<sup>314</sup> The association has around 13,000 members, 1,300 supporters and 86 regional groups ("convivia"). SlowFood has different commissions dealing with various topics, produces publications (e.g. SlowFood Magazine) and organises projects and action campaigns. As described in the following, SlowFood also engages in the "We've had enough!" campaign.

In Germany, the **ProVeg Germany** organisation represents vegetarian diets. Together with organisations from Spain, Poland and the United Kingdom, it has established the umbrella association ProVeg International. The organisation grew out of the German Vegetarian Union (VEBU). ProVeg Germany has around 14,000 members which are actively involved in 200 regional groups.<sup>315</sup> ProVeg International states it has a team consisting of over 100 employees from 22 different countries.<sup>316</sup> According to ProVeg, their goal is to reduce consumption of products of animal origin by 50% by the year 2040. ProVeg organises publicity campaigns, takes part in events and fairs, engages in a political dialogue and advises companies. As far as labelling is concerned, ProVeg promotes the V-Label for vegetarian products.

Apart from the developments described before, there is another new and interesting organisational civil society form at municipal level: the so-called **food councils** which have been established in several German cities over recent years.<sup>317</sup> On their website, the food councils describe their organisational form as: "A food council is a new platform within the food system. It coordinates the interests of the remaining local food supply stakeholders. Citizens are no longer only consumers but – in their functions as communal gardeners, food savers, food bank supporters or slow food activists – have also become important stakeholders within the food system."<sup>318</sup> Activities which the food councils engage in include e.g. promoting the supply of regional and

---

<sup>313</sup> <https://www.foodwatch.org/de/ueber-uns/fragen-und-antworten/>. According to its own statements, Foodwatch wants to have more than 75 members in order to make use of the right of associations to take legal action.

<sup>314</sup> <https://www.slowfood.de/wirueberuns/unsere-philosophie>.

<sup>315</sup> <https://proveg.com/de/die-geschichte-von-proveg/> (version as of 2017).

<sup>316</sup> <https://proveg.com/de/ueber-uns>.

<sup>317</sup> <http://ernaehrungsraete.de/ernaehrungsraete-deutschland-europa/>.

<sup>318</sup> <http://ernaehrungsraete.de/ernaehrungsrat-idee-ueberblick/>.

organically farmed products, the necessary consequent adaptations to communal catering, supporting school gardens and reducing food waste.<sup>319</sup>

Apart from the associations and food councils, there are also a number of **informal groups** which exchange information on certain diet forms mainly via social media. For example, the Facebook page on the paleo diet (<https://www.facebook.com/PaleoRecipesWorld/>) has more than 300,000 followers and is only one of many pages on this topic. Blogs also play an important role. The blog VeganHeaven (<https://veganheaven.de/presse-pr/>), for example, has 150,000 followers on social media. Persons who are successful with their blogs, YouTube videos or other forms of communication are known as influencers. An example, which was already mentioned in Section 3.3, is Saliha Özcan who has a Youtube channel on the topic of baking and cooking (“Sally’s World”). Her channel is watched by 1.7 million followers. From a governance point of view, one problem is that followers often do not know if an influencer was paid by the industry to make a certain statement and, if this is the case, what exactly they were paid for (cf. Section 8.5).

Furthermore, there are individuals who very effectively promote food, nutrition or diet-related topics in the media and thus have an influence on the public debate. One example is Udo Pollmer who, in his numerous publications, criticises official nutritional recommendations and was referred to as the “antichrist of food culture”<sup>320</sup> by the German newspaper Handelsblatt. Another example is the science journalist Bas Kast who received a lot of public attention for his book “The Diet Compass”.

### **Associations in the field of development policy**

Associations which are active in the field of development policy also deal with the aspects of promoting sustainability in food consumption with a special focus on the social and international dimensions. Examples of this include non-governmental organisations such as Welthungerhilfe or Oxfam as well as church development organisations such as Misereor and Bread for the World. In the field of food and nutrition, special mention must be given to the “Food First Information and Action Network (FIAN)”. It was established in 1986 and aims to realise the human right to food. FIAN is an international organisation with members from over 50 countries spread all over the five continents. In Germany, FIAN has about 1,300 members and sponsoring members.

### **Interconnections between civil society organisations**

As mentioned before, it is not only the stakeholder associations in the agri-food sector that are well connected; civil society groups also have good connections. The **“Wir haben es satt” (We’ve had enough!) / “Wir haben Agrarindustrie satt” (We’ve had enough of the agricultural**

---

<sup>319</sup> [http://ernaehrungsrat-berlin.de/wp-content/uploads/2017/09/Ernaehrungsrat\\_FK\\_2017\\_web.pdf](http://ernaehrungsrat-berlin.de/wp-content/uploads/2017/09/Ernaehrungsrat_FK_2017_web.pdf).

<sup>320</sup> <https://www.handelsblatt.com/unternehmen/management/udo-pollmer-der-antichrist-der-esskultur-seite-3/2596892-3.html?ticket=ST-2323317-kA5Tb3j9xfe6wPjNiSkM-ap5>.

**industry!**<sup>321</sup> campaign, which was established by an alliance of several organisations, plays a key role. It was initiated in 2011 under the motto “Meine Landwirtschaft” (My agriculture). Today, the group of funding bodies for the “**We’ve had enough!**” campaign consists of 50 organisations. These include, on the one hand, farmers’ stakeholder associations, i.e. the AbL as well as various organic farmers’ associations, and, on the other hand, civil society groups. All civil society environmental protection associations mentioned above are part of the group of funding bodies of “**We’ve had enough!**”. Of the aforementioned associations in the field of food and nutrition, only SlowFood is a member of the group of funding bodies. Oxfam and the church development organisations Bread for the World and Misereor are also members of the group of funding bodies.

According to its own information, the alliance supports an “agricultural reform”. Its common goal is “rural, more organic and thus social, more animal welfare-oriented and more environmentally compatible agriculture and food production in Germany and worldwide”.<sup>322</sup> The group of funding bodies pays five employees (some work part-time) and organises a large annual demonstration during the Green Week in Berlin as well as further events throughout the year, for example the youth festival “Beats und Bohne” (Beats and Bean).

Also, organisations which have specialised in campaigns (following the model of Greenpeace), such as the “**Aktion Agrar**” (**Agrarian Action**)<sup>323</sup> organisation which was established in 2014, are members of the group of funding bodies. This organisation has relatively few members and generates its income from the “Bewegungsstiftung” (Foundation for social movements)”. According to its own statement, the information provided by Agrarian Action reaches about 22,000 people. An example is the “Brot in Not” (Bread emergency) campaign which Agrarian Action initiated in order to fight against hybrid wheat breeding.

The **Foundation for social movements** generally promotes social movements based on the concept of “progressive philanthropy”. The website does not clearly state who the Foundation’s members are. However, its strategy – which is similar to the philanthropic model popular in the U.S.A. – seems to consist of raising funds from wealthy families and using them for social purposes. Persons who donate more than 5,000 euros can become founders of the Foundation for social movements and obtain the lifelong right to vote in the Foundation’s advisory board.<sup>324</sup>

Another organisation which is a member of the group of founding bodies of “We’ve had enough” is the “**Campact**” association which focuses on campaigns. Campact is involved in a number of political issues and “organic agricultural policy” is only one of them. However, this is its biggest subtopic and 30% of the campaign budget is spent on it (Campact 2018: 48). Campact has 12 association members. The association is financed by donations and sponsors’ contributions based

---

<sup>321</sup> All information contained in this section was taken from the website <https://www.wir-haben-es-satt.de/>.

<sup>322</sup> <https://www.wir-haben-es-satt.de/ueber-uns/>.

<sup>323</sup> [https://www.aktion-agrar.de/wp-content/uploads/2018/06/Aktion\\_Agrar\\_Jahresbericht17\\_web\\_final.pdf](https://www.aktion-agrar.de/wp-content/uploads/2018/06/Aktion_Agrar_Jahresbericht17_web_final.pdf).

<sup>324</sup> <https://www.bewegungsstiftung.de/stiftung/idee.html>. The brochure does not state who exactly the founders are.

on the principle of “participatory crowdfunding”. Campact’s annual budget for 2017 was 7.8 million euros and the organisation employed 50 people (full-time equivalents). Campact is sponsored by over 60,000 people and their newsletter is sent to more than 2.2 million people. Before starting a new campaign, Campact conducts a survey among randomly chosen newsletter recipients.

Examples of interconnections also exist between organisations dealing with food and nutrition-related matters and health organisations. In 2018, there was a joint signature campaign initiative of the professional association of physicians in child and adolescent medicine, the German Diabetes Society and Foodwatch. This resulted in the formation of an alliance of 15 physicians’ associations, professional associations and health insurance funds, demanding in an open letter addressed to Federal Chancellor Angela Merkel that she “finally get down to business” in preventing obesity, diabetes and other chronic diseases. The letter was signed by over 2,000 physicians including almost 60 professors of medicine. The following measures were requested in said letter making reference to the high economic costs: “Food labels indicating the nutritional content using the traffic light model, limitations on food advertisements directed at children including online advertisements, implementation of obligatory standards for catering in schools and preschools as well as tax incentives to support health-promoting food consumption, for example by introducing a VAT exemption for fruit and vegetables and imposing a special tax on sodas” (Laschet et al. 2018: 61).

With regard to civil society, interconnections can also be found not only at organisational level but also at personnel level. For example, the Political Director of Greenpeace International is an appointed member of Campact<sup>325</sup>. Campact’s CEO established the Foundation for social movements which supports the Agrarian Action.<sup>326</sup> A more detailed analysis on the types of civil society networks – similar to the aforementioned study conducted by the NABU – was not available at the time of drawing up this expertise. However, the fact that the formation of networks is of high strategic importance for the success of a campaign is well documented in scientific literature on social movements (e.g. Sommerfeldt & Yang 2017).

There are also interconnections between NGOs and the political sector which are similar to the interconnections found between stakeholder associations and the political sector. There are, for example, four Bundestag Members of Bündnis 90/Die Grünen who are part of the Committee on Food and Agriculture and, at the same time, are also members of environment and consumer protection associations.<sup>327</sup>

---

<sup>325</sup> <https://www.campact.de/campact/ueber-campact/vereinsmitglieder/>.

<sup>326</sup> <https://www.campact.de/campact/ueber-campact/team/>.

<sup>327</sup> E.g. members of NABU or the Federation of German Consumer Organisations, committee membership of the executive board of the North Rhine-Westphalian branch of BUND, membership of the executive board of the North Rhine-Westphalian Federation of cooperatives for organic meat and membership of the General Meeting of Germany’s development agency for agribusiness and rural areas, cf.: [https://www.bundestag.de/ausschuesse/a10\\_Ernaehrung\\_Landwirtschaft](https://www.bundestag.de/ausschuesse/a10_Ernaehrung_Landwirtschaft).

It is striking that the “campaign organisations”, such as Greenpeace, Foodwatch, Agrarian Action und Campact, have a large number of sponsors but only few association members who, in the end, make all important decisions in their respective organisations. This is the difference compared with the “traditional” environmental protection associations like NABU or BUND and the political parties as well as some of the stakeholder associations representing the economic sector (such as the German Farmers’ Association) where the representatives (who sometimes exist at different levels) are elected by a large number of members. Taking a look at the internal structure of these campaign organisations, one could actually argue that there is a lack of democracy and legitimation. This is a point which is hardly discussed even in the literature on social movements. Foodwatch, for example, justifies its restrictions on the number of members entitled to vote by saying that if this limitation did not exist, the movement could be undermined “by extreme political groups or stakeholder associations representing the economic sector”.<sup>328</sup>

### Conclusions on associations

Overall, the analysis shows that within the political and administrative system there are, on the one hand, numerous well-organised stakeholder associations representing the economic sector (Box I in Figure 7-1) and, on the other hand, numerous well-organised civil society associations in the field of environment and consumer protection (Box J in Figure 7-1). On both sides, there are several umbrella associations with head offices where their professional employees work. This makes it possible for them to effectively engage in lobby and press work. A substantial degree of interconnectedness can be found on both sides. However, in comparison with civil society associations, there is more in-detail documentation of this for economic stakeholder associations. Based on their economic power, one can presume that, compared with civil society associations, the economic stakeholder associations – especially in the upstream and the downstream sectors – have larger financial resources available or can mobilise them if necessary. However, there are indicators suggesting that, apart from membership contributions and donations, civil society groups have also come up with new forms of income sources during the last years – for example crowdfunding, which has become easier due to social media, and the philanthropic approach. Overall it can be concluded that there is an increasingly professionalised competition between the campaigns in the field of agricultural and food policies. This gives rise to the problem of “token politics” meaning that it is above all the suitability of an issue for a campaign that decides what role this issue plays in the political process. To what extent this impacts food policy will be discussed later, following the analysis of stakeholders within the innovation system.

---

<sup>328</sup> Cf. <https://www.foodwatch.org/de/ueber-uns/fragen-und-antworten/>.

### 7.2.3 Innovation system

As shown in Figure 7-1, the stakeholders within the innovation system play a significant role for the governance of the food system. In the areas of education, research and advisory services, these stakeholders can have an influence on producers and consumers. They can also influence the political process, for example by advising political parties or cooperating with economic stakeholder associations and civil society organisations. Given the focus of this expertise, the following description will cover the field of food consumption. The part of the innovation system which relates to agricultural production will not be discussed in detail.

#### Education

Due to the federal structure, there are a large number of study programme options in the field of agricultural and food sciences at universities and higher education institutions for applied sciences in Germany. For reasons of space, they cannot be discussed in detail. At university level, for example, the universities of Bonn, Giessen, Halle-Wittenberg, Hohenheim, Kiel and Munich offer degrees in nutritional sciences. With regard to higher education institutions, those in Fulda, Hamburg, Münster, Niederrhein, Osnabrück and Paderborn offer these courses of study. Apart from that, there are other study programmes which are relevant to the food system. These include food technology and food chemistry. Furthermore, it is possible to address food, nutrition and diet from other scientific perspectives, in study courses that do not necessarily specialise in these areas. Examples include psychology, sociology, economics and communications science.

Apart from the study programmes offered by universities and higher education institutions, training occupations offered within the dual education system also play an important role. In the field of food and nutrition, special mention should be given to the profession of dietician, which requires three years of training.

In principle, training is an important “lever” for promoting more sustainable food consumption, as experts and managers in that field can only be effective in advancing sustainability in food consumption if they have been trained accordingly. It would therefore make sense to evaluate the curricula of the relevant training institutions and verify whether the information provided by them relating to the different dimensions of sustainability are up to date and are reflected upon with students or trainees.

#### Research

In the study fields mentioned in the previous section, there are also research capacities available at the respective **universities and institutions of higher education**. Due to reasons of space they cannot be listed here in detail. One larger initiative in the field of research funding, which can be mentioned as an example, is a BMBF programme through which four regional nutrition clusters in Germany have received funding of more than 50 million euros since 2015: the “NutriAct – Nutritional Intervention for Healthy Aging” cluster in the Berlin-Potsdam area, the “DietBB – Diet-

Body-Brain” cluster in Bonn, which analyses how dietary factors influence cognitive development across a person’s lifespan, the “enable – promoting sustainable nutrition throughout all stages of life” cluster in the Munich-Freising-Nuremberg area and the “nutriCARD – Competence cluster for nutrition and cardiovascular health” cluster in the Jena-Halle-Leipzig area, which analyses the influence of nutrition on cardiovascular health. All clusters have regional industry and service companies from the food sector as partners.<sup>329</sup>

One of the non-university research institutes is the **Max Rubner Institute (MRI)**, a federal research institute responsible for food and nutrition. It employs around 200 scientists who work at four branches. The MRI consists of different institutes which conduct research on a broad range of food and nutrition-related topics including nutritional behaviour, child nutrition, physiology and biochemistry of nutrition and safety of different food groups.<sup>330</sup> The Federal Institute for Risk Assessment (BfR) is responsible for the assessment of food safety. It prepares scientifically-based expertises and is involved in the regulatory process (e.g. approval procedures for plant protection products).<sup>331</sup> Further aspects of promoting sustainability in food consumption, such as the environmental dimension, are dealt with by several agricultural research institutes e.g. the Thünen Institute. For reasons of space, these institutes cannot be described in detail here.

Substantial research capacities in the area of food and nutrition can also be found in **the private sector**. Again, due to the reasons of space, this cannot be analysed in detail. But, the example of Nestlé may serve to demonstrate the extent of these research capacities. According to its own statements, Nestlé employs around 3,500 people worldwide in a global network of 16 research and development centres on three continents – and 650 of them work at the Nestlé Research Center based in Lausanne.<sup>332</sup> In general, however, the food sector carries out only few research and development activities. In 2017, the research and development budget was around 333 million euros. Considering the total turnover of about 180 billion euros, the research and development budget only accounts for an average of 0.2% of the turnover (Stifterverband für die deutsche Wirtschaft (Donors’ Association for the Promotion of Sciences and Humanities in Germany), 2018). The specialised food trade, restaurants and catering and food retail sectors have even fewer research and development possibilities.

### **Science-based associations: German Society for Nutrition (DGE)**

As mentioned before, science-based associations are important stakeholders within the innovation system as they can influence food policy in different ways. As far as nutritional sciences are concerned, the German Society for Nutrition (DGE) plays a key role regarding the governance of the food system. As mentioned on its website, the DGE pursues the following goals: “By providing

---

<sup>329</sup> <https://www.gesundheitsforschung-bmbf.de/de/praevention-und-ernaehrung.php>.

<sup>330</sup> <https://www.mri.bund.de/de/ueber-das-mri/das-mri/>.

<sup>331</sup> <https://www.bfr.bund.de/de/lebensmittelsicherheit-3982.html>.

<sup>332</sup> <https://ernaehrungsstudio.nestle.de/ernaehrungswissen/nrc>.

nutritional and dietary information and assuring high-quality nutrition counselling and education, the DGE promotes wholesome food consumption and assures its quality, thus contributing to the health of the population. The DGE makes recommendations based on scientific evaluation.”<sup>333</sup>

At federal level, the DGE engages in the following activities according to its Statutes (§ 2, Section 3)<sup>334</sup>:

- “publishing the Nutritional Report,
- publishing the Reference Values for Nutrient Intake,
- publishing the DGE Consultation Standards and Guidelines,
- publishing a nutrition related scientific journal which is the organ of the German Nutrition Society,
- publishing further news and scientific information,
- preparing curricula,
- holding academic conferences, training courses, multiplier events and informative events.”

The DGE’s statutes also state that the DGE assumes a significant role regarding communal catering and regarding health-promoting food consumption for the population in the broader sense: “The DGE’s tasks include quality assurance in communal catering as well as coordinating quality assurance in nutritional counselling and education. The DGE contributes to protecting or restoring the population’s health, physical well-being and mental well-being” (Statutes, § 2, Section 4). Pursuant to the DGE’s statutes, the BMEL can furthermore entrust the DGE with special tasks that fall within the objectives of the organisation (§ 3).

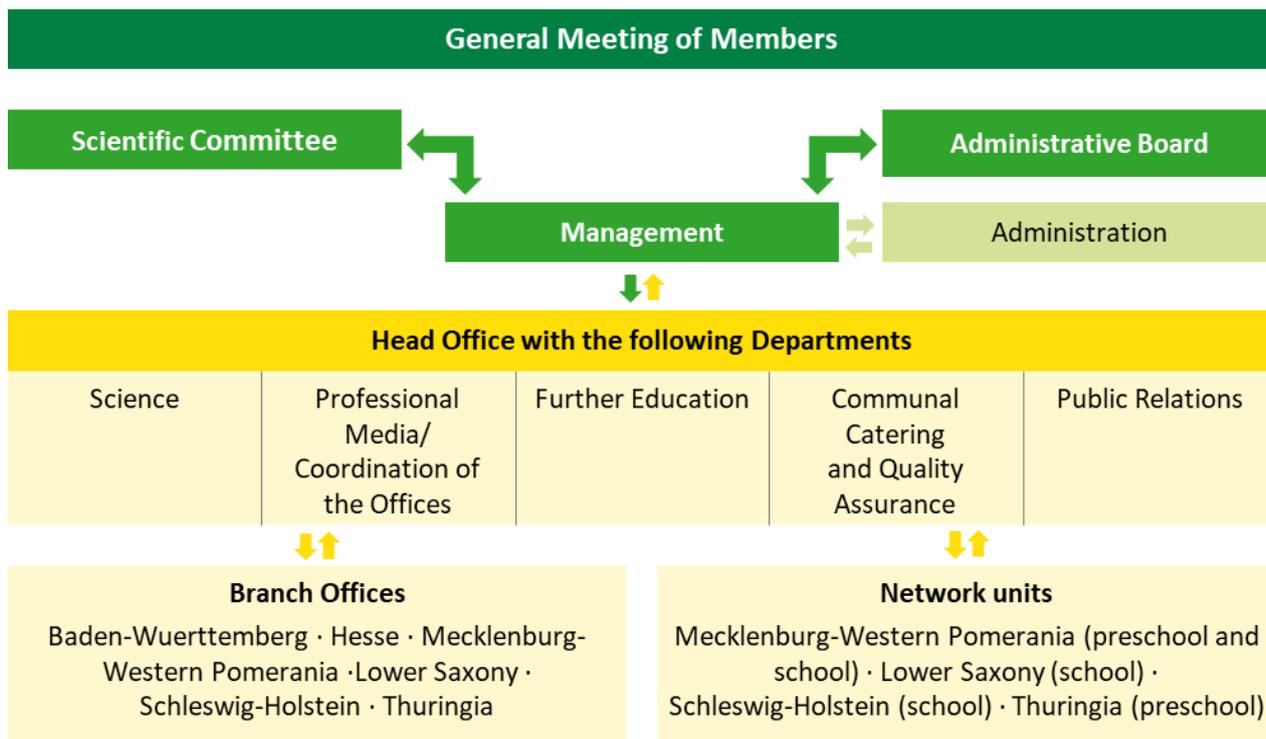
The DGE’s internal structure is illustrated in Figure 7-4. It is registered as non-profit organisation. Around 100 employees work at the DGE’s head office and, in 2017, it had a budget of around 8 million euros (including project funds). Around three quarters of funds are provided by the Federal Government and the states, and the remaining quarter comes from member contributions, fees and remunerations.<sup>335</sup> The over 4,000 members of the DGE include not only scientists but also companies, industrial associations and other associations. The statutes further stipulate that the DGE “shall have a scientifically independent committee (Scientific Committee)” which consists of persons “representing the field of nutritional sciences within the Federal Republic of Germany”. The Scientific Committee’s members as well as its president and two vice-presidents are elected by the DGE’s members. This also applies to the administrative board.

---

<sup>333</sup> This citation as well as the following ones can be found on the DGE’s Website: <https://www.dge.de/wir-ueber-uns/die-dge/> (last accessed on: 4 July 2019).

<sup>334</sup> <https://www.dge.de/fileadmin/public/doc/wueu/DGE-Satzung.pdf>.

<sup>335</sup> <https://www.dge.de/wir-ueber-uns/die-dge/>.

**Figure 7-4:** Structure of the German Nutrition Society (DGE)

Note: The Figure shows the federal states' networks which are incorporated into the branch offices.

Source: <https://www.dge.de/wir-ueber-uns/die-dge/> (last accessed on: 13 December 2019).

Compared with other European states, the DGE's governance structure differs from the structure of organisations which are responsible for formulating dietary recommendations in other countries. There, it is often the case that a ministry appoints a commission consisting of experts who are responsible for preparing dietary guidelines. Finland, for example, has established a "National Nutrition Council" consisting of experts appointed by the Ministry of Agriculture and Forestry of Finland. The experts are appointed based on the suggestions made by other ministries, universities, authorities, research institutes and independent stakeholders. In Great Britain, there is the "Scientific Advisory Committee on Nutrition" whose members are also appointed by the ministry responsible. Among its members there are currently 14 scientists as well as one industry representative and two non-experts.<sup>336</sup>

In comparison to that, the DGE can, due to its governance structure, act more independently of the responsible ministry (BMEL). Its governance is more oriented towards a democratic structure, as the commission, which consists of experts that decide on the nutritional recommendations, is appointed by the DGE's members and not by the BMEL. The BMEL only designates one member of the administrative board. Also, the head office staff are employed by the DGE and not by the BMEL

<sup>336</sup> <https://www.gov.uk/government/groups/scientific-advisory-committee-on-nutrition#membership>.

or one of its subordinate authorities. In practice however, the BMEL can demand more from the DGE than would be the case if it was a completely independent scientific society. It can demand that the DGE's work programme has to be agreed on by the ministry, for instance. It is also the BMEL and not a DGE body which decides on the funding of projects under the IN FORM National Action Plan (German national initiative to promote healthy diets and physical activity, [www.in-form.de](http://www.in-form.de)). Furthermore, many of the DGE's staff members are employed on a temporary basis and applications for extensions of these work contracts have to be sent regularly to the BMEL. This makes it difficult to work in a continuous way. It can also be observed that some tasks included in the DGE's statutes, were, after having established the Federal Centre for Food and Nutrition (BZfE), also transferred to the BZfE – this especially concerns communication-related tasks. In light of this, it would be helpful to develop an overarching nutritional strategy to ensure coordinated communication.

In view of the fact that the DGE has a relatively high level of independence compared with other European countries, the governance problem described further below does not exist in terms of governmental influence as far as the formulation of dietary recommendations is concerned. The problem rather lies in the influence which could potentially be exerted by the food industry, as the DGE's members include companies and economic associations that could exert influence. In practice, however, these members do not make use of this possibility (companies and associations representing the economic sector account for 3%). There are also no other indications that industrial associations or companies exert an influence on the DGE's Scientific Committee, although they do publicly criticise the DGE's statements. The consensus paper on the quantitative recommendation on sugar intake prepared by the DGE, the DAG and the DDG (Ernst et al. 2018), for instance, was strongly criticised by the Sugar Industry Association (WVZ) in its six-page statement (WVZ 2019).

### **Further science-based associations, professional associations and networks in the field of food and nutrition**

In addition to the DGE, there are further scientific societies and professional associations which engage in matters related to food and nutrition, such as the German Society for Nutritional Medicine (DGEM), the Alliance of German Medical Practitioners in the Field of Nutritional Science<sup>337</sup>, the Food Chemical Society<sup>338</sup>, the Association of Ecotrophologists<sup>339</sup>, the German Dietician's Association<sup>340</sup>, the Scientific Society for Nutritional Therapy and Prevention<sup>341</sup> and the Association for Independent Health Consultation (UGB)<sup>342</sup>. In addition to that, there are a number

---

<sup>337</sup> <http://www.bdem.de/>.

<sup>338</sup> <https://www.gdch.de/netzwerk-strukturen/fachstrukturen/lebensmittelchemische-gesellschaft.html>.

<sup>339</sup> <https://www.vdoe.de/>.

<sup>340</sup> <https://www.vdd.de/>.

<sup>341</sup> <https://fet-ev.eu/wir-ueber-uns/>.

<sup>342</sup> <https://www.ugb.de/ugb-verband/>.

of networks through which different associations have joined forces. An example of this is the “Expert Network Sustainable Nutrition”<sup>343</sup>, which has formed out of an initiative by the University of Giessen. There is also the German Nutrition Education and Information Network<sup>344</sup> which has a website offering links to the homepages of organisations involved in food and nutrition-related matters. There, you can also find links to websites offering information services related to food and nutrition.

The German Agricultural Society (DLG) is another important association within the innovation system. It has around 30,000 members and aims to promote progress in the industries of farming, agriculture and food by transferring knowledge, quality and technology.<sup>345</sup> In contrast to the DBV, the DLG does not see itself as a political interest group representing the agricultural or food industry’s interests but aims instead to be a bridge connecting science and practice. With regard to food, the DLG is especially active in quality labelling. These labels, however, mainly serve to provide information on a product’s taste.<sup>346</sup> In addition to that, the DLG also holds food-related specialist conferences, seminars and advanced training courses.

Recently, medical scientific societies have increasingly participated in matters relating to food and nutrition. Examples include the German Society for Nutritional Medicine<sup>347</sup> and the German Diabetes Society<sup>348</sup>. Networking is another aspect that can be observed in this field. The German Noncommunicable Diseases Alliance (DANK), consisting of 22 scientific medical societies, associations and research institutes, is one example.<sup>349</sup> As stated in DANK’s position paper, the alliance demands that several concrete measures be taken to encourage health-promoting food consumption. The measures include for instance “restructuring of food taxes in a way that promotes health” as well as imposing a “ban on advertisement directed at children for food that is conducive to obesity” (Schaller et al. 2016: 11 p.).

### European and international associations

At European and international level, there also exist a number of associations and scientific societies – with members from Germany – which deal with matters related to food, nutrition and diet. One of them is the “Society of Nutrition and Food Science” which was established in Germany in 2013 as a non-profit association. It is committed to providing scientifically-based independent nutrition guidance at international level without being influenced by the government or industry.<sup>350</sup>

---

<sup>343</sup> <https://ene.network/>.

<sup>344</sup> <http://www.ernaehrung.de/links/>.

<sup>345</sup> <https://www.dlg.org/de/ueber-uns/vision-mission-werte/>. The DLG plays an active role in the area of food not only by hosting a large number of events but also by conducting quality tests and presenting product quality awards.

<sup>346</sup> <https://www.dlg.org/de/lebensmittel/>.

<sup>347</sup> <https://www.dgem.de/>.

<sup>348</sup> <https://www.deutsche-diabetes-gesellschaft.de/home.html>.

<sup>349</sup> <https://www.dank-allianz.de/mitglieder.html>.

<sup>350</sup> <http://www.snfs.org/about/mission.html>.

At international level, the American Society for Nutrition, which was established in 1928, plays a leading role among the scientific societies.<sup>351</sup> Networking takes also place internationally. The international version of DANK is the NDC Alliance (Non-Communicable Disease Alliance), which was established in 2009. Over 2,000 organisations from 170 countries are members of the NDC Alliance.<sup>352</sup>

In addition to that, there are other associations with the declared goal of providing scientific information to advise policy-makers at European and international level. These include the European Food Information Council (EUFIC) and the International Life Sciences Institute (ILSI). As will be elaborated in Section 7.3, these organisations should, despite their scientific standards, be viewed more critically because they are influenced by industry.

### Scientific Advisory Boards

Scientific Advisory Boards are a key element in scientific policy advice in Germany. At federal level, the Scientific Advisory Board on Agricultural Policy, Food and Consumer Health Protection (WBAE), which is also the author of this expertise, is responsible for matters relating to food consumption. The WBAE, in its current form, was established in 2015. At that point in time, the task of advising policy-makers in terms of food and nutrition was shifted to the Scientific Advisory Board which, before that, was only responsible for providing advice in matters of agricultural policy. The WBAE consists of 19 scientists from research institutes belonging to universities or higher education institutions as well as from non-university research institutes. Like the BMEL's other Scientific Boards, the WBAE operates on a voluntary basis. It works independently and produces expertises and statements on topics of its own choosing.<sup>353</sup>

Scientific Advisory Boards also exist at federal state level. The Advisory Board for Sustainable Development of the State of Baden-Württemberg, for example, has a working group dealing with food, nutrition and diet-related topics. The Board consists of scientists and representatives from the economic and industrial sectors.<sup>354</sup>

Boards and advisory bodies which include scientist can usually also be found in the food industry. Nestlé Germany, for instance, has an "expert and NGO board" which also includes scientists.<sup>355</sup> As companies usually pay for advisory services it remains open to what extent governance problems could arise at that point. This will be further discussed in Section 7.3.

---

<sup>351</sup> <https://nutrition.org/>.

<sup>352</sup> <https://ncdalliance.org/who-we-are>. Formally, the NDC Alliance is registered as an NGO in Switzerland.

<sup>353</sup> [https://www.bmel.de/DE/Ministerium/Organisation/Beiraete/\\_Texte/AgrOrganisation.html#doc429078bodyText4](https://www.bmel.de/DE/Ministerium/Organisation/Beiraete/_Texte/AgrOrganisation.html#doc429078bodyText4).

<sup>354</sup> <https://www.nachhaltigkeitsstrategie.de/informieren/beirat/mitglieder.html>.

<sup>355</sup> <https://www.nestle.de/verantwortung/unsere-beiraete/experten-und-ngo-beirat>.

## 7.3 Public governance problems

In this expertise, we refer to a “governance problem” if processes and interactions within the market, the government and civil society, or between these sectors, lead to a situation where existing potentials for making food consumption more sustainable are not exploited. In principle, the government can influence market activities by adopting various types of measures; it cannot, however, in the interests of the common good, simply overcome all forms of market failure by acting as a “benevolent dictator”. Governmental action is rather subject to the governance mechanisms of the political-administrative system, in which citizens, citizen voting behaviour, political parties, stakeholder bodies from the economic sector, civil society associations and the scientific community play a role.<sup>356</sup> As will be outlined in the following, the interactions of all these stakeholders often do not lead to the problems described in Section 4 of this expertise being overcome. Thus, for example, the interests of children and young people from low-income households and the interests of future generations are particularly inadequately represented in the political-administrative system, as will be described in the following. Another public governance problem is the insufficient implementation of government regulations. In previous expertises, the Scientific Advisory Board pointed out considerable shortcomings in this regard, e.g. concerning the implementation of the Fertiliser Application Ordinance (WBA et al. 2013, cf. also WBAE 2019, Section 7.3.1) and in terms of animal welfare (WBA 2015).

For many of the environmental problems connected with agricultural production and set out in Section 4, adopting policy instruments that target producers, not consumers, would be the obvious solution (cf. Section 6.2). In the following, we will therefore first describe governance problems regarding policy measures in the field of agricultural production. Secondly, we will present governance problems regarding policy measures targeting consumers.

### 7.3.1 Governance problems regarding policy measures in the field of agricultural production

On the one hand, the **considerable lobbying power of agricultural stakeholder associations** (link from Box I to Box H in Fig. 7-1) impedes the adoption of consistent policy measures in the field of agricultural production. The nitrogen-related issues described in Section 4.4.1.2 illustrate this very clearly. These issues could be solved by tightening and strictly enforcing the Fertiliser Application Ordinance, a step that several Federal Government scientific advisory boards already called for in 2013 (WBA et al. 2013). Although the Fertiliser Application Ordinance was revised in 2017, the amendments have not been sufficient to effectively remedy the environmental problem. There is evidence suggesting that this outcome may be due to farmers’ protests, which included demonstrations. The president of a regional farmers’ association was quoted as stating that the

---

<sup>356</sup> This section is primarily based on Birner (2019).

protest had been “very helpful” to prevent a further tightening of the Fertiliser Application Ordinance (Deter 2017). After having been condemned by the European Court of Justice, the Federal Government initiated another amendment of the Fertiliser Application Ordinance. This initiative, again, sparked farmers’ protests in April 2019 (WDR 2019). In June 2019, the Federal Government submitted proposals for amending the Fertiliser Application Ordinance to the European Commission, which, however, regarded them as insufficient.<sup>357</sup> Subsequently, further angry protests were staged by the agricultural industry and, also due to the repeated insistence of the EU Commission, further amendment proposals were put forward by the Federal Government. At the time of finalising this expertise, it is impossible to predict how this issue will ultimately be resolved.

Lobbying (arrow I-H in Fig. 7-1) is nothing special in the political governance systems of representative democracies. The question arises, however, why civil society failed to respond effectively, e.g. through public protests staged by environmental conservation and consumer associations (link J-H). As described in Section 7.2.2.3, civil society is also well-organised and well-connected with regard to agricultural and environmental policy and would definitely be in a position to counterbalance farmers’ stakeholder associations.

The fact that the nitrate issue (Fertiliser Application Ordinance) did not spark any far-reaching, clearly noticeable **civil society protest** is partly due to the civil society associations’ dependence on public awareness and, thus, on the media. This dependence often pushes such associations to focus on issues with a high public **outrage potential**<sup>358</sup> as this is the only way of receiving attention from the media, making it easier to mobilise a significant number of people and raise funds. Political science literature analyses this strategy under the concept of “framing”. Framing aims to establish topics as problems by highlighting certain features of a situation while ignoring or neglecting others, in order to subsequently bring the highlighted features together into a coherent and generally comprehensible narrative (“story”) (cf. van Hulst & Yanow 2016: 96). Science also uses the “issues management” concept to analyse which social issues social movement organisations address at which point, and which topics do not lend themselves to social movement activities. The issues are subject to a life cycle, and issues management and network building are closely linked (Sommerfeldt & Yang 2017). For issues management, the extent to which images linked with the issue in question can be effectively communicated in the media also plays an important role. Evidence of this interrelation is not just found in political science literature, but is also reflected in statements by stakeholders in the field of agricultural and food policy. Thus, when asked in an interview how his organisation chose its topics, a representative of Campact (see above) mentioned the following two criteria, among others: a topic “needs to be largely comprehensible” and “it must upset people” (Bautz 2013; cf. also the explanations on factors of

---

<sup>357</sup> [https://www.bmel.de/DE/Landwirtschaft/Pflanzenbau/Ackerbau/\\_Texte/Duengung.html;jsessionid=0AC64CBE79A7012ED12CB45C7970D5C0.2\\_cid296#doc604012bodyText7](https://www.bmel.de/DE/Landwirtschaft/Pflanzenbau/Ackerbau/_Texte/Duengung.html;jsessionid=0AC64CBE79A7012ED12CB45C7970D5C0.2_cid296#doc604012bodyText7).

<sup>358</sup> Regarding the role of non-governmental organisations (NGOs) in exploiting public outrage (“outcry”) for campaigns, cf. Bernauer & Meins (2003).

newsworthiness in Section 5.3.2.1). Nitrate pollution obviously fails to meet these criteria (only a minor impact on the public as drinking water is nonetheless safe, complex interrelationships between the use of fertilisers and environmental problems, the Fertiliser Application Ordinance is hard to understand). Animal welfare, glyphosate and green genetic engineering, however, are examples that obviously lend themselves readily to framing by civil society stakeholders.

However, this raises the question as to why **governance by political parties** (box K in Fig. 7-1) does not work better, i.e. why political parties do not focus more strongly on those topics that, even if civil society stakeholders do not establish them as issues, have been shown by scientific findings to require political action (such as, for instance, the nitrate pollution issue). We can observe that even parties that traditionally receive little support from farmers anyway are not highly committed to solving the environmental problems connected with agriculture. This holds true even if they have governmental responsibility. This applies to the SPD, which, in the last elections in 2017, received the votes of 5% of the farmers, while 61% of the farmers voted for the CDU and 14% for the FDP (Krauss 2019). The political background of the members of the Bundestag Committee on Food and Agriculture suggests that the SPD, contrary to the other parties, obviously had few incentives or opportunities to send members with special agricultural expertise to the Committee (Table 7-7). This may be due to the fact that agriculture does not belong to the SPD's key topics and engaging in this area would not increase its popularity with its traditional voters. None of the SPD members represented on the Committee in 2018 had undergone professional training in the agricultural sector or in agricultural science or had followed an occupation in this field, while all of the Committee members from the CDU/CSU parliamentary group had done so.<sup>359</sup> This indicates that there is a high degree of professional expertise, which is generally to be welcomed. The fact that many members also held offices in the farmers' association in the course of their careers suggests that the CDU/CSU parliamentary group effectively represents agricultural stakeholder groups in the German Bundestag.

---

<sup>359</sup> This becomes evident from the official websites of the Bundestag Committee on Food and Agriculture ([https://www.bundestag.de/ausschuesse/a10\\_Ernaehrung\\_Landwirtschaft](https://www.bundestag.de/ausschuesse/a10_Ernaehrung_Landwirtschaft), 20 September 2018). Cf. also iaw & NABU (2019: 40 et seq.). The authors come to a similar conclusion.

**Table 7-7:** Professional background of the members of the Bundestag Committee on Food and Agriculture

Parliamentary group	Number of members that have undergone professional training or followed an occupation in the agricultural sector, in relation to the total number of members of the respective parliamentary group
CDU/CSU	13 / 13
SPD	0 / 8
Alliance 90/The Greens	4 / 4
Linke	2 / 4
FDP	1 / 4
AfD	1 / 4

Source: WBAE compilation based on biographical information regarding the Committee members published on the official website of the Bundestag Committee on Food and Agriculture ([https://www.bundestag.de/ausschuesse/a10\\_Ernaehrung\\_Landwirtschaft](https://www.bundestag.de/ausschuesse/a10_Ernaehrung_Landwirtschaft); last accessed on: 20 September 2018).

### 7.3.2 Governance problems regarding policy measures that target consumers

Considering the challenges that exist in solving sustainability issues relating to food consumption by means of policy instruments that target producers, the question arises as to whether policy instruments that target consumers would be easier to implement in the political system (cf. Section 6.2). Governance problems related to consumer-oriented policy instruments are of a fundamentally different nature to the governance problems mentioned above. In the case of policy instruments targeting the agricultural production sector, the political influence of well-organised stakeholder groups, as discussed above, often impedes policy measures (such as the tightening of environmental requirements).

Consumers, on the contrary, are a large group (ultimately all citizens) with a wide range of interests. As illustrated in Section 7.2.2.3, there are, of course, associations that represent consumers' interests. These include consumer advice centres, which are, to a large extent, government-funded. The mandate of these centres explicitly encompasses representing consumers' concerns in political processes.<sup>360</sup> And the centres certainly know how to express their opinion in a pointed way, as illustrated, for example, by the title of the publication issued by the consumer advice centre of North-Rhine Westphalia: "Food lies: how the food industry tricks and deceives us" (Weiß et al. 2016). However, the focus of the consumer advice centres' work is on providing advice to consumers; furthermore, food is only one of the many topics that consumer advice centres deal with. In the field of NGOs, there are also organisations that pursue the interests of consumers. As in the case of Foodwatch, they do not, however, have a broad basis of voting

<sup>360</sup> <https://www.verbraucherzentrale.de/ueber-uns>.

members. This may be one of the reasons why they concentrate on subjects with a high public outrage potential, as they are particularly dependent on public attention to obtain support, e.g. in the form of donations.

An important governance mechanism on the part of consumers is their tendency to change their voting behaviour if they do not accept certain policy measures, such as the meat tax, in particular if the media take up the subject. This prevents political parties from calling for, or implementing, appropriate measures, even if no lobby groups engage in relevant activities. Thus, the acceptance of policy measures in the population – also beyond the political influence of organised associations – is an important factor in food policy. Section 6.5 therefore dealt in detail with the problem of the acceptance of policy measures in the population. In the following, a number of examples of political processes will be given to illustrate the concrete impact that the problem of acceptance has on political processes.

One example is the experience the Green Party made in connection with “Veggie Day”. In the “intensive animal husbandry” section of its election manifesto for the 2013 federal elections, the party had formulated the following objective: “Vegetarian and vegan dishes and a ‘Veggie Day’ should become the norm” (election manifesto of the Green Party 2013: 165, cited from Probst 2015: 141). During the election campaign, the “Bild” newspaper took up this rather moderately formulated objective and ran a headline saying “The Greens want to ban us from eating meat”. This sparked a “media outcry” (Probst 2015: 149), which is considered to be one of the reasons why the Green Party lost so many votes in the 2013 federal elections. Spiegel Online, for instance, referred to Veggie Day as “the biggest joke of the election campaign” and quoted politicians from other parties as follows: “CDU Secretary-General Herrmann Gröhe warned against a ‘green Federal Republic dominated by Bans’ and the Federal Manager of the Left Party, Matthias Höhn, lashed out against a ‘green dictatorship prescribing how to behave’.” (Hunger & Kwasniewski 2013).<sup>361</sup> This case shows that the problem concerning the public outrage potential and the role of framing are also highly relevant with regard to food policy instruments.

The call for a rise in prices of foodstuffs of animal origin is another example that shows what a huge political challenge it is to apply public governance mechanisms that focus on the consumption side. The Scientific Advisory Board on Agricultural Policy, Food and Consumer Health Protection had demanded in its expertise on climate action that the VAT concession on animal products should be abolished. It recommended that the standard tax rate of 19% should be applied to these products rather than the reduced rate of 7%. At the same time, the WBAE recommended adopting sociopolitical measures to accompany this step (WBAE & WBW 2016: 347). The ensuing rise in prices of foodstuffs of animal origin was supposed to lead to a reduced consumption of animal products. As outlined in the present expertise, this would have a positive impact both on the environment and on public health (WBAE & WBW 2016: 206). In a statement on environmental

---

<sup>361</sup> However, together with the article, Spiegel Online also published a quiz that illustrated the ecological benefits of a Veggie Day (cf. Hunger & Kwasniewski 2013).

protection in the agricultural sector published in 2017, the Federal Environment Agency (UBA) also established that it “would be logical” to abolish the VAT concession on animal products and to support this step by means of adequate sociopolitical measures (UBA 2017: 5).

This policy measure is, however, popular with neither consumers nor agricultural stakeholders. It is therefore not surprising that representatives of the three governing parties, CDU/CSU and SPD (including Ms Hendricks, the Federal Environment Minister then in office), immediately voiced their opposition to the measure called for by the Federal Environment Agency. Representatives of the Green Party and the Left Party also rejected the proposal without delay (Drebes 2017). Yet the discussion on climate action that was encouraged by the “Fridays for Future” movement added momentum to the issue in 2019. The President of the German Animal Welfare Association called for an increase in meat prices for climate-action and animal-welfare reasons. However, he did not intend to achieve this aim by raising the VAT but by introducing a “specifically earmarked meat duty”.<sup>362</sup> In response to an enquiry by the “Die Welt” newspaper, agricultural policy-makers from the CDU, the SPD and the Green Party subsequently expressed their readiness for an increase in meat prices, whereas the Left Party, the FDP and the AfD as well as a number of political leaders from the CDU, the SPD and the Green Party rejected the proposal.<sup>363</sup>

As has been set out in Section 6.2.5, the political enforceability of food policy measures might be particularly problematic in Germany because in Germany, food-related problems tend to be considered an individual challenge rather than a social one. Nevertheless, international experience has also shown that enforcing excise duties by means of policy measures involves considerable challenges. Denmark, for instance, introduced the world’s first tax on fat in 2011, which took the form of a tax on saturated fatty acids. This tax, however, was repealed as early as 2012. An analysis of this case revealed that the tax had primarily been introduced for fiscal reasons, although it had originally been recommended by public health experts. As the tax was unpopular and had few supporters at political level, there was no hesitation in repealing it as soon as a new government took office. A study that was published shortly after the repeal showed that the measure had, in fact, been effective and had caused an – albeit moderate – reduction in fat consumption (Vallgård et al. 2015). Another study on the subject came to the conclusion that nutrition experts should have assumed a more proactive role in supporting the tax (Bødker et al. 2015).

Although political processes in the field of food policy are highly dependent on voters’ expected reactions and are influenced by the media, lobbying also plays an important role. The EU regulations on food labelling are an interesting example in this regard. A study by Kurzer and Cooper (2013) revealed that in this case, too, the public outrage potential as well as its framing were of key importance. Thus, civil society associations succeeded relatively well in getting

---

<sup>362</sup> Cf.: <https://www.welt.de/wirtschaft/article198285639/Fleisch-Konsum-Tierschutzbund-lehnt-hoehere-Mehrwertsteuer-ab.html>.

<sup>363</sup> Cf.: <https://www.welt.de/politik/deutschland/article198104111/Fleischsteuer-Union-SPD-und-Gruene-offen-fuer-Verteuerung-von-Fleisch.html>.

economic stakeholder groups to agree to their positions as far as the labelling of tobacco products and green genetic engineering was concerned. They did not succeed, however, in implementing “traffic light” coding or any comparable labelling system based on colour-coding within the scope of the EU regulation on food labelling for consumers.<sup>364</sup>

Political resistance to the taxation of foodstuffs is, however, not exclusively due to the fact that this kind of taxation lacks acceptance among consumers; it is also due to the food industry’s lobbying activities. In the above-mentioned case of the Danish tax on fat, the meat industry’s lobbying campaigns also contributed to the abolition of the tax (Bødker et al. 2015). Furthermore, an analysis conducted at EU level showed that the lobby tactics adopted by the sugar industry in opposition to sugar taxation were similar to those previously applied by the tobacco industry (Tselengidis & Östergren 2018). The authors identified a wide array of lobbying activities undertaken by the sugar industry, which ranged from framing approaches to establishing new relationships, for example with trade unions. Another lobbying strategy pursued by the food industry that has become increasingly important over the last few years is referred to as “AstroTurfing”.<sup>365</sup> It designates the creation of apparently grassroots-based organisations that are in fact being funded by industrial enterprises without making it transparent (for further information on the concept, cf. Lock et al. 2016; for details on its application in the food industry, cf. Miller & Harkins 2010).

Against this backdrop, the question arises as to what strategies can be applied to successfully implement policy instruments aimed at changing food consumption habits. The framing of a measure obviously plays an important role. It has become evident that, in political processes, framing that is aimed at “abstinence” (e.g. at reducing one’s meat consumption) has little chance of success. This holds true even if there is relevant scientific evidence demonstrating that such measures would be beneficial to the environment and human health. An alternative strategy is to frame measures that, while being linked with problems of acceptance, might be effective strategical instruments for promoting sustainability in food consumption in such a way that they stay under the “radar” of public or media awareness. One example of this is the call for implementing the DGE quality standards for communal catering. This would involve reducing meat consumption without having to mention it explicitly.<sup>366</sup> One disadvantage of such a strategy is, however, that it does not involve providing information to consumers and consequently lacks the potential to change their attitudes. Alternatively, measures with a low level of acceptance can be combined with other measures that are likely to increase acceptance and bundled together in

---

<sup>364</sup> The regulation referred to is entitled “Regulation on the provision of food information to consumers (COM(2008)0040)”. Alongside framing, the authors identified two further important influencing factors: the size of a lobbying coalition and the responsible European Parliament rapporteur’s own policy leaning.

<sup>365</sup> AstroTurf is the trademark name of an artificial turf.

<sup>366</sup> This is not a theoretical example. Policy-makers explicitly mentioned this strategy in informal talks with a member of the team of authors.

“policy packages”. For instance, a meat or fat tax could be combined with tax relief or transfer payments for the benefit of selected groups of consumers.

## 7.4 Governance problems in the innovation system

Governance problems also exist with regard to the innovation system (Fig. 7-1, Box M). Independent researchers must distance themselves from lobby interests. Lobby groups frequently try to monopolise scientific findings for their own way of reasoning, a strategy that is not limited to food policy (cf. e.g. Sabatier & Jenkins-Smith 1993). However, in the field of food policy, this poses particular problems. One problem is that scientific evidence on what is to be recommended from a nutritional and physiological point of view develops over time and the media sometimes take a simplistic and sensational approach to addressing these developments (cf. the explanations on factors of newsworthiness in Section 5.3.1.1).

Another problem is that food consumption recommendations, which should be based on scientific knowledge, have a direct, far-reaching impact on the commercial interests of the food industry. It is, therefore, not surprising that the food industry’s interest groups or individual companies try to influence the wording of food consumption recommendations by means of lobbying activities. This issue has been particularly thoroughly investigated with regard to the USA. In her book entitled “Food Politics”, which has meanwhile been published in its 10<sup>th</sup> edition, the nutritionist Marion Nestle analyses the food industry’s lobbying impact on political decision-makers and public authorities responsible for issuing food consumption recommendations (Nestle 2013).

Besides exerting direct influence on political or administrative decision-makers (classic lobbying), the food industry’s strategies also include the funding of scientific research. From a governance perspective, funding provided by the industry to the scientific community is not necessarily problematic as long as the relevant activities are transparent and the funding does not influence scientific findings. Moreover, a cooperation between industry, the scientific community and NGOs in certain panels and associations is definitely positive. It is an important social objective to transpose scientific findings (particularly in fundamental research) into concrete applications and products, which is only possible if industry, science and other organisations work hand in hand. This is the reason why the BMBF, the BMEL and the EU, for instance, call for consortia of that kind and promote them.

However, it is necessary to apply highly methodological standards and far-reaching transparency regulations in order to ensure that the funding or co-funding of studies by the industry does not lead to a bias in the study results. Furthermore, it is necessary to analyse whether existing standards are sufficient to effectively prevent a bias. For example, a systematic review of studies examining the effects of the consumption of sugar-sweetened beverages on health provided evidence to the fact that studies that were funded by the sugar industry were potentially biased (Litman et al. 2018). From a governance point of view, it therefore seems justified to further

investigate the question of whether the existing regulations and practices aimed at preventing bias in scientific studies are sufficient.

Another strategy pursued by industrial enterprises that is considered problematic from a governance perspective is the funding of organisations that appear to be independent scientific institutions while in fact being funded by the food industry. One problematic example in this regard is the International Life Sciences Institute (ILSI), which claims on its website to provide scientifically sound information in order to promote human health, well-being and environmental protection.<sup>367</sup> A study published in 2019, however, was able to demonstrate that companies from the food sector deployed the organisation as a tool to pursue their economic interests (Steele et al. 2019).<sup>368</sup> An investigation conducted by the Corporate Europe Observatory also came to the conclusion that ILSI's active role in the expert panels of the European Food Safety Authority (EFSA) led to a conflict of interests as ILSI should be regarded as an industry lobby group (CEO 2012).

Yet initiatives that issue recommendations for promoting more sustainable food consumption, such as reducing the consumption of meat, also receive support from financially strong funding agencies. One example is the "EAT Lancet Commission on Food, Planet, Health", which was established with the aim of bringing together more than 30 internationally renowned nutritionists to reach a consensus on how to define health-promoting and more sustainable food consumption.<sup>369</sup> Lancet is one of the world's leading medical magazines. The Commission's contribution, published in 2019, received considerable international attention. Its recommendations include reducing individual meat consumption to approximately 40 g per day (Willet et al. 2019: 541). However, the EAT Lancet Commission that came to this conclusion was by no means publicly funded but – as indicated on its website as well as in the mentioned article – received financial resources from the EAT organisation and the Wellcome Trust.<sup>370</sup> EAT is a non-profit organisation funded by the Stordalen Foundation, the Stockholm Resilience Centre and the Wellcome Trust to promote the transformation of the food system. The Stordalen Foundation was created by Mr and Mrs Stordalen, an entrepreneurial couple. Dr Gunhild Stordalen founded EAT and is also the director of the organisation. The Stockholm Resilience Centre is a partner of the foundation.<sup>371</sup> The Wellcome Trust is a foundation that primarily promotes research

---

<sup>367</sup> <https://ilsi.org/>.

<sup>368</sup> For the purpose of this study, e-mail chains between company representatives and scientists were evaluated. In the USA, scientists are obliged to disclose their e-mail correspondence with company representatives whenever NGOs such as "U.S. Right to Know" so require.

<sup>369</sup> <https://eatforum.org/eat-lancet-commission/>.

<sup>370</sup> EAT defines itself as "a non-profit startup dedicated to transforming our global food system through sound science, impatient disruption and novel partnerships" (<https://eatforum.org/about/who-we-are/>).

<sup>371</sup> <https://eatforum.org/about/who-we-are/what-is-eat/>.

in the medical sector. By its own account, its investment volume amounted to GBP 20.9 billion in 2016.<sup>372</sup>

From a governance perspective, a positive aspect of these trends is that they can counterbalance the funding of the science sector by the industry. Nevertheless, the principle of transparency should be applied here, too (which was put into practice in the case of the EAT Lancet Commission). Similar to the promotion of research by the industry, it is necessary in these cases to apply strict scientific principles in order to prevent any possible bias (e.g. with regard to political objectives pursued by the founding donors).

Against this backdrop, the general question arises as to what transparency rules should be applicable at civil society level. In Germany, all civil society associations dealt with in Section 7.2 participate in the “Transparent Civil Society Initiative” launched by Transparency International Germany.<sup>373</sup> They have thus committed themselves to ensuring a high degree of transparency, e.g. regarding their financial sources, which includes larger donations. From a governance perspective, this is considered a positive trend.

**Conclusion:** Science plays an important role in food policy, which is particularly due to the fact that food consumption recommendations are often based on scientific findings. As this advice has a direct impact on the commercial interests of the food industry, the industry can be expected to have every incentive to influence the scientific community. As illustrated by the ILSI example, there is also evidence that the industry adopts specific strategies to influence scientific bodies, which is problematic from a governance point of view. However, influencing the scientific community is equally attractive to foundations and non-profit associations that seek to pursue their goals. From a governance point of view, it is therefore crucial to apply high methodological standards and far-reaching transparency regulations, especially regarding financial sources of scientific work, to avoid a potential bias. While such standards are already being largely applied within the scope of good scientific practice, it appears nevertheless useful to conduct regular meta-analyses based on high methodological standards to find out to what extent a bias might be observed in scientific studies. This will help to recognise and remedy possible shortcomings at an early stage.

## 7.5 Specific governance problems

The previous sections address governance problems in policy-making processes (Section 7.3) as well as in the innovation system (Section 7.4). However, there are also far-reaching specific governance problems concerning the implementation of policy tools in certain fields of food

---

<sup>372</sup> <https://wellcome.ac.uk/about-us/history-wellcome>. The trust is directed by Baroness Manningham-Buller, member of the House of Lords, who held the post of Director General of the British Secret Service MI5 from 2002 to 2007. <https://www.parliament.uk/biographies/lords/baroness-manningham-buller/3857>.

<sup>373</sup> <https://www.transparency.de/mitmachen/initiative-transparente-zivilgesellschaft/?L=0>.

consumption. Section 7.5 describes three key elements for policies to promote more sustainable food consumption recommended by the WBAE which cause such specific governance problems: more sustainable catering in schools and preschools (Section 7.5.1), steering taxes geared to remove financial disincentives (Section 7.5.2), and labels that enable consumers to make informed sustainable decisions (Section 7.5.3).

## 7.5.1 Governance problems concerning catering in schools and preschools

As preschools and all-day schooling are expanded, these surroundings are becoming more important for infants, children and adolescents in Germany. This applies to both the nutritional quality of food and the environment in which food and drinks are consumed. Stakeholders on the federal and state level increasingly recognise catering in Germany's preschools and schools as a key area of action for food and health policy (Section 7.2.2). This is due to the fact that a) our food consumption habits and knowledge are shaped by our experiences from the very beginning of our lives (Section 3) and b) the well-recognised follow-up costs for society arising from unhealthy dietary patterns continue to rise (Sections 4.2 and 6.1.2). As shown below, the pertinent task to take action in this area is, however, politically complex and poses a significant challenge in terms of funding.

The explanations below refer to midday meals in schools and preschools as well as the food environment in which midday meals take place.<sup>374</sup> Section 7.5.1.1 analyses the status quo of catering in schools and preschools in Germany and outlines the availability and quality of catering. Section 7.5.1.2 illustrates why solely market-based governance will not suffice in order to bring about the quality offensive for catering in schools and preschools ([www.nqz.de](http://www.nqz.de)) which is considered necessary. Section 7.5.1.3 addresses the question of the financial responsibilities for the envisioned improvement in quality and examines to what extent a stronger governance by the federal government is possible.

### 7.5.1.1 Status quo of catering in schools and preschools in Germany

The number of children and young people who attend all-day schools in Germany is steadily growing. Some 3.3 million pre-school children, aged between 0 and 7 years, currently attend preschools, with roughly 2.4 million of them participating in midday meals at such facilities (Federal Statistical Office 2018e). In schools, the trend towards all-day care continues equally unabated. Roughly 40% of the 8.4 million children and adolescents currently attending general-education schools (Federal Statistical Office 2018a) are in all-day care now (KMK 2018). According to the

---

<sup>374</sup> The section will only take a brief look, if at all, at breakfasts in preschools as well as other programmes such as the EU school scheme ("Union aid for the supply of fruit and vegetables, bananas and milk in educational establishments").

decision by the German Standing Conference of the Education Ministers, it is a defining prerequisite for all-day schools that they offer a midday meal to students attending all-day schooling on every day that the school operates its all-day scheme (KMK 2018: 4).

More than two thirds of children attending preschools have their midday meals at the facility, whereas in all-day schools, in most cases fewer than 50%, sometimes even only 10% of children and adolescents participate in school midday meals.<sup>375</sup> The attendance rate for school midday meals differs according to the type of school as well as the age and background of the students. However, low attendance figures also indicate that the status quo of catering in schools and preschools in Germany may not be satisfactory.

In summary, relevant authors list the following critical aspects regarding catering in schools and preschools:

**Considerable disparities pertaining to quality and accessibility between and within different federal states and municipalities:** In Germany, the topic of catering in schools and preschools falls entirely within the sphere of competence of the federal states and the school and preschool providers. As a consequence, highly diverse institutional structures and a heterogeneous landscape regarding access and quality of communal catering have been established at the federal state level and the municipal level. The Federal authorities have a limited effect in this regard (cf. Section 7.5.1.3). The different federal states have their own legislation on schools and preschools and different administrative regulations, support guidelines and support systems. What is more, there is a highly diverse system of school providers<sup>376</sup> as well as different institutional arrangements with respect to the organisation of catering within schools and preschools (i.e. different catering systems and room concepts) and to the coordination and control structures. Children, adolescents and their parents hence face entirely different conditions depending on where they live, e.g. in terms of the available all-day schemes, the staffing levels, the quality of midday meals, and the share of costs parents have to shoulder (cf. Autorengruppe Bildungsberichterstattung (Authoring Group Educational Reporting) 2018, StEG Consortium 2019, KMK 2018, Textor & Bostemann 2018, Bertelsmann Stiftung 2018a). A comparative monitoring scheme for the conditions of catering in schools and preschools across Germany has proven to be difficult and is currently not available.

---

<sup>375</sup> Heide et al. (2019) specify an overall average utilisation rate of 37.4% for German all-day schools. A nationwide survey among school management on catering in schools found that the utilisation rate in 2014 was on average 50% in primary schools and 30% in secondary schools (Arens-Azevedo et al. 2015, see also Arens-Azevedo/Laberenz 2008 and Evers/Hämel 2010).

<sup>376</sup> The majority of schools in Germany fall under the responsibility of public entities, mainly municipalities and local authorities. However, a slightly upward trend can be observed regarding the number of schools with private providers, which currently stands at 11%, according to the Federal Statistical Office (2018g: 10). 32.8% of the 55,933 preschools in Germany currently (2018) have public providers, such as local authorities, supra-local authorities, municipalities or federal states. The remaining 67.2% have independent providers, such as the Arbeiterwohlfahrt (workers' welfare association), the Paritätische Wohlfahrtsverband (German Parity Welfare Association), the German Red Cross, the Protestant and Catholic Churches, or parents' initiatives, amongst others (Federal Statistical Office 2018e: 11 et seq.) The majority of preschools operate on a small scale, caring for up to 75 children (ibid.: 13). Preschools with independent providers are also subject to government supervision and are eligible for public grants according to state law provisions.

**Poor basic equipment:** Numerous municipal providers lack the necessary funding to afford adequate facilities and equipment for school midday meals. The bulk of preschools has neither a separate refectory nor a properly equipped kitchen (Arens-Azevedo et al. 2014). While roughly 90% of all general-education all-day schools have their own refectory, approximately two thirds of these refectories are inadequate (StEG Consortium 2019) and do not comply with requirements for an appropriate food environment and the basic needs of students and teachers in terms of the ambience, such as equipment and furniture, smell, light and noise. Sometimes refectories are even located in the basement or similar arrangements (Arens-Azevedo et al. 2015). Only every fifth all-day school has its own kitchen for preparing meals (ibid.: 45). The majority of schools have kitchen facilities for distribution only, which from the outset limits the room for getting students involved in terms of (nutrition) and physiological aspects (see below and Sections 8.2 and 8.8). Hence, there are considerable shortcomings regarding one fundamental pillar of good all-day schooling: adequate room and facilities and the aligning of these to the pedagogical concept of the school (Radisch et al. 2017). In order to bridge the funding gaps in improving the number and quality of all-day schools, different stakeholders recommend a relaunch of the investment programme for the future of education and child care (“Zukunft Bildung und Betreuung”, IZBB)<sup>377</sup> or greater and, above all, permanent financial support for municipal providers (Radisch et al. 2017).

**Hot midday meals delivered by caterers as the standard model:** Both in preschools and schools, the predominant type of catering organisation is that of external service providers (“Fremdbewirtschaftung”). Another comparably well-established model combines external service providers with the workforce available in schools. In this case, external caterers deliver the meals and the preschool or school staff distribute them. Fewer than 15% of the schools covered by the surveys organise lunch meals themselves without relying on external service providers (Arens-Azevedo et al. 2015, Tecklenburg et al. 2019). The type of catering corresponds to the catering system<sup>378</sup> in place in schools and the available kitchen: In most cases, hot meals are served (“Cook & Hold”). Hot meals require the availability of distribution facilities in the school kitchens. Hot-holding catering is by far the most cost-effective solution for small schools in terms of lunch catering.<sup>379</sup> However, this type of catering has certain shortcomings regarding the nutritional, physiological and sensory quality of the food, as meals have to be kept warm longer. A cook & serve catering system, which requires a fully equipped kitchen, is used at an average of only 20% of schools in all federal states.<sup>380</sup>

---

<sup>377</sup> From 2003 to 2009, the federal government invested 4 billion euros in the expansion and the improvement of all-day schools under the IZBB. In this context, the construction of refectories and school kitchens was also co-financed (cf. Federal Ministry of Education and Research (BMBF) 2009).

<sup>378</sup> For a more detailed definition of the different catering systems, see Kreutz (2012).

<sup>379</sup> According to current calculations, the full costs for a midday meal range from approximately 4.50 EUR to more than 8 EUR, depending on the catering system. The main parameter, however, is the number of participants. Cost are particularly high in smaller schools, i.e. in nearly all primary schools, especially for cook-and-serve catering systems (cf. Section 8.2).

<sup>380</sup> Production kitchens may also be used by external service providers.

**Poor nutritional values and sensory quality of the food:** The quality standards of the German Nutrition Society (DGE), which were specifically developed for settings such as preschools and schools, are the desirable minimum quality standards for meals in preschools and schools (cf. text box 17 on the DGE quality standards for catering in Section 7.5.1.1). In Germany, only every second invitation to tender stipulates by contract that these standards must be guaranteed (Arens-Azevedo et al. 2015). At the federal state level, binding provisions are in place only in individual federal states (cf. text box 18 on sustainable public procurement for preschool and school catering in Section 7.5.1.2). The objective of a blanket introduction and corresponding monitoring of the DGE quality standards in preschools and schools, which has been on the agenda of the federal government since 2018 according to the current coalition agreement, has yet to be attained. As a result, the quality of meals in preschools and schools remains poor. They consist of a significantly too low proportion of vegetables, lettuce, raw fruit, raw vegetables and wholemeal products. Fish is far too seldom on the menu, whereas the meals served include too much meat. What is more, experts, students and parents alike criticise the lack of options available as well as the sometimes unsatisfactory sensory quality of the food (Arens-Azevedo et al. 2015).

In this sense, the quality of the food served in preschools and schools does not appear convincing. The direct impact this has on the wellbeing of children and adolescents is quite problematic. In addition, this early exposure to and experience of food is particularly decisive for the child's acceptance and preference formation. Experimental studies tally in confirming repeated (positive) exposure as the most effective method for increasing acceptance of, for example, vegetables (Johnson 2016). As the "gate keepers of exposure", parents continue to play a vital role in controlling this exposure, particularly where very young children are concerned. Moreover, they serve as role models and shape the quality and emotionality of social interaction. As children grow older, peers and friends as well as the wider social network take over as the predominant influence. Children and adolescents may hence learn that a health-promoting and sustainable diet is important, but find that food and drink in their respective preschools and schools are neither very appealing nor of high quality. Therefore, these educational efforts are thwarted. Bearing in mind that more than two million children at preschool age already attend all-day childcare facilities, it becomes clear that catering in preschools and schools is becoming ever more crucial for the development of a child's food consumption habits (see next paragraph).

**Practical aspects prevail – the potential of catering in preschools and schools as a social learning location is scarcely exploited:** Eating together is an important social activity. Not only do we learn what food we like and what is socially acceptable, i.e. social norms regarding appropriate portion sizes or "socially prestigious" foodstuffs, but we also "synchronise" due to joint meal times and shared meals (cf. Sections 3.3 and 8.2.1.2). Different studies provide impressive evidence that eating significantly enhances our psychological well-being, social ties, cohesion and our work performance (Section 3.3, overview: Fischler 2011, Spence 2016). A shared meal contributes significantly to the exchange of information, it strengthens social bonds, common norms and values, and fosters social inclusion. Children and adolescents learn many of these things incidentally, e.g. by means of model learning. Birch (1980), for instance, showed that children learn

certain preferences, e.g. for vegetables, incidentally from observing their peers as early as at preschool age. Against this backdrop, researchers and experts in the field stress the key role and the great potential of understanding lunch breaks and shared lunch meals as a social learning environment and an educational element of all-day care (Radisch et al. 2017), where children and adolescents can learn about eating habits together from each other (e.g. Oostindjer et al. 2017, cf. Section 3.3).<sup>381</sup>

In contrast, relevant stakeholders far too often fail to recognize food and drink in the context of communal catering as anything other than a practical issue, particularly in schools. The “pedagogical bridge” connecting health-sustaining food, an appealing food environment and an overall dietary education concept tailored to the needs of the respective target groups does not appear to be well-developed (Jansen & Schreiner-Koscielny 2013). Against this backdrop, students, teachers, the school administration, and school providers often view school meals as a mere practical issue rather than an integrated aspect of school life and learning (e.g. Waskow & Blumenthal 2018). This is reflected, for example, by the fact that refectories are not very appealing, breaks are too short, there is little choice, and meals are not served in an appetising manner, but rather according to the principle of “the faster the better” (cf. Arens-Azevedo et al. 2015). Another issue regarding the food environment is the fact that schools often sell soft drinks and snacks. Higher exposure to snacks and soft drinks which may be purchased from vending machines or in the refectories in schools is associated with less health-promoting food consumption (Story et al. 2008, Chriqui et al. 2014, cf. Sections 3.3 and 8.2.1.2). Thus, the relevant stakeholders, such as the consumer advice centres, the Federal Ministry of Food and Agriculture or the European Commission, recommend that healthier alternatives, for example fruit, should be included. Some EU countries, for example France, have already banned vending machines in preschools and primary schools entirely (for an overview see EU COM 2018b).

**Access problems regarding children and adolescents from low-income households:** In preschools, primary and secondary schools alike, it is mostly the parents who shoulder the lion’s share of the costs for school midday meals, whereas the government’s contribution varies considerably (cf. Tecklenburg et al. 2019, Bertelsmann Stiftung 2018a, StEG Consortium 2019). In some cases, the school providers cover the running costs entirely, e.g. in Berlin. In other cases, they account for a part of the costs for midday meals and/or indirectly subsidise by assuming the costs of energy, water, cleaning, etc. In order to allow children and adolescents from households that receive public transfer payments (in particular Hartz IV, social welfare payments, and housing benefits) to participate in school lunch schemes, the Education and Participation Package has provided funds

---

<sup>381</sup> The federal government is increasingly recognizing how vital it is to link catering in schools and preschools with educational targets and is placing school and preschool catering in the context of overweight and obesity. However, the image conveyed focuses mainly on educational work being addressed within the scope of “normal” school lessons and separately from catering. An integral approach, which, for instance, places the food environment and social interaction while eating at the forefront, is hardly ever to be found. The government’s replies to a minor interpellation by the FDP parliamentary group in 2018 (German Bundestag 2019: 2) confirm this.

towards the costs of midday meals in preschools and schools throughout Germany since 2011.<sup>382</sup> Nonetheless, the consolidated usage rates for lunch subsidisation are well below 50%. Hence, the 2016 evaluation rightly points out that a “participation gap” persists for children and adolescents entitled to benefits compared with their peers from better-off households who do not receive social benefits. The reasons why children and adolescents do not participate range from the language barrier, a lack of understanding and the 1 EUR fee per meal to the fact that the application process is comparatively complex. In addition, children and adolescents have reported that they experienced discrimination due to the fact that the application process for the reduced fee meant they were recognised as being poor (SOFI & IAB 2016, see also Storey & Chamberlin 2001, Raine et al. 2003, Radisch et al. 2017, Oostindjer et al. 2017). Radisch et al. (2017: 28) consider the right for all students to participate irrespective of income to be a quality criterion of good all-day schools, especially from the standpoint of equal opportunities. Since the “Strong Families Act” was adopted in early 2019, parents have no longer had to pay a share of the amount themselves if they received transfer payments for midday meals in preschools and schools.<sup>383</sup> It remains to be evaluated if and to what extent this will have an impact on the participation rates of children and adolescents from these households. The fee to be paid by families themselves can also be an issue for families who are just above the limit for transfer payments.

**Lack of staff and funding in management and networking structures:** Expanding all-day schools and preschools has involved an enormous societal effort, and continues to do so. In this context, the equipment and buildings necessary for catering had to be improved or set up in a relatively short period of time, with the help of the federal government and other bodies (see above). Apart from this “hardware”, it is, however, also necessary to have the corresponding management structures in place. In principle, this has to be the responsibility of municipal school providers, with support from networking and coordinating structures at the national level and the level of the federal states.

Appropriate overhead structures are necessary at the level of school providers for the management of catering in preschools and schools. Individual preschools and schools generally do not have the capacities to appropriately manage these complex aspects, such as EU-wide tendering procedures (Section 7.5.1.2). Therefore, the municipalities, which often lack sufficient funding, must recruit appropriate staff and provide a sufficient amount of funding for management. As all-day school catering does not rank high on the political agenda in many regions, numerous schools report a lack of equipment and funding. This results, for example, in the issue that caterers are not monitored sufficiently regarding quality.

---

<sup>382</sup> As part of the Education and Participation Package, benefits in kind and services must be applied for individually; this method of granting benefits is linked to a high amount of paperwork in administrative bodies and is thus frequently subject to criticism (see e.g. SOFI & IAB 2016, Öchsner 2016, Bertelsmann Stiftung 2018b).

<sup>383</sup> Cf. <https://www.bmfsfj.de/bmfsfj/service/gesetze/starke-familien-gesetz/131178>. Families with a low household income just above the threshold for social assistance do not benefit from this.

Given the variety of institutional arrangements, the lack of experience and knowledge gaps in public procurement (cf. text box 18 in Section 7.5.1.2 on sustainable public procurement of school and preschool catering), it is key that information is pooled and made available, and there is networking and coordination between the various different bodies. In 2008, the federal government therefore began creating networking centres for school catering jointly with the federal states. These centres have successively been expanded in twelve federal states to include preschool meals.<sup>384</sup> There is a wide range of different arrangements and institutional links (for example the links with the State Centre for Food in Baden-Wuerttemberg or with the Consumer Organisation in North-Rhine Westphalia) (cf. BLE 2019a). The networking centres are intended to serve as advisory, coordination and networking platforms for all stakeholders involved in catering in preschools and schools, including dietary education.

To facilitate the exchange of expertise between different stakeholders at the level of the federal states and the communal level as well as to represent the interests of the networking centres at the federal level, the federal government additionally launched the National Quality Centre for Healthy Nutrition in Schools and Preschools (NQZ) at the Federal Centre for Food and Nutrition (BZfE) in Bonn in 2016. The NQZ is now based in Berlin and is intended to act as a partner for the networking centres in the federal states ([www.nqz.de](http://www.nqz.de)). The NQZ organises various events and national conferences (for instance the Federal Congress on School Meals in 2018). However, the current impact in relation to the set goals remains still quite low.

After setting up the NQZ, the federal government discontinued the regular support for the networking centres that had been granted hitherto. This now falls under the remit of the federal states. In support of the networking centres, the federal government provides funding for individual projects, such as flyers, events, or coaching. The networking centres have frequently criticised (see e.g. Deutscher Bundestag 2016b: 20) the uncertainties linked to project funding as well as the low level of funding and staff (in 2016 and 2017, a total of 341,778 euros in federal co-financing, a total of 1 million euros via IN FORM from the budget year of 2017 until the end of 2020), in response to which the BMEL doubled the funding for network centre projects to 2 million euros in 2019 and 2020. Yet it seems questionable whether such limited project assistance is sufficient with regard to the number of tasks to be tackled in respect of creating a blanket, high-quality catering system for all children and adolescents who attend public all-day schools.

In general, it is not surprising that the governance structures are “lagging behind” in a market that is growing so rapidly. According to WBAE estimates, many municipalities have not yet set up sufficiently professional structures, although improvements continue to be observed. Networking between the federal states and the federal government is therefore crucial. However, in some municipalities, the existing local structures are so understaffed that networking is not even possible. This exposes the issues that lie within the federal system.

---

<sup>384</sup> See <https://www.nqz.de/vernetzungsstellen/vernetzungsstellen-kitaverpflegung/>.

**Text box 17:** The DGE quality standards for catering

As of 2008, the DGE quality standards for catering were developed under the IN FORM National Action Plan (cf. Section 4.2). These standards now cover seven settings: preschools, schools, companies, rehabilitation clinics, in-patient institutions in the field of care for the elderly, and “meals on wheels” services.

Catering in line with DGE standards should be beneficial for physical and mental performance throughout the day and help avoid diet-related illnesses in the long term. Exposure to appropriate foods, particularly at young age, can shape consumption patterns while at the same time enabling children to learn an appropriate eating culture. To ensure that catering meets with approval, meals must be selected with great attention to sensory quality. Likewise, the surrounding conditions must also promote well-being and quality of life while eating. Hence, the principles of quality management form the bedrock of the DGE standards for catering. They systematically describe the quality of structures, processes and outcomes.

They define clear-cut requirements for health promotion, which are measurable and hence easily verifiable. They describe, for instance, the frequency and desired quality of food groups to be targeted on a weekly basis (in case of full catering) or on 20 days of catering (in case of part-catering). The food-related recommendations and the D-A-CH reference values are the basis of the frequencies and quality (cf. Section 4.2.1). Example of the composition of school lunch meals in a 5-day-week: vegetables – daily, including lettuce or raw vegetables at least twice; fruit – at least twice; carbohydrate content, e.g. potatoes, alternatively rice or pasta – daily; meat – twice per week maximum; fish – once per week maximum; dairy products – at least twice; water – daily. The standards also address different systems, as most settings offer different meals or menus to choose from or allow a free choice of components. Additionally to the standards, specific requirements for an ovo-lacto-vegetarian menu are set out.

Both the pertinent legal hygiene requirements and the general conditions are taken into consideration. This includes, for instance, the ambience (e.g. sufficient lighting and sound insulation of the rooms), organisation and operation (e.g. easy-to-clean furniture and floors), as well as marketing. As quality management encompasses a continuous enhancement of quality, the standards are re-evaluated on a regular basis and new evidence-based requirements are added as needed. In 2014, for example, additional sustainability criteria were included in all standards. From an ecological point of view, for instance, the recommendation is that catering equipment with low energy and water consumption should be used, that holding times should be reduced by optimising operational processes, that generally multi-portion packs should be purchased, and that leftovers should be avoided. Social sustainability criteria refer to the recommendation to give preference to fairly traded products, to appreciate employees as well as guests, and to communicate in a transparent manner.

If the requirements for catering are met, the respective institution may apply for certification. By 2018, 1,553 certificates had been issued in Germany, the majority of which related to preschools (648) and schools (417). This corresponds to 1.8% of preschools and 2.3% of all-day schools. Senior-citizen institutions are comparably underrepresented. For hospitals, the absolute figures are even lower (DGE 2019). Caterers who provide meals in different settings may also apply for a certificate if they fulfil the criteria. In this case, the requirements refer only to the food quality, the frequency of foods, the menus and the preparation of food.

### 7.5.1.2 Catering in schools and preschools as a merit good

From an economic point of view, catering in schools and preschools is a merit good. Merit goods are goods for which private demand is lower than would be desirable from a societal point of view. Examples of merit goods include school education, preventive healthcare (e.g. vaccinations) or cultural services (e.g. museums). Merit goods may in general be made available by the market, but they are frequently not offered or demanded in a quantity and quality that would be socially desirable. This is the reason why public authorities take action and policy makers bear responsibility.

In principle, it would be possible to have voluntary catering in schools and preschools, exclusively funded by parents and provided by private providers (caterers). In practice, however, this private-sector solution does not work for the simple reason that catering must take place on preschool and school premises. There hence must be some sort of public infrastructure. It is thus indisputable that public action is necessary. The preschool and school providers already support private providers by covering the operating costs, funding kitchen fittings or providing furniture (Tecklenburg et al. 2019, Arens-Azevedo et al. 2015, see also Berkemeyer 2015). In addition to that, individual providers subsidise the costs for midday meals (*ibid.*).

With the necessity of public action being indisputable, the question arises to what extent and at what level the government can and should assume its shared responsibility for the food consumption of children and adolescents within the scope of its independent responsibility for education according to Art. 2 (1) German Basic Law. In this regard, trade-offs exist at the level of preschool and school providers, as they must bring the objective to minimise expenses and to achieve cost-effectiveness in line with long-term preventive health goals. As many municipal providers have followed the privatisation trend of recent decades and outsourced many services (i.e. catering by external service providers, cf. Section 7.5.1.1), private caterers have come to represent the larger share of the market, with an upward trend. Economically, this results in a two-tier competition for caterers:

- (1) **Tendering procedure by preschool and school providers:** This process is primarily a competition about price, as there is a limited extent to which, for example, the quality of the food can be laid down *ex ante* in the tendering specifications in such a way that it is later able to be controlled. In practice, many preschool and school providers find it difficult to define sufficiently specific and verifiable catalogues of services and to enforce these afterwards. This is due to limited experience and a lack of knowledge among the responsible public providers, to a lack of control bodies (cf. text box 18 on sustainable public procurement for preschool and school catering), and also to the inherent nature of catering (e.g. it is difficult to verify the sensory quality).
- (2) **Day-to-day operations after securing the contract:** Caterers face a partial trade-off between acquiring and maintaining customers (via high quality) and minimising costs with given sale prices and subsidies. The revenue per meal (price) is fixed due to the tender. Therefore,

caterers can only increase their unit contribution margin by cutting costs. The profitability depends on this unit contribution margin and the sales volume, which in turn hinges, among other things, on customer satisfaction. As opposed to “normal” markets, caterers have no way of improving quality over the period of the contract via corresponding price increases. From a business point of view, the only incentive for caterers to achieve a high level of quality is the expectation that the increase in costs due to the enhanced quality may be overcompensated by the increase in sales and the hence improved capacity use which in turn cuts costs.

Customers, i.e. the children and adolescents and indirectly also their parents, cannot switch to a different caterer. This is a temporary monopoly held by the caterer which customers may only respond to by no longer availing themselves of this service (bringing their own food or not having midday meals) or by giving negative feedback (complaint). The school provider is in charge of awarding the contract. As there is a low level of transparency regarding quality, providers sometimes learn about problems rather randomly.

Additionally, customers in the melting pots that (primary) schools constitute have different ideas of quality requirements. The different food consumption habits of parents are reflected by their children. Caterers thus serve both children with high expectations, who are exposed to a balanced and tasty mixed diet at home, and children from families who eat nutritionally and physiologically less favourable food. The “regular” market solution would be quality differentiation, i.e. a range of different products or services tailored to different target groups with a corresponding price differentiation. This market differentiation, however, is not possible in catering in schools and preschools. Most schools have only one menu to choose from, or at most a few in the case of big schools (see Arens-Azevedo et al. 2015). However, the more relevant aspect is that, for good reasons, there is no price discrimination intended in preschools and schools, in order to counteract social segregation and discrimination of children from low-income families.

Given that caterers are only able or requested to offer a standard level of quality in any particular school, the question arises as to what quality level they should aim for. On the one hand, the bidding process defines the framework for the service, as it sets out the maximum price level. Hence the maximum level of quality is capped. Yet caterers may stay below this threshold. For reasons of costs, if the requirements are heterogeneous, then caterers tend to cater for the average demand, i.e. in simplified terms they tend to cater for the “median student”, for example, and thereby live up to the expectations of half of the students, who have lower requirements. However, in this case children or parents with higher expectations may eventually drop out. If a significant number of children opt out, the average expectation among those children who continue to participate is lowered even further – which in turn implies a decrease in quality in the long term. This results in a downward spiral of declining expectations, decreasing quality, and fewer participants. In addition, there is a risk that the reputation of the customers who continue to participate will suffer and that they will be subjected to social discrimination (“Only those who

can't afford anything else or whose parents are not willing or able to come up with alternatives have lunch at school").

**Text box 18:** Sustainable public procurement for preschool and school catering

In most cases, preschool and school catering is not managed by the schools themselves, but by third parties, i.e. external service providers. Hence, the bidding and procurement procedure is particularly relevant. As described above, there is a risk that the price competition will dominate. Sustainability issues are hence sometimes overlooked.

The legislator has responded to the need for sustainable public procurement, i.e. a public award procedure which, in addition to economic efficiency, can also address nutritional and physiological quality criteria and ecological as well as social aspects of sustainability, by amending EU legislation and national frameworks. Thanks to the amendment of the EU rules on public procurement in 2004 and 2014 respectively, competitive bidding procedures may now also take social and environmental considerations into account if they refer to the subject-matter of the contract. Municipalities (as public preschool and school providers) therefore have a certain buying power and power to shape the growing market of preschool and school catering. They may use this power to define the nutritional quality of the food or to set targets beyond that, such as the objective of a "20 per cent share of organic farming in agricultural land" (e.g. WWF et al. 2019: 29).

Yet municipalities currently frequently fail to use this "buying power". Empirical studies suggest that there are considerable gaps in their knowledge as well as legal uncertainties as to the options in EU public procurement legislation (Haak 2016). In addition, there is a lack of expertise which would enable municipalities to evaluate services in view of nutritional and health aspects or food preparation processes (Jansen & Schreiner-Koscielny 2013).

Binding contractual regulations on the quality of school meals based on a list of requirements, for instance, currently only exist in the states of Berlin and Saarland. If there are no standard criteria for awarding contracts, i.e. if different standards exist within one federal state, this may lead to a lack of transparency, unclear market signals and uncertainties among caterers. This is why it is recommended to have a binding and uniform definition of the criteria for awarding contracts in corresponding state legislation (Haack 2016).

A quality-focused competitive bidding procedure includes comprehensive quality management and customer relationship management. The corresponding methods, such as unannounced audits, surveys, evaluations of sensory quality, are well-known, but corresponding systems have so far not been established nationwide. Major shortcomings currently exist in terms of performance evaluation. To date, the federal state of Berlin is the only one to have established a central institution in charge of this issue. Berlin's quality control body for catering in schools ("Qualitätskontrollstelle Schulverpflegung") is intended to support the local education authorities in enforcing the quality standards that have been contractually agreed upon with caterers by carrying out controls, taking samples, and providing technical assistance to these authorities (cf. Berlin Senate 2016). There are a number of reasons why such structures should also be established at the level of the federal states (see, e.g., Lamprecht et al. 2017).

Hence there are several reasons why the market for catering in schools and preschools is not a “regular market”. In fact, catering in schools and preschools is a merit good. The government has assumed crucial responsibility for adequately providing this good by expanding all-day care, as is socially desired. Without government support, the market would potentially collapse. Catering in all-day schools in particular will only function well if the government manages to halt the downward spiral of decreasing quality mentioned above. It also becomes clear that if, for several (good) reasons, a society wants to have all-day schooling with catering, it must raise the quality to an ambitious level. This requires quality-orientated bidding processes, sufficient prices, subsidies and a procedure to ensure transparency regarding quality. The development of such structures in Germany is currently slow.

### 7.5.1.3 Opportunities and limits of governance by the federal government

The catering situation in schools and preschools, as illustrated in Section 7.5.1.1, will not improve sufficiently without stronger government assistance (Section 7.5.1.2). In the multi-level governance system consisting of the federal government, the federal states and the municipalities, the question arises as to what level assistance is possible and meaningful and, in particular, what governance opportunities and limits exist at federal level regarding catering in schools and preschools.

The federal government’s shared responsibility for the nutrition and diet of children and adolescents is based on its responsibility for supervising education according to Art. 7 (1) German Basic Law. The responsibility for the costs of catering in schools, however, must be compliant with the financial stipulations of the German Basic Law and comply with the apportionment of expenditures between the federal government and the federal states according to Art. 104a ff German Basic Law. According to the connectivity principle, Art. 104a (1) stipulates that the apportionment of expenditures is generally based on the responsibility for carrying out tasks, i.e. the party that is responsible for carrying out a task must also finance all the respective expenditures.<sup>385</sup> The organisation and the specific arrangements regarding catering in schools and preschools is one of the core duties of public entities according to the legislation governing schools and preschools. These public entities are usually municipalities, which hence must bear the costs. While Art. 104a (3) 1 German Basic Law authorises the federal government, in federal laws providing for money grants to be administered, to provide for a proportionate apportionment of expenditures and hence co-funding by the federal government, a federal law could not be used to transfer the cost burden to the federal government in this case. This is because Art. 104a (3) 1 German Basic Law does not contain the competence to adopt a law providing for money grants, but instead presupposes that there is such a competence and that a law providing for money grants has been adopted pursuant to it. However, the federal government does not have such

---

<sup>385</sup> BeckOK Grundgesetz/Kube, 41. Ed. 15.5.2019, GG Art. 104a Rn. 1.

competence for a preschool and school catering law. Hence at this stage direct co-financing by the federal government would indeed breach constitutional law. It would therefore be necessary to amend the German Basic Law to explicitly include school catering as a material component of the federal government's responsibility for education.

The federal government can, however, exert influence on catering in schools and preschools using the following measures:

- **Investing in municipal educational infrastructure:** It is possible to make use of Art. 104c German Basic Law, which was supplemented in 2019, in order to build refectories. This provision allows the federal government to deviate from the connectivity principle laid down in Art. 104a (1) and, beyond the scope of the enabling provisions laid down in Art. 104b, which are not relevant in this regard, to contribute to the financing of investments in municipal educational infrastructure. This also covers infrastructure facilities for school catering (Scientific Service of the German Bundestag 2019). However, the running costs for school catering are not part of said municipal educational infrastructure, which, as an exceptional case, must be subject to a narrow interpretation.
- **Improving the municipalities' financial situation (e. g. by increasing the municipal share of the turnover tax):** Improving the financial situation of municipalities could provide them with more financial leeway. The effects of this measure would only be indirect and not assigned to a definite purpose. However, if the turnover tax on certain foodstuffs was increased for environmental and health reasons, the federal government, the federal states and the municipalities could agree on policy objectives that the additional funds generated should be used to attain.
- **Improving the framework and the state of knowledge:** The federal government has a number of options for providing support under projects for advancing preschool and school catering. For instance, the federal government could use the networking centres to launch new projects to develop key quality control systems and conduct associated research projects as part of the expansion (Section 9.2).

The greater scope for federal funding of municipal educational infrastructure in accordance with the amendment to Art. 104c German Basic Law is crucial for other parts of this expertise (Section 8.12).

#### 7.5.1.4 Conclusions

The organisation and implementation of school and preschool catering in Germany is highly diverse and includes many aspects where there is room for improvement. This applies to the nutritional values and sensory quality of the food on the one hand and the more specific food environment on the other. The latter refers, for instance, to the way refectories are equipped, the variety of options available, the way dishes are served and the length of breaks. Germany is still far from

recognising school meals as an integral part of the school environment for living and learning. The expansion of all-day schemes aims not least to reduce educational disadvantages, while also improving the compatibility of work and family life. There is still a lot of unused potential relating to preschool and school catering. As explained above, there is a certain urgency to take action regarding the access problems relating to children and adolescents from lower income households as they are statistically more prone to have nutritionally and physiologically problematic dietary patterns (cf. Section 4.2).

In general, the policy area of preschool and school catering is characterised by the complex structures of the federal German decision-making system. The first coordinating bodies have been set up, but their organisational structure and financial resources are not adequate for their task. Organisational and funding deficits are particularly problematic because the market in the communal catering sector does not function well enough, as is already clear from the structural shortcomings mentioned above (downward spiral of quality). Stronger public governance and support is necessary (Section 7.1.1.2). The responsible municipalities are reaching their limits in this regard.

According to the German Basic Law, the federal government may not interfere with the education policy of the federal states. Hence there is scope for action at federal level, although this scope is limited. This scope ranges from investment schemes for improving the infrastructural conditions of school and preschool catering (Art. 104c German Basic Law) to increased research and increased financial allocations/funding for the networking centres (Section 8.2). The greater scope for federal funding granted under the amendment to Art. 104c German Basic Law is crucial for other parts of this expertise. High-quality school meals could serve as a key educational element in preschools and all-day schools, as they enable children to gain practical experience in dealing with food and drink and in doing so in a social context. This can help promote more sustainable food consumption in their day-to-day lives. Yet what also becomes clear is that the necessary quality offensive for catering in schools and preschools represents a serious challenge with major financial implications.

In principle, the governance problems described in greater detail here using the examples of catering in schools and preschools also apply to other fields of communal catering, which cannot be explained in detail here for reasons of space. Comparable structural challenges persist in the fields of catering for senior citizens (Sections 4.2.2.4 and 9.8.1), in hospitals and rehabilitation centres (Section 9.8.2), or in prisons. A healthcare system that cares for persons in need of long-term care in its facilities, but tends to regard nutrition as a secondary issue and accepts considerable quality deficits, sends a counterproductive signal to society.

## 7.5.2 Governance problems due to financial disincentives and possibilities of steering taxes

Labelling is a particularly important topic in the debate on food and nutrition policy in Germany. The BMEL has designated, inter alia, the issue of animal welfare labelling as a central goal to be achieved in the ongoing legislative term. The decision on the design of a simplified (interpretative) nutrition labelling scheme is a subject of similarly hot debate. Compared with the high level of political attention that labelling has received for many years, the implementation or efficacy of the instrument is highly disputed. In the following, the WBAE therefore fundamentally focuses on the governance problems arising from food labelling.

### 7.5.2.1 Relative prices of different food categories

From a sustainable development perspective, the current relative prices of different food categories pose two major problems. **From a health perspective**, there is now plenty of evidence suggesting that energy-dense foods with high starch and sugar levels are relatively inexpensive compared with foods such as fruit and vegetables, fish or lean meat which are more nutritious (see text box 5 „(Additional) costs of a health-promoting diet” in Section 4.2.3). If one calculates the ratio of EUR to calories, people can “eat a diet that is adequate in terms of calories” at particularly low prices by consuming soft drinks, bread, pasta or pizza, while fruit and vegetables are relatively expensive (Drewnowski & Specter 2004, Drewnowski 2018, 2010). Mineral water is more expensive than soft drinks in most countries of the world (Blecher et al. 2017). In terms of calorie content, only fats/oils and sugar are cheaper than starchy staple foods in wealthy countries. Snacks containing sugar and salt are also relatively cheap sources of calories.

In an extensive international study, IFPRI researchers have established the relationship between the price of a calorie of a specific foodstuff (e.g. fruit, milk, fish, soft drinks) and the price of a calorie of a representative basket of starch-containing staple foods (wheat, rice, maize, potatoes, etc.) in different countries and groups of countries (Headey & Aldermann 2019). Table 7-8 shows the values for the respective country groups.

**Table 7-8:** Price ratios of different food groups compared with starch-containing staple foods internationally

	All countries	Countries grouped according to income			
	(n = 176)	Wealthy (n = 64)	Middle income (upper tier) (n = 44)	Middle income (lower tier) (n = 41)	Low income (n = 27)
Fruits and vegetables rich in vitamin A	7.74	7.83	6.34	8.62	9.50
Dark green leafy vegetables	16.12	18.85	17.39	13.94	14.43
Other vegetables	4.69	4.98	3.86	5.05	6.05
Other fruits	5.35	3.10	5.85	6.23	4.02
Nuts	1.86	1.38	1.74	1.98	2.97
Pulses	1.86	1.50	1.34	2.16	3.55
Children's breakfast cereals	5.40	2.11	3.89	7.07	11.36
Milk	3.84	1.93	2.72	4.55	10.45
Milk products	6.93	2.46	6.25	9.40	8.53
Eggs	5.54	2.60	4.46	6.65	11.66
White meat	5.42	3.91	3.54	6.98	9.97
Red meat (unprocessed)	3.07	3.07	2.68	3.30	3.72
Red meat (processed)	11.51	7.50	9.34	14.89	15.26
Fish & seafood	6.00	5.65	4.31	6.90	10.20
Fats & oils	0.67	0.66	0.49	0.75	1.05
Sugar	0.83	0.36	0.57	1.06	2.07
Soft drinks	5.26	3.03	3.55	6.72	11.45
Juice	12.62	3.16	11.59	18.23	11.78
Sweetened snacks	2.16	1.43	2.09	2.44	2.92
Salty snacks	2.54	1.81	2.24	2.54	6.88

Note: The price of a calorie of a particular food group is indicated in relation to the price of a calorie of a representative basket of starch-containing staple foods; a value of 5 would mean that a calorie of this food is on average five times more expensive than a calorie from the average of wheat, rice, maize, potatoes, etc.; \* = fortified children's breakfast cereals.

Source: Headey & Aldermann (2019), graphically adjusted.

In part, these relative price differences are due to the nature of the products or agricultural production. To produce one energy unit from fruit and vegetables (so-called specialised crops) requires a higher input of land, labour and capital than to produce one energy unit from cereals or sugar beet. In particular, labour costs are higher in the case of horticultural, permanent and specialised crops because production cannot be mechanised to the same extent. Technological progress in the mechanisation of harvesting conventional arable crops on the one hand, and rising labour costs, which particularly affect horticultural, permanent and specialised crops, on the other hand, have made and continue to make fruit and vegetables comparatively more expensive over time. Products containing sugar and starch, on the other hand, are particularly easy to transport and store. Last but not least, it can be assumed that agricultural price and research policies exerts an influence on long-term consumption and eating behaviour (text box 19).

**Text box 19:** Long-term impact of agricultural support on food consumption

In recent decades, a major focus of agricultural policy has been placed on promoting a small number of crops, chiefly cereals, oilseeds and sugar beets (outside the EU also sugar cane). In the EU and other rich countries, the production of these crops has received special support since the mid-20<sup>th</sup> century by means of price subsidies for farmers in order to ensure the supply of these high-yielding products to the population (OECD 2018b). The price incentives made it lucrative for farmers to grow precisely these crops and to oust other, non-subsidised crops from crop rotation (Bowman & Zilberman 2013). Increased cultivation in turn created incentives for private and public institutions to focus research efforts specifically on these crops. International research has also been focussing on cereals and a few other crops to fight hunger (Evenson & Gollin 2003, Pingali 2015). It is not surprising, therefore, that technological progress has in recent decades been much greater for cereals, oilseeds and sugar beets than for less researched crops such as leguminous crops, fruit and vegetables.

The different yield developments resulting from technical progress additionally strengthened the already higher agricultural profitability of the subsidised crops compared with others. Even though direct price subsidies for cereals, oilseeds and sugar beets are now largely a thing of the past in the EU (OECD 2018b), this policy has resulted in certain path dependencies which still influence our dietary patterns nowadays.

Cereals, oilseeds and sugar beets provide mainly calories, but hardly any micronutrients. The marked increase in the production of these crops has shifted relative prices for consumers and tended to counteract a further diversification of diets (Khoury et al. 2014, DeFries et al. 2015). Calorie-containing foods have become cheaper, while legumes, fruits and vegetables have become relatively more expensive by comparison. The long-term trends in the varying availability of individual product groups and price ratios have not only influenced the purchasing and consumption behaviour of end consumers, but also the recipes and product trends of the food industry. Processed products frequently contain a lot of cereals, fat and sugar, because these raw materials have always been more readily available on the market at lower prices than others.

Many decades of agricultural policy promoting chiefly calorie-rich raw materials has helped to significantly reduce the undersupply of calories to the population. In the meantime, however, a major part of the population is affected by overweight, so that the focus on calories is rather counterproductive for a health-promoting diet, at least in Europe. It would be wrong to blame the problem of an unhealthy and unbalanced diet primarily on the agricultural policy in recent decades. But it is plausible that agricultural price and research policy has had and still has an influence on long-term consumption and eating behaviour.

In view of the price ratios outlined above, price-conscious households, such as low-income households and consumers for whom a health-promoting diet is not important or is less important than prices, are subject to financial pressure or have incentives to consume certain foods at low prices, which are (in part) responsible for many health-related dietary problems (cf. Section 4.2.3). Negative health effects, in turn, not only place a strain on the affected persons themselves, but also result in external effects, as the costs incurred by an individual who eats an unhealthy diet and therefore falls ill are borne by the social community in the form of compulsory health insurance (cf. Section 6).

The effect that cheap calories are the problematic ones does not hold true **in ecological terms**. The products listed in Section 5 with a particularly heavy environmental burden, in particular animal products, are comparatively expensive; conversely, the low price is actually an argument in favour of increased consumption of pulses, to highlight just two key examples. This does not mean, however, that specific foods would not be even more expensive if external costs or economic health costs were included. In recent years, numerous attempts have been made to identify negative external costs of the food system and to assign them to specific forms of production or product groups. For example, an English study has identified external costs of food consumption (environmental and health costs) that are roughly as high as the consumption expenditure of food (Sustainable Food Trust 2017). In a study for Germany, Gaugler and Michalke (2018) calculate how food prices would change if the external costs of energy consumption and greenhouse gas and nitrogen emissions were included. They identified price increases of 43% for meat, 32% for milk and 6% for plant-based products (for conventionally produced products), related to the selling price.

Section 5 of this expertise pointed out that the assessment of environmental problems along the entire value chain already shows considerable gaps and evaluation problems. The figures mentioned for the monetarisation of this damage, in the form of a calculation of external costs, give rise to further evaluation problems (cf. in overview Bünger & Matthey 2018). Today, calculations for external costs therefore differ by considerable orders of magnitude. It is, however, generally undisputed that certain forms of production and products cause higher environmental and health impacts than others and therefore generate greater external costs (Fanzo & Davis 2019).

### 7.5.2.2 Influencing demand by consumption-side steering taxes

If certain actions cause external costs or high economic burdens, environmental economists are typically in favour of government efforts to change price ratios. This is expressed in the dictum that prices should “tell the truth” (cf. Section 6). Subsidies and taxes can be used for this purpose. Both policy instruments can serve to internalise external effects: subsidies are intended to translate the benefits not included in market prices (e.g. higher micronutrient levels) into direct incentives for producers and consumers, while taxes are intended to translate the costs not included in market prices (e.g. high greenhouse gas and nitrogen emissions) into such incentives: while a subsidy increases the incentive to produce and consume the good in question; a tax has the opposite effect.

Traditionally, subsidies as well as taxes and duties are used to control the supply side (cf. Section 6.2). More recently, however, they have also been increasingly used as instruments to influence the demand side, e.g. in the mobility sector by subsidising electric cars and by reducing VAT on rail tickets.

In Germany, financial incentives have so far seldom been used as a tool to govern food consumption. Special steering taxes, which make a problematic consumption alternative more

expensive, exist mainly for alcoholic beverages. A more recent example is the so-called alcopop tax, a special tax introduced in 2004 in Germany and some neighbouring countries on spirit-based, ready-to-drink mixed beverages.<sup>386</sup>

In Germany, a relatively intensive debate about a meat tax is currently underway – for climate change mitigation and animal welfare reasons. With this in mind, the WBAE recommended in its expertise on climate change (WBAE & WBW 2016) that the reduced VAT rate for animal products as a whole (i.e. also for dairy products, eggs and fish) should be cancelled as a first step for phasing in such steering taxes.

Taxes on particularly energy-dense products (Niebylski et al. 2015, Thiele & Roosen 2018) are also subject to public debate, as their low prices are a key driver of obesity (Drewnowski & Darmon 2005, Huckfeldt et al. 2012, Darmon & Drewnowski 2015).

### 7.5.2.3 Steering effect of consumption-side steering taxes

The potential impact of a tax is measured by the (own-) price elasticity of demand, i.e. the percentage by which the demand volume for a product decreases when the price is raised by one percent. In a global meta-analysis of over 160 studies on price elasticities, Andreyeva et al. (2010) show average price elasticities ranging from -0.21 for eggs to -0.81 for away-from-home catering; with soft drinks being at the top end with -0.79. This means that, according to Andreyeva et al., if the price increases by 1%, demand for eggs would fall by around 0.2%, while demand for soft drinks would decline by just under 0.8%. Cornelsen et al. (2015) identified somewhat lower and closer values for industrialised countries, ranging from -0.42 for fats/oils and -0.6 for meat and -0.61 for fish. In a current review, Femenia (2019) shows own-price elasticities for Europe ranging between -0.17 for oils and fats and -0.55 for dairy products. Cabrera Escobar et al. (2013) and Long et al. (2015) arrive at higher elasticities of -1.3 and -1.2 for soft drinks, respectively. After the introduction of a roughly 10% tax in early 2014, soft drink consumption in Mexico fell by about 12% over the course of a year, corresponding exactly to this value (Schmacker 2018).

---

<sup>386</sup> The relatively high tax has significantly reduced the consumption of the spirit-based, ready-to-drink mixed beverages, with tax revenues falling from around 10 to 1 million EUR/year. However, the consumption of certain alcoholic substitutes by young people has increased. The overall alcohol consumption among young people has probably not decreased considerably due to the tax, but an increase might have been prevented (Müller et al. 2010).

**Table 7-9:** Own-price elasticities of the demand volume as a result of a meta-analysis

		Cereals	Milk/milk products	Fruit/vegetables	Meat	Oils/fats	Other
<b>North America</b>	Weighted average	-0.68	-0.41	-0.75	-0.62	-0.32	-0.41
	Weighted SD	0.61	0.66	0.74	0.49	0.47	0.58
	N	64	33	98	156	17	44
<b>South America</b>	Weighted average	-0.36	-0.58	-0.5	-0.54	-0.37	-0.61
	Weighted SD	0.41	0.5	0.43	0.36	0.46	0.3
	N	34	37	37	71	34	34
<b>Eastern Asia</b>	Weighted average	-0.63	-0.69	-0.67	-0.66	-0.64	-0.64
	Weighted SD	0.82	0.84	0.73	0.84	0.78	0.9
	N	81	48	95	137	33	31
<b>Other Asian countries</b>	Weighted average	-0.59	-0.53	-0.64	-0.53	-0.59	-0.71
	Weighted SD	0.86	0.55	0.79	0.54	0.52	0.66
	N	122	70	157	121	47	92
<b>European Union</b>	Weighted average	-0.19	-0.55	-0.49	-0.49	-0.17	-0.53
	Weighted SD	0.41	0.65	0.64	0.51	0.21	0.38
	N	63	76	108	165	54	75

Note: SD = standard deviation, N = number of studies evaluated.

Source: Femenia (2019: 76).

Estimates for particularly wealthy industrialised countries such as Sweden (Säll & Gren 2012) or Germany show slightly lower elasticities still. In general, own-price and income elasticities decrease with higher levels of prosperity, but even within a country the rule applies: the more prosperous, the less price-sensitive (Femenia 2019, Muhammad et al. 2019). For example, a value of -0.37 for meat and meat products and of -0.19 for milk and milk products was calculated for own price elasticities of demand in Germany (Effertz & Adams 2014). Neither are such low values implausible in methodological terms, as it can be assumed that long-term price elasticities are lower than the rather short-term responses measured in most studies due to habituation effects. Moreover, many

calculations are based on the (short-term) price fluctuations common to agricultural products and on reactions to promotional offers of the retail sector, while taxes/subsidies have a long-term effect, which has rarely been measured to date.

If, by way of example, one calculates the spectrum of possible effects for Germany, an increase in VAT from 7 to 19% for animal products would lead to a fall in demand of about 2 to 3% for elasticities of approx. 0.2, whereas demand for elasticities of roughly -1 would lead to a drop in demand of about 10% (WBAE & WBW 2016). In order to achieve major steering effects, relatively large tax increases are therefore necessary in wealthy countries such as Germany with rather low price elasticities (Muhammad et al. 2019).

At the same time, changes in value-added tax have a significant impact on the budget. For example, a cut in the VAT rate for all already reduced foods from 7 to 5% (lower limit proposed by the EU) would ease the burden on citizens by EUR 3.8 billion (Bach & Isaak 2017). An increase in the reduced VAT rate for animal products to 19% would generate additional tax revenue of just under EUR 5 billion (see below and Section 8.6.3).

In the literature, unfavourable substitution effects, the evasive behaviour of residents living close to the border and costs of red tape are mentioned as **economic challenges** to be taken into account when introducing a steering tax.

- **Unfavourable substitution effects** occur, for instance, if meat is replaced by low-cost products containing fat or sugar (Kehlbacher et al. 2016). In order to avoid such effects, it must be ensured, with regard to product taxes, that similarly unfavourable substitutes are taxed comparably (ECSIP 2014, Epstein et al. 2012). Here, broad-based steering taxes, which address several or ideally all less sustainable product groups simultaneously, have advantages (Alston et al. 2016).
- **Cross-border shopping** can undermine the effect of a steering tax. Such problems can currently be observed in US cities. When individual cities introduce steering taxes, e.g. on soft drinks, many consumers fall back on the surrounding rural areas (Schmacker 2018). However, since we will only assume national tax increases in the following, the problem is much less serious. In addition, Germany as a whole has rather favourable food price levels compared with its neighbours, so that the evasion effects would tend to be limited.
- **Bureaucracy-related costs** arise in particular when a new specific tax or levy is introduced. However, such special taxes are already in place, even those which, like the tax on spirits, rise proportionally with the level of alcohol content (or have increased, the tax on spirits was replaced in 2017 by an EU-harmonised excise duty on alcohol). Finally, the administrative costs will be reduced if there is a possibility to levy the tax at certain “bottlenecks” (e.g. at the level of the processing plants).

To sum up, the research on steering taxes is based on the following **impact effects and design recommendations**:

- Compared with taxation based on volume, price-related excise duties or a VAT increase, using targeted taxation of the reduction target (e.g. sugar content) improves the effect and reduces side effects that are undesirable in terms of distribution policy (Francis et al. 2016, Schmacker 2018).
- Stronger steering effects occur among younger target groups (due to lower income and higher price sensitivity, and also less habit-shaped behaviour).
- Tax increases have a stronger impact when initial prices are high in absolute terms than when products are cheap.
- Significant jumps in prices instead of several small steps have a stronger effect, but tax acceptance is decreasing (WHO 2016).
- The name of a tax (e.g. climate levy) is important because a descriptive name can simultaneously change mindsets (Li et al. 2012).
- Using tax revenues for health and social policy goals enhances acceptance (e.g. use of the planned soft drinks tax in Great Britain for school meals and school sports).
- The social balance of the overall package, consisting of regressive excise tax increases and possible compensatory payments to households, must be respected.
- The risk of consumers switching to unfavourable substitutes (e.g. alcohol instead of soft drinks) and to low-priced brands (with maybe a less favourable sustainability profile) must be taken into consideration (WHO 2016b, Thiele & Roosen 2018).
- Similarly, possible negative side effects caused by product reformulations must also be taken into account, for example when manufacturers switch to fat as the flavour carrier in the event of sugar being taxed (Thiele & Roosen 2018).

#### 7.5.2.4 Distribution effect of consumption-side steering taxes

People earning low incomes react more strongly to price hikes. In percentage terms, low-income households are more affected by price increases than high-income households. Consumption taxes are therefore typically regressive in their impact, i.e. they place a greater burden on low-income earners and thereby have a greater impact on them. This effect is even greater if products are taxed that are consumed disproportionately by lower-income households (such as soft drinks). For example, according to the results of an extensive analysis of soft drink taxes in the US, low-income people reduce their calorie intake more than twice as much as high-income people (Zhen et al. 2013), which is due to their greater price sensitivity but is also linked to their previously higher consumption levels (ECSIP 2014, Backholer et al. 2016). This is confirmed by experiences gained with the Mexican soft drinks tax (Schmacker 2018).

A steep rise in excise taxes, especially on staple foods, thus also raises socio-political questions (WBAE & WBW 2016, Darmon & Drewnowski 2015): if a tax is imposed on foodstuffs whose

current levels of consumption increase the likelihood of negative health effects, a steering tax will have a favourable effect on health. The tax thus supports changes in behaviour. On the one hand, if a steering tax has a particular impact on low-income earners, it is particularly beneficial to the health of this group (ECSIP 2014). On the other hand, with reference to the right to self-harm (cf. 6.1.2), it can be asked whether it is not unfair that low earners are less able to evade the steering effect of such a tax than people on a higher income, or that low earners who do not modify their behaviour are relatively more burdened by such taxes compared with people with a higher income.

The distributional impact of taxes that work in favour of a societal goal, such as a tax motivated by climate action policy, must be assessed from a slightly different perspective.<sup>387</sup> Such taxes have the same distributional impact as taxes on harmful products. In contrast to these, however, no individual benefit is intended. Furthermore, rich households, which would be less affected by a climate action tax, contribute more to climate change on average.

Therefore, if the use of steering taxes is increased, particular attention should be paid to the social equilibrium of the measure. For example, compensation is often proposed in the form of a personal tax refund or a tax refund differentiated<sup>388</sup> according to household types, which is independent of income or falls as income increases. With the help of such “steering tax compensation”, lower-income households could even be totally relieved (Bach 2011).<sup>389</sup> The refund scheme for the CO<sub>2</sub> steering levy in Switzerland works in a similar way, in this case by reimbursing health insurance contributions.

### 7.5.2.5 Acceptance of consumption-side steering taxes

Some recent empirical studies on the acceptance of steering taxes are available for Germany. In a representative survey for the Federation of German Consumer Organisations, Zühlsdorf et al. (2018) surveyed the acceptance of different variants. Table 7-10 shows the acceptance (or rejection) of a soft drinks tax, in which the additional tax revenue is used to reduce taxes on fruit and vegetables, and of a tax on meat, in which the additional revenue is used to enhance animal welfare. A majority (54%) of the respondents endorsed a tax on soft drinks accompanied by a reduction in the tax rates on fruit and vegetables. While the meat tax for more animal welfare is

---

<sup>387</sup> The high economic costs of a diet that is hazardous to health are also largely external effects. This is because the costs caused by an individual who eats unhealthy food and falls ill as a result are borne by society at large in the form of compulsory health insurance. In this sense, a tax on products that are hazardous to health also serves a social objective, i.e. a reduction in health insurance contributions.

<sup>388</sup> “Differentiated according to types of households” means that the size and structure of the households are also taken into account so that children and larger households, as appropriate, receive a decreasing per-capita bonus if lower average per-capita spending on taxes is incurred in this regard, e.g. because smaller children consume less.

<sup>389</sup> In the current debate on a CO<sub>2</sub> tax in Germany, supporters also frequently call for compensation through a climate bonus (per capita or per household), cf. e.g. Graichen and Lenc (2018). In its climate package, the Federal government has adopted a mobility allowance for low-income households that do not benefit from the increase in commuter allowance.

supported by 42% and rejected by only 32%, there are, in relative terms, many people who are still undecided (26%).<sup>390</sup>

**Table 7-10:** Acceptance of different steering tax concepts: Results of a representative survey

	I fully agree	I agree	I agree in part	I disagree	I do not agree at all
Should the government increase taxes/levies on soft drinks (like Coke and orange soda) and reduce them on fruits and vegetables instead?	24.3	29.2	15.5	17.4	13.6
Should the state raise the price of meat through a tax/levy and use the money to improve animal welfare?	17.1	24.7	25.9	19.3	12.9
Should the government increase taxes/levies on foods with very high sugar, fat, or salt content in exchange for lowering taxes on healthy foods (keeping taxes the same overall)? (n = 355)*	19.7	28.2	21.1	17.2	13.8
Should the government increase taxes/levies on foods which are very high in sugar, fat or salt and use the money to improve health care? (n = 342)*	17.3	26	17.8	18.4	20.5
Should the government increase taxes/duties on foods with very high sugar, fat or salt content? (n = 337)*	12.5	21.7	19.6	25.5	20.8

Note: Figures in % of all valid answers. \*Split survey, i.e. by means of random selection, the respondents each assessed one of the three differently structured taxes or levies. The items were randomised in the survey.

Source: Zühlsdorf et al. (2018: 22).

<sup>390</sup> A study conducted by the Thünen Institute (Hempel et al. 2019: 44) also points to a high level of uncertainty in the assessment of a meat tax, in which 75% of respondents deem the taxation of climate-damaging products important, but only 37% regard the taxation of meat and sausages as important. It is possible that many respondents are not aware of the climate impact of animal products.

The lower part of Table 7-10 presents the results of a so-called split-sample experiment, which was designed to systematically analyse the influence of different use options on the acceptance of a steering tax. To this end, one of the following three variants was presented to one third of the test persons in each case:

- (1) A revenue-neutral tax on foodstuffs with very high sugar, fat or salt levels, whereby the additional revenue would be used to reduce the tax rate on health-promoting foodstuffs.
- (2) A tax on foodstuffs with very high sugar, fat or salt levels, with the additional revenue being used to improve preventive health protection (non revenue-neutral).
- (3) A tax on foodstuffs with very high sugar, fat or salt levels without compensation (non revenue-neutral).

The revenue-neutral variant (1) is relatively popular with 48% of respondents (31% against). Variant (3), on the other hand, which would generate additional state revenues, is clearly rejected by 45% of the respondents (34% approval). The variant of promoting preventive health protection (2) is in between with 43% of respondents agreeing to it.

The overall results show that there is potential for health-based steering taxes which are either revenue-neutral or use the money for broadly accepted social objectives such as preventive health protection or animal welfare.

### 7.5.2.6 Conclusions

The current price ratios in the food sector are problematic from a health perspective, as energy-dense foods are (too) cheap compared with more nutritious foods. They are problematic in environmental terms because they do not adequately reflect external costs in the form of environmental pollution. The state can change price ratios by means of taxes or subsidies. More recently, these instruments have increasingly been used not only on the supply side but also on the consumption side, but financial incentives to govern food consumption behaviour have to date been only rarely employed in Germany. The taxation of meat or animal products and of particularly energy-dense products is currently under discussion.

The WBAE assesses the instrument of consumption-side steering taxes as being an instrument of sustainability policy that has hardly been tested in Germany and is conceptually still poorly thought through, but could be potentially effective. However, ideas still differ significantly about the significance of steering taxes in the context of food policy:

- (1) Some of the actors are fundamentally opposed to steering taxes because of the depth of their intervention in individual food consumption habits.

- (2) Other actors, who are open to a deep intervention policy, argue that steering taxes should be used to fine-tune negative externalities. Such micro-control would mean graduated steering taxes or subsidies on a variety of products depending on their respective climate impact, health value, etc.
- (3) A middle position backs the cautious and selective use of individual directionally stable taxes for key problem areas in order to achieve progress in sustainability in these areas and to gather experience with the use of the instrument on the basis of extensive evaluation.

To sum up, the research on steering taxes is based on the following impact effects and design recommendations:

- To achieve major steering effects, relatively large tax increases would have to be implemented in wealthy countries like Germany.
- Tax increases have a stronger impact when initial prices are high in absolute terms than when products are cheap.
- Consumption taxes are regressive in their impact, i.e. they place a greater burden on low-income earners and thereby have a greater impact on them. This effect is even greater if products are taxed that are consumed disproportionately by lower-income households (such as soft drinks). A steep rise in excise taxes, especially on staple foods, thus also raises socio-political questions. Compensation by means of a personal tax refund, or a tax refund differentiated by household type, can contribute to social equity.
- Stronger steering effects occur among younger target groups (due to lower income and higher price sensitivity, and also less habit-shaped behaviour).
- Significant jumps in prices instead of several small steps have a stronger effect, but tax acceptance is decreasing (WHO 2016).
- The risk of consumers switching to unfavourable substitutes (e.g. alcohol instead of soft drinks) and to low-priced brands (with maybe a less favourable sustainability profile) must be taken into consideration (WHO 2016b, Thiele & Roosen 2018).
- Steering taxes can complement other instruments well such as a reformulation strategy, as examples from Great Britain show.
- Similarly, possible negative side effects of product reformulations must also be taken into account, for example when manufacturers switch to fat as the flavour carrier in the event of sugar being taxed (Thiele & Roosen 2018).
- Compared with taxation based on volume, price-related excise duties or a VAT increase, using targeted taxation of the reduction target (e.g. sugar content) improves the effect and reduces side effects that are undesirable in terms of distribution policy (Francis et al. 2016, Schmacker 2018).
- The name of a tax (e.g. climate levy) is important because a descriptive name can simultaneously change mindsets (Li et al. 2012).

- Using tax revenues for health and social policy goals enhances acceptance (e.g. use of the planned soft drinks tax in Great Britain for school meals and school sports).

All in all, steering taxes (or the emissions trading systems which have a comparable economic effect) are increasingly viewed positively by experts in the current climate policy debate. Demand-side steering taxes have the key benefit of not impairing the competitiveness of domestic production. Nevertheless, experience with this instrument in politics is limited. There is therefore a lot to be said for a cautious start and for designing such steering taxes as a policy instrument where lessons can be learnt, which is subject to intensive evaluation, and for which readjustments are likely (cf. Sections 8.6, 9.6 and 9.10).

### 7.5.3 Governance problems regarding labelling

Labelling is a particularly important topic in the debate on food policy in Germany. Among other things, the BMEL has set the issue of animal welfare labelling as a central goal to be achieved in the ongoing legislative term. The decision on the design of a simplified (interpretative) nutrition labelling system is also being hotly debated. Compared with the high level of political attention that labelling has received for many years, the implementation or efficacy of the instrument is highly disputed. The colloquial expression of a “label jungle” indicates that some developments are problematic. In the following, the WBAE therefore fundamentally focuses on the governance problems arising from food labelling.

#### 7.5.3.1 Types of label, objectives and general challenges

In modern food markets, consumers are confronted with an abundance of differentiated products. A normal supermarket lists approx. 20,000 to 30,000 items. In this context labels are an important information tool for consumers because they pool several items of detailed information and are thus used more often and at an earlier point than complex individual items of information. Consumers who know little or nothing about production are usually overwhelmed by detailed information.

In a broad definition the term label means “any tag, brand, mark, pictorial or other descriptive matter, written, printed, stencilled, marked, embossed or impressed on, or attached to, a container of food” (WHO & FAO 2007: 2). The term label, understood to mean the above, serves as a synonym for product labelling. More narrowly defined, the term label refers to evaluative (interpretative) forms of supra-company product labelling, which are usually issued by a neutral body (third-party certification).

Labelling takes various forms, as voluntary (e.g. organic labels) or mandatory labels (e.g. nutritional labelling), on a private-sector basis (e.g. Fairtrade) or a statutory basis (e.g. organic labels). Labels

can be found on products, on supermarket shelves, on menus, on the front of products or elsewhere. Shapes can vary widely. Labels can be descriptive (e.g. information on calorie content) or evaluative (e.g. colour scale ranging from red to green like a traffic light) and can be differentiated in various ways. They can be found as binary (e.g. organic), multi-level (e.g. animal welfare) or metric labels (e.g. carbon footprint in kg), as a verbal statement and/or in the form of marks or images, for specific qualities (e.g. low salt levels), for individual dimensions of sustainability (e.g. animal welfare) or potentially also as a holistic sustainability assessment (at present this is how some consumers perceive the organic production label). In addition to product labels, there are also labels for the sustainability of an entire enterprise (e.g. for the use of an environmental management system), albeit with these being far less common. Finally, alongside these labels in the narrower sense, there are a confusing number of condensed indications and advertising claims which can have a similar impact on consumers, as they often do not know which labels document reliably tested quality and which are purely advertisements.

This list of different types already illustrates the variety of labels on the market today. The exact number of labels on the German food market is unknown. The BMJV-sponsored internet portal “labelonline.de” lists 225 labels for the food and beverage sector alone, of which 152 are highlighted as particularly recommendable. In terms of sustainability, there are 73 labels for organic and ecological food, 39 for resource conservation, 26 for fair trade, 14 for animal welfare, 13 for social affairs, 6 for climate change mitigation and 4 for health. 4 labels are available for management standards related to entire companies.<sup>391</sup>

Policy debates on sustainability frequently focus on labels as a priority issue (Reisch et al. 2013). Examples include nutrition labelling, the organic label or the planned state animal welfare label. Labels are designed to enhance market transparency for consumers and are regarded as market-based instruments. They are particularly relevant when it comes to the labelling of so-called credence attributes (Akerlof 1970, Jahn et al. 2005). Credence attributes are defined as characteristics which can no longer be identified by examining the product itself (such as animal welfare or the levels of greenhouse gas emissions). In these cases, neutral certification of the production process is the key option for gathering the information. This externally verified sustainability information from certification procedures is then often used as the basis for a label. Consumers are currently bewildered in fields where no relevant label exists, such as climate change mitigation; they are unable to assess the scale and contributions to action of various measures, and often cite incorrect indicators that they use for their actions (Feucht & Zander 2017, Bilstein 2019, cf. Section 5.3.3.2: Tab. 5-8).

There is an almost unmanageable number of empirical studies on the various sustainability labels on the food market. Studies on the willingness to pay for different labels represent an important area of agro-economic research (overview Hemmerling et al. 2015). These studies, as a rule, point

---

<sup>391</sup> See <https://label-online.de> (last accessed on: 20.05.2019).

to a high willingness to pay for sustainability among consumers, whereby a gap is frequently observed between their professed willingness to pay and their subsequent buying behaviour at the supermarket shelves – a phenomenon known as the “consumer–citizen gap” (Vermeir & Verbeke 2006, see text box 13 “Consumer–Citizen Gap” in Section 6.2.3).

The label situation in Germany has, for some time now, been viewed critically in several respects. In a joint expertise on the “Policy Strategy for Food Labelling”, the WBA and the Scientific Advisory Board on Consumer and Food Policies took a detailed stance on the problem areas associated with the label situation in 2011 and recommended a fundamental U-turn in label policy (WBVE & WBA 2011). Since then, however, no major changes have taken place either at EU or national levels. The following problems still persist:

- **Lack of labels on key sustainability fields:** in spite of numerous labels, there is a lack of information on key sustainability aspects associated with food consumption. For instance, there is no relevant label pertaining to climate change mitigation on the German food market.<sup>392</sup>
- **Low level of awareness:** the diversity of labels is juxtaposed with a low level of awareness in respect of almost all labels. In a study among German consumers (Sander et al. 2016), in which the unaided degree of awareness (recall/spontaneous open naming of all known labels) was surveyed, the test subjects named an average of only 1.3 labels. 31.4% could not name a single label, another 4.6% named labels that did not exist. 26% of the respondents were able to name one label, 38% two or more. In terms of marketing, such low values for unaided awareness are an indicator that consumers do not know these labels and that the labels cannot have a broad impact on the market (Hieke & Wilczynski 2012). If an aided query is carried out with the presentation of logos (recognition), more labels are recognised, but frequently they can only be classified very imprecisely (von Meyer-Höfer & Spiller 2013). The best-established sustainability label is the German government organic logo, for which recognition rates of up to 90% are recorded on the basis of an aided query (based on images) (Zühlsdorf et al. 2018). The state organic logo is the only German sustainability label for which – in the early 2000s – a major conventional advertising campaign was conducted. At that time the BMEL invested about EUR 14 million in an introductory campaign. Most of the other labels were and are only advertised with a small budget. The reason for this inadequate advertising consists of problems arising from collective action: since labels are an instrument of joint marketing, individual companies have no incentive to invest because these advertising measures also benefit the competitors who use the label as well. Public information campaigns can help to remedy this situation: if policy-makers want consumers to adopt active, sustainability-based purchasing behaviour and suitable labels are developed, the government should also publicise these labels. This applies all the more to labels introduced by the government itself, such as the planned state animal welfare label.

---

<sup>392</sup> Sunstein (2017: 6 et seq.) elaborates a number of reasons why a competitive system does not allow voluntary publication of such information under certain conditions.

- **Lack of commitment and “niche trap”:** another factor contributing to the low level of awareness is the fact that sophisticated voluntary labels are usually hardly used on the market. They are then hardly known and not present on the shelves, their advertising value is correspondingly low and they remain in a market niche, which in turn can cause high transaction and production costs (“vicious circle of niche labelling”, cf. Section 7.5.3.2). For this reason, the debate on labels is increasingly calling for mandatory state labels (Roodenburg 2017) with graded assessment criteria (multi-level labels, see below), such as those that exist in the field of egg husbandry labelling. However, this may conflict with trade law requirements (EU, WTO) (see below and Section 8.9).
- **Doubts about credibility:** partly linked to the low level of awareness, the population harbours considerable doubts about the credibility. A label for its part is a credence good, since consumers cannot check the quality of certification (control) themselves (Jahn et al. 2005, Hu & Zheng 2019). In view of the sometimes substantial price differences between labelled goods and the market standard, consumers demand a high degree of credibility from labels (Roodenburg 2017). At the same time, large price differences increase the risk of fraudulent behaviour (Jahn et al. 2005). Labels that clearly identify a credible institution as the sender (e.g. the government or a well-known NGO) are at an advantage here. But it is even in these cases problematic if there are control gaps and counterfeiting scandals, as has occasionally been the case with organic food in recent years. Ultimately, such gaps and scandals ensue from the fact that the certification systems behind the labels are still not functioning properly. Certification systems in the food industry have a number of shortcomings, starting with the fact that enterprises can choose their own inspectors and may even be able to change the certifier during the current mandate, which can lead to less critical inspection behaviour, right up to giving advance notice of the inspection (Schulze et al. 2007, 2008, Padilla-Bravo et al. 2013, Bar & Zheng 2018). In addition, the initial and further training of certifiers is often incomplete. Risk-based review systems, in which the inspection efforts are differentiated according to the likelihood and possible extent of fraud, are prescribed in EU systems, but have so far only been implemented to a limited extent. The EU itself sees considerable need for action in the prevention of food fraud (see [https://ec.europa.eu/food/safety/food-fraud\\_en](https://ec.europa.eu/food/safety/food-fraud_en)). The EU sees possibilities for improvement, for instance, in the combination of process certification and (new forms of) laboratory control such as identification of origin by means of isotope analysis.
- **Unregulated use of product names/sustainability terms:** in the area of organic farming, a labelling system has been created which legally protects the terms “organic” and “biological” for food certified in line with the EU Organic Regulation and thus defines minimum standards. The Food Information Regulation specifies various mandatory indications for pre-packaged food. Health-relevant mandatory information encompasses, for example, nutrition labelling or the declaration of allergens in the list of ingredients (see below, Section 8.9.1). However, many other designations can be used in a largely unregulated manner. Only the general ban on misleading information under competition and food law (Section 5 of the Unfair Competition Act; Section 11 of the Food and Feed Code) sets limits in this respect. Sustainability terms such as “eco-friendly”, “appropriate to the species” or “wholesome” are therefore widely used in marketing, without consumers being able to be sure that these products actually have any

added value. Labels in the narrow sense of the term and unprotected advertising designations then merge in marketing practice. Many consumers cannot distinguish between state-protected and unregulated labels. They know neither the issuer of the label nor whether and, if so, which, review concept (certification) is behind which seal. This is one of the reasons why many consumers subjectively feel overwhelmed by the flood of labels and complain that the host of different information and the difficulty of distinguishing between credible information and advertising claims is more likely to cause confusion than to contribute to informed consumer decisions (Sander et al. 2016).

- **Complicated label design that is difficult to understand intuitively:** complicated label design and inadequate graphic design of the labels add to the confusion. Some EU labels look confusingly similar (e.g. the labels “protected geographical indication” and “protected designation of origin”). Other labels are not very concisely designed or are misleading because of their colour (example: EU Organic). In view of the fact that, on average, consumers view the front of a product on the shelves for around 0.2 seconds (Königstorfer & Gröppel-Klein 2012), many labels do not have a fixed design and are therefore hardly eye-catching. As an example, the mandatory EU organic farming label is graphically not very striking and has no explanatory text, which means that it has little impact on the market (von Meyer-Höfer & Spiller 2013), even though it is present on several tens of thousands of organic foods. Such implementation deficits in the design phase can hardly be offset on the market later. A label must be professionally designed like a brand. Complicated labels are neither recognised nor understood, thus increasing the “cognitive tax”<sup>393</sup> of consumers, which is associated with every label (Sunstein 2017). Other labels, for example in the area of health claims such as detailed nutrition labelling, place unnecessarily high cognitive demands on consumers (Talati et al. 2017). For instance, nutritional information related to different packaging sizes requires conversions by consumers. Labels can also be confusing or useless. For instance, the information “may contain traces of ...” is important as a warning for allergy sufferers, but many companies simply print it on almost all products to be on the safe side, thus rendering it more or less useless. It is therefore not surprising that labels are first and foremost aimed at those citizens who are more used to working with complex linguistic information. Less educated people pay far less attention to such labels (Sander et al. 2016). They would need more clearly designed labels. The fact that certain nutritional issues are more strongly represented among this group of people reinforces the urgency of developing clearer labels.
- **The fragmented nature of labels and problematic “halo” effects:** besides intended effects, labels can have socially undesirable implicit effects. For instance, “healthy” can be unconsciously perceived as “not tasting good” (Raghunathan et al. 2006). But “healthy” can also be associated with a low calorie content and lead to higher intake (health halo effect, Chandon & Wansink 2007, Suher et al. 2016, cf. Section 3). In a similar way, fitness cues on food packaging can increase consumption or willingness to consume (“Eat fit – Get big”, Koenigstorfer et al. 2013). Such distortions of perception can also be observed in the case of

---

<sup>393</sup> I.e. the costs (in form of time, attention etc.) that consumers spend in order to discern and understand a label.

eco-friendliness (environmental halo effect), for instance, when organic products are suspected of having a number of other sustainability and health properties which are not all covered by the EU Organic Farming Regulation (von Meyer-Höfer et al. 2015). In such cases, consumers deduce from a label that assures the product meets some sustainability criteria that it also has other properties such as a high overall health or sustainability value. In order to reduce such “halo effects”, summary labels that cover as many sustainability-relevant sub-aspects as possible make sense. Instead, there are now a large number of individual labels for specific, sometimes relatively fragmented sustainability properties of products. Most of these labels are voluntary and statutorily unregulated (“label jungle”). An effective environmental label, on the other hand, would be based on valid, summarising information, for instance. Yet, this would require an aggregation of various environmental indicators (e.g. impacts with regard to climate and biodiversity), which in turn would necessitate an agreement on weighting criteria (see Section 5.3.3.1 on this assessment problem). While the Life Cycle Assessment (LCA) is an approach to broadly measure eco-friendliness, the LCA also so far lacks a final summarising assessment level. In addition, not all environmental problems are addressed in an LCA (e.g. biodiversity and soil protection are often missing). Finally, processed products containing many ingredients pose a special challenge if they are assessed differently in terms of sustainability. In this regard, accounting rules would have to be created. In the other dimensions of sustainability, too, there is still a considerable need for research and development on the methods (Section 5).

- **Low effectiveness due to leakage and deadweight effects:** in the case of a subgroup of sustainability labels, the intended effect is reduced by leakage and deadweight effects. Leakage and deadweight effects can occur when there are sufficient buyers for unlabelled (non-certified) goods on the market and if some of the suppliers already work according to the standards indicated by a label. In this case, a label may prove futile. Two different examples illustrate the problem: a label that refers to the conservation of tropical timber from rainforest clearings has little impact if there is already enough plantation wood available for market outlets with sustainability preferences, and if at the same time the goods from virgin forest logging continue to go to third countries where there are no comparable sustainability preferences. A split market then develops: the already existing plantation timber is labelled and marketed at higher prices, the goods from virgin forest logging are sold to third countries at lower prices (leakage). There will be no curbing of rainforest logging, so the actual problem of rainforest deforestation will not change. One example of the deadweight effect is the pasture milk label (milk obtained from pasture-raised animals) introduced in Germany for milk from cows from defined pasturage. As long as around 40% of cows in Germany have access to pasture anyway and the market share of labelled products remains well below this figure, the share of pasture grazing in Germany may stagnate or even fall further despite a certain dissemination of the label. The sustainability impact is therefore rather low despite market

success.<sup>394</sup> In such cases (i.e. a supply that outstrips the demand for labelled goods and split markets), sustainability labels can possibly contribute to maintaining certain desired production methods and prompt important discussions, but they are not a suitable instrument for promoting a broad or nationwide shift of supply towards more sustainability.

To sum up, this problem analysis illustrates that labelling is a complex instrument of sustainability policy and has more pitfalls than is evident at first glance. Many labels, including those that make sense in terms of content, are virtually unknown. The financial implications (e.g. information budgets) are also sometimes underestimated by policy-makers (Sunstein 2017). In their current form, labels make only a small contribution to promoting sustainability in food consumption, according to the WBAE. If labels are successful (e.g. the MSC label for fish), it is often because large commercial customers promote the label rather than because of direct stimuli to demand (Barclay & Miller 2018).

### 7.5.3.2 Cost of labelling

The lack of sustainability labels in some fields could also be due to the costs incurred in providing information. However, the costs of labelling differ widely according to the different themes:

Health-oriented labels (evaluative nutrition labelling) cause almost no costs, since the necessary information (nutritional information)<sup>395</sup> is available anyway, as this is required by law (see below and Section 8.9.1). There is no certification here either, as it is possible to check the nutritional properties in the end product. In the case of organic and animal welfare-related labels, on the other hand, considerable control costs are incurred for certification of the entire value chain. In the case of climate labelling, it is necessary to record the greenhouse gas emissions of the enterprises throughout the entire chain, ranging from the input industry via the agricultural sector to the food industry, transport, trade and disposal. A valid and reliable recording and evaluation of this data involves considerable costs, the amount of which has not been well studied. If, however, foodstuffs were initially only labelled with the standard CO<sub>2</sub> values of a product, the costs would on the other hand be much lower.

Overall, there is little data on the cost of labelling. Therefore, only rough approximate values can be given here. However, a distinction must be made between at least five types of costs, which may generate additional expenditure depending on the type of label:

---

<sup>394</sup> This would mean, for example in the case of pasture-raised milk, that substantial parts of the cheese market would also have to be covered, as the majority of the milk produced is used to make cheese, while fresh milk only amounts to just over 10% of the milk volume.

<sup>395</sup> Nutritional information could be determined based on secondary data (e.g. the national nutrient database) or analytically. Standard data are likely to differ considerably from the actual data (analytically measured). In 2012, the EU published a guidance document that sets out admissible derogations for individual nutrients (in many cases 20%), cf. <https://www.lebensmittelverband.de/embed/europaeische-kommission-gd-gesundheit-leitfaden-toleranzen>.

**Certification costs:** certification costs are only incurred for labels that display credence properties, as credence attributes for organic farming or animal welfare can no longer be identified in the end product. In this case, there must be process-integrated control.

The costs of certifying an agricultural holding can be derived, for example, on the basis of the organic farming control costs, which are given as around EUR 300 to 600 per year, or up to EUR 1,500 for larger farms.<sup>396</sup> The costs of an extensive DLG (German Agricultural Society) sustainability certification are higher at EUR 1,000 to 5,000. For a particularly detailed inspection of animal welfare in line with the so-called Welfare Quality Protocol, up to 8 working hours on the ground are estimated, resulting in four-digit certification costs.

Comparable costs totalling at least EUR 500 to 1,000 are also incurred by other small and medium-sized enterprises in the value-added chain, such as in the restaurant and catering sector or craft trades. While for larger companies, e.g. in food production, the costs per company are much higher, they are lower in percentage terms in relation to turnover.

**Data collection and evaluation:** in life cycle assessments or the carbon footprint, the cost of data collection plays a key role. Tesco has stated that it incurred costs of approx. EUR 50 to 60,000 per product in the context of the (later discontinued) climate labelling. However, these costs are mainly incurred during the initial data gathering. It is also to be expected that these costs will fall significantly as the data situation improves with respect to typical processes in the food industry. If only sector-specific standard values are used, i.e. typical values for certain foodstuffs, the costs are low, as a relatively large number of databases have now been set up. The costs of data collection and evaluation are very low, as mentioned earlier with respect to nutrition labels, because standard values are available here.

**Management costs:** the management costs of labelling systems relate to monitoring, maintenance of databases, labelling, administration and consumer information/communication. Taking the Animal Welfare Initiative, which has developed a relatively broad control concept, as an example, there are summary data available: the management and communication costs in 2018 amounted to 5.5% of the total budget, namely EUR 7.15 million for the certification of 5,707 livestock farms (which corresponds to EUR 1,253 per farm, Animal Welfare Initiative 2019).

**Production costs:** here, too, it is impossible to give uniform costs for the different labels. Higher production costs are only incurred if a label is associated with standards that exceed the statutory level. Organic farming is a classic case in point. The total additional costs of a label range from zero for a nutrition label to double the agricultural production costs (and more) for organic products.

---

<sup>396</sup> In the absence of reliable data, a price range based on an Internet query is given here, cf. <https://www.pcu-deutschland.de/node/129>, <https://www.it-recht-kanzlei.de/kontrollpflicht-zertifizierung-bio-produkte-kurzanleitung.html>, [https://www.gfrs.de/fileadmin/files/GfRS\\_Leistungskatalog\\_Bio-Zertifizierung.pdf](https://www.gfrs.de/fileadmin/files/GfRS_Leistungskatalog_Bio-Zertifizierung.pdf) and <https://www.organiccouncil.ca/whats-the-cost-of-certification/>.

For animal welfare, the additional costs in agricultural production range from a few per cent for the entry level up to 30–40% for the premium level (cf. Section 8.9.4).

**Niche costs (costs of product segregation and separate marketing):** at the processing and trade levels, product segregation can sometimes cause considerable additional costs: some labels, such as health-related labels on food products, do not result in product segregation, but others, such as the organic label or animal welfare labels, usually go hand in hand with a diversification of the product range, as new variants are added to the range. Along the entire value chain, this generates costs for the segregation of flows of materials and goods, and in the retail sector it also leads to additional shelf space requirements due to the deeper product range. These segregation costs are in some cases significantly higher than the above-mentioned certification costs, notably in small market segments. Niche costs can significantly exceed the additional costs incurred by more sustainable production if the products have low market shares (see below).

Ultimately, it is not possible to indicate a uniform cost of labelling. On the contrary, the costs vary greatly depending on the type of label: nutrition labelling causes negligible labelling costs. In the case of climate labelling, the collection costs are relatively low when working with industry averages, but they can be considerable if specific data are collected along the entire value chain, including the agricultural sector. An animal welfare label causes similar certification costs in the value chain to those of the current organic label. A rough estimation of the certification and administrative costs would then be that they equate to perhaps 0.5% of the value of the goods.<sup>397</sup>

What can make label products “really” expensive are the additional production costs in conjunction with the costs of separate processing, logistics and shelf placement in the retail sector. These are particularly high if a label product does not replace the standard product, but is instead introduced in addition for a small market segment. Typical cases here include organic, fair trade and animal welfare products. In many cases these products do not replace existing offers but are introduced as additional variants. Particularly high costs are incurred if these label products only target small market segments (market niches) and thus have low market shares. In this case small quantities need to be kept separate in logistics and production, higher transport costs are incurred and economies of scale in production are forfeited. In addition, the high (opportunity) costs of limited shelf space in the retail sector must be taken into consideration.

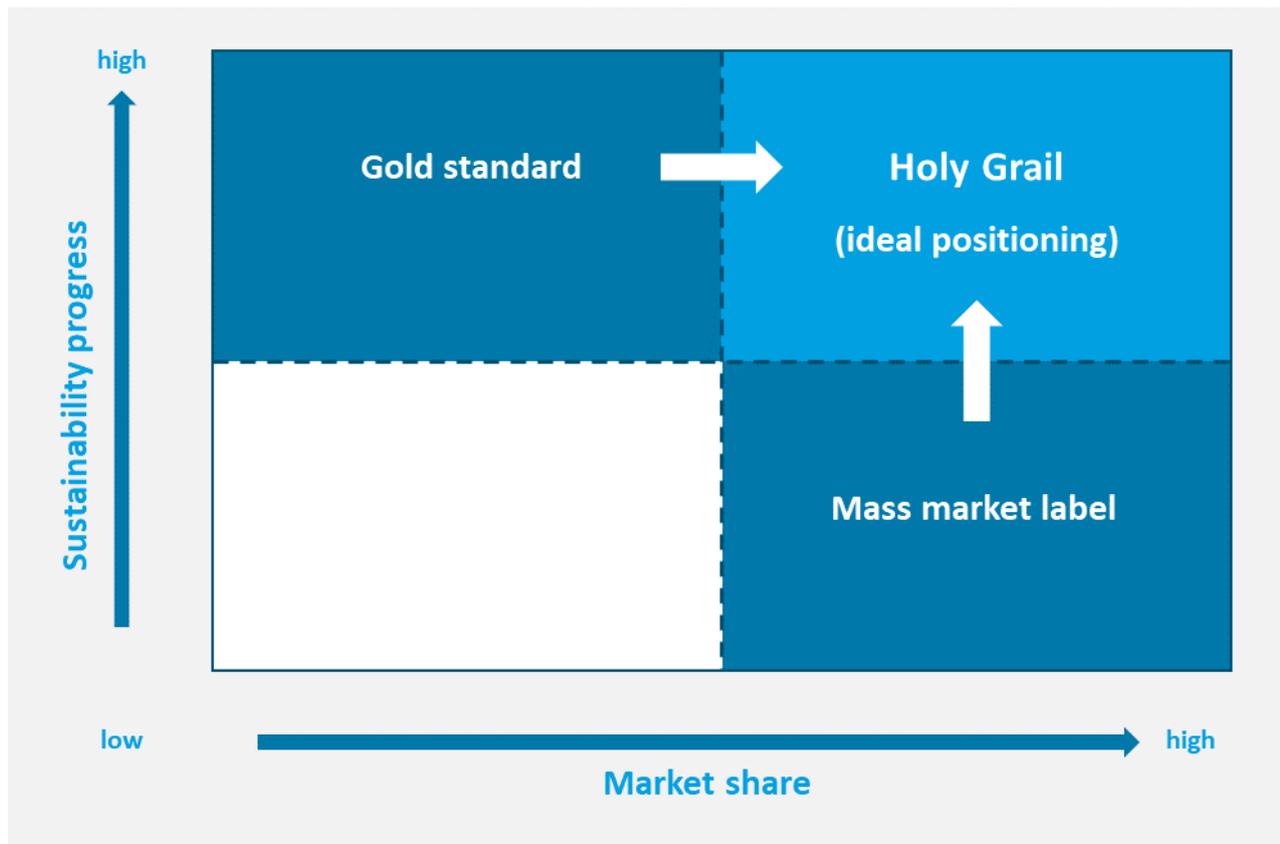
---

<sup>397</sup> For the Animal Welfare Initiative, the certification costs (without segregation of goods) can be roughly calculated (WBAE calculations based on Animal Welfare Initiative 2019): a production value of 7.120 billion for pig farming x 22% participation = a production value of 1.564 billion for certified pig farming. A production value of 2.213 billion for poultry farming x 69% participation = a production value of 1.527 billion for certified poultry farming. Together, the production value of the certified goods amounts to 3.091 billion. The administrative costs of the Animal Welfare Initiative amount to EUR 7.15 million; we estimate the certification costs at EUR 2.854 million (5,707 farms x EUR 500 annual certification costs). The total certification costs thus amount to around EUR 10 million per year. This 10 million in relation to a production value of 3.091 billion means certification costs of around 0.32% of the goods' value. The costs of organic certification, and of those for the state monitoring of the organic farming market, are probably somewhat higher.

High costs are therefore not caused by the label itself, but by the market differentiation that is partly related to it. The question therefore arises as to when such additional market differentiation occurs in respect of labelling and when a label is used for products that already exist. First of all, it is important to know whether it is a label that “only” makes existing properties of products visible, such as the energy content or the climate impact, or whether it is a label that distinguishes another form of production (e.g. organic farming).

With respect to the second type of label, the additional costs of label production (not those of certification, but the additional effort needed for label standards in production) and the availability of labelled goods are then decisive in ascertaining whether labelled products are introduced as an additional variant or whether the label is used for existing products (i.e. does not trigger additional market differentiation). Labels meeting sustainability requirements that clearly go beyond the market standard therefore run the risk of being initially “trapped” in a market niche. To take a well-known example: the additional revenues that organic farmers achieve for poultry amount to around EUR 2/kg carcass weight. The additional prices paid by consumers at the shop counter are between EUR 15 and 25 per kilogram of chicken breast fillet due to the different niche costs in processing and marketing. Ambitious labels (often referred to as the gold standard) thus ensure considerable progress made in terms of sustainability per product unit, but they may only apply to a small part of the market on account of the niche costs (Fig. 7-5).

**Figure 7-5:** Positioning of labels in terms of sustainability progress and market penetration



Source: WBAE presentation based on WBVE & WBA (2011: 18).

In order to avoid this niche trap, other labels (“mass market labels”) try to keep cost differences low and gain market shares quickly by raising sustainability standards only slightly.<sup>398</sup> A successful example for Germany is the MSC label for sustainable fishing, which has a sales share of some 60% on the German fish market.<sup>399</sup> One problem regarding mass-market-oriented labels, however, is credibility. Due to the small gap between the label standard and the statutory standard, there is regular criticism from social groups who fear “greenwashing”. Mass market labels are particularly prone to PR crises, which in turn impairs the credibility of sustainability labels as a whole.

In order to avoid the additional costs of niche labels and at the same time increase the effectiveness of labels in achieving the intended sustainability goal, multi-level labels are

<sup>398</sup> For such mass market labels, it is generally planned to raise the standard over time, once they have been successfully launched on the market.

<sup>399</sup> Fishing in line with the MSC criteria is only marginally more expensive than the standard procedure. Many trading companies today (almost) only list MSC goods, so that the trading costs are also markedly lower, because instead of expensive additional placements (which take up valuable shelf space) the standard goods are listed; the label becomes the de facto standard.

increasingly being launched throughout Europe. Labels with graded assessment criteria serve different segments of the market in parallel (e.g. the planned state three-level animal welfare label and the four-level husbandry label in Germany, cf. Section 8.9.4). They thus target different market segments, in which the willingness to pay varies. In addition, multi-level labels clearly demonstrate that there is a wide range of products on the market with different sustainability properties. They thus also contribute to a less polarised sustainability discourse (i.e. less “black and white thinking”).

**Interim conclusion:** When should the state intervene in the labelling system by introducing a sovereign label? Generally, the literature argues for state intervention when the properties in question are credence properties, when the underlying sustainability problem enjoys high political priority, when health hazards exist and when high organisational and market differentiation costs prevent a private-sector solution (WBVE & WBA 2011). These criteria frequently apply to the sustainability problems discussed in this expertise. Issues such as health, climate change mitigation, biodiversity, animal welfare, etc. are all linked to credence attributes (i.e. these attributes cannot be gleaned from looking at the product) and are a political priority. Despite many years of discussion, however, economic actors have so far succeeded in establishing very few convincing labels on the market.

In order to enable consumers to make a greater contribution to a more sustainable food consumption through labels, food policy should, according to the WBAE, make more ambitious use of this instrument. To this end, it is necessary to make these policies more binding and to increase the accompanying budget. The current situation is frustrating: there is a confusing myriad of labels, some of which contradict one another. Consumers are moreover unable to determine the scope of these labels, which therefore causes halo effects. The efficiency of a market economy depends on whether reliable information is available to consumers or not. Given that such information on complex sustainability properties is obviously rarely generated in the market process, the state should become more actively involved.

The WBAE is well aware of the fact that the collection of sustainability data along the value chain causes transaction costs and makes products more expensive. On the one hand, prices rise due to the necessary data collection and certification and to the separation costs that arise. On the other hand, however, consumers are otherwise not able to (reliably) assess the impact their purchasing decisions have on sustainability. In this case, a policy for promoting more sustainable food consumption would have to be based solely on a far higher level of intervention such as taxes and bans and on introducing measures on the supply side. This is possible to some extent and also necessary, as explained in Section 6 of this expertise. Labels are by no means always the best tool. However, the WBAE believes it is desirable to also involve consumers as actors in attempts to reach the desired level of sustainability in food consumption. The preconditions for this must be created. In the long run, it can also be assumed that labels help to inform consumers about the consequences of their consumption activities, which could ultimately lead to more informed policy decisions. And finally, even the more interventionist instruments frequently require a differentiated basis for decision-making, and a major part of the data must be gathered in any case.

New types of labels, including colour-coded and more interpretive multi-tier labels, represent innovative approaches to achieve a greater impact on the market.

### 7.5.3.3 EU and WTO regulatory framework for labelling

A uniform legal assessment of food labels is not possible. This is due to the large number of design options that, given the different targets, the different actors and the varying degrees of commitment, are conceivable and in many cases have already been implemented in practice. Therefore, a legal assessment can only be made on a case-by-case basis. First of all, a differentiation must be made according to the degree to which the label is to be binding (optional versus state-mandatory labels).

- Voluntary labels pose the least legal difficulties. Market operators voluntarily submit to a labelling system defined by themselves or adopted by private third parties or the state.
- In the case of mandatory state labels, on the other hand, the Member States or the EU introduce labelling systems that are legally binding. The hierarchy between European law and national law must be taken into account here. In principle, the EU has competing regulatory power for the introduction and design of labelling systems. Only to the extent that the EU does not exercise this power does this power pass to the Member States.

The following outlines the legal conditions for the various label types according to the actors involved and the degree to which the label is binding. Finally, the WTO regulations that need to be taken into consideration are set out.

#### **Voluntary labels agreed by the private sector**

Agreeing on one's own labels or adopting existing private labels is unproblematic from the perspective of both national law and European and WTO law. However, this presupposes that the adoption is also voluntary and that the adoption is not linked to further advantages or disadvantages in the event of non-adoption (e.g. tax benefits or tax disadvantages). If such links exist, one can no longer speak of a voluntary label but of an (indirectly) mandatory label.

National and European antitrust law constitutes a further barrier. If labels are created to split up customers or set prices, the private sector agreement on labels can be regarded as an anti-competitive arrangement.

In addition, from a WTO perspective, the fundamental idea of non-discrimination applies to such private-sector labels. If the state supports private labels that have a market-relevant discriminatory effect on third-country products, the discrimination needs separate justification (see below). Such market-relevant, private labels that are protected by the state are then subject to the restrictions mentioned in the next section. However, the market-relevant dimension (from what point is it market-relevant?) has not yet been precisely defined.

For voluntary labelling, the WTO TBT Agreement contains a code of conduct for the development, adoption and application of standards. Agencies and organisations which develop labelling requirements are called upon to accept this code.<sup>400</sup>

### **Voluntary labels defined by the state**

If the state defines labels for voluntary adoption by industry (as in the case of organic produce, for example), the state is required to define the access criteria for the labelling system in such a way that they are also open to market participants from other EU countries (under EU law) or third countries (WTO law) without discrimination. To this end, the labelling system must be transparent and the underlying criteria must also be compatible for foreign products. As part of the permissible discrimination against nationals (reverse discrimination), the state can define criteria for domestic products more strictly than for foreign products. If the criteria have a discriminatory impact vis-à-vis foreign products (e.g. through above-average environmental standards) and if these criteria have a market-relevant dimension (see above), the discrimination requires separate justification (see below).

### **State-mandated labels defined by the EU**

The EU is entitled to introduce and develop labelling schemes. However, in doing so, it must respect WTO obligations, both through its own membership and indirectly through the membership of its Member States in the WTO. For example, a state husbandry label certifying compliance with animal welfare requirements which is compulsory for all farms would not be permitted under WTO law, as it is a non-tariff import barrier. No egg label has therefore been developed for eggs from third countries; instead, a producer code (stamp) has been developed which allows the husbandry system to be identified via one of several numbers. In addition, EU imports can dispense with the labelling of the type of husbandry by using the wording “not specified”. Given that fresh eggs are only imported into the EU in small volumes and therefore have a low market-relevant dimension, the EU was able to enforce this system. However, if a comparable labelling system is to be introduced for products which account for a far higher proportion of imports, international resistance through the WTO is likely to be much greater. A mandatory label restricted exclusively to intra-European products is, however, as the example of eggs demonstrates, unobjectionable under WTO law.

### **State-mandated labels defined by the Member States**

Food labelling with cross-border impact is consistent with EU law if the labelling itself and the implementing regulations currently being developed comply with the following conditions. The labelling is excluded if EU marketing standards are already in place as final provisions for product labelling which rule out further state labelling. It must also be examined whether the labelling has not been standardised/harmonised by the European legislator. Only to the extent that there is no

---

<sup>400</sup> [https://www.wto.org/english/docs\\_e/legal\\_e/17-tbt.pdf](https://www.wto.org/english/docs_e/legal_e/17-tbt.pdf).

final regulation at Union level does the national legislator have the concurrent regulatory competence under the second sentence of Art. 2 (2) TFEU.

In this case, the Food Information Regulation (LMIV) in force since 2014 is relevant. It is based on the concept of full harmonisation, so that additions made by states are only possible if an opening clause explicitly enables them to do so (Article 38 (1) FIC Regulation). Such an opening clause can be found in Art. 39 of the FIC Regulation. According to this Article, Member States may “adopt measures requiring additional mandatory particulars for specific types or categories of foods” if one of the four justifications mentioned above (health protection, consumer protection, fraud prevention, protection of industrial and commercial property rights) is present. As an additional condition, the FIC Regulation requires that the majority of consumers attach considerable importance to this information (cf. Art. 39 (2) FIC Regulation). However, the national regime under Art. 39 FIC Regulation cannot bind foreign producers, who continue to need only comply with the general EU requirements of the FIC Regulation. This leads to discrimination against domestic producers and privileges for third country products. However, this is unproblematic as a consequence of the general standard of so-called reverse discrimination under EU law.

From a legal standpoint, the following applies regarding the mandatory national **animal welfare label** proposed in the expertise: there is currently no European animal welfare label. It is therefore possible to go it alone at national level as long as one of the justifications is met. However, the aspect of “animal welfare” is not a justification referred to in Art. 39 FIC Regulation. “Consumer protection” might be considered as a justification. But is the labelling of the type of animal husbandry really an aspect of consumer protection? A mandatory animal welfare label represents additional information for consumers, which only serves consumer protection in a very broad sense. In the narrower sense it serves neither the health nor the economic protection of consumers. It cannot be ruled out that as far as this specific label is concerned the Commission or the ECJ may interpret the term of consumer protection in a broad sense and also include basic ethical values as aspects to be considered under the FIC Regulation. In the light of the Commission’s and the ECJ’s understanding of consumer protection to date and the required narrow interpretation of justifications, it can currently be assumed that such a label can only be understood as being in conformity with European law if particular effort is made to justify it.

From a legal standpoint, the following applies regarding the mandatory national **nutrition labelling system** proposed in the expertise: there are already European requirements governing nutrition labelling in Art. 29 et seqq. FIC Regulation. They concern the following nutritional values: energy value, fat, saturated fatty acids, carbohydrates with specific reference to sugar and salt. Their scope of application is limited to packaged foods. No derogation from these indications may be made in the Member States, not even with a traffic light scheme. Where Member States wish to introduce mandatory labelling, this is only allowed if it contains additional information. Going it alone at national level is, in turn, possible only if one of the justifications is met. Insofar as the additional (!) nutrition labelling serves consumer health protection, it must be classified under the justification on consumer protection pursuant to Art. 9 FIC Regulation. Moreover, the national legislator must

provide reasons that this labelling is proportionate. This necessitates the following three aspects to be examined: suitability; necessity; and appropriateness of the measures. Here, it would have to be specifically established that labelling was necessary, i.e. that there was no conceivable milder measure that would be just as effective but would constitute a lesser interference. It would, for instance, be necessary to discuss why a general information policy by the government would not suffice to this end. To the extent that this could be justified, additional mandatory nutrition labelling would be consistent with EU law (limited to national products).

For non-prepacked foods, a Member State may make a derogation under Article 44 of the FIC Regulation from the particulars prescribed under Article 9(1) of the FIC Regulation (name of the food, list of ingredients, quantity of ingredients, net quantity, etc.) if consumers are nevertheless adequately informed. Ingredients which may cause allergies and intolerances are excluded from this provision.

From a legal standpoint, the following applies regarding the mandatory national **climate label** proposed in the expertise: there is currently no European climate label. It is therefore possible to go it alone at national level if a justification is also met. However, climate change mitigation, like animal welfare, is not a justification under Article 39 FIC Regulation. Therefore, the same applies as that said regarding the animal welfare label. The health dimension of the concept of consumer protection could theoretically be extended to cover the indirect causal health implications of climate change. In addition, it would be methodologically possible to extend consumer protection to also include consumers' environmentally-related information rights via recital 3 of the FIC Regulation. However, neither of these approaches has yet been implemented in legal practice. It will therefore require a considerable justification effort to convince the Commission or the ECJ that such an interpretation is possible. The question as to the proportionality of the measure will also arise. Is a state climate label suitable for achieving the objective in the first place? Is it the measure that, given a comparable effect, involves the least degree of intervention? If this justification were successful, the measure could be considered to be in conformity with European law.

In order to examine whether the conditions under which a state label is allowed by a Member State are fulfilled, Art. 45 FIC Regulation provides for a notification and approval procedure, which means that the introduction of a state label would have to be notified to the European Commission. This also holds true if the label relates exclusively to national products.

Further preconditions result from the fact that the labels are "relevant to trade in goods". Labelling represents an infringement of the free movement of goods if it cannot be justified by a goal in the general interest which takes precedence over the requirements of the free movement of goods. In particular, the goods must therefore be handled in a non-discriminatory manner vis-à-vis goods from other EU countries. The labelling scheme must also be open to products from other EU countries. Otherwise, Germany would, in a discriminatory manner and thus in violation of Union law, be denying products from other Member States access to the quality criterion that the label proves.

### WTO justifications for discriminatory measures

Three of the WTO agreements are relevant for assessing the admissibility of the European labelling requirement under world trade law, namely the Agreement on the Application of Sanitary and Phytosanitary Measures (ASPS), the Agreement on Technical Barriers to Trade (TBT Agreement) and the General Agreement on Tariffs and Trade (GATT). The ASPS, the TBT Agreement and the GATT are integral parts of the world trade order and are binding on all members by virtue of their membership of the multilateral part of the WTO Agreement. WTO law is based on the principle of non-discrimination. It requires that foreign products are not treated less favourably than similar domestic products. WTO members generally agree that labelling schemes to inform consumers can be cost-efficient and useful and are essentially less restrictive to trade than other methods. However, as these rules can also be abused to protect domestic producers, the regimes should only be allowed to discriminate in cases where a particular asset, which is generally recognised among states as a protected asset, is violated. These cases must either be explicitly regulated by WTO law (Article XX(a)-(j) GATT) or be recognised by the further contractual practice of the Member States (e.g. the SPS or TBT Agreements). In addition, measures must be proportionate and thus not create any unnecessary impediments or disguised restrictions on international trade (introductory clause, so-called “chapeau”).

The protected assets under GATT which are relevant for labelling systems include:

- measures necessary to protect public morals;
- measures necessary to protect human, animal or plant life or health;
- measures relating to the conservation of natural resources which threaten to be exhausted if such measures are made effective in conjunction with restrictions on domestic production or consumption;

With regard to the TBT Agreement, the provision of the third sentence of Article 2 (2) TBT Agreement specifies the legal rights worthy of protection. The rights mentioned are “national security requirements, the prevention of deceptive practices, protection of human health or safety, animal or plant life or health, or the environment”. Annex I to the TBT Agreement adds consumer protection as a legal interest.

If the label is linked to product-related measures, proof must be furnished that there is a direct link between the characteristics of the product and the risks to the legal interest. Specifically, measures covered by the SPS Agreement must be based on an objective risk assessment and scientific evidence. The use of criteria related to processes and production methods poses a problem in the debate on food labelling, both within the WTO and the EU. WTO members agree that under WTO rules countries have the right to stipulate criteria on how products are produced if the production method leaves traces in the final product.

However, if the discriminatory measures are based on non-product-related processes and production methods that leave no trace in the final product, the assessment remains disputed.

Under the TBT Agreement, production methods can also be used to establish the similarity of products. However, only those production methods are covered which have a noticeable effect on the final products.

In general, it can be noted that, despite isolated positions to the contrary by signatory states, WTO law does not accept production methods or conditions of production as justification for obstructing the import of goods, not even by means of a gradation of import tariffs. If a state wants to depart from this ban, high standards of justification apply, so that only major impairments of recognised legal interests are recognised. Moreover, the high standards also apply to the justification. It must be demonstrated that the protection objective can only be achieved by introducing a mandatory labelling system setting correspondingly high standards.

The particular challenge for Member States willing to opt for labelling is that there are only a few isolated internationally recognised standards for sustainably produced foodstuffs. They can be created, as in the case of the Tuna Dolphin Case<sup>401</sup>, by means of further international commitments by the contracting states. The case of Canadian seal products (Sonntag et al. 2017, Sonntag & Spiller 2018) seems to have remained an isolated case to date. In the absence of such standards on a regular basis, it can be assumed that the introduction of a state labelling system for commercial goods of considerable weight in global trade would cause trade disputes, given that such a labelling requirement is to-date considered by most State Parties to the WTO to be in breach of WTO law. This is also to be expected for systems in which – comparable to the classification of hen's eggs – third countries are given the opportunity to participate in trade by the label "standard unknown".

However, it should be noted that world trade law is constantly evolving. Organisations such as the WHO and the FAO are increasingly recognising worldwide the need to combat obesity and non-communicable diet-related diseases. It is well known that unhealthy diets are one of the main causes of the global disease burden and involve significant economic and social costs. Many countries have identified nutrition labelling as a policy option in order to prevent obesity and diet-related non-communicable diseases. At the Second International Conference on Nutrition (ICN2), the governments represented therefore agreed to "create an environment in which informed decisions on food products can be made". Food labelling was included in the recommendations made by the ICN2 Framework of Action (FAO 2015b).

More specifically, the Codex Committee on Food Labelling (CCFL) recommends that nutrition labelling should be mandatory for most pre-packaged foods. Other standards have also been defined. However, this is currently resulting in an inconsistency between the new and increasingly comprehensive Codex standards and the provisions of the TBT Agreement that have not been further developed. Moreover, the dissemination of different systems can prove confusing for consumers and cause problems in trade.

---

<sup>401</sup> [https://www.wto.org/english/tratop\\_e/dispu\\_e/cases\\_e/ds381\\_e.htm](https://www.wto.org/english/tratop_e/dispu_e/cases_e/ds381_e.htm).

### 7.5.3.4 Conclusion

When should the state intervene in the labelling system by introducing a sovereign label? In principle, the literature argues for state intervention when it is a matter of credence attributes, when the underlying sustainability problem enjoys high political priority, when health hazards exist and when high organisational and market differentiation costs prevent a private-sector solution (WBVE & WBA 2011). These criteria frequently apply to the sustainability problems discussed in this expertise. Issues such as health, climate change mitigation, biodiversity, animal welfare etc. are all credence characteristics (i.e. they are not visible to the product) and are a political priority. Despite many years of discussion, however, economic actors have so far scarcely succeeded in establishing any convincing labels on the market.

In order to enable consumers to make a greater contribution to promoting sustainability in food consumption through labels, food policy should, according to the WBAE, make more ambitious use of this instrument. To this end, it is necessary to make these policies more binding and to increase the accompanying budget. The current situation is frustrating: there is a confusing myriad of labels, some of which contradict one another. Consumers are moreover unable to determine the scope of these labels, which therefore causes halo effects. The efficiency of a market economy depends on whether reliable information is available or not. Given that such information on complex sustainability properties is obviously rarely generated in the market process, the state should become more actively involved.

The WBAE is well aware of the fact that the collection of sustainability data along the value chain causes transaction costs and makes products more expensive. On the one hand, prices rise due to the necessary data collection and certification and to the separation costs that arise. On the other hand, however, consumers are otherwise not able to (reliably) assess the impact their purchasing decisions have on sustainability. In this case, a policy for promoting more sustainable food consumption would have to be based solely on a far higher level of intervention such as taxes and bans and on introducing measures on the supply side. This is possible to some extent and also necessary, as explained in Section 6 of this expertise. Labels are by no means always the best tool. However, the WBAE believes it is desirable to also involve consumers as actors in attempts to reach the desired level of sustainability in food consumption. The preconditions for this must be created. In the long run, it can also be assumed that labels help to inform consumers about the consequences of their consumption activities, which could ultimately lead to more informed policy decisions. And finally, even the more interventionist instruments frequently require a differentiated basis for decision-making, and a major part of the data must be gathered in any case. New types of labels, including colour-coded and more interpretive multi-tier labels, represent innovative approaches to achieve a greater impact on the market.

## 7.6 Rebound effects as a fundamental governance challenge facing eco-friendly nutrition

Section 7.5 addresses challenges specific to certain settings, such as nurseries and schools, and various instruments, such as labels and taxes, which are key for the rest of this expertise. This section aims to cover rebound effects, an overarching dilemma facing sustainable development. Rebound effects pose a fundamental problem, in particular for environmental policy, and more specifically for climate change policy (Berkhout et al. 2000, Chitnis et al. 2014, for agriculture: Paul et al. 2019). Rebound effects occur whenever progress in terms of environmental policy, achieved for instance thanks to efficiency gains due to changes in behaviour or a shift in prices, is partially offset elsewhere. In such cases, the positive environmental impact is not as high as it might seem at first glance. There are three types of rebound effects:

- **Direct rebound effects:** an ecologically sound efficiency increase, such as lower fuel use in a car, may for example cut costs. As a result, people might use their car more often (due to the price and income effect). A highly energy-efficient refrigerator may encourage a household to purchase a second refrigerator. Direct rebound effects relate to those that occur in the same area of action that the sustainability policy addressed.
- **Indirect rebound effects:** indirect rebound effects occur whenever consumers spend money saved elsewhere, triggering a negative impact. They may, for instance, use money they saved by avoiding food waste to afford a plane ticket. If the action taken thanks to the money saved is particularly harmful to the environment, the overall effect may even be negative. This is referred to as a backfire effect. Hagedorn & Wilts (2019) model indirect rebound effects for the reduction of food wastage, calculating a rebound effect of just over 50%.<sup>402</sup> For a meat-free diet, Grabs (2015) calculates almost the same effect (only 49% fewer GHG emissions, cf. also Lusk & Norwood 2016). Indirect rebound effects highlight the necessity to employ a broad policy approach which covers all fields of consumption with relevance for the environment (and all those where strongly negative external effects occur) equally.
- **Indirect, market-related rebound effects (macroeconomic rebound effects):** environment-induced reductions in demand may lead to price effects on global markets resulting in increased consumption elsewhere and thus by other individuals. Cordts et al. (2014), for example, model the macroeconomic rebound effect of a reduction in meat consumption (by 22% in total) in industrialised countries. According to their calculations, such cuts in meat consumption would result in global price drops of approximately 10% for meat and up to 3.1% for certain grains. This, in turn, would cause an increased demand for meat in other, poorer regions of the world. The overall positive impact this has on the environment and climate is therefore lower than one would expect at first sight. However, an increased meat consumption in poorer regions of the world may result in the food supply situation of people in such regions improving, which is typical for macroeconomic rebound effects. They occur whenever a declining demand triggers price effects allowing someone to buy certain goods or a certain

---

<sup>402</sup> This is merely a model, which does not empirically account for actual behavioural patterns.

quantity of goods that they have hitherto been unable to afford. As the above-mentioned case outlines, this may very well be desirable for the sake of fair distribution.

It is very difficult to estimate short-term and long-term rebound effects since they are also driven by behavioural phenomena. This is the case, for instance, when more sustainable products lead to a “clear conscience” and boost consumption.<sup>403</sup> There is, however, a clear indication that rebound effects represent a fundamental and serious problem for sustainability policy as a whole. There is every reason to believe that rebound effects are the main reason why there has so far been only limited success in decoupling economic growth and energy consumption. Rebound effects occur if: (i) environmental policies result in increased efficiency for consumers; (ii) these efficiency gains are spent elsewhere; and (iii) this spending causes negative environmental effects.

Efficiency gains may result from both supply-side and demand-side policies/policy instruments (cf. (i)). That is why rebound effects do not serve as arguments to specifically oppose demand-driven policies.

One way of avoiding rebound effects is to spend efficiency gains in a way that has no negative environmental effects or that may even have positive environmental effects (cf. (iii)). For instance, a household might save money by cutting food losses and then invest the money saved in expensive, particularly sustainable products, e.g. regarding animal welfare, fair-trade or organic products (Grabs 2015). In this case, no rebound effect would occur. In fact, the positive effect in terms of sustainability would even be magnified.

Rebound effects may also be avoided by not spending efficiency gains elsewhere at all (cf. (ii)). Authors critical of growth point out that the fundamental principle that consumers spend money saved for consuming other goods elsewhere is intrinsically linked to the idea that consumers will always benefit from consuming more. There is another response to saving money thanks to efficiency gains which poses less of a problem for sustainable development: people may opt to reduce their working hours, hence their income. They may invest the additional time now available in personal matters, such as spending time with their children or caring for a family member, preparing meals, household chores, and the like, or non-consumptive activities, such as maintaining relationships or making donations (Schneidewind & Zahrnt 2013). There is strong evidence suggesting that shared, structured meals (cf. Section 3) and low degrees of convenience products, i.e. freshly prepared fruit and vegetables etc., are part of a health-promoting diet. However, this in turn tends to be quite time-consuming (cf. Section 4.2). What is more, all changes that lead to “less and better” consumption generally have a positive overall effect, since they are linked to buying more sustainable, yet also more expensive products.

---

<sup>403</sup> For more information on this psychological effect as well as other drivers of increased demand see Fischer and Griefhammer (2013: 12).

In other words: the debate about rebound effects makes it clear that it is **necessary to complement efficiency-driven approaches with sufficiency-driven policies**, i.e. an approach that allows for and facilitates a more sustainable lifestyle (Fischer & Grießhammer 2013). This expertise can merely touch upon such fundamental issues regarding lifestyles and diets. The WBAE has identified three main areas of action where **well-to-do households** in particular bear a **certain responsibility**, as they have the corresponding economic capacity while at the same time emitting on average significantly higher amounts of greenhouse gases at present:

- (1) Better-off households are all those that **buy** first and foremost **more expensive sustainable products** and can therefore stimulate such markets.
- (2) In the spirit of ethical consumption, these households should especially use for this purpose the **money they have saved from changing to a more sustainable dietary pattern, for instance by eating less meat**, as in this way they can avoid rebound effects.
- (3) Affluent households should **help support policies which provide lower-income households with options for more sustainable consumption**, for example by accepting socially adjusted reimbursement premiums for steering taxes (cf. Section 8.6). Rebound effects may also be mitigated by investing some of the revenue raised by steering taxes in measures such as improved animal welfare or ecological recovery measures like the rewetting of bogs, rather than returning it to consumers (Wackernagel & Rees 1997).

## 7.7 Conclusion

Section 7 analyses the reasons for the sustainability challenges described in Section 4 by using an analytical framework that has the German food system at its core. It covers the entirety of players and structures along the food value chain including consumption.

The starting point for analysing the governance problems is the fact that it is predominantly private sector stakeholders, such as companies and consumers, that shape the food system. These stakeholders are subject to the governing mechanism of the market. There are myriad market governance problems within the food system. As pointed out in Section 6, external effects, information asymmetries, and the limits of consumer sovereignty play a significant part in the existing partial market failure, which results in sustainability deficits and high economic costs. Given the market governance problems, government action is necessary to implement sustainability goals in the field of food and nutrition. The analysis, however, shows that significant governance problems also impede governance action. One issue is that different government levels in Germany's federal system share the responsibility for the field of food and nutrition. Moreover, different ministries focus on different aspects of food and nutrition. This leads to coordination challenges and to the problem of a possible "diffusion of responsibility". While there are indeed different coordination mechanisms, these could be harnessed in a much broader way in order to coordinate food-related issues more carefully. An important task which could be

fulfilled by means of expanded coordination between the Federal Government and the federal states is the evaluation of measures taken in the field of food consumption.

As the analysis of the political and administrative system shows, the political landscape is marked by quite different positions on the extent to which the government should pursue an active food policy (cf. Section 6). The political parties which prefer the government to play an active role mainly make suggestions relating to preschool and school meals. For the environmental dimension of a sustainable diet, they especially propose that organically produced foods should be used in preschool and school meals. In addition, they recommend promoting organic farming in general. Practically all political parties fail to address the social dimension of more sustainable food consumption, such as in particular food poverty or poor working conditions in different sectors. Likewise, the election manifestos of all political parties hardly mention any measures which aim to influence adults' food consumption habits. Both the fear of a lack of acceptance in society and the fact that such measures may attract major media attention are presumably to blame. The 'veggie day' proposed by the Green Party is a case in point.

The analysis of civil society stakeholders shows that within the political and administrative system there are a number of well-organised stakeholder associations from the economic sector on the one hand and numerous increasingly well-organised civil society associations on the other hand. On either side, several umbrella associations exist which have headquarters with professional experts working there. A substantial degree of networking can be seen on both sides. From a governance perspective, this development has a positive impact, as it implies that both economic and social interests are professionally represented in the political system. The problem, however, is that the political debate often focuses exclusively on issues which, due to their potential to cause an uproar, are suitable for campaigns and in some cases for 'token politics'. Less emphasis is put on the key issues of promoting more sustainability in food consumption that are identified by this expertise such as, for instance, food poverty and poor working conditions in different sectors. A consistent food policy should consider the different sustainability goals, namely the 'Big Four', which is currently not the case.

Likewise, the innovation system is crucial for promoting more sustainable food consumption, although the influences in this regard are diverse. Research, for example, is the bedrock for dietary recommendations and innovation in the food system. Moreover, the scientific training of specialist staff and executives is instrumental in achieving sustainability goals in the field of food and nutrition. The innovation system, however, also faces certain governance challenges. There are incentives for both economic and civil society stakeholders to underpin their demands with research findings. Therefore, they actively help promote research. High methodological standards as well as a comprehensive transparency framework are paramount to avoid a bias in scientific studies and scientifically-based recommendations. This applies in particular to the sources of funding for scientific work. Such standards are indeed applied as good practice in scientific research. Yet it makes sense to regularly analyse to what extent a bias might still be observed in scientific studies in order to recognise and remedy possible shortcomings at an early stage.

The policy tools which are of particular importance in this expertise, i.e. meals in schools and pre-schools, labels and incentive taxes, also face significant governance challenges.

As preschool and school facilities are expanded into all-day care, meals in these institutions are coming to the fore. Nonetheless, the political governance task remains complex in view of the multi-level governance system consisting of the federal, state and municipal levels: since the state and municipal levels are responsible for the governance of communal catering in Germany, whereas it is mainly municipalities that implement it, the organisation and implementation of school and preschool catering is quite diverse and there is in many ways room for improvement. This applies to the nutritional values and sensory quality of the food on the one hand and the specific food environment on the other. The latter refers, for instance, to the way refectories are equipped, the variety of options available, the way dishes are served and the length of breaks. In addition, children and adolescents from lower income households face certain constraints regarding social participation.

The first coordinating bodies were launched in order to better coordinate and interconnect the various players in the policy area of catering in preschools and schools. However, their organisational set-up and financial resources are not adequate for their task. The shortcomings in terms of organisation and funding are a problem because the market alone does not function sufficiently well in communal catering. Stronger public governance and support is therefore necessary, but the responsible municipalities are reaching their limits in this regard in terms of their management capacity and sources of funding.

According to the German Basic Law, the federal government may not interfere with the education policy of the federal states. Hence, the scope for action on the federal level is somewhat limited. The greater scope for federal funding granted by the amendment to Art. 104c German Basic Law are crucial for other parts of this expertise. High-quality school meals could serve as a key educational element in preschools and all-day schools, as they enable children to gain practical experience in dealing with food and drink and in doing so in a social context. This can help promote sustainability in food consumption – “in the moment” and in a real context – in their day-to-day lives. In addition, healthy school meals are instrumental in combating child food poverty and promoting integration. One issue has also become clear: The necessary measures to be taken in order to improve the quality of school meals represent a serious challenge with major financial implications (cf. Section 8.2).

Secondly governance using economic tools is examined more closely (Section 7.5.2). Demand-side steering taxes have the key benefit of not reducing the competitiveness of domestic production. They may hence also be introduced if an international consensus has yet to be achieved in terms of climate stewardship or animal welfare. Steering taxes make sense given that today’s price relations add to sustainability problems. Some production methods and foodstuffs are more harmful to the environment than others, and hence cause higher external costs. Subsidies and taxes may therefore result in changed price relations, thus ensuring that “prices tell the truth”. In

Germany, financial incentives have so far seldom been used as a tool of governance for food consumption habits.

In relatively rich countries such as Germany, however, changes in price have less of an impact on demand than they do in poorer regions. A major increase in taxes is necessary to achieve marked steering effects. However, significantly increasing excise taxes on foodstuffs raises socio-political questions due to their regressive effect. Providing socio-political compensations therefore makes sense. Steering taxes are more like to be accepted if they are revenue-neutral or if the tax revenue is invested in generally accepted goals such as preventive healthcare or animal welfare.

Finally, a more thoroughly assessed policy area is governance using labelling (cf. Section 7.5.3). In terms of sustainability, consumers regularly face credence attributes for which the market tends to lack transparency. Despite long-lasting debates, market participants have so far only developed labels for animal welfare. With regard to health, it appears the Nutri-Score system would be a more readily comprehensible approach for consumers. However, it remains uncertain as to whether it will be used (Section 8.9). The market still lacks labels pertaining to social challenges and to climate stewardship. The WBAE believes that food policies should incorporate labels more strongly as a tool so that they can contribute more effectively to promoting more sustainability in food consumption. To this end, it is necessary to make these policies more binding and to increase the corresponding budget. Consumers are frustrated by the confusing range of, in some cases, inherently contradictory labels currently on the market; they are also unable to assess the scope of the labels which may then cause halo effects. The efficiency of a market economy depends on whether reliable information is available to consumers or not. The government should become more actively involved by establishing binding labels insofar as possible, as there is an obvious lack of reliable information in the market processes in the context of complex sustainability characteristics.

The WBAE is well aware of the fact that the collection of sustainability data along the value chain causes transaction costs and makes products more expensive. On the one hand, prices rise due to the necessary data collection and certification as well as separation costs. On the other hand, however, consumers are otherwise not able to (reliably) assess the impact their purchasing decisions have on sustainability. In this case, the government would have to revert to much further-reaching instruments such as taxes and bans and introduce measures on the supply side in order to promote sustainability in food consumption. To some extent, this is both possible and necessary. Labels are by no means always the best tool. Yet the WBAE considers it desirable that consumers should be actively involved as stakeholders regarding the desired level of sustainability in food consumption. New types of labels, including colour-coded and interpretive multi-tier labels, represent innovative approaches to achieving a greater impact on the market. However, they will generally have to be binding in order to be broadly applied in the market.

Rebound effects (Section 7.6) are particularly challenging to environmental policy. They occur whenever environmental progress is offset, either entirely or in part, by behavioural changes and

changing prices elsewhere. Indirect rebound effects are especially relevant for the food sector. They occur whenever consumers take money they have saved, spend it on something else and trigger a negative impact. They may, for instance, use money they saved by avoiding food waste to pay to travel somewhere by plane. Indirect market-related rebound effects are caused by reductions for the sake of the environment, i.e. lower meat consumption which results in a global short-term and medium-term decline in prices for meat. This in turn may lead to increased consumption by other individuals, for instance in developing countries, which, however, to some extent has positive health impacts for said individuals. Rebound effects demonstrate the magnitude of the environmental challenge. These effects can be reduced if comparably well-off households use the money they have saved to purchase (more costly) sustainable products instead of consuming more elsewhere.



## 8 Instruments of a policy for greater sustainability in food consumption

In view of the problem areas identified in this expertise and the nutrition policy decision-making situation outlined, policymakers in Germany are faced with the challenge of developing a set of instruments that is as coherent as possible to promote sustainability in food consumption. The instruments available for this purpose have been intensively discussed in the scientific community in recent years and some are already being applied in various countries. Several systematic representations are available, some of which overlap. These classify the food policy instruments according to the following criteria:

- **Depth of intervention:** Instruments have different degrees of influence on the personal choices of consumers. Decision-supporting instruments (e.g. labels), for example, intervene less deeply in individual consumer habits than steering instruments (e.g. taxes and subsidies) or restrictive instruments (e.g. product reformulation) (see text box 16 “Heads of food policy interventions” in Section 6.5).
- **Addressees:** Some instruments address consumers directly (e.g. information campaigns), others address other market participants (e.g. the hotel and restaurant industry if an obligation to offer tap water free of charge and mineral water as the cheapest beverage were to be introduced) (cf. Section 9.7.2).
- **Starting point:** On another level, measures that start with the individual or the household (alternatively: behavioural changes) can be distinguished from approaches focusing on the setting (alternatively: situational changes). Approaches directed at behavioural changes usually aim to regulate the behaviour of individual persons in a particular manner. The primary objective of measures aiming at behavioural changes, such as providing information or education, is to motivate people to modify their behaviour. In contrast, setting-based approaches address specific organisations where a large number of people eat rather than directly addressing an individual person and cover communal catering facilities such as pre-schools, schools, universities, hospitals, senior-citizen institutions, and prisons.
- Finally, to systematise further, different instruments can address either **explicit (“rational mode”)** or **implicit aspects (“autopilot”)** of behavioural control (cf. Section 3.2). Information campaigns (e.g. Five-a-Day), which are chiefly intended to convey knowledge, primarily address our “ratio mode” and require a targeted control or regulation of our behaviour. This form of measures does not directly influence individual behaviour, but increases exposure and access to information. The actual “translation” into behaviour depends on many other factors (e.g. financial resources, social norms, competency) that are not directly addressed by this form of action. On the other hand, consumers need not be aware of implicit measures that address individual autopilot at the time of decision-making, but they nevertheless influence behavioural patterns, sometimes significantly (e.g. reduced portion sizes, cf. Section 3.4).
- **Primary starting point/behavioural effectiveness:** Finally, instruments can be classified according to where in the eating habit process they primarily come into play (Fig. 8-1). This is the system primarily used in this Section.

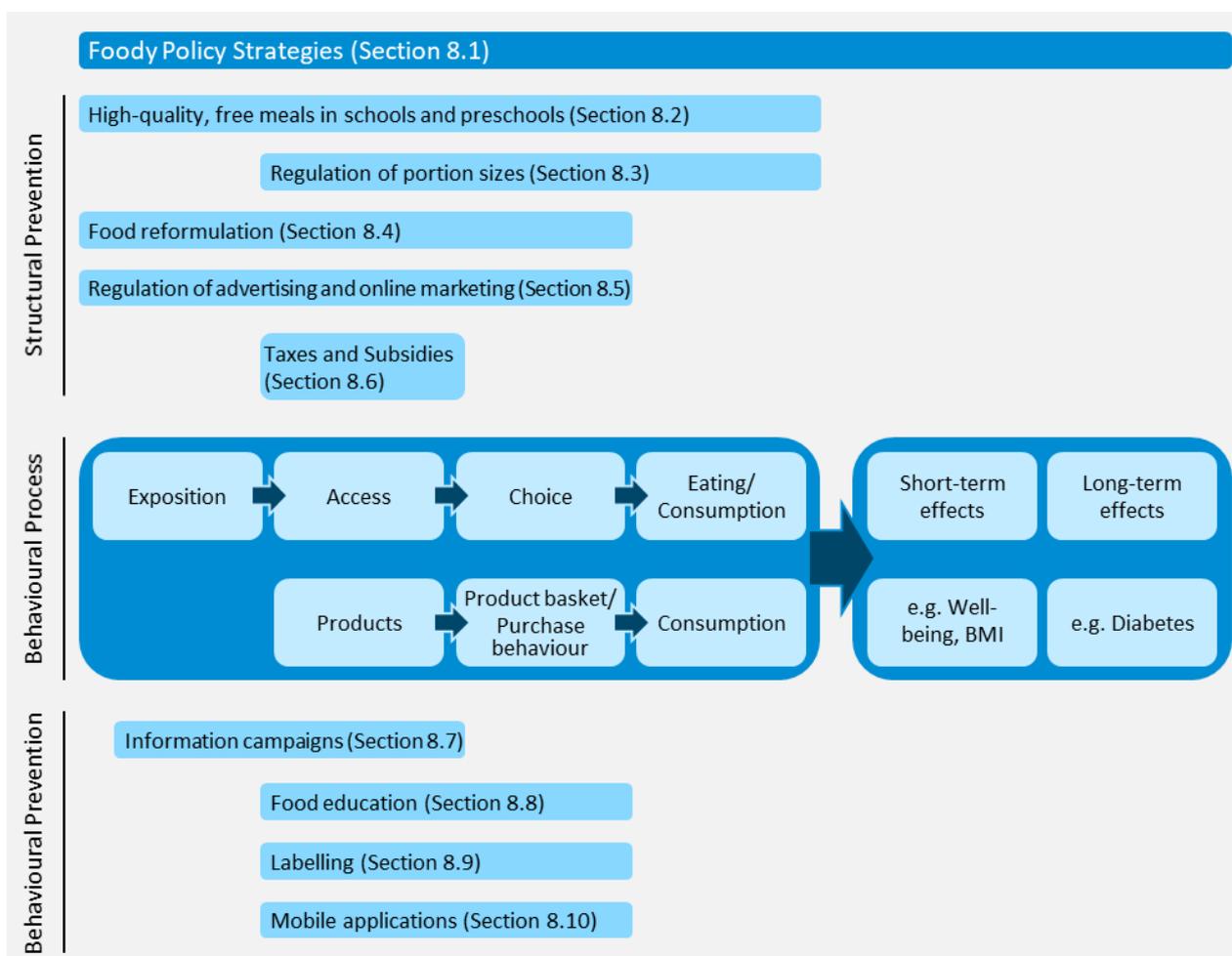
In the following, a separate sub-section will be devoted to each of the food policy instruments that are particularly relevant from the Advisory Board's perspective. To this end, the system used in Section 3 is used, which classifies the various instruments according to the phases of the behavioural process (Fig. 8-1). This overview illustrates what instruments are primarily applied at what points of the eating behaviour. It is plausible to assume that an instrument is more effective (in terms of promoting sustainability in food consumption) the more phases this instrument directly addresses (primary effect).

Some instruments address all phases of the behavioural process, such as catering in schools and preschools. For example, if catering in schools and preschools is offered, this increases the exposure to health-promoting foods and meals, but also changes the general access to the respective offers and the range of options available. The design of the food on offer (e.g. quality, portion size) and of the food environment (e.g. equipment in the dining room) also directly influences the eating behaviour. Free, high-quality school and preschool catering therefore has a broad effect on behaviour.

Other instruments, however, primarily target a specific aspect of the behavioural process. The density of supply (e.g. the number of supermarkets available locally that have a wide range of fresh produce) primarily influences exposure and access, while convenience aspects regarding the options of combining food, dishes or portion sizes primarily affect access and choice. These primary effects then also tend to have a (secondary) impact on the other stages of the behavioural process. Taxes, for example, primarily influence access to food by making the food more expensive and thus less accessible. This shift in access then also has secondary effects on the other phases of the behavioural process, for example on choice and consumption, and possibly on exposure, if products are no longer offered in the long run due to falling demand. In comparison with non-contributory and high-quality catering in schools and preschools, however, these effects are less direct or primary, but rather constitute indirect, secondary effects. From this point of view, free, high-quality preschool and school meals are a particularly comprehensive and effective measure. However, free and high-quality meals in schools and preschools address only a small part of the population, whereas taxes affect all consumers.

Figure 8-1 shows that those instruments that directly address consumers mainly concern access and choice. Instruments that primarily address other actors or fall within the field of situational changes often have a broader "behavioural impact". A policy for promoting sustainability in food consumption should therefore prioritise these instruments.

**Figure 8-1:** Systematic representation of policy instruments based on what phase of the behavioural process they primarily address



Source: WBAE illustration, cf. Section 3.3 and Figure 3-4.

In the following, the various different policy measures for promoting sustainability in food consumption are discussed based on Figure 8-1, starting with the development of a food-policy strategy, via the more broadly effective measures of situational changes up to the instruments focusing on individuals. In addition, measures to reduce food waste are discussed (Section 8.11), as is the question of the potential and limits of a voluntary sustainability commitment by private market participants (Section 8.12). Section 8.13 summarises the ideas on the available food-policy instruments.

Each section begins by identifying the problem situations (presented in section 4) that could be addressed by the respective instrument, followed by a presentation of the respective status quo regarding the use of each instrument in Germany as compared with other countries on the basis of empirical data. In particular, consideration is given to the extent to which the instrument is already being used and how effective this use is for promoting sustainability in food consumption.

Moreover, the possible uses and limitations of the instrument, as well as intended and potential side effects, are weighed up, with possible recommendations being derived. The latter are specified in Section 9.

## 8.1 Development of an integrated food policy strategy

The diverse food-policy instruments described below form a policy field in their own right and should be meaningfully combined with each other as part of an overall strategy. Section 7 highlighted key characteristics of the food system and its political governance.

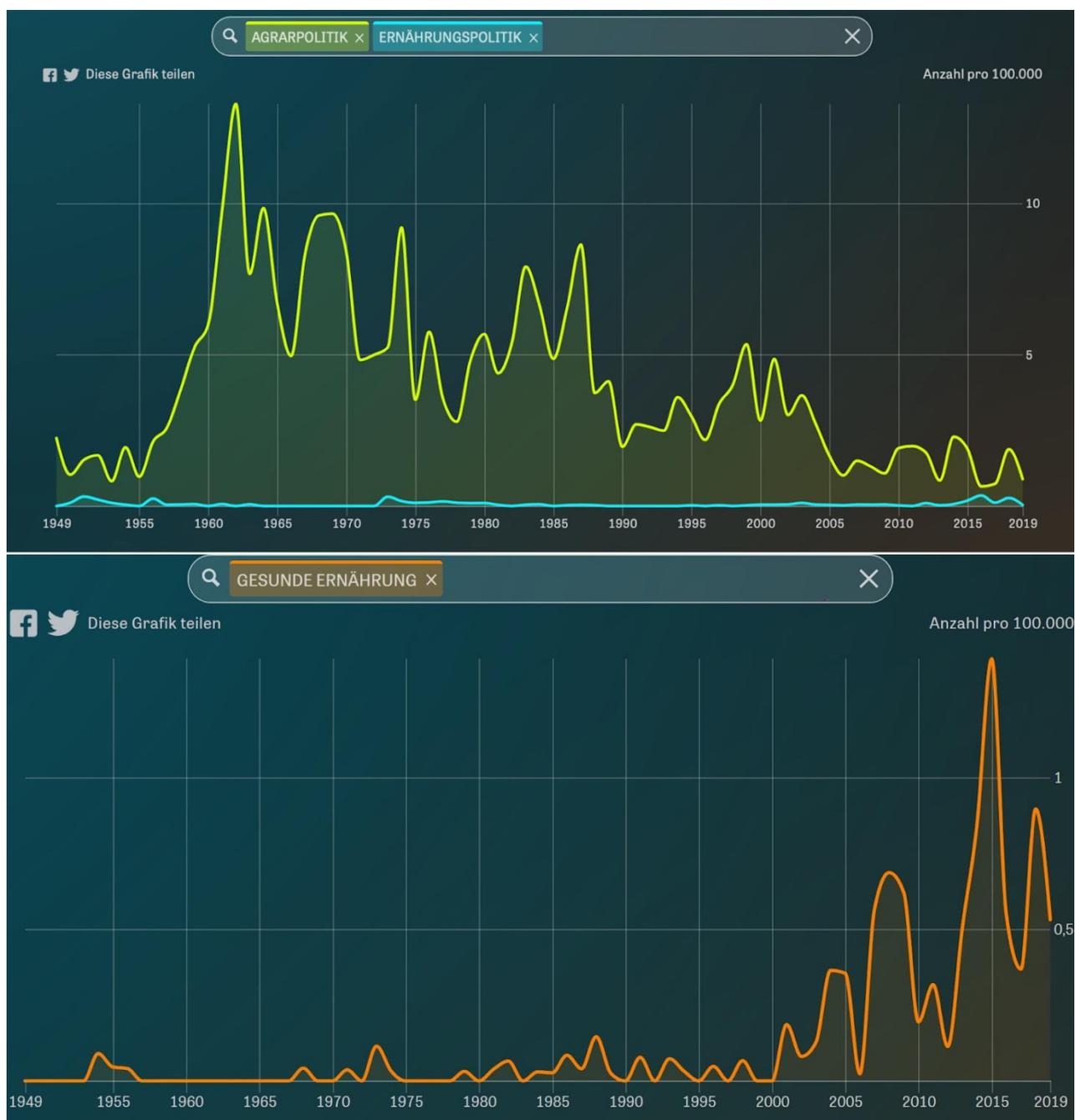
- Historically, food policy focused on food security issues and thus primarily addressed the production side, i.e. agricultural policy. Once there was a secure, adequate food supply for the whole of Germany, the focus shifted to environmental policy and increasingly also to health issues.
- Compared with traditional agricultural policy, however, food policy as a policy field has received considerably less political attention; it is only slowly establishing itself as a fully-fledged policy field. For example, the words “healthy diet” in combination are not found with any significant frequency in speeches in the Bundestag until the last decade (Fig. 8-2).
- Only recently has consideration been given to a policy for promoting sustainability in food consumption which – as in this expertise – looks at various dimensions of sustainable development in an integrated manner and also addresses the entire value chain up to the consumers and food disposal.
- In terms of personnel and budget, food policy in the BMEL is still significantly underfunded compared with traditional agricultural policy and with the magnitude of the societal challenge and is chiefly geared towards cognitive appeals and information campaigns.
- A policy for greater sustainability in food consumption is a cross-sectoral policy: The BMEL, which is responsible at the federal level, must not only establish networks with the Federal Ministry of Health, but also with the Federal Ministry for the Environment, the Federal Ministry of Labour and Social Affairs, the Federal Ministry for Economic Affairs and, in the case of topics such as catering in schools and preschools, also with the Federal Ministry of Education and Research and the Federal Ministry for Family Affairs, Senior Citizens, Women and Youth. In addition, it is necessary to involve all political levels, ranging from the EU to the municipalities. Due to the multiple responsibilities, there is a risk of a “diffusion of responsibility”.<sup>404</sup>
- Changes in the population’s food consumption habits tend to occur slowly over time. This pattern is due to the fact that food consumption behaviour is shaped by habits and genetic and

---

<sup>404</sup> This means that possible or necessary measures are omitted because there is no clear allocation of responsibility and each actor attributes responsibility for the first step to others.

epigenetic preconditions, but also strongly by the food environment. Food policy must therefore be strategically designed and requires a “learning policy approach” as well as, in general, demonstrate “staying power”.

**Figure 8-2:** Mention of the terms “agricultural policy”, “food policy” and “healthy diet” in speeches held in the Bundestag



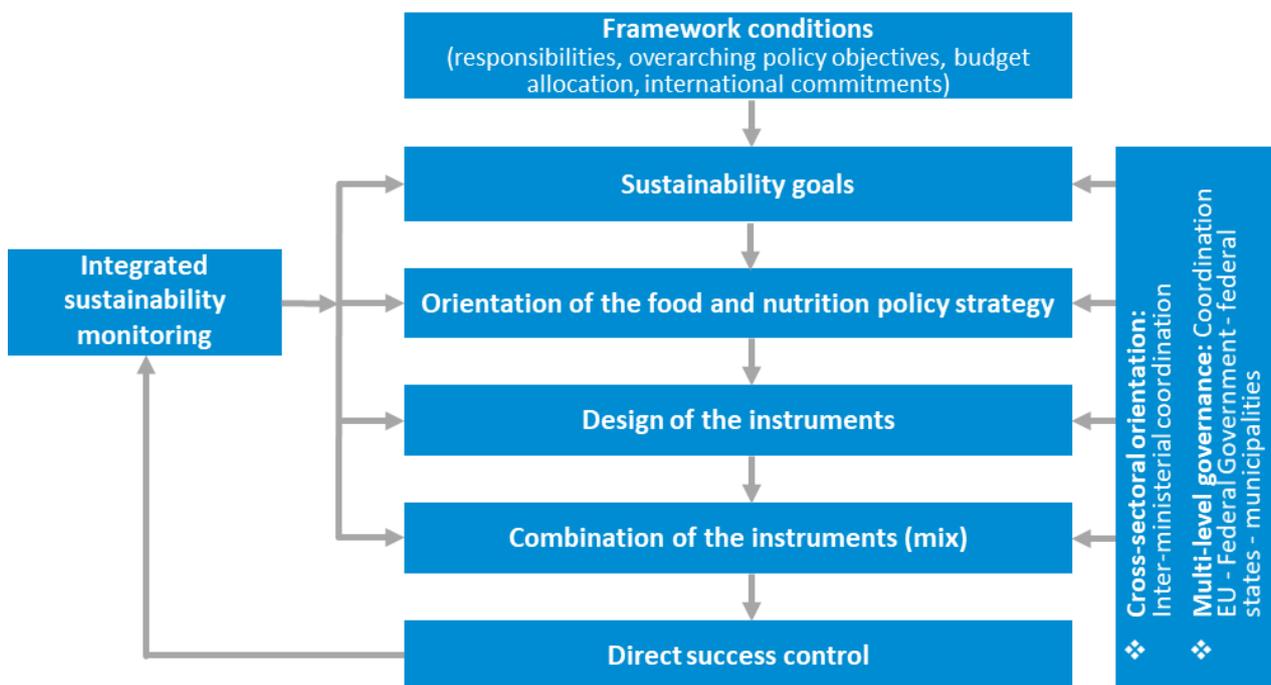
Note: The curves show how often a word was used in the Bundestag debates over the years. To make the attention paid to the terms comparable, the annual mentions per 100,000 words are shown.

Source: <https://www.zeit.de/politik/deutschland/2019-09/bundestag-jubilaeum-70-jahre-parlament-reden-woerter-sprache-wandel>.

The complexity of food consumption habits (Section 3), the analysis of sustainability challenges (Section 4), the difficulties of measurement and evaluation (Section 5), the fundamental (cultural) barriers to a more interventionist food policy (Section 6) and the complex political field shaped by strong lobbying influences (Section 7) provide a picture of the complexity of the governance task and show the need for development. The WBAE welcomes the expansion of food policy in the BMEL in recent years and the further organisational development of relevant federal agencies (e.g. establishment of the Federal Centre for Food and Nutrition (BZfE) at the Federal Office for Agriculture and Food (BLE)). **However, the WBAE cannot yet discern a clear-cut food policy strategy.**

The necessary long-term and cross-cutting alignment of the policy field “greater sustainability in food consumption” (Swinburn et al. 2019) requires a consistent objective, a long-term strategy, a coordinated link between measures and a consistent evaluation of success. The figure below outlines the ideal structure of such a concept.

**Figure 8-3:** Elements of a food policy concept



Source: WBAE illustration.

### Setting sustainability goals

Target-oriented governance (Kanie & Biermann 2017) is a central element of any sustainability policy. In a democracy, targets should be set in a transparent process with the broadest possible participation of stakeholders. The so-called TAPIC framework (“Transparency, Accountability, Participation, Integrity and Capacity”), which comes from the field of health management, has proven its worth. It underlines the need for a clear allocation of responsibilities and the provision of sufficient budgets and human resources (Greer et al. 2015).

The setting of sustainability goals in the field of nutrition should be integrated into the German government’s general **sustainability strategy** (Federal Government 2018). Some sub-areas of “sustainable food consumption” are already covered by the goals of the SDGs and their German operationalisation. The Federal Statistical Office regularly reports on progress in the achievement of the goals in Germany (Statistisches Bundesamt 2018d).

The targets listed in Table 8-1 are presented by the Federal Statistical Office for publicity purposes, with the progress in achieving the goals being reported. However, the SDG goals do not sufficiently cover the spectrum of sustainable food consumption and nutrition. As Table 8-1 shows, the area of “environment” is the most broadly covered, with 11 goals. The field of “food consumption and nutrition”, on the other hand, is addressed by only three goals (reducing premature mortality and obesity rates for children and adults). These are important targets, but they need to be complemented by other key health-related targets. This classification does not cover social targets specific to food consumption and nutrition, e.g. to combat food poverty, and ensure animal welfare.

Therefore, a specific target system would have to be developed for a “sustainable food policy”. This requires a comprehensive and **integrated consideration** of the “Big Four” (health, social, environment and animal welfare).

**Table 8-1:** Sustainability goals and indicators of the Federal Government relevant to food consumption and nutrition

Sustainability goals	Sustainability indicators
Healthy diet	
<ul style="list-style-type: none"> <li>• Reducing obesity in adolescents</li> </ul>	Obesity rate
<ul style="list-style-type: none"> <li>• Reducing obesity in adults</li> </ul>	Obesity rate
<ul style="list-style-type: none"> <li>• Reducing premature mortality</li> </ul>	Deaths per 100,000 inhabitants under the age of 70, excluding under the age of 1
Social aspects	
<ul style="list-style-type: none"> <li>• Supporting good governance in achieving an adequate diet around the globe</li> </ul>	Increasing the percentage of funds disbursed on the application of the Committee on World Food Security's guidelines and recommendations in the overall expenditure on food security
<ul style="list-style-type: none"> <li>• Improvement of the access to drinking water supply and sanitation funded by Germany worldwide</li> </ul>	People reached, in millions
<ul style="list-style-type: none"> <li>• Reduction of materially deprived and severely materially deprived persons in Germany</li> </ul>	Share in the total population
<ul style="list-style-type: none"> <li>• Supporting sustainable development worldwide through development cooperation</li> </ul>	Share of public development spending in the gross national income
Environment	
<ul style="list-style-type: none"> <li>• Increasing the organically farmed agricultural land</li> </ul>	Organically farmed agricultural land
<ul style="list-style-type: none"> <li>• Reducing the nitrogen surplus arising from agricultural activities</li> </ul>	Nitrogen surplus on agricultural land in kilograms per hectare
<ul style="list-style-type: none"> <li>• Reducing nitrates in groundwater</li> </ul>	Number of measuring points in percent where the threshold level is observed
<ul style="list-style-type: none"> <li>• Sustainably managed fish stocks in the North and Baltic Seas</li> </ul>	Share of sustainably managed fish stocks
<ul style="list-style-type: none"> <li>• Reduce nitrogen input via inflows in the North Sea and the Baltic Sea</li> </ul>	Nitrogen concentrations in water discharges from rivers to the North Sea and the Baltic Sea
<ul style="list-style-type: none"> <li>• Reducing the eutrophication of ecosystems</li> </ul>	Share of ecosystems exceeding the load limits for eutrophication caused by nitrogen inputs

Source: WBAE compilation based on the Federal Statistical Office (2018d).

**Table 8-1:** Sustainability goals and indicators of the Federal Government relevant to food consumption and nutrition- **continuation**

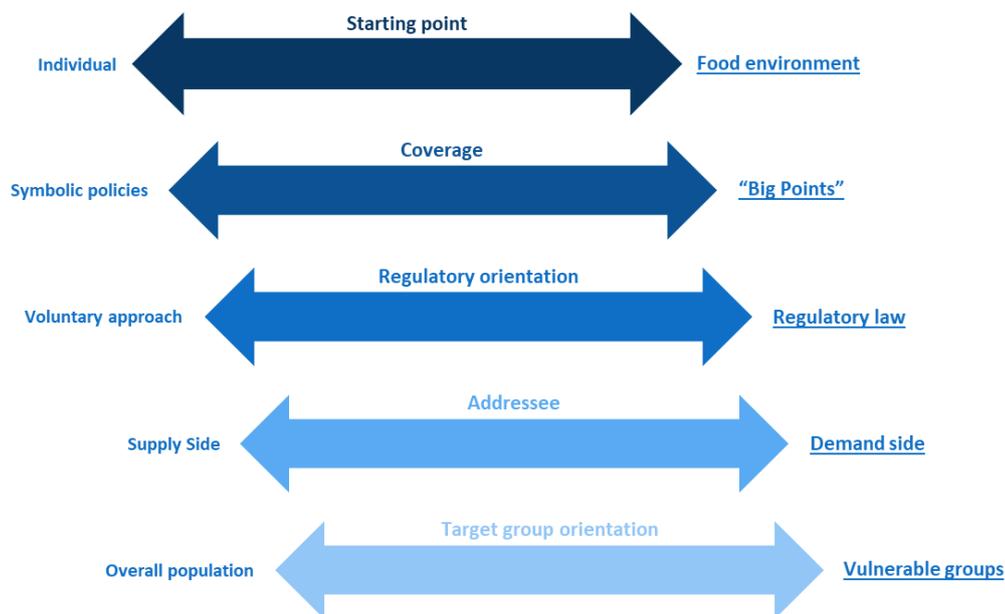
Sustainability goals	Sustainability indicators
Environment	
<ul style="list-style-type: none"> <li>Reducing phosphorus in running water bodies</li> </ul>	Number of measuring points where the guidance values for good environmental condition for total phosphorus are observed
<ul style="list-style-type: none"> <li>Improving species diversity and landscape quality</li> </ul>	Stock development for 41 selected species of birds in the form of an index
<ul style="list-style-type: none"> <li>Reducing the increase in the land used for settlement and transport</li> </ul>	Increase in hectare per day
<ul style="list-style-type: none"> <li>Reducing the energy consumption and CO<sub>2</sub> emissions of private households</li> </ul>	Level of energy consumption
<ul style="list-style-type: none"> <li>Reducing greenhouse gas emissions</li> </ul>	Greenhouse gas emissions in CO <sub>2</sub> equivalents
Animal welfare	not covered

Source: WBAE compilation based on the Federal Statistical Office (2018d).

### Orientation of the food policy strategy

Food policy can be fundamentally aligned to **five different decision-making fields** (Fig. 8-4).

**Starting point:** In terms of policy instruments, the focus can be placed primarily on individuals - as has been predominant in Germany so far - or alternatively on the design of food environments that make the more sustainable choice the easier choice. The previous sections explain that the Advisory Board interprets the term food environment broadly. The influence of the food environment on eating behaviour is very far-reaching and must be understood in far greater depth than is currently the case in food and nutrition policy. Policy instruments which assume that consumers make conscious and rational decisions at all times overtax the consumers (cf. Section 3). For this reason, the WBAE sees a need for a broad, coordinated use of instruments that places a **much stronger emphasis on the food environment**.

**Figure 8-4:** Five decision-making fields regarding the strategic policy orientation

Source: WBAE illustration.

**Coverage:** The analysis of the role of civil society actors in the policy field of food and nutrition shows that these actors primarily address issues that have a “potential for outrage” and are therefore deemed suitable for campaigns. Policymakers can respond to this with individual measures, but then risk slipping into symbolic politics. The alternative would be to strive for basic **measures with a high impact** (e.g. high-quality and non-contributory meals in schools and preschools) and to dovetail these in a meaningful way. A successful food and nutrition policy strategy aims to conceive high-impact measures and address the “Big points”.

**Regulatory orientation:** Food and nutrition policy moves between an orientation towards voluntary action – which relies on corporate social responsibility, consumer motivation for sustainability and market mechanisms – and an orientation towards imperatives and prohibitions (regulatory law). The BMEL currently relies relatively heavily on voluntary measures being taken by industry “in the shadow” of the threat of regulation (cf. Sections 6.2 and 6.5). The WBAE believes that a well-coordinated mix is needed, but in many fields research has meanwhile pointed out the limits of voluntary measures, so that **too strong an orientation towards voluntary commitments will not be sufficient** (see in detail Section 8.12 and, using the example of advertising, Section 8.5).

**Addressee:** Policies for promoting sustainability in food consumption can focus on the supply side or the demand side. As set out in Section 6, the previous focus on producers does not make sense, especially because there is a risk of leakage effects (shifting of negative external effects abroad) if producers are exposed to excessive cost increases. It therefore (also) makes sense economically to complement existing supply-side instruments by **introducing extensive demand-side instruments** and to link production-side and supply-side approaches in a meaningful way.

**Target group orientation:** Policymakers can focus their strategy on the population as a whole or on specific target groups. Policymakers should support all people in Germany in eating more sustainably, but they currently reach mainly educated middle-class groups by placing the focus on traditional information measures. In order to make more sustainable food consumption possible for **vulnerable groups** such as children and adolescents as well as food-insecure households, specific, target group-oriented measures for these vulnerable groups are also needed.

The next step is to design the instruments on the basis of clear goals and strategies.

### Design of the instruments

The design of the instruments specifically includes the concrete implementation and the dosage of the instruments. Since - as Section 7 shows - the field of food policy is exposed to powerful interests, there is much to be said in favour of policymakers implementing the policy in as **science-based and evidence-based a framework** as possible (Swinburn et al. 2019). The WBAE sees key development potential for food policy in this respect. Consumer reactions to certain policy instruments are difficult to predict in view of the complexity of consumption motives (cf. Section 3). Counter-reactions (e.g. reactance effects) may occur, but can also be mitigated by appropriate measures. By **using implementation studies, especially randomised control experiments**, a demand-oriented policy gains in efficiency and effectiveness. The WBAE, whose members have some experience in international policy environments, observes a conspicuous gap here in Germany.

### Combining the instruments into a consistent mix

Instruments need to be coordinated in terms of subject matter and timing and form part of an overall strategy in order to be more effective. Individual tools are, as a rule, not effective enough to change our habit-based food-consumption behaviour (Bailey & Harper 2015, Alston et al. 2016, Marette et al. 2019). Considerable synergies can be generated through a coordinated combination of instruments - a finding that is accepted in many fields such as commercial marketing ("marketing mix") or public health.<sup>405</sup> A **specific mix of instruments** must be designed **for each goal** (cf. Section 9).

### Integrated sustainability monitoring and success control

A policy for "promoting sustainability in food consumption" should build on systematic monitoring, based on the targets set. Governance presupposes suitable indicators for the setting of target values and the monitoring of progress in achieving the target (success control). As shown in Sections 4 and 5, the data situation in the various sustainability dimensions varies widely, and there are still considerable gaps in some areas, for example in the monitoring of food poverty or in the entire field of social impacts. In Germany, there is no integrated overall system for monitoring aspects of food consumption habits relevant to promoting sustainability in food consumption that integrates

---

<sup>405</sup> The literature has paid particular attention to the so-called NOURISHING policy framework, an acronym for various policy instruments to promote health-promoting food consumption, which the World Cancer Research Fund International proposes and for which it continuously compiles international experience reports, cf. <https://www.wcrf.org/int/policy/nourishing-framework/about-nourishing>.

the four different dimensions. Establishing such a system would be conditional on the cooperation between various federal and state authorities from different departments. Two central tasks need to be solved:

- **Selection and measurement of key indicators:** Selection of relevant steering indicators that reflect the strategy regarding the four dimensions (“Big Four”), namely health, social, environmental and animal welfare, are measured regularly and trigger action in the event of deviations.
- **Integrated consideration of the “Big Four”:** Sustainable food consumption means integrating the four dimensions (health, social, environmental and animal welfare); accordingly, the key indicators must be considered together, not least because there may be conflicting goals.

On the one hand, monitoring is based on the ongoing collection of data. Such **ongoing monitoring is central to identifying the initial situation and observing trends over time** (for the area of “health and nutrition” see also Section 4.2.2). Ongoing monitoring enables problems and risks to be identified at the level of the population and, on this basis, appropriate measures can be developed or adapted to improve the respective situation. The selection and harmonisation of indicators as well as the measuring period are key for the quality of the monitoring.

On the other hand, **specific monitoring** is always required when measures (interventions) are planned and implemented (cf. Section 8.2.4). In the context of such specific monitoring, meaningful and, as far as possible, complete indicators are selected that are collected prior to, during and after the intervention and allow a statement to be made about the success of a measure along the entire impact chain. This is intended, for example, as part of the BMEL’s innovation and reduction strategy (cf. Section 8.4), so that it will be possible in 2020, and comprehensively in 2026, to make statements on changes in ingredients (fat, sugar, salt) in defined product groups (MRI 2019e).

A specific monitoring of the **entire impact chain** (cf. Table 8-2) should encompass a systematic, validated recording of the **“input”**, i.e. the resources used for the intervention, and the immediate **“output”**, in particular the degree of implementation and the outreach of the intervention in the target group or population. In addition, the short-, medium- and long-term **“outcomes”**, i.e. results with respect to the specific and general objectives (e.g. increased consumption of fruit and vegetables by children and adolescents in communal catering, changes in attitudes and preferences, changes in overall eating habits, decline in diet-related risk factors and diseases), should be included. Here it becomes clear that the **selection of the respective indicators is quite decisive for the quality and informative value of monitoring**. It makes a lot of sense to include the input side for recording the use of instruments in order to avoid over- and underestimations of effectiveness (e.g. due to insufficient or heterogeneous implementation of the measure). The entire impact chain ranging from the immediate results to the long-term effects should also be covered, as the long-term impact indicators at the end of the chain (e.g. on the obesity rate) only allow statements and adjustments to be made after a very long period of time.

**Table 8-2:** Indicators along the impact chain using the example of the “non-contributory school meals” and “subsidies for fruit and vegetables” measures

Indicator	What is being measured?	Examples
Input	Resource input for the measure	Level of funding for free school meals in accordance with DGE standard Level of subsidies for fruit and vegetables
Output	Degree of implementing coverage of measure	Number of DGE-certified preschool and school refectories Price developments of fruit and vegetables.
Short-term outcome (specific goals)	Short-term impact of the measure	Changes in the fruit and vegetable consumption in communal catering facilities Changes in the consumers' shopping basket
Mid-term outcome (specific and general goals)	Mid-term impact of the measure	Changes in the preference and consumption patterns of children and adolescents with respect to fruit and vegetables Changes in the fruit and vegetable consumption in the population
Long-term outcome (general goals)	Long-term impact of the measure	Decline in the obesity rate

Source: WBAE illustration.

For benchmarking purposes, the achievement of goals can also be classified on the basis of comparable countries (Swinburn et al. 2019). New Zealand, for instance, identified important decision-making areas and targets for a more comprehensive food policy, as well as evaluated progress and implementation gaps in 2014 and 2017 using the Healthy Food Environment Policy Index (Food-EPI) (Vandevijvere et al. 2018). Through the use of expert panels, the Food-EPI records seven different target areas for shaping the food environment (food composition, labelling, promotion, steering taxes, supply, trade and regulation), three target areas for policy development and implementation (leadership, governance and monitoring) and three general infrastructure target areas (budget and resources, networking platforms and alignment with other health policy fields). On this basis, recommendations are then made for prioritising interventions, such as the implementation of a 20% tax on sugar-sweetened soft drinks or the regulation of the marketing of unhealthy foods to children. The fields mentioned in the Food-EPI refer to policy measures for healthier food consumption. In terms of sustainable food consumption, these should be widened to include environmental and social policy issues, as well as animal welfare.

**Conclusion:** In recent years, public health research has increasingly presented findings on the importance of consistent policy strategies (Sisnowski et al. 2017, Mozaffarian et al. 2018). The strategic capacity of food policy is a question of both political will and of institutional development of a policy field (see Section 9.10). Experiences gained in other countries show that the development of such strategic plans is susceptible to lobbying processes (Carey et al. 2015). This supports carrying out accompanying, independent implementation studies.

## 8.2 High-quality, free meals in schools and preschools

The improvement of nutrition in schools and preschools is pursued as a goal by both federal policy and the various *Länder* governments, and is backed in principle by all political parties<sup>406</sup> and civil society actors working on nutritional issues (cf. Section 7.2.2). This is especially true with regard to the quality of catering in schools and preschools. Thus, in contrast to many of the other instruments discussed in Section 8, there is a broad consensus on the objectives of the quality campaign in catering in schools and preschools called for by the National Quality Centre for Nutrition in Day-Care Centres and Schools (NQZ).

The current catering situation in schools and preschools is characterised by **low participation** (which leads to high costs per meal), **poor quality** of the food offered, and an **unattractive food environment**. This situation needs to be improved and for this - as explained in Section 7.5.1 - clear state control is required.

There is currently much discussion in Germany about how exactly this control should be designed in Germany's federal system, i.e. how the overarching goal of improved catering in preschools and schools should be operationalised and by means of what instruments and support funds it should be steered.<sup>407</sup> The debate focuses mostly on the quality campaign with regard to the food offered (Section 8.2.1.1), but increasingly the design of the food environment in preschools and schools is also being discussed (Section 8.2.1.2). In this context, the question of whether and to what extent state funding for lunch in schools and preschools should be expanded is also subject to controversy. Essentially, the question here is whether lunch in schools and preschools should be free of charge for all children and young people in all-day care, or whether parental contributions should be staggered based on parent income. This issue will be discussed in Section 8.2.2. Based on this, the Advisory Board estimates the financing needs associated with the qualitative expansion of catering in schools and preschools in Section 8.2.3. Section 8.2.4 summarises the considerations.

---

<sup>406</sup> Cf. the explanations in Section 7.2.2: The SPD, Alliance 90/The Greens and Die Linke, in particular, are currently placing a strong focus on catering in schools and preschools. The CDU/CSU supports in principle the goal of improved catering in schools and preschools, but the family sphere is still primarily seen as being responsible for health-promoting food consumption (cf. Deutscher Bundestag 2017a: 7).

<sup>407</sup> See, for example, the motion put forward by the parliamentary group DIE LINKE for a federal programme for catering in schools and preschools (Deutscher Bundestag 2016a), the corresponding resolution recommendation (Deutscher Bundestag 2017a) and the verbatim record of the public hearing on the motion (Deutscher Bundestag 2016b). Cf. also the minor interpellation by the Greens (Deutscher Bundestag 2017b) and the FDP (Deutscher Bundestag 2018c).

### 8.2.1 High quality

Children and adolescents spend a large part of their time in preschools and schools for around 190 days (school) or 235 days (preschools) a year. To keep them fit and alert throughout the day, a well-balanced, high-quality diet is a must. The diet should promote growth, keep the children or adolescents healthy, and contribute to their well-being. The DGE quality standards for catering in schools and preschools describe in detail how meals should be prepared (cf. Section 7.5.1, text box 17 “The DGE quality standards for catering”).

Apart from “what” children and young people eat, “how” they eat is also decisive. The food environment, notably the ambience and whether people eat and drink together, performs key emotional and social functions. Empirical findings provide impressive evidence that eating significantly enhances our psychological well-being, social ties, cohesion and our physical and mental performance (Section 3.1). The atmosphere in which food is eaten conveys appreciation of food implicitly and with long-term effects.

High-quality preschool and school catering therefore encompasses two perspectives:

- (1) “What” is eaten - quality of the food.
- (2) “How” food is eaten - an appropriate and fair food environment.

#### 8.2.1.1 What is eaten: High quality through (mandatory) quality standards

Germany is one of the EU countries that has not yet set mandatory (external) quality standards for preschool and school catering (Storcksdieck called Bonsmann et al. 2014). As a result, a preschool and school catering system with great municipal and Länder (federal state) diversity has emerged in Germany’s federal system. The nationwide introduction of the DGE quality standards for catering (cf. text box 17 of the same name in Section 7.5.1.1) is an objective of the Federal Government laid down in the current coalition agreement.<sup>408</sup> A requirement to implement the DGE standards in the preschool sector has so far only existed in the federal states of Mecklenburg-Western Pomerania and Berlin. Although the so-called “*Gute-KiTa-Gesetz*” (Act on Good Early Childhood Education and Care)<sup>409</sup>, which took effect on 1 January 2019, provides a total of 5.5 billion euros for realizing improvements in the quality of and participation in childcare facilities and calls for the development of suitable measures for quality development and management (Section 4, subsection 4), a

---

<sup>408</sup> In the original: “Der Bund unterstützt die Länder, damit die Standards der Deutschen Gesellschaft für Ernährung (DGE) als Mindeststandards flächendeckend in Schulen, Kitas und in der Gemeinschaftsverpflegung eingeführt werden. Dies erfolgt über die stärkere Unterstützung der Schulvernetzungsstellen und den Ausbau des „Nationalen Qualitätszentrums für Ernährung in Kita und Schule“ (NQZ). English: “The Federal Government supports the Länder so that the standards of the German Nutrition Society (DGE) are introduced as minimum standards across the board in schools, preschools and in communal catering. This occurs through greater support of the school networking centres and the expansion of the “National Quality Centre for Nutrition in Day-Care Centres and Schools” (NQZ). (CDU, CSU, SPD 2018: 90).

<sup>409</sup> In the original: Gesetz zur Weiterentwicklung der Qualität und zur Teilhabe in der Kindertagesbetreuung (Gute-KiTa-Gesetz), cf.: <https://www.bmfsfj.de/gute-kita-gesetz>. (Act on Good Early Childhood Education and Care)

binding introduction of the DGE standards at *Länder* level is not a funding requirement. The situation is similar in the school sector: Only Saarland and Berlin specify the DGE quality standards, and Berlin was the first federal state to set up a central quality control office. In addition, there is currently a bill for the binding implementation of the quality standards for all-day schools in Thuringia.<sup>410</sup>

All other *Länder* (federal states) rely on “softer”, non-binding quality assurance measures in the school sector. While they require catering concepts and endorse the implementation of the DGE quality standards, they do not check compliance with these standards, or do so insufficiently (cf. Section 7.5.1). The federal state of Hamburg, for instance, stipulates in its model contracts that the meal providers should base their supply on the DGE quality standards. The same applies to the Land of Bremen, which only awards service concessions to providers if they take the DGE quality standards into consideration. Here too, however, there has been no systematic examination of the quality level so far. Consequently, no reliable data on implementation is available.

A **binding introduction and enforcement** of the DGE quality standards would bring transparency and reliability for all parties involved - the providers, the preschool and school management as well as parents and children. This would also be an important precondition for the food providers, who could adjust to this and focus much more than before on the quality and quality assurance of the meals. A prerequisite for the binding introduction and enforcement of DGE quality standards would be the regular monitoring of the quality development and the qualification of the providers. Incentive schemes could also stimulate competition. Awards, as in the hotel and restaurant industry, are conceivable here, which could then also be used for advertising. Moreover, providers as well as preschool and school administrations would thus fulfil their special responsibility for the children’s health. Parents would also benefit, as they would be able to rely on their children receiving a high-quality diet at preschools and schools.

In order to ensure high quality diets in preschools and schools, enhanced coordination and funding is necessary. For improved coordination and the use of existing potentials, the various actors should be better networked, their experiences pooled and made freely available. The networking bodies at the *Länder* level are generally the right and important starting point, but the impetus they give has so far been too weak in the complex federal system. For an effective nutrition strategy, it is also essential to create long-term overall conditions; these cannot be implemented within the context of short-term project funding. Ultimately, a minimum quality standard is only a first building block in the implementation of high-quality nutrition. It is also crucial to improve the award guidelines and the competences of the actors accordingly, so that the minimum quality standards are also implemented reliably.

---

<sup>410</sup> See Section 3, subsection 2, p. 1 of the draft law on the further development of the school system in Thuringia. <https://forum.thueringer-landtag.de/dokument/weiterentwicklung-des-schulwesens>.

### 8.2.1.2 How food is eaten: High quality through a fair food environment

Many companies, such as the tech enterprises in Silicon Valley or companies like Aesculap<sup>411</sup> or Vega in Germany, have realised that eating and drinking is more than just taking in energy and nutrients. Offering high-quality and sometimes even free<sup>412</sup> food and drink in appealing environments is central to the corporate culture of these enterprises (see Fig. 8-5 for examples). These environments are designed not only so that many people can eat and drink within a very limited time window, but also that these people enjoy being there and that it is a central social meeting place. These are places where people don't have to go because they are hungry and there are no alternatives, but where they want to go.

**Figure 8-5:** Lunch rooms und cafeterias of tech firms Google (A), SAS (B) and Pixar (C). In contrast, examples of school canteens in Germany (D & E)



Sources: <https://www.dailymail.co.uk/femail/article-3473854/The-ULTIMATE-working-lunch-Inside-envy-inducing-canteens-companies-like-Dropbox-Google-Pixar-offer-free-food-extensive-menus-gourmet-desserts.html>; see also [https://www.huffpost.com/entry/apple-cafeteria-caffe-macs\\_n\\_983053?guccounter=1](https://www.huffpost.com/entry/apple-cafeteria-caffe-macs_n_983053?guccounter=1) <https://stadtelternratleipzig.de/2019/06/eroeffnung-der-neuen-mensa-in-der-grundschule-am-auwald/>.

The design of the dining environment shows, inter alia, the appreciation that is given to food and drink, as well as to the guests themselves. For example, the pride staff take in the above-mentioned enterprises manifests itself in sharing pictures of both the dining area and the food on social media; something that rarely happens in the context of classic refectories.

<sup>411</sup> <https://www.youtube.com/watch?v=MIPfmyyiWfE>; <https://www.suedkurier.de/ueberregional/wirtschaft/Mahlzeit-Unternehmen-entdecken-wieder-die-gute-alte-Betriebskantine;art416,10256736>.

<sup>412</sup> "Google gives its employees free breakfast, lunch, and dinner, among other enviable perks." Source: <https://www.dailymail.co.uk/femail/article-3473854/The-ULTIMATE-working-lunch-Inside-envy-inducing-canteens-companies-like-Dropbox-Google-Pixar-offer-free-food-extensive-menus-gourmet-desserts.html>.

At first glance, the question of the design of the food environment may appear to be a “luxury question”. However, as described in Section 3, food fulfils several **basic functions**, whereby in addition to **physiological** functions (satiation, nutrient supply), food also serves an important role in **emotional** (appreciation, rest and relaxation) and notably also **social functions** (social bonding, social norms, “synchronisation”)<sup>413</sup>. In order for food and drink to fulfil these basic functions and be of high quality, the design of the entire food environment is essential. This includes not only “what” we eat, i.e. the range of foodstuffs (quality, quantity, choice), but also “how” we eat. The direct and indirect design of the environment (e.g. noise, time pressure, stress), the ambience (space, light, temperature, smell) and the social environment (e.g. composition, placement) are thus key factors in creating a fair food environment, i.e. one that is attuned to our human perceptual and decision-making options and behavioural patterns, as well as to greater sustainability in food consumption. Therefore, the **appropriate food environment** is not just a “luxury”, but a **fundamental component** of a health-promoting diet and overall greater sustainability in food consumption for children and adolescents.

Part of the food environment in schools is the exposure and access to unhealthy food through **vending machines** and cafeterias. In Germany, compared with many other European countries, the installation of vending machines in public establishments such as schools or universities has not been restricted so far (cf. EU COM o. J., 2018b, Storcksdieck referred to as Bonsmann 2014). Higher exposure to snacks and soft drinks which may be purchased from vending machines or in the refectories in schools is associated with unhealthier food consumption (Story et al. 2008, Chriqui et al. 2014, cf. Sections 3.3 and 8.2.1.2). Thus, the relevant stakeholders, such as the consumer advice centres, the Federal Ministry of Food and Agriculture or the European Commission, recommend that healthier alternatives, for example fruit, be included. Some EU countries, such as France, have already banned vending machines in preschools and primary schools entirely (for an overview see EU COM 2018b). The restriction of the sale of soft drinks and “fast food” in schools is also supported by the population (cf. Section 6.5).

All too often, fire and accident prevention requirements and hygiene aspects are still at the forefront of interior design. While these must of course also be implemented, they can be integrated very well into a concept of an **appealing food environment**. Rooms that have a high level of noise, are cramped and have an unappealing ambience are more of a stressor and not a place that is conducive to regeneration and recreation. For instance, noise levels automatically rise in larger groups as everyone raises their voice to communicate with the people sitting next to them, which in turn causes the noise level to increase over time as individual conversation volumes are adjusted, etc. (“Lombard effect”, ISO 2003). Thus, the average noise level in refectories and cafeterias ranges between 45 and 82 dB (Rindel 2012). Lawn mowers and heavy traffic, for example, are within the 80 dB range. Noise at this level can already give rise to long-term health problems.<sup>414</sup> In addition to the stress caused by noise, a high noise level also means that a sensory, auditory

---

<sup>413</sup> These emotional and social effects in turn have an impact on physical and mental health.

<sup>414</sup> <https://www.sueddeutsche.de/wissen/laerm-wie-laut-ist-welcher-laerm-1.632597>;  
[https://www.hug-technik.com/inhalt/ta/schallpegel\\_laermpegel.html](https://www.hug-technik.com/inhalt/ta/schallpegel_laermpegel.html).

“marker”, one’s own eating noises, cannot be perceived, which markedly impairs the monitoring of consumption and can result in higher consumption and thus obesity (Elder & Mohr 2016).

**Eating together is a central “clock-pulse generator”**, i.e. it structures the long day at preschool and school by means of common meal times. Two aspects in particular are discussed here: Common mealtimes act as a **social norm** about when eating is appropriate and they enable **anticipatory learning** (cf. Section 3.3.2). For instance, we learn to associate times of day with eating. And these learning processes (conditioning) lead us to develop feelings of hunger before lunch. These learned expectations (e.g. 12 o’clock = lunch time = eating) trigger anticipatory physiological reactions (i.e. release of insulin before the actual intake of food). These learning experiences are quite functional, as our body adjusts to these mealtimes, so that ultimately, compared with unstructured mealtimes and snacking, less (permanent) self-regulation is required. Accordingly, common and sufficiently long mealtimes also form part of a high-quality diet and eating environment and have a long-term preventive impact on children and adolescents.

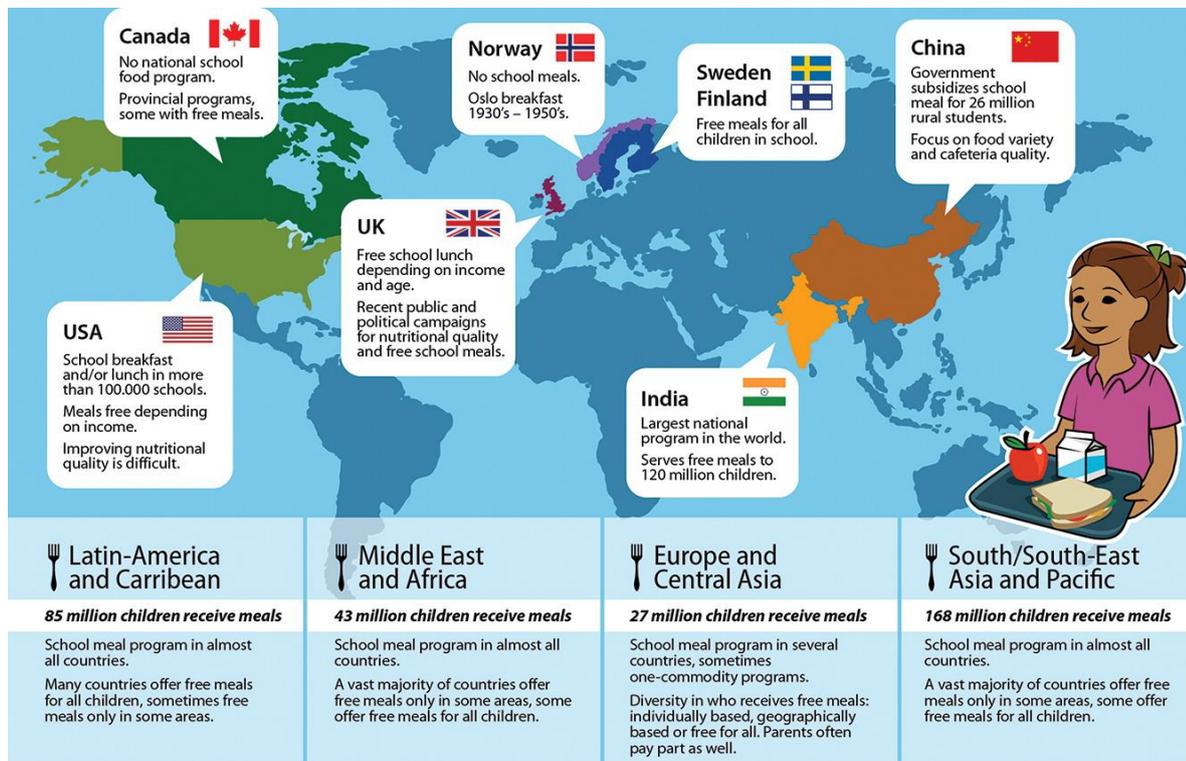
As set out in Section 3.3, various research studies in sociology, psychology and nutritional sciences impressively show that eating and drinking together has an important **social meaning** (e.g. sharing of information, transmission of norms). By eating together and sharing meals (cf. Section 3.3), we can exchange information in “real time”. This **“synchronisation” is ultimately the basis for the formation of a common social identity, value formation and social integration**. The fact that eating and drinking together form part of our natural behavioural repertoire is evident in all cultures and in the fact that many of us prefer eating together to eating alone and that “eating alone” is associated with an increased risk of illness. In preschools and schools, which have to provide high integration services in an increasingly diverse society, shared meals in an appealing atmosphere can be a key factor in promoting **social cohesion**. Eating and drinking together should therefore be understood as a social learning environment or “paedagogical all-day element” (Radisch et al. 2017) – an environment in which children and adolescents learn food consumption habits together and from each other (cf. Section 3.3 and 7.5.1.1).

## 8.2.2 Free lunch in preschools and schools

Many countries have school meal schemes. In 2011 alone, 70 low- or low-to-moderate-income states had at least one school meal scheme (Jomaa et al. 2011). School meal schemes also have a long tradition in high-income countries, although their role has changed over time (Oostindjer et al. 2017). In countries such as the USA, the UK or the Scandinavian countries, the focus was for a long time on reducing food insecurity, before later the focus shifted more to nutritional quality. Currently, health and psychosocial effects as well as educational and sustainability aspects also play an increasingly important role. Finland and France, for example, introduced quality standards for school catering as early as the 1970s, while the USA started introducing such standards in the 1990s, and Germany only in the 2010s.

These school programmes usually encompass income-based financial support for parents or free supply. While in the USA and the UK children and young people from poor households are entitled to free meals, Finland and Sweden provide free meals to all school children (Fig. 8-6). More recently, regions and cities are increasingly introducing free preschool and school meals. New York and London, for instance, have introduced free breakfast for all school children. Ireland has been offering free lunches at various schools since 2019 with its “Hot School Meals Scheme”.<sup>415</sup>

**Figure 8-6:** Examples of school catering schemes worldwide



Source: Oostindjer et al. (2017: 3944).

In Germany, improving the quality of preschool and school meals is a declared goal of the Federal Government and is widely supported by political parties as well as civil society organisations and actors working on food and nutrition issues (cf. Section 7.2.2). A particularly controversial issue in the public and political debate is whether this quality improvement should also include a stronger financial responsibility of the public sector with respect to the costs of lunch in preschools and schools (cf. for example the verbatim record of the public hearing on the motion put forward by the parliamentary group Die Linke for a federal programme for preschool and school catering: German Bundestag 2016b).

<sup>415</sup> <https://www.theguardian.com/education/2019/jun/05/london-council-launches-free-school-meals-pilot-scheme>; <http://www.welfare.ie/en/pressoffice/Pages/prb280119.aspx>.

As set out in Section 7.5.1, parents currently bear the bulk of the costs for lunch, both in the pre-school sector and in primary and secondary schools, and the level of state subsidies varies greatly (cf. Tecklenburg et al. 2019, Bertelsmann Stiftung 2018a, StEG-Konsortium 2019). There are some municipalities and federal states in which the parents of children and adolescents in all-day care are fully exempt from the costs (e.g. Berlin for grades 1 to 6), while in others there are partial subsidies for the costs of lunch and/or indirect subsidies. For children and young people from households receiving transfer payments (especially Hartz IV), the state already covers the costs as part of the education and participation package (BuT) (cf. Section 7.5.1.1).

The following reasons support having a financing system whereby all children and adolescents who are in all-day care at preschools or schools are provided with meals that **do not result in any costs** for their parents (i.e. the meals are “free of differential costs”):

- Such preschool and school meals, which are free of differential costs, mostly involve an **increase in use** compared with meals where parents have to pay for each individual meal or are free to decide whether their child participates in the meals for a fixed (monthly) fee. In Finland and Sweden, which introduced free meals in schools as early as 1943 and the 1970s, respectively, participation rates are on average significantly higher than in Germany. Moreover, studies from the UK and the US show that the introduction of free meals for all children and adolescents resulted in considerably higher participation rates (e.g. Kitchen et al. 2012, Leos-Urbel et al. 2013, Schwartz & Rothbart 2017, Turner et al. 2019). These higher participation rates in the case of generally free meals were not only due to a higher participation rate by children and adolescents who were not previously entitled to support due to their income level, but also to a higher participation rate by children and adolescents from low-income households who were already otherwise entitled to financial support (e.g. Kitchen et al. 2012; Leos-Urbel et al. 2013; Schwartz & Rothbart 2017). For instance, in 2003, New York City introduced free breakfast for all school children, which led to a marked increase in overall participation rates. The previously significantly diverging participation rates between children from different income groups aligned far more closely after the introduction (Leos-Urbel et al. 2013). Similar effects have been reported for free lunches (Schwartz & Rothbart 2017, Turner et al. 2019).
- Increased and, above all, stable numbers of participants lay the foundation for the previously described social learning place of preschool and school catering (Section 8.2.1). If, for instance, as is currently the case in schools, on average less than 40% of all pupils actually eat lunch at schools (cf. Section 7.5.1.1), then the special potential of school meals for social synchronisation and the sharing of information and social contacts in “real time” (cf. Section 8.2.1.2) cannot be used. However, participation is essential for the formation of social norms and integration. In other words: Only if “everyone” participates does the whole thing have a chance.
- Increased participation rates also enable the use of **economies of scale** in public procurement, which can (partially) offset the cost effects associated with an increase in the quality of the foodstuffs on offer and, in addition, provides the opportunity to implement social and environmental criteria. With approximately 8.4 million schoolchildren in Germany (Federal Statistical Office 2018f) and 3.3 million children aged 0 to 7 in preschools and kindergartens, preschool

and school catering has the potential to generate considerable demand effects, so that the purchase of goods by these institutions or caterers can provide key sustainability impulses. Full state funding reduces transaction costs: administrative costs are saved by the state and there is no need for families to apply for cost exemption under the BuT (*Education and Participation Package*).<sup>416</sup>

- Studies from Sweden and Norway show that, if differential-cost-free access for all children and adolescents involves high-quality meals, children and adolescents from **poorer households** benefit particularly strongly from quality-assured school meals (Alex-Petersen et al. 2017; Schwartz & Rothbart 2017). In addition, the study for Sweden demonstrates that children benefit more in terms of health, cognition and later income the earlier the programme reaches them (Alex-Petersen et al. 2017, cf. also Bütikofer et al. 2018 and Schwartz & Rothbart 2017). A (differential-cost) free and high-quality community catering scheme that starts with young children can thus **counteract social inequality in the fields of nutrition and health described in Section 4.2, promote social cohesion and have a preventive effect on health**. Finally, positive repercussions on nutrition at home can also be assumed.
- Moreover, extensive cost coverage by the state avoids the problem, well described in the literature, that children and adolescents perceive school lunches, which are subsidised in the case of low-income families, as “food for the poor” (Mirtcheva & Powell 2009, Bhatia et al. 2011, Leos-Urbel et al. 2013). Children and adolescents become recognisable as poor through their take-up and can experience **discrimination and stigmatisation** as a result, so that they in some cases do not even participate in school lunches because they are afraid (cf. SOFI & IAB 2016, Storey & Chamberlin 2001, Raine et al. 2003, Radisch et al. 2017, Oostindjer et al. 2017). This stigmatisation effect of the food on the one hand and the children and young people on the other hand is also backed by the observation that the more the support is focused on low-income households, the lower the uptake. And this applies both to those who are actually entitled to receive support and to those who are not entitled because of higher incomes (Kitchen et al. 2012, Leo-Urbel et al. 2013). Even a payment system, such as a chip card system, that does not make it overtly recognisable that the respective child belongs to a low-income family is unlikely to solve this problem, as it is also implicitly conveyed or recognisable in social contacts and the food itself is also “stigmatised”. In the USA, it has been shown that non-free, “competitive” food (such as additional paid menu lines or snacks offered by cafeterias, kiosks, vending machines, etc.) has stigmatising effects on free school meals, as only children with money can buy “competitive”, i.e. non-subsidised, food. This gives children the impression that free school meals are chiefly for poor children and not for all children. This **“competitive” stigmatisation effect** was associated with lower uptake and reduced participation (Bhatia et al. 2011). Shirley Watkins, the former Under-Secretary of the USDA, recognised as early as 2001 in her report for the US Congress that competitive foods undermine the integrity of school meal programmes and reduce participation (Bhatia et al. 2011).

---

<sup>416</sup> Current experience shows that this expense is a major obstacle to the use of benefits from the education and participation package (cf. Section 7.5.1.1).

- It could be argued that the problem could be solved by a model in which the parents of all children and young people are required to pay a flat monthly meal allowance and the requirement rates of needy households are increased accordingly. However, this would place a strain on those families who are in need but do not apply for assistance for various reasons. In addition, the means testing and implementation create **administrative obstacles**, which in turn act as a deterrent especially for households in need. Furthermore, additional administrative costs arise, so that the intended effect is at least in part counteracted (see also the debate on the “Online eligibility checking system (ECS)”<sup>417</sup> in Great Britain).

Against this backdrop, the Advisory Board believes that there is much to be said for the analysis of the success factors of a good all-day school presented by Radisch et al (2017)<sup>418</sup>. In this analysis, the interviewed school headteachers stress “how important it is that, particularly regarding equal opportunities at their schools, all components of the all-day school are free of charge. This means that access must be free of charge for pupils so that all can benefit from all offers and no selection effects arise. This is to be interpreted as an implicit call to enforce these regulations for all all-day schools” (Radisch et al. 2017: 25, see also Schwartz & Rothbart 2017).

**Preschool and school catering would thus become elements of general social services**, in which three central aspects - the (1) quality of “what” and (2) “how” children and young people eat and (3) that they do **so together** - would interact and influence each other: A free meal is not expedient if the quality of the food and the quality of the food environment are not improved at the same time. If the quality is low, only few children and adolescents will take up the offer, which again increases the cost per meal, reduces the health and social effects and hinders the learning process. The implementation of free preschool and school meals is therefore dependent on wide social acceptance. It requires a **transformation step**, a cultural change from a marginal “compulsory task” to a key element of the food environment and general public services.

When deciding on the scale of state funding for preschool and school meals, however, it must be taken into consideration that the financial resources that consequently benefit non-needy families are not available for other, targeted measures. The distributional effects must also be taken into account: Full state funding corresponds to an income transfer to households with children, which would also benefit households that, due to their income, do not rely on this state support. However, they also indirectly contribute more to the financing of the measure via tax progression. It should also be noted that in the event of full state funding, all taxpayers share in the costs, even if they do not have children attending preschools or schools. Far-reaching or full funding of preschool and school catering therefore seems to be justified especially if the promotion of a sustainable diet is seen as a **task for society as a whole**. This is the opinion of the WBAE.

---

<sup>417</sup> [https://dera.ioe.ac.uk/31079/1/SN04195%20\\_Redacted.pdf](https://dera.ioe.ac.uk/31079/1/SN04195%20_Redacted.pdf).

<sup>418</sup> Radisch et al. (2017) follow a “best practice approach” and in 2016 interviewed school administrators of ten all-day schools that had been awarded the German School Award (cf. <https://www.deutscher-schulpreis.de/was-macht-gute-schule-aus>) or the Jakob Muth Award (cf. <https://www.jakobmuthpreis.de/>) for their successful pedagogical work.

### 8.2.3 Estimation of public expenditure in the case of complete public funding

One of the key challenges regarding preschool and school catering at all-day facilities that is free for private households is to cover the costs from public budgets. Here, a distinction must be made between covering running costs (maintenance of buildings and equipment, personnel costs, cost of goods purchased, operating costs) and the one-off need to equip schools and preschools with kitchens and refectories for the first time or to increase the existing equipment to an adequate extent. The WBAE therefore makes a **rough estimate of these costs** in this Section and discusses their amount. A summary of the bases of the calculation and the results of a full cost calculation are set out in Table 8-3.

**Table 8-3:** Estimation of public expenditure for the full financing of high-quality and free preschool and school catering (full costs)

	Preschools	Primary schools	Secondary schools	Total
<b>Baseline data for schools and preschools</b>				
Number of children in schools and preschools (million)	3.30	2.86	5.54	11.70
thereof in all-day care	2.60	1.11	1.99	5.70
Operating days per year	235	190	190	
Size of preschool/school (number of children/adolescents) $\emptyset$	75	180	460	
<b>Investment in buildings &amp; equipment per school/preschool (EUR)</b>				
Investment into buildings, refectory and kitchen*	150,000	540,000	787,500	
Investment into equipment, refectory and kitchen*	32,200	141,900	321,200	
Quality premium equipment 20 %	6,440	28,380	64,240	
Sum of investment costs	188,640	710,280	1,172,940	
Costs of building and equipment per year	16,461	63,493	111,096	
<b>Costs per meal (EUR)</b>				
Costs building and equipment	0.93	1.86	1.27	
Staff costs	1.44	2.18	1.62	
Costs of goods purchased	1.54	1.22	1.71	
Operating and administrative costs	0.57	0.86	0.82	
Total costs per meal	4.48	6.12	5.41	
<b>Total costs across Germany at 95 % take-up (billion EUR per annum)</b>				
For today's all-day pupils and preschool places with lunch	2.6	1.2	1.9	5.8
For an 80 % share of all-day schools and all preschool places today	3.3	2.5	4.3	10.2

Note: \* For preschools, only investment in kitchens. For schools, 70% of the estimated investment costs are shown here, as 30% use for other purposes is assumed. Depreciation 4% for buildings, 10% for equipment; interest rate 3%; maintenance/repairs 2%.

Sources: Federal Statistical Office (2019d, 2018e, f), Tecklenburg et al. (2019), Arens-Azevedo et al. (2014), WBAE calculations.

In total, about 11.7 million children attend preschools and schools in Germany. The calculated average full costs per meal range from about 4.5 euros in preschools to just over 6 euros in primary schools. The calculations are based on the following data and assumptions:

- **Size of preschools and schools and operating days:** The calculations assumed an average school size of 180 pupils in primary schools and 460 pupils in secondary schools and that school kitchens operated on 190 days per year. For preschool catering, differences ensue from the fact that the size of preschools is on average smaller than that of primary and secondary schools (75 children/preschool) and the fact that the amounts consumed by children aged 0 to < 7 years are much smaller than those consumed by primary and secondary school pupils. Furthermore, preschools have longer operating hours, with an average of 235 operating days per year.
- **Investment costs for buildings and equipment:** A sum was added over and above the usual cost calculations when calculating the annual costs of buildings and equipment to allow for the creation of an appealing food environment. In order to calculate the investment costs in the preschool sector, it is assumed that meals are eaten at tables in the group rooms and that no dining rooms/canteens are required. For an average preschool size of up to 75 children, a small kitchen with a few large kitchen appliances such as commercial dishwashers and combi-steamers is assumed.

With respect to room sizes, it is assumed that the school canteens are operated in three shifts and that the average required room amounts to 1.5 m<sup>2</sup> per pupil. It is also assumed that the dining rooms of the refectories are occupied 30% of the time for other activities (theatre groups, conferences, etc.) and thus only 70% of the costs are to be assigned to school catering.

Both in preschools and in schools, 50% of the kitchens are assumed to be production kitchens with a fresh and mixed kitchen catering system. Apart from the high demands made on technical and sanitary facilities (ventilation, water supply with sinks, floor drains for water with grease separators, special non-slip flooring, three-phase AC current), a production kitchen also requires adequate equipment with appliances for preparation (cutting, grating, stirring), with cooking appliances, refrigerators and commercial dishwashers. The remaining 50% is divided equally between the Cook&Chill and hot food catering systems. Given that these systems supply the preschools and schools either with the complete meals or with the main components, only one relay kitchen is needed in the facilities on the ground. In this relay kitchen, refrigerated meals can be reheated and, if necessary, salads or desserts can be additionally produced at the school / preschool. The main and secondary utilisation areas of a relay kitchen are smaller than those of a production kitchen.

The investment costs calculated on the basis of these assumptions range between 188,640 euros per preschool and 1.17 million euros per secondary school. This results in annual costs (depreciation, interest and maintenance/repairs) ranging between 20 and 30% of the full costs per meal.

- **Running costs:** For the running costs, the annualised costs for buildings and equipment, personnel costs, cost of goods purchased and the operating and administrative costs were taken into consideration. The personnel costs account for the largest share here and total about 30 to 36% of the full costs of preschool and school catering. With regard to the cost of goods purchased, compliance with the DGE standard was assumed with an organic share of 20%.

- If the costs of the midday meal thus calculated for all children who are currently in all-day care in preschools or attend all-day schools were to be fully covered by the state, this would result in public expenditure of around 5.8 billion euros per year. It should be taken into consideration that a 95% take-up rate is assumed, which corresponds to the previous experience following the introduction of free school meals in Berlin<sup>419</sup>. The WBAE assumes that, as a realistic key scenario, around 80% of school children would, in the long term, attend all-day schools and around 3.3 million children would be looked after in all-day childcare facilities. Extrapolating today's figures, this would amount to 10 billion euros of public funding per year, of which around 32% would be needed for childcare facility meals, 25% for primary school meals and 43% for secondary school meals.
- In order to estimate the additional strain on public budgets, however, the public subsidies already paid for preschool and school catering must be deducted from the 10.2 billion euros of public expenditure in the key scenario. It can be assumed that both the costs for buildings and equipment as well as the operating costs (order of magnitude: about 1.8 billion euros) are already largely covered by public budgets (albeit with a lower uptake rate in communal catering). In addition, there are public subsidies for low-income households. If one also bears in mind that the Strong Families Act (*Starke-Familien-Gesetz*) has created an entitlement to free preschool and school meals for 4 million children (BMFSFJ 2019) and thus for about one third of all children and adolescents in preschools and schools (Table 8-3), this generates an additional expenditure of **about 5.5 billion euros after deducting payments already made and to be made in the future; a sum that amounts to about 4% of the annual public expenditure on education.**

Furthermore, it must be taken into account that these are **not economic costs**: If the children were catered for in private households, substantial costs would also be incurred, notably if one takes into account the opportunity costs of working in households where all adult household members are employed. The costs must also be compared with the benefits achieved by the measure, which would arise in the short, medium and long term through a high-quality diet, the influence on food consumption habits, the possible starting points for nutritional education and the experience of a common eating culture.

In addition to the long-term strain on public budgets, it must also be taken into consideration that many preschools and schools today have no or insufficient kitchen and dining facilities (cf. Section 7.5.1). In this respect, there is a need for "start-up funding" anyway. The scale of this initial investment, which would have to be made within a few years in the event of rapid implementation, is estimated in Table 8-4.

---

<sup>419</sup> According to an oral statement by the Association of Berlin and Brandenburg school caterers

**Table 8-4:** Investment needs in school kitchens and canteens

	Preschools	Primary schools	Secondary schools	Total
<b>Baseline data for schools and preschools</b>				
Number of schools	55,293	15,409	17,500	
Number of all-day schools/preschools	79 %	39 %	36 %	
Number of all-day schools/preschools*	43,617	5,970	6,293	
of which good (only improvement of eating environment)		40 %	40 %	
of which upgrade		50 %	50 %	
of which new investment		10 %	10 %	
<b>Investment in buildings and equipment per school/preschool (EUR)</b>				
Investment in eating environment (= quality premium for equipment)		28,380	64,240	
Upgrade (50 % of the costs of new construction kitchen + 10 % refectory)		102,344	226,577	
New investment	188,640	710,280	1,172,940	
<b>Total investment sum (billion EUR)</b>				
For today's all-day pupils and preschools with lunch	0	0.8	1.6	2.4
80 % share of all-day schools all preschools today with lunch	2.2	5.3	10.7	18.2

Note: \*Assumption: There is no acute need for investment in all-day childcare facilities.

Sources: KMK (2018), Federal Statistical Office (2018e, g), Arens-Azevedo et al. (2015), StEg (2019), WBAE calculations.

For the calculations, it was assumed that 40% of today's all-day schools are already well equipped with kitchens and canteens, so that only investments for improving the food environment are needed. Around 50% of the schools need an upgrade<sup>420</sup> of kitchens and dining halls and about 10% of all-day schools require the complete investment sum, as they are not yet equipped with usable kitchens and refectories. The above-mentioned percentage of production and relay kitchens was assumed in each case. This would result in a total investment requirement of about 2.4 billion if all of today's all-day schools were to be equipped accordingly. For the central scenario assumed above of 3.3 million children in all-day preschools and a proportion of 80% all-day schools, the investment requirement amounts to around 18 billion euros. Of this, about 59% is accounted for by secondary schools, 29% by primary schools and 12% by preschools. If one assumes that these investments

<sup>420</sup> For the upgrades, it was assumed that the kitchens would need 50% of the investment sum for a new building and the canteens 10% of the investment sum for a new building.

are spread over a period of 5 to 10 years, for instance, the annual burden amounts to about 18 to 36% of the full costs of school catering.

Given that the depreciation costs and interest for buildings and their equipment account for around 20 to 30% of the full costs of preschool and school catering (cf. Tab. 8-3), a potential participation in the investment costs offers the Federal Government the option to contribute considerably to the financing of preschool and school catering that is free of charge for private households. The remaining costs, which account for the bulk of the full costs, would have to be covered by the *Länder* or municipalities in the case of state financing; accordingly, considerations would have to be made concerning the distribution of tax revenues.

#### 8.2.4 Evaluation of the implementation and achieved effects of high-quality and free preschool and school meals

The implementation of high-quality preschool and school meals that are free of charge for parents poses a great challenge in the federal interplay between the Federal Government, the *Länder* and the municipalities (cf. Section 7.5.1) and implies comparatively high costs for public budgets (cf. Section 8.2.3). It is therefore dependent on broad social acceptance. Ultimately, the concept of free, comprehensive and controlled quality catering for preschools and schools presented here is a transformation step, a cultural shift from a marginal “compulsory task” to an essential element of the food environment.

Therefore, the WBAE recommends drawing up an **independent, scientific implementation and evaluation programme** (hereafter referred to as the “**HOW**” programme) that increases the political feasibility of the measures by creating evidence about implementation, efficacy and cost-effectiveness. Moreover, as recommended by the European Commission and OECD, this should establish a “culture of impact research”, in which policymakers take it for granted that policy measures in the food and nutrition sector are also examined for their impact using scientifically recognised methods (see also Section 5.3) and are to be further developed on the basis of these findings.

Against this backdrop and in view of the substantial costs of high-quality preschool and school meals that are free of charge for parents, an empirical evaluation of the implementation and the effects achieved is very important (Lobb & Colditz 2013). The evaluation of the implementation is aimed at assessing the extent to which the measure was implemented as planned and reached the target population (“impacts”), while the evaluation of the achieved effects (“outcomes”) systematically records the short- and long-term effects (e.g. quality of nutrition, psychological well-being and performance, body weight) (see also Table 8-2). The evaluation of comparable measures, such as educational policy schemes, now takes place in many OECD and EU countries (OECD 2018c). The European Commission has also established an “evaluate first” principle for new strategies and regulations since 2015 (EU COM 2015).

However, relatively few systematic evaluations of school-based interventions to improve pupils' food consumption habits are available so far (Alex-Petersen et al. 2017, Illøkken 2015, Illøkken et al. 2017, Oostindjer et al. 2017). In their systematic review and meta-analysis, Micha et al. (2018) were only able to identify a total of 91 school interventions, ranging from the supply of fruit, vegetables or drinking water to the introduction of quality standards, which overall showed a positive impact on the food consumption habits of children and adolescents.

In Germany, the Land of Thuringia is currently promoting the implementation of the DGE quality standards and the improvement of kitchen equipment in selected Thuringian schools.<sup>421</sup> This measure is to be scientifically accompanied and evaluated, e.g. through random quality checks by representatives of the competent Ministry. However, it is unclear to what extent the projects comprise a scientific evaluation.<sup>422</sup>

For the reasons mentioned above (cf. Sections 8.2.1 to 8.2.3), the WBAE recommends the gradual introduction of free preschool and school meals). However, the impact of free meals for all private households compared with income-dependent provision has not yet been systematically studied in Germany (cf. Section 8.2.2). Studies in other countries, including a three-year study in the UK<sup>423</sup>, studies in various regions in the USA (Leos-Urbel et al. 2013, Mirtcheva & Powell 2009, Schwartz & Rothbart 2017, Turner et al. 2019), as well as in Sweden (Alex-Petersen et al. 2017) and Norway (Illøkken 2015), show that free meals generally result in higher participation rates and have positive cognitive, social and health effects. However, these studies also demonstrated that the conditions of the implementation (e.g. quality of the offer, what age groups are included, cf. Section 8.2.2) are key for a successful implementation. It would therefore be imperative to systematically evaluate the impact that the implementation of free meals in Germany has on the participation rates and also to systematically evaluate the cognitive, social and health effects.

For the scientific evaluation programme, the broadest and most comprehensive data sources possible should be employed. On the one hand, measures to improve preschool and school catering that have already been adopted by the Federal Government and the *Länder*, or that are already ongoing, should be evaluated. On the other hand, a new Federal Government/*Länder* programme should create the possibility of comparing different implementation models with general free preschool and school catering in the context of pilot projects. Since a free preschool and school catering system cannot be implemented in one step on account of its scale, it makes sense to use the gradual introduction to carry out a well-founded evaluation, e.g. as part of either a wait-and-see control group design or randomised control group trials (RCTs; cf. Section 5.3). This approach would

---

<sup>421</sup> See: Guideline for promoting the implementation of scientifically recognised quality standards for school catering as part of the project for partial subsidisation of the midday meal in selected Thuringian schools (ThüriForRLSchulvQ). [https://www.thueringen.de/mam/th4/justiz/ernaehrung/rl\\_thuerfoerdrlsruhulvq.pdf](https://www.thueringen.de/mam/th4/justiz/ernaehrung/rl_thuerfoerdrlsruhulvq.pdf).

<sup>422</sup> <https://polit-x.de/documents/1597378/bundeslaender/thuringen/landtag/dokumente/antwort-auf-kleine-anfrage-2019-02-11-umsetzung-der-thuringer-forderungsrichtlinie-schulverpflegungsqualitat>.

<sup>423</sup> <https://www.gov.uk/government/publications/evaluation-of-the-free-school-meals-pilot-impact-report>.

be advantageous because implementation and design can be adjusted (see also the “learning by doing” approach, WBAE & WBW, 2016).

### Investigation of already adopted or ongoing measures

#### *Federal level: “Strong Families Act”<sup>424</sup>*

- The “Strong Families Act”, which was adopted in early 2019, abolished on 1 August 2019 the previously applicable parental contribution for children and young people from households receiving transfer payments to participate in communal meals in preschools and schools (cf. Section 7.5.1). It is expected that up to 4 million children nationwide will be able to benefit from this measure.
- “Gute-KiTa-Gesetz” (Act on Good Early Childhood Education and Care).<sup>425</sup> This Act, which took effect on 1.1.2019, provides for promotion of measures, for example in the areas of health, nutrition and physical exercise (Section 2 subsection 6), and the development of suitable measures for quality development and quality management (Section 4 subsection 4).<sup>426</sup>

#### *Länder level and municipalities:*

- Free school meals for grades 1 to 6 from 2019 in Berlin; a measure expected to affect over 170,000 pupils.<sup>427</sup>
- Specific measures taken by individual *Länder* or municipal school authorities to improve the quality of preschool and school catering.

These already planned or ongoing measures can provide very valuable data and indications with respect to implementation, effectiveness and acceptance if they are studied using appropriate research designs. This can be done as part of longitudinal field studies with repeated data collection or, if possible, using “natural experiments”.<sup>428</sup> In order to obtain meaningful data for evaluation, it

---

<sup>424</sup> See: <https://www.bmfsfj.de/bmfsfj/service/gesetze/starke-familien-gesetz/131178>.

<sup>425</sup> See: <https://www.bmfsfj.de/gute-kita-gesetz>.

<sup>426</sup> At the time of writing, it has become evident that some *Länder* would use the funds to improve the quality of childcare (e.g. Baden-Württemberg, see <https://km-bw.de/,Lde/Startseite/Service/2019+07+16+Qualitaetsschub+fuer+fruehkindliche+Bildung/?LISTPAGE=3448949>) and other *Länder* to reduce or abolish parental contributions (e.g. Mecklenburg-Western Pomerania, see <https://www.svz.de/regionales/mecklenburg-vorpommern/Gute-Kita-Gesetz-Kitas-in-MV-erhalten-106-Millionen-Euro-id25107197.html>). The extent to which the law will promote measures specifically in the area of food and nutrition was still unclear at the time of writing this expertise.

<sup>427</sup> See: <https://www.rbb24.de/politik/beitrag/2019/04/berlin-agh-schulessen-kostenlos.html> and <https://www.food-service.de/maerkte/news/schulverpflegung-berlin-beschliesst-kostenfreies-essen-in-schulen-41973>.

<sup>428</sup> Natural experiments contain an “experimental group” (schools and preschools where the intervention has been implemented) and a “control group” (schools and preschools where the intervention has not (yet) been implemented). In contrast to an experiment or a randomised controlled trial (RCT), assigning participants to the experimental or intervention group and to the control group is not randomised. The derivation of causal conclusions is therefore limited in natural experiments compared with classical experiments.

would be very useful to implement as quickly as possible in order to be able to conduct surveys prior to the implementation of the respective measures.

### **Federal Government - *Länder* programme for the implementation and evaluation of measures**

It is suggested that the interested *Länder* should implement pilot studies, preferably as soon as possible, on fully publicly funded catering in schools and preschools, co-financed by the Federal Government. The pilot studies are to be designed in such a way that effectiveness, problems of implementation and cost efficiency can be investigated based on randomised controlled studies. The Federal Government should coordinate the programme and ensure cross-state dissemination and utilisation of the research results. An important aim of this programme component is to comparatively investigate different variants of implementation in order to gain policy-relevant insights into their effectiveness and acceptance.

As set out above, the aim is to examine different implementation variants. It is essential in this respect that the effectiveness and cost efficiency of quality assurance measures is examined, e.g. strategies that rely more on state control should be compared with procedures that provide for greater user involvement (e.g. surveys among children and parents; formalised complaint options). Of particular interest are the interactions between the assurance of quality standards regarding the quality of the foodstuffs ("what" is eaten) and the food environment ("how" it is eaten) on the various "outcome" indicators (participation rates, cognitive, social, mental and physical health indicators). The studies on breakfast participation rates in New York, which compared free and (partial) cost-sharing, also show that it is necessary to implement longitudinal recording over a longer period of time (at least three years), as changes occasionally only occur with a time lag and only in this way can long-term effects be estimated.

It is also essential that the **evaluation meets generally accepted scientific quality standards**. This includes, for example, the prior specification of the measure, the target criteria (e.g. participation rate, quality standards) and the study design as well as an appropriate evaluation of data. With respect to the design of the research, it would be desirable, as already mentioned above, to use a randomised controlled trial design (RCT, cf. Section 5.3)<sup>429</sup>. This research design involves the units

---

<sup>429</sup> Randomisation prevents a bias due to selection effects which would arise if, for example, in the event of voluntary participation, the preschools or schools which participate in a pilot scheme are mainly those that already have better conditions for the implementation of high-quality school nutrition. In this case, the results of such a non-randomised pilot would not be transferable to all schools or preschools, because the positive impact of the measure would tend to be overestimated and the implementation issues underestimated. Randomisation is also deemed advantageous because conditions that influence the feasibility and effectiveness of measures (e.g. the quality of school management) can only be observed and statistically controlled to a limited degree. Randomised controlled trials on the effectiveness of measures are now well established on an international scale and are seen as the "gold standard" for planning evidence-based policy measures. An indication of this is the fact that the 2019 Nobel Prize in Economics was awarded to three scientists who had made particular contributions to this experimental method in developing countries (see <https://www.nobelprize.org/uploads/2019/10/press-economicsciences2019-2.pdf>). It is suggested that this quantitative research approach should be combined with qualitative and participatory research methods, as it is precisely the study of governance problems that necessitates research approaches that examine processes of implementation in more detail, e.g. the tendering process for catering, quality control processes or community management. See e.g. Birner and Sekher (2018) who suggest a participatory mapping of implementation processes (called: Process Net-Map) to identify governance problems in dietary schemes.

investigated, in this case the preschools and schools, being randomly selected from a defined population (hence “randomised”) and compared with a likewise randomly selected control group. An obvious option to implement this design is the waiting control group design. In this case, the measure is also implemented in the control group, but at a later point in time (hence waiting control group). However, more “pragmatic” study designs can also be used, such as those described in PRECIS (Pragmatic Explanatory Continuum Indicator Summary, Loudon et al. 2015).

### 8.2.5 Conclusion

Given the problems identified in Section 4.2 and the situation in preschool and school catering described in Section 7.5.1, the quality campaign in preschool and school catering called for by various stakeholders is to be welcomed. This quality campaign should consider not only the quality and quantity of the food offered, but also the entire food situation and environment, in order to promote social participation and inclusion. Further quality aspects in this sense include integrating preschool and school meals into the all-day pedagogical concept of preschools and schools, and securing access for all children and adolescents in all-day care, notably in order to avoid selection effects and to foster the potential of preschool and school meals as a social learning place for food consumption habits.

Against this backdrop, the WBAE suggests a reorientation of the preschool and school catering policy for Germany, towards **more sustainable, free and comprehensive preschool and school catering as part of the general services provided by the state**. It must be taken into consideration that the **quality aspects mentioned above are intertwined**, i.e. they influence each other: A free meal is not expedient if the quality of the food and the quality of the food environment are not improved at the same time.

The WBAE recommends a step-by-step introduction based on a scientific implementation and evaluation programme (“WIE” programme, cf. Section 8.2.4), since implementing the recommendation on high-quality catering in schools and preschools that is free of charge for the parents involves major challenges and costs for the public sector. This should explore the effectiveness and cost efficiency of the proposed measures based on pre-described criteria and identify problems in implementation as well as possible solutions.

## 8.3 Regulation of portion sizes

Section 3.4 of the present expertise illustrates that the larger the available portions are, the more food we consume without necessarily being aware of it (Hollands et al. 2015, Zlatevska et al. 2014) and that package and portion sizes have, in part, increased substantially (Benton 2015, Steenhuis & Poelman 2017). Based on the results of a systematic Cochrane review and meta-analysis, Hollands et al. (2015) estimate that differences in package size are equivalent to an absolute

change in average daily energy intake of 215 to 279 kcal and that the average daily energy intake could be reduced by approximately 12% to 16% among UK adults and by 22% to 29% among US adults if larger-sized portions were not available.

Therefore, as outlined in Section 3.4, there is, on the one hand, clear scientific evidence of problematic portion-size effects (overconsumption), which people are hardly aware of. On the other hand, developing instruments for reducing undesirable portion-size effects is no easy task due to the abundance of products on offer in shops and in away-from-home catering. In the following, we will therefore first present some findings gathered from scientific research on the effectiveness of relevant measures before discussing how practicable they would be in Germany in view of the applicable legal framework.

### 8.3.1 Instruments for addressing the portion-size effect

The issue of portion-size effects has been rarely discussed at political level so far, at least as far as Germany is concerned.<sup>430</sup> In the National Reduction and Innovation Strategy for Sugar, Fats and Salt in Convenience Foods, the BMEL put forward the reduction of portion sizes of foods as a possible starting point for reducing the population's energy intake. In contrast to the six remaining areas of action mentioned (e.g. reducing sugar, fats and salt), the BMEL did not, however, set out further measures or strategies regarding portion sizes (BMEL 2018).

Building on the factors and mechanisms described in Section 3.4, several studies suggested measures with different levels of intervention (Table 8-5; for an overview of these studies, cf. Marteau et al. 2015 and Steenhuis & Poelman 2017).

**Information and labelling:** Different dietary recommendations encourage consumers to eat adequate or smaller portions and to avoid consuming oversized portions (Raynor 2014). However, these recommendations are often unspecific and do not clearly describe what is to be understood by an adequate portion in the individual case. In general, providing information in the form of labelling (e.g. indicating portion or serving sizes) only produces minor or no effects at all. Portion-size information is currently provided on food packaging in two different forms: on the one hand, some producers provide recipes on their foods to voluntarily indicate the number of servings a specific packaging comprises when prepared. On the other hand, producers can also supplement the mandatory nutrition information with additional nutrition information referring to one serving.

---

<sup>430</sup> So far, consumers have primarily considered package sizes as problematic because they felt misled by them, e.g. in the case of slack filling or deceptive packaging. These terms designate the use of package sizes that are sometimes significantly larger than the actual content would require. The consumer advice centre in Hamburg reported a case in which the producer's sugar reduction strategy apparently did not consist in reducing the sugar content in its product (an instant tea with "vanilla-cinnamon chai latte flavour") but, instead, in reducing the level of package fill of the individual portions (to 14 instead of 25 g). Although the nominal price remained the same, this practice made the "less sugar" product nearly 80% more expensive than the "standard" product in relation to the basic price. <https://www.vzh.de/themen/lebensmittel-ernaehrung/produktchecks/krueger-chai-latte-weniger-suess-weniger-drin-weniger-chai-latte>.

Further indications of portion sizes can be found in recipes. It is, however, left to the producers' discretion to determine the size of a portion.

Even by explicitly informing consumers about the portion-size effect it cannot be eliminated. Even if people are made aware of the fact that larger portions sizes generally increase their food intake without them noticing, this effect still occurs without their conscious awareness and without adding to their sense of fullness (Cavanagh et al. 2014, cf. Section 3). Product names and designations implying a lower energy density or a smaller amount (e.g. "low-fat") may also lead to higher consumption (Chandon 2013). Designations implying larger amounts (e.g. "double"), in contrast, lead to reduced consumption (cf. Sections 3.3 and 6.4).

Approaches to informing consumers about portion sizes should therefore not only be of an explicit nature (i.e. raising awareness of the effects), but should first and foremost address implicit aspects. Product names and designations should, for instance, not imply a lower energy density or a smaller amount. Another option would be modifying "default sizes", such as the quantities specified in recipes provided by producers, cookbook authors or websites. This means that a main dish intended for adult consumers should not exceed a certain amount of calories determined by nutritionists.

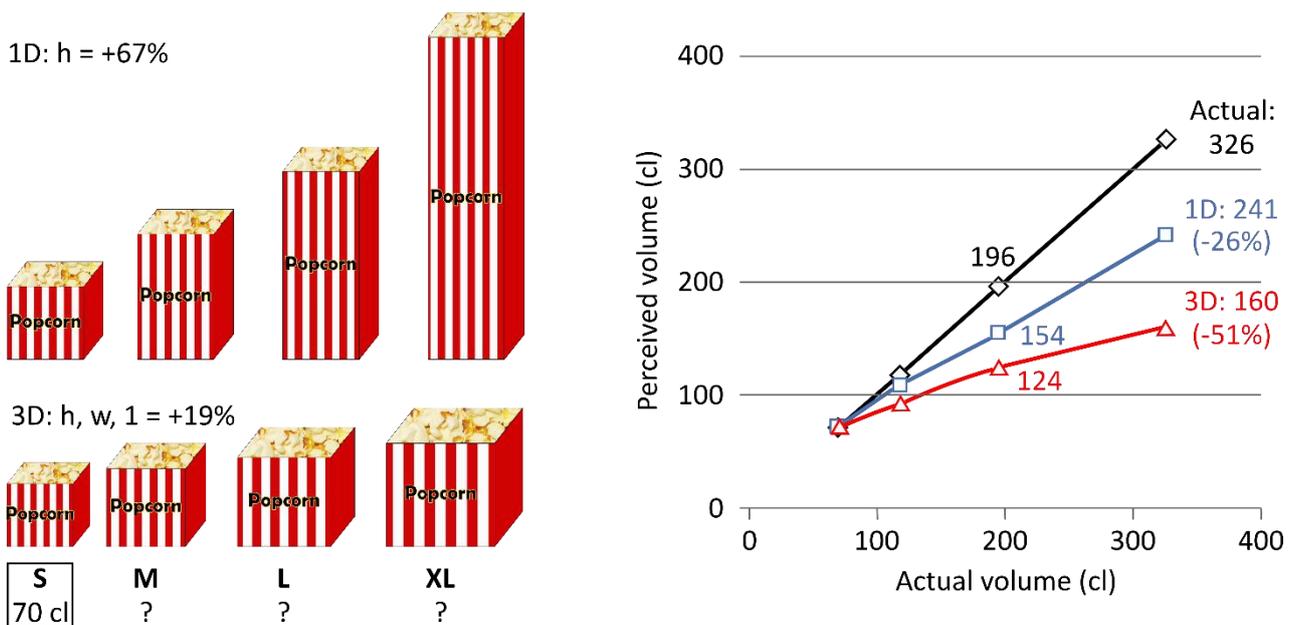
**Table 8-5:** Measures aimed at modifying portion sizes

<p><b>Information and labelling</b></p> <ul style="list-style-type: none"> <li>• General dietary recommendations encouraging consumers to eat appropriately sized portions</li> <li>• Portion size information on food packaging</li> <li>• Explicit awareness-raising regarding portion-size effects</li> <li>• Product names or designations should not imply a lower energy density or a smaller amount ("low-fat")</li> <li>• Modification of the standard size (defaults), e.g. quantities specified in recipes</li> </ul>
<p><b>Support in decision-making processes/nudging (modification of standards/defaults)</b></p> <ul style="list-style-type: none"> <li>• Segmenting product volumes into smaller units</li> <li>• Making available smaller product sizes or portions</li> <li>• Modification of packaging</li> <li>• Modification of tableware (dishes, cups, glasses, cutlery)</li> </ul>
<p><b>Limiting choice by regulating oversized packaging units/portions (downsizing)</b></p> <ul style="list-style-type: none"> <li>• Regulating the integration of smaller package or portion sizes into the available product range</li> <li>• Regulating all-you-can-eat restaurants and buffet meals</li> <li>• Regulating the placement of portion sizes on shelves, in restaurants, on the menu</li> <li>• Adjusting default sizes in away-from-home catering</li> <li>• Providing economic incentives for consumers</li> </ul>

**Support in decision-making processes/nudging** Various studies have demonstrated the effectiveness of measures to increase product choice and support or boost self-regulation. These include segmenting product volumes into smaller units. For example, the consumption of potato crisps was lower when the packaging contained coloured segmentation cues (Geier et al. 2012). These segmentation cues call attention to and encourage better monitoring of eating, thus preventing automated eating sequences. Making available smaller portions has also proven to be efficient. Chandon (2013) has shown that the smallest and the largest portion or serving size are the two extremes that define what is perceived as an adequate portion (anchor effect). Therefore, the availability of smaller portions not only has a direct effect on consumer behaviour by making consumers buy or consume them but also has an indirect effect by exposing consumers to these smaller portions as they implicitly define the appropriate amount to consume and the applicable social norm.

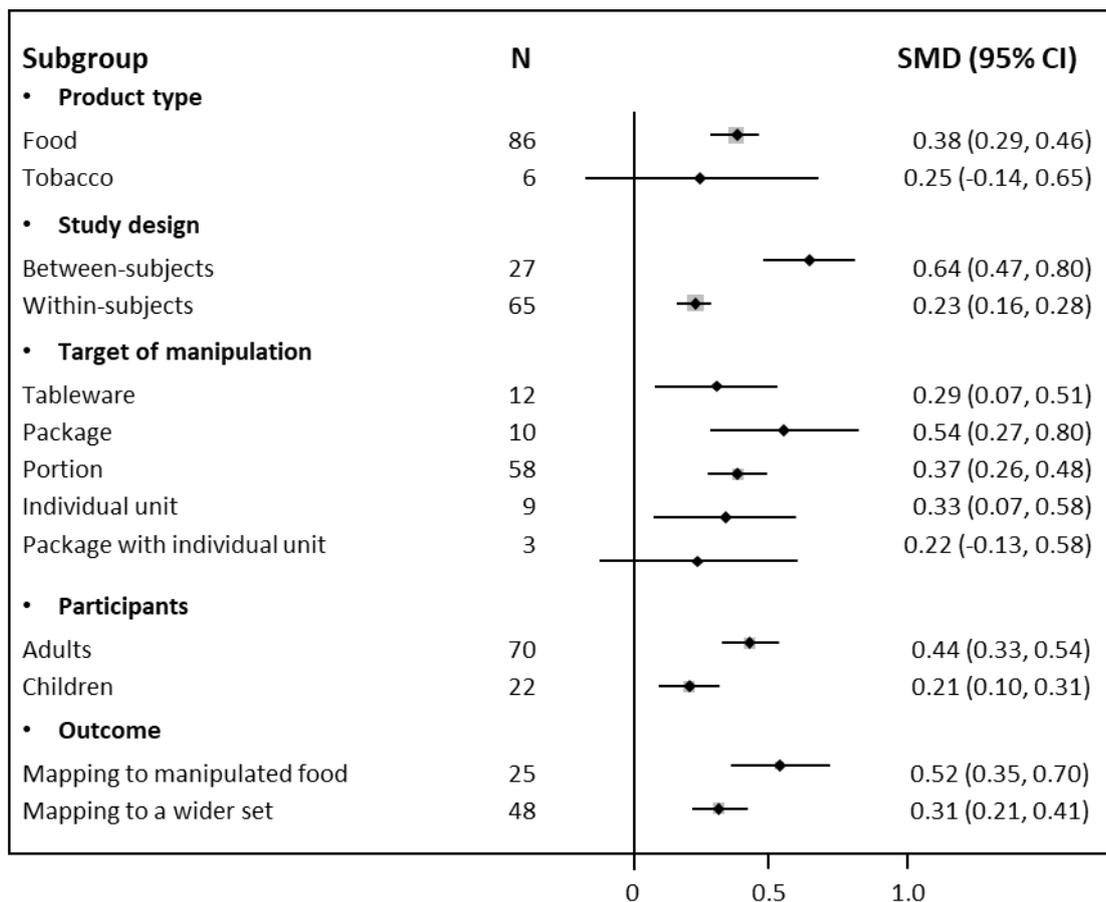
Chandon (2013) argues that where small portion sizes are not (or no longer) available, consumers' product choice will shift accordingly. This means that it is not just the size of the portion actually consumed that is relevant for consumer behaviour; instead, the entire range of portion sizes available produces behavioural effects due to exposure. Consequently, in addition to large portion sizes, there should always be adequate options for consumers to choose smaller-sized portions. Otherwise, the social norm will be recalibrated, e.g. what we perceive as a "normal" and appropriate portion will become larger, which ultimately leads to a change in portion choice and higher consumption (e.g. Haynes et al. 2019, Raghoobar et al. 2019). This may, however, bring about trade-offs, e.g. due to an increase in packaging waste through smaller package sizes.

The shape of the packaging or tableware sometimes has a significant impact on the estimation of amounts consumed. If only one aspect of a package changes, we underestimate the increase in volume less drastically than if height and width change proportionally (Fig. 8-7, Chandon 2013, cf. also Sharpe et al. 2008).

**Figure 8-7:** Underestimation of supersizing depending on the type of packaging

Source: Chandon (2013: 18).

Changes in standard sizes have a similar effect (defaults, nudging). Hollands et al. (2015) conducted intervention studies on the consumption of food, tobacco products and alcohol involving exposure to different sizes of portions, packages, individual units or items of tableware. These were summarised in a Cochrane review (and meta-analysis). Studies regarding food (with a total of 86 comparisons and 6,603 participants involved, cf. Fig. 8-8) found a significant overall portion-size effect (SMD = 0.38). Furthermore, positive effect sizes were found for tableware, package and portion sizes: the larger these were by default, the greater the quantities were that people consumed, compared to a control group or in a pre-post comparison (Fig. 8-8). Moreover, the review by Reynolds et al. (2019) shows that smaller plate sizes represent an effective instrument for reducing food waste, i.e. that they have positive side-effects.

**Figure 8-8:** Outcome of a Cochrane review and meta-analysis on portion-size effects

Note: SMD = standardised mean difference. A value of 0.2 represents a small effect, 0.5 a moderate effect and 0.8 a large effect (Cohen 1988). Re-expressed as equivalent to the average increase in the mean daily energy intake (in%) from food, which is estimated to be 1727 kcal/day according to a representative random sample taken among UK adults, the following SMDs correspond to the respective percentages: 0.1 = +2.7% (45 kcal), 0.2 = +5.5% (90 kcal), 0.3 = +8.2% (135 kcal), 0.4 = +10.9% (180 kcal), 0.5 = +13.6% (225 kcal), 0.75 = +20.5% (338 kcal).

Source: Hollands et al. (2015: 29), graphically adjusted.

Different instruments can be envisaged to reduce the problematic effects mentioned and to support consumers:

**Limiting choice by regulating oversized packaging units / portions (downsizing).** Reducing portion sizes is a possible measure that Michael R. Bloomberg, at that time mayor of New York, made widely known by putting forward a proposal to this effect. He wanted to limit the size of soft drinks to 16 ounces (473 ml), which sparked massive counter-reactions by the beverage industry and other stakeholder groups. Ultimately, the initiative was overruled by court decision one day before it was to enter into force.<sup>431</sup> Great Britain has announced efforts to reduce portion sizes within the scope of its “Public Health Responsibility Deal”. For example, Mars, Nestlé and Mondelez have

<sup>431</sup> Cf. New York Times, 2013: <https://www.nytimes.com/2013/03/12/nyregion/judge-invalidates-bloombergs-soda-ban.html>.

committed themselves to limiting the energy content of single-serve confectionery to 250 kcal and a number of cinemas have restricted the size of their soft drinks to a maximum of 32 ounces (946 ml) (Marteau et al. 2015). The extent to which these individual measures actually result in a reduction of consumers' energy intake has not been evaluated so far. Other well-known examples are oversized units of popcorn available in cinemas or XXL schnitzels offered by the catering sector. Overall, necessary measures should include abolishing particularly large units in order to positively influence what consumers perceive as a "normal size". The following section (8.3.2) will discuss to what extent this would be legally feasible.

**Regulating the integration of smaller package or portion sizes into the available product range.**

These measures would aim at obligating retailers or the catering industry to integrate specific smaller packaging or portion units into their product range. A voluntary scheme introduced in the Los Angeles catering sector (Gase et al. 2014) has shown that while smaller portion sizes can be offered, this leads to various trade-offs (logistics, possible decline in sales). The objective of such an obligation would, once more, be to influence what consumers perceive as a "normal size".

**Regulating all-you-can-eat restaurants and buffet meals.** These offer the perfect environment for facilitating the consumption of excessive portions (Temple & Nowrouzi 2013). So far, however, there has been a surprisingly small number of empirical studies investigating the relation between buffets / all-you-can-eat options and energy intake. However, case control studies have found that people who often eat in buffet / all-you-can-eat restaurants, are more often overweight or obese (Duerksen et al. 2007, Casey et al. 2008). The overeating effect seems to be particularly strong if diners pay for their meal before they eat instead of afterwards. Siniver et al. (2013) report that participants in two experiments ate 4.5 times more sushi when they paid for the all-you-can-eat buffet meal before eating, as compared to paying afterwards (the price being a fixed price of 45 NIS (= 11.78 euro). One reason for this effect might be that diners tend to eat in accordance with their actual feeling of fullness, sensory signals and social norms (= standard portion) if they pay after the meal. If they pay before the meal, however, the aim of obtaining good value for money and thus eating large quantities of food becomes much more important. The authors therefore advocate making diners pay after the meal as a general rule. Owing to a lack of studies and data, no estimations can be made, however, as to how long this effect could be expected to last. More far-reaching measures could aim at reducing these kinds of buffet options altogether, which would probably have a positive impact on food waste, too.

**Changing the placement of portion sizes.** Research on trade marketing and nudging has revealed the significant impact that the optical presentation of food has on consumers' choices. Therefore, targeted placement on the shelves, in a restaurant or on the menu, i.e. a presentation giving preference to smaller units, is an instrument to reduce portion sizes.

**Adjusting default sizes in away-from-home catering.** Providers in the catering sector and in communal catering must necessarily determine a specific portion size, i.e. they must decide how large the default portion is. One option to limit problematic portion-size effects and to prevent food

waste is reducing the default menu size – combined with the possibility of ordering a second helping (at an extra charge) or explicitly choosing a more expensive larger unit. Currently, many (but not all) providers only offer the option of choosing a smaller portion size (children’s meals, dishes for senior citizens), whereas their default size is the larger unit. Moreover, the terms “dish for senior citizens” or “children’s meal” have a rather negative psychological connotation for adult consumers.

**Providing economic incentives for consumers.** In most cases, larger packaging units are more cost-efficient than smaller ones when looked at in relation to 100 g or ml units. Volume discounts are particularly large where the raw material value of the products is low, making it easier for producers from an economic perspective to grant substantial quantity discounts. This applies both to soft drinks and to many types of sweets. Such quantity discounts provide incentives for consumers to buy the large package size, which leads to increased food consumption on the one hand and to rising food losses on the other hand. This problem could be regulated by limiting quantity discounts (e.g. by defining maximum percentages), in particular in away-from-home catering (e.g. in cinemas).

### 8.3.2 Legal framework applicable to the regulation of portion-size effects

To the WBAE’s knowledge, the instruments outlined have not yet been discussed in a national context. Essentially, they are regulatory interventions targeting the marketing policies of producers and caterers. There are currently no specific regulations on portion sizes in German food law. National packaging acts or ordinances do not contain any relevant provisions because this issue has, to a very large extent, been regulated by European law. In the following, we will therefore provide initial legal assessments regarding the general admissibility of such regulations, taking into account existing EU law, in particular.

From an EU-law perspective, the question arises as to how the admissibility of interventions is to be judged in view of the free movement of goods and services. Regulating portion sizes in Germany can affect the free movement of goods within the EU where cross-border matters are concerned. This can generally be assumed to be the case if the products in question are traded internationally. In the catering sector, regulating portion sizes may have a relevant impact where it is likely to reduce the demand for non-German EU products. A potential probability is sufficient here to assume an interference with the free movement of goods. Pursuant to the judgment of the European Court of Justice in the criminal proceedings against Bernard Keck and Daniel Mithouard, an interference in terms of marketing regulations (also referred to as selling arrangements) must only be assumed if these regulations do not affect in the same manner the marketing of domestic products and of those from other Member States (Kingreen, in Calliess/Ruffert, EUV/AEUV-Kommentar, 5<sup>th</sup> edition. Article 34-36 TFEU, paragraph 49). Thus, regulations regarding portion sizes would only represent an interference with the free movement of goods if they specifically affected foreign products. Consequently, the WBAE does not generally consider regulatory requirements that specify where

and how catering businesses are permitted to advertise/offer portion sizes, or any similar regulations, to be an interference with the free movement of goods. They do, however, represent an interference with occupational freedom pursuant to Article 12 (1) German Basic Law. For such interference to be justified, it may suffice that it is based on reasonable arguments in favour of the interests of the common good. One reasonable argument may be the safeguarding of public health.

This means that we must distinguish from a legal point of view between instruments that interfere with the **free movement of goods** and are therefore subject to **significant hurdles defined by EU law**, and instruments that only **have a national impact**. Many product-related regulations (outside the catering sector) belong to the first type of instruments. Where an interference is relevant under EU law, it may be justified by considerations of **public health protection**. The EU has a duty to protect its individual citizens in this regard – comparably to what is provided for under German law<sup>432</sup>. However, the European Court of Justice pays careful attention to ensuring that the respective evidence is provided in an accurate manner. One classic example is the Cassis de Dijon case, which shows that it is not sufficient to name only the potential health risk, but that it is also necessary to explain specifically the direct cause-effect-relation leading to that risk. In this regard, the European Court of Justice pursues a very pragmatic approach: thus, it dismissed the argument put forward by the German Federal Government in the Cassis case according to which provisions relating to the minimum alcohol content of liqueurs, as demanded by Germany, would serve the protection of public health because consumers would only be aware of a beverage's alcohol content if it was high enough. The Court countered this argument by stating that: “the consumer can obtain on the market an extremely wide range of weakly or moderately alcoholic products and furthermore a large proportion of alcoholic beverages with a high alcohol content freely sold on the German market is generally consumed in a diluted form.” (CJEU, ECLI:EU:C:1979:42, paragraph 11). Consequently, it is necessary to prove that larger portions lead or contribute to unhealthy food consumption. Here, however, a counter-argument could be presented: “You don't have to finish your meal” or “You can just eat less the next day”. Yet the above-mentioned empirical studies show that consumers are often unaware of their increased consumption, which is, among other things, illustrated by the fact that the sense of fullness experienced does not increase in line with the amount consumed. This means that a higher energy intake, brought about by larger portion sizes, is, apparently, not offset by later eating behaviour (Rolls et al. 2006, French et al. 2014).

Even if the hurdle of causality has been successfully overcome, the hurdle of **proportionality** remains. An interference with the free movement of goods (as well as with the occupational freedom of the enterprise concerned) is justified if it is **suitable, necessary and proportionate** with regard to the legitimate purpose (here: protection of public health, sustainability, consumer protection).

---

<sup>432</sup> As a general rule, an obligation of the state to protect its population against obesity is derived from Article 2 (2) German Basic Law (right to physical integrity). Seewald, *Gesundheit als Grundrecht*, 1982. Cf.: Federal Constitutional Court (BVerfG) 78, 155 (163) – Non-medical practitioners; Federal Constitutional Court (BVerfG), Decision of 14 August 1998, NJW 1999, 857 et seq.; Federal Social Court (BSG), Decision of 19 June 2001, MedR 2002: 532 et seqq.

The criterion of **suitability** requires that the measure in question at least serves to promote the legitimate purpose. Owing to the multidimensionality of the evaluation framework regarding sustainability, suitability is assessed in a differentiated manner:

- thus, “for a means to be suitable (...), it is only necessary for it to be capable of assisting the desired result; the possibility of achieving the purpose is sufficient” (cf. BVerfGE 96, 10 (23); 103, 293 (307)). In this process, the legislature has priority in assessment and prognosis. It is principally for the legislature, taking account of the inherent laws of the subject area in question, to decide what measures it wishes to take in the public interest” (cf. BVerfG, Judgment of 28 March 2006 – 1 BvR 1054/01, NJW 2006, page 1261 (1264)).<sup>433</sup>
- Empirical studies have shown that large packaging units and portion sizes act as an incentive prompting people to consume and eat more. The increased food consumption resulting from this aggravates health risks. However, it depends on the individual consumer whether these risks actually manifest themselves or not. Nevertheless, associated correlations may generally also serve the intended purpose (for these associated correlations cf. Section 3.4).
- Offering smaller packaging and portion sizes generally helps to achieve environmental sustainability goals because a reduction of food losses can be expected. This, however, leads to more packaging, which may prejudice the purpose of promoting ecological sustainability aspects. In most cases, however, packaging only accounts for a minor part of the ecological impact (cf. Section 4.4), and reduced consumption may well compensate for the increased amount of packaging.
- As regards the social component, it should be taken into account that smaller portion sizes are linked with higher production and trading costs and thus affect low-income groups more severely. Nevertheless, the long-term effects on the national economy can be expected to be clearly positive as the social follow-up costs of overweight and obesity will decrease (cf. Section 6).

The criterion of **necessity** means that no less severe and equally suitable instrument is available. In the present case, the assessment is quite evident:

- in general, providing information in the form of labelling (e.g. indicating portion or serving sizes) only produces very minor effects or no effects at all (see above).
- Moreover, the portion-size effect even manifests itself if people are aware of it. This is why policy instruments such as awareness-raising campaigns are only helpful to a limited extent.
- Furthermore, one of the major problems that has been identified is that the away-from-home catering sector often offers only a small range of options, if at all, and that these options are only geared towards specific population groups (e.g. so-called “children’s meals” or “dishes for senior citizens”).

---

<sup>433</sup> BVerfG, - 1 BvR 2228/02 -, paragraph 39.

The criterion of **proportionality** requires that there should be no imbalance between the intended purpose and the severity of the intervention.

- In this case, it is necessary to first assess the severity of the intervention. It should be taken into account that production processes might need to be reorganised. For instance, packaging machines might need to be replaced.
- As a matter of principle, the purpose of safeguarding public health has a very high priority because it is enshrined in Article 2 (2) of the German Basic Law. However, this purpose cannot generally be assumed to prevail in the present case as there is only an associated correlation. Due regard should be given to the fact that (a) the consumption of large quantities of “unhealthy” foods alone does not necessarily cause illness (a lack of physical exercise etc. is part of the problem) and (b) smaller portion sizes can be compensated for by a change in consumption patterns (e.g. consumers can simply buy two portions). Consumer protection might also stand in the way of the argument of proportionality.
- In addition to that, it can be noted that even products that are much more harmful to human health, such as cigarettes and alcohol, are not subject to regulatory interventions. The above-mentioned environmental sustainability aspect, i.e. the increasing packaging waste, must be taken into account in the assessment.

Based on the stated criteria, the instruments outlined in Section 8.3.1 should be evaluated in detail. All aspects considered, it is ultimately possible to present arguments for each of the two positions, depending on the individual case. Regulations connected with a high level of intervention, such as provisions limiting the portion size (ban on large package sizes) or limiting quantity discounts (ban on price reductions for large packages), are likely to be regarded as disproportionate based on forceful arguments in the light of free movement of goods (but also in the light of occupational freedom according to Article 12 (1) German Basic Law).

However, a regulation that obliges an enterprise (e.g. a restaurant) to include additional, smaller portion or package sizes in its range of products must be viewed differently according to the WBAE. Such a regulation is to be considered proportionate because it only represents a minor interference with the free movement of goods. Nevertheless, considerable efforts will be needed in order to justify that the hurdle of causality has been overcome in both cases, i.e. that portion sizes really are a threat to human health and the environment.

Regulations that only affect national suppliers (e.g. in the retail or catering sector), for instance a regulation providing for a more prominent placement of smaller portion sizes or a different menu layout, are not deemed to interfere with the free movement of goods within the EU. The given interference with occupational freedom would be considered proportionate from a constitutional law perspective. The severity of the intervention in the case of a regulation on the placement of larger portion sizes is to be regarded as low because it would only require a reorganisation of supermarket shelves / restaurant menus. Therefore, the intended legitimate purposes of safeguarding public health, environment conservation and consumer protection clearly prevail in this case.

### 8.3.3 Conclusion

The WBAE believes that the issue of portion-size effects has so far been neglected in Germany. This may be due to the fact that its impact is implicit and usually not noticeable. Yet, it is not possible to clearly legitimise relevant regulatory measures on the basis of scientific evidence. This is because research has mainly been focused on laboratory experiments so far (even if some of these are highly significant and show an obvious relationship between portion size and quantity consumed). Possible measures to address the portion-size effect must therefore be considered from a differentiated perspective (causality), including from a legal point of view. On the whole, there are both legal options and narrow legal boundaries for instruments to regulate portion-size effects.

All legal aspects considered, it is ultimately possible to present arguments for each of the two positions, depending on the individual case. It can be assumed that regulatory measures with a relatively high level of intervention (e.g. limiting quantity discounts or mandatory reduction of portion sizes) will, for the time being, not be practical. However, implementing measures that have a lower level of intervention (e.g. obligation to also offer smaller servings in the away-from-home catering sector), is more likely to be successful. This is because they only marginally interfere with the free movement of goods and can therefore be considered proportionate. Nevertheless, considerable efforts will be needed in order to justify that the hurdle of causality has been overcome in both cases, i.e. that portion sizes really are a particularly serious threat to human health and the environment. Furthermore, it must be taken into account that part of the instruments are subject to regulatory decisions at EU level. Examples of rather “soft” measures that can be successfully implemented at national level include, for instance, regulations providing for a more prominent placement of smaller portion sizes or a different menu layout.

Thus, introducing legal regulations to reduce problematic portion-size effects is generally a complex matter and often means entering into unknown territory. This presents a strong case for further promoting scientific evidence on possible effects.

As mentioned above, soft instruments, such as awareness-raising campaigns concerning portion-size effects, have hardly any impact. They could nevertheless help to improve people’s understanding of the issue and thus increase their acceptance of regulations. Finally, it is recommended that voluntary measures taken by the industry should be initiated (cf. Section 9.7.1).

## 8.4 Product reformulation

Across the EU, the reformulation of products, i.e. reducing ingredients considered problematic in terms of their nutritional content in processed products, is deemed to be an important instrument to lower the high prevalence of overweight and obesity (cf. EU COM 2018). In the following, the issue will be briefly outlined and the objectives and ways of implementing product reformulations in Germany will be described (Section 8.4.1). Based on this, strategies for reducing the levels of fat

(Section 8.4.2) as well as of sugar and salt (Section 8.4.3) in manufactured foods will be discussed. Section 8.4.4 summarises the possibilities and limitations of product reformulations regarding the ingredients mentioned.

### 8.4.1 Objectives and ways of implementing reformulation in Germany

In Germany, 52.7% of adults and 15% of children and young people aged between 2 and 17 are overweight and therefore have an increased risk of developing cardiovascular diseases or type-2 diabetes mellitus. Apart from insufficient physical activity, overweight is mainly due to an excessive calorie intake and, thus, principally to an average intake of sugar and fat (cf. Section 4.2) that significantly exceeds the dietary recommendations issued by the German Nutrition Society (DGE) and the WHO. Furthermore, the intake of cooking salt is assumed to provoke certain forms of hypertension, which is why an excessive salt intake is associated with secondary diseases caused by high blood pressure. If it is assumed that approximately 50% of adults suffer from hypertension, which in 30 to 50% of cases is attributable to the individual salt consumption, up to 25% of the population would benefit from a reduced salt intake. As there are no known negative side-effects of a reduced consumption of salt, measures targeting all consumers alike may well be recommended. For these reasons, reducing the intake of sugar, fat and cooking salt is an important health-promoting measure.

One measure suited to achieve this objective is referred to as product reformulation, referring to **changing the formulas of processed products** with the aim of reducing ingredients considered problematic in terms of their nutritional content, such as sugar, fat and salt, while maintaining the same quality of taste. Other health-oriented or environmentally compatible formula changes would also be possible (e.g. reducing the proportion of ingredients of animal origin). So far, however, discussions on the instrument of reformulation have been focusing rather clearly on the ingredients mentioned.

In 2018, the BMEL initiated the German National Reduction and Innovation Strategy. It is aimed at bringing about a reduction in food ingredients considered problematic from a nutritional point of view by promoting the cooperation between policymakers, the private sector, the scientific community, the healthcare sector and society. To this effect, it also provides for measures regarding formula changes that are, for the time being, of a voluntary nature (BMEL 2018).

In addition to the option of voluntary commitments, reformulation can also take the form of regulatory interventions such as product bans or quality requirements. An intermediate form of reduction measures consists of agreements on self-imposed restrictions that, while voluntary, are expressly encouraged by policymakers. In these cases, policymakers prefer economic actors (mostly industry associations) to commit to implementing voluntary measures, while threatening to enforce regulatory measures (“in the shadow of regulation”). The BMEL currently promotes this intermediate form.

### 8.4.2 Fat reduction: reasonable from a nutritional point of view, but individual solutions required

With regard to product reformulation, scientific studies, developments, and innovations as well as socio-political discussions primarily focus on reducing sugar and salt, yet fat is the food ingredient with the highest energy density (cf. Section 8.4.3). A reduced fat intake may therefore help to reduce overweight, which is why lowering the fat content of processed foods is generally worth striving for. Moreover, recent studies indicate that foods with a high fat and carbohydrate content may be associated with “addiction-like” eating habits (cf. Section 3.1).

However, contrary to salt and sugar, fat does not only serve as a flavouring ingredient in processed foods. Among other things, fat has an impact on the consistency, texture, viscosity, creaminess and spreadability of products. Furthermore, fat serves as a flavouring agent; it is the parent compound of important flavouring substances that develop when foods are manufactured, and it facilitates the heat transfer when foods are cooked. Thus, fat is used in food production for manifold reasons. It must also be noted that there are different types of fat. While an intake of primarily saturated fats is associated with the occurrence of various diseases and overweight, omega-6 fatty acids, for example, are essential nutritional components that must necessarily be ingested via food to ensure a healthy metabolism. Long-chain polyunsaturated omega-3 fatty acids additionally have a positive impact on the development of coronary heart diseases. Trans fatty acids, on the other hand, have a detrimental effect on human health because they increase the risk of lipometabolism disorders, among other conditions. The fat content of foods must therefore be considered from both a quantitative and a qualitative perspective. Consequently, reduction strategies should take into account not only the fat content of a food product but also the composition of fatty acids. Additionally, it should be kept in mind that reducing fat can also lead to a reduced content or resorption of health-promoting unsaponifiable matter, such as vitamins soluble in fat. Thus, skimmed milk, for example, contains less than one tenth of the amount of vitamin A and K that is contained in whole milk and is free from any measurable amounts of vitamin D.

Reducing fat in food compositions by means of reformulation is also made more difficult by the fact that no widely applicable fat substitutes are available. The use of calorie-free substitutes that largely have characteristics comparable to fat, such as sucrose polyester, is currently not (or no longer) permitted. Authorised fat substitutes, e.g. on the basis of whey proteins, usually only comply with individual fat characteristics like, for instance, texture, and are not heat-resistant. As such, they can only be used in few specific foods, such as mayonnaise or salad dressings.

Thus, from a nutritional perspective, it is reasonable to adopt reformulation strategies aimed at reducing the fat content of foods; however, as a result of the various functions that fat fulfils in different formulas or products and the structural variety of edible fats, it is almost impossible to issue generalised statements. Instead, product-specific evaluations should be made in order to find out in which cases reducing fat is possible and reasonable and how it can be achieved by techno-

logical means. It should also be noted that for many high-fat foods, such as sausage products, margarine, cheese or milk, low-fat alternatives, i.e. reformulated products, have already been available (or used to be available) on the market for a long time and have met with more or less widespread consumer acceptance.

For this reason, the following section will mainly focus on the issue of reducing sugar and salt.

### 8.4.3 Reformulation with regard to sugar and salt

Depending on the functions that sugar or salt have in a food product, we can differentiate between three **reformulation scenarios**:

- sugar and/or salt only have a flavouring function in the product; reformulation is achieved by reducing the sugar and/or salt content (scenario 1);
- sugar and/or salt only have a flavouring function in the product; reformulation is achieved by (partly) replacing sugar and/or salt with other ingredients that have a sweet or salty taste (scenario 2);
- in addition to their flavouring function, sugar and/or salt have other functions in the product; reformulation should only be carried out if a significant effect can be expected (scenario 3).

In the following, these three scenarios will be discussed with regard to the ensuing possibilities and limitations of reducing the sugar and/or salt content.

#### **Scenario 1: Sugar and/or salt only have a flavouring function in the product; reformulation is achieved by reducing the sugar and/or salt content**

Similar foods produced by different manufacturers often differ significantly in their sugar and salt contents. The minimisation strategy consists in reducing sugar or salt contents exceeding the median value by more than 25% in individual products offered by individual manufacturers. To this end, the minimum levels that are technologically feasible and acceptable from a sensory point of view, contained in the “best” products, are adopted as reference standards to be achieved by all products and manufacturers. This approach allows for the reduction of the sugar and/or salt consumption without creating trade-offs.

Another advantage is that avoiding overly sweetened foods can have a positive impact on consumers' preference for sweet foods, as consumers become used to food that tastes less sweet and reduce sugar consumption in other areas. The same principle applies to overly salted products. However, the total amount of reduced sugar is limited. If, for example, the amount of added sugar in soft drinks and similar products was reduced by 20%, the overall consumption of sugar in processed foods would drop from 2.31 million tonnes to 2.203 million tonnes, which corresponds to a

4.6% decrease.<sup>434</sup> Thus, on average, every citizen of the Federal Republic of Germany would consume 1.3 kg less sugar per year, i.e. 4 g less per day. Applying the consumption data specified in the National Food Consumption Survey (NVS) II delivers a similar result (MRI 2016). According to this data, reducing the sugar content of lemonades by 20% would lead to a decrease in sugar consumption by 2.6 g/day for men and by 0.9 g/day for women.

It must, however, be considered that individual population groups may receive higher-than-average benefits from the reduction. For instance, male adolescents aged between 14 and 18 consume about three times the amount of soft drinks than the population average and more than 20 times the amount consumed by the group with the lowest consumption (Heuer et al. 2015). Thanks to the measure, male adolescents would consequently avoid a significantly higher amount of sugar than the average population. Reducing sugar contents exceeding the median value by more than 25% is particularly easy for soft drinks, dairy products and cereals. These products have also been selected for sugar reduction as part of the BMEL's reformulation strategy (BMEL 2018).

It must be noted, however, that reducing sugar does not necessarily lead to a reduction of calories. This applies in particular to cases where sugar is replaced by fat or whole milk powder in order to achieve similar product characteristics (cf. scenario 3). Furthermore, even if sugar is eliminated without being replaced, the caloric content (kJ/g) of high-starch or high-fat foods, such as cereals, does not automatically change because the energy density of the cereals (starch) is comparable to that of sugar (cf. Carle 2018). However, this does not affect the potentially positive impacts of sugar reduction that may be brought about by a more favourable glycaemic index, a more favourable glycaemic load or a stronger satiety effect of the food matrix in comparison to sugar. Thus, while reducing sugar in cereals, for instance, does not lead to a direct reduction of the caloric content per gramme per se, it does potentially lead to smaller portion sizes because the starch contained in cereals creates a more profound and longer lasting feeling of satiety than added sugar. An indirect effect of the reduction of portion sizes is that the energy intake when consuming the reduced-sugar food is lower than when consuming the sugar-sweetened alternative. Furthermore, reducing the sugar proportion can help mitigate other negative effects of sugar consumption, including its cariogenic effect. Before adopting a minimisation approach, it should therefore be clearly defined what effects are envisaged and what maximum effect sizes can be achieved.

In the past, minimisation strategies of this kind (consisting in defining guidance values that are technologically feasible and acceptable from a sensory perspective by placing best-practice products on the market) have already proven to be viable in practice, for example, in order to reduce the content of acrylamide or trans fatty acids in foods.

The WBAE therefore unconditionally supports the BMEL's efforts to reduce excessive sugar contents in soft drinks, dairy products and cereals by adopting relevant minimisation strategies. It is, however, to be expected that the sugar reduction achieved will be rather modest compared to the

---

<sup>434</sup> Calculation based on the figures for 2016/2017 according to the report on the market and supply situation for sugar (BLE 2019b:39).

population's overall sugar intake. The WBAE therefore recommends that, in addition to the monitoring planned, realistic model calculations should be made to determine possible effect sizes as soon as minimisation measures are initiated. These calculations should determine what maximum reduction of the entire sugar consumption can be achieved if the respective reformulation strategy produces optimal results and what maximum impact this reduction could have on the overall calorie intake and on body weight.<sup>435</sup>

Similar considerations apply to reducing salt contents. Eliminating excessive salt contents in processed foods can help to reduce salt consumption. This is of particular interest with regard to breads and rolls, meat and sausage products, dairy products and cheese, which account for 27 to 28%, 15 to 21% and 10 to 11% of daily salt intake, respectively (BfR et al. 2011). However, before adopting this measure, appropriate model calculations are needed to determine the maximum impact on the total salt intake that can be achieved. According to a simple estimation, for instance, the average salt intake would be reduced by 750 mg/d, i.e. from 9 to 8.25 g/d for men, if all breads and rolls had the lowest salt content available on the market. An intake of 3.5 up to a maximum of 6 g/d is recommended.<sup>436</sup> Besides a moderate reduction of the salt intake, reducing excessive amounts of salt can help to positively influence people's preference for salty foods. This measure is also supported by the fact that reducing the salt content does not necessarily weaken consumer acceptance but even slightly increases it in some cases (Bolhuis et al. 2011, Cluff et al. 2017). Consumers are often not aware of this reduction, especially when it is introduced gradually (Girgis et al. 2003). However, producers need to act together and in a concerted manner to reduce salt levels slowly and gradually. This represents great challenges for conventional food manufacturers that still use traditional methods and are less organised.<sup>437</sup>

**Scenario 2: Sugar and/or salt only have a flavouring function in the product, reformulation is achieved by (partly) replacing sugar and/or salt with other ingredients that have a sweet or salty taste.**

With regard to sugar, this approach also mainly lends itself to soft drinks, dairy products and cereals. Sugar can, for example, be replaced with synthetic or plant-based sweeteners (e.g. stevia) and with sugar substitutes. Alternatives like honey, agave syrup or concentrated grape juice are not suited to this end as they do not reduce the sugar content (i.e. of mono- and disaccharides). One advantage of this approach is that sugar consumption can be reduced more significantly than by reducing excessive sugar contents.

---

<sup>435</sup> Thus, the dairy industry's reformulation commitment is limited to products with a design especially targeted at children (cf. Association of the German Dairy Industry 2019b).

<sup>436</sup> Based on the assumption of an average salt intake of 9 g/d for men in Germany, a 25% salt intake via bread and rolls, an average salt content of 1.6 g/100 g in bread and a minimum content of 1.1 g/100 g on the German market (salt content of bread taken from a study by CVUA Stuttgart, 2 May 2014, available at <http://www.ua-bw.de/pub/beitrag.asp?suid=1&ID=1894&lang=DE>; last accessed on 3 June 2019).

<sup>437</sup> As of 2016, for example, the German bakery trade comprised more than 11,000 registered enterprises.

A wide range of artificial sweeteners and sugar substitutes has been on the market for a long time already. This shows that neither the relevant technological and regulatory implementation nor the marketing poses any problems. According to current scientific studies, sugar substitutes do not seem to have any adverse effects on human health. A systematic evaluation and meta-analysis of all available intervention and monitoring studies revealed no relation between the intake of sugar substitutes and food consumption habits, the preference for sweet foods or the onset of diseases like cancer, renal disorders or cardiovascular diseases (Toews et al. 2019). This outcome corresponds to evaluations conducted by the EFSA or the FDA, which classified all approved sugar substitutes as safe (EU KOM 2019). However, scientific findings are, to date, incomplete, in particular with regard to long-term intervention studies and the preference for sweet foods. It is known that high amounts of sugar alcohols used as sugar substitutes have a laxative effect. Therefore, products containing these substances must be labelled with a corresponding warning message (EU KOM 2019). Furthermore, only a minor beneficial effect on the BMI could be attributed to sugar substitutes, whereas no connection between the substitutes and overweight was established (Toews et al. 2019). The EFSA shares this view, seeing no cause-and-effect relationship between the consumption of sugar substitutes and body weight (EFSA Panel on Dietetic Products, Nutrition and Allergies 2011). Thus, although replacing sugar with sugar substitutes leads to reduced sugar consumption, this is not necessarily reflected in a lower body weight. Nevertheless, a positive impact on blood sugar levels and dental health is considered to be sufficiently substantiated (EFSA Panel on Dietetic Products, Nutrition and Allergies 2011).

Yet market experience also demonstrates the limits of this approach: many consumers do not accept the substitution of sugar with artificial sweeteners for sensory reasons. Although the sweetening quality of artificial sweeteners has been significantly improved over the last few years, especially thanks to the use of sweetener mixtures, the sweet taste of sugar cannot yet be fully imitated. Consequently, many consumers do not accept the respective products. Thus, 55% of cola/mixed drinks purchased are regular products, whereas 14% are low-sugar and 31% sugar-free products (MRI 2018). It is therefore necessary to take a critical look at what measures would be suitable for further increasing the market share of reformulated products containing sugar substitutes. Moreover, it must be ensured that the wide use of additives and ingredients that taste sweet does not have adverse effects on human health. As a general rule, approved artificial sweeteners have been subject to risk assessment by the EFSA and are considered safe for consumption. However, sugar substitutes, like maltitol for example, may have a laxative effect when consumed in large amounts.

Another important aspect to be considered when reducing sugar levels is that, contrary to artificial sweeteners, sugar substitutes are not always calorie-free. Sugar alcohols can have up to 60% of the energy value contained in sugar. Replacing sugar with sugar substitutes does therefore not necessarily lead to a complete reduction of sugar calories. In addition, the use of sugar substitutes does not primarily result in a reduction of sweetness, which is why a possible positive impact on consumers' preference for sweet foods is not to be expected. Finally, the increased use of sweetening additives runs contrary to the current clean labelling trend. This means that especially health-

aware consumers feel that “free-from” labels are a positive sign, whereas they perceive a great number of E numbers in the list of ingredients as negative.

Substituting sugar with other sweetening ingredients can thus reduce the intake of sugar calories more significantly than limiting excessive amounts of sugar. However, as reformulated products of this kind have been available for a long time already, their market potential can be assumed to be largely exploited.

For cooking salt, too, there are various approved substitutes that may be used to, at least partially, replace salt in foods. Potassium chloride, calcium chloride and zinc chloride are the most widespread of these substitutes. Not only are they deemed absolutely safe for human consumption but they can even have a health-promoting effect.<sup>438</sup> Supplementing with potassium, for instance, may help to reduce high blood pressure (BfR et al. 2011). However, the taste of some cooking salt substitutes differs noticeably from that of cooking salt itself. For example, they can have a bitter or metallic aftertaste. Unlike sugar, cooking salt can therefore only be substituted to a certain extent and cannot be fully replaced without compromising a product’s sensory properties. Nevertheless, there are only few foods (e.g. broths, condiments, table salt) in which cooking salt has an exclusively flavouring function. It is relatively easy to replace a certain proportion of the common salt contained in these products with salt substitutes. Especially in foods that significantly contribute to human salt consumption, such as bread, sausage products and cheese, however, cooking salt has various other functions. Among other factors, it influences storage life, water retention, maturation, fermentation, and texture. Salt substitutes cannot fulfil these functions in every case (Bautista-Gallego et al. 2013). Generalised forecasts are difficult in this context, which is why every product and every formula requires extensive development efforts and testing. In this regard, interesting developments have been made with a view to achieving a salt reduction while maintaining the same salty taste by modifying the physico-chemical properties of common salt. For instance, crystal size, microstructure or distribution can distinctly influence the intensity of the salty taste. However, further research and development is still needed in this field.

**Scenario 3: In addition to their flavouring function, sugar and/or salt have other functions in the product; reformulation should only be carried out if a significant effect can be expected.**

Besides its sweetening effect, sugar can fulfil various other functions in foods. For instance, a high sugar content in marmalades or jams has a preserving function while it serves as a humectant in bakery products. To avoid that jams spoil or cookies become tough or start to crumble, further additives/ingredients, such as preserving agents or glycerine, must therefore be used in addition to the sweetening substitutes so that the product’s characteristics can be maintained. This may conflict with a clean label strategy. Before developing innovative substitution strategies, a model calculation should be made to assess the effect sizes to be expected with regard to sugar/calorie

---

<sup>438</sup> The EU has authorised a number of health claims regarding potassium, calcium and zinc (Commission Regulation (EU) No 432/2012 of 16 May 2012). They do not apply to consumers who suffer from renal insufficiency, to whom the intake of potassium may be harmful.

reduction and body weight reduction. It must also take into account the amounts consumed. Owing to the disadvantages of this approach, minimisation strategies should, in this case, only be supported where a significant effect can be expected. Reformulating traditional recipes and specialties (e.g. protected designations of origin) should not be pursued.

As has been outlined in scenario 2, cooking salt fulfils various other functions in many foods apart from taste. This is particularly true of breads, sausage products, and cheese, which account for up to roughly 60% of our salt intake. For this reason, leaving out or replacing cooking salt is only technologically feasible within a certain limit without causing significant changes in a product's storage life, texture or consistency. Therefore, reformulation can only make a limited contribution towards consumers' compliance with the recommended maximum daily intake of cooking salt. Patients with salt-sensitive high blood pressure should also change their food consumption habits.

#### 8.4.4 Conclusion

Overall, health-related reformulations are a **relevant measure**; however, they will have only a **limited impact** if carried out as currently planned in Germany. This will hold true even if the different sectors fully implement their self-commitments made towards the BMEL. **Reasons** for this include the following:

- Whereas reducing sugar in processed foods is to be considered as absolutely positive, it has only limited potential for significantly reducing the overall amount of added sugar in consumers' diets and thus lowering the risk of overweight and secondary diseases. A substitution strategy based on the use of sugar substitutes and artificial sweeteners can also be assumed to have only a minor impact on overall sugar consumption. Reducing and replacing sugar without drawbacks is mainly feasible in foods where the sugar content primarily has a flavouring function. The situation is similar when fat and salt are reduced by means of reformulation.
- Reformulation does not lead to a change in food consumption patterns. The intake of added sugar could be reduced most drastically and most effectively by cutting down the consumption of sweets, lemonades and fruit-based drinks. A reformulation strategy should therefore be integrated into a set of measures aimed at changing food consumption habits.
- To date, ready-to-eat dishes have not been comprehensively taken into account when developing reformulation measures. For this product group, the aim should be a genuine change in recipes – including a substantial increase in the proportion of fruit, vegetables, and wholemeal cereals in the ingredients. In addition to reducing the fat and, possibly, the sugar content, this would result in potentially enhancing the fibre content of ready-to-eat dishes, making them more healthy to consume.
- At present, Germany's reformulation strategy does not include the growing away-from-home catering sector. Important potential, especially in communal and system catering, therefore remains untapped.

Furthermore, this reformulation instrument could be implemented more effectively as part of a comprehensive strategy for promoting sustainability in food consumption if health-related goals were complemented with further sustainability objectives (e.g. climate stewardship). It is, for example, advisable to consume more fruit, vegetables and fibre-rich cereals or to choose particularly climate-friendly varieties of fruit, vegetables or nuts. Furthermore, the share of animal products in composite foods and ready-to-eat dishes could be reduced. One example would be the mixture of butter and vegetable fat, which has already proved a major commercial success and also offers convenience benefits (spreadability). Another example would be using more vegetables instead of sausage products for ready-to-eat pizzas. Consumers' acceptance for products reformulated in that manner can be increased by optimising the products' sensory characteristics (Spenser et al. 2018). However, such reformulations raise questions regarding food labelling and may also raise issues of consumer protection.

## **8.5 Regulating advertising and online marketing**

### **8.5.1 Restrictions on advertising for food with unfavourable nutrient profiles, particularly in the case of children**

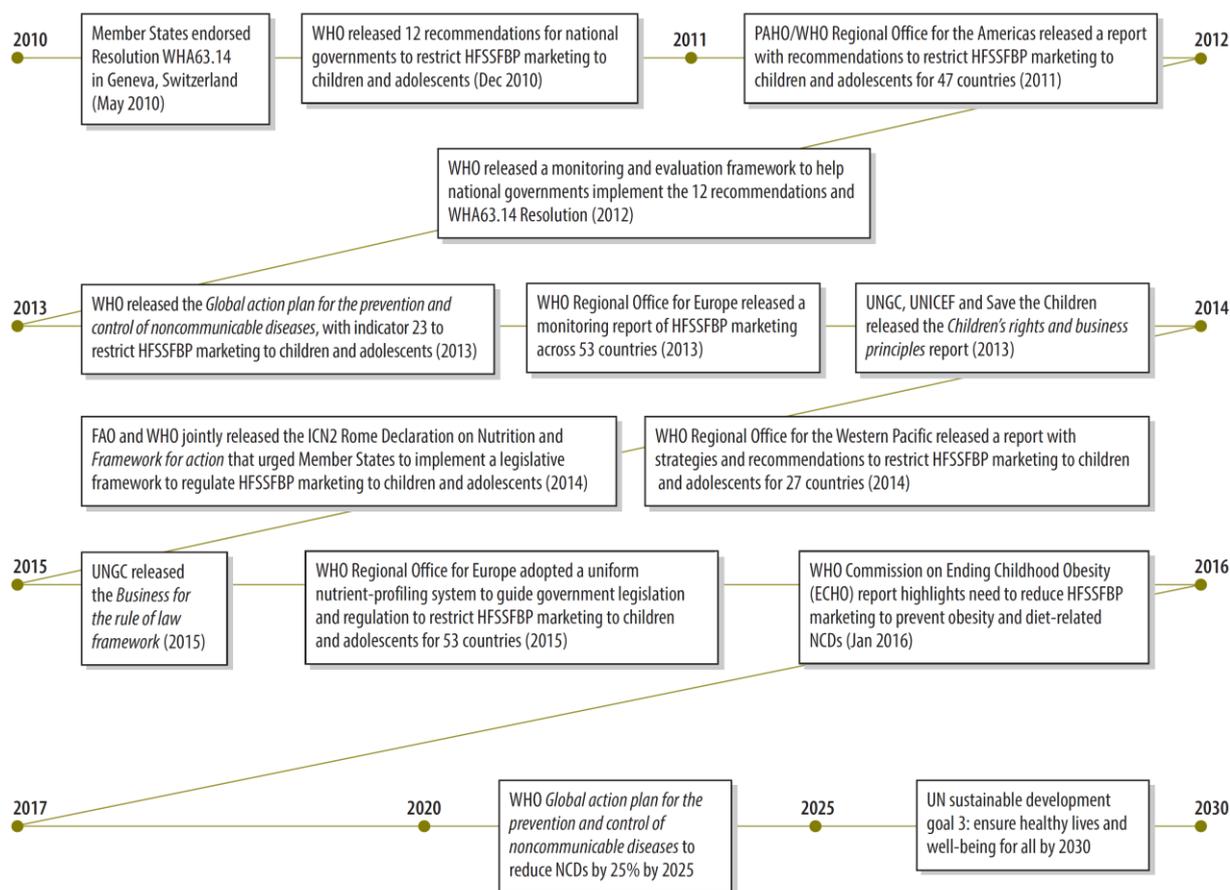
Sections 3.3. and 6.4 of the present expertise demonstrate that significantly more advertisements are shown for products that tend to have an unfavourable nutrient composition (e.g. confectionery, soft drinks) than, for instance, for fruit and vegetables or nuts. This is mainly due to the higher profit margins in these product groups, which include significantly more branded goods, typically leading to higher margins, while many fresh foods are unbranded products. Advertising and brand profiling thus contribute to the market position of more processed and energy-dense food.

The contribution of marketing to the spreading of problematic food consumption patterns is subject to particularly intensive discussions regarding advertising targeted at children and adolescents. Food advertising aimed at children and adolescents primarily promotes food that is less conducive to good health (Effertz & Wilke 2012, Cairns et al. 2013, Maschkowski et al. 2014, Hallmann 2014). In a study across 22 countries, Kelly et al. (2019) show that, on average, four times as many advertisements are shown for rather unhealthy products than for health-promoting ones. Different studies and summary meta-analyses consistently and relatively clearly indicate that there is a connection between media consumption (TV, internet) and thus advertising influence on the one hand and an excessively high calorie intake and a higher BMI on the other (IOM 2006, Cairns et al. 2009, Giese et al. 2015, Boyland et al. 2016, Sadeghirad et al. 2016, Norman et al. 2018, Ahrens et al. 2017, Emond et al. 2019, Russell et al. 2019). Over the last few years, this situation has given rise to an intensified discussion about restrictions on advertising in general and on advertising targeted at children in particular (Bragg et al. 2018, Gortmaker et al. 2011). The WHO has long recommended limiting advertising for foods with unfavourable nutrient profiles aimed at children and sees this as an important element in combating malnutrition (WHO 2010, Kraak et al. 2016, Fig. 8-9).

At international level, such advertising restrictions are increasingly applied (World Obesity Federation & WHO 2018). For instance, Great Britain, Australia, Greece, Denmark, Finland, Belgium and different federal states in the US have introduced restrictions on advertising aimed at children. In Sweden and Norway, food advertising aimed at children under the age of 12 is prohibited (Bragg et al. 2018, Mazur et al. 2017).

Kovic et al. (2018) summarise the effect of various forms of advertising restrictions in the field of junk food based on country data (n=79) (Table 8-6). Between 2002 and 2016, these resulted on average in a decrease (-2.0%) of per capita consumption of junk food in those 49 countries that introduced restrictions, while countries without restrictions registered an increase (+13.9%). Yet, this drop in consumption can only be observed in countries with mandatory restrictions (-8.9%), while countries with restrictions based on voluntary commitment experienced an increase (+1.7%) in the same period. Significant effects can also be observed in cases where advertising to the target group of children is banned completely (-0.8% compared to limited restrictions or no restrictions) and where advertising is permitted only for products that meet clear nutritional standards (-8.6%).

**Figure 8-9:** Support to restrict the marketing of branded high-fat, salty and/or sugary food and beverage products to children and adolescents (2010-2016)



Source: Kraak et al. (2016: 541).

**Table 8-6:** Changes in the sales of junk food depending on policy measures for advertising restrictions based on an analysis of the international literature

Form of advertising restriction		N	Junk food sales kg/capita (SD)		Difference 2002 - 2016 in %
			2002	2016	
Policy in place	No	30	44.0 (31.6)	50.1 (36.9)	+ 13.9
	Yes	49	79.6 (44.4)	78.0 (40.3):	- 2.0
Level of obligation	None	30	44.0 (31.6)	50.1 (36.9)	+ 13.9
	Voluntary industry commitment	33	78.1 (35.4)	79.4 (37.0)	+ 1.7
	Mandatory restriction	16	82.7 (58.8)	75.3 (47.5)	- 8.9
Target group restriction <sup>a)</sup>	None	34	49.5 (35.4)	55.5 (40.0)	+ 12.1
	Tiered approach	38	81.5 (45.0)	79.1 (40.0)	- 2.9
	Integrated approach	7	62.6 (45.6)	62.1 (40.5)	- 0.8
Nutrition criteria <sup>b)</sup>	None	34	48.8 (33.6)	54.0 (38.0)	+ 10.7
	Guidelines	34	73.3 (39.0)	73.8 (38.7)	+ 0.7
	Standards	11	97.5 (60.7)	89.1 (47.2)	- 8.6

Note: N = number of evaluated studies; SD = standard deviation; <sup>a)</sup> advertising restrictions depending on advertising time, share of children in the target group or share of advertising space for junk food, integrated approach = complete ban on advertising to children; <sup>b)</sup> advertising restrictions for certain foods, voluntary and based on nutritional guidelines or mandatory on the basis of nutritional standards.

Source: Kovic et al. (2018: 765), abridged.

In the past, Germany generally approached the issue of advertising restrictions for health reasons with restraint, as the discussion on advertising bans for cigarettes demonstrates (cf. Section 6). In the area of food advertising, beyond the general rules for health-related advertising and the general protection of minors, mainly **voluntary self-restrictions** on the part of the German and European industry exist.

The protection of children and adolescents as target groups in need of special protection from improper advertising influence is embedded in the German Federal Youth Protection Act (*Jugend-schutzgesetz, JuSchG*) (cf. sections 11-16 JuSchG) and is complemented by specific laws regarding the media such as the Interstate Broadcasting Treaty (*Rundfunkstaatsvertrag, RStV*) and the Interstate Treaty on the Protection of Minors from Harmful Media (*Jugendmedienschutz-Staatsvertrag, JMStV*). Advertising aimed at children and adolescents must not prejudice children's interests or take advantage of their inexperience. The aim of the JMStV is to ensure that advertising causes no

physical or psychological harm to children and adolescents (section 6, subsection (2) JMStV). Advertisements aimed at children that include direct prompts to buy or consume a certain product are also inadmissible.

These general clauses are set out further by the rules of the German Advertising Standards Council (*Deutscher Werberat*), an institution set up by the advertising industry and the advertising companies in order to provide self-regulation of the industry ([www.werberat.de](http://www.werberat.de)). These rules consist of general principles, such as: commercial communication regarding food should not run counter to a balanced, healthy food consumption and should not encourage excessive or one-sided consumption of the advertised products. Regarding advertising aimed at children, the German Advertising Standards Council also sets out rather vague principles, such as: commercial communication regarding food should not run counter to children learning about a healthy, active lifestyle; commercial communication regarding food aimed at children should not launch sales promotion initiatives (e.g. give-away articles) and aleatoric advertising methods (e.g. raffles and prize competitions) in a way that takes advantage of children's inexperience in business matters; and in particular commercial communication regarding food should not attract children by offering excessive benefits in an unduly unobjective manner. These self-imposed restrictions are evidently implemented very "reluctantly," since give-away articles for children (plastic figures etc.) are still used in food marketing.

Besides these national self-imposed restrictions, there is the Children's Food and Beverage Advertising Initiative (CFBAI) at international level and at EU level there has been a comparable initiative in place since 2007 (EU Pledge). With this self-imposed restriction, internationally leading food business operators, originally primarily from the US, have committed themselves to only promoting products to children that meet certain health-related criteria (e.g. salt and sugar limits) (CFBAI 2018). Part of the food business operators refrain from advertising to children below the age of 12 as a matter of principle. Initially targeted at TV advertisements, the scope of this agreement was expanded in 2016 to include radio, cinema, DVD, direct marketing, product placement, online games, apps, and mobile marketing (EU Pledge 2018). Advertising aimed at children therefore includes, by definition, all formats where more than 35% of recipients are under 12 years of age. The criteria for voluntary commitment by this group of international producers are thus more specific than the general recommendations by the German Advertising Standards Council.

As a whole, the available scientific studies on the effectiveness of voluntary commitments paint a **sceptical picture**. A study by Römer and Steffensen (2008) on the effects of self-regulation in advertising concludes the following for the protection of children in Germany: the German Advertising Standards Council mainly reacts to complaints; its decision-making practice is controversial,<sup>439</sup> it cannot issue any sanctions apart from a public reprimand; and major effects of these advertising

---

<sup>439</sup> As an example, reference can be made to a complaint by the German Diabetes Society and Foodwatch against an advertising campaign by Coca Cola, which was rejected by the German Advertising Standards Council on the grounds that the criticised Panini football pictures represent advertising that is not primarily aimed at children. The German Advertising Standards Council concluded that, accordingly, collecting pictures of the national team was not a hobby specifically reserved for children (Deutscher Werberat 2016).

regulations cannot be identified. Effertz and Wilcke (2012) compared children’s advertising before and after the introduction of the voluntary commitment and determined that the share of advertising spots for food with unfavourable nutrient profiles had actually increased. A current Canadian study (Kent et al 2018b) as well as a comprehensive international comparative study (Kelly et al. 2019) also conclude that voluntary self-imposed restrictions on marketing aimed at children are only partially effective or do not work at all, thereby confirming the sceptical assessment prevailing in the literature (Powell et al. 2013, Kunkel et al. 2015, Frazier & Harris 2017, Watson et al. 2017). The small effects of self-imposed restrictions also apply to companies participating in the US and EU Pledges (Kelly et al. 2019). The authors call for a clear legal basis.<sup>440</sup>

Among the population, there is relatively strong support for advertising restrictions to protect children. Zühlsdorf et al. (2018) determine the following outcomes in a representative survey (Table 8-7).

**Table 8-7:** Attitude of the German population towards restricting advertising for products with a high sugar, fat and salt content aimed at children

Marketing targeted at children for food containing high levels of fat/sugar/salt ...								
should be banned regardless of the circumstances			partially in favour/partially against			should not be banned under any circumstances		
30.3	16.1	13.1	7.4	19.7	3.2	2.8	4.0	3.6

Note: Representative online survey among 1,035 consumers in November 2017. Figures in% of all valid answers.

Source: Zühlsdorf et al. (2018: 23).

Against the backdrop of similar experiences with insufficient effectiveness of voluntary self-controls regarding marketing aimed at children, **the following measures, among others, are being called for or tested at international level:**

- bans or far-reaching legal restrictions on advertising to children up to the age of 12, in particular advertising bans for products with an unfavourable nutrient profile (“junk food”) (WHO 2015b);
- advertising-free schools (very different federal regulations across Germany);
- advertising-free spaces (“neutral zones”) around schools (World Obesity Federation & WHO 2018) (very different federal regulations across Germany);
- increased extension of the above-mentioned protective mechanisms to internet marketing, including new social media and new forms of advertising, such as influencer marketing (see below).

<sup>440</sup> The possible contribution of the recently increased self-regulation measures of some leading advertising companies (EU Pledge) should be subject to intensive scientific evaluation by policymakers. To date, there is no reliable data available for a review of the self-regulation measures, on the development of the companies that do not participate, or on the effects of new online forms of advertising.

### 8.5.2 Transparency and restrictions on online marketing

Recently, great emphasis has been placed on the subject of online marketing, including influencer marketing (cf. Section 3), since it has become a major advertising instrument for the target group of children and adolescents. Individual **social media influencers** in the food sector have several hundred thousand followers. This advertising practice plays an increasing role in food marketing, since it successfully aims at target groups' problems (e.g. weight reduction) or interests (e.g. vegan food) and provides information in an entertaining manner (Tapinfluence 2019). Suggestions are perceived as personal recommendations and thus as particularly authentic; influencers are accepted as credible experts.

Coates et al. (2019) show that influencer advertising in a controlled experiment promotes the consumption of unhealthy snacks. Where it is successful, influencer communication not only causes direct advertising effects but also further word-of-mouth communication among the target group. Influencers have a similar effect as typical opinion leaders from the peer group.

Particularly **problematic** for influencer marketing is the question of how to bypass the principle of **separation of advertisement and programme**, as enshrined in advertising law (Evans et al. 2018). In Germany, the question whether social media influencers need to disclose their commercial character in their presentations (e.g. YouTube clips) accordingly is currently being legally disputed. Research indicates that mandatory transparency is useful (as mandated for other media) as this improves the ability of young people to realistically assess advertising intent (Jans et al. 2018, Evans et al. 2018). The form (placement, size and duration) of the notices required and whether this is sufficient for people in younger age groups to be able to judge the intention of the online advertising has not yet been sufficiently researched. The relatively high level of trust that children and young people place in these influencers can possibly only be relativised to a limited extent by brief references to advertising. Ultimately, the regulations regarding online marketing are lagging behind the dynamic developments in reality. As a result, the WHO called for increased efforts by countries in this area as early as 2016 (WHO 2016c). A current Canadian study (Kent et al. 2018a) determined, for instance, that children see food advertising approximately 111 times per week on social media apps (44% thereof for fast food, 9% for soft drinks, 7% for sweets, 6% for snacks, and 5% for alcohol).

### 8.5.3 Conclusion

Overall, restrictions of marketing measures for foods with unfavourable nutrient profiles aimed at the target group children is a legally and practically complex field. The example of the regulation of cigarette advertising shows that in the context of event marketing, sponsoring, product placement and new internet marketing forms, diverse strategies for avoiding regulations must also be considered. In addition, many marketing measures start with the product (colour, packaging, tes-

imonials, giveaways etc.) and therefore also have an effect at the shopping location (retail, restaurant and catering sector), which is not subject to regulations regarding advertising aimed at children (Nguyen et al. 2019). Last but not least, by making indirect references to sport and health, many advertising concepts lead to misconceptions of health compatibility due to health halo effects, which makes it even more difficult to regulate the content of claims (Whalen et al. 2018 and Section 3).

There is growing scientific evidence that more stringent advertising restrictions for unhealthy products are important for the protection of children – especially for children from vulnerable homes. Therefore, there is much to be said for relying less on differentiating between permissible and impermissible child-related food advertising in terms of content in the future, but rather – as is already being tested in some Scandinavian countries today – enacting **general restrictions on advertising to certain target groups** (Prowse 2017). In addition, the planned introduction of the Nutri-Score in Germany (cf. Section 8.9.1) will in future provide an opportunity to make a visible distinction between products with more favourable nutritional properties and those with less favourable nutritional properties, which should be advertised to children in a restricted way.

In addition, the information content of advertisements can be improved by making it legally binding to include the **Nutri-Score** in food advertising (as approved by parliament in France).<sup>441</sup> This also contributes to the protection of children and adolescents, since a substantial part of the advertising exposure of children and young people is via popular shows (e.g. Germany's Next Topmodel) or sports programmes that are not predominantly targeted at children. Experiences gained from Great Britain have shown that restricting advertising explicitly aimed at children results in bypassing strategies, i.e. these advertisements being shown in such programmes (The Food Foundation 2017).

## 8.6 Taxes and subsidies

Subsidies as well as taxes and duties can be motivated by a policy of income distribution, but they are also traditional policy instruments for the **internalisation of external effects**. They can help to translate the benefits not included in the market prices (e.g. a beautiful landscape, increased animal welfare) as well as costs (e.g. health or environmental impacts) into direct incentives for consumers and producers: a subsidy increases the incentive to produce or consume the respective good and thus has the effect of increasing production or consumption; a tax or duty has the opposite effect, i.e. it increases the costs of production or consumption, thus resulting in lower production or consumption (cf. Section 7.5.2).

---

<sup>441</sup> The planned French regulation provides that producers may be released from this obligation by paying a sum amounting to 5% of the advertising costs (media costs before discounts) to the French Public Health Fund, cf. [https://www.just-food.com/news/france-makes-push-on-nutri-score-but-companies-can-still-avoid-use\\_id141026.aspx](https://www.just-food.com/news/france-makes-push-on-nutri-score-but-companies-can-still-avoid-use_id141026.aspx).

In their expertise on climate stewardship, the WBAE and WBW (2016) already expressed their opinion on the general preferability of economically broad-based and incentive-compatible instruments, also for the food sector, and recommended that the Federal Government advocate the consistent pricing of GHG emissions. For instance, consistent international GHG taxation of transport emissions, including non-European air traffic, would relieve consumers of the need to factor transport distances and means of transport into their purchasing behaviour (as is the case, for example, with fish as well as fruit and vegetables transported by air). In the following, the possibilities and limitations of economic instruments will be discussed in greater detail.

### 8.6.1 Subsidies for sustainable products

While subsidies for particularly environmentally-friendly agricultural production methods or specific environmental services of the agricultural sector are offered across Germany, **product subsidies providing an incentive to consume especially healthy or environmentally-friendly food** have so far played only a **minor role** in Germany; they exist for instance for school milk and fruit. Instead, with the reduced VAT rate for most foods, there is a broad subsidy for food in general (section 12 German VAT Act). The scope of this subsidy is considerable and amounts to approximately 17 billion euro/year. The reduced VAT rate does not accompany specific health or environmental policies. In addition, it is criticised by many for reasons relating to the tax system. Historically, it can be explained by the distribution policy goal of taxing essential goods at a lower rate than other goods. Value added tax has a regressive effect: since low-income households spend a higher percentage of their income on food in relation to their income, they pay more value added tax on food than high-income households. The reduced rate, which was motivated by social policy, thus eases the burden on low-income households in particular (cf. Section 7.5.2).

In Germany, two VAT rates apply: the regular rate of 19% and the reduced rate of 7%. The assigning of food groups, food trade, the restaurant and catering sector, and communal catering respectively to either of the two value added tax rates has historic reasons, no underlying system and is repeatedly criticised. For example, in the restaurant and catering sector, 19% VAT is charged for food consumed on site and 7% for take-away food, which supports the fast-food sector. Similarly, 19% is charged for infant food, while 7% is charged for dog and cat food. Milk is taxed at 7%, while soy milk is taxed at 19%; the same as mineral water. These examples show that the tax classification according to section 4 of the German VAT Act partly results in subsidies that are environmentally and socially disadvantageous (cf. Section 8.6.2).

The support for school milk and school fruit is a traditional subsidy explicitly motivated by food policy. It has been in place for decades in many EU countries and has been coordinated since the early 2000s as an EU programme under the Common Agricultural Policy (CAP).<sup>442</sup> The programme

---

<sup>442</sup> For more information about the legal basis and the design of the EU school scheme, i.e. today's "Union aid for the supply of fruit and vegetables, bananas and milk in educational establishments" in Germany, see the BMEL website at [https://www.bmel.de/DE/Ernaehrung/GesundeErnaehrung/KitaSchule/\\_Texte/Schulobst.html](https://www.bmel.de/DE/Ernaehrung/GesundeErnaehrung/KitaSchule/_Texte/Schulobst.html). Whether it still makes sense to subsidise milk from a health and climate policy view will not be discussed here.

has so far been a singular element of agricultural and food policy. Its existence has not resulted in a broader debate on subsidising particularly health-promoting food for different target groups. In the past, the development of the subsidy in Germany was also influenced by agricultural support objectives; it was not always about health but sometimes only about promoting milk sales. For a long time also milk drinks with a high sugar content, for instance, were subsidised (Foodwatch 2018a).

Subsidies for particularly sustainable food change the price ratios between different foods. In terms of distribution policy, they therefore have a similar effect to incentive taxes (Waterlander et al. 2013, Thow et al. 2014). If subsidies make a healthier product less expensive in equal measure for all consumers, those parts of the population with a healthier diet benefit more. If healthier food consumption goes hand in hand with social differences, i.e. if people from lower socio-economic classes eat less healthily, subsidies may also have a socially unequal effect (Muller et al. 2016). Yet, it could also be argued that subsidies could balance out health disadvantages of socially disadvantaged groups to some extent and thus provide disproportional support to these groups because consumers with low incomes react more strongly to price changes.

For psychological reasons, the reactions to a product becoming more expensive could be stronger than those to the introduction of a subsidy, since taxes cause loss aversion (Kahneman & Tversky 1979). For this reason, **subsidies would have to be stronger in comparison to achieve specific changes in demand**. For instance, the WHO (2016b) recommends subsidies for fruit and vegetables that result in a reduction in the sales price of at least 10% to 30% (also cf. Milani et al. 2019). In contrast to taxes, however, subsidies cause fewer reactance effects. This might contribute to them being more effective in comparison (Just & Hanks 2015).

Unlike taxes, subsidies put strain on the state budget, but they are more widely accepted. School fruit and school milk schemes are classic examples. Weible et al. (2013) have found out that the provision of free school milk is the most important factor for milk consumption in school. However, they have also established that a broad range of products, teacher role models and parents' attitude also play a vital role, and that support schemes have a more lasting effect if they are integrated into education, for instance by teaching the benefits of fruit and vegetables in class.

The WBAE considers it useful to discuss the instrument of subsidies more broadly and with a view to sustainable food groups, thus going beyond the hitherto narrowly limited area of individual products for school children. Current international studies show the positive effects of fruit and vegetable subsidies on the quality of food composition (Milani et al. 2019). Given the comparatively low consumption of vegetables in Germany (in particular among men), this is an important objective. However, there is mixed evidence as to whether this will lead to a reduction in calories (WHO 2016b). For health and climate policy reasons it would also make sense to subsidise legumes. Mineral water is currently taxed at a VAT rate of 19%, which from a health policy viewpoint is counter-productive (however, tap water is even more preferable in environmental terms, as it is taxed at 7%).

Comprehensive subsidies for fruit, vegetables and legumes are expensive for the state. In addition to food policy considerations, budgetary reasons as well as reasons of acceptance might support the use of revenues from incentive taxes motivated by health or environmental policy (cf. the following Sections) for subsidies on fruit and vegetables (Niebylski et al. 2015). For financial reasons, a support scheme would be particularly easy to implement with a (further) reduction of the **VAT rate**. However, according to EU law the subsidised rate must generally not fall short of 5%. Furthermore, it should be noted as a framework condition that the **EU Commission only allows two reduced tax rates**. Although there are member states that use a further reduced rate or a 0% rate, the EU Commission only allows rates below 5% within the scope of historic standstill arrangements and in principle strives to further harmonise and simplify the VAT rates between the different countries (EU KOM 2016).

**Conclusion:** Flexibility regarding a simple VAT reduction for food is limited, since most foods are already only taxed at a rate of 7%. Further reducing the VAT on fruit, vegetables and legumes to 5% would be possible, however, and would at least give a limited impetus (a reduction of the VAT by two percentage points would lead to an increase in demand of approximately one per cent, Schröck 2013: 57) and would also have a communicative (symbolic) effect. Further differentiating the VAT rates does at present not appear possible under EU law.

### 8.6.2 Health-oriented tax on sugar-sweetened beverages

At global level, Germany ranks among the countries with the highest per capita consumption of sugar-sweetened beverages (hereinafter SSBs) and other sugar-containing drinks. Among the latter are, in particular, fruit juices, fruit-based drinks and juice spritzers, but also other sugar-sweetened beverages (typically included in other statistics) such as drinking chocolate and other sweetened mixed milk drinks (cf. also Sections 4.2.2.1 and 5.3.1.2.).

The consumption of sugar-sweetened beverages has dropped slightly over the last few years (not least due to demographic change). Taken together, the consumption level of sugar-sweetened drinks and fruit juices that are similarly high in calories is on a similar level to that of mineral water. Adding to this the consumption of alcoholic beverages that are also high in calories, it becomes clear that the energy supply in the form of drinks is a major problem area. Fruit juices, nectars and SSBs together account for almost one third of the consumption of added sugar in Germany (MRI 2016). Table 8-8 shows the development of the per-capita consumption of non-alcoholic beverages in Germany from 2012 to 2018.<sup>443</sup>

---

<sup>443</sup> Not included in this table are drinking chocolate and other mixed milk drinks. It is difficult to calculate the total consumption of these beverages. This is because there are, on the one hand, industrially manufactured products (production in 2017 about 577,000 tonnes, of which 183,000 tonnes were chocolate drinks, cf. Association of the German Dairy Industry 2019a: 50). On the other hand, chocolate drinks are also prepared from scratch in the restaurant and catering sector and in private households.

**Table 8-8:** Development of the per capita consumption of soft drinks, fruit juices/nectars and water (in litres) in Germany 2012-2018

	2012 <sup>1)</sup>	2015 <sup>1)</sup>	2018 <sup>2)</sup>
Lemonades	82.9	78.9	82.3
Spritzers/water plus fruit juices	7.6	7.9	7.6
Flavoured water	7.4	5.3	5.7
Diet soft drinks	0.8	0.7	0.7
Enriched drinks and energy drinks	3.2	3.8	4.9
Sodas and other soft drinks	5.0	4.0	4.6
Coffee and tea	7.6	7.3	6.3
Fruit-based drinks	10.9	10.9	11.0
Soft drinks (total)	125.4	118.8	123.1
Fruit juices and nectars	33.9	33.0	32.2 (2017)
Mineral/healing/spring and table water	143.4	153.4	154.4

Note: <sup>1)</sup> For the years 2012 and 2015, the population figures published by the Federal Statistical Office were used as the basis for calculation. <sup>2)</sup> The calculations for the year 2018 are based on the estimated total population (83,000,000 inhabitants, cut-off date: 31 December 2018) and an extrapolation based on the manufacturing figures published by the Federal Statistical Office (1<sup>st</sup> – 3<sup>rd</sup> quarter of 2018) as well as preliminary foreign trade figures (January to November 2018).

Source: wafg (2019).

The consumption of SSBs is particularly high among **younger age groups** (cf. Sections 4.2.2.3 and 5.3.1.2), and regular consumption is linked with a number of health-damaging consequences, including obesity and tooth decay (Vartanian et al. 2007, Malik et al. 2013, Te Morenga et al. 2012, Weed et al. 2011, Malik et al. 2010, Libuda et al. 2009, Popkin & Hawkes, 2016, Malik et al. 2019; on controversial aspects: Stanhope 2016, Khan & Sievenpiper 2016). Reducing the consumption of sugar-sweetened beverages is therefore an important strategy for preventing and controlling obesity and numerous obesity-related diseases (Vartanian et al. 2007, Ernst et al. 2018). The sense of satiety is lower after the consumption of sugar-sweetened beverages than after the consumption of solid food containing the same amount of calories (cf. Section 4 and Ernst et al. 2018). SSBs contain no health-promoting ingredients and do not provide protection from diseases. They are thus a central objective of public health interventions (**no regret measure**). Substituting SSBs with unpackaged drinks, such as tea and in particular tap water, is linked with clearly positive environmental effects.

Against the backdrop of health benefits, it comes as no surprise that several policy tools have been used in the last few years to reduce the consumption of soft drinks and other sugar-sweetened beverages (Cornelsen & Carreido 2015, von Philipsborn et al. 2019). The measures most often employed are taxes (Falbe et al. 2016, Wang et al. 2012, Long et al. 2015, Silver et al. 2017, Thiele & Roosen 2018), limiting the availability in certain settings (e.g. banning vending machines in schools, Bergallo et al. 2018, Goryakin et al. 2017), restricting the marketing to children (Chriqui et al. 2014,

Gesualdo & Yanovitzky 2019), warning labels (Donnelly et al. 2018, Roberto et al. 2016, VanEpps & Roberto 2016) and public campaigns (Popkin & Hawkes 2016).

Many countries, among them industrialised countries such as France, Great Britain, Ireland, Belgium and Hungary, as well as developing and emerging countries such as Chile, Mexico and Saudi-Arabia and several cities in the U.S. have introduced incentive taxes on products with a high sugar content, mainly on SSBs, in the last few years (Backholer et al. 2016, Thiele & Roosen 2018). For instance, Great Britain introduced a tax on sugar-sweetened beverages in 2018; not included are fruit juices, milk-based products and products from very small businesses.

There are two types of tax increases with SSBs.

- A **relatively minor tax increase** aimed mainly at creating additional state revenue, which can be reinvested in public health (Brownell et al. 2009, Brownell & Frieden 2009). For instance, many U.S. American federal states have introduced a specific turnover tax on soft drinks with an average tax rate of 5.2%. This tax increase is too low to have a direct influence on the demand. Through its symbolic effect (tax increases can be understood as a health risk warning and can influence the social norm, Capacci et al. 2019) and the financing of other measures, however, these could indirectly influence food consumption.
- A **higher consumption tax** aims at lowering demand. Hungary has introduced a consumption tax on some foods, including an additional tax on soft drinks, amounting to 0.16 euro/litre (Villanueva 2011). France has introduced a consumption tax on non-alcoholic beverages to the amount of 0.36 euro/litre (Villanueva 2011). Australia applies a special VAT rate, charging soft drinks (and a series of other foods) with an additional tax rate of 10% (Mytton et al. 2012). The WHO recommends a tax on sugar-sweetened beverages that raises prices by at least 20% in order to reduce consumption by a relevant degree (WHO 2016b).

Economic analyses on own-price elasticity provide indications as to what extent the introduction of taxes results in a decrease in per capita sales of SSBs. The meta study by Andreyeva et al. (2010) indicates a medium price elasticity of -0.79; the study by Wang (2015) a value of -0.57. The WHO (2016b) indicates a range of -0.9 to -1.3 in its overview study. In wealthy countries like Germany, own-price elasticity is more in the lower range; for higher-income households it is even lower than for poorer households (Muhammad et al. 2019). Analyses regarding which age groups are more affected by an SSB tax are inconsistent: Rivard et al. (2012), Curry et al. (2018) and Gollust et al. (2014) show that there are stronger effects in younger people, Julia et al. (2015) in older people; Muhammad et al. (2019) confirm both and show that particularly low price elasticities can be found for middle-aged people. In comparison, smaller tax increases will probably have no effect on wealthy middle-aged people.

Assessing the **effects of tax increases** is a relatively complex issue, since these do not only depend on the consumers' price sensitivity and their substitution behaviour; but also on the pricing policy, i.e. to what extent tax increases are passed on to consumers (Thiele & Roosen 2018, Redondo et

al. 2018). The available assessments of tax increases that have already been introduced provide more valid proof:

- An empirical assessment for Mexico shows that in the first year following the introduction of the tax increase on SSBs by approximately 10%, household purchases of SSBs decreased on average by about 6% to 7%, and purchases of bottled water increased by 5% (Colchero et al. 2016a, b).
- In 2014, Chile increased the consumption tax on beverages with a high sugar content (> 6,25 g/100 ml) from 13% to 18% and decreased the tax on beverages with a sugar content below this threshold from 13% to 10% (Nakamura et al. 2018b). Beverages such as flavoured milk, pure fruit juices (100%) or unflavoured water remained tax-free. Caro et al. (2018) show that the prices for carbonated soft drinks increased by 2.0% and those for non-carbonated sugary drinks by 3.9%. Following the tax cut, the prices for drinks with a low sugar content decreased by 6.7%. One year after the tax cut, two thousand households observed in a longitudinal comparison decreased their monthly per capita purchases of drinks with a high sugar content by 3.4% in relation to quantity and by 4.0% in relation to calories. These changes were greater in households with a higher socio-economic status. Nakamura et al. (2018b) also refer to surprisingly large effects despite the relatively minor tax differentiation. Within one year after the introduction, the consumption of drinks exceeding the threshold decreased by 21.6%, with a particularly sharp drop among consumers with a high level of consumption of these products.
- In the U.S., Falbe et al. (2016) determined that within 4 months following the introduction of a tax of 33.8 cent per litre of soft drink introduced in March 2015, the consumption of SSBs in Berkeley declined by 21% and increased by 4% in reference cities where no tax had been levied. At the same time, water use in Berkeley rose by 63% and in the reference cities by 19%. On the basis of different data and for a one-year period after the introduction of the tax, Silver et al. (2017) show that taxed soft drinks decreased by 9.6%, while the sales of untaxed beverages rose by 3.5%. The comparison indicates that the effects are greater during the initial phase due to high media attention and then decrease slightly.

All in all, there is sufficient evidence based on economic model studies and first implementation experience in different countries showing that taxing soft drinks results in decreased demand (Thiele & Roosen 2018, Redondo et al. 2018). Measuring long-term effects on weight or health status is difficult outside the context of model calculations. Success in this area depends on substitution behaviour, among others (Schaller & Mons 2018).

Experience has shown that with regard to incentive taxes, enforceability also depends on **policy acceptance** (cf. Section 6). A slightly earlier U.S. study on the acceptance of different measures to reduce the consumption of SSBs (Gollust et al. 2014) finds that the respondents show the highest level of support for displaying the caloric value on foods (65%) and removing SSBs from schools (62%), while they least support taxes (22%) or limiting portion sizes (26%). In the past few years, a number of U.S. states have held votes on soft drink taxes, with mixed results. Donaldson et al.

(2015) examine the characteristics of those in favour of and against a tax on SSBs. The levels of support were higher among Democrats as well as those assuming that SSBs are one of the major causes of childhood obesity and those who believe that childhood obesity requires social intervention. Curry et al. (2018) show that there is stronger support among women, young people and liberals. For Great Britain, Timpson et al. (2013) demonstrate that, in general, citizens believe that taxing SSBs is acceptable, but that they are of the opinion that a tax increase of 20% would not be enough to influence consumption.

A meta-analysis by Eykelenboom et al. (2019) assesses the general elements that influence acceptance. According to this analysis, the political acceptance of taxes on soft drinks depends on, among other things: the perceived efficiency of such a tax for the reduction of consumption on the one hand; and the resulting health effects on the other hand; and thus also on peoples' assumptions regarding the contribution these products make to the development of obesity. The reduction effect regarding consumption, in turn, is based on the tax being passed on to the consumers, which is assessed differently. Further elements of the discussion on the purpose of a soft drink tax are the assumptions about indirect effects of a tax, for instance on the product formulations (reformulations) and the availability of health-sustaining and acceptable alternatives. A universal factor of acceptance is the outcome of the discussion on the necessity versus the adequacy of such a tax, which depends, among other things, on the fundamental assessment of the obesity problem and its causes (individual or social) as well as on possible negative distribution effects and economic implications. Trust in the different stakeholders, including the scientific community, is another factor of acceptance. Finally, the credible use of tax revenue for health measures is critical (Gollust et al. 2017).

Regarding SSB taxes, there is also a discussion on the extent to which these have a regressive effect (i.e. place a particularly heavy burden on low-income households) since people with a lower socioeconomic status drink more soft drinks, on average (cf. Section 4). How households with a lower income are affected by an SSB tax depends on the price elasticity of such a tax and the type of substitution behaviour, as well as on whether media discussions or other behavioural incentives impact their consumption. Households that cut back their soft drink consumption because of the tax and switch to, for instance, tap water, will experience economic and probably also health benefits. Households that do not change their consumption patterns will pay more taxes. It is ultimately an empirical question, depending on the policy mix design, whether an SSB tax has a regressive economical effect. Yet, it is a central lever to help improve the health of population groups with a particularly high SSB consumption and especially that of children and young adults (Schmacker 2018).

In order to **develop** an incentive tax, decisions need to be made about a) the taxable item, b) the tax rate, c) the tax type, d) the use of the tax revenues, e) the expected substitution behaviour and f) accompanying instruments. In the following, these aspects will be discussed for a health-oriented tax on sugar-sweetened beverages.

- a) **Taxable item:** Should only SSBs or all sugar-containing drinks (e.g. also fruit juices/nectars and milk drinks containing sugar) be subject to the tax? An argument against including fruit juices and milk drinks is that – unlike soft drinks – they contain nutritionally valuable ingredients besides their high (fruit) sugar content. A high consumption of fruit juices, fruit nectars and sweetened milk drinks is also problematic from a health perspective, although the health effects of the consumption of pure fruit juices are a contentious issue in the literature (Imamura et al. 2015, Crowe-White et al. 2016, Auerbach et al. 2018). The sugar content is comparable to that of SSBs. While a moderate consumption of pure fruit juices may also have positive effects, an increase in the average consumption due to people switching from soft drinks to juices would be problematic; also because the general sugar consumption in Germany is too high (Ernst et al. 2018). In addition, at 32 litres per year, the per capita consumption of fruit juices and fruit nectars in Germany is already particularly high by European standards (ibid.) The DGE recommends water as the standard beverage and additionally, to a certain extent, light spritzers with a juice content of about 25% (1 part juice, 3 parts water). Such light juice spritzers would only be affected to a limited extent by a “sugar tax”.

An argument in favour of including juices and sweetened milk drinks in a tax would also be that many consumers underestimate their sugar contents. Many parents, in particular, largely underestimate the sugar content in juices, even more so than with soft drinks (Dallacker et al. 2018).

- b) **Tax rate:** The tax rate should depend on the governance objective. How much is consumption to be reduced? Since the consumption of SSBs has no positive food consumption effects, a significant reduction should be aimed for. As described in Section 7.5.2, there is also empirical evidence that tax increases in several bigger increments have more impact than a one-time tax rise or many very small increments.
- c) **Tax type:** There are several possibilities for the technical implementation of taxation, e.g. increasing the VAT rate or introducing a special tax. Increasing the VAT rate for soft drinks, which is currently at 19%, is only possible to a limited extent, even though there is no formal upper limit for the VAT rate in the EU. However, the number of increments is capped. In addition to that, considerations regarding the tax system need to be taken into account. If a significant reduction is to be achieved, it would therefore be better to levy a special tax. Several alternatives would be worth considering in this context. An important decision is the issue of the reference point of the taxation, which serves as the basis of assessment.

A special tax can be levied i) as an absolute amount on the quantity of beverages (quantity tax), ii) by percentage on the price of soft drinks (value tax, ad valorem tax) or iii) specifically on the sugar content. For the most part, the literature calls for the third option, since this – as can be seen in Great Britain – provides incentives for a reduction of the sugar content (i.e. for a reformulation, cf. Section 8.4) as soft drinks that are less sweet are subject to lower tax rates. There are two ways to levy a tax based on the sugar content (iii): as a tax on the total sugar content or on the added sugar content (see above).

Targeted taxation of the reduction target, e.g. in the form of a proportional tax on sugar content in beverages, improves the effect and reduces side effects that are undesirable in terms of distribution policy compared to taxation based on volume, price-related excise duties or a VAT increase. Taxing the sugar content has the advantage that switching to cheap product variations is not supported.

The tax rate can increase in a linear fashion or in steps. The advantage of a gradual increase is that there are major incentives to remain just below a certain level, which allows quick effects on the supply side (see the example of Great Britain). The continuous incentive for improvement is an argument in favour of the linear approach. Products containing only very small amounts of sugar are also included.

Another unresolved issue is the handling of non-caloric artificial sweeteners. The empirical evidence on the negative health effects of artificial sweeteners is weak, although the argument of keeping up a high preference for sweetness can be put forward with some plausibility (cf. Section 8.4).

d) **Use of the additional tax revenues:** In line with the Budgetary Principles Act, all revenues must be used to cover all expenses (principle of universality), i.e. they are not collected for a specific purpose. However, for social policy reasons and to safeguard acceptance of the tax, the additional state tax revenues should be accompanied by tax relief in other areas so as not to increase the overall burden on taxpayers. The revenues could also be refunded as a lump sum or used for social policy measures or for subsidising health-promoting food consumption, in particular among vulnerable groups. Against this backdrop, the following options are possible, among others (cf. Section 8.6.3, Table 8-11):

- Refund of part of the state additional earnings through a yearly bonus (“health premium”/“sustainability bonus”), similar to what is currently being discussed in the context of climate protection.<sup>444</sup> In public debate, it is sometimes argued that compensatory payments would counteract the steering effects. This argument fails to appreciate that it is primarily price ratios, i.e. the relations between, for instance, soft drink prices and prices of possible substitutes, that are key for people’s product choice. These price ratios are influenced by incentive taxes.
- Such a bonus could be paid out to all citizens, either per person or per household. A personal rebate supports households with (smaller) children, since they consume less food in relation to the number of people, thus benefiting more from the reimbursement.
- Rather than for all citizens, the bonus could also be used exclusively to relieve the strain on households with a lower income, i.e. for compensating the regressive effect of an

---

<sup>444</sup> For low-wage labourers who do not benefit from an increase in the commuters’ allowance, in its climate package the Federal Government has earmarked a mobility allowance to be applied for at the tax office. The fear is that the associated administrative expenses may be inappropriately high. The introduction of the rebate for households with low incomes discussed here for the food sector would therefore be practicable for administrative reasons in particular if a uniform rebate model were developed for various incentive taxes.

increase in consumption tax.<sup>445</sup> This could, for example, be done by only offering the bonus to households with a low income.

- The bonus could be paid before the tax increase takes effect in the form of a special payment that is clearly recognisable to households in order to increase acceptance.
- As an alternative to rebates, the additional earnings could also be used for food policy purposes, e.g. to subsidise fruit and vegetables and/or to finance improved catering in schools and preschools.

e) **Substitution behaviour:** By simultaneously supporting the consumption of drinking water and specifically the consumption of tap water, e.g. by setting up drinking water wells or by promoting tap water consumption at home, targeted incentives should be made for a health-sustaining substitution. At EU level, these points are currently under debate within the scope of an amendment to the Drinking Water Directive, which is planned for 2020.<sup>446</sup> In addition to improved quality controls, this amendment commits member states for the first time to improve the access to and the use of drinking water and to promote its use (Art. 13). To this end, facilities for free drinking water are to be installed and maintained in public spaces. In addition, the provision of tap water (free or for a small service charge) to customers in restaurants, canteens and as part of catering services are to be “promoted” (Art. 13).

An increasing substitution of soft drinks with alcoholic products, such as beer or wine, would be counterproductive (cf. Quirnbach et al. 2018 on this danger). Here, a concomitant tax increase should be considered given the very low taxation of alcoholic beverages compared with other EU countries (e.g. 0.5 litres of beer: around 5 cent beer tax; no alcohol tax on wine)<sup>447</sup> and the high (social) secondary costs of alcohol consumption (Barrio et al. 2017).<sup>448</sup> Adams & Effertz (2009) calculate that increasing alcohol taxation in Germany to an average EU level would result in a decrease in alcohol consumption by 1.8 litres of pure alcohol per capita/year; the additional tax revenues would amount to 3.8 billion euro per year (data for

---

<sup>445</sup> This collateral social component of a consumption tax increase received little attention in the past (in contrast to compensation in companies) and has contributed to the “yellow vests problem” in France (Gagnebin et al. 2019).

<sup>446</sup> P8\_TA(2019)0320 Quality of water intended for human consumption: European Parliament legislative resolution of 28 March 2019 on the proposal for a directive of the European Parliament and of the Council on the quality of water intended for human consumption (recast) (COM(2017)0753 – C8-0019/2018 – 2017/0332(COD)). Regarding the status of the legislative procedure, see [https://eur-lex.europa.eu/procedure/DE/2017\\_332](https://eur-lex.europa.eu/procedure/DE/2017_332).

<sup>447</sup> Cf. on beer [https://www.zoll.de/DE/Fachthemen/Steuern/Verbrauchssteuern/Alkohol-Tabakwaren-Kaffee/Steuerhoehe/Bier/bier\\_node.html](https://www.zoll.de/DE/Fachthemen/Steuern/Verbrauchssteuern/Alkohol-Tabakwaren-Kaffee/Steuerhoehe/Bier/bier_node.html). In 2017, the tax revenues from alcohol special taxes amounted to: alcopop duty 2 million, sparkling wine duty 368 million, beer tax 664 million, spirits duty 2.094 billion, no additional tax on wine (for information only: coffee tax 1.057 billion, tobacco tax 14.399 billion, cf. [https://www.spirituosen-verband.de/fileadmin/introduction/images/Presse/BSI-Datenbroschuere\\_2018.pdf](https://www.spirituosen-verband.de/fileadmin/introduction/images/Presse/BSI-Datenbroschuere_2018.pdf)).

<sup>448</sup> Although the level of alcohol intake among the adult population is a serious problem, the effects of too high a consumption are only addressed here with regard to the special risk group of pregnant women and infants (Section 4.2.2.2). The WBAE is aware that high consumption of alcohol increases the risk of developing certain non-communicable diseases. The consumption of alcoholic beverages and tobacco, however, is subject to clearly different motives of consumption than the consumption of food and results in complex problems, whose well-founded analysis and discussion exceeds the limits of this expertise.

2009). All in all, working towards increasing the consumption of tap water would be particularly effective in order to realise a more sustainable consumption of beverages. The concerns over safety that are being raised by parts of the beverage industry do not convince (cf. the following text box 20).

- f) **Accompanying instruments:** The objective of an incentive tax and the de facto use of tax revenues for rebates, tax breaks or to subsidise health-promoting food consumption should be clearly communicated to society. A reformulation strategy may – as the example of Great Britain shows – be useful to complement a tax on soft drinks (cf. Section 8.4).

**Text box 20:** Promoting tap water consumption – Are the last metres a health issue?

Tap water is a particularly environmentally- and climate-friendly way to quench thirst. Depending on which beverage is replaced by tap water, the consumption of tap water can have additional health benefits. This is the case especially when sugar-sweetened soft drinks or drinks containing alcohol are avoided in favour of tap water. In Germany, tap water is considered a particularly safe food. The Drinking Water Ordinance stipulates that drinking water may not contain pathogens or substances in concentrations harmful to health. To this end, safety thresholds have been defined for more than 50 chemical and microbial ingredients and contaminants, and compliance is monitored by the public health authorities. However, the responsibility and thus also the mandatory monitoring requirement of the central water utilities ends at the water connections in private households, so that (re)contamination on the last metres from the household connection to the tap cannot be ruled out. In the past, lead contamination caused by water pipes was of particular importance, which is why the use of lead pipes for the water supply has been banned in parts of southern Germany since 1878 and in the remaining Federal territory since 1973. Since 2013, apartment and house owners have been legally obligated to exchange all lead pipes, whereby lead contamination can be excluded. To prevent the uptake of further entries, e.g. nickel from nickel-containing fittings or copper from non-compliantly installed copper pipes, it is recommended to flush out the stagnant water. This means that consumers should let the water run after the water has been left standing for longer periods of time until the water coming out of the tap is cool ([www.umweltbundesamt.de/publikationen/ratgeber-trink-was-trinkwasser-aus-hahn](http://www.umweltbundesamt.de/publikationen/ratgeber-trink-was-trinkwasser-aus-hahn)). Legionella, which may reproduce in hot water installations that are not operated properly, however, are not transmitted to humans by drinking. Instead, an infection occurs by inhalation of aerosols that are released when showering, for instance (RKI 2019).

In summary: From the WBAE's point of view, the safety concerns sometimes raised against tap water in the current discussion are not justified. The problem with the last metres is not limited to tap water. All foods may come into contact with health-damaging chemical or microbial contaminants due to inadequate processing or storage at home. These contaminations at home are hardly systematically recorded and can eventually only be addressed by making consumers aware.

**Conclusion:** Given the high consumption of soft drinks as well as fruit juices and fruit-based drinks in Germany, specifically among children and young people and particularly in low-income households, there are many arguments in favour of a linear tax on the sugar content of beverages. The following model calculation (Table 8-9) illustrates the consumption of the essential sugar-sweetened beverages in Germany and calculates the tax based on a tax rate of 20 cent/100 g of sugar.

**Table 8-9:** Calculation of possible tax revenues of a tax on sugar-sweetened soft drinks and juices<sup>449</sup>

	Consumption in Germany in litres/capita 2018	Total consumption in Germany in billion litres <sup>1)</sup>	Sugar content in % (estimated) <sup>2)</sup>	Total sugar consumption in million kg	Tax revenues in million euro (at a rate of 20 cent/100 g sugar)
Cola/cola-mixed drinks	36.6	3.0	10 %	303.8	607.6
Lemonades	31.3	2.6	10 %	259.8	519.6
Energy drinks	4.9	0.4	10 %	40.7	81.3
Total fruit juices/nectars	32.2 (2017)	2.7	10 %	267.3	534.5
Fruit-based drinks	9.8	0.8	5 %	40.7	81.3
Fruit-based spritzers	7.6	0.6	5 %	31.5	63.1
<b>Total</b>	<b>122.4</b>	<b>10.1</b>		<b>943.8</b>	<b>1,887.4</b>

Note: Without light beverages and flavoured water, <sup>1)</sup> for 83 million inhabitants, <sup>2)</sup> vast differences between the sugar contents of the different brands, cf. Foodwatch (2018b).

Sources: WBAE illustration based on Foodwatch (2018b) and wafg (2019) data.

With this tax rate of 20 cent/100 g of sugar – given that there are no recipe changes and no decline in demand – the tax revenues would amount to about 1.89 billion euro per year. In practice, however, the range of sugar content is wide. Regarding some energy drinks, the content currently exceeds 150 g of sugar per litre (Foodwatch 2018b). In Great Britain, the sugar content of Fanta, for instance, was reduced to below 5% after the sugar tax had been introduced. It is therefore to be expected that with such a tax (and the simultaneous reformulation efforts, cf. Section 8.4) significant sugar reductions would also be achieved in Germany. The state revenues would therefore be considerably lower. In addition, and as an intended effect of the tax, consumption would drop as expected.

To avoid unfavourable subsidies, water consumption should be promoted simultaneously and a higher taxation of alcoholic beverages should be considered. The tax on sugar-sweetened beverages should be socially viable and be used to subsidise health-sustaining food consumption.

<sup>449</sup> Sugar-containing milk drinks have been excluded from the following calculation for reasons of simplicity, but they should be included in the tax.

### 8.6.3 Sustainability tax on animal products

The very high impact of animal farming, and thus the consumption of animal products on the environment and the climate described in Sections 4 and 5, is a major challenge in terms of sustainability. For these reasons, there is some consensus among the international research community that the reduction of animal products is a key starting point for the improvement of sustainability in food consumption. In its guidelines, the German Nutrition Society recommends reducing the average meat consumption by roughly 50 per cent, the EAT-Lancet Commission advocates a reduction of approximately one quarter of the current consumption (cf. Section 5 and Willet et al. 2019).

Autonomous consumption reductions, i.e. those not induced by policy but rather by changed preferences of the population, have only been observed to a lesser degree in the past years and are not expected given the global consumption of animal products (OECD & FAO 2019). However, about 25% of consumers in Germany state that they are considering reducing their meat consumption (Zühlsdorf et al. 2016) and the share of vegetarians in Germany (most of whom are women) almost tripled to about 5% from 2006 to 2016 (ibid. and MRI 2008). These individuals, who tend to be younger and highly educated women on average, could provide impetus for social change due to their increasing position as opinion leaders. In addition, substantial risk capital is spent on research on meat and cheese substitute products, be it plant-based alternatives or in vitro meat, which in the future will probably provide better substitutes for animal protein. In this respect, projections about the consumption of meat and milk products for the OECD countries are uncertain.

Among the general population, no major decline in consumption has been observed to date. Without political support, such a decline is not expected in the foreseeable future. As described in Section 3, our food consumption habits are based on several factors and are always enshrined socially, materially and historically. With regard to the consumption of animal products, the very high socio-cultural symbolisms and importance of “meat” as food or “eating meat” as a social practice must be stressed (cf. e.g. Kofahl & Weyland 2016, Trummer 2015, Barlösius 2016). For example, social science studies and cultural studies illustrate the perpetuating association of meat and masculinity. Such associations are cultural barriers to giving up meat (cf. Setzwein 2004, Nath 2010, Rozin et al. 2012, Kofahl & Weyland 2016).

Meat consumption and abstention from meat are particularly contested food consumption practices from a social and moral perspective – discussions in the media also illustrate this (cf. Flick & Rose 2012, Trummer 2015). At the moment, meat consumption is questioned in particular by consumers who eat little meat anyway, while information on the health, climate and environmental impacts of meat consumption have so far had little effect on the behaviour of “heavy meat consumers” (Tobler et al. 2011, Stoll-Kleeman & Schmidt 2017). Overall, the relevance of the consumption of animal products for environmental protection (Tobler et al. 2011) and in particular greenhouse gas emissions (Vanhonacker et al. 2013, de Boer 2016) continue to be underestimated among the population. De Boer et al. (2016) show that Dutch and US citizens consider the consumption of seasonal and regional products to be a significantly more effective climate action than

a reduction in meat consumption. Dairy products are discussed even less, which is probably due to, among other things, the better animal welfare and health image of milk compared to meat. Surveys among the population also show that the climate impact of cattle farming is hardly known among the population. When asked about climate change mitigation measures concerning their own food consumption, 36.4% of Germans mention reducing meat consumption, but almost no one refers to a reduction in milk or cheese consumption.<sup>450</sup>

At the same time, it becomes clear that the technical reduction potentials in the field of production are limited, which was confirmed by the German Council of Economic Experts. The experts stated that the target to reduce greenhouse gas emissions in the agricultural sector by 31% to 34% by 2030 compared to 1990 levels, as set out in the Climate Action Plan 2050, is unlikely to be achieved through measures in fertiliser management and crop and livestock production alone. Since, in contrast to other sectors, the technological possibilities of emission reduction are naturally limited with livestock farming, the only option, according to the German Council of Economic Experts, is to reduce the number of animals (Sachverständigenrat zur Begutachtung der gesamtwirtschaftlichen Entwicklung 2019: 50). At the same time, the experts state that reducing livestock farming in Germany without reducing consumption would essentially only lead to leakage effects. Therefore, if this key driver is to be tackled, a policy to influence the demand for animal products is essential.

Such a strategy for addressing the (excessively high) consumption of animal products currently does not exist in Germany. Also at international level, relatively few political efforts for the targeted reduction of the consumption of animal products have been seen so far. In China, the government has launched the first information campaigns on reducing the heavily increased consumption of meat and aims at halving consumption in the long run (Awater-Esper 2016). However, it is still unclear what level of intensity this policy will reach (Mason & Lang 2017). This also applies to other countries striving to further strengthen the links between food and climate policy (Mason & Lang 2017). The BMEL has not yet established reduction targets for animal products (cf. the BMEL's Livestock Husbandry Strategy). Although there is some political interest expressed in moving towards "moderate meat consumption", political interventions (with the exception of information campaigns in the area of health prevention) are rejected.

To initiate the much-needed transformation of society as a whole towards a significantly more plant-based food consumption (cf. Sections 4 and 5), the WBAE recommends that the BMEL develop and implement a **strategy for the reduction in the consumption of animal products** to close this gap (cf. Section 9.3). The expert committee sees an increase in prices for animal products as a key element of this strategy (WBAE & WBW 2016).

---

<sup>450</sup> These figures are from an approximately representative population survey presented in Lemken et al. (2018), which was conducted in 2017. However, they are not included in the cited publication.

Different options can be used to this end, two of which will be presented in more detail:

- (3) **A differentiated climate tax on food (of animal origin):** a tax that is adjusted as precisely as possible to the climate impacts of the various animal products (or of foodstuffs as a whole) (Moberg et al. 2019).
- (4) A simplifying, **flat-rate tax increase for commodity groups that are particularly damaging to the environment and to the climate**, especially for animal products, possibly coupled with VAT at first.

**Option 1: a differentiated climate tax on food (of animal origin).** This option would include the food market in a differentiated climate tax. There is now a relatively large amount of data available on the GHG effects of different foods (cf. Section 5.3). A sufficiently differentiated taxation on this basis would therefore be possible. The benefit would lie in the more precise governance effect regarding climate stewardship if a quantity-related taxation were to be applied.

Taking for instance the (discounted) damage costs of GHG emission of about 180 euro/t of CO<sub>2</sub><sup>451</sup> that was calculated by the German Environment Agency, this would lead to relatively high tax surcharges (Table 8-10, column 3). However, it would make sense – as with the debate on climate tax in general – to start smoothly and begin with the (often proposed) amount of 35 euro/t of CO<sub>2</sub>.<sup>452</sup> In its Climate Action Programme 2030, the Federal Government plans for a starting amount of 25 euro/t of CO<sub>2</sub> for the year 2021 in the transport and building sectors. By 2025, the price is to increase to 55 euro (Bundesregierung 2020).

---

<sup>451</sup> As an alternative, CO<sub>2</sub> avoidance costs could be used, but they differ among industries and products and are not known in many cases today. The market price in the European emissions trading system is only of limited use due to different distortions. In August 2019, the price was about 25 euro/tonnes of CO<sub>2</sub> (24.90 euro, as of 23 August 2019, <https://www.eex.com/en/market-data/environmental-markets/spot-market/european-emission-allowances>), the climate compensation system “Atmosfair” estimated 23 euro in August 2019 (as of 25 August 2019, [www.atmosfair.de](http://www.atmosfair.de)).

<sup>452</sup> Different economic research institutes currently propose 35 euro/t of CO<sub>2</sub> as a starting price. Cf. Sachverständigenrat für gesamtwirtschaftliche Entwicklung der Bundesregierung (2019), Forum Ökologisch-Soziale Marktwirtschaft (2019), Gechert et al. 2019 and Bach et al. (2019).

**Table 8-10:** Climate tax surcharge on selected foods at different tax rates

Food (and GHG emission per kg)	Tax of 55 euro per t of CO <sub>2</sub> equivalent	Tax of 180 euro per t of CO <sub>2</sub> equivalent
1 kg of beef (with 26.6 kg of CO <sub>2</sub> equivalents)	1.46 euro/kg	4.79 euro/kg
1 kg of beef (with 5.8 kg of CO <sub>2</sub> equivalents)	0.32 euro/kg	1.04 euro/kg
1 kg of poultry meat (with 3.7 kg of CO <sub>2</sub> equivalents)	0.20 euro/kg	0.66 euro/kg
1 kg of milk (with 1.29 kg of CO <sub>2</sub> equivalents)	0.07 euro/kg	0.23 euro/kg
1 kg of butter (with 9.3 kg of CO <sub>2</sub> equivalents)	0.51 euro/kg	1.67 euro/kg
1 kg of cheese (with 8.6 kg of CO <sub>2</sub> equivalents)	0.47 euro/kg	1.55 euro/kg
1 kg of legumes (with 0.5 kg of CO <sub>2</sub> equivalents)	0.03 euro/kg	0.09 euro/kg
1 kg of asparagus imported by air (with 12 kg of CO <sub>2</sub> equivalents)	0.66 euro/kg	2.16 euro/kg
1 kg of asparagus from Germany (with 1 kg of CO <sub>2</sub> equivalents)	0.06 euro/kg	0.18 euro/kg
1 kg of tomatoes heated greenhouse (with 2 kg of CO <sub>2</sub> equivalents)	0.11 euro/kg	0.36 euro/kg
1 kg of tomatoes unheated greenhouse (with 0.5 kg of CO <sub>2</sub> equivalents)	0.03 euro/kg	0.09 euro/kg

Source: WBAE calculations, GHG emissions according to Clune et al. (2017), cf. Section 5.3.2.

The examples above demonstrate the high greenhouse gas relevance of i) animal products, in particular beef and dairy products, ii) transportation by air and iii) heated greenhouses (cf. Section 5.3). The price increase for pork and in particular for poultry meat would be less significant (cf. also Forum Ökologisch-Soziale Marktwirtschaft 2020).

How could such a (quantity-related) climate tax on food be implemented? VAT is not suitable for such a highly differentiated and spread tax burden; in the EU, only three different tax rates are admissible. In addition, VAT is linked to turnover, not the product volume relevant to climate.

For this reason, a new consumption tax would have to be developed that specifically targets the quantity and the greenhouse gas emissions of the respective food. An advantage of such a new consumption tax would be that it could be given a name with a strong communication impact (e.g. climate stewardship tax). The tax amount could also be variable. As a consumption tax it would not affect competition with regard to exports and imports. In addition, it would only place a burden on the buyers of the respective products (for instance, vegetarians would not be affected with regard to meat).<sup>453</sup> Finally, the tax revenues could be assigned to a specific purpose and be used for specific targets (e.g. animal welfare, cf. Kompetenzkreis Nutztierhaltung 2020).

A disadvantage of the new consumption tax would be that for compound, processed foods the tax would have to be calculated on the basis of the formula, since the different ingredients contain

<sup>453</sup> In February 2020, the authority network on animal welfare (the so-called “Borchert Commission”) proposes a new consumption tax on animal products in its recommendations to the BMEL (Kompetenznetzwerk Nutztierhaltung 2020).

varying GHG levels. This would be possible for the major producers thanks to modern EDP technology but would reach its limits in the craft trade as well as the restaurant and catering sector and make generalised data and threshold values necessary. For this reason, it would involve less effort to tax at the bottleneck of the value-added chain, for instance at the dairy farm, slaughterhouse or at wholesale level. The tax paid towards the German Agricultural Marketing Fund (“German Agricultural Marketing Board Tax”) was previously levied in this way, involving relatively little bureaucracy. However, the problem would then be with external trade: imported goods would need to be taxed subsequently, and export products would need to be relieved. Given the intricate interdependencies within the EU, such a tax at the bottleneck could only be implemented across the EU.<sup>454</sup>

In addition, a differentiated climate tax on all foods disregards further sustainability goals or trade-offs between goals. For instance, from a climate stewardship perspective, poultry performs comparatively well due to the high feed efficiency and gets a rather positive assessment from a health perspective. Yet, poultry production is problematic with regard to animal welfare due to its high intensity (WBA 2015). Beef and sheep meat as well as dairy products would be subject to higher taxation with a tax differentiated according to CO<sub>2</sub> equivalents. However, this would also affect grassland grazing by ruminants, which is important from an environmental stewardship and biodiversity viewpoint. Organic meat and meat with an animal welfare label would be taxed the same as meat from standard supermarkets. In this respect, a mere climate tax contradicts the purpose of this expertise to consider the different sustainability dimensions in an integrated manner (cf. therefore the possibility to prospectively introduce a comprehensive, label-based sustainability tax in food, which is discussed in Section 8.6.4).

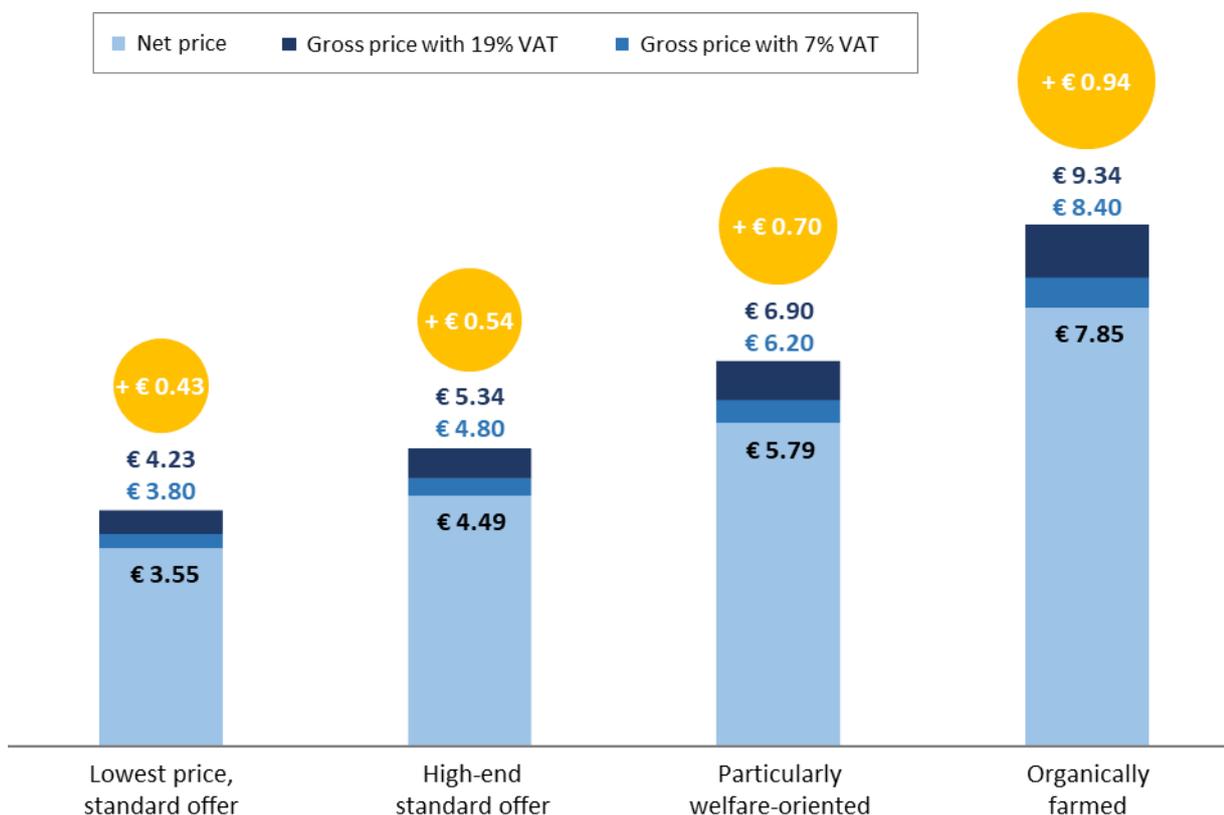
**Option 2: a simplifying tax increase for particularity environmentally- and climate-friendly product groups.** As long as a differentiated climate and sustainability tax is not enforceable, the objective should be to implement transitional models. Here, option 2 proposes a simplified, flat-rate tax solution for groups of goods that are particularly damaging to the environment and to the climate. As the WBAE already proposed in its expertise on climate stewardship together with the WBW (WBAE & WBW 2016), abolishing the reduced VAT rate for animal products would be a nationally implementable first step. Abolishing the reduced rate, which currently results in a taxation of animal products of 7% instead of 19%, can be realised in the short term and causes only a minor bureaucratic burden.

However, the VAT is not intended as an incentive tax. It is therefore not targeted. With regard to climate protection, it is positive that more expensive beef is taxed more heavily in absolute terms than, for example, poultry meat, due to the value-based tax surcharge of the same percentage. The relative cheapness of the more climate-friendly poultry increases through the starting price for beef, which is about twice as high. At the same time, the relation to the price results in (expensive) environmentally- and animal-friendly options being taxed more heavily. Figure 8-10 shows this using the example of different pork meat options.

---

<sup>454</sup> Such border tax adjustments are being proposed by the EU Commission’s president as of late.

**Figure 8-10:** Price increase of various meat segments in the case of harmonisation of VAT with the standard rate



Source: HBS et al. (2018: 17), graphically adjusted.

The harmonisation of VAT on animal products is a targeted yet not precise contribution to climate change mitigation, which, however, has negative effects on other sustainability dimensions. For this reason, from the WBAE's point of view, it is advisable to abolish the VAT reduction. Further increasing VAT beyond the normal rate, however, would be problematic.

The WBAE has already given an estimate on the effect of such a VAT alignment for all animal products (meat and meat products, milk and dairy products, eggs, fish, animal oils and fats) with the normal rate in its expertise on climate stewardship (WBAE & WBW 2016: 98 et seqq.). Two scenarios, each with a different price elasticity, were calculated. With a low price sensibility, there are decreases between only 1.4% (butter) and 4.2% (meat, meat products) after VAT has been raised to the normal rate. In the case of high price elasticities, the decreases are between 4.7% (butter) and 11.8% (meat). Banse and Sturm (2018) calculate a decrease in private consumption of all animal products by 6%.

The state's additional earnings due to the tax increase after deduction of the decrease in demand are between 4.3 and 5 billion euro per year (WBAE & WBW 2016: 100). These calculations are at a

similar level as Buschmann and Meyer's (2013), who estimate additional revenue amounting to approximately 2 billion euro for meat/meat products alone.

The price elasticity of animal products in Germany is relatively low. For this reason, the VAT harmonisation only makes a limited contribution to climate change mitigation. It could be that the price effect is somewhat strengthened by an intensive social debate about the GHG effects of animal production. In the medium and long run, however, another tax would have to be introduced if the reduction in the consumption of animal products – which is desirable from a climate stewardship perspective – is to be achieved, in particular through taxes/economic incentives and disincentives. This could be the label-based sustainability tax discussed in Section 8.6.4. If such a comprehensive sustainability tax on food should not be enforceable across the EU, it could be considered to introduce a special tax on animal products, the amount of which should then be determined based on the experiences. A new tax should then definitely be levied on quantity rather than revenue in order to prevent the problematic effects regarding products that are expensive because they were produced in a particularly environmentally-, climate- or animal welfare-friendly way.

The **use** of the additional tax revenues is fundamentally subject to the principle of universality, according to which all income is intended to cover all expenses. However, the additional tax revenues increase the budgetary scope. As previously illustrated in great detail (Sections 7.5.2 and 8.6.1), three options are worth considering for different reasons: (1) a tax increase with a corresponding flat-rate tax rebate as a climate stewardship premium, (2) the use of additional tax revenues to subsidise health-promoting products, such as fruit and vegetables or (3) a use for a specific purpose, e.g. animal welfare. A mix of the three options is also possible. Table 8-11 shows the advantages and disadvantages of the different options with regard to acceptance, administrative costs and effects as well as side effects. The implementation costs of a flat-rate rebate to lower-income parts of the population – as was adopted, for instance, in 2019 within the scope of the climate package as a mobility premium – depends, among other things, on whether several such premiums could be processed under a harmonised administrative operation.

**Table 8-11:** Use of the additional tax revenues in the event of abolition of the reduced VAT rate for animal products – options and arguments for and against

	Acceptance	Implementation costs	Effect and side-effects
<b>Flat-rate repayment to (parts of) the population (“climate stewardship premium/sustainability bonus”)</b>	Relatively good level of acceptance among the population	High implementation costs (provided that climate premiums, mobility premiums or similar are not already introduced within the scope of a general CO <sub>2</sub> equivalent)	Compensates the regressive effect particularly well
<b>Use for a subsidy on fruit and vegetables</b>	Particularly high acceptance among the population	Can be implemented at low cost	(Small) positive health effect, regressive effect remains
<b>Use for animal welfare (remodelling of livestock husbandry)</b>	Particularly high acceptance among the population (and increased chances of acceptance in parts of the agricultural industry)	Implementation costs differentiated according to action	Plausible interconnection regarding content and positive animal welfare contribution, regressive effect remains
<b>No specific use</b>	Poor acceptance among the population	Corresponds to the principle of universality, implementation costs are low	Regressive effect

Note: It should be noted that according to the principle of universality all earnings are used to cover the expenses. For instance, this means the VAT is not levied for a specific purpose, but the legislative authority could simultaneously decide on proposals for repayment/use.

Source: WBAE illustration.

A revenue-neutral tax increase could be achieved through an annual personal repayment. It would be conceivable to compensate all citizens. A climate bonus of 50 euro/year per person would, for instance, compensate for additional fiscal expenditure of approximately 4.1 billion euro and would thus roughly correspond to the VAT increase for animal products. If the objective were to only compensate the lowest-income 40% of the population (to counteract the regressive effect of consumption taxes),<sup>455</sup> it would be around 1.63 billion euro (Thöne et al. 2019).

(Partial) compensation requires, among other things, a complete central personal register or new procedures at the tax offices in order to make the payments. It would therefore be more cost-efficient if compensatory payments were also used in other fields of sustainability apart from food consumption. So far, however, the Federal Government has no plans to introduce such a general

<sup>455</sup> Compensating the lowest-income 40% of the population would mean that the upper ceiling of the 2017 net disposable income in Germany would have amounted to 19,318 euro/year (Thöne et al. 2019).

climate bonus, which could be used as a starting point (cf. the current Climate Action Programme 2020 of the Federal Government).

Furthermore, a partial use of the funds for animal welfare purposes is possible. In its expertise on the future of a socially accepted livestock husbandry (WBA 2015), the WBAE estimated the annual additional costs of significantly increasing animal welfare to amount to approximately 3-5 billion euro (similar to Kompetenznetzwerk Nutztierhaltung 2020). However, from the WBAE's point of view, reallocating the funds of the EU's Common Agricultural Policy (CAP) is the more obvious option for financing at least a part of this challenge (cf. also WBAE 2018, 2019). In Germany, the direct payments of the CAP amount to almost 5 billion euro annually and should in future be spent for the remuneration of services of general interest, according to the WBAE. It must be taken into account, however, that in addition to animal welfare, there are also considerable funding challenges in agri-environmental policy (e.g. biodiversity, climate stewardship) and that the direct payments should only be reallocated gradually. Therefore, further funds are required for animal welfare (Kompetenznetzwerk Nutztierhaltung 2020), so that the use of sustainability-induced tax increases would be useful for this purpose. If a part of the revenue from a sustainability tax on animal products should be used for animal welfare, socio-political arguments speak in favour of compensating at least lower-income brackets with the remaining funds due to the regressive effect of the tax.

**Substitution behaviour:** A possible problem might be that population groups with unfavourable food consumption habits, including the frequent consumption of animal products, react to price increases by turning to more affordable, high-fat meat-containing products or fast food that is unfavourable in other respects instead. There might also be reactance effects. A tax increase would therefore have to be monitored in order to be able to counteract such behavioural trends early on.

**Accompanying instruments:** In agriculture, the debate on reducing the consumption of meat or animal products is perceived as a threat to domestic livestock husbandry. Animal products are responsible for more than 60% of the value-added of agriculture in Germany. In the upstream and downstream sectors, a reduction in consumption might result in the decreased use of existing capacities, which would compromise international competitiveness. Taxing animal products is therefore met with resistance by parts of industry. Against the above-mentioned background, the WBAE recommends to the BMEL a programme for the long-term reduction in the consumption of animal products, which is embedded in a comprehensive livestock husbandry strategy. As was already presented in detail in the expertise on livestock husbandry (WBA 2015), this programme should be designed under the "less and better" principle, i.e. it should not only be targeted at reducing the consumption but also at an improved animal husbandry that rewards the additional effort to comply with animal welfare standards. From the WBAE's point of view, such a reduction programme has a high priority and should be established at an early stage because of the significant long-term economic side-effects; but it should be designed with due care and as a learning programme.

#### 8.6.4. In future: a label-based sustainability tax on all foods

To date, the discussion on sustainability taxes on food in the health and environmental areas (Erfertz 2017, WBAE & WBW 2016) have been focussed very strongly on VAT. In the case of foodstuffs, different VAT rates already exist, but their former justification (tax reduction for essential foodstuffs) and implementation in the present form are no longer convincing from a tax system perspective, so that other reasons can be used for a (different) differentiation. However, the possible differentiation is limited by VAT increases and reductions (cf. Section 8.6.3). In addition, since they are related to turnover, the VAT increases discussed in the previous sections disproportionately increase the price of products that are more expensive but often preferable from a sustainability perspective (e.g. environmentally-friendly and animal welfare-oriented products). Finally, the differences between the different types of meat (beef, pork, poultry) are considerable with regard to their climate footprint and also animal welfare. A **uniform taxation of broad commodity groups** such as meat is therefore **not targeted enough**.

The differentiated climate tax on the basis of greenhouse gas emissions, which has also been discussed in the previous section, is more specific. However, it only considers one area (climate) of the sustainability dimension (environment). This is particularly problematic in the case of **trade-offs** between the different sustainability dimensions (e.g. between climate stewardship on the one hand and animal welfare on the other hand) or subdimensions (e.g. between climate stewardship and the protection of biodiversity).

In order to promote food consumption of more sustainable products in general, it would be more suitable in the medium- and long-run to introduce a **specific and comprehensive incentive tax on food that is staggered according to the sustainability level**. It is therefore necessary to find a basis for taxation that, on the one hand, is target-oriented with regard to the four central sustainability dimensions and, on the other hand, can be recorded sufficiently cost-effectively in order to limit transaction costs. In the future, such a consolidated sustainability tax could replace the individual, product-based incentive taxes and subsidies discussed above.

From the WBAE's point of view, a possibly target-oriented option of a general sustainability tax is taxation on the basis of the classification of foodstuffs into different (compulsory) sustainability labels (cf. Section 8.9 above for details). There are signs indicating that consolidated, tiered labels are used increasingly. According to such a model, a consumption tax could be levied, for example, depending on the classification under the three **government labels** proposed in this expertise. If it were assumed simply that 5-tiered sustainability labels were used for the three areas of climate stewardship, health and animal welfare, and if the classification were coded from 0 (= particularly sustainable) to 4 (= not very sustainable), then an overall index of 0 (very sustainable) to 12 (worst classification for all three labels) could be calculated. Should the planned state animal welfare label have four tiers (without a label and one to three stars), the concept would need to be modified accordingly (cf. Table 8-12). With this overall index, a tax rate could be set that would either be

based on the price or (possibly more target-oriented) on the quantity of the respective product. A possible evaluation matrix, which is to be further specified, is outlined in Table 8-12.

**Table 8-12:** A possible evaluation matrix for a comprehensive sustainability tax on food

Label	Classification				
Nutrition label	dark green (0 points)	light green (1 point)	yellow (2 points)	orange (3 points)	red (4 points)
Climate label	dark green (0 points)	light green (1 point)	yellow (2 points)	orange (3 points)	red (4 points)
Animal welfare label (for animal products)	Tier 3 (0 points)	Tier 2 (1 point)	Tier 1 (2 points)	Tier 0 (3 points)	-
Range from 0 to 11 points (for animal products) or 0 to 8 points (for plant-based products) as the basis for the amount of a specific incentive tax.					

Source: WBAE illustration.

The model is based on tiered labels for the different sustainability dimensions. A tiered state animal welfare label (standard plus three label tiers) and the five-tiered Nutri-Score are currently in the legislative process. With regard to the environmental dimension, only one climate label is currently developed to the extent that it could be implemented in the foreseeable future. For other important environmental targets, such as biodiversity, and possibly for social objectives, corresponding systems would still have to be developed. Taxation based on label classifications would be a pragmatic approach to simultaneously considering different sustainability goals. However, the model requires legally regulated mandatory labels because there must be corresponding values for all products.<sup>456</sup> The weighting of the individual dimensions would also need to be defined. A possible weighting and also the overall tax rate would have to be determined with regard to the policy goals.

Such a **label-based sustainability tax** would be complex to calculate as a consumption tax that is only levied at the point of consumption, especially when it comes to composite food. In principle, however, differentiated product-specific consumption taxes can be realised in the digital age – compare this, for instance, with the comprehensive product lists for the turnover tax (Section 12 (2) (1) of the German VAT Act in conjunction with Annex 2 No 35).

From the WBAE's point of view, the concept of a label-based sustainability tax has several advantages compared with a differentiated climate tax (option 1, Section 8.6.3):

<sup>456</sup> This option would not prevent the problem mentioned with regard to a differentiated climate tax, namely that for processed foods the formula would have to be used in order to make an assessment possible; here, too, a climate label must be calculated for these complex products.

- The label-based sustainability tax takes into account several sustainability dimensions and thus trade-offs between goals and synergies;
- If respective labels have been developed, it is relatively easy to calculate the sustainability tax;
- The sustainability tax would link economic incentive components with an information component that is visible to consumers and would thus be easier to communicate.

If such a universal label for the central sustainability dimensions should not be enforceable in the political decision-making process, an alternative would be to introduce a sustainability-based consumption tax on selected foods, which is based on relatively fixed values, such as the ones developed by the BMEL's authority network on animal welfare from an animal welfare perspective in February 2020 (Kompetenznetzwerk Nutztierhaltung 2020).

### 8.6.5 Conclusions

A reduction in the consumption of animal products is a major "sustainability lever". A reduction in the consumption of to date approximately 10 billion litres of sugar-sweetened beverages is a no-regret measure, which – if substituted predominantly with tap water – would have additional positive environmental policy and economic side effects. Using a part of the additional tax revenues from the proposed beverage tax and from the proposed abolition of the reduced VAT rate for animal products in order to reduce the VAT rate on fruit, vegetables and legumes continues to contribute to climate stewardship and health-promoting food consumption. In the long run, a differentiated sustainability tax on food should be implemented, e.g. based on the classification for the different state sustainability labels proposed here.

If the tax revenues are repaid to the population as a flat-rate rebate, this would increase acceptance for this sustainability policy. Against this backdrop and the regressive effect of consumption taxes and considering the issue of healthy food consumption among low-income population groups identified in the expertise, there are many arguments in favour of a sustainability bonus, at least for low-income households.

However, the additional earnings could also be used to pursue other relevant and significant governance objectives. The WBAE proposes to use part of the climate tax on animal products for the remodelling of livestock husbandry in Germany towards greater animal welfare (cf. Sections 9.3 and 9.4.1).

## 8.7 Information campaigns

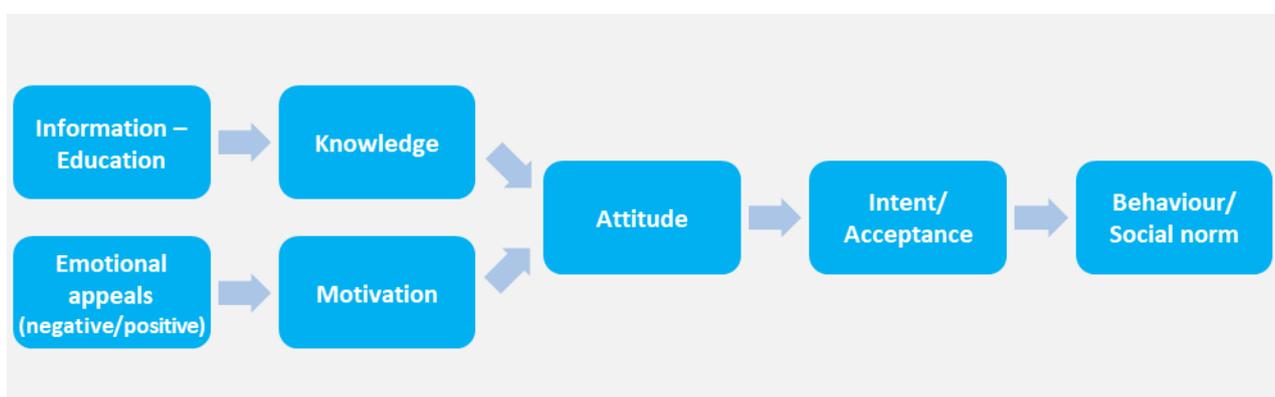
Information addressed to consumers is a core area of the current food policy. In many cases this includes recommendations for food consumption habits that are ultimately intended to achieve behavioural changes in the population in general and in specific target groups. The spectrum of media used to convey information is diverse and comprises e.g. flyers, brochures, websites, videos and blogs. For example, many measures of the National Action Plan entitled “IN FORM - Germany’s national initiative to promote healthy diets and increased physical activity”, which runs until 2020, aim to better inform the population about sustainable food consumption and exercise (BMEL & BMG 2014).

The following provides an overview of the targets, content and forms of information communicated (Section 8.7.1) as a first step in addressing the overall conditions needed for successful communication and both the difficulty and need for evidence-based evaluation (Section 8.7.2). Section 8.7.3 summarises the considerations and illustrates the potential for optimisation in current information campaigns on food and nutrition policy.

### 8.7.1 Aims, content and forms of information

There are almost unmanageable quantities and forms of information and corresponding strategies for communicating it. A **simple causal model of the impact of information** is frequently implicitly assumed (Fig. 8-11): information leads to an improvement in knowledge and thus also causes a change in attitudes and behaviour, enhances acceptance and, in the long term, changes social norms.

**Figure 8-11:** Simple causal model on the effect of information and emotional appeals

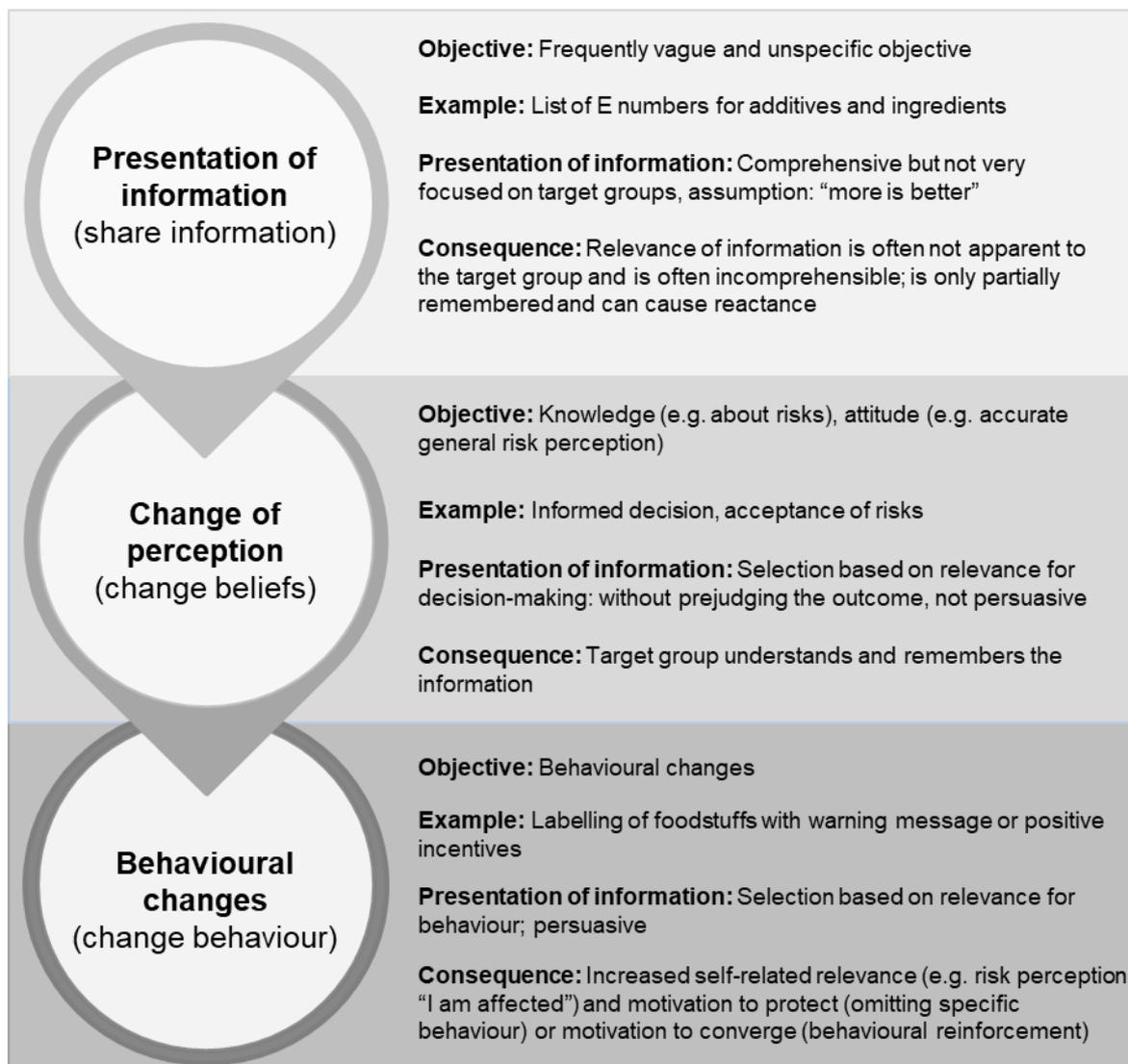


Source: Renner (2017)

The chosen communication strategies thus differ not only in terms of their content, forms and target groups, but also in their objectives and impact. Basically, **three possible goals or effects of information communication** can be distinguished (Fig. 8-12): the pure provision of information (goal 1), the change of perceptions, attitudes and convictions (goal 2) and the change of behaviour, of acceptance and/or of the social norm (goal 3).

Often information is generally assessed as having little “intervention depth” (cf. Section 6). However, depending on the way in which it is selected and communicated, information can vary in terms of the desired impact, ranging from very little intervention (objective 1) to very deep intervention (objective 3). Nevertheless, information campaigns differ from measures that are classified as being more deeply interventionist in Section 6 in that the translation into different behaviour is usually of a voluntary nature, without monetary incentives being used.

**Presentation of information (goal 1):** Communication which is aimed solely at presenting information is often non-specific, i.e. the target group and the intended effect are not clearly defined (Just-say-it method; Brewer 2011). However, if the information is not selected on the basis of its relevance, comprehensibility and usefulness to consumers, it is not to be expected that it will be noticed or remembered and as a result is also not to be expected to have an impact on behaviour. This information is often presented, for example, primarily in order to rule out legal claims rather than for it to be understandable and guide consumer behaviour (see, for example, the discussion on E-numbers for food additives or medicine leaflets).

**Figure 8-12:** The three goals (or effects) of information communication

Source: Adapted presentation according to Renner & Gamp (2014) and Brewer (2011).

**Changing perceptions and attitudes and beliefs (goal 2):** Communication aimed at changing knowledge and attitudes is usually based on the selection of information. Specifically, the communication of relevant facts (factual and information appeals) should allow consumers to make an accurate assessment of facts and circumstances (e.g. an accurate assessment of health risks, greater acceptance of and confidence in food and nutrition policy measures) so that they can make an informed decision (Gigerenzer et al. 2007). What matters here is the non-persuasive character of the selection and presentation of information. Ideally, the relevant information should be presented in a target group-oriented and comprehensible manner. Yet the decision on what ultimately constitutes "relevant" information often depends on the respective perspective, which can also be guided by economic interests. There are therefore initiatives in various areas intended to ensure that relevant and evidence-based information is provided. An example from the field of medicine can illustrate this: as part of health-related patient information, for example, the aim is to provide

data on the benefits and harm of the respective measures, based on systematic evidence-based research and evaluation of the literature by expert commissions (<https://www.leitlinien.de/patienten/patienteninformation>). In the case of food, corresponding consensus papers drawn up by professional societies could assume this role.

It is often assumed that as much information as possible must be provided in order to have an impact. However, given limited attention and processing resources (cf. Sections 3 and 6), it is unrealistic to assume that “more” is always better. Therefore, **information selection** is of **vital importance**. It should be fact-based and evidence-based<sup>457</sup> and include aspects which are relevant to decision-making. This can also be illustrated by an example from medicine: smoking causes a variety of diseases. For the risk assessment by consumers, however, it is probably not crucial to know all of them in detail; it is sufficient to know the most likely and most serious diseases. One problem with communication on food-consumption issues is that cause-effect relationships are not as clear as with smoking. An important aspect of information and communication campaigns aimed at changing knowledge and attitudes is that it is up to consumers to decide what choices or behaviour they ultimately choose. This has clear implications for the evaluation of the efficacy of such information measures, as there is no single target form of behaviour to be used as an evaluation criterion. What matters first and foremost is an increase in knowledge and competence or a change in the acceptance of measures (if this is the target criterion).

**Behavioural change (goal 3):** when a change in behaviour is aimed at, information selection and presentation is often both selective and persuasive. Information is typically selected and presented in a way that maximises the likelihood of a desired behaviour pattern occurring (e.g. in advertising). For this reason, it is mainly emotionally effective information which is presented alongside factual information in this regard. This emotional information can be negative and even frightening. Within the framework of so-called fear appeals, “shock images”, for example, are used to induce immediate attention and fear, which is then intended to motivate a change in attitude and behaviour. Here, too, smoking can serve as an illustration: In 2012, for instance, the US Centers for Disease Control and Prevention (CDC) launched a campaign called “Tips From Former Smokers”, which shows former smokers who tell their personal stories of illness and suffering caused by tobacco consumption. According to an empirical study that evaluated the first wave of the campaign in spring 2012, around 80% of smokers in the USA were reached via multiple channels such as television, radio, print media and the Internet (e.g. via Facebook, Twitter and YouTube) (McAfee et al. 2013). In particular, the ex-smoker Terrie Hall, who died of her disease in 2013, reached more than 9.7 million viewers with her testimonials available on YouTube via the CDC (as of 21 January 2016). The accompanying empirical study by McAfee et al. (2013) came to the conclusion that at least 100,000 smokers would give up or permanently refrain from smoking. In a meta-analysis on the effectiveness of fear appeals, which included 127 publications and more than 27,000 people, a

---

<sup>457</sup> This always includes value-based decisions, i.e. the question as to what information is considered relevant for decision-making and, in general, what information should and should not be presented, cannot be answered based on the facts alone.

significant effect on behavioural changes was shown ( $d = 0.21$ ; Tannenbaum et al. 2015). Campaigns that induced a relatively high level of fear were particularly effective; it was also important that the (protective) effectiveness of behavioural changes was clearly communicated. In food-consumption communication, some countries such as Chile and Israel have recently begun to use warning labels on certain foods. The use of black labels on foods with high sugar, salt or fat levels is intended to act as a deterrent.<sup>458</sup>

In contrast, **advertising often uses emotionally positive images** and information in order to motivate buying behaviour. In the field of food and nutrition, for example, food is associated with fun, attractive people (social influencers) and a positive attitude to life and belonging (cf. Sections 3 and 6). For example, in 2009, Coca-Cola launched a new marketing campaign in the outdoor, print, music and digital sectors as part of its “Open Happiness” campaign, which links the product with a positive attitude to life. Among other things, “Hug-Me” beverage dispensers were set up, which directly link the product with positive social gestures (Purkayastha et al. 2011, Kosner 2012).

In addition, factual information is often presented in a certain form (“**framing**”) to facilitate certain conclusions. For example, the reference value is of central importance when presenting information on the effectiveness of measures or the degree of health risks (Hoffrage 2003). In October 2015, for example, the WHO warned that the risk of developing colorectal cancer rises by 18% per 50 g daily consumption of processed meat (e.g. sausages) (WHO 2015a). Given that this is relative risk information, a benchmark is also needed in order to be able to interpret this information. The reference value in this example is the absolute risk of developing colorectal cancer. This is approximately 5%. A relative risk increase of 18% in this case means that the absolute risk rises by about 1% ( $5 \cdot 18 / 100 = 0.9$ ) from about 5% to 6% (Max Planck Institute for Human Development 2015, cf. text box 3 “Absolute and relative risk” in Section 4.2.1). Various studies have repeatedly shown that the two types of presentation result in very different risk assessments: relative risk information proved to be far more persuasive than absolute risk information (Hoffrage 2003, Gamp et al. 2016). Sometimes comparatively “small” format changes can lead to substantial behavioural changes (cf. section 8.9 “Labelling”). Focusing on normative rules of action that are part of everyday life (e.g. “*Iss bunt*” (*Eat the rainbow*)), which provide support for behavioural decisions in many different situations, can also contribute to changes in habitual behavioural patterns (König & Renner 2019).

---

<sup>458</sup> <https://blickpunkt-lateinamerika.de/artikel/regierung-verschaerft-lebensmittel-warnhinweise/>.

### 8.7.2 Design and evaluation of information campaigns

Wakefield et al. (2010) summarise the impact of media information campaigns to modify health behaviour in the population (nutrition, alcohol consumption, smoking etc.) and identify **core conditions for designing** successful campaigns:

- (1) Campaigns should be frequent and long-lasting with wide coverage; adequate funding is needed to achieve this.
- (2) It must be ensured that the necessary infrastructure and resources are available for implementation.
- (3) Campaigns should be part of an overall strategy that supports the desired changes in behaviour (e.g. by changing incentive structures; limiting competing marketing campaigns).
- (4) Campaigns should be based on empirical studies and data (target group analysis; testing before implementation).
- (5) Campaigns should be independently evaluated according to defined target criteria and the results should be made available to experts (if possible in peer-reviewed journals) (cf. 8.2.4).

The implementation of a sufficiently intensive campaign is expensive in today's media society. Businesses that want to make a new food brand known in the German market, for example, usually invest double-digit millions of euros in advertising. For comparison: For the central campaign to reduce food waste ("Too good for the bin"), the BMEL invested a total of only 3 million euros in the period from early 2012 to the end of 2015 (Federal Court of Auditors 2016). The pressure of communication (number of repetitions, duration of the campaign, coverage of the information media used) is one of the factors determining its success.

Overall, the information campaigns need to have a specific objective and be systematically evaluated. The three goals of information communication mentioned above require different presentations of information and formulate and imply different **criteria** for evaluating the measure (knowledge gain, change in attitude or behaviour). In many cases, however, information campaigns are currently not evaluated empirically and on the basis of evidence, in some cases with the argument that this would not be possible due to the complex situation (cf. also Sixsmith et al. 2014).

**Table 8-13:** Process stages and four standards for the evaluation of information campaigns run by the Center of Disease Control and Prevention (CDC), USA

Steps in the evaluation	Standards for effective evaluation
<b>Involvement of relevant actors</b> - those directly concerned, the target group and the users of the evaluation	<ul style="list-style-type: none"> <li>● <b>Usefulness</b> – meeting the information needs of the intended users</li> <li>● <b>Feasibility</b> – proceeding realistically, carefully, respectful and frugally</li> <li>● <b>Adequacy</b> – legal, ethical, taking the well-being of all concerned into account</li> <li>● <b>Accuracy</b> – collecting and transmitting of technically accurate data</li> </ul>
<b>Program description</b> - intervention logic, need/problem, expected outcomes, measures, resources, state of progress and context.	
<b>Targeting/focus of the evaluation design</b> – purpose, user, use, questions, methods, arrangements	
<b>Data collection</b> – suitable indicators, sources, logistics, quantity and quality	
<b>Drawing and justifying conclusions</b> – standards, interpretation and analysis, assessment and recommendations	
<b>Ensuring use and sharing findings</b> – conception of the evaluation along all stages of the process to dissemination	

Source: Sixsmith et al. (2014: 12), adapted.

Frequently, criteria are also used which say little about the actual target criteria. For example, access figures to websites or downloads of apps are an indicator of attention, which is particularly interesting for businesses if, for example, the sale of an app is the goal. However, these criteria do not directly yield any information about changes in knowledge, attitudes or behaviour (see also the 2016 assessment of the “Too good for the bin” campaign by the Federal Court of Auditors). Various institutions have therefore formulated guidelines and recommendations for planning and evaluating campaigns (overview e.g. Sixsmith et al. 2014, e.g. RE-AIM framework: Glasgow et al. 2006, ACME framework: Noar 2012). The Centers of Disease Control and Prevention (CDC) in the USA evaluate information campaigns based on six process stages and four standards (Table 8-13). As described in Section 8.2.4, it is key that the evaluation meets generally recognised scientific quality standards. This includes, alongside the prior specification of the measure and the target criteria, also the implementation of a study design that meets scientific standards, with appropriate data evaluation. A randomised controlled study design (RCT, cf. Section 5.3) would be desirable, whereby more “pragmatic” study designs can also be employed (e.g. PRECIS - Pragmatic Explanatory Continuum Indicator Summary, Loudon et al. 2015). Evaluation is important not only to assess the effectiveness of the measure (does the campaign achieve what it is supposed to achieve and to what extent?), but also to estimate its cost-effectiveness and to estimate and avoid undesired, unintended effects (e.g. misattribution effects (e.g. “culpability”), desensitisation effects; see the list of the European Centre for Disease Prevention and Control (ECDC), Sixsmith et al. 2014).

### 8.7.3 Conclusion

The communication of information is a very heterogeneous field of action. Information is a necessary, although usually insufficient, part of an overall food-policy strategy. For information to be effective, it is essential that the target criteria are clearly specified. Often, however, rather diffuse and multiple effects are intended, ranging from knowledge transfer, education, changes in attitudes and acceptance of measures to individual and population-based behavioural changes which, due to their rather general nature, are often not clearly and meaningfully evaluable and likely exert only a small or diffuse effect. The use of surrogate indicators (e.g. access figures as an indicator for behavioural changes) is surely a step towards an evidence-based assessment of effectiveness, but - as proposed by the US Centers for Disease Control and Prevention, for example - what is needed is a systematic formulation of process steps and standards and a corresponding evaluation based on defined target criteria. WBAE therefore proposes to pool information and information campaigns and to focus on clearly specified communication goals (focussing on central goals, “key points”) and target groups that are integrated into an overall strategy. In the context of promoting sustainability in food consumption, it is important to integrate new technologies (e.g. apps, social media) more strongly than before (cf. Section 8.10) so that information can be communicated in a target group-specific and up-to-date manner. This requires a far higher budget than previously made available by BMEL, an appropriate technological infrastructure and a long-term orientation of the measures.

## 8.8 Dietary education

Dietary education takes place over the course of a lifetime and is formally implemented most notably in preschools and schools. Socially speaking, it is a largely undisputed instrument, the importance of which is widely recognised in view of the conditioning of our food consumption habits in early childhood (Section 3) and the increasing problem of overweight and obesity even in childhood and adolescence (Section 4.2). However, dietary education is also a particularly typical example of the cross-cutting and multi-level problem of food policy, as it involves different ministries and all political levels from the local to the federal level, including the providers of day-care centres for children, which hampers coordination and a coherent policy (Section 7).

The following first presents the goals (Section 8.8.1), institutional responsibilities and contents (Section 8.8.2) and media (Section 8.8.3) of dietary education. Building on this, Section 8.8.4 asks about the effects of dietary education and stresses the need for action-oriented educational schemes and their subsequent evaluation. Section 8.8.5 summarises these analyses.

### 8.8.1 Aims of dietary education

Education is a continuous process of humans coming to terms with themselves and their living conditions. It takes place both in everyday life and in institutions. A distinction is made between formal and informal educational processes.

Formal educational processes are target-oriented, build on each other within a learning area and are verifiable. They follow a curriculum which, in addition to the specialist content to be imparted, above all describes the skills to be acquired - the “learning outcomes”. These constitute the basis for behavioural changes. Competence-focused curricula have become standard at all educational levels. They also allow a better transparency of the education system<sup>459</sup>. Competence descriptions aim at intended qualifications and rely heavily on individual personality development (LI 2011: German Standing Conference of the Education Ministers (KMK) 2015: 9, Council of the European Union 2017).

Informal educational processes, on the other hand, tend to be less structured and sometimes take place without pre-formulated targets and intentions. The first place of learning here is the family. Nutrition in preschools and schools is also an influential informal educational process - unless it is explicitly designed as a formal educational process - in which children and adolescents make important and formative learning experiences with regard to food and nutrition. Informal educational processes often involve a pre-(conditioning) that can have an impact on formal educational processes. All in all, formal and informal educational processes are crucial for individual life chances and, in the field of food and nutrition, also for health opportunities.

Dietary education begins practically from the first day of life, whereby influences during the pregnancy already play a role, because, for example, the mother’s taste or food preferences influence the child’s preference formation. These preferences can be modified in the course of life and can be guided in a different direction through formal and informal educational processes in preschools and schools (Bartsch et al. 2013: 84).

The concept of “food literacy”<sup>460</sup> was initiated by the European Commission and developed for adults. The aim is to promote people’s ability to plan their everyday food consumption independently, responsibly and enjoyably. **Food literacy** is regarded as a cross-cutting theme in adult education, but addresses comparable skills to those in school dietary education. Special emphasis is placed on a critical analysis of the environment and sustainable food choices (Palumbo 2016: 104, Binot-Hafke et al., 2018).

---

<sup>459</sup> See the German Qualifications Framework for Lifelong Learning (DQR), which was developed on the basis of the European framework: [www.dqr.de/content/60.php](http://www.dqr.de/content/60.php). for further information.

<sup>460</sup> The concept goes back to a European Commission international cooperation project. Its content was expanded in 2017 to include the area of physical activity (in cooperation with the Federal Centre for Food and Nutrition (BZfE) and the European University of Flensburg, cf. [www.bzfe.de/inhalt/food-literacy-1390.html](http://www.bzfe.de/inhalt/food-literacy-1390.html)). The term food literacy has been established worldwide, among others by the WHO.

Dietary education based on action and problem-solving from early childhood on has great potential because it enables children to acquire knowledge, skills and abilities that can be directly applied in everyday life. The more that the conveying of knowledge is systematically structured and integrated into affective and social skills, the more sustainable the understanding of food and its production within the value-added chains will be. This dietary education lays the foundation for appreciating food, using it carefully, avoiding waste and understanding its significance for health and well-being. At the same time, there is a great opportunity to focus on the aspect of sustainability of food consumption and to influence behaviour accordingly.

To date, systematic curricula proposals for preschools and schools can be found in the Federal Government's action programme on sustainable development, which implements Unesco's action programme and focuses on SDGs. Thus, the programme aim is to embed the following key skills at all levels of education: critical thinking skills, networked thinking skills, forward-looking thinking skills, normative skills, integrated problem-solving skills, strategic skills, collaboration skills, empowerment (cf. ESD Expert Net 2018: 3 et seq.). At the same time, monitoring to evaluate existing materials and regular focus group interviews is being carried out in this context (Brock 2017, Singer-Brodowski 2017). The action programme was scheduled to run until 2019 and a successor programme until 2030 is currently being drawn up. Unfortunately, some of the good approaches of Education for Sustainable Development (ESD, National Platform Education for Sustainable Development 2017) remain isolated; a dovetailing of these approaches with other fields of action, e.g. in the context of dietary education, is so far only being made in the federal state of Hamburg.

**Text box 21:** Nutrition counselling

Nutrition counselling has a different focus from dietary education. Although it also aims to change individual behaviour, it has so far mostly been used to assist in therapy for various diseases. Nutritional counselling is provided individually, for example in doctors' surgeries and clinics, or in groups in the context of specific courses. The profession of "nutritionist" is not protected by law.

In practice, there are a whole range of occupations for which nutrition counselling is regarded as a possible professional goal and relevant training consequently provided (cf. Chap. 7.2.3). Nutrition counselling is firmly embedded in the training curriculum for dietitians, ecotrophologists and nutritionists. Nutrition counselling is also provided by people from a range of different professions which do not originally have corresponding modules in their curriculum. These include nurses (who may be specialised in geriatric care, nursing, paediatric care, etc.), midwives, health scientists, nursing scientists and doctors or non-medical practitioners.

Within the new generalist training scheme for qualified nurses, which is to be implemented beginning in 2020 in accordance with the Nursing Professions Act, nutrition plays only a minor role. Subsequent specialisation, e.g. in the field of care for the elderly, is still possible. Similar to the level of training occupations, hardly any nutritional counselling skills are envisaged in the study courses of nursing science and nursing management. Doctors have the opportunity to complete an additional module in nutritional medicine in line with the DGEM (German Society for Nutritional Medicine) curriculum. In addition, courses of study specialising in food and nutrition are now offered, such as the Bachelor's and Master's degree courses in "Medical Nutrition Science" at the University of Lübeck.

Since nutrition counselling is intended to encourage patients to make meaningful changes in their eating habits, quality assurance measures are absolutely necessary in training. In order to achieve this, leading professional associations (DGE, Association of Dietitians - VDD, Association of Ecotrophologists - VDOE, German Society of Qualified Nutrition Therapists and Dietitians - Quetheb) have developed quality criteria, which describe the required specialist modules and skills to be acquired in qualified nutrition counselling. As a rule, this means that after a relevant course of study or training as a dietitian, a specific qualification course must be completed which, if successfully completed, results in the award of a corresponding certificate. This certificate is still a precondition for health insurance funds to fund nutrition counselling (Brehme et al. 2018). The German National Association of Statutory Health Insurance Funds (GKV) has now issued new guidelines which aim to lower the requirements for qualified nutrition counselling from 2020 onwards. The current protests by the professional associations have not yet had any effect.

Nutritional counselling is an unprotected professional title, so practically anyone can carry out this activity. Countless nutrition guides are available on the market and at least as many consultations are offered via the Internet, which are often superfluous, and in the worst case even a health hazard. There are no checks whatsoever and no quality assurance whatsoever, e.g. by means of appropriate quality labels, so that consumers are faced with a completely uncontrolled market and run the risk of being guided in the wrong direction.

## 8.8.2 Institutional responsibilities and contents of dietary education in preschools and schools

Formal nutritional education takes place in institutions such as preschools and schools, but also in relevant courses of study at universities or in further education in appropriate courses and seminars. The respective federal states are responsible for education in preschools and schools. They also have sovereignty over the curricular development of the framework plans for both early childhood education and training and for nutrition and consumer education in schools. The framework plans are binding, but allow scope for flexibility in terms of content and methods in order to be adaptable to the respective preschool and school-specific framework conditions. Core elements of school education are regulated at the level of the Standing Conference of Ministers of Education and Cultural Affairs (KMK) and are incorporated in all federal state-specific curricula. With respect to dietary education, for instance, these are the resolutions on health promotion in schools (KMK 2012) and on dietary and consumer education (KMK 2013).

In addition, each federal state reserves the right to set its own priorities, so the framework plans are only comparable to a limited degree (Heseker et al. 2019). The training of teachers or pedagogical staff in preschools is also regulated differently from federal state to federal state. While the proportions of general pedagogy and didactics in training and degree programmes are comparable in most cases, this does not apply to the specific diet-related subject content. These proportions are often so low that neither a professional overview nor a corresponding depth of subject-matter can be achieved. Therefore, valid statements by the educational staff with regard to a health-promoting diet cannot readily be expected (Heseker et al. 2019).

Framework plans are available for all federal states for both preschools and schools, including different school types and class levels. These set out the learning contents to be dealt with in each case and the skills to be obtained. At school, the descriptions of competences also form the basis of monitoring learning success. A characteristic feature of all curricula in the various federal states is that, alongside the cognitive and affective levels, the acquisition of skills in the context of food preparation is also aimed at.

### Preschools

In all 16 federal states, the framework plans for early childhood education and training include food and nutrition in at least one educational area, mostly under the title: “Body, physical exercise and health”. What the plans have in common is that all federal states underline the significance of a health-promoting and balanced diet for children’s health and development. In addition, the social importance of eating, food preparation and the environment is addressed in 13 federal states (Heseker et al 2019: 9). The joy of eating and diverse sensory perceptions are described in 11 federal states and 12 plans take up the technology of food preparation. No connection is made with the food on offer, although this would be particularly appropriate in the preschool living environment (Arens-Azevedo et al. 2016: 118, Binot-Hafke et al., 2019: 44 et seq.).

As different as the framework plans are, so different is the qualification of the educational staff. Several professional groups are admitted to the preschools, including above all educators, social assistants and child carers. Although diet-related issues are dealt with in these training occupations in all federal states, both the few nutritional recommendations and the statements on dietary education are formulated in a general manner and not specified with regard to the target group (Heseker et al. 2019: 14 et seq.).

## Schools

Different types of school and different priorities yield a very heterogeneous picture of school dietary education. Comparability is only possible to a limited extent given that both the proportions of hours and the names of the subject areas right up to the didactic concepts can differ from one federal state to another.

At primary schools, **general studies** is the central subject for dietary education at schools. Here, the subject areas of health and prevention are explicitly anchored. Within this framework, various nutritional issues are raised (Heseker et al. 2019: 84). Only in one federal state is this direct reference to nutrition missing. While nutrition is not included in any curriculum and educational plan in the title of a superordinate learning area, “healthy nutrition” is also named as such in the priorities within the learning area. At secondary schools, **biology or natural sciences** are the central subjects for dietary education. The curricula of all federal states and all school types also include nutrition-related content in other subjects such as business and employment studies, economics and technology or home economics. Nutritional topics are also to be found in the elective modules, where subject content is intensified where necessary (ibid.: 85). Nutritional Science as an independent subject is only found at specifically oriented nutritional science grammar schools. A typical feature of this subject is its scientific focus.

In the past, there have been repeated calls for introducing a separate subject of nutrition and consumer education. However, such a subject has so far only been established in general education schools in Schleswig-Holstein. The advantage of an independent subject is obvious: a spiral curriculum can be developed in which the competences to be acquired systematically build on each other. On the other hand, other subjects such as work or home economics are by all means also suitable for acquiring everyday skills and nutritional education. However, this can only succeed if nutrition topics are not only addressed sporadically and selectively, e.g. on project days.

The interdisciplinary reference framework for reforming nutrition and consumer education in schools (REVIS)<sup>461</sup> was already devised in 2005. The curriculum comprises nine central educational objectives that met with a broad consensus in dietary education (Heseker 2005: 22). The goals are specifically:

---

<sup>461</sup> The REVIS reference framework was developed to establish nutrition and consumer education in schools in a competence- and action-oriented way. The research project was completed in 2005. The reference framework has not been further developed.

- Reflecting on your own eating biography and shaping it in a self-determined way;
- Make nutrition health-promoting;
- Acting safely in the culture and technique of food preparation and mealtimes design;
- Develop a positive self-image through food and nutrition;
- Making consumer choices in a reflective and self-determined way;
- Reflecting on your own role as a consumer in a legal context;
- Making consumer choices based on quality;
- Develop a sustainable lifestyle;
- Develop a personal resource management and be able to take responsibility for yourself and others.

In the context of the development of REVIS, there was no explicit call for an independent subject of nutrition and consumer education, although it was pointed out that the acquisition of competences must be continuously integrated into the various subjects<sup>462</sup> taught. Neither was an independent subject demanded for the ESD field, but rather an embedding in different learning fields and in the overall learning area.

### 8.8.3 Media of dietary education

In addition to textbooks on nutrition, which have been developed for different types of schools and fields of learning, there is a wide range of other media that can be used in preschools and schools. Publishers include not only organisations such as the BZfE or the Federal Centre for Health Education (BZgA), but also scientific associations such as the German Nutrition Society or the statutory health insurance funds.

To date, the print media have predominated, with apps or interactive e-learning modules only very slowly gaining acceptance. However, modules are also common which implement the concept of **action-based teaching** and usually require a school kitchen or a comparable practice room. Particularly well-known are the nutrition licence, which is mainly implemented by rural women in primary schools, and the SchmeXperten programme. Both programmes are teaching developments of BZfE for primary and secondary schools, customised to the target groups and can support teachers in dietary education. However, they are limited in time and content and therefore do not guarantee continuous dietary education.<sup>463</sup>

---

<sup>462</sup> The disciplines taught were replaced by learning fields, depending on the respective federal state. Fields of learning are generally based on an interdisciplinary action and solution-oriented acquisition of competence.

<sup>463</sup> Cf.: <https://www.bzfe.de/inhalt/ernaehrungs-und-verbraucherbildung-in-der-schule-931.html>.

A nationwide stocktaking identified 246 materials of very different quality from associations, publishers and the business community for primary schools alone. There are no quality standards for nutrition-related subject content and no control of the different materials (Eisenhauer et al. 2018). However, in some federal states textbooks undergo a procedure of approval by the competent Ministry of Education. This procedure also checks the factual correctness of subject content.

Heseker et al. (2019:159 et seq.) came to similar conclusions in their final report. Of the 248 reviewed books for general education schools, 69.8% had technical deficiencies. These concerned incorrect, inaccurate or missing information, generalising statements or recommendations that do not correspond to the current level of knowledge.

**School kitchens and also school gardens** are good prerequisites for action-based teaching, as they allow learning with all the senses and the acquisition of diverse skills in dealing with one's own diet. School (teaching) kitchens are available in more than half of the schools<sup>464</sup>. Where they are available, they are also used. No nationwide figures are available on the number of school gardens.

The school cafeteria is also well suited as a social learning location; here, a combination of the health-promoting food on offer with appropriate dietary education could succeed if, for example, the catering concept is incorporated into the school profile. The concept of student companies is also a suitable instrument.

#### 8.8.4 What can dietary education achieve?

Appropriate dietary education is expected to have an influence on eating behaviour. If children learn about the importance of fruit and vegetables, the hope is that this knowledge will lead to greater openness and more frequent intake of fruit and vegetables. Although several systematic reviews on the connection between dietary education and dietary habits have been published in the meantime, the authors' conclusion is initially rather sobering: in corresponding intervention studies on increasing the intake of fruit and vegetables, the impact of changes in dietary habits were only extremely small, even when parents were also involved (Hodder et al. 2018). Even if idols or role models who are particularly popular in the respective age groups back the interventions, effects are only minor (Black et al. 2017, Cown et al. 2017, Hamulka et al. 2018). Long-term effects could not be measured at all. If dietary and physical activity education were combined and, in addition, the environment and families were also included, weak effects in terms of changes in BMI were measurable (Verjans-Janssen et al. 2018, Martin et al. 2018). The authors of the reviews particularly point out that the quality of the intervention studies varies greatly and general statements can only be made vaguely.

---

<sup>464</sup> In the nationwide study on the quality of school catering (Arens-Azevedo et al. 2015) a percentage of 56.3% was determined.

Various authors have suggested that the involvement of parental homes should be done by means of recurring face-to-face talks and not only sporadically on the occasion of a parent-teacher conference. It is also crucial to train the teachers, who must be sensitised to dietary education. The intervention should have a minimum duration of 6 months and be target-group-specific. The pupils' respective stage of development should be taken into consideration. An essential precondition for the success of dietary education is the observation of pupils' behaviour. Only if strengths and weaknesses have been identified here can education exercise a targeted influence (Murimi et al. 2018).

Most authors agree that good **study design** to demonstrate the effects of dietary education is at least as important as smart, action-based educational programmes and that there is still a considerable need for more research to be done (Swindle et al. 2019, Sadegholvad et al. 2017). The effectiveness and efficiency of education programmes are too rarely assessed and valid and reliable instruments that clearly identify behavioural changes and knowledge gains are still too rarely developed (Byrd-Bredbenner et al. 2017).

In adulthood, the focus is particularly on breaking down barriers that can have a negative influence on dietary habits. As is the case with regard to school children, there are calls for the development of new study designs that allow clear statements to be made about the impact of such programmes (Truman & Elliott 2019, Truman et al. 2017, Honrath et al. 2018, Clark et al. 2019b, Wagner et al. 2016). Since social inequalities are reflected in dietary habits, the specific and traditional eating habits of people from lower socio-economic strata should be taken into account and their empowerment promoted. Furthermore, participation in the planning and selection of content should be enabled and the settings in which people live and work should be appropriately integrated. It is also important to train and sensitise all multipliers who are active in the respective setting (Fekete & Weyer 2016: 202).

### 8.8.5 Conclusion

The first foundations of abilities and skills, values and norms in dealing with ourselves and others are laid in early childhood and at school. Dietary education right from the very beginning makes it possible to promote knowledge, positive attitudes and ultimately eating habits in the long term. Herein lies a great opportunity. This opportunity is all the greater the better it succeeds in addressing the needs and knowledge of children and young people, implementing action-based didactics and integrating modern materials and media. Dietary education can thus form the basis for health-promoting decisions and help to prevent diet-related diseases or reduce their frequency. Places where children can learn by doing, such as school kitchens or school gardens, are key to success. Several studies have been carried out internationally on the effectiveness of dietary education. The results allow only cautious conclusions, because on the one hand the different programmes are hardly comparable with each other, and on the other hand long-term effects have not yet been measured at all or only in small cohorts (Wolfenden et al. 2017).

The WBAE believes that multifactorial approaches are therefore rightly called for, such as **linking dietary education with preschool and school catering**. Here, children and adolescents could play an active role, for example by supporting the production of snacks or lunch in a school company. Such approaches are also conceivable in preschools. The concepts attach importance to the sensual experience of food: feeling, smelling or tasting, appreciating food and the practical handling when preparing snacks, food and drinks. The quality of dietary education should be continuously improved, tailored to the respective target groups and adapted to their concrete level of experience. It is becoming evident that only an interdisciplinary approach, taking into account the families and the habits of parental homes, will be successful in the case of older children in the respective reference groups (peer groups). However, there is a lack of comprehensive studies so far that provide solid evidence of the effects of dietary education in such contexts. It would be desirable to have a better understanding of the impact of dietary education in order to be able to target teaching and specific programmes accordingly. In view of the numerous dietary suggestions and trends in the media without any evidence of a health-promoting effect, dietary education should primarily enable people to be critical of promises and marketing and to develop their own health-promoting lifestyle.

## 8.9 Labelling

Against the backdrop of the fundamental requirements for effective sustainability labelling outlined in Section 7.5.3, the following sections will discuss options for the four fields of action considered in this expertise: health, social aspects, environment and animal welfare.

### 8.9.1 Health-related labels

The issues discussed below include labels, designations and advertising claims for foods that make a reference to nutrition-physiology. The labelling of health claims is far more legally regulated than other labels.

The EU provides the basic framework for health claims through the **Food Information Regulation** (FIC, EU Regulation No 1169/2011) and the **Health Claims Regulation** (EU Reg. No 1924/2006). Figure 8-13 gives an overview of regulated and unregulated fields. A distinction can be made between mandatory detailed indications on specific contents (ingredients, nutritional values) and voluntary information, notably the health claims and the energy and nutrient indications in relation to the Guided Daily Amounts (GDA). Alongside these advertising claims and labels regulated by EU law, there is a growing debate about voluntary, evaluative (interpretative) health labels (e.g. traffic light system, Nutri-Score, see below). Besides initiatives from the industry, some EU countries have adopted national recommendations in this respect.

Finally, there is the field of health-related advertising measures (“feel-good labels and claims”), which make a loose reference to health benefits. Businesses can also exert an influence on consumer perceptions through marketing concepts that are not legally regulated. For instance, Zühlsdorf et al. (2019) demonstrated in a survey experiment that the use of product names that suggest sportiness (e.g. fitness bread, sportsman’s bread) significantly enhanced the perceived health benefits of bakery products. Similar effects can be assumed for images of athletes on product packaging and sports sponsoring of confectionery brands, etc., which aim at transferring the image of sport, fitness and health to the advertised foodstuff.

**Figure 8-13:** Overview of different labelling systems for assessing the health-promoting characteristics of foodstuffs

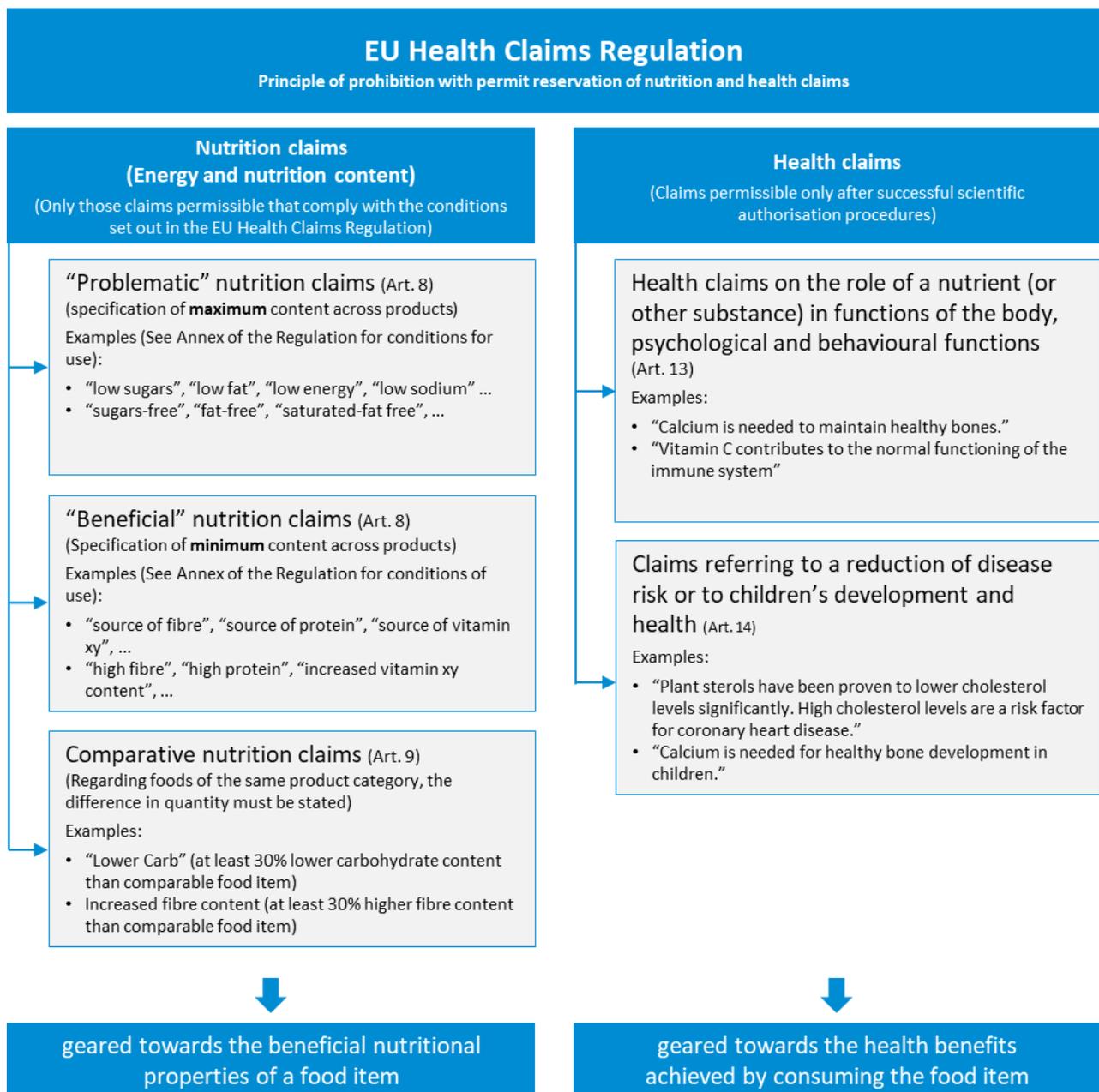
Descriptive presentation of ingredients (regulated by law EU-wide)	Evaluative health labels (different forms internationally)	Associative health reference ("Feel-good labels and claims")
<p>List of ingredients</p> <ul style="list-style-type: none"> <li>• Mandatory information according to the Food Information Regulation</li> </ul>	<p>Keyhole label (e.g. Sweden)</p> <ul style="list-style-type: none"> <li>• Voluntary single-tier positive label for health-promoting foods within a product group</li> </ul>	<p>Product names</p> <ul style="list-style-type: none"> <li>• Fanciful names with a health or fitness reference</li> <li>• Reference to healthy ingredients</li> <li>• ...</li> </ul>
<p>Nutrition labelling</p> <ul style="list-style-type: none"> <li>• Mandatory information according to the Food Information Regulation</li> <li>• Presented in a table</li> <li>• Related to 100 gram</li> </ul>	<p>Traffic light labelling (e.g. UK)</p> <ul style="list-style-type: none"> <li>• Colour-graded evaluative three-level labelling of health-relevant nutrients plus detailed values</li> </ul>	<p>Illustrations and visual representations</p> <ul style="list-style-type: none"> <li>• Representations of athletes or of sports equipment</li> <li>• Associations with the topic of slimness and fitness</li> <li>• Highlighting healthy ingredients</li> <li>• ...</li> </ul>
<p>Nutrition and health claims</p> <ul style="list-style-type: none"> <li>• Voluntary information</li> <li>• Their use is tied to certain conditions, which are defined in the Health Claims Regulation</li> </ul>	<p>Health Star Rating (e.g. Australia)</p> <ul style="list-style-type: none"> <li>• Voluntary, multi-level label based on energy content as well as positive and risk nutrients (algorithm)</li> </ul>	<p>Advertising, sponsoring and PR</p> <ul style="list-style-type: none"> <li>• Athletes as testimonials</li> <li>• Doctors/pharmacists as demand consultants in advertising</li> <li>• Life style advertising</li> <li>• Sports sponsorship</li> <li>• ...</li> </ul>
<p>Repeated nutrition labelling on the front (GDA information)</p> <ul style="list-style-type: none"> <li>• Possible voluntary information in addition to the nutrition information panel according to the Food Information Regulation</li> <li>• Guideline values for the daily intake of energy and selected nutrients for adults</li> <li>• Mostly related to the portion size</li> <li>• Mandatory indication of calorific value per 100 grams</li> </ul>	<p>Nutri-Score (e.g. France)</p> <ul style="list-style-type: none"> <li>• Five-level colour and verbal rating scale based on energy content and positive and risk nutrients (algorithm)</li> </ul>	

Source: Zühlsdorf et al. (2019: 26), modified and graphically adjusted.

In recent years, the list of ingredients and nutrition labelling have been reformed within the scope of the EU Food Information Regulation. Both must now be indicated on packaged food - but not on unpackaged products, e.g. in the craft-based food industry, and not in away-from-home catering (gastronomy, communal catering).

A special feature in labelling is the EU Health Claims Regulation. This Regulation, which is unusual for the field of advertising and does not exist in this form in any other product group, aims to ensure that health-related marketing of foodstuffs is only permissible based on scientifically verifiable statements. The Health Claims Regulation covers two central fields: health claims and nutrition claims. With respect to health claims, the Regulation stipulates that all advertising claims must be based on scientific studies that are to be submitted by the industry, reviewed by EFSA and published by the European Commission in a list of admissible claims. Such strictly “science-based advertising” is a novelty in the field of advertising law.

**Figure 8-14:** Overview of provisions of the EU Health Claims Regulation



Source: Zühlsdorf et al. (2019: 27), graphically adjusted.

While the Health Claims Regulation protects consumers from misleading health-related advertising claims, it is not suitable for providing information about whether a product is, overall, beneficial to health or problematic. This is mainly due to the fact that nutrition and health claims only refer to a specific ingredient and do not take account of the entire nutritional profile. As a result of restrictive authorisation as well as the detailed and also unwieldy nature of the approved advertising claims (“Calcium is needed in order to maintain normal bones”, “Biotin sustains the normal function of the nervous system”), the Health Claims Regulation has resulted in advertising claims only being found very rarely nowadays. Instead, associative or comparative claims are increasingly employed, which avoid a direct statement but imply health implications (e.g. the listing of ingredients and vitamins which sound quasi-medical).

As a result, the Health Claims Regulation has greatly reduced the scale of abusive health marketing but has not ensured the creation of comprehensible and effective labels.

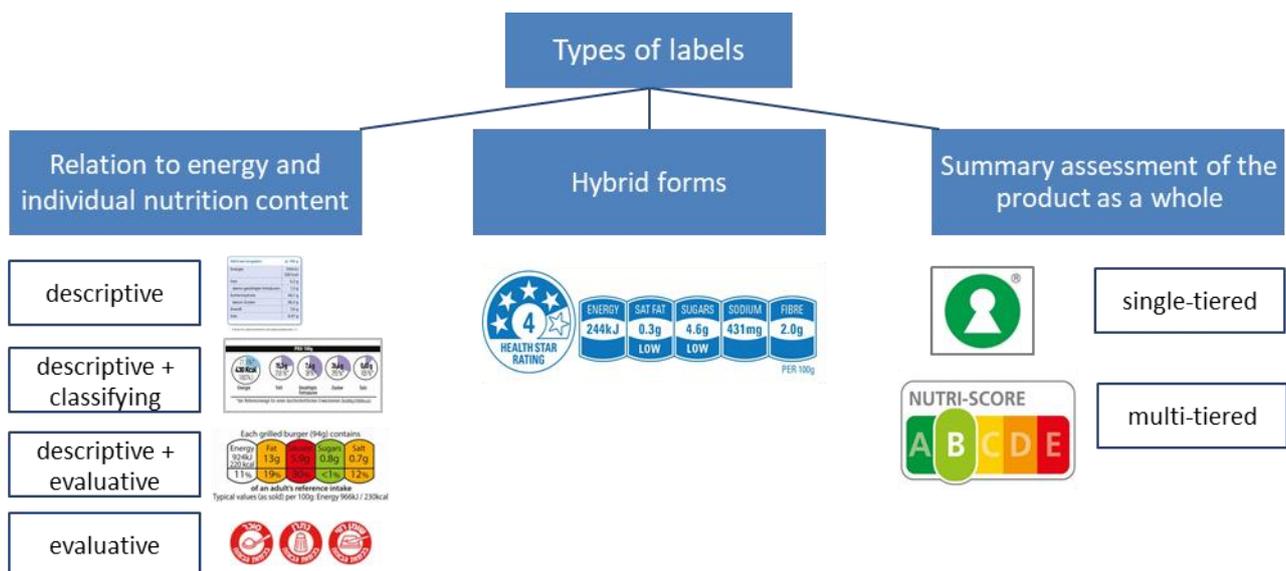
The second category of claims regulated in the Health Claims Regulation, the nutrition claims, also fail to provide comprehensive and sufficient information for consumers about the health value of a product. These target individual nutritional characteristics of foods and set quantity specifications for the advertising of certain nutrients (e.g. protein, sugar, fat, dietary fibres, saturated fatty acids) and the products’ energy content. Three types of claims are regulated in this area:

- (1) Setting maximum levels for nutrients that are deemed problematic for health and that are advertised as being present only in low quantities (e.g. low-sugar, sugar-free, low-fat, fat-free, low-sodium/salt, very low-sodium/salt). Low-sugar, for instance, means: contains no more than 5 g of sugar per 100 g or 2.5 g sugar per 100 ml. Sugar-free means no more than 0.5 g sugar per 100 g/100 ml. Low-fat refers to 3 g fat per 100 g or 1.5 g fat per 100 ml, for milk the limit is 1.8 g/100 ml.
- (2) Setting minimum levels for specific nutrients that are deemed beneficial to health and that are advertised as being present in higher quantities (e.g. source of fibre, high fibre, source of vitamin x). For instance, “source of fibre” means a content of at least 3 g/100 g or 1.5 g/100 kcal, while “high-fibre” means at least 6 g/100 g or 3 g/100 kcal.
- (3) Comparative nutrition claims: These can refer to both negative and positive connotations for nutritional values and express a minimum percentage reduction/increase compared with foodstuffs within the same product category (e.g. increased fibre content, increased protein content, lower carb, reduced salt/sodium content). For example: “Reduced salt/sodium content” means at least a 25 per cent reduction compared with similar products. For most other substances, a 30 per cent reduction or increase is required. The term “light” is to be interpreted in the same way as the term “reduction”, with the same conditions having to be met. In addition, when using the claim “light”, the reason for the properties that make the food “light” must always be indicated too, e.g. “light cheese because of less fat”.

For consumers, the different gradations of the claims are not always easy to understand as they are generally neither actively nor comprehensibly communicated. For instance, the claim “high protein” guarantees a higher content than the term “source of protein”. Yet, these are not generally valid and everyday language terms that are easy to understand in themselves. Thus, consumers find some claims hard to grasp (Zühlsdorf et al. 2019). In particular, however, there are far-reaching halo effects (see above) because the nutrition claims each refer to an individual substance and thus identify an isolated nutritional characteristic. From the consumer’s point of view, however, they contribute to a positive overall health perception of the products. As is the case with health claims, it has proved problematic that the EU has not implemented the use of claims exclusively for foods with an overall positive nutritional profile, as initially envisaged in the Health Claims Regulation. This is because the necessary nutritional profiles were not implemented as a result of pressure from trade associations.

As a result of the problems outlined above, new variants of **evaluative (so-called interpretative) health labels** (cf. Fig. 8-15) have been developed recently and in various countries.<sup>465</sup> The introduction of such a label is also an element of the coalition agreement concluded by the CDU, CSU and SPD in the 19<sup>th</sup> legislative period. In this regard, labels that specifically mention various nutrients or the energy content can be distinguished from those that make a summary health statement.

**Figure 8-15:** Overview of types of health-related interpretative labels



Source: Zühlsdorf (2019: 8).

<sup>465</sup> Pursuant to Article 35 of the Food Information Regulation (FIC), businesses have the opportunity of voluntarily providing nutrition labelling on the front of food packaging (front-of-pack label, FoP), in addition to the mandatory nutritional information panel on the back of the packaging. This is generally issued for processed foodstuffs, not for mono-products such as fruits and vegetables. Furthermore, it is not permitted for products aimed at infants.

The labels related to energy and nutrient contents can be purely descriptive, such as the nutritional information panel that is mandatory today under the FIC Regulation. The same information can also be classified graphically in relation to an adult's daily requirements (as in the proposal made by the German Food Federation (BLL) for nutrition labelling, see MRI 2019c in this regard) or assessed (as is the case with the British food traffic light system). A sign that converts the energy content of a food item into the necessary sports time to absorb this energy would be a specific form of a descriptively classifying label (so-called PACE label/Physical Activity Calorie Equivalent, cf. Daley et al. 2019 for an overview). The Israeli labelling system shown bottom left in Figure 8-15 is purely evaluative in respect of sugar, salt and fat, i.e. in the form of a warning label (Israel also continues to have a summary positive label).

On the right side of the diagram, single-tier (here the Scandinavian Keyhole label) and multi-tier (here Nutri-Score) labels are shown, which do not provide any information on individual nutrients but instead make an overall statement based on a weighting system. The label shown in the middle is the Australian Health Star Rating System, which contains a summary overall assessment in the form of stars but also indicates and rates the contents of specific nutrients and the energy content. Most of the FoP labels that are described in greater detail below are of a voluntary nature, not least for reasons of commercial law. Some, however, such as the British food traffic light system or the French Nutri-Score, are being recommended by the respective governments.

For the most part, summary health-related labels are assessed as positive in the relevant scientific literature (Hawley et al. 2013, Hersey et al. 2013, Hodgkins et al. 2015, Nikolova & Inman 2015, Mhurchu et al. 2018). In an analysis of supermarket data conducted before and after the introduction of an interpretative label in a supermarket chain, Cawley et al. (2014) calculate a significant decline in the sales of products labelled as being unhealthier. In a four-week smartphone experiment, labels were studied on approximately 20% of the products purchased, with health-promoting variants regularly being chosen then. Interpretative labels are analysed mostly in product groups that are characterised by heterogeneous quality, e.g. dairy products and cereals, less so in simple and clearly health-promoting (fruit, vegetables) or unhealthy products (e.g. confectionery) (Mhurchu et al. 2018).

The keyhole label developed in Sweden and used in several Scandinavian countries has the longest tradition. Recently, various countries have increasingly introduced (partly coloured) evaluative, multi-level labels, such as the British traffic light label, the Australian Health Star rating label and the French Nutri-Score label (Kanter et al. 2018).

The optional Nutri-Score label (Fig. 8-16), which has been recommended by the French government since 2017, is currently gaining particular importance in the EU. This Nutri-Score label marks products based on five levels based on letters and extended traffic light colours. The concept was also adopted by Spain and Belgium in 2018 and is currently favoured in other EU countries. The approach is deemed relatively valid and, in particular, easy to understand (Julia & Hercberg 2017, Egnell et al. 2018). In Germany, some major food producers tried to use the label on a voluntary

basis in spring 2019; this, however, gave rise to legal disputes within the industry.<sup>466</sup> In autumn 2019, the BMEL announced that it would introduce the Nutri-Score on a voluntary basis in Germany in 2020 (BMEL 2019h).

**Figure 8-16:** The French Nutri-Score label for foods and beverages

Food		Drinks	
TOTAL SCORE	NUTRI-SCORE	TOTAL SCORE	
-15 to -1		Water	
0 to 2		-15 to 1	
3 to 10		2 to 5	
11 to 18		6 to 9	
19 and more		10 and more	

Source: Danone (2019).

The Nutri-Score is based on a rating of various beneficial and unfavourable nutritional values of foods, as established by the British Food Standards Agency (FSA) in the Nutrient Profiling System (FSA-Score), and it has been adapted to French eating habits.<sup>467</sup> The relevance of the FSA score has been assessed in several prospective studies for different health-related targets and is mostly positively evaluated (MRI 2019d).

Thus, the Nutri-Score is a scoring system based on the FSA score, which results in an aggregated, five-stage overall score represented by the letters A-E and extended traffic light colours (Julia & Hercberg 2017). It is calculated slightly differently for three product groups (cheese, fats, all others) and for beverages. Unfavourable nutrients (energy value, sugar, saturated fats and salt) result in penalty points; points for the positively rated elements fruit/vegetables (incl. legumes), fibre and protein are subtracted from this. The total value can range between -15 and 40. The higher the value, the more negative the product assessment. For food, the limits for the different colours are -1 for green, 2 for light green, 10 for yellow, 18 for orange and red for anything above 18 points. Beverages are generally classified as follows: water is green, artificially sweetened beverages light

<sup>466</sup> Legally, it is controversial whether the Nutri-Score represents health-related marketing and thus comes under the EU Health Claims Regulation. On these grounds, the Regional Court of Hamburg (ruling of 16.04.2019, ref. 411 HKO 9/19) prohibited the company Iglo from using the Nutri-Score by way of an interim injunction in April 2019, notably because it was not based on scientific evidence as prescribed by Section 35 FIC. The MRI (2019d) takes a different view. A recommendation by the legislator to use the label on a voluntary basis would (as in other EU countries) amend the legal assessment. Pursuant to Section 35 of the FIC (2), Member States can recommend additional nutrition declarations to companies; EU countries such as France, Spain and Belgium have done so with respect to the Nutri-Score. In countries such as Switzerland, Luxembourg and Portugal, the discussion process is ongoing and a recommendation is deemed likely.

<sup>467</sup> The FSA score is often used at an international level for labels and also forms the basis for the Health Star rating label, for instance.

green, fruit juices yellow, soft drinks with a reduced sugar content orange and conventional soft drinks red (see MRI 2019d for more examples of ratings).

A French study showed that the Nutri-Score (or a very similar predecessor model) is easier to understand compared with other labels such as the classic (British) food traffic light, the Scandinavian Keyhole label or the Australian Health Star rating system (Ducrot et al. 2015). These results were replicated (Crosetto et al. 2018) in a more recent study using the now commonly used form of Nutri-Score. A study for Germany also shows similar findings (Egnell et al. 2019).

Further studies have also identified beneficial effects on consumer choices (Julia & Hercberg 2017). Nutri-Score performs better than the Health Star Rating System with respect to perception and influence on purchases (Ares et al. 2018). Warning labels, which Chile has introduced for food and which are to be introduced in Israel in 2020, are rated as even more effective in this study. The meta-analysis by Clarke et al. (2019) also provides evidence of the significant impact of text-based and, in particular, image-based warning labels. Warning labels can be a useful instrument for products whose consumption should be reduced. They are particularly easy to identify when they use stop signals which are embedded in the respective culture. Warning labels can increase self-regulation in people's food consumption (Rosenblatt et al. 2018). They can reduce intentions to eat and to purchase labelled products (Ares et al. 2018, David et al. 2018) and they can promote the purchase of healthier foods (Mhurchu et al. 2018, Neal et al. 2017).

The usefulness of interpretative (summary) health labels is essentially based on four key points:

- (1) **Validity** of the summary classification: The complexity of the issue is necessarily simplified by reducing it to selected indicators and aggregating them - the question then arises whether the result still offers sufficient directional stability.
- (2) **Comprehensibility** of the presentation: Do consumers understand the label? Do they interpret it correctly?
- (3) **Dissemination** of the label on the market.
- (4) **Impact** of the label: Does the label cause a positive change in behaviour among a relevant number of people?

**Validity:** In this context, the question arises whether the staggered classification of foods under the interpretative health labels is sufficiently valid. In a literature review on the validity of nutrition profiling systems, Cooper et al. (2016) arrive at a somewhat positive conclusion. This is because a good 80% of the 83 studies included reveal that such classifications are sufficiently precise in reflecting the health assessment. Jones et al. (2018) compare the Australian dietary recommendations and the Australian Health Star rating system and note that the label is consistent with the dietary recommendations in 83% of cases. They also identify room for improvement for the label.

**Comprehensibility:** Various research studies have compared the comprehensibility of different labelling systems. Egnell et al. (2018) carried out a study in 12 EU countries and for three product groups. They showed that in all countries and for all product categories examined, the Nutri-Score results in a more accurate health assessment than the other systems (UK traffic light better than Health Star rating better than warning label better than Guideline Daily Amounts).

**Dissemination:** This depends first of all on whether the label is mandatory or voluntary. The issue of how widely used voluntary labels will be on the market is complex and depends on supply factors (labelling costs, behaviour of competitors and traders, etc.) as well as demand factors (preferences and involvement of consumers). A health label that is hardly disseminated will have little impact. To date, there is little information regarding the dissemination of the above-mentioned labels. For the Australian Health Star Rating label, a market share of around 20% for packaged foods is mentioned for 2018 (Becher et al. 2019). It is also evident that the articles that producers voluntarily label are chiefly positively rated articles (ibid.). Similar results are reported for the Nutri-Score in France. Yet, studies show that labelling with negative signalling colours (red) is particularly effective in terms of influencing behaviour (Marette et al. 2019). Thus, a mandatory label is probably much more effective.

**Impact:** In a meta-analysis, Cecchini and Warin (2016) show that food labelling leads to an average rise of 18% in the number of people who opt for healthy food options. In this respect, evaluative and condensed labels such as the traffic light system or a health star rating are slightly more effective than descriptive forms of labelling (Cecchini & Warin 2016, similar to Pettigrew et al. 2017). They are also slightly more successful in reaching problem target groups that display little interest in nutrition (Julia et al. 2017, INFO GmbH 2019). The Health Star Rating System is described as a cost-effective intervention by an Australian study (Mantilla Herrera et al. 2018). A meta-analysis on warning labels reports an average reduction of 26% in the quantity demanded (Clarke et al. 2019).

Overall, there is growing evidence supporting the use of a condensed, evaluative health label on the front of the product that is complemented by detailed mandatory information on the back of the product and, as appropriate, by QR codes and apps (see Section 8.10). This gives rise to the question as to which of the different variants currently under discussion is preferable. In this regard, the MRI (2019d) has presented a comprehensive study comparing twelve different internationally developed labelling models. Beyond that, the MRI has developed its own proposal for labelling (2019a, 2019b), which, however, did not prove to be convincing (no contrasting colours, complicated mixed model of assessment and nutrient indications, the latter colour-coded counter-intuitively).

In autumn 2019, an extensive mixed-method study (focus group discussions combined with a representative survey) commissioned by the BMEL, which was aimed at comparing different nutritional labelling systems (BLL model, Keyhole, MRI model as well as Nutri-Score), came to the conclusion that the Nutri-Score system provides the most help for consumers (INFO GmbH 2019) and

thus confirms the existing research activities on labelling. The WBAE, too, believes that the benefits of a label that is relatively easy to understand and intuitive due to the use of signal colours as well as the chance of possibly achieving an EU consensus argue in favour of the Nutri-Score. The Advisory Board therefore backs the decision made by the BMEL to introduce the label in 2020.

With regard to further developing the Nutri-Score, the WBAE points out the following aspects:

- There are still some open questions about the calculation formula underlying the score (cf. MRI 2019d), e.g. with respect to the non-linear assessment of dietary fibre. With this assessment, no further positive points can be achieved with a fibre content of over 4.7 g/100 g, even though the Health Claims Regulation only regards products with a content of more than 6 g/100 g as high in fibre. It is also discussed whether the sugar content is adequately taken into consideration in the assessment algorithm (cf. MRI 2019d, Ernst et al. 2018).
- Products are assessed as positive, even if it can be typically expected that they are still subject to change by the consumer's preparation (e.g. if frozen French fries are heavily salted, in some cases also deep-fried). In these cases, typical preparations could be included in the assessment or additional ranges could be indicated.
- The classification of some food groups, such as oils for instance, is worth looking into; the further development indicates that the general calculation system should be supplemented by some individual solutions (Lebensmittelverband Deutschland 2019).
- Nutri-Score does not specifically cover micronutrients and secondary plant constituents. It does so only indirectly by including food groups that are rated as positive, such as fruits and vegetables. This makes the calculation easier. However, adding micronutrient density (vitamins, minerals, etc.) is also being considered.<sup>468</sup> Yet, since this content is currently not subject to mandatory labelling, it is not directly available for many products but would have to be calculated, e.g. via the Federal Food Code, which would render the implementation more complex. It is also unclear how vitamin supplements would be dealt with in this case.

Nutri-Score can only be used to a very limited degree for unprocessed mono-products. Yet, fruits, vegetables or nuts are undeniably key to a healthy diet (cf. Section 4.2 and 5.3). Nutri-Score is, at present, a registered trademark whose trademark rights are held by Santé Publique France, a subordinate authority of the French Health Ministry. This authority stipulates in its licence terms, pursuant to the FIC, that extended nutrition labelling (FOPNL) is also possible on unprocessed raw products if the food item bears a voluntary nutritional information panel. In the case of unpackaged raw products, however, marketing quickly reaches its limits, as nutritional information on unpackaged apples, bananas, etc. is not feasible. In addition, in order to communicate the special health value of unprocessed raw products, it would be useful if Nutri-Score could also be used for further marketing measures for these products at the sales location. Relevant provisions in Articles 30 et seqq. of the FIC Regulation would have to be amended.

---

<sup>468</sup> See also Section 5.3. Drewnowski et al. (2019) develop a proposal on how nutrient density could be combined with an approach such as the Nutri-Score.

Nutri-Score is currently only optional in all participating countries; it is only a recommendation made by the individual countries. Its impact, however, depends on its market penetration and, last but not least, on the labelling of less beneficial alternatives, too. Here, the French labelling authority is trying to provide incentives in that the product of a specific brand may only be labelled if all products of the brand are labelled (prevention of “cherry-picking”). It remains to be seen whether this regime will promote market penetration on a lasting basis.<sup>469</sup> According to a French analysis, some of the world’s leading food manufacturers, such as Mars for instance, only sell products in categories D and E of the Nutri-Score (Herzberg & Chantal 2017). An analysis for 8,587 broadly selected processed foodstuffs in Germany based on the Open Food Facts database shows the following ratings: 18.9% are classified as category A, 12.1% B, 18.5% C, 27.5% D and 23.0% as E (Szabo de Edelenyi et al. 2019). Manufacturers of category D and E produce will have limited interest in voluntary labelling.

The impact of the Nutri-Score could be substantially increased if more EU countries were to adopt the Nutri-Score over time and thus trigger a momentum to adopt the approach as mandatory labelling at EU level. Given an incomplete distribution of the label, it is not evident for consumers why a particular product is not labelled, which can give rise to uncertainty. Mandatory labelling makes sense since businesses whose products perform poorly will, speaking from experience with other countries and other labels (see below), rarely implement voluntary labelling.

Given the growing relevance of away-from-home consumption, consideration should also be given to the introduction of comparable schemes for the labelling of meals that are adapted to the restaurant and catering sector (Giebel et al. 2017). Studies show that the share of dishes with an unfavourable nutritional profile is very high in both the classic restaurant and catering sector and the fast food industry and has only improved slightly in recent years (Liu et al. 2020).

**Conclusion:** Nutri-Score is an innovative health label, which has been available since 2015. The WBAE believes that, despite some open questions, it could bring about a major improvement in consumer information (cf. Section 9.6.2). There is now relatively widespread scientific evidence suggesting that the Nutri-Score is easy to understand. Therefore, the Nutri-Score offers an introduction to more supportive health assessment. The effectiveness of the system and possible improvements should then be examined through intensive evaluation.

Yet the WBAE also points out that, apart from the legally regulated area and the summary interpretative health labels, there are other label-like options for health claims, e.g. through product names, visual representations and other advertising and sponsoring measures (so-called “feel-good labels and feel-good claims”). Studies show that such claims also influence consumers’ product evaluations. One effect of the growing statutory regulation of health-related labels and claims

---

<sup>469</sup> The Nutri-Score for many foodstuffs can already be seen via QR code and app, irrespective of the manufacturers, using the open source software OpenFoodFacts, even though this form of research is hardly known to date and not particularly user-friendly.

is the industry's shift to such feel-good labels and claims. This bypassing strategy lessens the intended effects of the legislation since consumers can hardly distinguish between regulated and unregulated claims. The legal prevention of misleading bypassing strategies is confined to individual cases and has little broad-based impact. A more consistent prevention, e.g. by a ban on the use of health claims on products with an unfavourable nutrient composition or health marketing along the same lines, could improve the information situation of consumers (cf. Section 8.5 and 9.6.2).

### 8.9.2 Social label

As stated in Sections 4.3 and 5.3.2, there are different assessment systems that record the social dimension of the sustainability of farm businesses and food. Some of these assessment systems are linked to labels. As explained in Section 4.3., a distinction must be made between the protection perspective (minimum social standards) and the equity perspective (reducing social inequality). It is also useful to distinguish between foodstuffs produced in Germany and food that has been imported. Social labels are of particular importance for imported food. This is because consumers have – other than in their role as voters in Germany – little opportunity to influence the working conditions of those engaged in production via statutory social standards. Therefore, the social labels for imported food will be addressed first.

Among the social labels for imported food, the “Fairtrade” label is particularly well known. The social criteria covered by this label were addressed in Section 4.3.2 and comprise both basic social standards and, notably, higher and more stable prices (equity perspective). The Rainforest Alliance label and the UTZ label, which recently merged, also label some social standards but cover wider aspects with a focus on environmental conservation. The “Bio” organic farming label also encompasses individual social standards, as explained in Section 4.3.2.

Even though the Fairtrade label, which was introduced about 20 years ago, is one of the sustainability labels that is better-known in the population and is recognised by society (level of awareness: Fairtrade 67%; UTZ 35%; Rainforest Alliance 23%; cf. Buxel 2018),<sup>470</sup> this label nonetheless shows a slow diffusion process. The market share (2016) of coffee, the main product, is 4.4% and there is an upward trend. The social **impact** of the Fairtrade concept is the subject of controversial debate in the relevant literature, with relatively few studies available. A positive impact on the participating small-scale farmers in developing countries is ascertained in most cases. Thus, recent studies from Africa indicate that Fairtrade increases the income of small-scale farmers, reduces the likelihood of poverty and, in some cases, also has positive gender effects (Chiputwa et al. 2015, Meemken & Qaim 2018b). A systematic review paper on the socio-economic effects on small producers and farm labourers in different developing countries (43 studies) arrives at the conclusion that Fairtrade certification achieves some, but not all of the objectives set (Oya et al. 2017). On average, Fairtrade certification raises the producer price by 14%, the farm income of small-scale

---

<sup>470</sup> In contrast to Fairtrade, the UTZ and Rainforest Alliance labels are not only less well-known among consumers but also command less trust, cf. Buxel (2018: 67).

farmers by 11% and the household income by 6%. Yet the wages of salaried employees were on average 13% lower, with considerable variance across the individual studies (Oya et al. 2017). Krumbiegel et al. (2018) found that farm labourers on Fairtrade-certified plantations received a higher hourly wage and were more satisfied than workers on non-certified plantations. Meemken et al. (2019) ascertained that Fairtrade improves the wages and working conditions of employees in agricultural cooperatives, but that it has no impact on the wages of agricultural workers in the smallholder sector, not even when the small-scale farmers themselves benefited from Fairtrade certification. There is a major monitoring problem as far as workers in the smallholder sector are concerned given that working conditions on a large number of very small farms can only be checked at a very high cost. Overall, the institutional and economic context has a major influence on the social impact. It can also be observed that the price mark-up for buyers of Fairtrade products in Germany is relatively high compared to the additional revenue that farmers and workers earn in developing countries (Minten et al. 2018).

UTZ and Rainforest Alliance have fewer positive social effects, and where measurable socio-economic improvements for producers occur, they do not chiefly result in higher producer prices, but in improved access to agricultural extension services (Chiputwa et al. 2015, van Rijsbergen et al. 2016, Meemken & Qaim 2018b). However, as a mass market label, the UTZ market dissemination is much higher; with a 39% market share for cocoa in Germany, for instance. The additional cost for consumers is also significantly lower for UTZ than it is for Fairtrade products. Therefore, UTZ and Rainforest Alliance labels are less clear in their message to consumers, and it remains rather unclear to what extent they also cover aspects of social justice in addition to minimum social standards (which in the view of the WBAE should not be used for marketing, see below).

GLOBALG.A.P. + is a label that has to date (almost) not been used for end consumer marketing since it is clearly focused on statutory minimum standards (cf. Section 4.3.2). GLOBALG.A.P. certification was initially intended as a business-to-business label for food safety. As mentioned in Section 4.3.2, GLOBALG.A.P. with GLOBALG.A.P. + has developed a GLOBALG.A.P. Risk Assessment for social concerns of workers (GLOBALG.A.P. Risk Assessment on Social Practice/GRASP), and an additional module that audits the aspects of occupational safety, health protection and social concerns of employees and identifies them for business customers. However, there is still a need for research on the effectiveness of this approach. An initial prerequisite for effectiveness would be the widespread use of certification in the respective value chains. Yet, as explained in Sections 4.3.4.1 and 5.3.2, the food trade and food industry have to date made only limited efforts to embed social aspects in their business policies.

**Text box 22:** Safeguarding minimum social standards in supply chains

According to estimates by the UN Conference on Trade (2013), around 80% of global trade is now conducted within global value chains (UNCTAD 2013). Global value chains, which are often multi-level, have also gained considerable relevance in the agri-food industry. Here, enterprises exploit locational advantages of specific regions and cost differences on international markets. Agricultural commodity chains, and notably commodities (standardised bulk goods) such as soy or palm oil, have not been particularly transparent in the past. In many cases, users in Germany have so far not always been able to trace them back along the entire supply chain.

German manufacturers benefit from the cost benefits of international supply chains but are currently not legally responsible for possible shortcomings regarding human rights and environmental conservation that occur with their upstream suppliers. Some companies check compliance with fundamental social and environmental protection standards as part of corporate social responsibility measures, for instance through internal supplier audits. Yet there is no obligation to do so or to make use of other risk management instruments. This situation creates incentives to outsource risky value-added activities to independent upstream suppliers. If protection rules are not in place or not enforced in the countries of origin, this can result in breaches of fundamental legal interests.

In its National Action Plan on Business and Human Rights (NAP) (Federal Government 2017) and in the Coalition Agreement 2018, the Federal Government announced it would strive to bring about improvements in compliance with minimum social standards in global value chains. To this effect, it initially relies on voluntary commitment by businesses but provides for a statutory regime should the businesses' commitment turn out to be insufficient. For higher-risk countries, companies should adequately analyse risks related to human rights and environmental protection. This due diligence should also include suppliers and service providers along the value chain. The (voluntary) implementation in the industry was examined in a survey of companies in the second half of 2019, with a second survey having been scheduled for 2020.

More recently, different countries have already enacted legal provisions. In the USA, California passed the Transparency in Supply Chains Act in 2010 (Senate Bill 657); a similar act took effect in Great Britain in 2015 (UK Modern Slavery Act 2015, Section 54). These acts require large traders and manufacturers to publicly disclose the extent to which they implement specific measures against human trafficking and slavery as well as for the protection of basic human rights standards in their supply chains. As mentioned in Section 5.3.2.2, such information requirements alone do not bring about radical improvements.

Intensive discussions about a mandatory supply chain act are also currently underway in Germany. Comparable to similar initiatives, e.g. in France and the Netherlands, there are debates about compulsory measures and, as appropriate, also the liability of businesses in Germany for violations of human rights committed by their suppliers (Huysse & Verbrugge 2018, <https://lieferkettengesetz.de>). Figure 8-17 classifies possible measures that range from voluntary implementation as part of Corporate Social Responsibility (CSR) to political-moral appeals, reporting requirements, mandatory certification schemes and management liability.

**Figure 8-17:** Policy instruments to safeguard minimum social standards in international supply chains



Source: WBAE presentation.

The experience gained in other countries speaks more in favour of regulatory rules that require large-scale enterprises to exert an influence regarding compliance with fundamental human rights standards in respect of their procurement.

As far as food that is produced in Germany is concerned, consumers should be able to rely on legislation providing minimum social protection for the labour force. As explained in Section 4.3.3.2, social problems arise in this context as well, especially regarding the labour situation of seasonal workers. In 2006, there was a trade union initiative to introduce a label for “fair seasonal work”; however, this proved unsuccessful.<sup>471</sup> By now, the rules of the Minimum Wage Act should have brought about an improvement of the social situation of seasonal workers, even if there is evidence of deficits in the implementation. The safeguarding of legal minimum (social) standards is the task of the legislator in Germany and in the EU and should not be imposed on consumers by labels, as advertising featuring self-evident facts is illegal under competition law (Section 3(3) of the Unfair Competition Act (UWG) in conjunction with no. 10 of the Annex to Section 3 UWG).

Social labels should thus be used to address consumer preferences that go beyond minimum social protection, notably including the objective of paying producers of agricultural produce a higher or more stable price than the price that forms on the market. The “Die Faire Milch” (fair milk) and “Sternen-Fair” (stars fair) labels serve as examples of this approach. However, a study carried out by “Stiftung Warentest”, a German consumer foundation, in 2017 concluded with a critical assessment because the additional income for the farmers involved was relatively low for the “Sternen-Fair” label and poorly documented for the “Die faire Milch” label.<sup>472</sup> To date, these labels have not been widely used either.<sup>473</sup>

<sup>471</sup> EFFAT (European Federation of Trade Unions in the Food, Agriculture and Tourism), 2006. “Fair seasonal work” cited in Capezzone (2019): Migrant Labour in German Agriculture – a blind Spot. Unpublished Manuscript, University of Hohenheim.

<sup>472</sup> <https://www.test.de/Test-Milch-1590601-1590466/>.

<sup>473</sup> The research institute Fibl, commissioned by Aldi, is implementing an interesting concept for assessing social sustainability under the SMART approach (cf. Sections 4.3.1 and 5.2.1) in Austria (Hofer) (cf. <https://www.zurueckzumursprung.at/nachhaltigkeit/>). This includes, among other things, criteria regarding regional value creation and the issue of fair prices (cf. also Schader et al. 2016).

Beyond that, social aspects can also be found in advertising concepts, especially in the organic sector (e.g. Upländer Bauernmolkerei, FairBio). There are no comprehensive approaches that cover issues such as minimum wage, the protection of workers, equal rights for women, diversity, etc. for Germany or Europe (cf. Section 5.3.2). As explained in Section 4.3.3.1, the social situation of women on agricultural holdings is not covered in systems that assess sustainability in Germany, and limited data is available on this matter. Advertising occasionally uses terms such as traditional farming or “from the farm”, but these are not defined and are, in some cases, used quite freely.

A further approach to pursuing social sustainability targets is the certification of farms in line with the concept of Economy for the Common Good, as addressed in Section 4.3.2. This approach is of interest for agriculture because it comprises social criteria not only for the employees but also for the farm owners. However, only a few farms have been certified according to this system so far (cf. Section 4.3.2). These can identify themselves as “reporting companies of the common good economy”. If the approach becomes more widespread, a product-related label could also be developed on this basis.

Overall, the issue of social labels is relatively poorly developed in conceptional terms (Bangsa & Schlegelmilch 2020). As already shown in Section 5.3.2, there is a lack of approaches for an integral evaluation. Partial aspects prevail. Furthermore, only a few products are labelled with voluntary labels, and the slightly more widespread labels, such as UTZ/Rainforest Alliance, are hardly known. Serious problems, such as especially problematic forms of child or slave labour that occur in parts of the world, are therefore de facto not recognisable for consumers, except in the case of individual luxury foods through the Fairtrade label that addresses these aspects in its labour standards.

**Text box 23:** Green Button for social standards in textiles as a comparative case

The Federal Government has been trying for some years to promote the development of social labels in the textile sector, which sees similar problems to those in international food trade. There have been initiatives in this sector for many years, such as the Gepa ([www.gepa.de](http://www.gepa.de)), that seek to label sustainable textiles but only reach niche markets. In 2014, at the initiative of the BMZ, the Partnership for Sustainable Textiles (<https://www.textilbuendnis.com/>) was founded, which, alongside environmental aspects, is chiefly concerned with fair working conditions across the board in the industry. The BMZ has continued to apply significant political pressure, trying to urge textile and clothing companies as well as retail chain stores to voluntarily label textiles, and it intends to reinforce this with an overarching “meta-label” (“Grüner Knopf” - Green Button). This label was launched in autumn 2019 (<https://www.gruenerknopf.de>).

Overall, the WBAE takes the view that specific social labels for some product groups in the food sector can play a bigger role than before, notably when it comes to luxury foods such as coffee, tea, cocoa or tropical fruits imported from developing countries. For these products, there is definitely a greater willingness among some consumers in Germany and Europe to pay for socially labelled options. In order to take advantage of this willingness to pay, social labels must be well managed and reliable for consumers. Notably in the small-scale farm sector, this often involves

high transaction costs for certification and monitoring. In addition, there are high costs caused by niche marketing and premium marketing strategies of the companies, which result in price premiums in Germany that restrict the circle of buyers. Beyond these specific segments, the options of using social labels to significantly improve the social conditions of those engaged in the agri-food sector are likely to be rather limited.

It would therefore make sense for broader sustainability labels to **also take minimum social standards into consideration**, even if the main focus has been placed on environmental aspects (UTZ/Rainforest Alliance) or on quality assurance (GLOBALG.A.P., QS). The MSC standard for fish, for instance, has recently been extended in this direction. Enhanced impact research should ensure that a positive impact will actually be achieved. With a view to the broader enforcement of improved working conditions and other minimum social standards, other policy instruments are needed apart from labels, in particular in the context of international trade agreements and in the management of supply chains (cf. Section 9.6.3).

For the EU and neighbouring countries, e.g. in eastern Europe and the Mediterranean region, an intense cost competition is emerging, which has recently resulted in the relocation of production of labour-intensive produce, such as fruits and vegetables, to countries where very low labour standards prevail. In Germany, the minimum wage and the rising standard of living in neighbouring countries such as Poland have caused an increase in labour costs. In some Mediterranean countries, migrants are recruited as seasonal workers, sometimes under problematic conditions. This is an issue that society is becoming increasingly aware of. Given that these products from the fruit and vegetable sector are nowadays almost universally subject to quality certification, it would be reasonable to add minimum social standards to GLOBALG.A.P. and QA.

**Text box 24:** Regional label

The question of the regionality of food production and distribution is a dimension of sustainability that is much debated by the general public. It presents several unique characteristics, in the view of the WBAE, and should thus not be part of the sustainability labelling proposed here.

Regionality alone is not an indicator that offers sufficient stability for the sustainability of a food product. However, society frequently interprets “regional” as an environmental and climate stewardship indicator due to shorter transport distances. Yet, the explanations in Sections 4 and 5 have shown that distance alone is not very meaningful and that the means of transport play a much more decisive role. Buying from regional farm shops and driving there by car can generate more greenhouse gases than transport by ship from other continents. Air transport is particularly damaging to the climate. Food miles are therefore too rough an indicator.

Consumers often associate regional agriculture with smallholder farm structures and, as a result, greater environmental conservation and animal welfare. However, the WBAE has made it clear in the past, for instance in its livestock expertise of 2015, that farm size in agriculture is not a suitable indicator of sustainability either (cf. Section 5.4). This also holds true for social acceptability; here, too, a regional farmer may use seasonal labour in a manner that is not socially acceptable, for instance.

Finally, the strengthening of local value creation that goes hand in hand with regional production should not be deemed entirely positive. On the one hand, it can lead to a desirable relationship between consumers and food production and help close the often lamented gap between the perception and reality of agriculture (cf. also Section 5.4). On the other hand, the preference for regionality can result in an unreflective ethnocentric shopping behaviour and can thus also exclude sustainable consumption alternatives or promote protectionism. Locational benefits of agricultural production and the advantages of a global division of labour can certainly lead to more sustainability under certain conditions. For example, soy production should only play a limited role in Germany, since other countries have comparative advantages in this respect.

Against this backdrop, “regional origin” should not be an element of a sustainability label. The “Regionalfenster” (regional label) initiated by the BMEL, which discloses the origin of different stages of the value chain, is a useful tool to ensure more transparency on the food market. The Regionalfenster is less suitable as a sustainability indicator. The BMEL could increase the impact of the Regionalfenster if it were to carry out marketing campaigns providing information about the message of this label.

A second meaning of regionality lies in regional specialities in the sense of protected indication of origin (protected geographical indication, protected designation of origin, traditional speciality). These indications of origin are protected by specific labels in the EU that promote the marketing of these traditional products. The EU believes that these are a central instrument of quality marketing, specifically also with respect to the sensory properties (May et al. 2017). Compared to other EU countries, the use of protected indications of origin in Germany has been somewhat restrained to date. Protected indications of origins do not guarantee sustainability per se.

### 8.9.3 Environment-related labels

Section 4 of this expertise illustrates the wide range of environmental problems that arise in the agricultural sector and at the upstream and downstream stages. The special characteristic of the food market is the link between land management (including livestock farming) with its specific environmental challenges on the one hand and the industrial and logistical processes grouped

around it up to the food trade on the other hand. Against this backdrop, **two forms of environmental labelling** have developed in contrast to other sectors:

- (1) Labels that relate to the form of land management (in particular organic labels, cf. Section 5.2) and
- (2) labels that evaluate the entire production path of a foodstuff, including consumption and disposal (LCA, cf. Section 5.3.1).

In research, environment labels based on a life cycle assessment are generally deemed the standard when it comes to labelling. Yet such a life cycle-based environmental assessment of foods is currently only being tested on a voluntary basis and only by a few food manufacturers (e.g. Barilla). In addition, LCA only covers part of the environmental problems, and the specific characteristics of agricultural production cannot yet be sufficiently mapped. Universal implementation is also thwarted by the lack of methodological consensus with respect to the summary assessment (cf. Section 5.3.1.2).

A carbon footprint label that records greenhouse gas emissions along the life cycle is a simpler option. While the methodology for this is available, efforts aimed at widely establishing such a climate label on the market have failed to date primarily due to the fact that the effort needed to implement it has been greater than initially expected and ultimately no trading company has wanted to incur the pioneering costs for the broad development of the database (Liu et al. 2016b).

While LCA and carbon footprint labels are de facto not present in the German food market, the “Bio” organic farming label has, also on a global level, gained further importance as a central label for eco-friendly foods in recent years. As a label for a specific farming system, the label “Bio” has some strengths, but it also has its limitations, which have already been comprehensively set out in Section 5.2. Organic farming addresses key environmental and nature conservation issues. However, the WBAE believes that it is not a comprehensive environment label for foodstuffs.

A gradual expansion of organic farming in Germany cannot and should not be the main or only instrument applied to solve the environmental problems caused by the agricultural sector. Significant adjustments to conventional agriculture are also necessary. In its expertise on policy strategy regarding food labelling, the WBA argued in favour of a multi-tier environmental assessment of foodstuffs (WBVE & WBA 2011). This is the direction of the planned government animal welfare label, which provides for a three-tier assessment, and of the climate label proposed in this expertise (cf. Section 9.6.4). In contrast, other important aspects of the environmental dimension, including nitrogen (N) leaching and effects on biodiversity, can less easily be expressed in a product-specific manner (cf. Section 5.2.2.3) and are thus only suitable for labels to a limited extent. The standardisation, certification and labelling of further farming systems would enable consumers to place greater emphasis on these aspects in their purchasing decisions.

Alongside the organic farming label, the GMO-free label has become significantly more widespread in recent years to signal environmentally sound farming. However, from a scientific point of view, the GMO-free label does not constitute a valid indicator for the eco-friendliness of a foodstuff, but addresses a specific technology that is often deemed risky by the public. From the WBAE's perspective, GMO-free is not a meaningful sustainability indicator (cf. Section 5.2.4).

**Text box 25:** On the failure of an integrated farming label

There have been attempts since the 1960s to establish a market segment between “organic farming” and “conventional farming” under the term of “integrated farming” (integrated pest management/IPM). Studies show that it is possible to reduce the input and residues of pesticides if pesticides are used more curatively (Bakery et al. 2002). Nevertheless, this concept has failed in marketing. Also at a global level, only Switzerland has had some success in establishing the label “IP-SUISSE” and its key image of the ladybird as a brand. Even though there has not been a market breakthrough in Switzerland, the level of awareness amongst the general public still accounts for over 80% (supported; Moog & Gebhardt 2017). Since 2014, integrated cultivation has been prescribed as an EU-wide compulsory production system (Lefebvre et al. 2015). It is no longer possible to use this term in advertising (since advertising with self-evident facts (observance of applicable laws) is prohibited).

What are the market-based reasons for the failure of integrated cultivation as a marketing concept? First of all, the term integrated is not a particularly succinct choice. “Integrated” might trigger positive associations in the sense of holistic, but it remains rather vague at the same time. A clear, communicable target is missing (Lefebvre et al. 2015). Moreover, the willingness to pay for residue-free produce is limited, since consumers expect residue-free produce as a fundamental condition of food safety (Misra et al. 1991). More recent studies for several EU countries also indicate a low willingness to pay for integrated farming (Bazoche et al. 2014, overview at Lefebvre et al. 2015). Willingness to pay for organic produce is around 2.5 times higher than for pesticide-free production (Edenbrandt et al. 2017).

In addition, integrated farming was driven by companies in the pesticide industry and the farmers' union, which, in a polarised public debate, lowered the perceived credibility and trust in the promoters (Frewer et al. 1996). Given that no independent control (certification) was sought, it was relatively easy for critics to attack the concept in the debate. In contrast to organic farming, integrated farming did not take the path of certification and labelling that emerged in the 1990s. Consumers prefer independent control (OTT 1990). The approach remained unclear for civil society. Finally, there was and still is no uniform label for integrated production throughout Europe, which makes the standard unattractive for international traders and manufacturers.

Other environment labels, including notably the Rainforest-Alliance label, the Roundtable on Sustainable Palmoil (RSPO) label and the Roundtable on Sustainable Soy (RTRS) label, focus on specific products from tropical regions or developing countries and the environmental problems that are particularly present there. These labels also fail to address the entire product life cycle but provide certification with respect to selected environmental problems caused by agriculture. One important aim of this label – i.e. stopping deforestation and the destruction of habitats – has not been achieved to date (Gatti et al. 2019, van der Ven et al. 2018, Carlson et al. 2018). Moreover, consumers hardly know these labels. The recently merged UTZ and Rainforest Alliance labels are somewhat better known (cf. Section 8.9.2), with studies suggesting a (minor) positive environmental impact (Tscharrntke et al. 2015, Ibanez & Blackman 2016, DeFries et al. 2017, Vanderhaegen et

al. 2018). However, the data situation is rather poor, and there are also studies to the contrary (Sanderson Bellamy et al. 2016). There is also evidence of the Fairtrade label having some positive environmental effects (DeVries et al. 2017); this label, however, is essentially aimed at social criteria (cf. Section 8.9.2). It has not been studied whether the requirements of the UTZ and Rainforest Alliance labels for the reduction of pesticides result in lower residue levels in the end product.

Other company-specific labels, such as the Pro Planet label of the Rewe Group, a so-called hotspot label that addresses only one specific environmental problem identified as particularly relevant, also have a very narrow focus, in most cases on agricultural subjects. Other labels exist for fish, both for the eco-friendliness of sea fish (in particular the MSC label, which is widely used, cf. Section 5.3.3) and for aquaculture systems (organic, ASC).

**Interim conclusion:** To date, only the Biolabel (organic farming label) has been widely used to label eco-friendly farming systems, gaining in significance on the market and in political support in recent decades. For fish, the MSC label is very successful on the market. Other labels have not achieved a market breakthrough. In particular, there has been no development so far of a label for an environmentally sound progression of conventional agriculture in Germany.

There are also no comprehensive labels for environmental effects in later stages of the food chain, but only indications of specific advantages, such as the “Reusable” label for the packaging of beverages; however, this label is not a consistently valid proof of overall ecological benefits (cf. Section 4.4.2.3). The Regionalfenster (regional label), a private-sector label initiated by the BMEL for products from the respective region, can also provide evidence of the eco-friendliness of transport. It does not, however, specify how large a region must be; instead, it demands a transparent indication of the respective understanding of “region”. In ecological terms, the validity of the Regionalfenster is therefore not guaranteed, not least because transport distances (food miles) are not crucial in determining how environmentally-friendly the food is overall (cf. Section 5.3).

The number of labels has, particularly in recent years, tended to increase overall, with further special labels being demanded (e.g. a biodiversity label by several academies in their expertise on biodiversity: National Academy of Sciences Leopoldina et al. 2018). Therefore, the situation for consumers is confusing (cf. Section 7.5.3).

In view of the above, the question arises as to why Germany is not working hard on developing a comprehensive life cycle assessment for measuring the overall eco-friendliness and for labelling foods. Transparency regarding different alternatives from a life cycle perspective and thus reliable data for comparing options are needed not only for consumers but for environmental policy as a whole. In the absence of such data, society too often engages in debates based on emotional or symbolic assessments; currently, for instance, there is yet again a strong and narrow focus on plastic packaging (Hempel et al. 2019). Given this focus, it is astonishing that the few LCAs available on types of packaging are outdated and that there are few current values despite significant progress in respect of technologies.

However, the WBAE is aware of the fact that a nationwide implementation of LCAs for all foods based on company-specific data is currently not possible. There are several reasons for this:

- The food market has many different product categories and products with diverging key issues.
- As a result of the land-related nature of farming, there are a particularly large number of environmental and nature conservation indicators that need to be assessed on a regional and, in some cases, even local basis. Water consumption is a perfect example of an aspect that needs to be addressed on a larger scale because water scarcity varies widely at global level. Sub-elements of biodiversity should be assessed on a smaller scale.
- Owing to the scarcity of land as a production factor and the environmental effects related to land use, indirect land-use effects (cf. Section 5.2) play a role in the sustainability assessment.
- There are many businesses involved in the food value chain, which is also more fragmented than other sectors. This adds to the challenges of data collection.
- In the case of food, the agricultural stage is, as a rule, by far the largest contributor to environmental effects. Even though agricultural emission data are available from research activities, the data set is not yet sufficiently complete in order to enable reliable LCA. These data are sometimes hard to access for consumer-related food business operators who source their raw materials from many farms. Therefore, farm data must be complemented by other sufficiently accurate data sources in order to reflect the actual production conditions for the different types of production. For instance, Scandinavian researchers (Hermansen et al. 2017) ascertained that one of the main challenges lies in accessing representative life cycle inventory data on the use of animal feed. The feedstuffs used can vary significantly depending on the type of production, the region and so on. Data on young animals purchased and their rearing must also be available. It is also necessary to stipulate the relevant emission factors, e.g. for the intensity of fertilisation and the technology used in the process. This aspect is currently poorly documented in the Product Environmental Footprint Guidelines. Beyond that, the WBAE considers it essential to define standard data for auxiliary processes.
- Finally, there is already a label in place that, in the eyes of many consumers, reflects the environmental friendliness of foods, namely the Bio-Siegel (organic farming label). In Section 5.2, however, the limits of this farming system were highlighted.

**Conclusion:** Currently, only the Biolabel is sufficiently present and established on the market. It is also supported by policymakers. In 2018, the Federal Government reaffirmed the target of “20% organic farming on agricultural land” in its sustainability strategy and topped up funding for the Federal Organic Farming Scheme (BÖLN). Organic farming has major benefits, but it is not a comprehensive environment label for food because it fails to cover further life cycle stages. Neither is organic farming per se the most sustainable form of land management. There are also products on the organic market that involve very costly packaging, extremely long transport routes, high losses along the production chain – in short properties that would result in a problematic assessment in a life cycle assessment. However, this is not evident for consumers. It is unclear in how many cases

the ecological benefits of organic farming described in Section 5.2 might be offset by disadvantages at other stages of the manufacturing route.

Against this backdrop, **three strategic options emerge:**

- (1) The Biolabel is further developed into a comprehensive environmental impact assessment or even an overall sustainability label, which would entail significant basic changes to the (just amended) EU Organic Farming Regulation. This would have to encompass further stages of the value chain after the agricultural sector and an additional product focus as a benchmark. This would ultimately constitute a break with the system and is rather unlikely, not least because of the approach to organic farming, which is now uniform throughout the EU and globally coordinated by the IFOAM.
- (2) In the long term, a label for food is introduced on the basis of a comprehensive life cycle assessment. The EU already considered this option as early as 2011 when it had options for using the EU Ecolabel (the EU flower, (EC) No 66/2010) also examined for foodstuffs (Sengsts Schmid et al. 2011). To date, foodstuffs have been exempt from labelling with the EU Ecolabel. An extension to also cover foodstuffs was not made at the time. Extensive methodological groundwork and data collection are still required in order to integrate agriculture into a comprehensive life cycle assessment. The introduction of an ecolabel based on a life cycle assessment, which is desirable in the long term, is therefore not yet feasible. There are still too many data challenges involved and the aggregation into an overall assessment is, in methodological terms, not sufficiently standardised (cf. Section 5.3.1.2 on the ongoing development of Product Environmental Footprint Category Rules - PEFCR).
- (3) A climate label (CO<sub>2</sub> label) is introduced first because this methodology does not necessitate a summary assessment of the different ecological dimensions and the data situation has improved significantly in recent years. However, this should only be an interim step because the CO<sub>2</sub> equivalent balance of a product is only a limited indicator of other relevant environmental effects in production and the value chain.

The WBAE currently only sees opportunities for the third option, i.e. the **introduction of a climate label**. Reducing greenhouse gas emissions is a central environmental goal of the Federal Government and requires urgent action. The methodology is sufficiently developed (British Standards Institution 2011, Greenhouse Gas Protocol 2011).<sup>474</sup> Studies also show that the climate impact of foodstuffs is poorly understood by consumers. They can hardly assess the different GHG emissions and underestimate the overall climate relevance of foodstuffs (Camilleri et al. 2019).

Yet the experience other EU countries have gained with the voluntary introduction of such a climate label has also shown that it has not yet been possible to implement a climate label on a

---

<sup>474</sup> The trade and consumption stages still lead to inaccuracies when it comes to calculating the Product Carbon Footprint. This is because assumptions have to be made about the average transport distances of a product to the various retail stores and about the energy-relevant behavioural patterns of consumers.

voluntary basis. Indeed, such attempts in several EU countries have been discontinued. On the one hand, the costs incurred in data collection were too high. On the other hand, the interest in transparency was too low among many businesses, which have to reckon with the fact that at least some of their products could perform poorly. Moreover, many consumers only have a limited understanding of the link between food consumption and climate change mitigation, entertaining many different ideas about what constitutes the climate impact of foodstuffs (Feucht & Zander 2017). Frequently, regionality, the type of animal husbandry and organic farming are already seen as sufficient indicators of climate change mitigation (*ibid.*, cf. Section 5.3 on why these indicators are problematic). Finally, the willingness to pay for climate change mitigation when buying food has hitherto also been rather limited (Muller et al. 2019).

In addition, studies show that consumers find absolute greenhouse gas levels (i.e. in kg CO<sub>2</sub> equivalents) hard to understand (Feucht & Zander 2017). A challenge therefore lies in developing a climate label that is easy to understand and provides motivation. Currently, very different forms of climate labelling exist on the market - albeit in small niches: they range from absolute (numerical) CO<sub>2</sub>-eq values (e.g. in Japan) and compensation labels (climate neutral label/climate offset, widespread for flights)<sup>475</sup> to relative ratings (best-in-class labels/front-runner-labels, e.g. Blue Angel and Climatop label) up to energy use labelling (as for household appliances or cars) (Gensch et al. 2017, Feucht & Zander 2017).

From the WBAE's perspective, the approach of a multi-tier, colour-coded label would be appropriate (cf. Section 7.5.3). As is the case with other sustainability labels, too, (nutrition labelling see above, animal welfare label see below), the latest developments in consumption research argue in favour of a colour-coded, multi-tier label dispensing with detailed CO<sub>2</sub> indications since this type of labelling is much easier for consumers to understand (Thøgersen & Nielsen 2016, Meyerding et al. 2019, Muller et al. 2019).

The key challenge, however, lies in the costs incurred in data collection to enable a climate label to be implemented at reasonable cost. Ideally, a climate label would be based on company-specific data. However, the costs for identifying these data are very high for pioneering businesses, which also have to collect numerous standard processes besides their specific data. As a starting point, it is therefore useful to draw upon generic data for the respective product group (Timmermans & Achten 2018, Moberg et al. 2019). In this case, foods are thus initially labelled with the average value of a product group. The gathering of this data could receive government funding. Over time, businesses could then collect increasingly detailed greenhouse gas levels for their specific modules

---

<sup>475</sup> In the case of compensation labels, producers commit to offset GHG emissions arising in production and distribution through measures and receive a corresponding label - generally from a neutral organisation that coordinates and certifies such compensatory measures. The WBAE regards different types of climate labelling for food as confusing. A compensation label poses the problem that consumers do not receive any information about the relative climate-friendliness of food.

(ingredients, types of packaging, logistics processes, disposal routes etc.) resulting in brand-related CO<sub>2</sub>-equivalent balances.<sup>476</sup>

Thus, the climate label is primarily an instrument to inform consumers about the relative greenhouse gas effects of their food (Cohen & Vandenberg 2012). The aim is to enable consumers to modify their consumption patterns by comparing different product categories.<sup>477</sup> This is also relevant because consumers mostly underestimate the greenhouse effect of their food consumption and find it hard to classify different food groups (Camilleri et al. 2019). A Product Carbon Footprint based on standard industry levels fulfils a key educational purpose in this regard.

Over time, the label will then evolve into a competitive instrument that provides producers with the opportunity to differentiate their products as climate-friendly. To this end, company-specific data must then be collected. One disadvantage of a multi-tier label based on, for example, five categories is that differences between brands of the same product only become evident when the greenhouse gases vary widely, i.e. when the brand is moved into the next better category. However, this is certainly also the case, for instance, when food is transported to Europe by plane or alternatively by ship. Different packaging can also result in significant differences in greenhouse gases. With respect to processed products, manufacturers can also massively reduce greenhouse gas emissions through the choice of raw materials, which would then trigger a better classification, for instance if they cut the meat content. But even for unprocessed agricultural products or relatively simple products such as pasta, the pilot tests conducted by Tesco in Great Britain revealed considerable differences in some cases. The difference between the most climate-friendly and the worst variant amounted to a factor of 2 for pasta and also for potatoes. However, there were also product groups with differences of only a few grams of CO<sub>2</sub> equivalent (Tesco 2012).<sup>478</sup>

A **multi-tier, colour-coded climate label** would thus already be possible and would make sense. However, as set out above, the incentives for producers to voluntarily introduce a climate label are currently too low, even for committed manufacturers. Producers of climate-damaging food and those that perform poorly within their product category will not voluntarily use such a label anyway. To sum up, the following can be noted on the subject of environment labels:

- (1) From the WBAE's point of view, a mandatory, multi-tier and colour-coded climate label should be aimed for (cf. Section 9.6.4). The strong preference in the population, the political relevance of the issue and the reasonable costs argue in favour of a mandatory climate label, provided standard values can be used initially (Roe et al. 2014). As explained in Section 7.5.3,

---

<sup>476</sup> An example illustrating this is the IFEU Institute's "milk calculator" for the German dairy industry, which enables businesses to calculate their carbon footprint on the basis of different typical production scenarios (Müller-Lindenlauf et al. 2014).

<sup>477</sup> The IFEU Institute's climate calculator gives a first impression of these results ([https://www.klimatarier.com/de/CO2\\_Rechner](https://www.klimatarier.com/de/CO2_Rechner)). However, such CO<sub>2</sub> calculators on the Internet or as an app only reach particularly highly involved consumers and are, at present, not very suitable for everyday purposes.

<sup>478</sup> Meier et al. (2018) show considerable differences between the GHG emissions of different refectory meals.

a mandatory label should be introduced EU-wide if possible. However, the examples of animal welfare labelling and nutrition labelling illustrate that a Europe-wide debate only picks up speed after the introduction of national labels in some Member States. The WBAE therefore believes that Germany should take the initiative.

- (2) At present, the **“Bio” organic farming label** is by far the best-known environmental label from the public’s perspective. It is particularly strongly embedded in the critical strata of civil society, i.e. among those who take a particular interest in the eco-friendliness of agriculture. The organic label has strengths and weaknesses in terms of the various sustainability aspects. One clear weakness is the lower yield, which is problematic against the backdrop of a growing world population. One clear strength of organic farming lies in the positive environmental effects relating to many environmental goods and its “workshop” function for the development of environmental innovations (Taube 2017). Overall, the WBAE supports boosting organic farming and recommends the system as an element for promoting sustainability in food consumption – and even more so if the consumption of organic products goes hand in hand with a reduction in the consumption of animal products and less food wastage. Organic will also retain its importance for those consumers who have a particularly strong preference for the “naturalness” of production processes.
- (3) Yet the WBAE believes that the dichotomy between “organic” and “conventional” will be insufficient in the long term. After all, viewed globally, it is possible to conceive of farming systems that are more sustainable than organic farming as it is currently defined. These must be developed and then also made recognisable to consumers. The WBAE takes the view that significant research efforts should be made on the appropriate definition, measurement and weighting of environmental indicators in order to develop a **label for eco-efficient farming systems**<sup>479</sup>.

#### 8.9.4 Animal welfare label

The best-known form of animal welfare labelling in Germany is the mandatory husbandry labelling for table eggs (whole eggs bought by consumers), which was introduced throughout Europe in the early 2000s. Other than on the egg market, animal welfare labelling did not play a major role until the early 2010s (Spiller & Zühlsdorf 2018).

Germany is not one of the pioneering countries with respect to animal welfare and corresponding label systems. Besides Switzerland and Great Britain, which established animal welfare labels on the market a long time ago, the Netherlands introduced a voluntary, three-tier animal welfare label

---

<sup>479</sup> In conventional agriculture, a number of position papers have recently been published in which different associations formulated elements of an eco-efficient agriculture (extended crop rotations, inter alia with leguminous crops, reduced use of pesticides, precision farming, conservation tillage practices, flower strips, habitat networking, resistance breeding etc.), e.g. by the Schleswig-Holstein Farmers' Association (BVSH 2019) and the German Agricultural Industry Association (IVA 2019).

in 2007. After an initially rather slow dissemination, it has since secured a very high market share in meat with products in the entry level (Spiller & Zühlsdorf 2018). Level 2 was not very successful. Level 3 is for organic meat and has also seen significant growth (ibid.). This success has fuelled the debate about an animal welfare label for Germany.

In 2013, the **German Animal Welfare Federation's** label, "For more animal welfare", was introduced on the market. This initiative has attracted considerable attention, largely due to the fact that some large slaughtering and processing enterprises (Wiesenhof, Vion) and retailers (Edeka, Tengelmann, later Lidl) have participated. While the label's market share for poultry has grown slowly but relatively steadily, that for pork has remained very low. All in all, however, the market share for animal welfare labels for meat is estimated to have been just under 1% in 2019 (Jasper 2019).

As an alternative to the animal welfare label, the **industry initiative "Brancheninitiative Tierwohl" ("Industry Initiative Animal Welfare", ITW)**, which is supported by key associations from the agricultural sector, meat industry and food trade, was founded in 2014. Characteristics of the ITW (in its original form) include: a budget guaranteed by the food retail sector for a three-year period to finance animal welfare measures in agriculture (extended by a further three years in 2018); a set of animal welfare measures from which farmers can choose, with each measure being equipped with a budget; a focus on smaller improvements in animal welfare across the board; and dispensing with the separation of flows of goods, so that the transaction costs, which are known to be high for labels in the introductory phase, can be avoided (Gassler & Spiller 2018). With this "mass market approach", the ITW has been able to motivate a relatively large number of farmers to get involved within a short period of time as the guaranteed budget of around 80 million euros in the first period was calculated attractively for farmers in relation to the measures to be implemented (Recke & Strüve 2014). Moreover, the focus on 10% more space in livestock buildings rendered it possible to reduce herd sizes, thereby delivering further benefits due to the fertiliser problem in intensive regions (Deter 2018). However, dispensing with a separation of goods also means that the meat from the participating holdings could not be labelled as such in trade (lack of so-called identity of goods). Therefore, it was initially not a label. Nonetheless, label-like markings were increasingly used by the participating traders, which caused credibility issues. These also arose because the standard only went slightly beyond the statutorily defined level, as is typical of mass market approaches. For this reason, the animal welfare NGOs that were initially involved withdrew from the ITW over time.

Against the backdrop of this unclear conflict situation, the BMEL announced an initiative for a government, voluntary and multi-tier label in 2016 and discussed this issue in several rounds of talks with stakeholders from the industry, NGOs and scientific community. In early 2017, initial ideas for designing the system for pork were presented. It is worth highlighting the BMEL's plan to carry out an extensive marketing launch campaign for the label, costing around 70 million euros.

The BMEL's announcement coincided with the phase of negotiations on extending the ITW between the agricultural sector, industry and the food trade. Following some uncertainty among the stakeholders, they finally reached an agreement on a second ITW contract period equipped with an increased annual budget of 130 million euros for the 2018-2020 period. However, it also became clear that there was hardly any willingness, especially on the part of the food retail sector, to implement the originally planned vision of a nationwide ITW that would be backed by all livestock farmers in Germany. The transition to a label will be completed in the third phase of ITW, agreed in late 2019; only for sow husbandry will a budget, funded by the retail sector on a pay-as-you-go basis, be provided (30 million euros, Arden & Awater-Esper 2020).

The realignment is, inter alia, due to more requests from the retail sector for a clear labelling of produce. As early as in the first phase, starting in 2016 and contrary to the initial notion, individual trading companies labelled fresh meat with the ITW emblem with a reference to the lack of product separation (claim: "This information does not mean that the products purchased already come entirely from holdings participating in the initiative"). Recently, increased efforts have been made to separate goods (identity), notably in the poultry sector. Therefore, the ITW logo has developed to some extent into an animal welfare label (claim: "This product comes from a holding participating in ITW"). In the pork sector, too, there are indications of a stronger separation of the flow of goods, which is to be expanded in the third ITW phase.

At the same time, animal welfare labels have gained further relevance in Germany. For instance, the German Animal Welfare Federation widened the range of animal products labelled to include eggs and milk in 2016. In the dairy sector, a stakeholder initiative, based on the highly successful Dutch model and backed by the federal state of Lower Saxony, introduced a pasture milk label ("Pro Weideland" (*For pasture land*), Kühl et al. 2017).

Finally, in April 2018, the Schwarz Group (Lidl, Kaufland) announced the introduction of so-called **husbandry labelling** for fresh meat of its own brands. This encompasses four levels: 0 = legal standard, 1 = higher husbandry standard in the livestock building, 2 = access to outdoor climate/free-range area and 3 = organic farming or comparable systems. In the course of 2018, other leading retail companies, such as Aldi, Netto, Rewe and Penny, followed Lidl's example and introduced similar systems. Lidl and Aldi have announced their intention to convert essential parts of their own-brand fresh meat products to level 2, while Lidl no longer intends to list any level 1 own-brand meat products in the long run ([www.lidl.de/de/haltungsform/s7377909](http://www.lidl.de/de/haltungsform/s7377909)). In April 2019, the animal husbandry labelling was standardised across the participating companies in food retailing ([www.haltungsform.de](http://www.haltungsform.de)).

This form of husbandry labelling has great potential – not only to be directly effective in the final consumers' purchasing decisions but also to contribute to broad-based improvements through the listing policy of the retail trade, i.e. the delisting of the statutory standard. At the same time, there are great challenges for a further development of the system: for improved effectiveness and credibility, the various animal welfare stages must be made more dynamic, the entire value chain must

be involved (e.g. piglet rearing, transport and slaughter) and outcome indicators such as animal health must increasingly be included.

Given the dynamic development of private sector animal welfare labelling, the question arises as to what role a **government label** can and should play in the future. In September 2019, the Federal Government adopted a draft act on the introduction and use of an animal welfare label (Animal Welfare Labelling Act) (Federal Government 2019). The corresponding ordinance containing criteria for pig husbandry is scheduled to be adopted in 2020. Products will most likely not be available on the market before 2021. The label is to be a three-tier voluntary label. As far as the label criteria are concerned, the label is characterised by the inclusion of sow husbandry and piglet rearing, which are missing from the previous concepts of the German Animal Welfare Federation and husbandry labelling. There are significant challenges for animal welfare at these stages (e.g. the crate stall).

The compatibility with and the added value of a government label compared with the husbandry labels introduced by trade is a controversial issue. Possible benefits include the greater credibility of the government and an incorporation of all stages along the value-added chain; potential disadvantages lie in the unclear market dissemination, particularly if it proves impossible to align the government label with the husbandry label. The animal welfare requirements for the individual levels of the multi-tier label are still being discussed. The “entry level”, an improved indoor housing system, is particularly contested (Spiller & Zühlsdorf 2018). This is because the criteria only go marginally beyond the legal standard and existing EU law will probably not be implemented in one respect: dispensing with the routine docking of piglets, which is prescribed by EU law, is not yet likely to be part of the label in the entry level.

Some federal states (e.g. Lower Saxony, Bavaria), agricultural interest groups and many NGOs are calling for a mandatory government husbandry labelling system based on the current husbandry labelling used by large food retailers instead of a voluntary animal welfare label. However, as pointed out in Section 7.5.3, mandatory labelling is problematic under EU law. Yet, it would probably be possible to make it mandatory only for domestic producers, with traders being free to urge foreign suppliers to use the label.

The subject of animal welfare labelling has thus gained considerable importance in Germany over the past decade. The **parallel existence of competing systems** makes transparency more difficult for society and consumers. The progress brought about by labels has so far fallen far short of what the WBAE, in its livestock expertise (2015), considered to be necessary steps towards socially more acceptable animal husbandry.

The WBAE has estimated the current (variable) additional expenditure for a more animal-friendly husbandry above the EU legal level at approx. 3–5 billion euros (WBAE 2015, along the lines of the Group of Experts on Livestock Husbandry 2020). Recent experience, e.g. from experiments to avoid tail docking, has further supported these calculations. In addition, there are investment measures

aimed at the conversion of animal husbandry to more animal-friendly husbandry systems (one-off investments): while these are generally not very high for new buildings, they are very high for the conversion of livestock buildings that have not been depreciated.

To date, these additional costs are not being covered at all by the additional revenues on the market for labelled products and brands that guarantee more animal welfare. The additional revenues generated by the various animal welfare labels are estimated at approx. 70 million euros for 2019, while the Animal Welfare Initiative contributes approx. EUR 150 million per year. Thus, although animal welfare labelling can make a financial contribution, it is also obvious that labelling on its own cannot achieve changes to animal husbandry practices on an adequate scale and cannot cover the above-mentioned associated variable and investment costs.

A nationwide delisting of goods with low animal welfare standards, for instance goods without the government label or goods at husbandry level 1, would have a broader impact. However, case studies from successful countries like the Netherlands show that this path takes several years and cannot fully transform the sector since goods for export are not included. In the Netherlands, the animal welfare label has created a divided market: animal welfare products are chiefly produced for the domestic market and are very successful there, but most of the animals in the Netherlands, which is an export-oriented country, are still produced to the usual EU standards.

Against this backdrop, the WBAE is only cautiously optimistic about the overall contribution an animal welfare label can make. As is the case in the Netherlands, a voluntary label can only deliver smaller benefits for an individual animal and can only reach a relatively high number of animals if the entry level is set low and the market constellations are favourable. A mandatory label increases the chances of broad market dissemination. Overall, an animal welfare label is an important cornerstone of an animal welfare policy, but according to the WBAE it is by no means sufficient on its own. Considerable government funding would also be needed (see also Section 8.6 and 9.4 on this issue). Without clear political leadership (strategy) with sufficient clarification of substantive goals and financing, the necessary transformation of animal husbandry will not be successful. On the contrary, there is currently growing uncertainty among the stakeholders.

### 8.9.5 Conclusion

According to the WBAE, sustainability labels can make an important but limited contribution to more sustainable food consumption (cf. Tørris & Mobekk 2019, Cadario & Chandon 2019). Sustainability labels are needed because without them consumers have no opportunity to take action themselves with regard to credence properties such as environmental conservation, climate change mitigation and animal welfare. However, this commitment is important for sustainability policy as a whole. For various reasons, **labels alone are not enough.**

- In many cases, implementation has so far been inadequate (“jungle of labels”, low level of awareness, control deficits etc.).

- There remains a systematic gap between our attitudes, intentions and actions as citizens and our actual behaviour as consumers (e.g. due to the joint production problem concerning meat, free-rider problems etc.).
- Mandatory labels could have a greater impact on the market (e.g. animal welfare) or are in some cases a precondition for a successful market launch (e.g. climate label). Increased efforts should therefore be undertaken with a view to EU-wide and mandatory labels. Mandatory labels for national suppliers only (reverse discrimination) could also be tested.
- Labels are only one part of the mix of instruments, they must be flanked by further supply-side and demand-side policy measures.
- In some sustainability fields (environment, social affairs), comprehensive development and standardisation work still needs to be done, and databases need to be established before (meaningful) comprehensive labels can be created.

Despite all limitations, the WBAE takes the view that sustainability labels – as a precondition for informed consumer actions and for more market transparency with respect to process characteristics – will continue to gain in importance. The information purpose of labels also creates acceptance for more far-reaching measures. Policymakers should promote government labels through more extensive development work, greater standardisation towards an umbrella label concept and reinforced advertising.

## 8.10 Mobile applications

Given the wide reach of the Internet and social media, a very large number of people can now be reached in a short time. Traditional analogue forms of communication would only be able to do this with a considerable use of resources. These “new” media, along with mobile technology, make it increasingly possible to provide information when consumers need it (**just-in-time**) and want it (**on-demand**). In addition, information can be tailored more closely to the individual requirements of consumers (**message tailoring**) (Debbeler et al. 2020, Lustria et al. 2013, Moorhead et al. 2013).

### 8.10.1 Mobile apps in the behavioural process

The technological options that enable interactive, adaptive, just-in-time interventions and presentations of information have so far only been used to a limited extent in the food market and, above all, in a fragmented manner (“app jungle”). Compared with conventional information channels, apps offer the option of giving consumers information when they actually need it, whether in making their choices (e.g. in shops), when preparing meals or in the eating situation (e.g. to evaluate the meals, energy density, size of portions etc.). Even after the meal, mobile sensors can be used to measure physiological processes and parameters (e.g. blood sugar with a portable sensor or a sensor implanted under the skin).

Thanks to the close links with behaviour, it is to be expected that apps are far more effective than general information campaigns, which do not have such close links to behaviour and are not as individualised. Furthermore, mobile applications have the advantage that the scope of information presented by them is (at least theoretically) not limited, as is otherwise the case, for example due to the size of packaging or brochures. Instead, they can integrate a wide range of information and databases. A further key benefit is the topicality and speed. Information can be updated virtually in real time, and very different sources of information can be integrated (e.g. user ratings, databases). These mobile applications offer consumers the opportunity to access detailed information and comprehensive databases for their food choices and dietary habits, and to document and optimise their own behaviour and dietary patterns in ever better resolution (see also “self tracking” and “quantified self”)<sup>480</sup>.

### 8.10.2 Are dietary apps effective in terms of behaviour? Food consumption habits and nutrition-related health parameters

Nutrition apps, especially for weight reduction and healthier food consumption, have become very popular. For example, the “Lose-it” app has 35 million members worldwide and offers around 15 million articles in its food database as well as more than 25 macronutrient and health goals. According to the extensive study conducted by the Federal Ministry of Health (BMG) entitled “Opportunities and Risks of Health Apps” (“Charismha”), which deals with the markets of health apps and the options provided by them, there are a wide range of possible applications, but evidence of their effectiveness is frequently lacking (Albrecht 2016).

In a recent meta-analysis, the results regarding the impact of 30 different commercial and non-commercial nutrition apps were analysed on the basis of 41 intervention studies involving a total of more than 6,000 people. Significant positive changes were consistently shown for a number of different health parameters (Hedges’  $d = .26$ ; Villinger et al. 2019).<sup>481</sup> In addition to an increase in fruit and vegetable intake, the results showed a reduction in weight and an improvement in various blood parameters (e.g. cholesterol). The analyses show that these positive effects are not limited to specific groups of people or specific types of apps or interventions.<sup>482</sup>

However, this metastudy, similar to the Charismha report (Albrecht 2016), showed that the potential of apps is far from being exhausted. Many of the apps use four conventional techniques in order to modify behaviour (Michie et al. 2013; see Section 3), which are also successfully used in many analogue intervention approaches: (1) behavioural monitoring & feedback; (2) goals & planning, (3) social support and (4) knowledge transfer. There is still a very high potential to expand the

---

<sup>480</sup> <https://www.welt.de/gesundheit/article153220938/Wie-wirksam-ist-Self-Tracking-wirklich.html>.

<sup>481</sup> Cf. also <https://idw-online.de/de/news728682> und <https://www.aerzteblatt.de/nachrichten/108083/Apps-koennen-Ernaehrungsverhalten-verbessern>.

<sup>482</sup> Cf. also <https://www.uni-konstanz.de/universitaet/aktuelles-und-medien/aktuelle-meldungen/aktuelles/aktuelles/apps-verbessern-ernaehrungsverhalten/>.

possibilities of mobile technologies as a measure for prompting behavioural changes (Villinger et al. 2019). Here, the question arises as to why the development of new innovative concepts in this regard is not even more pronounced. One reason could be that commercial providers are not primarily interested in health-oriented behavioural changes, but rather in achieving high sales figures.

In addition to apps that are directly tailored to aspects of the behavioural process, there is an increasing number of mobile sensors and apps that offer consumers new opportunities to access information and bring together different settings inside and outside the home.

### 8.10.3 Digital applications and the merging of different settings: smart “digital ecosystems”

Current developments in digital and mobile technologies, applications and sensors go beyond conventional measures such as general information campaigns or education courses on offer. They can thus influence our consumption and behaviour in very different and new ways and in different settings. The range of digital applications includes the ability to order products and food online at the touch of a button on the kitchen cupboard (e.g. “Amazon dash”), to order them via an app (e.g. “Hello Fresh”), to have them delivered automatically (e.g. “Just Eat startship”, London) or in a personalised manner (e.g. door dash”, New York) and, with the help of Internet of Things (IoT), to have them prepared at least semi-automatically (e.g. “Thermomix”) and stored in a “smart” way (Smarthome, e.g. “Samsung Family Hub”). Finally, various sensors on the body (e.g. sleep and movement trackers) and in the household (e.g. “smart toilet” by Toto; “smart bed” by eightsleep) can be employed to measure changes in different biomarkers in real time.

A special feature characterising digital development is that intelligent (“smart”) and inter-connected systems, so-called “digital ecosystems”, are emerging, which integrate **different offers and applications, even from various providers**. Such new smart digital ecosystems are evolving not only in and around the home, but also in the out-of-home area. With the launch of Amazon Go, Amazon has created a new form of digitalised shopping in which all purchases are made “analogue” in the shop, but payment is made digitally by customers via an app and a digital account (Amazon pay). Conventional payment is no longer required here; the debit is made via an Amazon account as soon as the customers leave the shop. Goods and products are registered in a fully automated way with the help of numerous cameras and sensors in the store. This shows a merging of the domestic environment with various areas outside the home. In order to be able to take advantage of digital services, the digital account is playing an increasingly important role. Many services are handled via Amazon Pay, Google Pay or a customer account, points which then also see the converging of the various data on consumer habits. In a number of areas, there is a merging of the analogue and digital worlds. In many restaurants and shops, for example, orders can be placed via apps or via the Internet. In restaurants, for example, meals can be ordered which are then made available on the ground at the desired time (e.g. “Data kitchen”, Berlin). Another example is the

integration of recipe apps with shopping apps. A recipe can be selected at home and the app automatically generates the right shopping list. The corresponding products can be quickly located in the supermarket by guided shopping using indoor “GPS”. Finally, the automatic payment allows a time-efficient handling of the payment process. Other companies aim to digitally simplify access to products at any time and any place. Domino’s Pizza, for example, which describes itself as a “digital first” company, offers its customers 15 ways to order their pizza, e.g. via SMART TV from the sofas at home, via SMART Watch en route or via Alexa, Twitter, Facebook and One-Click, based on voice, text or gestures (<https://anyware.dominos.com/>). The dialogue-based AI platform “Twilio Autopilot” and the AnyWare app provide customer-oriented, automated ordering processes.

In addition, individual ranges of foods are increasingly being offered in areas where such offers did not previously exist (e.g. “Bodega” - automated sales shelves in offices). These offers are also controlled by means of apps and usage data.

#### 8.10.4 Challenges and measures of digital applications and apps

The WBAE takes the view that three major challenges arise from the above observations for a sensible use of digital and mobile applications from the consumer’s point of view, i.e. one that supports more sustainable food consumption:

**“Exposure and Convenience Pressure”**. Although the new offers in some cases differ significantly in terms of implementation and technology, they are often aimed at increasing convenience, availability and ultimately consumption. One consequence of this is that we are increasingly being offered food almost anywhere and at any time. This enhances our exposure to stimuli that draw our attention to “food”. We are thus increasingly reminded of food and as a consequence we have to say “no” explicitly more often and regulate corresponding behavioural impulses. This high availability also contributes to the fact that social structures (fixed times, places and settings for meals) are increasingly dissolving, which further raises the demands on individual behavioural regulation.

We are also running the risk of reducing choices through the development of networked digital systems (ecosystems) that increase availability and convenience. For instance, a customer account becomes a necessary precondition for access and participation, and there may then be a significant decrease in product diversity, especially with regard to smaller or regional offers.

**“App Jungle” - creating a “digital ecosystem for a more sustainable diet”**. The apps and digital applications which are currently available are often designed very specifically for certain aspects of daily consumer and food consumption habits (“app jungle”). Here, a systematic pooling of data for consumers is urgently needed so that valid and comprehensible information and data are available more easily (convenient), more quickly (just-in-time) and in a personalised (tailored) way in everyday life. By merging and integrating databases and applications, consumers could access the

desired information directly on the store shelf, in the restaurant or at home while preparing their meals.

By creating and continuously developing a “digital ecosystem for more sustainable food consumption”, which provides applications and data for the entire behavioural process and integrates them in an understandable way, consumers could be enabled to play a more pro-active role as responsible stakeholders in the market economy.

**Data quality and availability - creation of a valid, integrated open-access database.** A further problem is that consumers are, as a rule, unable to understand either the validity of the underlying (behavioural) standards and the recommendations derived from them or the quality of the underlying databases and algorithms used to calculate, for instance, energy intake and energy consumption. A typical example of this is the “10,000 steps a day rule”, a behavioural norm that can be found as a goal in almost all fitness apps. In fact, this is not the outcome of scientific research, but of a Japanese marketing campaign by the Yamasa company in the 1960s, which used it to promote its “Manpo-kei” portable pedometer for the Olympic Games.<sup>483</sup>

As it is often not easy for consumers to understand which criteria and what data stock are used by the apps when recommending or evaluating something, it is essential to provide more validated and high-quality databases that are generally accessible. The WBAE therefore recommends further expanding the national nutrient database (BLS, MRI) as a basic (and free of charge) database and, for example, including data on climate pollution and making available the corresponding infrastructure. A wide variety of companies and institutions could then develop corresponding applications on the basis of such a state-funded data infrastructure.

Apps are - just like labels - based on the availability of condensed and valid information. There is therefore no competition between these two instruments. Both are based on an information infrastructure which, as already explained, has yet to be developed and made available by the government.

The gathered data are usually not accessible to consumers. Network externalities also favour the danger of data monopolisation by one or a few key companies (“the winner takes it all”). The large volume of data (Big Data) constitutes a strong benefit for the largest companies and their development. Methods such as machine learning can only be used in a meaningful manner with large volumes of data. Conversely, the users of the dominating company with the largest group of users tend to benefit most from this (analogous to social media). Here it would be urgently necessary to clarify how the availability of one’s own data can be regulated and, as appropriate, better safeguarded. In addition, the options of consumers donating data to research institutions or public authorities should be examined, so that non-commercial applications can be developed to a greater extent.

---

<sup>483</sup> <https://www.theguardian.com/lifeandstyle/2018/sep/03/watch-your-step-why-the-10000-daily-goal-is-built-on-bad-science>.

**Text box 26:** Lebensmittelwarnung.de (food alert website) as an example of missed technological options

The Lebensmittelwarnung.de website is operated by the Federal Office of Consumer Protection and Food Safety (BVL) in cooperation with the federal states: “The federal states or the BVL issue public alerts and information here under Section 40 (1) and (2) of the Food and Feed Code (LFGB). This generally concerns references by the competent authorities to information for the public or a recall by the company” (<https://www.lebensmittelwarnung.de>). It is a traditional internet presentation. One can follow it on Twitter, but the alert is not posted there, only the information that there is a new warning. The system is therefore not useful for consumers unless they want to actively search for alerts every day. In addition, only a few consumers are familiar with the website (Zühlsdorf et al. 2018). However, Lebensmittelwarnung.de provides information for privately run product alert apps such as Produkttrueckrufe.de and Produktwarnung.eu. BVL also provides an RSS feed, a technology that is hardly used nowadays.

These websites and apps are examples of a well-intentioned alert system which is, however, very cumbersome for consumers and therefore hardly usable. Up to now, users have been receiving alerts from throughout Germany almost on a daily basis, regardless of whether they are in the respective region and whether they are consuming the product in question at all. The large number of (non-prioritised) messages that are irrelevant for the assessment of one’s own risk makes this type of app unattractive for most users. Technologically speaking, this system could become considerably more user-friendly. In the USA and other countries, so-called “wireless emergency alerts” (WEA) or push messages are used for various hazard areas in order to reach the people in affected regions independently of a specific app (<https://www.fema.gov/frequently-asked-questions-wireless-emergency-alerts>). For less serious incidents, it would be desirable to provide a “toolbox” app that integrates various services and applications with regard to food and nutrition. In this way, consumers would not have to install many individual “special” apps, but would have a “food gateway” that offered many different services (e.g. food alerts, label library, seasonal calendar, etc.).

### 8.10.5 Conclusion

Compared with conventional information channels, the Internet, social media and apps offer the possibility of giving consumers information when they actually need it, whether to help them make their choices (e.g. in shops), for the preparation of food or in the eating situation (e.g. to evaluate the meals, energy density, size of portions etc.). Due to the close link to behaviour, apps can be much more up-to-date, faster, and more effective than general information campaigns. Information can be updated virtually in real time, and very different sources of information can be integrated. On balance, it is clear that while there are also risks involved in innovative mobile technologies, they also offer opportunities for user-friendly, implementable sustainability information that is suitable for everyday use:

- (1) **Data quality and availability.** Consumers are generally unable to understand the quality of the underlying databases and algorithms or the validity of underlying (behavioural) standards (e.g. for dietary habits) and recommendations derived from them. The recorded data are usually not accessible to consumers and other stakeholders. This goes hand in hand with the risk of companies monopolising data. As it is often not easy for consumers to understand

which criteria and what data stock apps are using to make recommendations or assessments, it is essential to provide more validated and high-quality databases that are generally accessible.

- (2) **“App Jungle”.** The technical possibilities have so far only been used in the food market to a limited extent and above all in a fragmented manner. By creating and continuously developing a “digital ecosystem for more sustainable food consumption”, which provides applications and reliable data on food and nutrition for the entire behavioural process and integrates them in an understandable way, consumers would be enabled to play a more proactive role as responsible stakeholders in the market economy.
- (3) **Provider-driven smart “digital ecosystems” increase exposure and convenience pressures.** There are an increasing number of other mobile sensors, apps and digital technologies that influence consumption and consumer habits in different ways and in different settings. Thus, new smart “digital ecosystems” are developing not only at home, but also in the away-from-home setting. These smart “digital ecosystems” differ widely in some cases in terms of implementation and technology, but are often aimed at increasing the convenience and availability and thus ultimately the consumption of food. The development of such “ecosystems” and high availability increases the exposure and convenience pressures on consumers and contributes to the dissolution of social structures (e.g. specific times, places and settings for meals), which further increases the demands on individual behaviour regulation. In addition, there is the risk of reduced choices in the long run.

A lot of risk capital is currently flowing into the development of smart “digital ecosystems”. By making reliable sustainability data available, the government could contribute to a more diverse provider structure and support non-commercial providers. It should be examined to which extent further regulations, such as the certification of nutrition apps, will be necessary.

## 8.11 Reduction of food losses

The reduction of avoidable food losses<sup>484</sup> is seen both at national and international levels as one of the most important fields of action for more sustainable food consumption (cf. Section 4). The “Too good for the bin” ([www.zugutfuerdietonne.de](http://www.zugutfuerdietonne.de)) information campaign underpins a broad-based social discussion in Germany on ways to curb the “throwing away of food”. Reducing food waste could have manifold positive sustainability effects, as production, processing and preparation could be reduced accordingly, which would have a direct impact on key environmental targets. In Germany, the total food waste volume in 2015 accounted for approx. 11.9 million t of fresh mass, broken down into 1.4 million t (12%) by the agricultural sector, 2.2 million t (18%) by processing, 0.5 million t (4%) by trade, 1.7 million t (14%) by away-from-home catering and 6.1 million t (52%)

---

<sup>484</sup> As explained in footnote 124 of Section 4.4.2, this expertise uses the terms “food losses” and “food waste” synonymously for the sake of simplicity.

by private households (Schmidt et al. 2019a, cf. Section 4.4.2). Around half of this amount is deemed technically or theoretically avoidable (Schmidt et al. 2019a), with the avoidable shares being estimated to be higher for enterprises than for consumers (cf. Fig. 4-34). Schmidt et al. (2019a) estimate the absolute volumes of avoidable food waste for 2015 at 0.4 million t for trade, at about 1.2 million t each for primary production, processing and away-from-home catering and at 2.7 million t in private households.

As with other sustainability problems relating to food consumption, food policy can focus on the supply and/or the demand side. An overview of relevant instruments is given below. The Federal Government - like many other OECD countries - has set itself ambitious goals for reducing food losses, i.e. in line with **SDG goal 12.3**, “to halve per capita global food waste **at retail and consumer level** by 2030 (...) and to reduce food losses along the production and supply chain, including post-harvest losses” (BMEL 2019f: 5; BMEL 2020). In the Federal Government’s own estimation, the target is ambitious, and experience from other EU countries also suggests that it is. In the UK, for example, following the initial successes of the initiative to recycle food waste in the 2007 to 2012 period, waste levels rose again after 2012 (WRAP 2017). A programme launched in 2009 to reduce food waste in the Netherlands showed hardly any effect between 2009 and 2011 (Hamilton & Richards 2019). On behalf of the BMEL, Schmidt et al (2019a, cf. Sections 4.4.2 and 4.4.3) presented a baseline study on the scale of food losses in 2019. The comparison with older estimates - a comparison which is, however, very uncertain - has so far not indicated any radical reductions (Schmidt et al. 2019b: XVIII).

### 8.11.1 Supplier-focused instruments

Section 4.4 describes the considerable scale of food losses right along the value chain to the consumers. Supplier-focused instruments are applied at the levels of agriculture, industry and trade, including logistics and away-from-home markets. In line with the aim of this expertise, only those instruments that are related to consumer behaviour and come into play at the last stage of the chain, i.e. in the retail trade or in the food service market, will be addressed in the following.<sup>485</sup>

Basically, two opposing drivers act on food operators: initially, technological progress (transport, refrigeration, packaging, artificial intelligence-based planning systems, etc.) improves the possibilities for avoiding food losses. For economic reasons, companies have an interest in curbing avoidable food losses as long as the avoidance costs do not exceed the value of the foodstuffs. The more expensive the foods in question, the stronger the economic motivation. Given the long-term decreasing percentage of raw material costs in food prices compared with processing and service costs (Koester 2012), it is obvious that companies along the food chain today include the loss of raw materials in their planning to a comparatively lower degree.

---

<sup>485</sup> Schmidt et al (2019b: 98 pp.) discuss measures at producer level.

Teller et al (2018) and Schmidt et al (2019b), in studies on the causes of food losses in retailing trade, highlight the following **drivers on the trade side**, most of which can also be transferred to the away-from-home market:

- limited predictability of actual customer demand or inadequate planning systems (Teller et al. 2018, Schmidt et al. 2019b)
- Poor implementation of planning and shop-shelf maintenance by local staff (ordering, replenishment), low motivation, inadequate numbers, lack of experience, inadequate leadership and commitment (Teller et al. 2018).
- Products that are already too close to the best-before or use-by date at the time of delivery. Conversely, the requirement that can frequently be encountered in trade, namely that goods must still have at least two-thirds of the best-before date envisaged for trade ahead of them, results in losses for suppliers (Schmidt et al. 2019b: 106).
- Instructions to suppliers not to sell elsewhere any returned goods bearing trademarks which trade returns to the manufacturers or to hand these goods over to social institutions.
- High quality standards e.g. regarding the appearance of fruit and vegetables<sup>486</sup>, but also regarding maximum residue levels.<sup>487</sup>
- Poor product quality in the supply of fresh produce to the market (Teller et al. 2018).
- Planning errors of the retail head offices: too many products are assigned to a store, e.g. during promotions (Teller et al. 2018).
- Internal retail requirements to ensure 100% availability of products on shelves: low tolerance for empty shelves (Teller et al. 2018). This also affects agricultural suppliers, who therefore calculate safety margins of 10 to 20% for fruit and vegetables, for example, i.e. they produce more than contractually agreed with retailers (Schmidt et al. 2019b: 95).
- Large breadth (number of product categories) and depth (choice within categories) of the product range increase the risk of food losses (Teller et al. 2018).
- Excessively large packaging units e.g. for trademarks (Teller et al. 2018).
- Causing fluctuations in demand through price-oriented marketing, e.g. through forms of special offers such as “buy two - pay for one” (Teller et al. 2018).

Traders generally have an economic self-interest in reducing losses, except when they can charge their suppliers for these losses (returns, but these play a major role e.g. in the case of bakery products, cf. Schmidt et al. 2019b: 19). Spoilage is a key element in the so-called inventory differences

---

<sup>486</sup> For example, the Lidl trading company has recently raised the size requirements for strawberries to a minimum fruit size of 30 mm, which could result in approx. 20 to 25% more rejects that would then have to be sold, processed or disposed of elsewhere (Schmidt et al. 2019b: 89).

<sup>487</sup> Schmidt et al. (2019b) call for a reconsideration of maximum residue levels for plant protection products, some of which are set by leading food retailers at much lower levels than required by law. In this respect there are conflicting goals with regard to food safety.

(deviations between the purchase and sale of goods) and thus one of the central parameters of trade management. Larger retail companies therefore operate with specific logistics software to reduce planning errors and try to take factors such as weather, public holidays, major events, etc. into consideration, e.g. in the volume of their orders. Nonetheless, the analysis conducted by Teller et al. (2018), which also includes interviews with retail employees, shows that the employees themselves definitely see potential for improvement. A stronger focus by suppliers on avoiding food losses could thus still produce economically and ecologically meaningful improvements and create win-win solutions. Carrying on from the causes outlined above, the following instruments, among others, could be employed for this purpose:

- better planning systems (e.g. systems for forecasting fluctuating customer demand, better networking of branches);
- better training of staff (e.g. knowledge of goods, shelf maintenance, ordering);
- improved transport logistics (e.g. reduction of journey times through more regional purchasing, cooling, transport containers);
- enhanced delivery systems (e.g. branch-specific pre-picking, more frequent deliveries);
- processing of surplus fresh produce into convenience products on the ground in the stores;
- reduction of depth of product range (delisting of frequently spoiled item variants) and width of product range (delisting of rarely purchased secondary articles that spoil more frequently);
- reduction of packaging sizes (e.g. by means of packaging units that can be opened separately or smaller portion sizes<sup>488</sup>);
- price campaigns for goods before spoilage (e.g. Happy Hour for baked goods, Schmidt et al. 2019b: 119);
- offer menus tailored to target groups; this ensures high acceptance and significantly lower waste volumes in schools, for example (Schmidt et al. 2019b: 165, Binot-Hafke et al., 2017).

There is expected to be potential for reduction via improved logistics and planning systems, particularly in the area of medium-sized companies, e.g. in the away-from-home market (small-scale restaurant and catering sector, small caterers) and in artisanal food production. Politics could support better planning, especially for medium-sized food business operators, by promoting the development of logistics software systems that also map food losses.

While there may be win-win situations with the above-mentioned measures, which can be achieved through information measures and better availability of planning tools, other measures are hard to implement, as suppliers are in such cases at least partly dependent on modified consumer behaviour or, alternatively, on interbranch agreements:

---

<sup>488</sup> Schmidt et al. (2019b), for example, found that portion sizes in school catering are on average 100 g smaller than the benchmarks set by the DGE guidelines, and that guideline-compliant production would therefore be likely to lead to a significant increase in food waste.

- Reduction of price-oriented marketing, especially for large packaging units and “buy two, pay one” promotions.
- Lowering quality standards, e.g. with regard to the visual appearance of fruit and vegetables, is risky, as customers will conclude that there are shortcomings with respect to the freshness of the products - one of the most important parameters for customer satisfaction in retail trade.<sup>489</sup>
- Lowering the requirements for the availability of products on shop shelves (tolerance of shelf gaps) is risky because customers are dissatisfied if they can no longer buy their preferred products in the evening.

When measures to reduce food losses lower customer satisfaction, voluntary action by enterprises reaches its limits. Appealing to the “good will” of the companies then only achieves limited effects, according to the experience gained by research into company environmental management. In this case, economic incentives must be modified or regulatory measures taken and, in the long run, a clear change in consumer attitudes must be worked towards (information campaigns, dietary education).

Another area of focus comprises food and hygiene requirements for passing on food from mass catering and questions of product liability. Italy has recently made it legally possible to donate food after the best-before date has expired and has considerably simplified red tape for food donations (Busetti 2019).

France and the Czech Republic have obliged retailers to give unsaleable goods to aid organisations. Economically speaking, this leads to more consumers receiving free goods, which reduces the overall turnover of retailing (and thus perhaps in the long run creates incentives to avoid waste). In addition, the obligation to pass on goods could increase personnel costs in trade. However, it is unclear how strong avoidance incentives are all in all.

### 8.11.2 Consumer-focused instruments

There are many causes of food waste in the household. Often more food is purchased than needed, which is due to impulsive shopping behaviour, underestimation of food waste and the advertising behaviour of retail traders, such as the provision of quantity discounts. In addition, households do not fully use up food after purchases because they: do not plan purchases and menus completely; want to create scope for spontaneous food choices; have little understanding of best-before and sell-by dates; have poor cooking skills; or do not know how to deal meaningfully with leftovers (Schanes et al. 2018).

---

<sup>489</sup> In studies on their purchasing criteria for food, freshness of products is regularly mentioned as the key feature, see e.g. Schmidt et al. (2019b: 195).

Better planning of purchases can contribute to waste prevention. Many consumers already use a shopping list (Schmidt et al. 2019b). Checking stocks before shopping also helps to avoid waste (Schanes et al. 2018). Consumers deliberately deciding to conduct retail shopping based on their needs has proved to be relevant behaviour for reducing food waste (Schmidt et al. 2019b). Opting to shop less frequently but to then shop in large-scale retail centres tends to generate more waste. Worrying about not meeting the wishes of other household members or guests or wanting to ensure plenty of variety also tends to generate more waste (Schanes et al. 2018). Improved cooking skills can help to turn leftover ingredients or leftovers into tasty dishes.

In the literature, measures to promote the above-mentioned behaviours focus on **education** and **information** (see Sections 8.7 and 8.8). While information campaigns can promote a willingness to act (Chen 2019), the impact is rather small, as two extensive reviews show (Schanes et al. 2018, Reynolds et al. 2019). Young adults and small households (one to two-person households) generate particularly high per capita food waste, which means that communication should focus on these target groups (Schmidt et al. 2019b). Studies show that the environmental effects of food waste among consumers are mostly not yet known (Schanes et al. 2018). So far, general ethical concerns and feelings of guilt have prevailed as reasons for reducing waste (ibid.), although Rohm et al. (2017) point out that sustainability messages can have a particularly positive effect at the point of purchase.

In **school catering**, as an important learning area for more sustainable food consumption, it would be possible to make particularly intensive - and visible - efforts to reduce food waste (Schmidt et al. 2019b). Given that around 25% of the meals in this sector are disposed of, considerable volumes of waste are generated (ibid.: 186). As explained in Section 7.5.1, there are considerable management challenges in this field, which also make a consistent reduction strategy difficult. Waste reduction targets could be included in tendering procedures, while waste management methods could be incorporated into the basic and advanced training of kitchen staff (ibid.). Pupils could eat smaller portions with the possibility of having a second helping.

Low-cost nudges such as the advice in buffet restaurants to take smaller portions and return to the buffet more often if required show positive albeit small effects (Reynolds et al. 2019).

A sensible measure is the **reduction of portion sizes** (cf. also Section 8.3). A study showing that a smaller plate size in hotels reduces the proportion of food leftovers by 20% (Kallbekken & Sælen 2013) was also confirmed in other studies (Reynolds et al. 2019). Consumers could also use this effect in their households by using smaller plates.

There could also be options regarding the **communication** of the date of minimum durability, which is misinterpreted by some consumers as the use-by date (Schmidt et al. 2019b), so that food is thrown away directly afterwards. Changes or additions to the term are therefore being discussed. For example, “Too Good To Go”, a food-sharing company, has suggested supplementing the date

of minimum durability with an “Often fine for longer” label, which should be printed near the date of minimum durability and point consumers to products that are typically still edible.<sup>490</sup>

**Economic incentives**, e.g. by raising the price of compostable waste (organic waste bins), initially appear an obvious instrument, because they address the problem directly. However, this could trigger disincentives, e.g. to discard the waste in the household waste bin or to throw it away improperly (littering). Moreover, garden owners can still do their own composting, so the instrument is unlikely to be effective.

In Germany, the use of leftover food from the retail sector by so-called Tafel organisations (food banks) is another instrument for reducing waste. According to their own information, the 942 food banks (as of 2018) distribute approx. 264,000 t of food per year to around 1.5 million regular users, with an upward tendency (Tafel Deutschland e. V. 2018, 2019). By supporting low-income households, food banks have now become an established instrument for alleviating food poverty (cf. Sections 4.2.3 and 9.5). Measures to strengthen the **food banks** could include the following, for instance:

- an improved infrastructure of the food banks (e.g. premises, cold and frozen storage). The Tafel Deutschland e.V. (German Association of Food Banks) sees the lack of (deep-freeze) storage centres as a key bottleneck factor (Tafel Deutschland e. V. 2018). In addition, the transport of meat, which has to date rarely been “rescued” by the food banks, requires transport vehicles with refrigeration at 2 degrees centigrade to maintain an unbroken cold chain;
- the supply of more goods to the food banks by food retailing and the hotel and restaurant industry;
- a further processing of the goods by the food banks, e.g. via a wider range of catering options such as breakfast or offers for senior citizens in the evening etc.

The reduction potential offered by innovative **apps** (e.g. [www.toogoodtogo.de](http://www.toogoodtogo.de)), which establish electronic business models for consumers to procure foods and meals shortly before the close of business, is still unclear. Literature refers to the educational effect rather than to direct reductions (Reynolds et al. 2019).

When reducing food losses, **trade-offs** between the various sustainability goals must be taken into account. For example, frequent shopping can increase traffic congestion; additional packaging can keep products fresh for a longer period of time, whilst, however, increasing the packaging effort; and lower temperatures in the refrigerator can increase energy consumption. Policymakers must give particular attention to the trade-off between cutting the price of fruit and vegetables for health reasons (cf. Section 8.6.1) and reducing food losses, as low prices tend to lead to a more carefree handling of these vulnerable products (Hamilton & Richards 2019). Cereals and sugar are highly efficient in cultivation and less susceptible to spoilage (Conrad et al. 2018). Finally, a strong

---

<sup>490</sup> The approach is supported by some large businesses from industry and food retailing and is to be tested shortly, press release of 05.11.2019, <https://toogoodtogo.de/de/press/releases/oft-laenger-gut-label>.

focus on avoiding food waste could result in consumers eating larger portions, which could contribute to obesity (Reynolds et al. 2019).

### 8.11.3 Conclusion

The target of halving avoidable food waste in the retail sector and among consumers by 2030 is an important but also ambitious reduction target for environmental protection and climate change mitigation. At present, around 6.1 million tonnes of food waste are produced annually in private households in Germany, which corresponds to around 75 kg per capita (Schmidt et al. 2019a). Of this, 2.7 million tonnes are regarded as avoidable (ibid.). At the level of private households, halving the amount of avoidable waste would mean saving some 1.3 million tonnes.

According to the WBAE, halving avoidable food waste is hardly achievable with the approaches pursued to date. There are two reasons for this. First, the proportion of avoidable losses, particularly in the value chain, is probably overestimated (Bellemare et al. 2017), while the costs of implementation and the conflicting goals of companies are underestimated. More importantly, however, there is a stark contrast between the goal, which is widely accepted in society, and the range of instruments available. At the key level of the households, everything ultimately focuses on education and the presentation of information. Experience to date shows that these instruments, as they are currently being implemented, have not led to any drastic reductions either in the value chain or at the household level.

The waste behaviour of households is difficult to address politically. Nevertheless, the only remaining key policy option at household level is a significant expansion of education and information. The instruments in this field must be further developed and used much more intensively. The current state of research indicates that the presentation of information does not have a major impact if the budget earmarked for it and thus the pressure to communicate (scale of information measures) is not sufficiently large. Significantly more extensive campaigns than the BMEL has launched to date are required if the (meaningful) policy objectives are to be met.

At the level of retailing and the away-from-home market, the WBAE believes there is potential in the increased promotion of structures that enable the passing on of leftover food that is still suitable for consumption (e.g. food banks and apps, cf. Busetti 2019). It should be examined whether requiring the retail trade to pass on such materials could provide meaningful support in this regard. In addition, food banks could increasingly become involved in preparing meals, which would also have further positive effects on the problem of food poverty.

## 8.12 Voluntary self-restraint and corporate social responsibility: integrating corporate commitment into food policy

This **expertise focuses on policy measures** to promote sustainability in food consumption. The WBAE by no means fails to recognise the role played by companies, trade associations and organised civil society. Agri-food companies can initiate and actively shape sustainability progress along national and international value chains, but they can also impede or block it. Policymakers set the underlying conditions for this. They can influence companies not only through regulatory law and economic incentives, but also through soft policy measures to provide motivation to pursue voluntary approaches.

The literature on corporate social responsibility (CSR, Carroll 1999) increasingly recognises that progressive companies that implement sustainability measures of their own accord or respond particularly swiftly and in a sustainability-oriented manner to government incentives can be key drivers for a more sustainable development. In this respect, the policy instruments outlined above work more efficiently and effectively in a cooperative atmosphere in which food business operators are open to sustainability goals. Ultimately, neither policymakers, businesses nor civil society can solve the challenges relating to sustainability in food consumption on their own. In view of the influence exerted by industry, it is important that as many companies as possible set out to find win-win situations, i.e. try to seize the economic opportunities of sustainability issues in an innovative manner (Porter & Kramer 2011).

Food policy can contribute in many ways to the **promotion of a corporate commitment to sustainability** (Albareda et al. 2008, Knudsen et al. 2015, Reinecke & Ansari 2016):

- Specifying clear goals and strategies (creating attention, assigning responsibility, mandating, conveying visions, communicating best practices);
- Exchange on objectives, barriers and implementation options (multi-stakeholder processes);
- Support for pioneering businesses (financial, overall conditions, partnerships, publicity for pioneers, awards and prizes);
- Use of public procurement (e.g. in catering) to support pioneering enterprises;
- Promotion of voluntary industry commitments (regulatory threats, monitoring);
- Stimulating dialogue and mediation in the debate between business operators and civil society.

The outlined possibilities for the government to promote corporate or association sustainability initiatives offer a broad spectrum of action. Some of these instruments are used quite intensively in German sustainability policies. In the field of food policy, the German government has so far relied especially on the instrument of voluntary commitments, for example in the context of reformulation (Section 8.4) or advertising control (Section 8.5). Self-restrictions are legally non-binding commitments by industry, individual business sectors or enterprises to implement specific

measures or to refrain from or reduce critical activities (von Flotow & Schmidt 2001). Self-regulation yields benefits: it conserves government resources and is less controversial, more flexible and possibly less time-consuming than governmental regulation (Sharma 2010). However, Germany has had only limited success with a strong focus on self-regulation (cf. also Section 8.1). On important sustainability issues (e.g. labels for nutritional values, climate change mitigation and animal welfare, quality standards in childcare facility and school meals etc.). Germany tends to be in mid-field by European standards, while some Scandinavian countries, for example, are relatively successful in bringing together smart regulation and voluntary initiatives by industry (Strand et al. 2015).

Currently, as set out in Section 7, there are a relatively large number of deadlock situations in Germany. In recent years, **civil society and NGOs** have gained in importance with regard to agricultural and food issues - societal demands on agriculture and food have increased. This applies in particular to animal welfare and climate change mitigation. Turning these increasing social demands into successful market offerings and opening up market segments both nationally and internationally has not yet been sufficiently successful. This is illustrated by the example of animal welfare labels, where the various initiatives have been obstructing each other for years and where Germany has fallen behind in comparison to important competing countries such as the Netherlands or Denmark. The WBA proposed a governmental animal welfare label for the first time as early as 2011 (WBA 2011, cf. also WBA 2015). It was not until 2016 that the BMEL announced such a label - and thus put the brakes on economic and civil society initiatives such as the Animal Welfare Initiative and the label of the German Animal Welfare Association that had meanwhile emerged. The government label may be introduced in 2020.

As is the case with the example of the animal welfare label, Germany is not in a pioneering position with regard to other innovative sustainability measures (e.g. nutritional labelling, new substitutes for meat and dairy products), although there could be opportunities here for the German food industry as a sector in a high-wage country. Speed plays a central role in the competition for sustainability innovations. Against this background the WBAE sees a number of starting points for sustainability policy in Germany:

- greater support for pioneering initiatives by industry.
- An acceleration of policy processes to buttress international competitiveness in the sustainability field.
- A stronger orientation of soft policy instruments towards those companies and sectors that are able and willing to successfully implement voluntary initiatives in the food value chain (e.g. because they have and want to have corresponding positions of power in the value chain).

With respect to the latter point, the potential function of concentrated **food retailing** for greater sustainability of the entire value chain is repeatedly emphasised (cf. Section 4.4). The four main remaining dominant companies (Edeka, Rewe, Aldi, Lidl/Kaufland) have considerable (discretionary) room for manoeuvre, despite fierce competition. By way of example: Section 6 has shown

that, in the past, products that were not very health-promoting, such as elaborately packaged confectionery or highly processed convenience products, yielded particularly high returns. Retail companies in Great Britain that have deliberately banned unhealthy products from the checkout area (voluntary checkout food policy) have been able to reduce sales of these products by around 16% (Ejlervskov et al. 2018). For Germany, the catalytic role played by retail companies in the phasing-out of battery eggs in the early 2000s is a much-cited example that contributed to the acceleration of statutory regulation - but which at the same time gave contradictory impulses to upstream suppliers due to the restriction to table eggs (WBA 2015). However, the high level of concentration and intense competition can also turn out to be a disadvantage for voluntary agreements, as even the withdrawal of one of the four major retailers can bring down an agreement (see text box 8 “Listing of non Fairtrade-certified bananas at Lidl and withdrawal of the 2018/2019 measure” in Section 4.3.4.1).

Sustainability initiatives and industry self-restraint offer considerable opportunities for more sustainability, which the government can promote. However, the self-regulation process and voluntary agreements between politics and industry also harbour risks due to excessive lobbying influence, lack of transparency, delaying tactics and deficient interbranch organisation. An example of such problems is the so-called 2008 “Düsseldorf Declaration” and the “Brussels Declaration” (of 2010), both on ending piglet castration without anaesthesia, in which all key associations from agriculture, industry and trade jointly committed themselves to ending this practice as soon as possible (cf. DBV et al. 2008 and <https://ec.europa.eu/food/animals/welfare>) - which, as is well known, did not succeed until early 2020.

The literature identifies various **success factors for self-regulation**, often in the run-up to a threatened legal regulation (Zerle 2004, Sharma et al. 2010, Mozaffarian et al. 2018):

- intrinsic motivation of economic operators to improve the situation;
- transparency of the process, including publication of findings and participation of non-industry funded scientists;
- participation of NGOs and international organisations (such as WHO or FAO);
- sufficient degree of organisation of the sector: high outreach, low risk of being an outsider (in particular, all major companies must take part);
- homogeneous distribution effects, i.e. no particular profiteers or losers in any one sector;
- SMART<sup>491</sup>, but not overly ambitious goals;
- functioning implementation controls;
- comprehensive public monitoring of progress with narrow intermediate targets by credible third parties<sup>492</sup>; and

---

<sup>491</sup> S=Specific, M=Measurable, A=Attainable, R=Relevant, T=Trackable.

<sup>492</sup> The monitoring system by the MRI initiated as a result of the reform agreement is an important step in this direction; the WBAE is less positive about the low public transparency of the procedure.

- accompanying, government-supported scientific research to facilitate implementation.

The international literature generally views the self-regulation mechanisms in the food industry sceptically (Ronit & Jensen 2014, Sharma et al. 2010, Caraher & Perry 2017). Thus, small-scale, weakly organised sectors, such as away-from-home catering and artisanal food production, can hardly be controlled. Due to the large number of actors and the low level of organisation of associations, there is a lack of opportunities to establish broadly effective and sufficiently binding agreements. Voluntary initiatives are also difficult when sectors are highly cost-oriented. For example, companies in the German meat market have been nationally and internationally successful in recent decades with a cost leadership strategy, which has left little chance for enhancing animal welfare (WBA 2015). Finally, industries dominated by large companies with a high level of organisation can jeopardise political programmes due to their lobbying power, an experience that has also been relevant with regard to tobacco policy (UK Health Forum 2018).

Wherever companies do not take action or where voluntary commitments are not made or are not effective, binding government requirements are needed. In the context of this expertise, this refers, for instance, to the areas of child marketing and quality standards in public procurement policy. Voluntary initiatives in these areas fall short of the recommendations of, for example, professional medical organisations and the scientific community. Too much reliance on voluntary action ignores the market incentives to which many companies in the heavily cost-driven German food market are exposed.

Against this backdrop, the WBAE pleads for a **better balance between voluntary measures and legal regulations**. Given the scale of the challenges and the market blockades and path dependencies that are in place in some cases, voluntary measures alone are not sufficient.

A policy to promote sustainability in food consumption should monitor private sector trends and flank them in the sense of a co-evolutionary policy. The WBAE takes the view that this requires institutional strengthening of the policy field, clear rules and greater transparency and the use of voluntary measures only for those issues where - in accordance with the criteria outlined above - successful self-regulation can be expected. The Federal Government should draw up clear guidelines for more transparency and target orientation in the dialogue process with business operators, including an accompanying external monitoring of processes and results (Mozaffarian et al. 2018). This should also encompass a stronger scientific focus. It is also in the interest of business that self-regulation processes gain credibility in the public and in the scientific community (Ronit & Jensen 2014).

### 8.13 Conclusion Transformative policy

There is agreement in the literature that complex sustainability problems cannot be successfully tackled with a single instrument. Owing to a wide variety of interlinked problems, institutional barriers, organisational lethargy and individual inertia, it is normally the case that behavioural patterns

only change if several adjustments are made in parallel. This insight is not new for corporate food marketing and is discussed in this area under the term of marketing mix. According to this, a change in consumer behaviour desired in marketing will only happen if the different marketing instruments (product design, price, distribution channels, advertising, in-store sales promotion etc.) are used in parallel and are well coordinated (Kotler et al. 2019). This view, which has been established in marketing for decades, is also increasingly being recognised in preventive healthcare (Rutter et al. 2017, von Philipsborn et al. 2019).

For a policy aiming at promoting sustainability in food consumption, this means that individual problem areas must be tackled in an integral manner. The following recommendations therefore propose, for example, a **policy mix** of taxes, information, education and labelling to reduce animal products (Alston et al. 2016). The transition from packaged beverages containing plenty of sugar to increased consumption of tap water could be achieved through health and climate labels, taxes, advertising restrictions, infrastructure development and specifications of portion sizes.

One of the pre-eminent policy objectives for the WBAE is to provide high-quality, free **childcare facility and school meals**, which can contribute to several central objectives at the same time: To reduce food poverty, to increase the consumption of health-promoting foods and to accustom consumers to a more sustainable diet by eating together in an appealing atmosphere, i.e. through action-based dietary education by means of combining teaching with daily meals (inter alia through school kitchens and a food environment without problematic snacks and brand advertising). Such a setting can only be achieved through a combination of different instruments, embedded within a framework that views preschool and school meals as a service of general interest.

The discussion of the various instruments in this section has illustrated the complexity of a policy for promoting sustainability in food consumption. A coherent policy mix therefore presupposes the conceptual and budgetary expansion of the policy field. Without consistent, evaluable sustainability goals, the achievement of which should be publicly reported, there is a risk of fragmentation. A policy to promote sustainability in food consumption based on the four central dimensions discussed in the expertise is particularly in need of a **strategic orientation**. In addition, intensive cooperation between the various **policy levels** and **ministries** is necessary (Graça et al. 2018).

The path towards significantly more sustainable food consumption is thus a **transformation challenge** in the sense of the “Great Transformation” called for by the Federal Government’s Advisory Council on Global Environmental Change (2011). This involves technological leaps and new lifestyles, including social innovations, and will only succeed if it is managed with great resolve. Or as the Federal Government (2016: 18) puts it in its sustainability strategy: “Without technological progress, no sustainable development will be able to be achieved at global level. But sustainable development cannot be achieved solely or primarily through technological progress. A cultural change is needed in order to align the attitudes and behaviour of individuals, social groups and societies as a whole towards sustainability

## 9 On course for greater sustainability in food consumption: recommendations

### 9.1 Tackling sustainability in food consumption as a transformation challenge

As early as 2011, the German Advisory Council on Global Change (WBGU) highlighted that a “great transformation” towards greater sustainability was required (WBGU 2011). Such a transformation process includes lifestyles. It is not enough simply to modify production. Consumption must change too. It is insufficient simply to consume products that are produced more efficiently. Consumption patterns must also become more sustainable (cf. the problem of rebound effects in Section 7.6).

Our food consumption plays an important role in this context: how we eat has a significant impact on our individual health status (Section 4.2), our quality of life and our well-being (Section 3); in addition, many foodstuffs have a large social, environmental, climate and animal-welfare-related footprint (Sections 4.1, 4.3, 4.4 and 4.5). The challenges in the areas outlined above are enormous: Germany has a high rate of obesity, resulting in significant healthcare costs. Mandatory climate change mitigation and environmental protection objectives are being missed.

The necessary progress can only be achieved through a comprehensive transformation of today’s food system. We require policies that do not assign responsibility to each individual in their role as a consumer but significantly improve the food environment.

The influence of food environments is clearly underestimated in the public and political debate, while individual control of action is significantly overestimated. Consumers or policy-makers are often not aware of the highly effective influences of food environments (Section 3), as the focus is usually only on the consumption phase and on individual food choices. It is therefore assumed that following a more sustainable and healthy diet is a “simple” individual choice and thus primarily a question of motivation and self-regulation (e.g. choosing an apple instead of chocolate). Consumers have to make a lot of food decisions every day, namely deciding what, how much, when, where and with whom they eat, as well as explicitly saying “no” and suppressing the corresponding behavioural impulses in an environment that draws attention to food and eating almost constantly.

In the past and for certain cultural and historical reasons, Germany put (too much) emphasis on individual and family responsibility in terms of food (cf. Section 6.5), leading to overwhelmed individuals in a food environment that is not very sustainable. Against the backdrop of these enormous challenges, we urgently need dedicated policies to promote more sustainable food consumption.

The WBAE defines policies to promote sustainability in food consumption as the total of all measures that are intended to contribute to more sustainable food consumption. This expertise addresses four key **objectives** for greater sustainability in food consumption (“Big Four”):

- **A health-promoting diet, contributing to a longer life expectancy, more healthy years of life as well as greater well-being and quality of life for all** (Section 4.2): Measured against its prosperity levels, Germany's ranking is only average with regard to diet-related health indicators. Furthermore, food-related diseases and (supportive) resources for a health-promoting diet are unevenly distributed across society. Poverty correlates substantially with diet-related health conditions.
- **Food consumption that guarantees minimum social standards along value chains** (Section 4.3): Forced labour, slavery, severe forms of child labour or other violations of ILO's core labour standards continue to occur in global agriculture to a significant extent. Consumers currently have little to no chance to make a contribution to improving these conditions with their shopping behaviour. One of the prerequisites for a fair world trade system that is accepted by society, however, is the compliance with minimum standards.
- **Environmentally and climate-friendly food consumption that matches Germany's medium and long-term sustainability goals** (Sustainability Strategy/SDGs, climate change mitigation goals) (Section 4.4): Food consumption can and must contribute significantly to environmental protection and climate stewardship. It is the consumption of animal products in particular that induces significant amounts of the climate-relevant emissions of methane and nitrous oxide in the agricultural sector. The measures for greater climate stewardship proposed in this expertise also make a positive contribution to many environmental and nature conservation goals.
- **Food consumption that supports greater animal welfare and thus meets the changing ethical demands of society** (Section 4.5): The transition of livestock husbandry towards significantly greater animal welfare is an important social objective (WBA 2015). Several steps have been taken in this direction in the last few years. As yet, however, there is no comprehensive political strategy that would allow for the funding of the necessary changes in animal husbandry and thus greater progress.

This expertise takes a holistic approach on these four objectives. There are many synergies but also a number of trade-offs, which further complicates the challenge. This expertise evaluates recommendations for action directed at consumers and the Advisory Board confirms some of the recommendations that have been discussed for a while, such as to reduce food waste and the consumption of animal products. The Advisory Board simultaneously provides different perspectives on, puts into context and corrects certain widespread ideas (cf. Table 5-13 to 5-15). This expertise demonstrates, for example, that reducing not only the consumption of meat but also of other animal products plays an important role for greater sustainability in food consumption. Reusable packaging is not always more environmentally friendly. Regional products are not always the most sustainable choice. Organic products should be part of a sustainable shopping basket; however, 100% organic farming is not a sensible sustainability goal.

The question of what constitutes greater sustainability in food consumption and therefore also in agriculture (and fisheries) is more difficult to answer than is usually assumed by the public. At the

same time, as consumers we are currently faced with confusing information and food environments that provide little benefit, hindering more sustainable grocery shopping and diets and making it partly impossible to gain understanding of the key elements of more sustainable food consumption.

In this expertise, the WBAE recommends that consumers should be given much more support in achieving greater sustainability in food consumption through the design of appropriate food environments. To this end, it is first of all necessary to reduce those factors in today's prevailing food environments that hamper greater sustainability in food consumption (e.g. large portion sizes, high advertising expenditure on foods with little or no health-promoting effects, ubiquitous availability of food, especially those with unfavourable nutrient profiles). Secondly, it is important to offer more health-promoting, social, environmentally- and animal-welfare-friendly food choices, to make it easier to identify more sustainable choices, to facilitate easier access to information and to set price incentives that entice consumers to opt for food that is healthier and has greater social, environmental and animal-welfare compatibility.

The WBAE describes such food environments as fair because and insofar as they are: firstly, attuned to our human perception and decision-making abilities as well as behaviour patterns; and secondly, more health-promoting and have greater social, ecological and animal-welfare compatibility and thus contribute to sustaining the livelihoods of the world's current and future generations.

By implication, this also represents a critical view of placing too much responsibility for food consumption on the individual. According to many studies, Germany is an EU country where the responsibility for one's diet has so far been placed to a larger degree than elsewhere on the level of the individual and/or household (or family). Emphasising the importance of appropriate food environments thus implies that a national policy to promote greater sustainability in food consumption requires significantly more and deeper interventions.

On the basis of the analysis presented in this expertise, the WBAE makes the key recommendations presented in Figure 9-1 for a policy to promote more sustainable food consumption in Germany.

**Figure 9.-1:** Nine key recommendations for an integrated policy to promote more sustainable food consumption



Source: WBAE illustration.

These partially overlapping key recommendations will be briefly explained below and further specified in the subsequent Sections 9.2 to 9.10. The scale of financial implications will be set out in Section 9.11.

- (1) **Bring about a system change in preschool and school catering – “Focusing on children and young people”.** Preschools and schools are important places of learning and social integration. By expanding them into all-day care facilities, they have turned into important social spaces for children and adolescents to learn about food consumption habits. A comprehensive quality strategy to create fair food environments and a possibly unrestricted access of all children and young people attending all-day schools or preschools are required in order to take advantage of the potential for greater sustainability in food consumption. The WBAE recommends an urgently needed change in the system, towards free and high-quality school and preschool catering. High-quality catering in schools and preschools should be established as an essential public service (Section 9.2).

- (2) **Make the consumption of animal products globally compatible – “Less and better”.** Cutting the share of animal products is the key lever to reducing the resource intensity of food consumption with regard to climate stress and land use while it also offers opportunities to improve animal welfare. The WBAE recommends a comprehensive programme to reduce animal products in our diet (“less and better”, Section 9.3).
- (3) **Use price incentives – “Prices should tell the truth”, i.e. reflect the costs to society.** The required transition towards more sustainable patterns of consumption cannot be built on intrinsic motivation alone. The Advisory Board recommends setting clear price incentives for greater sustainability in food consumption in key areas, such as the consumption of animal products and sugar-sweetened drinks. This transition should be implemented in a socially viable manner by reducing the burden on low-income households (Section 9.4).
- (4) **Ensure health-promoting food consumption for all – “Reducing food poverty”.** Even in a relatively prosperous country such as Germany, poverty-related malnutrition and even hunger occur. A policy to promote sustainability in food consumption should take into account the life circumstances of low-income population groups and further develop support services addressed at specific target groups (Section 9.5).
- (5) **Provide reliable information – “Enhancing choices”.** One key prerequisite for sustainable consumption is reliable information on the sustainable properties of a product. The WBAE recommends establishing sustainability labels – preferably binding labels – for health (“Nutri-Score”), greenhouse gas emissions (climate label) and animal welfare and to expand the existing Federal Food Code (Bundeslebensmittelschlüssel, BLS) into a Federal Sustainability Code for Food, as a basic and free database. The Advisory Board also recommends developing a “digital ecosystem for greater sustainability in food consumption”, providing mobile applications and data for the entire behavioural process and integrating it in a coherent manner so that consumers can see more transparently what impact their actions have (Section 9.6).
- (6) **Greater sustainability in food consumption as the “new normal” – “Calibrating social norms”.** The food environment with the available foods and portion sizes “calibrates” our field of perception and what we regard as “normal” and “appropriate” (social norm). Social norms significantly influence consumer behaviour. It is therefore important to focus much more on exposure and access to more sustainable products and that this becomes the “new normal” for food environments. The WBAE recommends: providing for smaller portion sizes and taking innovative measures to reduce or prevent the portion-size effect, “normalising” the consumption of tap water (e.g. by providing tap water free of charge in the public sphere and in the restaurant and catering sector), tapping into the potential of reformulation and reducing food waste efficiently (e.g. in communal catering) (Section 9.7).
- (7) **Improve services in public institutions – “Making canteen kitchens more sustainable”.** The public health care system and public institutions consider nutrition to be a secondary topic.

Owing to the cost pressure, considerable quality deficits are being accepted, sending counter-productive messages to clients and society. For this reason, the WBAE recommends that the provision of food in residential care homes for the elderly, in hospitals and in rehabilitation clinics should not be viewed simply from a nutrition supply perspective but also that the food and the food environment should be of high quality (Section 9.8).

- (8) **Develop and label agricultural systems – “Organic and more”.** Organic farming is a comparatively environmentally-friendly system, which also provides impetus for innovation for the entire agricultural sector. Organic farming is no “universal remedy”, however, and the often generalised comparison of “conventional” versus “organic” does not do justice to the reality of agriculture and its myriad farming concepts. The Advisory Board recommends continuing the support for organic farming while also developing other eco-efficient farming systems and providing consumers with clear labelling (Section 9.9).
- (9) **Strengthen and advance the policy field of “promoting more sustainable food consumption” – “Establishing an integrated food policy”.** The policy field of “promoting more sustainable food consumption” is a fairly recent concept and is heavily influenced by vested interests. In order to be able to act in this field, the government’s food policy must be significantly expanded. The WBAE recommends a comprehensive reorientation and strengthening of the policy field of “food consumption” both in terms of concepts and institutions. This reorientation should cover all four objectives in an integrated manner. This requires an adaptable policy approach including a comprehensive strategy based on long-term measurable targets. The necessary mix of instruments should be systematically tested, evaluated and adapted based on evidence. This necessitates transparent monitoring and better networking between the ministries (especially between the Ministry of Food and Agriculture, the Ministry of Health and the Ministry for the Environment) and between the different levels of government (ranging from municipal to EU level), as well as the scaling-up of personnel capacities with considerable budgetary increases for an integrated food policy (Section 9.10).

## 9.2 Bring about a system change in preschool and school catering – “Focusing on children and young people”

Our food-consumption habits and competences are influenced by our experiences from the moment we are born (cf. Section 3). For this reason and considering the well-known follow-up costs for society arising from unhealthy dietary patterns (cf. Sections 4.2 and 6.2.1), food and drink in Germany’s childcare facilities and schools<sup>493</sup> should become a key area of action for food and health policy instead of remaining as a necessary but secondary task (cf. Sections 7.5 and 8.2). This means that catering in schools and preschools must not simply be considered from a nutrition supply perspective; instead it must also be ensured that the food and the food environment for children and young people are of high quality (cf. Section 7.5.1). High-quality food promotes health and keeps

---

<sup>493</sup> The term “school” in this expertise covers primary and secondary schools, while vocational schools are not included.

children and young people fit and alert. Communal eating in a fair food environment promotes not only physiological functions (satiety, supply of nutrients) but also in particular psychological well-being, individual performance, appreciation of food as well as social cohesion and integration. Eating together, i.e. a high participation rate, is the key element for taking advantage of the specific potential of catering in schools and preschools. Only if everyone participates can the full potential be realised.

The WBAE regards all three aspects – the (1) quality of *what* and (2) of *how* children and young people eat and (3) that they eat together (commensality) – as high priority items as they are inter-linked and influence each other: food that is (largely) free of charge, for example, does not meet this purpose if the quality of food and the specific food environment are not improved at the same time. It is also true that if quality is low, only few children and young people will take up the offer which in turn increases the cost per meal and reduces the health and social effects and hinders the learning process.

The WBAE therefore recommends that the Federal Government, the federal states and municipalities **realign the policy of catering in schools and preschools** to achieve high-quality catering in schools and preschools and make meals available at no charge to parents (evidence-based, in stages). In detail, the WBAE recommends the following:

- Gradual, evidence-based introduction of free meals in schools and preschools (recommendation addressed to: municipalities, federal states, Federal Government). The WBAE recommends making catering in schools and preschools available at no charge to parents (cf. Section 8.2.2) and to finance this from public budgets in order to enable the transition from a secondary task to a key task of society so that high-quality meals are accessible to all children and young people. The WBAE estimates the average full cost per meal to be around 4.50 euros in preschools and just over 6 euros in primary schools (cf. Section 8.2.3). Full coverage of the costs of a lunch meal for all children and young people currently in all-day preschools or schools would amount to around 5.8 billion euros of public funds each year. As a central and realistic scenario, the WBAE estimates that roughly 80% of school children will attend all-day schools in the long term and all 3.3 million younger children will be looked after in all-day preschools. Extrapolating today's figures, this would amount to 10.2 billion euros of public funding per year, around 32% of which would be needed for preschool meals, 25% for primary school meals and 43% for secondary school meals. The government already covers a share of the costs for facilities and equipment as well as operating expenditure. Since 1 August 2019, around 4 million children have been eligible for free lunch meals anyway under the "Strong Families Act" and the Education and Participation Package (cf. Section 8.2.3). After deducting current and future payments, additional costs of 5.5 billion euros would arise each year if the measures were fully implemented. The realistic scenario also includes an additional investment of around 18 billion euro. Assuming that these investments are spread over a period of 5–10 years, the annual investment need stands at 1.8–3.6 billion euros per year.

Implementing the recommendation on high-quality meals in schools and preschools that are free of charge for parents involves major challenges and costs for the public sector. For this

reason, the WBAE recommends a gradual introduction based on a scientific implementation and evaluation programme (“WIE” programme, cf. Section 8.2.4), covering the empiric evaluation of the implementation and the achieved effects. The advantage is that the implementation and design can be adjusted (see also the “learning by doing” approach, WBAE & WBW 2016). In particular, the WBAE recommends evaluating the impact of food, i.e. not only the quality of the food (“what” is being eaten), but also the immediate food environment (“how” the food is being eaten) and the interaction between “what” and “how”. The evaluation should consider various result indicators (participation rate, cognitive, social, psychological and physical health indicators) (cf. Section 8.2.4). Interested federal states are encouraged to implement pilot studies, co-financed by the Federal Government, on fully publicly funded catering in schools and preschools as soon as possible. The pilot studies should be designed in a way that allows for randomised controlled trials to investigate effectiveness, problems of implementation and cost efficiency. The Federal Government should coordinate the programme and ensure that the research results are shared and used across different federal states. This component of the programme aims to compare and investigate different implementing options in order to gain insights into the future design of catering in schools and preschools that are relevant to policy-makers.

The WBAE also makes the following recommendations for creating fair food environments in preschools and schools:

- **Improving what children and young people eat: mandatory implementation of the DGE quality standards for catering in schools and preschools (recommendation addressed to: federal states, municipalities, school and preschool management).** The meals and food on offer (in terms of quality, quantity and choice) should meet the DGE quality standards. School children should also become more involved in decisions regarding the choice of foods provided by the refectories (participation and empowerment). Implementing the DGE standards and participation would not only improve food quality and health but also reduce meat consumption and contribute to a change of social norms (“less and better”).
- **Improving how children and young people eat: supporting commensality by providing appropriate facilities and equipment as well as joint, adequate meal times (recommendation addressed to: Federal Government, federal states, municipalities, school and preschool management).** A high-quality design of the food environment is needed for food and drink to not only “fill the stomach” but to also meet its basic emotional, social and learning-related functions. This includes joint and adequate meal times and appropriate facilities and interior design (acoustics, space, light, temperature, smell) that enable social interactions (e.g. by appropriate seating arrangements). Refectories should be spaces that children and young people like to go to rather than have to go to because of a lack of alternatives. Only then can appreciation for food and more sustainable behaviour be firmly embedded.
- **Regulating competing catering services (recommendation addressed to: Federal Government, municipalities, school authorities).** Private cafeterias, kiosks and vending machines in schools and preschools and the immediate vicinity of schools jeopardise the success of free and

high-quality school meals and should therefore be generally prohibited or at least be subject to regulation regarding the products they offer.

- Strengthening the quality of action-orientated food consumption education (recommendation addressed to: federal states, head teachers). Food education in preschools and schools has enormous potential to positively influence eating habits. The WBAE therefore recommends the following measures: expanding existing curricula by including everyday activities (preparing food, gardening, student-run companies), establishing infrastructure (teaching kitchens), continuous professional development of the teaching staff and quality assurance of the materials used (e.g. textbooks). In principle, the better the real world is reflected and the clearer the experiences of the target groups are depicted (including in the own refectory) and the more sensible the different needs and wishes are addressed, the more successful an action-orientated food education will be. The measures should be systematically tested, evaluated and adapted based on evidence.

In addition, the WBAE recommends:

- **Launching “Best-canteen”, a federal investment programme for the qualitative and quantitative expansion of preschool and school catering (recommendation addressed to: Federal Government, federal states, municipalities).** Many all-day preschools and schools have either underequipped kitchens and refectories or none at all (cf. Section 7.5.1). Initial funding is therefore needed to implement high-quality meals in preschools and schools. This should be realised through an investment package from the Federal Government that also includes contributions from the federal states. The WBAE’s rough estimate is that the existing all-day schools and childcare facilities that already provide lunch would require an investment of 2.4 billion euros and that including the assumed 80% of all schools set to transform into all-day schools and all existing childcare facilities, the investment would rise to around 18 billion euros (part of which would be incurred anyway for the expansion of all-day schools).

### 9.3 Make the consumption of animal products globally compatible – “Less and better”

In the face of large international differences in meat consumption, malnutrition in many countries of the global south and climate change mitigation challenges, a globally compatible food consumption means reducing the high consumption of animal products in prosperous countries. This concerns meat and meat products as well as the high consumption of dairy products. Germany’s consumption of meat and milk is four times higher than the EAT-Lancet Commission’s recommendation. Reducing the consumption of these products could also result in beneficial health effects in Germany. In many prosperous countries, society also demands greater animal welfare, making the “less and better” approach (WBA 2015) a sensible one.

Reducing the consumption of animal products should go hand in hand with a transition of livestock husbandry towards higher standards of animal welfare and should be embedded in a comprehensive livestock and food consumption strategy. The WBAE recommends:

- **Drafting a programme to reduce the consumption of animal products (recommendation addressed to: Federal Government).** This programme should aim to reduce the consumption of animal products significantly while improving livestock husbandry conditions, taking into account the greater effort necessary for higher animal welfare standards and positive externalities of extensive livestock management. The WBAE considers reducing consumption a high-priority part of the programme. Owing to the significant long-term economic side effects, this part should be designed as an adaptive programme at an early stage (cf. Sections 8.1 and 9.10) with the necessary due diligence.

The WBAE recommends the following elements as key parts of such a programme:

- **Abolishing the reduced VAT rate for animal products (recommendation addressed to: Federal Government).** In their expertise on climate change mitigation, the WBAE and WBW (2016) already recommended that the VAT on animal products should be raised to the standard rate. The resulting price incentive is one of the cornerstones of a “less and better” strategy (cf. Section 9.4.1 for details). The Federal Government and the federal states should use a proportion of the additional tax income (that is not ring-fenced for a particular purpose) for the necessary transition towards a viable and more animal-friendly livestock industry in Germany. In the long term, the WBAE recommends developing a new excise tax on food, guided by the key sustainability criteria (cf. Section 9.4.2).
- **Introducing a mandatory climate label for all foodstuffs (recommendation addressed to: Federal Government)** (cf. Section 9.6.4 for details). A climate label is a central component of providing hands-on information to the population. If the information were shown on the product, the consumer would be provided with transparent information on the negative impact on the climate of animal products, products imported by plane, products from conventionally heated greenhouses, certain fish species, etc. Consumers would consequently be able to identify climate-friendly alternatives. The label should be colour-coded and interpretive (see Nutri-Score) and may be based on standard values initially. Ambitious companies could then determine specific values for their products and label them accordingly. Climate action and health apps that should be available for products and meals for out-of-home consumption could enhance transparency and effectiveness.
- **Information campaign to raise awareness and motivation (recommendation addressed to: Federal Government).** Consumers significantly underestimate the negative impact of animal products, milk and fatty dairy products on greenhouse gas levels. The Federal Ministry of Food and Agriculture should therefore launch an awareness-raising campaign to inform consumers about the climate footprint of different food groups (cf. Section 8.7, in particular Fig. 8-11). As a second step, the campaign should encourage specific target groups to change their behaviour.

- **Mandatory implementation of the DGE quality standards for communal catering (recommendation addressed to: Federal Government, federal states, municipalities).** Every day, millions of people eat in canteens and refectories that are partly or fully funded by the Federal Government, federal states and municipalities. The public sector thus has considerable transformative power thanks to the high demand it generates. If the DGE standards recommended from a health and environmental policy perspective were implemented, this would contribute to a reduction in meat consumption and, in the long term, would most likely lead to a change in social norms (“less and better”).

With regard to counteracting undesired side-effects, the WBAE recommends:

- **Socially cushioning the increased tax burden (value-added tax, incentive tax) (recommendation addressed to: Federal Government).** Bearing in mind the regressive effect of a higher VAT rate and of increases in excise tax rates in general, the WBAE recommends reducing the burden for the lower income brackets (cf. Section 9.5). Designing incentive taxes in a socially acceptable manner is necessary and feasible.
- **Monitoring problematic substitution effects and counteracting these if necessary (recommendation addressed to: Federal Government).** The intended reduction of the consumption of animal products may lead to problematic substitutions by certain groups with high consumption and otherwise poor food consumption patterns, resulting in unwanted health side-effects (e.g. food with a less favourable nutrient profile). The BMEL should monitor any substitution relations and counteract them if necessary. The BMEL should also work towards ensuring that vegans are aware of potential micronutrient deficiencies of their diet.
- **Observing undesired animal welfare side-effects in production (recommendation addressed to: Federal Government, federal states).** Efficiency gains in the breeding and keeping of livestock that may result in lower greenhouse gas emissions may also lead to trade-offs in terms of animal welfare. Poultry has certain advantages in terms of food and climate policy compared to other types of meat and would benefit from a normalised VAT rate as the cheapest meat on offer. At the same time, there are considerable animal welfare problems in the poultry industry, which are due to the intensity of production. The Federal Government and the federal states should consider conflicts of interests and monitor developments regarding different animal species and also pursue efforts to improve animal welfare while paying due regard to climate change mitigation and resource conservation objectives.
- **Drafting and implementing a transformation strategy for the sector (recommendation addressed to: Federal Government, federal states).** Reducing the consumption of animal products affects around half of the value creation by the German agri-food industry as well as arable farming via feed production. The Federal Government and the federal states should therefore draft and implement (funding) strategies early on to improve added value in order to compensate for a reduction in volume. This includes supporting innovation in production and marketing.

The WBAE also recommends:

- **Considering the provision of funding for sustainable aquaculture in Germany (recommendation addressed to: Federal Government, federal states).** Some fish species from certain types of aquaculture could be a healthier and more climate-friendly alternative to meat. The focus should be on pond farming and recirculating aquaculture systems that use renewable energy. The Federal Government and the federal states should review a corresponding research and funding programme.

## 9.4 Use price incentives – “Prices should tell the truth”

Major transformation processes cannot rely on intrinsic motivation and conscious decisions alone because our food consumption behaviour is deeply rooted in habits (cf. Section 3). Financial incentive mechanisms must thus also contribute to facilitating choice. All over the world, there is now greater awareness of the advantages of incentive taxes that internalise negative external effects (cf. Section 6.2) because they contribute to prices that “tell the truth”, i.e. prices that reflect the real costs for society caused by the production of certain foodstuffs. Introducing a sustainability tax on animal products is a key lever in this regard. The high economic costs of a food consumption that is hazardous to health are also primarily external effects. One important instrument in this regard is a tax on sugar-sweetened beverages. In addition to taxes, positive incentives in the form of subsidies, e.g. on fruit and vegetables could also contribute to a more sustainable food consumption. The WBAE recommends:

- raising taxes on animal products (Section 9.4.1),
- introducing a tax on sugar-sweetened beverages (Section 9.4.2),
- subsidising the consumption of fruit, vegetables and pulses (Section 9.4.3),
- introducing a new sustainability tax in the long term (Section 9.4.4).

### 9.4.1 Abolishing the reduced VAT rate for animal products

Most researchers around the globe agree that reducing the consumption of animal products is an essential approach to a more sustainable food consumption. The WBAE expects that an autonomous change, i.e. a reduction in consumption induced by changing consumption patterns and the development of technological alternatives to animal products, will not come about quickly enough.

The WBAE recommends:

- **Abolishing the reduced VAT rate for animal products (recommendation addressed to: Federal Government).** Prices for animal products are currently being subsidised by the reduced VAT rate, a situation that is no longer suited to today’s challenges. Subsidising the consumption of animal products by reducing the VAT rate is inadequate for environmental and climate policy reasons. As a first step, the reduced VAT rate of 7% should be abolished and the standard tax

rate of 19% should be applied to all animal products. Abolishing the reduced rate would increase tax income by 4.3–5 billion euros (likely to be reduced in the long term, however, due to further measures, cf. Section 9.3) and the consumption of animal products would probably decrease by around 6% (cf. Section 8.6.3).

The WBAE recommends that the financial leeway resulting from the higher VAT income, which is not ring-fenced and is allotted to the Federal Government, federal states and municipalities, should be used for a combination of the following four options (cf. Sections 7.5.3 and 8.6.1):

- **A tax rebate in the sense of a sustainability bonus (recommendation addressed to: Federal Government, federal states).** In light of the regressive effect of increasing the excise tax, the WBAE recommends reducing the burden on the lower income brackets (cf. Section 8.6 and in particular Section 9.5). Compensating the 40% lowest-income households with 50 euros per capita and year for the higher expenditure due to increased VAT would cost around 1.6 billion euros in total (Thöne et al. 2019).
- **Reduction in VAT on fruit, vegetables and pulses (recommendation addressed to: Federal Government).** Based on a turnover of around 24.6 billion euros for fruit and vegetables (Federal Statistical Office 2016), reducing the VAT rate for health-promoting products, such as fruit, vegetables and pulses, from 7% to 5% would result in tax income decreasing by around 460 million euros from 1.61 to 1.15 billion euros (without pulses, cf. Section 9.4.3).
- **Using taxes for greater animal welfare (recommendation addressed to: Federal Government, federal states).** Implementing the nine guidelines for animal-friendly and socially acceptable livestock husbandry drafted by the WBAE (2015) will cause significantly higher production costs in the long term (around 3–5 billion euros per year), which cannot be covered by private sector initiatives such as the initiative “Initiative Tierwohl” alone or by higher revenues from labels (cf. Section 8.9.4). In order to achieve the necessary animal welfare improvements in an open economy, it is expedient to plan for long-term animal-welfare support funded by the Federal Government to compensate for additional expenditure (cf. also Kompetenznetzwerk Nutztierhaltung 2020).
- **Using taxes for high-quality and free catering in schools and preschools (recommendation addressed to: Federal Government, federal states, municipalities).** In light of the high consumer expenditure for animal products, tax increases could make an important contribution to high-quality and free catering in schools and preschools as proposed in this expertise, particularly if such raises were to go beyond adjusting the VAT to the normal rate (cf. Section 9.4.4).

#### 9.4.2 Introducing a tax on sugar-sweetened beverages

Reducing the consumption of sugar-sweetened drinks is an important strategy for preventing and controlling obesity and diet-related diseases (cf. Section 9.7.2). Since targeted taxation of the reduction target improves effectiveness and reduces unwanted side effects due to distribution poli-

cies of a price-related excise tax or a VAT increase (cf. Sections 8.6.2 and 9.4), the WBAE recommends that the BMEL **introduce a new and specific tax proportional to the free-sugar contents**<sup>494</sup>. The WBAE recommends:

- **Including all sugar-sweetened beverages (recommendation addressed to: Federal Government).** All beverages that contain free sugars, including mixed drinks (also mixed milk drinks), should be included in order to prevent unhealthy substitutions.
- **Linear taxation and incremental increases (recommendation addressed to: Federal Government).** Taxation should be proportional to the sugar content in order to set coherent incentives for improvements, including for products containing less sugar. The Advisory Board proposes to begin with a tax rate of 20 cent/100 g of sugar (free sugar) and to raise this rate step by step. If consumption and formulae remained unchanged, tax income would initially increase by 1.89 billion euro/year for soft drinks and fruit juices; when including mixed milk drinks the additional tax income would be correspondingly higher (cf. Section 8.6.2).<sup>495</sup> Changes in consumption and formulae are intended, however, and judging from UK experience, may be significant. The real additional tax revenue may therefore be lower.
- **Using tax revenue for health-related subsidies (recommendation addressed to: Federal Government).** The WBAE recommends using the expected tax revenues for subsidising the consumption of fruit, vegetables and pulses (cf. Section 9.4.3) as well as returning these revenues (e.g. via a sustainability bonus) to low-income groups in Germany (cf. Section 9.5).
- **Considering increasing the tax on alcohol (recommendation addressed to: Federal Government).** The WBAE recommends that the Federal Government consider a raise of the tax on alcohol since beer in particular tends to be a substitute product for soft drinks. Increasing the tax on alcohol would also lead to further positive health effects. At the very least, the actual substitution behaviour should be closely monitored and addressed if undesirable effects were to be observed.

### 9.4.3 Subsidies on the consumption of fruit, vegetables and pulses

In Germany, the consumption of fruit, and in particular of vegetables including pulses, is far below the levels recommended by the DGE and other scientific societies. Compared with other EU countries, it is particularly low among men. In light of the health-promoting effects of the consumption of fruit, vegetables and pulses and the environmental benefits of this product category, the WBAE recommends the following:

- **Reducing the VAT rate on fruit, vegetables and pulses (recommendation addressed to: Federal Government).** Reducing the VAT on fruit, vegetables and pulses from 7% to 5% leads to an

---

<sup>494</sup> "Free sugars" are mono- and disaccharides added by the manufacturer or the consumer, including sugars naturally present in honey, syrup and fruit juices and nectars. The term "free sugars" does not include naturally occurring sugars in milk and dairy products (lactose) and in fruits, vegetables or potatoes (glucose and fructose).

<sup>495</sup> More details are needed for including mixed milk drinks.

annual reduction of tax revenue of around 460 million euros (from 1.61 to 1.15 billion euro), not considering consumption changes and with a turnover of 24.6 billion euros of fruit and vegetables (Federal Statistical Office 2016; pulses not included due to low consumption levels of only 1.5 kg/person/year).

#### 9.4.4 Introducing a sustainability tax on all foods in the long term

Reducing the subsidies on animal products by changing the VAT rate alone would not achieve the recommendations (e.g. by the DGE and other scientific bodies) for considerably reducing the consumption of animal products – this would likely also hold true if the additional measures proposed in Section 9.3 were implemented. The same applies to boosting the consumption of fruit, vegetables and pulses. Moreover, changes in VAT as a value-based tax do not tend to be very targeted (cf. Section 8.6). The WBAE therefore recommends the following:

- **Introducing a specific incentive tax on all foods in the long term (recommendation addressed to: Federal Government).** The WBAE recommends introducing a specific incentive tax in the long term, staggered according to the sustainability level of a food in order to promote the consumption of more sustainable products. Since turnover-based taxation would tend to increase the price of products that are preferable from a sustainability point of view (e.g. animal-welfare friendly products), volume-based taxation should be reviewed. As a potential approach, the WBAE recommends taxation based on food categories assigned to different (mandatory) sustainability labels (cf. Section 8.6.4). According to this approach, an excise tax would be raised that would depend on how a food is evaluated according to different aspects of the label (nutritional values, climate stewardship, animal protection). This sustainability tax should then replace the individual incentive taxes discussed above.

### 9.5 Ensure health-promoting food consumption for all – “Reducing food poverty”

Food poverty, i.e. poverty-related malnutrition to the point of hunger and the limited socio-cultural participation associated with it, is a problem that currently receives hardly any attention in a prosperous country such as Germany. However, qualitative studies, in particular on diet-related consumption patterns in poor households or of food bank users, show very convincingly that it exists (cf. Section 4.2.3). Even if no comprehensive estimates can be made due to a lack of data on the extent and intensity of food poverty in Germany, the WBAE believes there is need for action, justified by the principle of social justice.

The WBAE recommends the following in order to ensure access to health-promoting food consumption for all:

- **Taking adequate account of the costs of health-promoting food consumption in the calculation of social security benefits by the state (recommendation addressed to: Federal Government).** As outlined in Section 4.2.3, the standard benefits as provided under basic social services are insufficient to ensure health-promoting food consumption: further supporting resources are required. The WBAE therefore recommends that the Federal Government adjusts the calculation method in order to assess demand in a way that allows for health-promoting food consumption as part of basic social services.
- **Gradually introducing free and high-quality catering in schools and preschools in based on evidence (recommendation addressed to: Federal Government, federal states, municipalities)** (cf. Section 9.2). By expanding childcare facilities and schools into all-day facilities, they have been turned into important social spaces for children and young people to learn about food consumption behaviour. Government action, especially a comprehensive quality strategy and school and pre-school catering that is accessible to all children and young people in all-day care, is required in order to seize this potential for more sustainable food consumption. Disproportionally positive effects can be expected for the more than two million children and young people from low-income households (cf. Section 8.2.2).

To avoid undesirable negative effects of a policy to promote sustainability in food consumption on low-income groups, the WBAE recommends:

- **Social cushioning of incentive taxes (recommendation addressed to: Federal Government)** (cf. Sections 8.6 and 9.4). The WBAE believes that incentive taxes in key areas, based on sustainability criteria, are a key food-policy instrument. Low-income households are particularly affected by price incentives since they spend a larger proportion of their income on food compared to households with a higher income. For this reason, incentive taxes should only be introduced when combined with social cushioning measures. Social cushioning can be designed in different ways, depending on the distribution effect, accuracy and administrative expenditure. Options include (a) a direct payment to lower income groups, either as one sum for all or as a staggered payment on a diminishing scale, or only to the lowest-income groups, and (b) the reduction of the income tax rate for lower-income groups combined with an increase in social benefits in order to reach groups that do not pay income tax. In Section 9.11 it is assumed that the different incentive taxes are compensated by introducing an annual sustainability bonus of 50 euros per capita and year for the 40% lowest-income households, resulting in additional public expenditure of 1.6 billion euros per year. This amount is only a rough approximation since a calculation of the full compensation depends on consumption and substitution behaviour of this income group.<sup>496</sup>
- **A fundamental review of the effects of the food-policy instrument mix on low-income households (recommendation addressed to: Federal Government).** Many of the food policy instruments discussed in this expertise and recommended by the WBAE have intended and possibly

---

<sup>496</sup> Households with a higher income consume more expensive animal products, lower income households are therefore less affected by a value-based VAT increase. All households would also benefit from the subsidy on fruit, vegetables and pulses as suggested in Section 9.4.3, which would need to be offset.

unintended consequences (e.g. price increases) on the options that lower-income households have regarding consumption and participation. The WBAE recommends that the BMEL, when evaluating food policy measures, should always consider the impact on households bearing a higher food-poverty risk. This applies in particular to the implementation and evaluation programme on the introduction of free catering in schools and preschools (“WIE” programme, cf. Section 8.2.4), as proposed in Section 9.2.

The WBAE also recommends:

- **Improve monitoring of food poverty (recommendation addressed to: Federal Government, federal states).** The WBAE sees urgent need for action to improve empiric evidence on food poverty and the effectiveness of measures intended to address this issue. Access to existing data sources should be improved and used, and additional data should be collected. Although large-scale population studies such as the National Food Consumption Survey (NVS II), the DEGS and the KIGGS study provide valuable data on the food consumption situation of the population, there is no specific analysis on the food consumption situation of the lowest income bracket. To find out more about the determining reasons and extent of the material and social deprivation of households in terms of food consumption needs, the WBAE recommends that the Federal Government commission an evaluation based on income groups. Further data that is already available could be used for this purpose (e.g. school entry medical examinations), and, if applicable, more target-group specific data should be collected. Last but not least, the Federal Government should be committed to facilitating access to the primary data of these studies for other scientific research.

## 9.6 Provide reliable information – “Enhancing choices”

Policies to promote more sustainable food consumption that count on consumers’ motivation require a much better information infrastructure than the one currently in place. Currently there is a great lack of reliable information on and about products (cf. Sections 8.7 and 8.9). Advertising, modern information media and digital applications tend to be fragmented, not very user-friendly and not targeted to more sustainable choices. The information policy by the Federal Government is not well-equipped. The Advisory Board therefore recommends implementing the following key components regarding an information policy to promote greater sustainability in food consumption:

- Official, preferably mandatory, interpretative labels on key sustainability dimensions (Sections 9.6.1–9.6.5).
- A more sustainable design of advertising environments in which (social) influencing – in particular towards the target group of children and young people – is limited and, where it is permitted, more transparent (Section 9.6.6).

- Developing and expanding modern information media (especially apps) into a “digital ecosystem for greater sustainability in food consumption” (cf. Section 8.10) that enables easy, inter-linked access to information based on reliable data ranging from exposition all the way to consumption (Section 9.6.7).

### 9.6.1 Establishing an effective labelling policy

Section 8.9 of this expertise identifies the key challenges of current sustainability labelling: There are almost no labels for key sustainability issues such as environmental conservation, climate change mitigation and social standards. The large number of existing unknown labels that tend to be rather unintuitive, partially misleading and too detailed hinder market transparency. This results in small sustainability effects of the existing labels which trail behind expectations and therefore contribute to the demotivation of previously committed consumers and companies.

The WBAE therefore suggests a long-term overhaul of the policy on labelling, which is to contribute to better comprehensibility and a greater impact of labels. The Advisory Board recommends:

- **An official, preferably mandatory, interpretative label for the key sustainability dimensions (recommendation addressed to: Federal Government)** (cf. Sections 9.6.2–9.6.5).
- **Promoting the development of EU-wide sustainability labels (recommendation addressed to: Federal Government).** The Federal Government should step up its efforts to develop EU-wide sustainability labels (cf. Section 8.9.3) and seize e.g. its Council Presidency in the second half of 2020 to promote EU-wide labels for extended nutritional information, animal protection and climate stewardship. The BMEL could boost this process at EU level by presenting a “Food Labelling” strategy paper and a corresponding conference in Brussels. If this is not successful, a mandatory introduction for national companies should be reviewed. Mandatory labelling is particularly important for interpretative (evaluative) labels since negative product evaluations are usually not conducted on a voluntary basis. For the same reason, mandatory labelling must include provisions on the placement and minimum size of the label.
- **Initiating a national initiative for a climate label (recommendation addressed to: Federal Government).** Experience shows that an EU-wide label will likely only be developed if there are corresponding initiatives at national level. This applies to animal welfare as well as extended nutrition labelling. In the case of the climate label, the BMEL should launch a national initiative while also forging alliances with EU Member States that already have similar initiatives, such as Denmark.
- **Reducing the flood of labels by means of summary labels (recommendation addressed to: Federal Government).** To reduce the “flood of labels”, the BMEL should use and promote summary, interpretative labels. Given the complexity of the matter, these should be multi-tiered. In its expertise on policy strategy regarding food labelling (WBAE & WBA 2011), the Advisory Board suggested an umbrella label for key credence attributes (health, environmental standards, animal welfare, ethical aspects), for which the different aspects could be labelled as part

of a multi-tiered evaluation. An umbrella label of this kind could improve recognition of the logo.

- **Laying down a standard design for governmental food labels (recommendation addressed to: Federal Government).** The BMEL should predefine a uniform design of existing and newly developed governmental food labels as well as align the different labelling systems so that consumers are able to recognise governmental labels and can build trust in them (concept of “umbrella labels”). The WBAE recommends using the traffic light colours green/amber/red as one key element of harmonisation. The EU energy labelling for white goods and cars as well as Nutri-Score, which is set to be established in Germany by 2020, could serve as a blueprint. The upcoming government animal welfare label should be adapted accordingly.
- **Protecting governmental labels from terminology and logos in the same style (recommendation addressed to: Federal Government).** The BMEL should determine minimum standards for using certain marketing claims on sustainability, thus protecting consumers from misleading (similar) terms.
- **Promoting awareness of and trust in governmental labels via public awareness-raising campaigns (recommendation addressed to: Federal Government).** In light of the collective-good character of labels, the Federal Government should raise awareness of and build trust in the government labels by launching extensive information campaigns. The WBAE therefore supports an information policy such as the BMEL envisages for the planned governmental animal welfare label, i.e. providing a comprehensive budget for communication (in this case, almost 70 million euro, cf. also Section 8.7). The BMEL should increase trust in labels by improving the control procedures of label user certification.
- **Strengthening the development of methods and data collection by commissioning a (governmental) agency (recommendation addressed to: Federal Government, federal states).** The BMEL and the BMBF should improve the validity of these labels by considerably stepping up efforts regarding method development. This affects life-cycle assessment methods in general and climate labelling in particular, but also sustainability dimensions, such as biodiversity and social aspects for which concepts have not yet been developed. The Federal Government and federal states need to improve the preconditions for adequate data collection.
- **Creating a valid, integrated open-access database (“federal sustainability code” (recommendation addressed to: Federal Government)).** It is essential to provide additional valid and high-quality, publicly accessible databases as a baseline for developing labels and information-based digital applications (e.g. apps), such as a “digital ecosystem for greater sustainability in food consumption” (cf. Section 9.6.7). The WBAE therefore recommends that the BMEL expands the national nutrient database (“Federal Food Code”) as a fundamental and free database into a national sustainability database so that data on climate impact and further sustainability data can be included and the necessary infrastructure provided. Companies and other bodies could use such a publicly financed data infrastructure to develop corresponding applications.

Against the backdrop of these general recommendations, the following specific recommendations refer to different sustainability areas.

## 9.6.2 Introducing a health-related label

The WBAE sees a need for a consolidated, interpretative evaluation system. Scientific studies conclude that the Nutri-Score label is the most comprehensible system with the highest health impact. Full labelling of all (processed) food would have much greater effects than voluntary and thus selective labelling of food because only full labelling permits a meaningful distinction between different products and, in particular, within a product group. With regard to processed foodstuffs in Germany, Szabo de Edelenyi et al. (2019) showed that the Nutri-Score not only differentiates between products (e.g. between sugary snacks and fruit and vegetables) but also within product categories and that there is a good overlap with the DGE recommendations. The costs for businesses to use the Nutri-Score are low, including in the case of mandatory labelling, since the necessary information to evaluate foods is already available for the mandatory indications of nutrients and ingredients. Currently, the Nutri-Score can only be used for processed and packed foods and not for particularly sustainable unpackaged raw products, such as fruit, vegetables, pulses, and nuts.

Health claims are currently being made in advertising, even concerning foodstuffs that, overall, are not very beneficial to our health. The nutrient profiles that were originally provided for in the EU Health Claims Regulation (Art. 4) in order to restrict the use of health claims to products that comply with certain upper and lower limits for specific nutrients, have not yet been implemented in the EU. Health claims may therefore trigger very strong health halo effects among consumers, leading to distortions of perception. In line with a tighter regulation of health-related labelling, there is a greater risk that producers whose foods have a negative score could resort to evasive marketing strategies.

The WBAE therefore recommends:

- **Continuing to promote the introduction of the Nutri-Score in Germany (recommendation addressed to: Federal Government, industry).** The WBAE supports the BMEL's decision to recommend and promote the use of the Nutri-Score among the food industry as an extended nutrition labelling system in accordance with Section 36 of the Food Information Regulation (First Draft Regulation amending the Food Information Implementing Regulation of the BMEL as of 21 November 2019). The BMEL should incorporate the Nutri-Score in a comprehensive, health-related communication strategy on food consumption and continuously develop it further. Industry should use the Nutri-Score as extensively as possible, not only for products with a positive score.
- **Supporting the EU-wide mandatory introduction of the Nutri-Score (recommendation addressed to: Federal Government, EU).** The BMEL should support the widespread use of the label across the EU and also be committed to mandatory labelling because it is hardly to be

expected that producers of less health-promoting foods will implement voluntary labelling. For this purpose, the BMEL should aim to amend the Food Information Regulation (review of Art. 39 Food Information Regulation). The BMEL should seize the 2020 German Council Presidency (as announced) for such an initiative. In case an EU-wide mandatory solution is not feasible, the BMEL should aim for extended national use based on a voluntary commitment by industry or a mandatory introduction at national level for domestic producers.

- **Continuing to improve the validity of the Nutri-Score through research (recommendation addressed to: Federal Government).** The BMEL and BMBF should fund research that aims to further improve the validity of the Nutri-Score system. For such improvements to be implemented, it would be pertinent to stipulate the formalities at EU level. Furthermore, the extent to which the Nutri-Score could be applied in the away-from-home catering sector over the medium term should also be reviewed.
- **Emphasising the preferability of many unprocessed raw products not included in the Nutri-Score (recommendation addressed to: Federal Government, industry).** In an accompanying information campaign, the BMEL should underscore the specific benefits of unprocessed raw products (e.g. pulses, nuts, fruit and vegetables). The legal options for retailers to use the Nutri-Score in the marketing of unprocessed raw products should be improved (Art. 30 et seqq. Food Information Regulation).
- **Restricting the use of health claims to products with a positive health rating according to the Nutri-Score (recommendation addressed to: Federal Government, EU).** The WBAE's recommendation to the BMEL is to advance an amendment of the EU Health Claims Regulation to ensure that with the introduction of the Nutri-Score, the use of health claims is restricted to products with a positive health rating (A and B). In return, these health-promoting products could be subjected to a less complex implementation of the Health Claims Regulation.
- **Making it mandatory for companies to display the Nutri-Score in food advertising (recommendation addressed to: Federal Government).** The WBAE recommends that the Federal Government introduces a special provision in competition law that stipulates a mandatory indication of the Nutri-Score in food advertising (products for which no Nutri-Score can be determined, such as fresh fruit, should be exempt). This contributes to the protection of children and young people because a significant amount of their exposure to advertising happens during programmes that are not specifically aimed at children (cf. Section 9.6.6).
- **Monitoring and, if necessary, prohibiting the use of so-called "feel-good labels" and "feel-good claims" (recommendation addressed to: Federal Government, federal states).** The Federal Government and the federal states should very closely monitor the use of "feel-good labels" and "feel-good claims" (marketing terms and signs that indirectly refer to health and are not regulated by law) and, if necessary, prohibit problematic evasion strategies for products that are not health-promoting (according to the Nutri-Score).

### 9.6.3 Ensuring minimum standards in the social field and labelling fairness aspects

The social dimension of sustainable food consumption can be divided into a protection aspect (social minimum standards) and a justice aspect (reducing social injustice). In Germany there is far-reaching labour and social legislation to achieve protection objectives; at the same time, there are indications of deficits in implementation, above all regarding seasonal workers, the slaughtering industry and the restaurant and catering sector. To implement the protection objectives at global level, ILO developed the core labour standards, which are the basis of many sustainability evaluation methods in the agri-food sector. In many countries, there are large deficits in the implementation of the core labour standards, however; child labour, forced labour and dangerous working conditions are common in agriculture (cf. Section 4.3.4). It is almost impossible for consumers to detect these deficits. The WBAE takes the view that the implementation of social minimum standards for food produced in Germany and abroad is the responsibility of the state, supranational organisations and companies. Consumers cannot and should not be expected to enforce compliance with social minimum standards through their shopping behaviour.

The WBAE therefore recommends:

- **Ensuring appropriate monitoring of compliance with the Minimum Wage Act along the value chain for food produced in Germany (recommendation addressed to: Federal Government).** The WBAE believes that there is a need for action to improve the monitoring of compliance with the requirements stipulated by the Minimum Wage Act (in particular for seasonal workers, agency workers, workers in the slaughtering industry and the restaurant and catering sector) to ensure a level playing field in Germany.
- **Strengthening the commitment to securing EU-wide minimum social standards (recommendation addressed to: Federal Government, EU).** The WBAE recommends that the Federal Government takes action at EU level, e.g. during the Council Presidency, to address illegal employment contracts for migrants, seasonal workers and agency workers to preserve equal competition across Europe.
- **Monitoring voluntary commitment and, if necessary, enacting appropriate legislation (recommendation addressed to: Federal Government, industry).** The WBAE welcomes the “National Action Plan for Business and Human Rights” and recommends rapidly implementing the agreement in the government’s coalition agreement that stipulates the introduction of legal provisions in case voluntary industry commitments are revealed to be inadequate. For higher-risk countries, companies should adequately analyse risks related to human rights and environmental issues. These due diligence requirements should also include suppliers and service providers along the value chain. Companies should set up verifiable management systems (naming a commissioner, contracts, controls, complaint and whistleblower systems, public reporting) in order to monitor compliance with social minimum standards in countries where, according to experience, these tend to be neglected. In particular, companies should draw on recognised certification systems. The Federal Government should investigate which certification systems

reliably guarantee compliance and provide a list of approved systems. Companies of a certain size should have to report about their compliance with the above-mentioned requirements. Infringements of these requirements should be sanctioned through administrative fines, and intentional violations of the duty of truthful reporting should be treated as criminal offences.

- **Further developing the WTO regulations (addressed to Federal Government, WTO, EU).** The WBAE reaffirms the recommendation made in its expertise addressed to the Federal Government on the public-service orientation of agricultural policy (WBAE 2018) to advocate the further development of the WTO regulations on ethical matters at European and international level, so that labelling requirements and import restrictions can be permitted under clearly and strictly defined rules. This way, provisions to declare compliance with minimum labour standards could be established pursuant to WTO rules.

With regard to the aspect of social justice, the WBAE welcomes the development of fairness labels, which enable consumers to follow their preferred social goals that go beyond minimum standards. The WBAE sees a need for action, however, in terms of further developing existing labels. There is evidence suggesting that existing labels, such as the Fairtrade label, improve the situation of workers employed in plantations and that of smallholders, but they do not improve the situation of farm workers working on smallholder farms. Additionally, the price mark-ups for consumers are relatively high, compared to the impact they have. The WBAE therefore recommends:

- **Promoting the further development of international fairness labels to protect dependent employees (recommendation addressed to: Federal Government, industry, NGOs).** Regarding the fairness labels that were designed for international trade, e.g. the Fairtrade label, the WBAE recommends further developing the labels to take greater account of the working conditions of farm workers working on smallholder farms. The WBAE recommends that the Federal Government increases its commitment at the level of international organisations to promote the development of fair-trade labels, including by promoting stakeholder initiatives and impact studies.
- **Reviewing a legal framework for the use of voluntary fairness labels in Germany (recommendation addressed to: Federal Government).** It must be ensured that fairness labels that are to be developed for food production in Germany clearly highlight to consumers the impact on the farmers' income. The WBAE therefore recommends that the BMEL reviews whether a regulatory framework for voluntary indications could be established, e.g. as a reserved term or a voluntary label based on governmental minimum requirements, similar to the regional label "Regionalfenster". This could for example include a reporting duty where the labelled product shows its producer price compared to the average producer price.
- **Advancing research on measuring and managing the social dimension of greater sustainability in food consumption (recommendation addressed to: Federal Government).** In light of the obvious conceptual deficits of defining, measuring and implementing the social dimension of greater sustainability in food consumption, in particular in international value chains, the Federal Government should fund research in this area, including the further development of labelling.

### 9.6.4 Advancing a climate label

Comprehensive environmental labels that include the agricultural production stage are particularly complex for several reasons (difficult data collection due to small agricultural structures, particularities of agricultural production, evaluation of different environmental indicators and their consolidation in an overall assessment, local and/or regional character of many environmental challenges, region-specific scarcity). Climate labels do not face these challenges, or at least not to the same extent. Measuring greenhouse gases is generally easier because there is only one target figure (CO<sub>2</sub> equivalents), they are additive and assessable and there are databases for many standard processes (products). In their expertise on climate change mitigation, the WBAE and WBW (2016) recommended that the BMEL review possible climate labels in research and demonstration projects. This recommendation has not yet been addressed. Implementing a climate label has so far failed as a result of a lack of certain preconditions (e.g. generally recognised databases, determination of evaluation rules) and in particular the lack of interest from industry. In recent years, no initiatives to assess a climate label have been undertaken by the BMEL. Such a climate label could, however, be an important supplement to comprehensive GHG emission pricing (which should cover transport and air-freight traffic, for example), in particular because agriculture itself is not included in the planned GHG pricing.

Against this backdrop, the WBAE recommends:

- **Introducing a climate label based on product-specific standard values and supplementary company-specific values (addressed to: Federal Government, industry).** As long as there is no information on the specific greenhouse gas emissions for certain products or brands, the different foods should be labelled with average values from existing databases. Consumers will thus get an overview of the climate impact of their chosen products and can choose to adopt more climate-friendly consumption patterns. Companies whose production is more climate-friendly could then label their brands based on their LCAs – verified by independent bodies – and could thus gain a competitive edge.
- **Aligning the concept and design of the climate label with the Nutri-Score and energy labelling (recommendation addressed to: Federal Government).** The Federal Government should design the climate label as a multi-tiered, colour-coded label.
- **Examining the introduction of a mandatory requirement to display the climate label in food advertising (recommendation addressed to: Federal Government, industry).** In the long term, the Federal Government should consider making it mandatory for food producers to indicate the climate label in food advertising in order to make climate action information more accessible to consumers and to improve market relevance.
- **Take action at EU level to advocate the EU-wide mandatory introduction of a climate label (recommendation addressed to: Federal Government).** For reasons of EU law, a climate label could only be implemented voluntarily at first. Similar attempts to introduce such a label on a voluntary basis in other EU Member States have failed so far due to high costs and limited marketing possibilities; significant support measures would therefore be required. The Federal

Government should seek an alliance with other interested Member States, e.g. in Scandinavia, supporting a mandatory and EU-wide introduction. If applicable, the option of a mandatory introduction only for domestic producers should be considered.

- **Creating a database and promoting methodological conventions (recommendation addressed to: Federal Government).** The WBAE renews its recommendation on capacity building (WBAE & WBW 2016), e.g. to commission a (state) institution to develop and potentially implement climate labelling (see Carbon Trust in England). This would encompass the development of a database on the average greenhouse gas emissions of different foodstuffs. Research has provided numerous reviews that indicate the mean values and the standard deviations of different product groups. Reliable data for German production conditions are currently not always available.
- **Promoting methods for measuring greenhouse gas emissions in agriculture (recommendation addressed to: Federal Government, industry).** The Federal Government should advance the development of methods for measuring and estimating specific greenhouse gas emissions in agriculture to allow for the cost-effective assessment of the impact of process technologies (e.g. in applying fertiliser) and management decisions (e.g. timing of fertilisation, weather influences). Based on these results, companies can then decide when to switch from average values to specific greenhouse gas values to be able to showcase their climate action success, providing them with a competitive edge.

### 9.6.5 Introducing a broad-impact animal welfare label

In its expertise on the introduction of an animal welfare label and in its expertise on livestock husbandry from 2011 and 2015, respectively, the Advisory Board underscored the importance of introducing a government animal welfare label. In 2017, the BMEL addressed the Advisory Board's proposal and launched the development of a government animal welfare label for pork. It is envisioned as a voluntary, three-tier positive label. The WBAE welcomes in particular that the BMEL earmarked a substantial amount (around 70 million euro) for marketing this logo. Since April 2019, the setting for an official animal welfare label has changed insofar as the private sector has launched a label for livestock husbandry systems in large parts of the retail food industry.

The WBAE recommends:

- **Developing a multi-stage governmental animal welfare label with increasing requirements over time (recommendation addressed to: Federal Government).** The WBAE continues to recommend a multi-tier state label. So far, the BMEL has only developed criteria for pork. The BMEL should rapidly advance the development of criteria for poultry, beef, milk, and eggs. The entry level should aim to be compatible with existing approaches, such as the retailers' husbandry labelling, and ensure a swift transfer of holdings that are currently under the "Initiative Tierwohl" label. The requirements should be raised within a clear time frame in order to guarantee the implementation of key animal welfare criteria, in particular abandoning amputations

stipulated in EU law (such as tail docking in pigs). The undermining of current EU law by universally applying a derogation to holdings whose products are labelled with an animal welfare logo is difficult to communicate in the short term and impossible to communicate in the long term.

- **Integrating the animal welfare label into a national livestock strategy (recommendation addressed to: Federal Government, federal states).** The governmental animal welfare label should be linked with a clear objective for livestock husbandry for each stage and be embedded into a national livestock strategy. Farmers should receive state funding for higher levels of animal welfare because the additional profit that can be achieved on the market is insufficient to cover the additional production costs (cf. Kompetenznetzwerk Nutztierhaltung 2020). The Federal Government should provide more funding than previously for the development and introduction of sustainable housing systems. This would ensure that the label's distribution does not remain limited to the entry level and that viable husbandry forms attain more widespread distribution. For this purpose, legal provisions concerning construction permits for livestock buildings will need to be adapted. The Federal Government should develop information and funding programmes in order to rapidly integrate the meat-processing and butchery sectors as well as the restaurant and (communal) catering sector. A considerable proportion of tax revenue resulting from abolishing the reduced VAT rate for animal products as suggested in Section 9.4.1 should therefore be used by the Federal Government and the federal states for the national animal welfare strategy in general and for compensating the additional costs of animal welfare in particular.
- **Increasing the use of result indicators for classification (recommendation addressed to: Federal Government, industry).** The BMEL should ensure that result indicators, such as animal-health indicators – which could be gathered at slaughterhouses – are also used for the classification into the different label tiers. This requires further increasing the efforts to standardise the collection of valid data.
- **Working towards mandatory labelling at EU level (recommendation addressed to: Federal Government, EU).** The Federal Government should work towards implementing EU-wide mandatory animal-welfare labelling at EU level (the same applies to the other labels). As an interim solution, the BMEL should assess whether it could be made compulsory for the domestic food sector to use the animal-welfare label when marketing products on the domestic market if the retailers' husbandry labelling system should prove insufficient.
- **Designing the animal welfare label in the style of the Nutri-Score logo (recommendation addressed to: Federal Government).** In order to guarantee that the different sustainability labels are easy to recognise, the BMEL should ensure that the animal-welfare label is very close in style to the Nutri-Score logo.
- **Regulating under law the use of animal-welfare terms (recommendation addressed to: Federal Government).** The Federal Government should regulate under law the use of animal-welfare terms (e.g. "animal-friendly" etc.) in marketing and – as soon as the official animal welfare

label is introduced – limit these terms to products that comply with certain minimum requirements for animal welfare. The Federal Government should also push for such provisions at EU level.

### 9.6.6 Making the advertising environment more sustainable

A disproportionate amount of advertising shown in Germany is for products with a fairly poor nutrient composition (e.g. sweets, soft drinks), including advertising aimed at children. Some children are exposed to food advertising in social media applications more than 100 times per week. Meta-analyses have revealed a correlation between media consumption and increased calorie intake. Advertising is increasingly being restricted internationally. The Nutri-Score, whose implementation is being planned by the BMEL, will in future provide a politically and scientifically recognised tool that can form the basis for measures intended to improve the advertising environment.

With regard to protecting children and young people (cf. Section 8.5) and in light of the long-term positive impact of such measures (learning and habituation effects, cf. Section 3), the WBAE recommends the following marketing regulations:

- **Restricting adverts for foods with little or no health-promoting effects that are aimed at children (recommendation addressed to: Federal Government).** The WBAE recommends that the Federal Government prohibits advertising for unhealthy foods aimed at children aged 13 years or younger, including novel marketing elements, such as event marketing, sponsoring, product placement and online marketing. Food advertising aimed at children should be restricted to foodstuffs with a beneficial nutrient profile (Nutri-Score A or B).
- **Banning advertising for foods in schools and preschools (recommendation addressed to: federal states, municipalities).** The federal states and municipalities should ensure that childcare facilities and schools are advertising-free spaces.
- **Making the Nutri-Score mandatory in food advertising (recommendation addressed to: Federal Government).** The WBAE recommends that the Federal Government introduces a special provision in competition law that stipulates a mandatory indication of the Nutri-Score in food advertising (products for which no Nutri-Score can be determined, such as fresh fruit, should be exempt). This contributes to the protection of children and young people because a significant amount of their exposure to advertising happens during programmes that are not specifically aimed at children. The above-mentioned restrictions of advertising aimed explicitly at children tend to lead to evasion strategies, i.e. these advertisements being shown in such programmes. In addition, the mandatory indication of the Nutri-Score in advertising (incl. social media) would accelerate the process of food producers introducing the Nutri-Score on their products even while this is still voluntary.

- **Making it mandatory for advertising measures in social media to always be identified as such (recommendation addressed to: Federal Government).** The WBAE recommends that the Federal Government legislates that digital advertising measures on the Internet, such as social influencing, are be clearly identifiable as advertising by the target groups.

### 9.6.7 Creating a “digital ecosystem for greater sustainability in food consumption”

Compared with conventional information channels, the Internet, social media and software applications make it possible to provide consumers with information when they actually need it (cf. Section 8.10), whether in making their choices (e.g. on the shop floor) or whilst preparing or eating food (e.g. to evaluate the meals, energy density, size of portions etc.). As a result of the high behavioural proximity, apps can be much more effective than general information campaigns. Further benefits are timeliness and speed. Information can be updated almost in real time, and a multitude of different information sources can be integrated. However, consumers are generally unable to identify the quality of the underlying databases and algorithms or the validity of underlying (behavioural) standards (e.g. for food consumption habits) and the recommendations derived therefrom (cf. Section 8.10.4). In addition, the technical possibilities have so far been used only to a limited extent and above all in a fragmented way in the food market (“app jungle”).

There is also an increasing number of other mobile sensors, apps and digital technologies that influence consumption and consumer habits in different ways and in different settings. These different technologies and digital services are becoming increasingly integrated and interlinked. For example, novel smart “digital ecosystems” are being developed not only in and for private households but also in the away-from-home sector (cf. Section 8.10.3). These smart “digital ecosystems” differ widely in terms of implementation and technology, but are often aimed at increasing the convenience and availability and thus ultimately the consumption of food (cf. Section 8.10.4). There is also the risk of reducing choice through the development of such “digital ecosystems” that increase the availability and convenience of certain products.

Against this backdrop, the WBAE recommends that the BMEL introduces the following measures:

- **Developing a “digital ecosystem for greater sustainability in food consumption” (recommendation addressed to: Federal Government).** The mobile and digital applications that are currently marketed are often designed for certain specific aspects of daily food consumption habits. The BMEL should initiate the creation and continuous development of a “digital ecosystem for greater sustainability in food consumption”, which makes applications and data available for the entire behavioural process and integrates them in a readily comprehensible manner, so that applications are made available to consumers more easily in their daily lives by making them more convenient, faster (“just in time”) and customised (“tailored”). This should allow

consumers to play a more pro-active role as responsible actors in the market economy. In addition, existing and new services and applications targeting food consumption should be integrated.

- **Creating a valid, integrated open-access database (“Federal Sustainability Code”) (recommendation addressed to: Federal Government).** As a baseline for developing labels and information-based digital applications (e.g. Apps), such as a “digital ecosystem for greater sustainability in food consumption” (cf. Section 8.10.3), and so that consumers are more easily, more quickly and better able to identify the criteria and data used for recommendations or assessments, it is essential to provide additional validated and high-quality databases that are generally accessible. The WBAE therefore recommends that the BMEL expands the national nutrient database “Federal Food Code” as a fundamental and free database into a national sustainability database in order to compile data on climate impact and further sustainability data as well as to provide the necessary infrastructure. Companies and other bodies could use such a publicly financed data infrastructure to develop corresponding applications.
- **Ensuring the availability of data and permitting voluntary data donations to be made (recommendation addressed to: Federal Government).** The data generated by consumers when using digital applications are usually not accessible to the consumers nor other stakeholders. This goes hand in hand with the risk of companies monopolising data (cf. Section 8.10.4). The WBAE therefore recommends that the Federal Government strengthens consumers’ legal right to access their own personal data. Furthermore, the option of voluntary consumer data donations (cf. Section 8.10.4) to research institutes should be assessed so that additional non-commercial applications can be developed. In order to develop this strategy, the Federal Government could initiate pilot projects for assessing the general conditions for data processing and incentive models for voluntary data donations.
- **Subjecting private smart “digital ecosystems” to quality control measures (recommendation addressed to: Federal Government, federal states).** In order to prevent the problem of consumers being manipulated by digital applications (Apps etc.), programmes for evaluation, examination and information should be established. This could be done along the lines of the digital market monitoring programme set up by the Federation of German Consumer Organisations (marktwaechter.de).

## 9.7 More sustainable food consumption as the “new normal” – “Calibrating social norms”

The food environment, with the available foods and portion sizes, “calibrates” our field of perception and what we regard as “normal” and “appropriate” (social norm). For example, portion sizes, which have increased over the years, change the perception of what is considered to be an appropriate portion, a meagre portion or an overly large portion (cf. Section 3.4.1). If many processed products are relatively sweet or relatively salty, our preference for sweetness or salt adapts to this, and we perceive less sweet or salty products as being tasteless. Also, which foods are considered

edible (e.g. the previous day's meals) and whether and to what extent it is acceptable to dispose of edible food depends on social norms. For the active design of more sustainable food environments, it is necessary to establish social norms throughout the entire behavioural process that help to make it normal for us to consume food more sustainably. The WBAE recommends:

- that smaller portion sizes should be the new standard (Section 9.7.1);
- that the consumption of sugar-sweetened drinks should be reduced and that tap water consumption should be vigorously encouraged (Section 9.7.2);
- that reformulation potentials should be assessed and used realistically (Section 9.7.3); and
- that food waste should be reduced efficiently (Section 9.7.4).

### 9.7.1 Making smaller portion sizes the standard

Generally, the Advisory Board is of the opinion that the issue of portion size effects has been neglected in Germany to date, perhaps because it is an influence that is usually imperceptible (cf. Sections 3 and 8.3). However, legal regulations to reduce problematic portion size effects are difficult overall and would often enter into uncharted territory (cf. Section 8.3.3).

The WBAE recommends:

- **Making the adoption of the DGE quality standards mandatory for public communal catering (recommendation addressed to: federal states, municipalities).** If the DGE standards that are recommended from the point of view of health and environmental policy were implemented, this would contribute to a reduction in portion sizes and consumption and, in the long term, would most likely lead to a change in social norms ("less and better"). The federal states, municipalities and the Federal Government should implement this measure in their public communal catering facilities.
- **Ensuring the availability of smaller portion sizes in away-from-home catering (recommendation addressed to: Federal Government, federal states, municipalities, industry).** As a measure that can be implemented at national level, the WBAE recommends that the Federal Government should develop and implement a legal framework for the better placement of smaller portion sizes and the design of menus, such as the obligation to offer at least two main dishes in smaller portions and at comparatively low prices.
- **Integrating the issue of portion sizes more strongly into the BMEL's "Too Good for the Bin" campaign (recommendation addressed to: Federal Government).** Even if awareness-raising campaigns hardly have any direct effects on consumer behaviour, they can contribute to improving the understanding of the issue and hence the acceptance of regulations (cf. Section 8.7). The WBAE recommends that the BMEL should address the subject of portion sizes more strongly than in the past in the "Too Good for the Bin" campaign, while also addressing potential trade-offs and supply-side problems (e.g. environmental and health problems of "all you can eat buffets").

- **Testing innovative measures to reduce or avoid the portion-size effect (recommendation addressed to: Federal Government, federal states).** In order to design effective strategies, the Federal Government and the federal states should carry out pilot projects to test the conditions and measures to reduce or avoid the portion-size effect by means of a scientific implementation and evaluation programme (“WIE” programme, cf. Section 8.2.4).
- **Initiating voluntary measures by industry (recommendation addressed to: Federal Government, industry).** Building on the results of the above-mentioned pilot projects the Federal Government should incentivise additional voluntary measures to be taken by industry.

### 9.7.2 Reducing consumption of sugar-sweetened beverages and ambitiously promoting consumption of tap water: Avoiding the “beverage trap”

Germany is one of the EU countries with the highest per capita consumption of sugar-sweetened beverages (soft drinks and fruit juices/juice drinks). The consumption of soft drinks is particularly concentrated on younger age groups. For young people in Germany aged between 12 and 17, these drinks account for 25% to 30% of the daily energy intake. Reducing the consumption of sugar-sweetened beverages is therefore an important strategy for preventing and controlling obesity and diet-related diseases. This is particularly true for children and adolescents. People have a lower sense of satiety from “drink calories” than they do from “food calories”. Cutting back on sugar-sweetened beverages (soft drinks) is a no-regret measure. If they are substituted by tap water, this entails other clearly positive environmental effects thanks to transport and packaging being no longer required.

The WBAE recommends:

- **Launching a national Action Programme on Reducing Sugar-Sweetened Beverages (recommendation addressed to: Federal Government).** There is strong scientific evidence from research that a combination of different instruments is needed in order to change drinking behaviour. The Federal Government should coordinate the implementation of the following measures by launching a national Action Programme on Reducing Sugar-Sweetened Beverages.
- **Introduction of a tax on sugar-sweetened beverages according to their sugar content (recommendation addressed to: Federal Government).** The WBAE recommends that the Federal Government should introduce a tax based on their free-sugar content<sup>497</sup>, since a targeted taxation of the reduction target boosts the effect and reduces undesirable, distribution-related side effects compared with a price-based consumption tax or a VAT increase (cf. Section 9.4.2).

---

<sup>497</sup> ‘Free sugars’ means mono- and disaccharides which are added by the manufacturer or the consumers, including sugar which is naturally contained in honey, syrup, fruit juices and fruit nectars. The term ‘free sugars’ does not refer to naturally occurring sugars found in milk and dairy products (lactose) and in fruit, vegetables or potatoes (glucose and fructose).

The effect of this tax should be strengthened by different accompanying instruments and unfavourable substitution behaviour reduced. The consumption of tap water should be the obvious first choice for consumers; this requires a corresponding food environment.

- **Free provision of tap water in public places (recommendation addressed to: Federal Government, federal states, municipalities).** The WBAE recommends – as envisaged in the amendment to the EU Drinking Water Directive currently in the legislative process – establishing a broad infrastructure ranging from simple, publicly visible and easily accessible (near toilets) taps in public buildings (schools, universities, hospitals, senior citizens' facilities, administrations) with clear labelling to piped drinking water dispensers ("drinking fountains") in outdoor areas for free use.
- **Mandatory labelling of beverages with the Nutri-Score (recommendation addressed to: Federal Government).** The introduction of the Nutri-score planned by the BMEL and endorsed by the WBAE (cf. Section 9.6.2) would have a much greater effect if it were binding, since otherwise it will mainly be products with positive scores which are labelled; this would water down the effect of the instrument (cf. Section 9.6.2). This is also the case for the restaurant and catering sector. Should the Nutri-score not be mandatory, consideration should be given to putting a warning label on drinks with a high sugar content (e. g. > 5 g/100 ml) (e. g. "high, unhealthy sugar content, consume with care").
- **Ambitious promotion of tap water being provided in the restaurant and catering sector and in retail (recommendation addressed to: Federal Government, federal states).** At present, the federal-state regulations for restaurants stipulate that at least one non-alcoholic beverage must not be sold at a higher price than the cheapest alcoholic beverage. It would be even better for promoting the consumption of calorie-free drinks if the federal states amended the Licensing Act in such a way that henceforth mineral water (still and sparkling) must be offered at a price which may not exceed 50% of the price of the second cheapest drink. Such a regulation could then be similarly introduced into the relevant legal texts for all catering businesses, including the away-from-home sector (health and senior citizens' facilities, travel catering, event catering, etc.) and all sales outlets of food retailers and the craft-based food industries. In the catering industry, this obligation could also be met by actively providing free tap water. The EU Drinking Water Directive, which is currently being amended, provides that Member States must encourage the supply of tap water (free or for a small service charge) to customers in restaurants, canteens and as part of catering services. Such promotion or encouragement (Art. 13 of the EU Drinking Water Directive) should be implemented in Germany in an ambitious manner, e.g. through an obligation to provide the water free of charge or at a low price.
- **Offer health-promoting drinks as the standard option in children's menus (recommendation addressed to: Federal Government, federal states).** In many areas of away-from-home catering, high-caloric sugar-sweetened beverages are currently the standard option on children's menus – a classic example of a less-than-beneficial food environment. The BMEL should lend its support for children's menus to contain water or other non-calorific variants as a standard option (default). As the restaurant and catering sector is in many areas small-scale and poorly

organised, this is unlikely to be achieved by means of voluntary commitments (interbranch agreement), so that legislation is necessary (see above).

- **Reduction in the supply of sugar-sweetened beverages in public institutions and an increase in the attractiveness of tap water consumption (recommendation addressed to: Federal states, municipalities, Federal Government).** Schools are requested to refrain from offering sugar-sweetened beverages, if possible. Some municipal school boards have already committed themselves to not offering these drinks. At the very least, schools as well as universities and public administrations should give priority to non-calorific beverages by installing drinking water fountains across the board, by price differentiation and by changes in standard options (social norms, nudging). Similarly, to the situation in the restaurant and catering sector, it could be required that the price of mineral water should be limited to 50% of the cheapest sugar-sweetened beverage. Comparable requirements should be made of hospitals and retirement homes, railway stations, airports, motorway service stations and public enterprises. The Federal Government could also conduct campaigns for the voluntary introduction of such measures in private companies.
- **Widespread information campaign on avoiding the “beverage trap” (recommendation addressed to: Federal Government).** This information campaign should communicate the risks of sugar-sweetened beverages and promote alternative behaviour. The economic and environmental added value of tap water over mineral water should also be conveyed (tap water as the first choice).
- **Promotion of small beverage sizes (recommendation addressed to: Federal Government, federal states).** Obligation to also offer small drink sizes in respect of sugar-sweetened beverages in the restaurant, catering and away-from-home sectors.
- **Ban on advertisements for high-sugar products that target children (recommendation addressed to: Federal Government).** The previous voluntary commitments regarding restrictions on beverage advertising that targets children should be replaced by a statutory ban on advertisements for high-sugar beverages that target children.
- **Promotion of the consumption of light spritzers through reformulation (Federal Government).** The DGE recommends light juice spritzers (Water to juice ratio of 3:1) as an occasional alternative to the consumption of water and other unsweetened drinks. The consumption of light juice spritzers should be promoted by suitable reformulation measures at the expense of beverages with a higher sugar content (cf. Section 9.7.3).

### 9.7.3 Realistically assessing and harnessing the potential of reformulation

With its National Reduction and Innovation Strategy for Sugar, Fats and Salt in Convenience Foods, the BMEL has initiated a number of voluntary industry commitments aimed at changing the recipes of processed products with the aim of reducing ingredients considered problematic from a nutritional point of view while maintaining the same quality of taste. The WBAE considers the reformu-

lation of food by manufacturers to be a suitable measure towards more sustainable food consumption. However, as the absolute impact on diet-related diseases and obesity will be rather small, a reformulation strategy can only be one element of a comprehensive instrument mix (cf. Section 9.10).

The WBAE recommends that the BMEL should continue the **National Reduction and Innovation Strategy, which has important aspects that should be further developed (recommendation addressed to: Federal Government, industry):**

- **Prioritising reformulation measures and initially focusing on sugar content and specific product groups (recommendation addressed to: Federal Government, industry).** The Advisory Board supports putting the focus of reformulation measures on the sugar content and the product groups soft drinks, breakfast cereals and dairy products, since for these product groups the sugar content can be reduced quickly, easily and at low cost (cf. Section 8.4). Even if a reduction of the sugar content in these products without any substitution will, at first glance, only lead to a slight decrease in the total sugar intake of the population, a significant secondary effect on taste preference can be expected. The WBAE believes that a further reduction of the sugar content in these three product groups by using sugar substitutes and sweeteners would also be meaningful. In the sugar-sweetened beverages sector, the reformulation of beverages to provide light juice spritzers with a reduced fruit juice content should continue to be pursued as a high priority in accordance with the recommendations of the DGE (3 parts water, 1 part juice).
- **Systematically underpinning measures under the reformulation strategy with scientific evidence (recommendation addressed to: Federal Government).** Recommendations for reformulation measures should henceforth be subject to more intensive systematic scientific preparation, monitoring of the implementation and evaluation of the successes. Scientific support should, among other things, calculate the maximum effect sizes in advance of the measures, formulate explicit targets based on these effect sizes and regularly evaluate the achievement of these targets. In this case, the measured variables must not only be the sugar/salt/fat content of products and product groups. In order to be able to estimate in advance whether a particular reformulation measure is worth the effort or to be able to assess the success of a measure, the effects on the overall intake of sugar, salt and fat, depending on the population group, must also be predicted and evaluated, as well as possible effects on overweight and nutrition-related diseases. Reformulated products on the market are only desirable if they also lead to intended effects on consumers.
- **Expanding the reformulation strategy (recommendation addressed to: Federal Government, industry).** Should the scientific preparation of the reformulation measures identify further product groups where a reduction in sugar, salt and fat is expected to have significant effects, the BMEL's reformulation strategy should be extended to these foods. In addition, away-from-home catering should also be included. In this context, communal and system catering and big restaurant suppliers are most important.
- **Integrating more sustainability aspects such as climate change mitigation into reformulation measures (recommendation addressed to: Federal Government, industry).** The reformulation

measures should be extended to sustainability aspects other than health, for instance climate change mitigation via an increased use of plant products instead of animal products in compound or convenience food (cf. Chapter 8.4.4). Since this is also about issues of consumer protection and comprehensible product descriptions, the focus should first be placed on voluntary measures.

- **Providing food manufacturers with a science-based toolbox (recommendation addressed to: Federal Government, industry).** In the case of products in which the use of sugar, salt or fat is not only for sensory purposes, there are often complex relationships between sugar, salt and fat content on the one hand and health-promoting and health-damaging effects, quality, sensory characteristics and the shelf life of the food on the other. For this reason, and also in light of the fact that the German food sector is characterised by medium-sized and in some cases still artisanal enterprises, the WBAE recommends that the BMEL develop a science-based toolbox that combines practical and evaluated measures for defined products. In order to develop the toolbox, the WBAE recommends funding research projects by the Federal Ministry of Education and Research, the Federal Ministry of Food and Agriculture, the EU and pre-competitive industrial funds (e.g. the Research Association of the German Food Industry (FEI)). The topics of the calls for proposals should be specified top-down for selected product groups.
- **Monitoring the achievement of reformulation goals and tightening food law requirements where necessary (recommendation addressed to: Federal Government).** The current reformulation strategy is based on a voluntary commitment by industry. The WBAE assumes that the recommended introduction of health and sustainability labels (cf. Section 9.6) and sustainability taxes (cf. Section 9.4) will be a decisive driver for further reformulation efforts. Should the reformulation goals still not be achieved, the BMEL should consider setting guidance or limit values for individual products. The WBAE strongly supports the ban on the addition of sugar to infant and baby food that is planned by the BMEL.

#### 9.7.4 Efficiently reducing food waste

The Federal Government's target of halving avoidable food waste in the retail sector and among consumers by 2030 is an important but also ambitious reduction target for environmental protection and climate change mitigation. The WBAE takes the view that this target cannot be achieved with current policy approaches. There is a considerable gap between the goal, which is widely accepted in society, and the range of instruments available. At consumer level, everything ultimately focuses on education and the presentation of information. However, from the experience gained so far, no reliable statement can be made about the reach of these instruments among consumers – at the current intensity of use, they will by no means suffice to achieve the set target.

The instruments in this area need to be better evaluated and refined and the efficient instruments need to be used much more intensively. The database will improve in future as the BMEL has to report regularly on the development of food waste across the entire value chain. It is planned to establish a monitoring system to this effect. The WBAE welcomes the fact that the BMEL developed

the National Strategy for Food Waste Reduction, a conceptual framework adopted in February 2019. In addition, new instruments are also to be developed, e.g. for the adaptation of portion sizes.

The WBAE recommends:

- **Establishing a system for monitoring food waste (recommendation addressed to: Federal Government).** For Germany to fulfil its reporting duties, but especially for the evaluation of measures for waste prevention, a valid data base is required. The WBAE therefore recommends that the BMEL should establish a science-based monitoring system for food waste in Germany and to make the data available for scientific analysis.
- **Evaluating reduction measures more systematically (recommendation addressed to: Federal Government).** A monitoring of food waste also makes it possible to evaluate reduction measures more systematically. This is necessary in order to reach the goal of halving food waste as efficiently as possible. For this, intermediate targets should also be set.
- **Expanding the “Too Good for the Bin” campaign (recommendation addressed to: Federal Government).** The WBAE recommends that the BMEL should consider the subject of food losses as a pilot field for the implementation of a comprehensive information campaign. The BMEL should develop the concept and funding of the “Too Good for the Bin” campaign started in 2012 into a comprehensive information campaign with integrated social media and a digital communication strategy. The initiative should be evaluated and prioritised and prospectively be integrated into the “digital ecosystem for greater sustainability in food consumption”. Without a comprehensive, significantly increased budget, however, an effective information policy cannot be realised in the current media-orientated society. The level of the necessary budget should be deduced from the desired ambitious reduction targets.
- **Research into the reduction potential of smaller portion sizes (recommendation addressed to: Federal Government).** Reduced portion sizes are a hitherto little-noticed starting point for reducing food losses (cf. also Section 9.7.1). The aim should be to recalibrate the social norm with regard to appropriate portion sizes (on plates, at self-service buffets, in packaging etc.) in society. The BMEL should promote research and innovation programmes to this effect.
- **Better support for food banks (recommendation addressed to: Federal Government, federal states, municipalities).** The Federal Government, the federal states and the municipalities should provide investment aid to food banks that want to become more involved in the preparation of meals. This would also have further positive effects on the problem of food poverty and on commensality. Furthermore, the Board recommends more public support for the infrastructure of the food banks, e.g. by providing premises, cold and deep-freeze storage and transport vehicles with refrigeration equipment to maintain an uninterrupted cold chain.
- **Examining a legal requirement for retailers and bakeries to donate food which is still edible (recommendation addressed to: Federal Government, federal states).** At the level of retailing and away-from-home catering, the WBAE believes there is potential in the increased promo-

tion of structures that facilitate the passing on of food still suitable for consumption. The Federal Government should check whether a legal obligation for retailers and bakeries to pass on food that is still suitable for consumption can be a helpful tool.

- **Public communal catering to set a good example (recommendation addressed to: Federal Government, federal states, municipalities).** Many measures taken to reduce food waste in away-from-home catering can be implemented quickly in public communal catering facilities. The WBAE recommends that the Federal Government, federal states and municipalities should set a good (management) example in their facilities. This also involves the use or further development of planning tools developed by publicly funded projects. If the DGE standards recommended from a health and environmental policy perspective were implemented, this would contribute to a reduction in portion sizes and consumption and, in the long term, would most likely lead to a change in social norms (“less and better”).

## 9.8 Improve services in public institutions – “Making canteen kitchens more sustainable”

A health system that cares for persons in need of long-term care in its facilities, but tends to regard nutrition as a secondary issue and accepts considerable quality deficits, not only provides worse care for its clients than would be possible; it also sends a counterproductive signal to society. The WBAE recommends, while keeping in mind the practical aspect of providing food for the elderly, hospitals and rehabilitation clinics, also ensuring high quality food and a high-quality food environment for clients.

### 9.8.1 Rethinking catering for senior citizens: “On wheels to meals” (auf Rädern zum Essen)

In 2050 one in three people in Germany will be over 65, with an upward tendency. As a result, there is an increasing focus at political level on the specific living conditions and needs of senior citizens; for example, target group-specific internet platforms or networking centres for senior citizens’ nutrition are being set up in the municipalities and at state and federal level (cf. Section 4.2.2.4). The Advisory Board welcomes these developments, but feels that the current measures are insufficient and poorly coordinated, considering the problem situations highlighted in Section 4.2.2.4.

To improve the nutrition- and health-related food supply situation of senior citizens, the WBAE recommends:

- **Making the DGE quality standards for catering for senior citizens compulsory in all senior-citizen institutions (recommendation addressed to: Federal Government, municipalities).** High-quality food that is geared to the specific needs of the elderly should be available at all in-

patient institutions and midday meal services. Therefore the WBAE recommends that the Federal Government should make the implementation of the DGE quality standards binding for the operators of senior-citizen institutions. The implementation of this standard should be supported by the networking centres for senior citizens' nutrition that have either already been set up or are yet to be launched.

- **Establishing decentralised lunch arrangements and municipal “carers” (recommendation addressed to: municipalities, Federal Government).** Just like deficient nutrition-related and health-related supply structures, social isolation is a major challenge in old age. In order to enable as many older people as possible to enjoy their old age with as few troubles as possible, what is needed above all is an infrastructure that enables social participation in addition to specific health-related care. Against this backdrop the Board welcomes the establishment of decentralised lunch arrangements “On wheels to meals” (auf Rädern zum Essen) and the “carer” systems that are increasingly being introduced at municipal level, i.e. persons who organise domestic services or provide help in procuring foodstuffs and meals for senior citizens (cf. Section 4.2.2.4). The WBAE recommends that the municipalities should further expand such activities. The reach, effect and acceptance of such measures should, however, be evaluated, ultimately also with regard to the extent to which supply structures can be created which do not only rely on the support of voluntary helpers. The Federal Government could flank such measures in selected German regions by implementing an evaluation project.

In order to improve the data situation on the living conditions of the over 65s, the WBAE recommends:

- **Monitoring of the care situation and evaluation of measures (recommendation addressed to: Federal Government, federal states, municipalities).** The data situation on the living conditions of the over 65s in Germany is very deficient (cf. Section 4.2.2.4). These shortages should be remedied by the Federal Government producing regular surveys in this age group, so that targeted offers for a balanced diet can be planned and implemented on the basis of such monitoring. In the implementation by the municipalities, the Federal Government and the federal states should support the evaluation, i.e. analyse the ability to reach older people, older people's access to the services and the effectiveness of the offers themselves. Special focus must be placed on old-age poverty (cf. Section 4.2.3).
- **Introducing nutritional screenings and sensitising nursing staff and physicians to nutritional issues (recommendation addressed to: Federal Government, SHI & private health insurers, Medical Associations).** All over the world, screening for malnutrition is required in clinics, inpatient institutions or GP practices in the event of sudden weight loss in older people. A subsequent examination and monitoring of risk patients can clarify the individual causes and facilitate specific interventions. The identification of nutritional deficiencies takes precedence in old age. Carrying out a screening could be demanded and implemented both by the German National Association of Statutory Health Insurance Funds/ private health insurance funds and by the Medical Chambers. The awareness of nurses and doctors can also be raised by suitable mandatory further training (adaptation of the advanced training regulation).

### 9.8.2 Advocating health-promoting food in the health system: “Making the connection between nutrition and health tangible”

Hospitals and rehabilitation clinics offering less health-promoting meals of poor sensory quality convey to their patients a very problematic idea of the role of nutrition in health. They also fail to recognise the psychological role of nutrition for recovery and well-being. Although good catering is an important factor for the satisfaction of patients and hence actually relevant for marketing, the pressure on costs in in-patient care facilities often leads to poor consideration of diet and nutrition.

The WBAE recommends that the Federal Government should:

- **Make the implementation of the DGE quality standards for catering in hospitals and rehabilitation clinics mandatory (recommendation addressed to: Federal Government, federal states, SHI and private health insurers).** The WBAE recommends that the Federal Government, the federal states, hospital owners and insurance institutions should prescribe and monitor the implementation of the DGE quality standards for catering in hospitals and rehabilitation clinics. The implementation should be supported by accompanying research and innovation projects (“WIE” programme, cf. Section 8.2.4).
- **Examining the possibility of including quality-related factors in the financing of catering services (recommendation addressed to: Federal Government, federal states, SHI and private health insurers).** The WBAE recommends that the Federal Government, the SHI and private health insurers should examine whether quality-based indicators (e.g. the results of external quality checks) could be integrated as a factor for financing catering services (as implemented for medical services in the 2015 Hospital Structure Act (Krankenhausstrukturgesetz)).

## 9.9 Develop and label agricultural systems – “Organic and more”

It is a tremendous challenge to assess and compare the sustainability of farming systems because numerous economic, social and environmental effects must be identified, assessed, weighted, and – in the case of trade-offs – weighed up against each other. Meanwhile, a variety of scientific concepts for assessing sustainability have been developed (cf. Section 5.2). They primarily have the potential of gradually making agriculture more sustainable. But they reach their limits when it comes to the consumers’ point of view, so that these comprehensive assessment systems are not currently used for labelling systems.

Organic farming is a specific example. When it comes to the various sustainability aspects, it shows both weaknesses and strengths, which can vary depending on the location, type and management of the holding. With regard to many environmental goods, it shows positive effects and can hence contribute to reducing the current environmental and resource policy challenges in Germany. The low yields, however, are definitely a weakness of organic farming. Firstly, according to current

knowledge, organic farming has similarly high levels of greenhouse gas emissions to those of conventional farming due to its low yields and therefore cannot in principle be rated more climate-friendly than conventional farming (WBA & WBW 2016). Secondly, the low yields are problematic against the backdrop of a growing world population. In order to produce the same amount of food through organic farming as that produced using conventional methods, arable farming would have to be intensified in other regions and/or arable land would have to be expanded considerably.

Overall, the WBAE supports boosting organic farming and recommends the system as one element for promoting more sustainable food consumption – and even more so the more the consumption of organic products goes hand in hand with a reduction in the consumption of animal products and a reduction of food wastage. What is also clear, however, is that the gradual expansion of organic farming in Germany should not be the major or only instrument for solving environmental problems caused by agriculture. Significant adjustments to conventional agriculture are also necessary. In the long term, however, the dichotomy between “organic” and “conventional” is insufficient, since, viewed globally, it is in principle possible to conceive of farming systems that are more sustainable and have greater land-use efficiency than organic farming as it is currently defined. However, it has not yet been possible to describe such alternative eco-efficient farming systems in detail, to provide them with sufficient controls and, as a result, with sufficient credibility among consumers and thus to establish them on the market. Ultimately, organic farming still has an important social function as a “benchmark” setting the course for a more ecologically friendly farming sector.

The WBAE recommends:

- **Advancing the promotion of organic farming in a targeted manner (recommendation addressed to: Federal Government, federal states).** The WBAE believes that, for sustainability reasons, specific support for organic farming makes sense because this sector provides important environmental services and impetus for sustainability innovations (cf. Chapter 5.2). Since ecological contributions vary depending on the location and type of holding, existing organic farming support should continue to be expanded in areas where benefits are particularly high, e.g. in Section 13 of the Fertiliser Application Ordinance (“red areas”). In this case the reduced intensity of organic production can contribute to protecting groundwater; in areas with a high stocking density the reduced livestock density per hectare of area in organic farming also has very positive effects. To boost the sustainability benefits of organic farming, it should also be possible, under the second pillar of the CAP, to better combine organic measures with other agri-environmental measures for organic farms.
- **Reviewing the positive effects of organic farming at intervals (recommendation addressed to: Federal Government).** Organic products can contribute to a more sustainable shopping basket as long as the positive environmental effects of organic farming in combating major environmental problems in Germany are of greater significance than the potential negative relocation effects. Since both farming systems continue to develop and the assessment depends heavily on the degree of expansion of organic farming as well as other changes in the food system (e.g. the level of consumption of animal products), this positive assessment of organic

products must be reviewed periodically, e.g. once organic farming has reached the political objective of a 20% share of agricultural land.

- **Developing more sustainable farming systems and making them recognisable to food processors and, in later development stages, also to consumers (recommendation addressed to: Federal Government).** To achieve more sustainable development it makes sense both to advance organic farming (aim: to reduce the yield gap between organic and conventional farming) and to develop farming systems that can compete with organic farming in terms of environmental performance but that achieve higher yields. To facilitate reliable labelling of these farming systems, it must be possible, with acceptable effort and expense, to inspect holdings or products in a valid and reliable manner. However, in contrast to climate and animal welfare impacts, other important aspects of sustainability, such as the impacts on biodiversity, are not able to be expressed as clearly in a product-specific way and have therefore hitherto played only a very minor role when it comes to labelling. One possibility could be a summary sustainability assessment of holdings, which would allow farms (and the products produced there) to be classified in different sustainability levels (cf. Section 5.2.3). In its statement on the post-2020 CAP (WBAE 2019), the WBAE commended an ecopoints model as one possible approach to recording ecosystem services within the scope of agricultural land use. In the WBAE's view, such approaches could be further developed, with the aim being a certifiable farming standard and thus a label. This label (which could be a multi-stage label as for animal welfare) could help food processors and retailers in their purchasing policies, on the one hand, and consumers in their selection of foods on the other. The discussion on environmental protection in agriculture, which has sometimes polarised people, would be put on a more rational footing. The Federal Government should support research for the development and definition of eco-friendly farming systems and the corresponding practical trials in pilot projects. In this context, it should be borne in mind from the outset that inspections and certifications must be possible and that the cost of these inspections and certifications must be as low as possible. The possibility to certify products is primarily important whenever the consumers' willingness to pay higher prices for particularly environmentally friendly products in parts of the market is to be used to cover additional production costs.
- **Developing and introducing a climate label (recommendation addressed to: Federal Government).** Both in conventional and in organic farming, greenhouse gas emissions can in some cases be substantially curbed. By introducing a climate label (cf. Section 9.6.4), the Federal Government could provide incentives for greenhouse gas emissions to be reduced in all food produced by both conventional and organic farming. In combination with an animal welfare label (cf. Section 9.6.5), a climate label provides the option for consumers to compare and categorise products with respect to the sustainability dimensions of environment and animal welfare, with these dimensions being particularly strongly influenced by farming systems.
- **Rethinking technological developments with regard to their sustainability assessment and approval processes (recommendation addressed to: EU, Federal Government, federal states).** New technologies, e.g. in the areas of robotics, sensor technology and genome editing, can open up new prospects for sustainable food security and mitigation of adverse environmental

effects arising from farming systems. Plant protection agents, used selectively and in a targeted manner, can reduce food losses and contribute towards enhanced sustainability in farming systems. Policy-makers should ensure that the potential of technological solutions for greater sustainability in production is not wasted. Otherwise, there would be an undesired risk of displacing production to regions or countries with lower environmental and climate stewardship standards. The social debate on technological developments in the agricultural and food system should be intensified.

### **9.10 Strengthen and advance the policy field of “promoting more sustainable food consumption” – “Establishing an integrated food policy”**

Food consumption is a key area of sustainable consumption. It provides important contributions to achieving pivotal sustainability objectives and is proven to contribute to a fulfilled life and to higher healthy life expectancy and greater well-being for all. Against this backdrop, policies for greater sustainability in food consumption need to be established as long-term policy areas. At this stage, food policy is a rather young policy field (cf. Section 7) and – both in terms of concepts and institutions – has not yet been developed as much as e.g. agricultural policy. Food policy has a much smaller budget, and in the past it has often focused too much on individual instruments (especially information policy elements) rather than on targeted combinations of measures.

With an eye to the decision areas of a food policy strategy outlined in Section 8 (cf. Section 8.1) it is consequently necessary to reorient this strategy: the government should be given greater responsibility to shape and improve food environments in a targeted manner so that the burden on consumers is reduced and consumers are given more, and more sustainable, choices. A concentration on the main areas of action is necessary in order to increase the reach of food policies. A broad and coordinated mix of instruments should be implemented, including stronger regulatory law, stronger economic incentives and more reliable information to enhance consumer choices. Comprehensive demand-side instruments should be introduced in order to achieve a better link-up between demand-side and supply-side instruments. It is necessary to focus on target groups so that greater consideration is also given to vulnerable groups (children, households affected by food poverty).

**Figure 9-2:** Realignment of food policies along five decision areas

Source: WBAE illustration.

The BMEL should step up efforts to generate empirical evidence on the implementation and effectiveness of measures promoting changes in consumption (cf. "WIE" programme, Section 8.2.4). Agriculture and food are policy fields that are fiercely debated within society. Policies imposing more regulations on designing fair food environments have the potential to unleash more conflicts. A fact-based, appropriate, empirical foundation cannot resolve the different value concepts (e.g. with regard to the importance of consumer sovereignty versus the need to protect vulnerable consumers, cf. Section 6.3), but it can prevent policies to promote more sustainable food consumption from being based on assumptions about causal links that are empirically wrong.

In order to ensure a technically appropriate empirical basis for policies to promote more sustainable food consumption, it is essential that the evaluation of policy measures meets generally recognised scientific quality standards. These include in particular the pre-specification of measures, target criteria and study design as well as appropriate data analysis. Randomised controlled trials (RCT) are the gold standard for the study design. However, more "pragmatic" study designs may also be used (cf. Section 8.2.4). Such "Learning-by-doing approaches (cf. also WBAE & WBW 2016) can generate robust data on the effectiveness of measures in different population groups which can provide the basis for implementing and developing government measures.

The WBAE recommends strengthening and advancing the policy field of "promoting more sustainable food consumption" by taking the following measures:

- **Dedicating a higher budget to the policy field of "promoting more sustainable food consumption" that is appropriate to the great challenges (recommendation addressed to: Federal Government).**

- **Developing consistent goals and performance indicators for the policy field of “promoting more sustainable food consumption” (recommendation addressed to: Federal Government).** A system of consistent goals and indicators should be developed for the promotion of greater sustainability in food consumption. This system should include the four central dimensions and a manageable number of goals and related performance indicators in each case. The Federal Government should communicate these goals, indicators and their achievement to the public. The most important ones should be incorporated into the German Sustainable Development Strategy of the Federal Government.
- **Promoting the networking of the ministries in charge by establishing, among other things, an inter-ministerial working group on greater sustainability in food consumption (recommendation addressed to: Federal Government).** Efforts to dovetail food policies among ministries should be stepped up. At federal level, there are major interdependencies between the BMEL, BMU and BMG, so that both at working and government level durable and project-related links should be developed. The WBAE proposes setting up an inter-ministerial working group on more sustainable food consumption, which the following ministries should be involved in: BMEL, BMU and BMG as well as BMZ, BMAS, BMJ and BMFSFJ. The expansion of catering in preschools and schools recommended by the WBAE puts high demands on this network. Due to the multi-level issue for policy-makers, the financial implications and the advisable dovetailing with educational goals, the challenges are particularly high (cf. Section 9.2 for details).
- **Reinforcing food policy within the BMEL (recommendation addressed to: Federal Government).** A policy for more sustainable food consumption is a comprehensive cross-cutting theme involving several federal ministries. Choosing the BMEL as the lead ministry would come with both advantages and disadvantages (cf. Section 7). Against the background of the ministry’s tradition, the central challenge is that in the event of conflict, e.g. on a topic such as reducing the consumption of animal products, the interests of the agricultural sector prevail. The WBAE therefore recommends that the BMEL continues to upgrade food policy within the ministry. If consideration is given to society as a whole, ensuring more sustainable food consumption is more important than sectoral interests. Involving more ministries, such as the BMG and BMU, would be an important contribution to strengthening a comprehensive focus on sustainability.
- **Strengthening the DGE und BZfE (recommendation addressed to: Federal Government).** To make sure that consumer interests are safeguarded by institutions, the WBAE recommends that the BMEL provide special support for the newly established Federal Centre for Food and Nutrition (BZfE) in the coming years. DGE und BZfE should have sufficient financial resources to be able to perform their duties as defined in the statutes, also in the long term. Thus, the DGE performs an independent scientific assessment of the core issues in the fields of nutrition and the derivation of evidence-based recommendations and standards on the basis of relevant scientific research. Digital innovation, applications and databases as well as “digital ecosystems” offer more and more new options and place new demands on the derivation of evidence-based recommendations and standards (e.g. in the scope of a “digital ecosystem for greater sustainability in food consumption”, cf. Section 8.10.4). The DGE should place additional and increased focus on this field and should be provided with special support in this regard. The

BZfE should be encouraged to focus on consumers and to evolve into a centre of evidence-based communication for food consumption issues in Germany. The implementation and effect of communication measures should be evaluated and implemented on the basis of scientific quality standards (cf. Section 8.2.4, implementation and evaluation programme (“WIE” programme)).

The WBAE also recommends the following central elements to upgrade and develop institutions to establish an integrated food policy:

- **Combining and employing food policy instruments meaningfully (recommendation addressed to: Federal Government).** The WBAE recommends that the Federal Government should increasingly use food-policy instruments in combination with other tools (i.e. as a coordinated mix of instruments). The WBAE pleads for a better balance between voluntary measures and legal regulations. Developing an adequate mix of instruments is a conceptual challenge. The Federal Government should adopt a learning approach, i.e. with a focus on evidence-based design and evaluation. The individual measures each have only limited (weak to moderate) effects. If taken together, they can have a considerable impact over time.
- **Comprehensively evaluating the implementation and effectiveness of food-policy measures (recommendation addressed to: Federal Government, federal states).** The WBAE recommends that the Federal Government and the federal states should investigate the implementation and effectiveness of food-policy measures more comprehensively than before and on the basis of generally recognised scientific standards so that they can take evidence-based decisions (cf. “WIE” programme, Section 8.2.4). This kind of “Learning-by-doing” approach can generate data on the effectiveness of measures in different population groups, which can provide the basis for implementing and developing state measures. In addition, it should be planned to continually evaluate international experience and results.
- **Expanding the monitoring of developments that are relevant to food policy (recommendation addressed to: Federal Government, federal states).** The WBAE recommends that the BMEL should initiate the establishment of a scientific monitoring system to monitor social sustainable development goals related to food consumption. Food-based and health-based monitoring should be expanded with a focus on target groups that are particularly vulnerable (children, the elderly and people affected or threatened by food poverty). Studies on the nutritional and health situation, such as the National Nutrition Survey (NVS) should in principle also be evaluated based on income groups (cf. Section 9.5).
- **Making monitoring data from public research institutions available for research more quickly (recommendation addressed to: Federal Government, federal states).** The Federal Government and the federal states should have data on nutrition monitoring collected by public research institutions made available for more scientific analyses more quickly. To improve monitoring, the WBAE considers it essential to make the data available early on and comprehensively as scientific or public use files for scientific questions in order to speed up comprehensive scientific analysis. In this context, the KiGGS Wave 2 study is a positive example.

- **Publish a report on sustainability in food consumption (recommendation addressed to: Federal Government).** With respect to the policy field of “Promoting food consumption” the WBAE recommends that the BMEL should set itself long-term evaluable goals. These goals should address the interfaces between health-promoting, social, environmentally sound and animal-welfare oriented food consumption. To review these goals, monitoring systems in the subfields need to be modified accordingly or developed and the pooled results should be presented, for instance in a quadrennial report on sustainability in food consumption.
- **Creating a “digital ecosystem for greater sustainability in food consumption” (recommendation addressed to: Federal Government).** The apps and digital applications that are currently marketed are often designed for certain specific aspects of daily consumer and food consumption habits. The BMEL should initiate the creation and continuous development of a “digital ecosystem for greater sustainability in food consumption”, which makes applications and data available for the entire behavioural process and integrates them in a readily comprehensible manner, so that applications are made available to consumers more easily in their daily lives by making them more convenient, faster (“just in time”) and customized (“tailored”). In this way, consumers would be enabled to play a more pro-active role as responsible actors in the market economy. In addition, existing and new services and applications targeting food consumption should be integrated (cf. Section 9.6.7).
- **Creating a valid, integrated open-access database (“Federal Sustainability Code”) (recommendation addressed to: Federal Government).** As a baseline for developing labels and information-based digital applications (e.g. apps) such as a “digital ecosystem for greater sustainability in food consumption” (cf. Section 9.6.7), and so that consumers are more easily, more quickly and better able to grasp which criteria and what data base the apps currently on offer use to recommend or assess something, it is essential to provide more validated and high-quality databases that are generally accessible. The WBAE therefore recommends that the BMEL develop the Federal Food Code (“Bundeslebensmittelschlüssel”), as a basic and free database, into a “Federal Sustainability Code”, to add data on the climate change impact and further sustainability data and to provide the corresponding infrastructure. Companies and other bodies could use such publicly financed data infrastructure to develop corresponding applications.
- **Focus the health insurance funds for prevention measures more on prevention in the area of food consumption and do so in an objective and evidence-based manner (recommendation addressed to: Federal Government, SHI).** The WBAE recommends that the Federal Government should work towards the health insurance funds using more of the funds spent on prevention measures for prevention in the area of food consumption and doing so in an evidence-based manner. The implementation and effect of measures should be evaluated on the basis of scientific quality standards (cf. Section 8.2.4, implementation and evaluation programme, “WIE” programme). A stronger networking of food and health policy institutions including health insurance funds, DGE, BZfE and MRI should be targeted.
- **Provide voluntary measures with clear transparency requirements and clearly defined goals (recommendation addressed to: Federal Government).** Voluntary measures should be limited to those questions where self-regulatory measures are likely to be successful (cf. Section 8.12).

The Federal Government should draw up clear guidelines for more transparency and target orientation in the dialogue process with business operators, including an accompanying external monitoring of processes and results. This should also encompass a stronger scientific focus. National platforms for action involving academia, industry, healthcare organisations and consumer associations could be a useful instrument for hybrid governance approaches, namely where they include binding and verifiable objectives and have a transparent design.

## 9.11 Financing of a policy to promote more sustainable food consumption

The previous recommendations have already listed some of the financial implications of the measures proposed for the public budgets. Table 9-1 summarises the most important additional governmental revenues and expenditures associated with the proposed measures.

**Table 9-1:** Range of the additional annual governmental revenue and expenditure associated with the most budget-relevant food and nutrition policy measures

Additional governmental revenue		Additional annual governmental revenue/expenditure	
Measure	Amount Billion euro	Measure	Amount Billion euro
Abolishing the reduced VAT rate <sup>1)</sup> for animal products	4.3 - 5.0	Reduction in VAT on fruit and vegetables from 7 % to 5 %	0.5
New excise tax on sugar-sweetened drinks	1.0 - 1.9	Compensation for lower-income households (50 euro per capita and year)	1.6
		Government-funded free school and preschool meals	approx. 5.5
		Funding of animal-friendly livestock husbandry	approx. 2 <sup>2)</sup>
<b>Total</b>	<b>5.3 - 6.9</b>	<b>Total</b>	<b>approx. 9.6</b>
<b>Financing gap</b>	<b>Additional expenditure of 9.6 billion euro minus additional revenue 5.3 billion - 6.9 billion euro = <u>2.7 - 4.3 billion euro</u></b>		

Note: <sup>1)</sup> 54% of changes in value-added tax are allocated to the Federal Government, 44% to the federal states and 2% to the municipalities; <sup>2)</sup> In its expertise on the future of socially accepted livestock husbandry, the WBA (2015) estimated the additional annual costs of a significant increase in animal welfare at around 3–5 billion euros. From the perspective of the WBAE, however, redirecting the funds of the Common Agricultural Policy is also an obvious option to finance at least part of this challenge (cf. Section 8.6.3). Against this backdrop, an exemplary additional financing contribution of 2 billion euros from the German national budget was assumed.

Source: WBAE calculations (cf. Section 8).

Abolition of the VAT concession on animal products and the introduction of an excise tax on sugar-sweetened beverages would generate additional revenue totalling about 5–7 billion euros per year, of which about 54% would be allocated to the Federal Government, about 44% to the federal states and about 2% to the municipalities.

More funds for a scaling-up of food policies could come from funds under the Prevention Act (Act on strengthening health promotion and prevention, PräVg); more of the total budget of around EUR 500 million/year could possibly be made available for healthy eating, particularly in communal catering in preschools, schools, municipalities, businesses and nursing homes. This source is not included in table 9-1, since this would not be additional government revenue but a fund transfer.

The additional annual value added and consumption tax revenue for the Federal Government and federal states would be enough to finance the recommended reduction of the value added tax on fruit, vegetables and pulses, the compensation of the 40% lowest-income households with 50 euros per capita and year, and a contribution of around 2 billion euros for the conversion to more animal-friendly livestock husbandry.

If, however, roughly 5.5 billion euros are estimated for the high annual additional expenditure of government-funded school and preschool meals, this would result in a total financing gap of 2.7 to 4.3 billion euros per year, which would have to be covered by additional tax revenue or reduced expenditure in other policy fields. In this context, one should also bear in mind that the expenses for free meals would have to be assumed by the municipalities, which raises questions of tax distribution. Pursuant to Article 104c of the Basic Law, the Federal Government should pay for a major part of the necessary structural and technical investments (one-off investments of 2.4 to 18 billion euros) over a period of five to ten years.

Table 9-1 does not include the additional costs for the public budgets resulting from the other measures proposed, e.g. the accompanying research programme on expanding school and preschool catering, the implementation of the DGE quality standards in senior-citizen institutions, hospitals and public administrations, the investments in the public drinking water supply, the expansion of monitoring, the information campaigns that need to be significantly expanded (“Too good for the bin”, labels), the establishment of “digital ecosystems”, the development of sustainability labels and the expansion of the data infrastructure of the Federal Food Code. The recommendations of the expertise hence require a significant increase in the budget for food-policy measures at different policy levels, ranging from municipalities to the Federal Government.

In economic terms, this expenditure for prevention and sustainability would be offset by considerable potential for savings. Government expenditure for school and preschool meals, for example, would substitute expenditure by parents, which would probably be higher if the opportunity costs of the time parents spend on preparing meals when their children do not eat in school or preschool were to be included. In the long term, most of the proposed measures offer great potential for reducing health care and environmental costs and for increasing physical and mental performance

and well-being. By changing their food consumption styles, in particular by reducing the consumption of animal products, consumers can also save money. On the other hand, it would require the agricultural sector – just as it would with higher levels of animal welfare – to make great adjustments in changing over to business strategies focused on value added. This process would have to be flanked by appropriate policies.

## 9.12 Conclusion

How we eat has a major impact on our individual health status, our well-being and our quality of life. Many foods have a major social, environmental, climate and animal welfare footprint. The challenges are huge. The necessary progress can only be achieved by a comprehensive transformation of today's food system.

It is more difficult to answer the question as to what greater sustainability in food consumption involves than the public often assumes. And as consumers, we are also confronted with food environments that run counter to more sustainable grocery shopping and food consumption. In this expertise, the WBAE recommends that consumers should be given much more support in achieving greater sustainability in food consumption through the design of appropriate food environments. To this end, it is first of all necessary to reduce those factors in today's prevailing food environments that are obstacles to greater sustainability in food consumption (e.g. large portion sizes, high advertising expenditure on foods with little health-promoting effects). Secondly, it is important to offer food choices that are more health-promoting and have greater social, environmental and animal-welfare compatibility, to make it easier to identify more sustainable choices, to facilitate easier access to information and to set price incentives that make it easier for consumers to opt for more sustainable choices.

The WBAE describes such food environments as fair because and insofar as they are (1) attuned to our human perception and decision-making capabilities and our behaviour; and (2) are more health-promoting and have greater social, ecological and animal-welfare compatibility and thus contribute to sustaining the livelihoods of the world's current and future generations.

The existing conditions in Germany are not very helpful as too much responsibility is given to the individual and many available support instruments are not being used. In this regard, Germany is lagging behind by European standards (cf. Section 6). Emphasising the importance of appropriate food environments thus implies that a national policy for promoting more sustainable food consumption requires significantly more and pervasive interventions, such as steering taxes. In this expertise, the WBAE provides recommendations for a number of significant steps towards fair food environments. One main starting point is to provide high-quality and free school and preschool meals.

The WBAE recommends a comprehensive reorientation and strengthening of food and nutrition policies, integrating the following four sustainability dimensions: health, social aspects, environment and animal welfare. This requires policy-makers to adopt a learning approach based on long-term, verifiable objectives. The necessary mix of instruments should be systematically tested, evaluated and adapted based on evidence. This necessitates stronger networking between the ministries (especially between the Ministry of Food and Agriculture, the Ministry of Health and the Ministry for the Environment) and at the various levels of government ranging from the municipal level to EU level, as well as the scaling-up of personnel capacities with considerable budgetary increases for food policy.

The proposed integrated food policy, with its coordinated mix of policy instruments and greater intervention intensity than hitherto, represents an important and necessary step to protect our health and environment, enhance climate stewardship, mitigate food poverty, ensure compliance with minimum social standards and enhance animal welfare. Fair food environments protect us all and benefit us all. Implementation of the recommended measures requires considerable additional government expenditure at national level. However, in relation to the current high costs of our present food consumption for society and individuals, and the expected high (follow-up) costs in the future, this additional expenditure represents a worthwhile investment in our society as a whole. Postponing the necessary reorientation would exacerbate both the problems to be addressed and the need for adjustment. The analysis presented in this expertise shows:

**A comprehensive transformation of the food system is meaningful, feasible and should begin without delay.**

## Literature

- Ackermann P (1977) Landwirtschaftliche Interessenpolitik in der Bundesrepublik. Organisationsstruktur – Adressaten – Erfolgsbedingungen. *Der Bürger im Staat* 27/4: 298-301.
- Ackermann P (1982) Interessendurchsetzung: Das Beispiel des Deutschen Bauernverbandes (DBV). *Sozialwissenschaftliche Informationen* 11/1: 29-36.
- Adams M, Effertz T (2009) Höhere Steuern auf Alkohol. *ifo Schnelldienst* 19/2009: 14-19.
- AfD (2017) Programm für Deutschland: Wahlprogramm der Alternative für Deutschland für die Wahl zum Deutschen Bundestag am 24. September 2017, Berlin.  
[https://www.bundestagswahl-bw.de/wahlprogramme\\_btwahl2017.html](https://www.bundestagswahl-bw.de/wahlprogramme_btwahl2017.html)  
(letzter Zugriff: 19.12.2019).
- AfD Baden-Württemberg (o.J.) Für unser Land – für unsere Werte: Landtagswahlprogramm 2016 der AfD Baden-Württemberg, Stuttgart.  
<https://www.landtagswahl-bw.de/wahlprogramme.html> (letzter Zugriff: 19.12.2019).
- AfD Mecklenburg-Vorpommern (2015) Wahlprogramm der Alternative für Deutschland Mecklenburg-Vorpommern zur Landtagswahl 2016.  
<https://www.abgeordnetenwatch.de/mecklenburg-vorpommern/wahlprogramme>  
(letzter Zugriff: 19.12.2019).
- Agnew DJ, Pearce J, Pramod G, Peatman T, Watson R, Beddington JR, Pitcher TJ (2009) Estimating the worldwide extent of illegal fishing. *PLOS ONE* 4(2): e4570. Doi: 10.1371/journal.pone.0004570.
- Agnoli C, Baroni L, Bertini I, Ciappellano S, Fabbri A, Papa M, Pellegrini N, Sbarbati R, Scarino ML, Siani V, Sieri S (2017) Position paper on vegetarian diets from the working group of the Italian Society of Human nutrition. *Nutrition, Metabolism & Cardiovascular Diseases* 27(12): 1037-1052. Doi: 10.1016/j.numecd.2017.10.020.
- AgrarBündnis (2018) Der kritische Agrarbericht 2018 Schwerpunkt Globalisierung gestalten. *AbL Bauernblatt*, Hamm.
- Ahrens W, Siani A, Adan R, Henauw S de, Eiben G, Gwozdz W, Hebestreit A, Hunsberger M, Kaprio J, Krogh V, Lissner L, Molnár D, Moreno LA, Page A, Picó C, Reisch L, Smith RM, Tornaritis M, Veidebaum T, Williams G, Pohlabeln H, Pigeot I, I.Family consortium (2017) Cohort profile: The transition from childhood to adolescence in European children – How I.Family extends the IDEFICS cohort. *International Journal of Epidemiology* 46(5): 1394-1395. Doi: 10.1093/ije/dyw317.
- Aiello LM, Schifanella R, Quercia D, Del Prete L (2019) Large-scale and high-resolution analysis of food purchases and health outcomes. *EPJ Data Science* 8: 14. Doi: 10.1140/epjds/s13688-019-0191-y.
- AIJN (European Fruit Juice Association) (2018) Liquid fruit market report 2018, Brussels.
- Akerlof GA (1970) The market for „lemons“: Quality uncertainty and the market mechanism. *The Quarterly Journal of Economics* 84(3): 488-500. Doi: 10.2307/1879431.
- Akkermans MD, van der Horst-Graat JM, Eussen SR, van Goudoever JB, Brus F (2016) Iron and Vitamin D deficiency in healthy young children in Western Europe despite current nutritional recommendations. *Journal of Pediatric Gastroenterology and Nutrition* 62(4): 635-642. Doi: 10.1097/MPG.0000000000001015.

- Albareda L, Lozano JM, Tencati A, Midttun A, Perrini F (2008) The changing role of governments in corporate social responsibility: Drivers and responses. *Business Ethics* 17(4): 347-363. Doi: 10.1111/j.1467-8608.2008.00539.x.
- Albrecht UV (2016) Chancen und Risiken von Gesundheits-Apps (CHARISMHA). Medizinische Hochschule Hannover. [https://www.bundesgesundheitsministerium.de/fileadmin/Dateien/3\\_Downloads/A/App-Studie/CHARISMHA\\_gesamt\\_V.01.3-20160424.pdf](https://www.bundesgesundheitsministerium.de/fileadmin/Dateien/3_Downloads/A/App-Studie/CHARISMHA_gesamt_V.01.3-20160424.pdf) (letzter Zugriff: 14.02.2020).
- Aleksandrowicz L, Green R, Joy EJM, Smith P, Haines A (2016) The impacts of dietary change on greenhouse gas emissions, land use, water use, and health: A systematic review. *PLOS ONE* 11(11): e0165797. Doi: 10.1371/journal.pone.0165797.
- Alexander P, Brown C, Arneith A, Finnigan J, Moran D, Rounsevell DA (2017) Losses, inefficiencies and waste in the global food system. *Agricultural Systems* 153: 190-200. Doi: 10.1016/j.agsy.2017.01.014.
- Alexander DD, Weed DL, Miller PE, Mohamed MA (2015) Red meat and colorectal cancer: A quantitative update on the state of the epidemiologic science. *Journal of the American College of Nutrition* 34: 521-543. Doi: 10.1080/07315724.2014.992553.
- Alex-Petersen J, Lundborg P, Rooth DO (2017) Long-term effects of childhood nutrition: Evidence from a school lunch reform. Institute of Labor Economics (IZA) Discussion Paper Series, IZA DP No. 11234.
- Alkire S (2002) Dimensions of human development. *World Development* 30(2): 181-205. Doi: 10.1016/S0305-750X(01)00109-7.
- Allen T, Prosperi P, Cogill B (2014) Metrics of sustainable diets and food systems. Workshop Report. Bioversity International & CIHEAM-IAMM. Montpellier, France. <https://www.bioversityinternational.org> (letzter Zugriff: 13.12.2019).
- Almeida C, Vaz S, Ziegler F (2015) Environmental life cycle assessment of a canned sardine product from Portugal. *Journal of Industrial Ecology* 19: 607-617. Doi: 10.1111/jiec.12219.
- Alouki K, Delisle H, Bermúdez-Tamayo C, Johri M (2016) Lifestyle interventions to prevent type 2 diabetes: A systematic review of economic evaluation studies. *Journal of Diabetes Research* 2016: 2159890. Doi: 10.1155/2016/2159890.
- Alston JM, MacEwan JP, Okrent AM (2016) The economics of obesity and related policy. *Annual Review of Resource Economics* 8: 443-465. Doi: 10.1146/annurev-resource-100815-095213.
- AMI (Agrarmarkt Informations-Gesellschaft mbH) (2019) Umsätze mit Biolebensmitteln dynamisch. <https://www.oekolandbau.de/handel/marktinformationen/der-biomarkt/marktberichte/biomarkt-in-deutschland-legt-2018-zu/> (letzter Zugriff: 19.12.2019).
- Anderson K (2014) The intersection of trade policy, price volatility, and food security. *Annual Review of Resource Economics* 6: 513-532. Doi: 10.1146/annurev-resource-100913-012600.
- Andorfer VA, Liebe U (2012) Research on fair trade consumption – A review. *Journal of Business Ethics* 106(4): 415-435. Doi: 10.1007/s10551-011-1008-5.
- Andreß HJ (2008) Lebensstandard und Armut – Ein Messmodell. In: Groenemeyer A, Wieseler S (Hrsg.) *Soziologie sozialer Probleme und sozialer Kontrolle. Realitäten, Repräsentation und Politik.* Springer VS, Wiesbaden: 473-487.
- Andreyeva T, Long MW, Brownell KD (2010) The impact of food prices on consumption: A systematic review of research on the price elasticity of demand for food. *American Journal of Public Health* 100(2): 216-222. Doi: 10.2105/AJPH.2008.151415.

- Annaheim J, Jungbluth N, Meili C (2018) Ökobilanz von Haus- und Heimtieren. ESU Services GmbH, Schaffhausen. Doi: 10.13140/RG.2.2.35878.98882.
- Anschütz M (2015) Betriebswirtschaftliche Untersuchungen an Betrieben mit Solidarischer Landwirtschaft. Bachelorarbeit, Universität Kassel/Witzenhausen, Fachbereich Ökologische Agrarwissenschaften, Kassel.
- Antão EM, Wagner-Ahlf C (2018) Antibiotikaresistenz. Eine gesellschaftliche Herausforderung. Bundesgesundheitsblatt 61(5): 499-506. Doi: 10.1007/s00103-018-2726-y.
- Arbit N, Ruby M, Sproesser G, Renner B, Schupp H, Rozin P (2017) Spheres of moral concern, moral engagement, and food choice in the USA and Germany. *Food Quality and Preference* 62: 38-45. Doi: 10.1016/j.foodqual.2017.06.018.
- Arden M, Awater-Esper S (2020) Tierwohl Finanzierung: „Die neue Initiative Tierwohl ist eine Jahrhundertchance“. TopAgrar online, 16.01.2020. <https://www.topagrar.com/schwein/news/initiative-tierwohl-ist-jahrhundertchance-11957161.html> (letzter Zugriff: 20.01.2020).
- Arens-Azevedo U, Labrenz H (2008) Bundesweite Strukturanalyse Schulverpflegung. Im Auftrag der CMA. Abschlussbericht, Hamburg.
- Arens-Azevedo U, Pfannes U, Tecklenburg E (2014) Is(s)t KiTa gut? KiTa-Verpflegung in Deutschland: Status quo und Handlungsbedarfe. Studie im Auftrag der Bertelsmann Stiftung, Gütersloh.
- Arens-Azevedo U, Schillmöller Z, Hesse I, Paetzelt G, Roos-Bugiel J (2015) Qualität der Schulverpflegung – Bundesweite Erhebung, Abschlussbericht. Bundesministerium für Ernährung und Landwirtschaft, Berlin.
- Arens-Azevedo U, Tecklenburg ME, Häusler M, Pfannes U (2016) Verpflegung in Kindertageseinrichtungen (VeKiTa): Ernährungssituation, Bekanntheitsgrad und Implementierung des DGE-Qualitätsstandards. In: Deutsche Gesellschaft für Ernährung e.V. (Hrsg.) 13. DGE-Ernährungsbericht, Bonn: 103-160.
- Arens-Azevedo U, Wollmann C (2012) Situation, Qualität und Zufriedenheit mit dem Angebot von „Essen auf Rädern“. In: Deutsche Gesellschaft für Ernährung (DGE) (Hrsg.) Ernährungsbericht 2012, Bonn: 189-235.
- Ares G, Varela F, Machin L, Antúnez L, Giménez A, Curutchet MR, Aschemann-Witzel J (2018) Comparative performance of three interpretative front-of-pack nutrition labelling schemes: Insights for policy making, *Food Quality and Preference* 68: 215-225. Doi: 10.1016/j.foodqual.2018.03.007.
- Aschemann-Witzel J, Bech-Larsen T, Capacci S (2016) Do target groups appreciate being targeted? An exploration of healthy eating policy acceptance. *Journal of Consumer Policy* 39(3): 285-306. Doi: 10.1007/s10603-016-9327-7.
- Asioli D, Aschemann-Witzel J, Caputo V, Vecchio R, Annunziata A, Næs T, Varela P (2017) Making sense of the „clean label“ trends: A review of consumer food choice behavior and discussion of industry implications. *Food Research International* 99(1): 58-71. Doi: 10.1016/j.foodres.2017.07.022.
- Astbury CC, Penney TL, Adams J (2019) Home-prepared food, dietary quality and socio-demographic factors: A cross-sectional analysis of the UK national diet and nutrition survey 2008–16. *International Journal of Behavioral Nutrition and Physical Activity* 16(1): 82. Doi: 10.1186/s12966-019-0846-x.

- Atzberger M, Sauerwein S, Chini B, Stähler B (2015) Energieeffizienz im Einzelhandel. Analyse des Gebäudebestands und seiner energetischen Situation, Studie im Auftrag der DENA. [https://effizienzgebaeude.dena.de/fileadmin/dena/Dokumente/Pdf/9133\\_\\_Energieeffizienz\\_im\\_Einzelhandel.\\_Analyse\\_des\\_Gebaeudebestands\\_und\\_seiner.pdf](https://effizienzgebaeude.dena.de/fileadmin/dena/Dokumente/Pdf/9133__Energieeffizienz_im_Einzelhandel._Analyse_des_Gebaeudebestands_und_seiner.pdf) (letzter Zugriff: 13.12.2019).
- Auerbach BJ, Dibey S, Vallila-Buchman P, Kratz M, Krieger J (2018) Review of 100% fruit juice and chronic health conditions: Implications for sugar-sweetened beverage policy. *Advances in Nutrition* 9(2): 78-85. Doi: 10.1093/advances/nmx006.
- Aune D, Keum N, Giovannucci E, Fadnes LT, Boffetta P, Greenwood DC, Tonstad S, Vatten LJ, Riboli E, Norat T (2016) Whole grain consumption and risk of cardiovascular disease, cancer and all causes and cause specific mortality. A systematic review and dose response meta-analysis of prospective studies *BMJ* 353: i2716. Doi: 10.1136/bmj.i2716.
- Autorengruppe Bildungsberichterstattung (Hrsg.) (2018) Bildung in Deutschland 2018. Ein indikatorengestützter Bericht mit einer Analyse zu Wirkungen und Erträgen von Bildung. Doi: 10.3278/6001820fw.
- Avadí A, Bolaños C, Sandoval I, Ycaza C (2015) Life cycle assessment of Ecuadorian processed tuna. *The International Journal of Life Cycle Assessment* 20: 1415-1428. Doi: 10.1007/s11367-015-0943-2.
- Awater-Esper S (2016) China will den Fleischkonsum seiner Bevölkerung halbieren. *TopAgrar* vom 29.06.2016. <https://www.topagrar.com/management-und-politik/news/china-will-den-fleischkonsum-seiner-bevoelkerung-halbieren-9594698.html> (letzter Zugriff: 10.01.2020).
- Ayuya OI, Gido EO, Bett HK, Lagat JK, Kahi AK, Bauer S (2015) Effect of certified organic production systems on poverty among smallholder farmers: Empirical evidence from Kenya. *World Development* 67: 27-37. Doi: 10.1016/j.worlddev.2014.10.005.
- Bach S (2011) Der Mehrwertsteuer-Bonus: Eine Alternative zu ermäßigten Mehrwertsteuersätzen, *DIW Wochenbericht* Nr. 24.2011.
- Bach S, Isaak N (2017) Senkung der Mehrwertsteuer entlastet untere und mittlere Einkommen am stärksten, *DIW Wochenbericht* Nr. 31.2017.
- Bach S, Isaak N, Kemfert C, Kunert U, Schill WP, Wäger N, Zaklan A (2019) Für eine sozialverträgliche CO<sub>2</sub>-Bepreisung. Forschungsvorhaben „CO<sub>2</sub>-Bepreisung im Wärme- und Verkehrssektor: Diskussion von Wirkungen und alternativen Entlastungsoptionen“ im Auftrag des Bundesministeriums für Umwelt, Naturschutz und nukleare Sicherheit (BMU). Deutsches Institut für Wirtschaftsforschung, Juli 2019.
- Backhaus J, Breukers S, Mont O, Paukovic M, Mourik R (2012) Sustainable lifestyles: Today's facts and tomorrow's trends. UNEP/Wuppertal Institute Collaborating Centre on Sustainable Consumption and Production (CSCP). [http://www.sustainable-lifestyles.eu/fileadmin/images/content/D1.1\\_Baseline\\_Report.pdf](http://www.sustainable-lifestyles.eu/fileadmin/images/content/D1.1_Baseline_Report.pdf) (letzter Zugriff: 13.12.2019).
- Backholer K, Sarink D, Beauchamp A, Keating C, Loh V, Ball K, Martin J, Peeters A (2016) The impact of a tax on sugar-sweetened beverages according to socio-economic position: A systematic review of the evidence. *Public Health Nutrition*: 19(17): 3070-3084. Doi: 10.1017/S136898001600104X.
- Badgley C, Moghtader J, Quintero E, Zakem E, Chappell MJ, Avilés-Vázquez K, Samulon A, Perfecto I (2007) Organic agriculture and the global food supply. *Renewable Agriculture and Food Systems* 22(2): 86-108. Doi: 10.1017/S1742170507001640.

- Bailey R, Harper DR (2015) Reviewing interventions for healthy and sustainable diets. Chatham House Research Paper, London.
- Bakery BP, Benbrook CM, Groth I, Benbrook LK (2002) Pesticide residues in conventional, integrated pest management (IPM)-grown and organic foods: Insights from three US data sets. *Food Additives and Contaminants* 19(5): 427-446. Doi: 10.1080/02652030110113799.
- Banerjee A, Mullainathan S (2010) The shape of temptation: Implications for the economic lives of the poor. NBER Working Paper No. 15973, May 2010.
- Bangsa AB, Schlegelmilch BB (2020) Linking sustainable product attributes and consumer decision-making: Insights from a systematic review. *Journal of Cleaner Production* 245: 118902. Doi: 10.1016/j.jclepro.2019.118902.
- Banse M, Sturm V (2019) Preissetzung auf agrarrelevante THG-Emissionen auf der Produktions- vs. Konsumseite: Was bringt mehr? In: Landwirtschaftliche Rentenbank (Hrsg.) Herausforderung Klimawandel: Auswirkungen auf die Landwirtschaft und Anpassungsstrategien. Schriftenreihe der Rentenbank Nr. 35: 7-42.
- Bar T, Zheng Y (2018) Choosing certifiers: Evidence from the British Retail Consortium Food Safety Standard. *American Journal of Agricultural Economics* 101(1): 74-88. Doi: 10.1093/ajae/aay024.
- Barański M, Rempelos L, Iversen PO, Leifert C (2017) Effects of organic food consumption on human health; the jury is still out! *Food & Nutrition Research* 61(1): 1-5. Doi: 10.1080/16546628.2017.1287333.
- Barański M, Srednicka-Tober D, Volakakis N, Seal C, Sanderson R, Stewart GB, Benbrook C, Biavati B, Markellou E, Giotis C, Gromadzka-Ostrowska J, Rembiałkowska E, Skwarło-Sońta K, Tahvonnen R, Janovská D, Niggli U, Nicot P, Leifert C (2014) Higher antioxidant and lower cadmium concentrations and lower incidence of pesticide residues in organically grown crops. A systematic literature review and meta-analyses. *British Journal of Nutrition* 112(5): 794-811. Doi: 10.1017/S0007114514001366.
- Barclay K, Miller A (2018) The sustainable seafood movement is a governance concert, with the audience playing a key role. *Sustainability* 10(1): 1-20. Doi: 10.3390/su10010180.
- Barlösius E (2014) *Dicksein. Wenn der Körper das Verhältnis zur Gesellschaft bestimmt*. Campus, Frankfurt am Main, New York.
- Barlösius E (2016) *Soziologie des Essens. Eine sozial- und kulturwissenschaftliche Einführung in die Ernährungsforschung*, 3. durchgesehene Auflage. Beltz Juventa, Weinheim und Basel.
- Barnard ND, Willett WC, Ding EL (2017) The misuse of meta-analysis in nutrition research. *JAMA* 318(15): 1435-1436. Doi: 10.1001/jama.2017.12083.
- Barrio P, Reynolds J, García-Altés A, Gual A, Anderson P (2017) Social costs of illegal drugs, alcohol and tobacco in the European Union: A systematic review. *Drug and Alcohol Review* 36: 578-588. Doi: 10.1111/dar.12504.
- Bartsch S, Büning-Fesel M, Cremer M, Heindl I, Lambeck A, Lührmann P, Oepping A, Rademacher C, Schulz-Greve S (2013) Ernährungsbildung – Standort und Perspektiven. Position der Fachgruppe Ernährungsbildung der DGE. *Ernährungsumschau* 2: M84-M95. Doi: 10.4455/eu.2013.007.
- Basen T (2016) Auswirkungen des Klimawandels auf die Fische. *AUF AUF* 2/2016: 26-31. [www.researchgate.net/publication/306039508](http://www.researchgate.net/publication/306039508) (letzter Zugriff: 13.12.2019).

- Basen T, Ros A (2018) Wie warm darf's denn sein? Temperaturbedürfnisse der Bachforelle in Baden-Württemberg. *AUF* 1/2018: 46-50.  
<https://www.researchgate.net/publication/324910150> (letzter Zugriff: 13.12.2019).
- Bastian B, Loughnan S, Haslam N, Radke HRM (2011) Don't mind meat? The denial of mind to animals used for human consumption. *Personality and Social Psychology Bulletin* 38: 247-256.
- Baten J, Böhm A (2010) Childrens height and parental unemployment: A large scale anthropometric study on eastern Germany 1994–2006. *German Economic Review* 11(1): 1-24. Doi: 10.1111/j.1468-0475.2009.00478.x.
- Baudry J, Assmann KE, Touvier M, Allès B, Seconda L, Latino-Martel P, Ezzedine K, Galan P, Hercberg S, Lairon D, Kesse-Guyot E (2018) Association of frequency of organic food consumption with cancer risk. Findings from the NutriNet-Santé prospective cohort study. *JAMA Intern Med.* 178(12): 1597-1606. Doi: 10.1001/jamainternmed.2018.4357.
- Baughcum AE, Burklow KA, Deeks CM, Powers SW, Whitaker RC (1998) Maternal feeding practices and childhood obesity: A focus group study of low-income mothers. *Archives of Pediatrics & Adolescent Medicine* 152(10): 1010-1014. Doi: 10.1001/archpedi.152.10.1010.
- Bautista-Gallego J, Rantsiou K, Garrido-Fernández A, Cocolin L, Arroyo-López FN (2013) Salt reduction in vegetable fermentation: Reality or desire? *Journal of Food Sciences* 78(8): R1095-1100. Doi: 10.1111/1750-3841.12170.
- Bautz C (2013) „Wir können das Zünglein an der Waage sein“. Interview mit Christoph Bautz, 2. April 2013, *JUSTmag*.  
[https://web.archive.org/web/20130402154713/http://www.justmag.net/artikel\\_interview\\_christoph\\_bautz.html](https://web.archive.org/web/20130402154713/http://www.justmag.net/artikel_interview_christoph_bautz.html) (letzter Zugriff: 19.12.2019).
- Baxter J (2019) Systematic environmental assessment of end-of-life pathways for domestic refrigerators. *Journal of Cleaner Production* 208: 612-620. Doi: 10.1016/j.jclepro.2018.10.173.
- Bayerisches Landesamt für Gesundheit und Lebensmittelsicherheit (2017) Überblick zur Rückstandssituation bei Pflanzenschutzmitteln in pflanzlichen Lebensmitteln – Untersuchungsergebnisse 2017.  
[https://www.lgl.bayern.de/lebensmittel/chemie/pflanzenschutzmittel/pestizide\\_pflanzlich\\_lm/ue\\_2017\\_uebersicht.htm](https://www.lgl.bayern.de/lebensmittel/chemie/pflanzenschutzmittel/pestizide_pflanzlich_lm/ue_2017_uebersicht.htm) (letzter Zugriff: 19.12.2019).
- Bazoche P, Combris P, Giraud-Héraud E, Seabra Pinto A, Bunte F, Tsakiridou E (2014) Willingness to pay for pesticide reduction in the EU: Nothing but organic? *European Review of Agricultural Economics* 41(1): 87-109. Doi: 10.1093/erae/jbt011.
- BDI (Bundesverband der Deutschen Industrie e. V.) (Hrsg.) (2014) Verbraucherleitbild und Positionsbestimmung zum „Mündigen Verbraucher“, BDI-Publikations-Nr. 0017, Berlin.
- Becher SI, Gao H, Harrison A, Lai JC (2019) Hungry for change: The law and policy of food health labeling. *The Wake Forest Law Review*.  
<https://ssrn.com/abstract=3352241> (letzter Zugriff: 10.01.2020).
- Becker I (2012) Finanzielle Mindestsicherung und Bedürftigkeit im Alter. *Zeitschrift für Sozialreform* 58(2): 123-148. Doi: 10.1515/zsr-2012-0203.

- Becker I (2016a) Regelbedarfsbemessung – Methodisch konsistente Berechnungen auf Basis der EVS 2013 unter Berücksichtigung von normativen Vorgaben der Diakonie Deutschland. Projektbericht im Auftrag der Diakonie Deutschland - Evangelischer Bundesverband.  
[https://www.diakonie.de/fileadmin/user\\_upload/Becker\\_11\\_2016\\_Gutachten\\_Regelbedarfsbemessung.pdf](https://www.diakonie.de/fileadmin/user_upload/Becker_11_2016_Gutachten_Regelbedarfsbemessung.pdf) (letzter Zugriff: 06.12.2019).
- Becker J (2016b) Grundwissen Verkehrsökologie: Grundlagen, Handlungsfelder und Maßnahmen für die Verkehrswende. Oekom-Verlag, München.
- Beckmann V, Tiemann S, Reuter K, Hagedorn K (2003) Kosten der Erreichung von Umweltqualitätszielen in ausgewählten Regionen durch Umstellung auf Ökologischen Landbau im Vergleich zu anderen Agrarumweltmaßnahmen unter besonderer Berücksichtigung von Administrations- und Kontrollkosten. Bundesanstalt für Landwirtschaft und Ernährung (BLE), Bonn.
- Bedunah DJ, Angerer JP (2012) Rangeland degradation, poverty, and conflict: How can rangeland scientists contribute to effective responses and solutions? *Rangeland Ecology & Management* 65(6): 606-612. Doi: 10.2111/REM-D-11-00155.1.
- Begley A, Paynter E, Butcher LM, Dhaliwal SS (2019) Effectiveness of an adult food literacy program. *Nutrients* 11(4): e797. Doi: 10.3390/nu11040797.
- Bell BG, Schellevis F, Stobberingh E, Pringle M (2014) A systematic review and meta-analysis of the effects of antibiotic consumption on antibiotic resistance. *BMC Infectious Diseases* 14: 13. Doi: 10.1186/1471-2334-14-13.
- Bellemare MF, Çakir M, Peterson HH, Novak L, Rudi J (2017) On the measurement of food waste. *American Journal of Agricultural Economics* 99(5): 1148-1158. Doi: 10.1093/ajae/aax034.
- Benoît-Norris C (2013) Data for social LCA. *The International Journal of Life Cycle Assessment* 19: 261-265. Doi: 10.1007/s11367-013-0644-7.
- Benton D (2015) Portion size: What we know and what we need to know. *Critical Reviews in Food Science and Nutrition* 55(7): 988-1004. Doi: 10.1080/10408398.2012.679980.
- Benz A, Lütz S, Schimank U, Simonis G (2007) Einleitung. In: Benz A, Lütz S, Schimank U, Simonis G (Hrsg.) *Handbuch Governance – Theoretische Grundlagen und empirische Handlungsfelder*. VS Verlag für Sozialwissenschaften, Wiesbaden: 1-25.
- Bergallo P, Castagnari V, Fernández A, Mejía R (2018) Regulatory initiatives to reduce sugar-sweetened beverages (SSBs) in Latin America. *PLOS ONE* 13(10): e0205694. Doi: 10.1371/journal.pone.0205694.
- Berkemeyer N (2015) Ausbau von Ganztagschulen Regelungen und Umsetzungsstrategien in den Bundesländern. Studie im Auftrag der Bertelsmann Stiftung, Gütersloh.
- Berkhout PHG, Muskens JC, Velthuisen JW (2000) Defining the rebound effect. *Energy Policy* 28(6-7): 425-432. Doi: 10.1016/S0301-4215(00)00022-7.
- Berliner Senat (2016) Berlin führt Qualitätskontrollstelle Schulessen ein. Pressemitteilung vom 27.09.2016. <https://www.berlin.de/rbmskzl/aktuelles/pressemitteilungen/2016/pressemitteilung.520703.php> (letzter Zugriff: 19.12.2019).
- Bernauer T, Meins E (2003) Technological revolution meets policy and the market: Explaining cross-national differences in agricultural biotechnology regulation. *European Journal of Political Research* 42(5): 643-683. Doi: 10.1111/1475-6765.00099.
- Bertelsmann Stiftung (2016) Factsheet Kinderarmut. Kinder im SGB-II-Bezug in Deutschland, Gütersloh.

- Bertelsmann Stiftung (2018a) ElternZoom 2018. Schwerpunkt: Elternbeteiligung an der KiTa-Finanzierung, Gütersloh.
- Bertelsmann Stiftung (2018b) Kommt das Geld bei den Kindern an? November 2018, Gütersloh.
- Bertling J, Bertling R, Hamann L (2018) Kunststoffe in der Umwelt: Mikro- und Makroplastik. Ursachen, Mengen, Umweltschicksale, Wirkungen, Lösungsansätze, Empfehlungen. Kurzfassung der Konsortialstudie. Fraunhofer-Institut für Umwelt-, Sicherheits- und Energietechnik, Oberhausen.
- Best H (2008) Organic agriculture and the conventionalization hypothesis: A case study from West Germany. *Agriculture and Human Values* 25: 95-106. Doi: 10.1007/s10460-007-9073-1.
- BfR (Bundesinstitut für Risikobewertung) (2004) Quecksilber und Methylquecksilber in Fischen und Fischprodukten – Bewertung durch die EFSA. Stellungnahme des BfR vom 29. März 2004.
- BfR (Bundesinstitut für Risikobewertung) (2015a) Antibiotikaresistenz in Nutztierbeständen und Lebensmitteln – Ihre Bedeutung für die Humanmedizin und Handlungsoptionen für das Risikomanagement. BfR-Mitteilung Nr. 003/2015 vom 22. Januar 2015.  
<https://mobil.bfr.bund.de/cm/343/antibiotikaresistenz-in-nutztierbestaenden-und-lebensmitteln-ihr-bedeutung-fuer-die-humanmedizin-und-handlungsoptionen-fuer-das-risikomanagement.pdf> (letzter Zugriff: 06.12.2019).
- BfR (Bundesinstitut für Risikobewertung) (2015b) EU-Höchstgehalte für anorganisches Arsen in Reis und Reisprodukten durch Verzehrsempfehlungen zum Schutz von Säuglingen, Kleinkindern und Kindern ergänzen. Aktualisierte Stellungnahme Nr. 017/2015 des BfR vom 06. Februar 2014.
- BfR (Bundesinstitut für Risikobewertung) (2019a) BfR-Verbrauchermonitor 08/2019.  
<https://www.bfr.bund.de/cm/350/bfr-verbrauchermonitor-08-2019.pdf> (letzter Zugriff: 13.03.2019).
- BfR (Bundesinstitut für Risikobewertung) (2019b) Total Diet Study. [https://www.bfr.bund.de/de/a-z\\_index/total\\_diet\\_study-188810.html](https://www.bfr.bund.de/de/a-z_index/total_diet_study-188810.html) (letzter Zugriff: 06.12.2019).
- BfR, MRI, RKI (Bundesinstitut für Risikobewertung, Max Rubner-Institut, Robert Koch-Institut) (2011) Blutdrucksenkung durch weniger Salz in Lebensmitteln. Stellungnahme Nr. 007/2012 des BfR, MRI und RKI vom 19. Oktober 2011.
- Bhatia R, Jones P, Reicker Z (2011) Competitive foods, discrimination, and participation in the National School Lunch Program. *American Journal of Public Health* 101(8): 1380-1386.  
Doi: 10.2105/AJPH.2011.300134.
- Biermann G, Geist J (2019) Life cycle assessment of common carp (*Cyprinus carpio* L.) – A comparison of the environmental impacts of conventional and organic carp aquaculture in Germany. *Aquaculture* 501: 404-415. Doi: 10.1016/j.aquaculture.2018.10.019.
- Biernat L, Taube F, Loges R, Kluß C, Reinsch T (2020) Nitrous oxide emissions and methane uptake from organic and conventionally managed arable crop rotations on farms in northwest Germany. *Sustainability* 12: 3240. Doi: 10.3390/su12083240.
- Biesalski HK (2013) *Hidden Hunger*. Springer, New York.
- Biesalski HK (2016) The 1000 day window and cognitive development. In: Biesalski, HK, Black R. (eds.) *Hidden hunger. Malnutrition and the first 1,000 days of life: Causes, consequences and solutions*. *World Review of Nutrition and Dietetics* 115: 1-15. Doi: 10.1159/000442377.
- Biesalski Hk, Black R, Koletzko B (eds.) 2016) *Hidden hunger and the 1000 day window*. Karger, Basel.

- Biesalski HK, Meyer T (2017) Nahrungsmittelintoleranzen und -allergien im Fußball: Angemessenes diagnostisches Vorgehen, therapeutische Konsequenzen und Gefahren durch Überdiagnostik. Deutscher Fußball-Bund, Frankfurt / Main.
- Biesalski HK, Tinz J (2018) Micronutrients in the life cycle: Requirements and sufficient supply. *NFS Journal* 11: 1-11. Doi: 10.1016/j.nfs.2018.03.001.
- Bilharz M (2010) „Key Points“ nachhaltigen Konsums. Ein strukturpolitisch fundierter Strategieansatz für die Nachhaltigkeitskommunikation im Kontext aktivierender Verbraucherpolitik. 2. Auflage, Metropolis-Verlag, Marburg.
- Bilharz M, Fricke V, Schrader U (2011) Wider die Bagatellisierung der Konsumentenverantwortung. *GAIA* 20(1): 9-13. Doi: 10.14512/gaia.20.1.3.
- Billingsley HE, Carbone S, Lavie CJ (2018) Dietary fats and chronic noncommunicable diseases. *Nutrients* 10(10): e1385. Doi: 10.3390/nu10101385.
- Bilstein F (2019) What reduces our personal CO2 footprint? We have no clue! <https://www.linkedin.com/pulse/what-reduces-our-personal-co2-footprint-we-have-clue-frank-bilstein/> (letzter Zugriff: 13.12.2019).
- Bingli CC, van der Voort JR, Grofelnik K, Eliasdottir HG, Klöss I, Perez-Cueto FJA (2019) Which diet has the least environmental impact on our planet? A systematic review of vegan, vegetarian and omnivorous diets. *Sustainability* 11(15): 4110. Doi: 10.3390/su11154110.
- Bioland e. V. (2019) Bioland-Richtlinien. Fassung vom 18. März 2019. [https://www.bioland.de/fileadmin/dateien/HP\\_Dokumente/Richtlinien/Bioland\\_Richtlinien\\_18\\_Maerz\\_2019.pdf](https://www.bioland.de/fileadmin/dateien/HP_Dokumente/Richtlinien/Bioland_Richtlinien_18_Maerz_2019.pdf) (letzter Zugriff: 13.12.2019).
- Birch LL (1980) Effects of peer models' food choices and eating behaviors on preschoolers' food preferences. *Child Development* 51(2): 489-496. Doi: 10.2307/1129283
- Birch LL, Zimmerman SI, Hind H (1980) The influence of social-affective context on the formation of children's food preferences. *Child development* 51(3): 856-861. Doi: 10.2307/1129474.
- Birkenberg A, Birner R (2018) The world's first carbon neutral coffee: Lessons on certification and innovation from a pioneer case in Costa Rica. *Journal of Cleaner Production* 189: 485-501. Doi: 10.1016/j.jclepro.2018.03.226.
- Birkey RN, Guidry RP, Islam MA, Patten DM (2018) Mandated social disclosure: An analysis of the response to the California Transparency in Supply Chains Act of 2010. *Journal of Business Ethics* 152: 827-841. Doi: 10.1007/s10551-016-3364-7.
- Birner R (2019) Ernährungssicherung und Landwirtschaft, Natur - Wissenschaft – Gesellschaft: Rückblick und Ausblick nach zehn Jahren Nationale Akademie der Wissenschaften. In: Hacker J (Hrsg.) *Nova Acta Leopoldina, Neue Folge, Nummer 424, Wissenschaftliche Verlagsgesellschaft Stuttgart*: 77-103.
- Birner R, Sekher M (2018) The devil is in the detail: Understanding the governance challenges of implementing nutrition-specific programs on a large scale. *World Review of Nutrition and Dietetics* 118: 17-44. Doi: 10.1159/000484341.
- Black AP, D'Onise K, McDermott R, Vally H, O'Dea K (2017) How effective are family based and institutional nutrition interventions in improving children's diet and health? A systematic review. *BMC Public Health* 17(1): 818. Doi: 10.1186/s12889-017-4795-5.

- BLE (Bundesanstalt für Landwirtschaft und Ernährung) (2019a) Vernetzungsstellen Schulverpflegung in den Bundesländern.  
<https://www.in-form.de/materialien/vernetzungsstellen-schulverpflegung-in-den-bundeslaendern/> (letzter Zugriff: 19.12.2019).
- BLE (Bundesanstalt für Landwirtschaft und Ernährung) (2019b) Bericht zur Markt- und Versorgungslage Zucker. Bundesanstalt für Landwirtschaft und Ernährung, Bonn.
- Blecher E, Liber AC, Drope JM, Nguyen B, Stoklosa M (2017) Global trends in the affordability of sugar-sweetened beverages, 1990-2016. *Preventing Chronic Disease* 14(5): 160406.  
Doi: 10.5888/pcd14.160406.
- Blokhuis HJ, Veissier I, Miele M, Jones B (2010) The Welfare Quality® project and beyond: Safeguarding farm animal well-being. *Acta Agriculturae Scandinavica, Section A – Animal Science* 60(3): 129-140. Doi: 10.1080/09064702.2010.523480H.
- BMAS (Bundesministerium für Arbeit und Soziales) (2017a) Lebenslagen in Deutschland. Der Fünfte Armuts- und Reichtumsbericht der Bundesregierung, Berlin.
- BMAS (Bundesministerium für Arbeit und Soziales) (2017b) Sozialbericht 2017, Stand Juli 2017, Bonn.
- BMAS (Bundesministerium für Arbeit und Soziales) (2018) Grundsicherung für Arbeitsuchende. Sozialgesetzbuch SGB II. Fragen und Antworten.  
[https://www.bmas.de/SharedDocs/Downloads/DE/PDF-Publikationen/a430-grundsicherung-fuer-arbeitsuchende-sgb-ii.pdf?\\_\\_blob=publicationFile&v=9](https://www.bmas.de/SharedDocs/Downloads/DE/PDF-Publikationen/a430-grundsicherung-fuer-arbeitsuchende-sgb-ii.pdf?__blob=publicationFile&v=9)  
(letzter Zugriff: 06.12.2019).
- BMBF (Bundesministerium für Bildung und Forschung) (2009) Gut angelegt – Das Investitionsprogramm Zukunft Bildung und Betreuung, Berlin.
- BMEL (Bundesministerium für Ernährung und Landwirtschaft) (2014) Einkaufs- und Ernährungsverhalten in Deutschland. TNS-Emnid-Umfrage des BMEL.  
<https://www.bmel.de/SharedDocs/Downloads/Umfragen/TNS-Emnid-EinkaufsErnaehrungsverhaltenInDeutschland.html> (letzter Zugriff: 13.12.2019).
- BMEL (Bundesministerium für Ernährung und Landwirtschaft) (2018) Nationale Reduktions- und Innovationsstrategie für Zucker, Fette und Salz in Fertigprodukten. Stand Dezember 2018, Berlin.
- BMEL (Bundesministerium für Ernährung und Landwirtschaft) (2019a) Haushaltsentwurf 2020 des Bundesministeriums für Ernährung und Landwirtschaft.  
[https://www.bmel.de/SharedDocs/Downloads/Presse/PM139-2019-HaushaltAnlage.pdf?\\_\\_blob=publicationFile](https://www.bmel.de/SharedDocs/Downloads/Presse/PM139-2019-HaushaltAnlage.pdf?__blob=publicationFile) (letzter Zugriff: 04.12.2019).
- BMEL (Bundesministerium für Ernährung und Landwirtschaft) (2019b) Die wirtschaftliche Lage der landwirtschaftlichen Betriebe. Buchführungsergebnisse der Testbetriebe des Wirtschaftsjahres 2017/2018, Bonn.
- BMEL (Bundesministerium für Ernährung und Landwirtschaft) (2019c) Agrarpolitischer Bericht der Bundesregierung 2019, Berlin.
- BMEL (Bundesministerium für Ernährung und Landwirtschaft) (2019d) Klöckner: „Schutz des Grundwassers geht uns alle an“ Bundesregierung legt EU-Kommission Maßnahmenkatalog zur Änderung der Düngeverordnung vor. Pressemitteilung Nr. 32 vom 01.02.2019.
- BMEL (Bundesministerium für Ernährung und Landwirtschaft) (2019e) Nitratrichtlinie: Bundesregierung sendet weitere Vorschläge zur Anpassung der Düngeverordnung nach Brüssel. Pressemitteilung Nr. 195 vom 26.09.19.

- BMEL (Bundesministerium für Ernährung und Landwirtschaft) (2019f) Nationale Strategie zur Reduzierung der Lebensmittelverschwendung, Berlin.
- BMEL (Bundesministerium für Ernährung und Landwirtschaft) (2019g) Deutschland, wie es isst. Der BMEL-Ernährungsreport 2019, Berlin.
- BMEL (Bundesministerium für Ernährung und Landwirtschaft) (2019h) Ergebnis der Verbraucherbeteiligung liegt vor: Bundesministerin Julia Klöckner wird Nutri-Score® einführen, Pressemitteilung Nr. 197 vom 30.09.19, Berlin.
- BMEL (Bundesministerium für Ernährung und Landwirtschaft) (2020) Grundsatzvereinbarung zur Reduzierung von Lebensmittelabfällen, Berlin.
- BMEL, BMG (Bundesministerium für Ernährung und Landwirtschaft, Bundesministerium für Gesundheit) (2014) IN FORM: Deutschlands Initiative für gesunde Ernährung und mehr Bewegung. Nationaler Aktionsplan zur Prävention von Fehlernährung, Bewegungsmangel, Übergewicht und damit zusammenhängenden Krankheiten, Berlin.
- BMFSFJ (Bundesministerium für Familie, Senioren, Frauen und Jugend) (2019) Bundesrat stimmt dem Starke-Familien-Gesetz zu. Für starke Familien und gegen Kinderarmut. Aktuelle Meldung vom 12.04.2019.  
<https://www.bmfsfj.de/bmfsfj/themen/familie/bundesrat-stimmt-dem-starke-familien-gesetz-zu/131328> (letzter Abruf 05.02.2020).
- BMU (Bundesministerium für Umwelt, Naturschutz und nukleare Sicherheit) (2018) Biologische Vielfalt in Deutschland. Fortschritte sichern – Herausforderungen annehmen! Rechenschaftsbericht 2017 der Bundesregierung zur Umsetzung der Nationalen Strategie zur biologischen Vielfalt, Berlin.
- BMUB, BMEL (Bundesministerien für Umwelt, Naturschutz, Bau und Reaktorsicherheit, Bundesministerium für Ernährung und Landwirtschaft) (2017) Nitratbericht 2016, Stand: Januar 2017, Bonn.
- BMZ (Bundesministerium für wirtschaftliche Zusammenarbeit und Entwicklung) (2012) Investitionen in Land und das Phänomen des „Land Grabbing“ BMZ Strategiepapier 2/2012, Bonn.
- Bødker M, Pisinger C, Toft U, Jørgensen T (2015) The rise and fall of the world's first fat tax. *Health Policy* 119: 737-742. Doi: 10.1016/j.healthpol.2015.03.003.
- Boehm R, Wilde PE, Ver Ploeg M, Costello C, Cash SB (2018) A comprehensive life cycle assessment of greenhouse gas emissions from U.S. household food choices. *Food Policy* 79: 67-76. Doi: 10.1016/j.foodpol.2018.05.004.
- Boeing & Schwingshackl L (2016) Evidenzbasierte Analyse zum Einfluss der Ernährung in der Prävention von Krebskrankheiten, Diabetes mellitus Typ 2 und kardiovaskulären Krankheiten. In: DGE (Hrsg.) 13. DGE-Ernährungsbericht: 265-313.
- Bögli S, Bickel R, Bernhard S (2017) Mineralölrückstände in Lebensmitteln – mögliche Ursachen. Studie des FIBL für den WWF Deutschland. <https://mobil.wwf.de/fileadmin/fm-wwf/Publikationen-PDF/20171207-WWF-Studie-Mineraloel.pdf> (letzter Zugriff: 06.12.2019).
- Bolhuis DP, Temme EHM, Koeman FT, Noort MWJ, Kremer S, Janssen AM (2011) A salt reduction of 50% in bread does not decrease bread consumption or increase sodium intake by the choice of sandwich fillings. *The Journal of Nutrition* 141(12): 2249-2255. Doi: 10.3945/jn.111.141366.

- BÖLW (Bund Ökologische Lebensmittelwirtschaft e. V.) (2019) Zahlen, Daten, Fakten: Die Bio-Branche 2019. [https://www.boelw.de/fileadmin/user\\_upload/Dokumente/Zahlen\\_und\\_Fakten/Broschüre\\_2019/BOELW\\_Zahlen\\_Daten\\_Fakten\\_2019\\_web.pdf](https://www.boelw.de/fileadmin/user_upload/Dokumente/Zahlen_und_Fakten/Broschüre_2019/BOELW_Zahlen_Daten_Fakten_2019_web.pdf) (letzter Zugriff: 20.02.2020).
- Bommer C, Heesemann E, Sagalova V, Manne-Goehler J, Atun R, Bärnighausen T, Vollmer S (2017) The global economic burden of diabetes in adults aged 20–79 years: A cost-of-illness study. *The Lancet Diabetes & Endocrinology* 5(6): 423-430. Doi: 10.1016/S2213-8587(17)30097-9.
- Bonaccio M, Di Castelnuovo A, Pounis G, Costanzo S, Persichillo M, Cerletti C, Donati MB, de Gaetano G, Iacoviello L (2017) High adherence to the mediterranean diet is associated with cardiovascular protection in higher but not in lower socio-economic groups: Prospective findings from the Moli-sani-Study. *International Journal of Epidemiology* 46(5): 1478-1487. Doi: 10.1093/ije/dyx145.
- Boogaard BK, Bock BB, Oosting SJ, Wiskerke JSC, van der Zijpp AJ (2011) Social acceptance of dairy farming: The ambivalence between the two faces of modernity. *Journal of Agricultural and Environmental Ethics* 24(3): 259-282. Doi: 10/fppzkk
- Borga M, West J, Bell JD, Harvey NC, Romu T, Heymsfield SB, Leinhard OD (2018) Advanced body composition assessment: From body mass index to body composition profiling. *Journal of Investigative Medicine* 66(5): 887-895. Doi: 10.1136/jim-2018-000722.
- Born B, Purcell M (2006) Avoiding the local trap. Scale and food systems in planning research. *Journal of Planning Education and Research* 26(2): 195-207. Doi: 10.1177/0739456X06291389.
- Borrmann A (2016) Determinanten des Kochverhaltens und der Zusammenhang zwischen selbst zubereiteten Mahlzeiten und dem Lebensmittelkonsum von Erwachsenen in Deutschland. Master-Arbeit, Institut für Ernährungswirtschaft und Verbrauchslehre, Christian-Albrechts-Universität zu Kiel. Doi: 10.25646/5352.
- Borrmann A, Mensink G (2016) Kochhäufigkeit in Deutschland. *Journal of Health Monitoring* 1(2): 43-49. Doi: 10.17886/RKI-GBE-2016-037.
- Bos C, van der Lans I, van Rijnsoever F, van Trijp H (2015) Consumer acceptance of population-level intervention strategies for healthy food choices: The role of perceived effectiveness and perceived fairness. *Nutrients* 7: 7842-7862. Doi: 10.3390/nu7095370.
- Bossert L (2014) Tierethik. Die verschiedenen Positionen und ihre Auswirkungen auf die Mensch-nicht-menschliche Tier-Beziehung. In: Voget-Kleschin L, Bossert L, Ott K (Hrsg.) *Nachhaltige Lebensstile – Welchen Beitrag kann ein bewusster Fleischkonsum zu mehr Naturschutz, Klimaschutz und Gesundheit leisten?* Metropolis, Marburg: 32-57.
- Bossert L (2015) *Wildtierethik. Verpflichtungen gegenüber wildlebenden Tieren.* Nomos, Baden-Baden.
- Bouvard V, Loomis D, Guyton KZ, Grosse Y, Ghissassi FE, Benbrahim-Tallaa L, Guha N, Mattock H, Straif K (2015) Carcinogenicity of consumption of red and processed meat. *The Lancet Oncology* 16: 1599-600. Doi: 10.1016/S1470-2045(15)00444-1.
- Bouwman AF, Beusen AHW, Griffioen J, van Groenigen JW, Hefting MM, Oenema O, van Puijenbroek PJTM, Seitzinger S, Slomp CP, Stehfest E (2013) Global trends and uncertainties in terrestrial denitrification and N<sub>2</sub>O emissions. *Philosophical Transactions of the Royal Society B* 368: 20130112. Doi: 10.1098/rstb.2013.0112.
- Bovay J, Zhang W (2019) A Century of profligacy? The measurement and evolution of food waste. *Agricultural and Resource Economics Review*. Doi: 10.1017/age.2019.16.
- Bowman MS, Zilberman D (2013) Economic factors affecting diversified farming systems. *Ecology and Society* 18(1). <https://www.jstor.org/stable/26269286>.

- Boyland EJ, Nolan S, Kelly B, Tudur-Smith C, Jones A, Halford JCG, Robinson E (2016) Advertising as a cue to consume: A systematic review and meta-analysis of the effects of acute exposure to unhealthy food and nonalcoholic beverage advertising on intake in children and adults. *American Journal of Clinical Nutrition* 103: 519-533. Doi: 10.3945/ajcn.115.120022.
- Boyland EJ, Whalen R (2015) Food advertising to children and its effects on diet: Review of recent prevalence and impact data. *Pediatric Diabetes* 16: 331-337. Doi: 10.1111/pedi.12278.
- Bragg MA, Roberto CA, Harris JL, Brownell KD, Elbel B (2018) Marketing food and beverages to youth through sports. *Journal of Adolescent Health* 62(1): 5-13. Doi: 10.1016/j.jadohealth.2017.06.016.
- Branca F, Lartey A, Oenema S, Aguayo V, Stordalen GA, Richardson R, Arvelo M, Afshin A (2019) Transforming the food system to fight non-communicable diseases. *British Medical Journal* 364: l296. Doi: 10.1136/bmj.l296.
- Brehme U, Kreutz J, Kroll S, Müller A, Woyke M (2018) Traumberuf Ernährungsberater. Formale Regelungen, die Berufsanfänger und Quereinsteiger kennen sollten. *Ernährung im Fokus* 03/04: 82-90.
- Breitschuh G, Eckert H, Matthes I, Strümpfel J, Bachmann G, Herold M, Breitschuh T, Gernand U (2008) Kriteriensystem nachhaltige Landwirtschaft (KSNL). Ein Verfahren zur Nachhaltigkeitsanalyse und Bewertung von Landwirtschaftsbetrieben. *KTBL-Schrift* 466, Darmstadt.
- Brewer NT (2011) Goals. In: Fischhoff B, Brewer NT, Down JS (eds.) *Communicating risks and benefits: An evidence-based user's guide*. US Department of Health and Human Services, Food and Drug Administration, Silver Spring, MD: 3-10.
- Brink C, van Grinsven H, Jacobsen B, Rabl A, Gren I, Holland M, Klimont Z, Hicks K, Brouwer R, Dickens R, Willems J, Termansen M, Velthof G, Alkemade R, van Oorschot M, Webb J (2011) Costs and benefits of nitrogen in the environment. In: Sutton MA, Howard CM, Erisman JW, Billen G, Bleeker A, Grennfelt P, van Grinsven H, Grizzetti B (eds.) *The European nitrogen assessment: Sources, effects and policy perspectives*. Cambridge: Cambridge University Press: 513-540. Doi: 10.1017/CBO9780511976988.025.
- Brink D (2016) Mill's moral and political philosophy. In: *The Stanford Encyclopedia of Philosophy* (Winter 2016 edition), zuletzt geprüft am 19.07.2017.
- British Standards Institution (2011) PAS 2050: 2011 – Specification for the assessment of the life cycle greenhouse gas emissions of goods and services, London
- Brock A (2017) Executive Summary. Verankerung von Bildung für nachhaltige Entwicklung in der Schule. Freie Universität Berlin, Institut Futur, Arbeitsstelle beim Wissenschaftlichen Berater des Weltaktionsprogramms „Bildung für nachhaltige Entwicklung“, Berlin.
- Brodthorn S, Kramer KJ, Kendall A, Feenstra G (2013) Comparing environmental impacts of regional and national-scale food supply chains. A case study of processed tomatoes. *Food Policy* 42: 106-114. Doi: 10.1016/j.foodpol.2013.07.004.
- Brombach C, Haefeli D, Bartsch S, Winkler G (2014) Ernährungsmuster im Verlauf von drei Generationen: Gibt es inter- und intraindividuelle Unterschiede? *Internationaler Arbeitskreis für Kulturforschung des Essens. Mitteilungen* 21: 12-22.
- Brot für die Welt (2017) EU-Hähnchenfleisch überschwemmt Afrikas Märkte. <https://www.brot-fuer-die-welt.de/pressemitteilung/2017-eu-haehnchenfleisch-ueberschwemmt-afrikas-maerkte/> (letzter Zugriff: 14.12.2019).

- Brown C, Miller S (2008) The impacts of local markets: A review of research on farmers markets and Community Supported Agriculture (CSA). *American Journal of Agricultural Economics* 90(5): 1296-1302. Doi: 10.1111/j.1467-8276.2008.01220.x.
- Brownell KD, Farley T, Willett WC, Popkin BM, Chaloupka FJ, Thompson JW, Ludwig DS (2009) The public health and economic benefits of taxing sugar-sweetened beverages. *The New England Journal of Medicine* 361(16): 1599-1605. Doi: 10.1056/NEJMp0905723.
- Brownell KD, Frieden TR (2009) Ounces of prevention – The public policy case for taxes on sugared beverages. *The New England Journal of Medicine* 360(18): 1805-1808. Doi: 10.1056/NEJMp0902392.
- Brückler M, Resl T, Reindl A (2017) Comparison of organic and conventional crop yields in Austria. *Die Bodenkultur: Journal of Land Management, Food and Environment* 68(4): 223-236. Doi: 10.1515/boku-2017-0018.
- Bruinsma J (2009) The resource outlook to 2050: By how much do land, water and crop yields need to increase by 2050. Paper presented at the FAO Expert Meeting, 24-26 June 2009, Rome on „How to Feed the World in 2050“. <http://www.fao.org/docrep/pdf/012/ak542e/ak542e06.pdf> (letzter Zugriff: 05.12.2019).
- Brunstrom J (2011) The control of meal size in human subjects: A role for expected satiety, expected satiation and premeal planning. *The Proceedings of the Nutrition Society* 70(2): 155-161. Doi: 10.1017/S002966511000491X.
- Bucher T, Collins C, Rollo ME, McCaffrey TA, de Vlioger N, van der Bend D, Truby H, Perez-Cueto FJ (2016) Nudging consumers towards healthier choices: A systematic review of positional influences on food choice. *British Journal of Nutrition* 115(12): 2252-2263. Doi: 10.1017/S0007114516001653.
- Bullock G, van der Ven H (2020) The shadow of the consumer: Analyzing the importance of consumers to the uptake and sophistication of ratings, certifications, and eco-labels. *Organization & Environment* 33(1). Doi: 10.1177/1086026618803748.
- Bundeskartellamt (2014) Sektoruntersuchung Lebensmitteleinzelhandel: Darstellung und Analyse der Strukturen und des Beschaffungsverhaltens auf den Märkten des Lebensmitteleinzelhandels in Deutschland, Bericht gemäß §32e GWB, Sept. 2014, Bonn.
- Bundeskartellamt (2016) Bericht über die großstädtische Trinkwasserversorgung in Deutschland, Bonn.
- Bundesrechnungshof (2016) Bemerkungen Band I Nr. 25 – Informationskampagne „Zu gut für die Tonne“ – Unzureichend vorbereitet und Erfolg nicht nachweisbar, Bonn.
- Bundesregierung (2016) Deutsche Nachhaltigkeitsstrategie. Neuauflage 2016, Berlin.
- Bundesregierung (2017) Nationaler Aktionsplan Wirtschaft und Menschenrechte. Umsetzung der VN-Leitprinzipien für Wirtschaft und Menschenrechte 2016-2020, Berlin.
- Bundesregierung (2018) Deutsche Nachhaltigkeitsstrategie. Stand 15. Oktober 2018, Berlin.
- Bundesregierung (2019) Entwurf eines Gesetzes zur Einführung und Verwendung eines Tierwohlkennzeichens (Tierwohlkennzeichengesetz – TierWKG). [https://www.bmel.de/SharedDocs/Downloads/GlaeserneGesetze/Kabinettfassung/TierWKG.pdf?\\_\\_blob=publicationFile](https://www.bmel.de/SharedDocs/Downloads/GlaeserneGesetze/Kabinettfassung/TierWKG.pdf?__blob=publicationFile) (letzter Zugriff: 10.01.2020).
- Bundesregierung (2020) Klimaschutzprogramm 2030 beschlossen. <https://www.bundesregierung.de/breg-de/themen/klimaschutz/massnahmenprogramm-klima-1679498>, (letzter Zugriff: 26.01.2020).

- Bündnis 90/Die Grünen (2013) Zeit für den grünen Wandel. Teilhaben. Einmischen. Zukunft schaffen. Bundestagswahlprogramm 2013 von BÜNDNIS 90/DIE GRÜNEN.  
[https://www.gruene.de/fileadmin/user\\_upload/Dokumente/Wahlprogramm/Wahlprogramm-barrierefrei.pdf](https://www.gruene.de/fileadmin/user_upload/Dokumente/Wahlprogramm/Wahlprogramm-barrierefrei.pdf) (letzter Zugriff: 19.07.2017).
- Bündnis 90/Die Grünen (2017) Zukunft wird aus Mut gemacht. Bundestagswahlprogramm 2017, Berlin.  
[https://www.bundestagswahl-bw.de/wahlprogramme\\_btwahl2017.html](https://www.bundestagswahl-bw.de/wahlprogramme_btwahl2017.html)  
(letzter Zugriff: 19.12.2019).
- Bündnis 90/Die Grünen Baden-Württemberg (o.J.) Grün aus Verantwortung für Baden-Württemberg – Wahlprogramm zur Landtagswahl 2016, Stuttgart.  
<https://www.landtagswahl-bw.de/wahlprogramme.html> (letzter Zugriff: 19.12.2019).
- Bündnis 90/Die Grünen Mecklenburg-Vorpommern (o. J.) Für Land und Leute. Neue Perspektiven für Mensch, Wirtschaft und Natur. Programm zur Landtagswahl 2016.  
<https://www.abgeordnetenwatch.de/mecklenburg-vorpommern/wahlprogramme>  
(letzter Zugriff: 19.12.2019).
- Bünger B, Matthey A (2019) Methodenkonvention 3.0 zur Ermittlung von Umweltkosten, Methodische Grundlagen. Umweltbundesamt, Dessau-Roßlau.
- Burgoine T, Monsivais P (2013) Characterising food environment exposure at home, at work, and along commuting journeys using data on adults in the UK. *International Journal of Behavioral Nutrition and Physical Activity* 10: 85. Doi: 10.1186/1479-5868-10-85.
- Burlingame B, Dernini S (Hrsg.) (2010) Sustainable diets and biodiversity – Directions and solutions for policy, research and action. Proceedings of the International Scientific Symposium „Biodiversity and Sustainable Diets United Against Hunger“, 3-5 November 2010, Rome.  
<http://www.fao.org/3/a-i3004e.pdf> (letzter Zugriff: 05.12.2019).
- Buschmann S, Meyer E (2013) Ökonomische Instrumente für eine Senkung des Fleischkonsums in Deutschland. Beiträge zu einer klima- und umweltgerechteren Landwirtschaft. Studie im Auftrag von Greenpeace, durchgeführt vom Forum Ökologisch-Soziale Marktwirtschaft e. V., Hamburg.
- Busetti S (2019) A theory-based evaluation of food waste policy: Evidence from Italy. *Food Policy* 88: 101749. Doi: 10.1016/j.foodpol.2019.101749.
- Bush SR, Toonen H, Oosterveer P, Mol APJ (2013) The ‘devils triangle’ of MSC certification: Balancing credibility, accessibility and continuous improvement. *Marine Policy* 37: 288-293.  
Doi: 10.1016/j.marpol.2012.05.011.
- Bütikofer A, Mølland E, Salvanes KG (2018) Childhood nutrition and labor market outcomes: Evidence from a school breakfast program. *Journal of Public Economics* 168: 62-80. Doi: 10.1016/j.jpubeco.2018.08.008.
- Buxel H (2018) Prüf- und Gütesiegel bei Lebensmitteln: Verbrauchereinstellungen, Bekanntheit und Einfluss auf die Produktwahrnehmung sowie die Kauf- und Zahlungsbereitschaft, Münster.
- BVE (Bundesvereinigung der deutschen Ernährungsindustrie) (2019) Jahresbericht 2018 | 2019, Berlin.
- BVL (Bundesamt für Verbraucherschutz und Lebensmittelsicherheit) (o. J.) Gemeinsame Zentralstelle „Kontrolle der im Internet gehandelten Erzeugnisse des LFGB und Tabakerzeugnisse“ Jahresbericht für den Zeitraum vom 01.01.2017-31.12.2017.  
[https://www.bvl.bund.de/SharedDocs/Downloads/01\\_Lebensmittel/Internethandel/Jahresbericht\\_2017\\_G@zielt.pdf?\\_\\_blob=publicationFile&v=2](https://www.bvl.bund.de/SharedDocs/Downloads/01_Lebensmittel/Internethandel/Jahresbericht_2017_G@zielt.pdf?__blob=publicationFile&v=2) (letzter Zugriff: 07.12.2019).

- BVL (Bundesamt für Verbraucherschutz und Lebensmittelsicherheit) (2016) GERMAP 2015 Antibiotika-Resistenz und -Verbrauch. Bericht über den Antibiotikaverbrauch und die Verbreitung von Antibiotikaresistenzen in der Human- und Veterinärmedizin in Deutschland, Berlin.
- BVL (Bundesamt für Verbraucherschutz und Lebensmittelsicherheit) (2018) Absatz an Pflanzenschutzmitteln in der Bundesrepublik Deutschland: Ergebnisse der Meldungen gemäß § 64 Pflanzenschutzgesetz für das Jahr 2017, Braunschweig.
- BVL (Bundesamt für Verbraucherschutz und Lebensmittelsicherheit) (2019a) Jahresbericht 2018 der Bundesrepublik Deutschland zum mehrjährigen nationalen Kontrollplan nach VO (EG) Nr. 882/2004, Berlin.
- BVL (Bundesamt für Verbraucherschutz und Lebensmittelsicherheit) (2019b) Nationale Berichterstattung „Pflanzenschutzmittelrückstände in Lebensmitteln“ Zusammenfassung der Ergebnisse des Jahres 2017 aus der Bundesrepublik Deutschland. Januar 2019, Berlin.
- BVSH (Bauernverband Schleswig-Holstein e. V.) (2019) Veränderungen gestalten im Ackerbau. Positionspapier, 22. April 2019.  
[https://www.bauern.sh/fileadmin/download/Presse/Pressemitteilungen/20190718\\_Veränderungen\\_gestalten\\_im\\_Ackerbau.pdf](https://www.bauern.sh/fileadmin/download/Presse/Pressemitteilungen/20190718_Veränderungen_gestalten_im_Ackerbau.pdf) (letzter Zugriff: 10.01.2020).
- Byerlee D, Falcon WP, Naylor RL (2016) The tropical oil crop revolution: Food, feed, fuel, and forests. Oxford University Press, New York. Doi: 10.1111/joac.12272.
- Byrd-Bredbenner C, Wu F, Spaccarotella K, Quick V, Martin-Biggers J, Zhang Y (2017) Systematic review of control groups in nutrition education intervention research. *International Journal of Behavioral Nutrition and Physical Activity* 14(1): 91. Doi: 10.1186/s12966-017-0546-3.
- Cabrera Escobar MA, Veerman JL, Tollman SM, Bertram MY, Hofman KJ (2013) Evidence that a tax on sugar sweetened beverages reduces the obesity rate: A meta-analysis, *BMC Public Health* 13: 1072. Doi: 10.1186/1471-2458-13-1072.
- Cadario R, Chandon P (2019) Which healthy eating nudges work best? A meta-analysis of field experiments. *Marketing Science*. Doi: 10.1287/mksc.2018.1128.
- Cairns G, Angus K, Hastings G (2009) The extent, nature and effects of food promotion to children: A review of the evidence to December 2008. Review prepared for the WHO. Institute for Social Marketing, University of Stirling & The Open University, United Kingdom.
- Cairns G, Angus K, Hastings G, Caraher M (2013) Systematic reviews of the evidence on the nature, extent and effects of food marketing to children. A retrospective summary. *Appetite* 62: 209-215. Doi: 10.1016/j.appet.2012.04.017.
- Caldeira C, de Laurentiis V, Corrado S, van Holsteijn F, Sala S (2019) Quantification of food waste per product group along the food supply chain in the European Union: A mass flow analysis. *Resources, Conservation & Recycling* 149: 479-488. Doi: 10.1016/j.resconrec.2019.06.011.
- Cameron AJ, Waterlander WE, Svastisalee CM (2014) The correlation between supermarket size and national obesity prevalence. *BMC Obesity* 1: 27. Doi: 10.1186/s40608-014-0027-z.
- Camilleri AR, Larrick RP, Hossain S, Patino-Echeverri D (2019) Consumers underestimate the emissions associated with food but are aided by labels. *Nature Climate Change* 9: 53-58. Doi: 10.1038/s41558-018-0354-z.
- Campact (2018) Transparenzbericht 2017. Kampagnen, Finanzen, Über uns: So wirkt Campact. <https://www.campact.de/campact/ueber-campact/transparenz/> (letzter Zugriff: 10.03.2020).

- Capacci S, Allais O, Bonnet C, Mazzocchi M (2019) The impact of the French soda tax on prices and purchases. An ex post evaluation. *PLOS ONE* 14(10): e0223196. Doi: 10.1371/journal.pone.0223196.
- Caraher M, Lang T (1999) Can't cook, won't cook: A review of cooking skills and their relevance to health promotion. *International Journal of Health Promotion and Education* 37(3): 89-100. Doi: 10.1080/14635240.1999.10806104.
- Caraher M, Perry I (2017) Sugar, salt, and the limits of self regulation in the food industry. *BMJ* 357: j1709. Doi: 10.1136/bmj.j1709.
- Carbone S, Canada JM, Billingsley HE, Siddiqui MS, Elagizi A, Lavie CJ (2019) Obesity paradox in cardiovascular disease: Where do we stand? *Vascular Health and Risk Management* 15: 89-100. Doi: 10.2147/VHRM.S168946.
- Carbone S, Mauro AG, Mezzaroma E, Kraskauskas D, Marchetti C, Buzzetti R, van Tassell B, Abbate A, Tolledo S (2015) A high-sugar and high-fat diet impairs cardiac systolic and diastolic function in mice. *International Journal of Cardiology* 198: 66-69. Doi: 10.1016/j.ijcard.2015.06.136.
- Carey R, Caraher M, Lawrence M, Friel S (2015) Opportunities and challenges in developing a whole-of-government national food and nutrition policy: Lessons from Australia's National Food Plan. *Public Health Nutrition* 19(1): 3-14. Doi: 10.1017/S1368980015001834.
- Carle R (2018) Reformulierung – Was ist lebensmitteltechnologisch möglich? *Deutsche Lebensmittelrundschau* 114: 445-454.
- Carlson KM, Heilmayr R, Gibbs HK, Noojipady P, Burns DN, Morton DC, Walker NF, Paoli GD, Kremen C (2018) Effect of oil palm sustainability certification on deforestation and fire in Indonesia. *PNAS* 115(1): 121-126. Doi: 10.1073/pnas.1704728114.
- Carlson S, Keith-Jennings B (2018) SNAP is linked with improved nutritional outcomes and lower health care costs. Center on Budget and Policy Priorities, Washington. <https://www.cbpp.org/sites/default/files/atoms/files/1-17-18fa.pdf> (letzter Zugriff: 07.12.2019).
- Caro JC, Corvalán C, Reyes M, Silva A, Popkin B, Taillie LS (2018) Chile's 2014 sugar-sweetened beverage tax and changes in prices and purchases of sugar-sweetened beverages: An observational study in an urban environment. *PLoS Medicine* 15(7): e1002597. Doi: 10.1371/journal.pmed.1002597.
- Carroll AB (1999) Corporate social responsibility: Evolution of a definitional construct. *Business and Society* 38(3): 268-295. Doi: 10.1177/000765039903800303.
- Carroll AE, Doherty TS (2019) Meat consumption and health: Food for thought. *Annals of Internal Medicine* 171(10): 767-768. Doi: 10.7326/M19-2620.
- Caruso FS (2017) Unionism of migrant farm workers: The Sindicato Obreros del Campo (SOC) in Andalusia, Spain. In: Corrado A, de Castro C, Perrotta D (eds.) *Migration and agriculture: Mobility and change in the Mediterranean area*. Routledge, London: 277-292.
- Casey AA, Elliott M, Glanz K, Haire-Joshu D, Lovegreen SL, Saelens BE, Sallis JF, Brownson, RC (2008) Impact of the food environment and physical activity environment on behaviors and weight status in rural US communities. *Preventive Medicine* 47(6): 600-604. Doi: 10.1016/j.ypmed.2008.10.001.
- Cassman K (2007) Editorial response by Kenneth Cassman: Can organic agriculture feed the world - science to the rescue. *Renewable Agriculture and Food Systems* 22(2): 83-84. Doi: 10.1017/S1742170507001871.

- Cavanagh K, Vartanian LR, Herman CP, Polivy J (2014) The effect of portion size on food intake is robust to brief education and mindfulness exercises. *Journal of Health Psychology* 19(6): 730-739. Doi: 10.1177/1359105313478645.
- Cawley J, Sweeney MJ, Sobal J, Just DR, Kaiser HM, Schulze WD, Wethington E, Wansink B (2014) The impact of a supermarket nutrition rating system on purchases of nutritious and less nutritious foods. *Public Health Nutrition* 18(1): 8-14. Doi: 10.1017/S1368980014001529.
- CDU Baden-Württemberg (o. J.) Gemeinsam Zukunft schaffen – Das Regierungsprogramm der CDU Baden-Württemberg 2016-2021, Stuttgart.  
<https://www.landtagswahl-bw.de/wahlprogramme.html> (letzter Zugriff: 19.12.2019).
- CDU Mecklenburg-Vorpommern (o. J.) „Heimat im Mittelpunkt“ Wahlprogramm der CDU Mecklenburg-Vorpommern, beschlossen auf dem 31. Landesparteitag der CDU Mecklenburg-Vorpommern am 3. Juni 2016 in Güstrow.  
<https://www.abgeordnetenwatch.de/mecklenburg-vorpommern/wahlprogramme> (letzter Zugriff: 19.12.2019).
- CDU, CSU (2017) Für ein Deutschland, in dem wir gut und gerne leben. Regierungsprogramm 2017-2021, Berlin. [https://www.bundestagswahl-bw.de/wahlprogramme\\_btwahl2017.html](https://www.bundestagswahl-bw.de/wahlprogramme_btwahl2017.html) (letzter Zugriff: 19.12.2019).
- CDU, CSU, SPD (2018) Ein neuer Aufbruch für Europa. Eine neue Dynamik für Deutschland. Ein neuer Zusammenhalt für unser Land. Koalitionsvertrag zwischen CDU, CSU und SPD. Koalitionsvertrag der 19. Legislaturperiode vom 12. März 2018, Berlin.
- Cecchini M, Warin L (2016) Impact of food labelling systems on food choices and eating behaviours: A systematic review and meta-analysis of randomized studies. *Obesity reviews* 17(3): 201-210. Doi: 10.1111/obr.1.
- Cederholm T, Nouvenne A, Ticinesi A, Maggio M, Lauretani F, Ceda GP, Borghi L, Meschi T (2014) The role of malnutrition in older persons with mobility limitations. *Current Pharmaceutical Design* 20(19): 3173-3177. Doi: 10.2174/13816128113196660689.
- Celikates R, Gosepath S (2013) Politische Philosophie. Reclams Universal-Bibliothek, 18473, Stuttgart.
- CEO (Corporate Europe Observatory) (2012) The International Life Sciences Institute (ILSI), a corporate lobby group. European Parliament report on EFSA budget rightfully judges links to ILSO as conflicts of interest. <https://corporateeurope.org/sites/default/files/ilsi-article-final.pdf> (letzter Zugriff: 19.12.2019).
- Cernansky R (2018) Rethinking baby food pouches: They are so convenient – But experts say they can be a gateway to bad eating habits. *The New York Times*.  
<https://www.nytimes.com/2018/06/19/well/rethinking-baby-food-pouches.html> (letzter Zugriff: 04.12.2019).
- Cerri CEP, You X, Cherubin MR, Moreira CS, Raucci GS, Almeida de Castigioni B, Alves PA, Cerri DGP, de Castro Mello FF, Cerri CC (2017) Assessing the greenhouse gas emissions of Brazilian soybean biodiesel production. *PLOS ONE* 12(5): e0176948. Doi: 10.1371/journal.pone.0176948.
- CEval GmbH (2018) Verbraucher\*innenbefragung des Forum Fairer Handel 2018, Ergebnisdarstellung, [http://www.forum-fairer-handel.de/fileadmin/user\\_upload/dateien/fairer\\_handel/zahlen\\_fakten/2018\\_Bericht\\_Verbraucherbefragung\\_2018.pdf](http://www.forum-fairer-handel.de/fileadmin/user_upload/dateien/fairer_handel/zahlen_fakten/2018_Bericht_Verbraucherbefragung_2018.pdf) (letzter Zugriff: 13.12.2019).
- CFBAI (Children's Food and Beverage Advertising Initiative) (2018) Category-specific uniform nutrition criteria, 2nd ed., 2018 White Paper. Council of Better Business Bureaus, Inc., Arlington.

- Chaix B, Bean K, Daniel M, Zenk SN, Kestens Y, Charreire H, Leal C, Thomas F, Karusisi N, Weber C, Oppert JM, Simon C, Merlo J, Pannier B (2012) Associations of supermarket characteristics with weight status and body fat: A multilevel analysis of individuals within supermarkets (RECORD study). *PLOS ONE* 7(4): e32908. Doi: 10.1371/journal.pone.0032908.
- Challa HJ, Uppaluri KR (2019) *Paleolithic Diet*. StatPearls Publishing, Treasure Island (FL), USA.
- Chambers A, Lal R, Paustian K (2016) Soil carbon sequestration potential of US croplands and grasslands: Implementing the 4 per Thousand Initiative. *Journal of Soil and Water Conservation* 71(3): 68A-74A. Doi: 10/gf78qz.
- Chan DS, Lau R, Aune D, Vieira R, Greenwood DC, Kampman E, Norat T (2011) Red and processed meat and colorectal cancer incidence: Meta-analysis of prospective studies. *PLOS ONE* 6(6): e20456. Doi: 10.1371/journal.pone.0020456.
- Chandon P (2013) How package design and packaged-based marketing claims lead to overeating. *Applied Economic Perspectives and Policy* 35(1): 7-31. Doi: 10.1093/aep/pps028.
- Chandon P (2015) *Pleasure, size & marketing: Understanding and influencing portion size perception and preferences*. NYU School of Medicine, Department of Population Health, <https://faculty.insead.edu/pierre-chandon/documents/Presentations/Chandon%20Pleasure%2C%20Size%20%26%20Marketing%20Sept%2030%202015.pdf> (letzter Zugriff: 20.12.2019).
- Chandon P, Wansink B (2007) The biasing health halos of fast-food restaurant health claims: Lower calorie estimates and higher side-dish consumption intentions. *Journal of Consumer Research* 34: 301-314. Doi: 10.1086/519499.
- Chandon P, Wansink B (2012) Does food marketing need to make us fat? A review and solutions. *Nutrition Reviews* 70: 571-593. Doi: 10.1111/j.1753-4887.2012.00518.x.
- Chandrasekaran A (2018) Body mass index – Is it reliable indicator of obesity? *Journal of Nutrition & Weight Loss* 3(1): 111. Doi: 10.35248/2593-9793.18.3.111.
- Chang-Claude J, Hermann S, Eilber U, Steindorf K (2005) Lifestyle determinants and mortality in German vegetarians and health-conscious persons: Results of a 21 year follow up. *Cancer Epidemiology, Biomarkers & Prevention* 14(4): 963-968. Doi: 10.1158/1055-9965.EPI-04-0696.
- Chaparro CM (2008) Setting the stage for child health and development: Prevention of iron deficiency in early infancy. *Journal of Nutrition* 138(12): 2529-2533. Doi: 10.1093/jn/138.12.2529.
- Chemnitz C, Weigelt J (Hrsg.) (2015) *Bodenatlas. Daten und Fakten über Acker, Land und Erde*. Heinrich-Böll-Stiftung, Berlin.
- Chen C, Chaudhary A, Mathys A (2019) Dietary change scenarios and implications for environmental, nutrition, human health and economic dimensions of food sustainability. *Nutrients* 11: 856. Doi: 10.3390/nu11040856.
- Chen HS (2019) Environmental concerns and food consumption: What drives consumers' actions to reduce food waste? *Journal of International Food & Agribusiness Marketing* 31: 273-292. Doi: 10.1080/08974438.2018.1520179.
- Chernev A, Gal D (2010) Categorization effects in value judgments: Averaging bias in evaluating combinations of vices and virtues. *Journal of Marketing Research* 47(4): 738-747. Doi: 10.1509/jmkr.47.4.738.
- Chiputwa B, Spielman DJ, Qaim M (2015) Food standards, certification, and poverty among coffee farmers in Uganda. *World Development* 66: 400-412. Doi: 10.1016/j.worlddev.2014.09.006.

- Chitnis M, Sorrel S, Druckman A, Firth SK, Jackson T (2014) Who rebounds most? Estimating direct and indirect rebound effects for different UK socioeconomic groups. *Ecological Economics* 106: 12-32. Doi: 10.1016/j.ecolecon.2014.07.003.
- Chriqui JF, Pickel M, Story M (2014) Influence of school competitive food and beverage policies on obesity, consumption, and availability: A systematic review. *JAMA Pediatrics* 168(3): 279-286. Doi: 10.1001/jamapediatrics.2013.4457.
- Christen O, Deumelandt P, Erdle K, Packeiser M, Reinicke, F, von Daniels-Spangenberg H (2013) Nachhaltiger Ackerbau. Effizienz steigern, Image pflegen, Ressourcen schonen. DLG-Merkblatt 369. Deutsche Landwirtschaftsgesellschaft (DLG), Frankfurt am Main.
- Christen O, O'Halloran-Wietholtz Z (2002) Indikatoren für eine nachhaltige Entwicklung der Landwirtschaft. Schriftenreihe des Instituts für Landwirtschaft und Umwelt Bonn, Heft 3.
- Christian P, Stewart CP (2010) Maternal micronutrient deficiency, fetal development and risk of chronic disease. *The Journal of Nutrition* 140(3): 437-445. Doi: 10.3945/jn.109.116327.
- Christoph B (2016) Was fehlt bei Hartz IV? Zum Lebensstandard der Empfänger von Leistungen nach SGB II. *Informationsdienst Soziale Indikatoren* 40: 7-10. Doi: 10.15464/isi.40.2008.7-10.
- Christoph-Schulz I, Hartmann M, Kenning P, Luy J, Mergenthaler M, Reisch L, Roosen J, Spiller A (2018) SocialLab - Nutztierhaltung im Spiegel der Gesellschaft. *Journal of Consumer Protection and Food Safety* 13(2): 145-236. Doi: 10.1007/s00003-017-1144-7.
- Cicia G, Colantuoni F (2010) Willingness to pay for traceable meat attributes: A meta-analysis. *International Journal on Food System Dynamics* 1(3): 252-263. Doi: 10/gf744s.
- Clark M, Tilman D (2017) Comparative analysis of environmental impacts of agricultural production systems, agricultural input efficiency, and food choice. *Environmental Research Letters* 12(6): 064016. Doi: 10.1088/1748-9326/aa6cd5.
- Clark MA, Springmann M, Hill J, Tilman D (2019a) Multiple health and environmental impacts of foods. *Proceedings of the National Academy of Sciences* 116(46): 23357-23362. Doi: 10.1073/pnas.1906908116.
- Clark CL, Oluremi AF, Holásková I, Infante AM, Murray PJ, Olfert IM, McFadden JM, Downes MT, Chantler PT, Duespohl MW, Cuff CF, Olfert MD (2019b) Educational interventions improves fruit and vegetable intake in young adults with metabolic syndrome components. *Nutrition Research* 62: 89-100. Doi: 10.1016/j.nutres.2018.11.010.
- Clarke N, Pechey E, Kosıte D, König LM, Mantzari E, Blackwell AKM, Marteau TM, Hollands GJ (2019) Impact on selection and consumption of image-and-text and text-only health warning labels on food and alcohol products: Systematic review with meta-analysis. Doi: 10.31234/osf.io/jt52m.
- Claupein E, Oltersdorf U, Walker G (2001) Zeit fürs Essen – Deskriptive Auswertung der Zeitbudgeterhebung. In: Ehling M, Merz J (Hrsg.) *Zeitbudget in Deutschland – Erfahrungsberichte der Wissenschaft*. Schriftenreihe Spektrum Bundesstatistik, Band 17: 202-213.
- Cluff M, Kobane IA, Bothma C, Hugo CJ, Hugo A (2017) Intermediate added salt levels as sodium reduction strategy: Effects on chemical, microbial, textural and sensory quality of polony. *Meat Science* 133: 143-150. Doi: 10.1016/j.meatsci.2017.06.014.
- Clune S, Crossin E, Verghese K (2017) Systematic review of greenhouse gas emissions for different fresh food categories. *Journal of Cleaner Production* 140: 766-783. Doi: 10.1016/j.jclepro.2016.04.082.

- Clydesdale FM (1993) Color as a factor in food choice. *Critical Reviews in Food Science and Nutrition* 33(1): 83-101. Doi: 10.1080/10408399309527614.
- co2online (2019) Der Stromverbrauch im Haushalt.  
<https://www.co2online.de/energie-sparen/strom-sparen/strom-sparen-stromspar-tipps/stromverbrauch-im-haushalt/> (letzter Zugriff: 05.12.2019).
- Coates AE, Hardman CA, Halford JCG, Christiansen P, Boyland EJ (2019) Social media influencer marketing and children's food intake: A randomized trial. *Pediatrics* 143(4): e20182554. Doi: 10.1542/peds.2018-2554.
- Coelho-Júnior HJ, Rodrigues B, Uchida M, Marzetti E (2018) Low protein intake is associated with frailty in older adults: A systematic review and meta-analysis of observational studies. *Nutrients* 10(9): 1334. Doi: 10.3390/nu10091334.
- Cohen J (1988) *Statistical power analysis for the behavioral sciences*. 2nd ed., Erlbaum, Hillsdale, NJ.
- Cohen MA, Vandenberg MP (2012) The potential role of carbon labeling in a green economy. *Energy Economics* 34: S53-S63. Doi: 10.1016/j.eneco.2012.08.032.
- Colao A, Lucchese M, D'Adamo M, et al. (2017) Healthcare usage and economic impact of non-treated obesity in Italy: findings from a retrospective administrative and clinical database analysis, *BMJ Open*; 7:e013899. Doi: 10.1136/bmjopen-2016-013899.
- Colb C (2014) *Ernährungsmanagement in Pflegeeinrichtungen*. Urban & Fischer, München.
- Colchero MA, Guerrero-López CM, Molina M, Rivera JA (2016b) Beverages sales in Mexico before and after implementation of a sugar sweetened beverage tax. *PLOS ONE* 11: e0163463. Doi: 10.1371/journal.pone.0163463.
- Colchero MA, Popkin BM, Rivera JA, Ng SW (2016a) Beverage purchases from stores in Mexico under the excise tax on sugar sweetened beverages: Observational study. *BMJ* 352: h6704. Doi: 10.1136/bmj.h6704.
- COMA (Committee on Medical Aspects of Food and Nutrition Policy) (1989) *Dietary Sugars and Human Disease*. Department of Health, Report on Health and Social Subjects 41.  
<https://www.gov.uk/government/publications/coma-reports> (19.12.2019).
- COMA (Committee on Medical Aspects of Food and Nutrition Policy) (1991) *Dietary Reference Values for Food Energy and Nutrients for the United Kingdom*. Department of Health, Report on Health and Social Subjects 41.  
<https://www.gov.uk/government/publications/coma-reports> (19.12.2019).
- Connor DJ (2008) Organic agriculture cannot feed the world. *Field Crops Research* 106(2): 187-190. Doi: 10.1016/j.fcr.2007.11.010.
- Conrad Z, Niles MT, Neher DA, Roy ED, Tichenor NE, Jahns L (2018) Relationship between food waste, diet quality, and environmental sustainability. *PLOS ONE* 13(4): e0195405. Doi: 10.1371/journal.pone.0195405.
- Cooke SJ, Twardek WM, Lennox RJ, Zoldero AJ, Bower SD, Gutowsky LFG, Danylchuk AJ, Arlinghaus R, Beard D (2018) The nexus of fun and nutrition: Recreational fishing is also about food. *Fish and Fisheries* 19(2): 201-224. Doi: 10.1111/faf.12246
- Cooksey-Stowers K, Schwartz MB, Brownell KD (2017) Food swamps predict obesity rates better than food deserts in the United States. *International Journal of Environmental Research and Public Health* 14(11): e1366. Doi: 10.3390/ijerph14111366.

- Cooper SL, Pelly FE, Lowe JB (2016) Construct and criterion-related validation of nutrient profiling models: A systematic review of the literature. *Appetite* 100: 26-40. Doi: 10.1016/j.appet.2016.02.001.
- Cordain L, Eaton SB, Sebastian A, Mann N, Lindeberg S, Watkins BA, O'Keefe JH, Brand-Miller J (2005) Origins and evolution of the western diet: Health implications for the 21st century. *The American Journal of Clinical Nutrition* 81(2): 341-354. Doi: 10.1093/ajcn.81.2.341.
- Cordts A, Duman N, Grethe H, Nitzko S, Spiller A (2014) Potenziale für eine Verminderung des Fleischkonsums am Beispiel Deutschland und Auswirkungen einer Konsumreduktion in OECD-Ländern auf globale Marktbilanzen und Preise für Nahrungsmittel. In: Kirschke D, Bokelmann W, Hagedorn K, Hüttel S (Hrsg.) *Wie viel Markt und wie viel Regulierung braucht eine nachhaltige Agrarentwicklung. Schriften der Gesellschaft für Wirtschafts- und Sozialwissenschaften des Landbaues e. V., Band 49, Münster: 209-222.*
- Cordts A, Spiller A, Nitzko S, Grethe H, Duman N (2013) Imageprobleme beeinflussen den Konsum. Von unbesorgten Fleischessern, Flexitariern und (Lebensabschnitts-)Vegetariern. *FleischWirtschaft* 07/2013: 59-63.
- Cornelsen L, Carreido A (2015) Health-related taxes on food and beverages. Food Research Collaboration Policy Brief, [www.foodresearch.org.uk](http://www.foodresearch.org.uk).
- Cornelsen L, Green R, Turner R, Dangour AD, Shankar B, Mazzocchi M, Smith RD (2015) What happens to patterns of food consumption when food prices change? Evidence from a systematic review and meta-analysis of food price elasticities globally. *Health Economics* 24(12): 1548-1559. Doi: 10.1002/hec.3107.
- Cown MH, Grossman BM, Giraudo SQ (2017) Nutrition education intervention to improve nutrition related knowledge, attitudes, and behaviors for Hispanic children. *Ecology of Food and Nutrition* 56(6): 493-513. Doi: 10.1080/03670244.2017.1381606.
- Creutzig F, Roy J, Lamb WF, Azevedo IML, Bruine de Bruin W, Dalkmann H, Edelenbosch OY, Geels FW, Grubler A, Hepburn C, Hertwich EG, Khosla R, Mattauch L, Minx JC, Ramakrishnan A, Rao ND, Steinberger JK, Tavoni M, Ürge-Vorsatz D, Weber EU (2018) Towards demand-side solutions for mitigating climate change. *Nature Climate Change* 8: 260-263. Doi: 10.1038/s41558-018-0121-1.
- Crocker DA (2008) *Ethics of global development. Agency, capability and deliberative democracy.* Cambridge University Press, Cambridge. Doi: 10.1017/CBO9780511492594.
- Crosetto P, Lacroix A, Muller L, Ruffieux B (2018) Nutritional and economic impact of 5 alternative front-of-pack nutritional labels: Experimental evidence. Working Paper GAEL No. 11/2018. <https://hal.archives-ouvertes.fr/hal-01805431> (letzter Zugriff: 10.01.2020).
- Crowder DW, Reganold JP (2015) Financial competitiveness of organic agriculture on a global scale. *Proceedings of the National Academy of Sciences USA* 112(24):7611-7616. Doi: 10.1073/pnas.1423674112.
- Crowe-White K, O'Neil CE, Parrott JS, Benson-Davies S, Droke E, Gutschall M, Stote KS, Wolfram T, Ziegler P (2016) Impact of 100% fruit juice consumption on diet and weight status of children: An evidence-based review. *Critical Reviews in Food Science and Nutrition* 56(5): 871-884. Doi: 10.1080/10408398.2015.1061475.
- Cuhra M, Bøhn T, Cuhra P (2016) Glyphosate: Too much of a good thing? *Frontiers in Environmental Science* 4: 28. Doi: 10.3389/fenvs.2016.00028.

- Curl CL, Porter J, Penwell I, Phinney R, Ospina M, Calafat AM (2019) Effect of a 24-week randomized trial of an organic produce intervention on pyrethroid and organophosphate pesticide exposure among pregnant women. *Environment International* 132: 104957. Doi: 10.1016/j.envint.2019.104957.
- Curry LE, Rogers T, Williams P, Homsy G, Willett J, Schmitt CL (2018) Public attitudes and support for a sugar-sweetened beverage tax in America's heartland. *Health Promotion Practice* 19(3): 418-426. Doi: 10.1177/1524839917709759.
- DAFA (Deutsche Agrarforschungsallianz) (2014) Aquakulturforschung gestalten! Fachforum Aquakultur, Strategie der Deutschen Agrarforschungsallianz, Stand 7/2014, [www.dafa.de/de/startseite/fachforen/aquakultur.html](http://www.dafa.de/de/startseite/fachforen/aquakultur.html) (letzter Zugriff: 13.12.2019).
- Daigle CL, Ridge EE (2018) Investing in stockpeople is an investment in animal welfare and agricultural sustainability. *Animal Frontiers* 8(3): 53-59. Doi: 10.1093/af/vfy015.
- Daley AJ, McGee E, Bayliss S, Coombe A, Parretti HM (2019) Effects of physical activity calorie equivalent food labelling to reduce food selection and consumption: Systematic review and meta-analysis of randomised controlled studies. *Journal of Epidemiology & Community Health*. Doi: 10.1136/jech-2019-213216.
- Dallacker M, Hertwig R, Mata J (2018) Parents' considerable underestimation of sugar and their child's risk of overweight. *International Journal of Obesity* 42(5): 1097-1100. Doi: 10.1038/s41366-018-0021-5.
- Daneshzad E, Emami S, Mofrad MD, Saraf-Bank S, Surkan PJ, Azadbakht L (2018) Association of modified nordic diet with cardiovascular risk factors among type 2 diabetes patients: A cross sectional study. *Journal of Cardiovascular and Thoracic Research* 10(3): 153-161. Doi: 10.15171/jcvtr.2018.25.
- Dangour AD, Lock K, Hayter A, Aikenhead A, Allen E, Uauy R (2010) Nutrition-related health effects of organic foods: A systematic review. *The American Journal of Clinical Nutrition* 92(1): 203-210. Doi: 10.3945/ajcn.2010.29269.
- Danone (2019) Der Nutri-Score. Aufbau des Systems und erste Erfahrungen zur Wirksamkeit. [https://www.ernaehrungs-umschau.de/fileadmin/Ernaehrungs-Umschau/Branchenverzeichnis/Danone/N7011\\_Nutriscore\\_Flyer\\_180406\\_print-1.pdf](https://www.ernaehrungs-umschau.de/fileadmin/Ernaehrungs-Umschau/Branchenverzeichnis/Danone/N7011_Nutriscore_Flyer_180406_print-1.pdf) (letzter Zugriff: 10.01.2020).
- Danziger S, Levav J, Avnaim-Pesso L (2011) Extraneous factors in judicial decisions. *Proceedings of the National Academy of Sciences* 108(17): 6889-6892. Doi: 10.1073/pnas.1018033108.
- Darmon N, Drewnowski A (2015) Contribution of food prices and diet cost to socioeconomic disparities in diet quality and health: A systematic review and analysis. *Nutrition Reviews* 73(10): 643-660. Doi: 10.1093/nutrit/nuv027.
- Darnhofer I, Lindenthal T, Bartel-Kratochvil, Zollitsch W (2010) Conventionalisation of organic farming practices: From structural criteria towards an assessment based on organic principles. *Agronomy for Sustainable Development* 30(1): 67-81. Doi: 10.1051/agro/2009011.
- Daugbjerg C, Feindt PH (2017) Post-exceptionalism in public policy: Transforming food and agricultural policy. *Journal of European Public Policy* 24(11): 1565-1584. Doi: 10.1080/13501763.2017.1334081.
- Daum T, Buchwald B, Gerlicher A, Birner R (2018) Smartphone apps as a new method to collect data on smallholder farming systems in the digital age: A case study from Zambia. *Computers and Electronics in Agriculture* 153: 144-50. Doi: 10.1016/j.compag.2018.08.017.

- David IA, Krutman L, Fernández-Santaella MC, Andrade JR, Andrade EB, Oliveira L, Pereira MG, Gomes FS, Gleiser S, Oliveira JM, Araújo RL, Volchan E, Braga F (2018) Appetitive drives for ultra-processed food products and the ability of text warnings to counteract consumption predispositions. *Public Health Nutrition* 21(3): 543-557. Doi: 10.1017/S1368980017003263.
- Davies J, Davies D (2010) Origins and evolution of antibiotic resistance. *Microbiology and Molecular Biology Reviews* 74(3): 417-433. Doi: 10.1128/MMBR.00016-10.
- Davis KF, Gephart JA, Emery KA, Leach AM, Galloway JN, D'Odorico P (2016) Meeting future food demand with current agricultural resources. *Global Environmental Change* 39: 125-132. Doi: 10/f8234h.
- Davis KF, Paolo DO, Rulli MC (2014) Land Grabbing: A preliminary quantification of economic impacts on rural livelihoods. *Population and Environment* 36: 180-92.
- DBV (Deutscher Bauernverband) (2018) Situationsbericht 2018/19: Trends und Fakten zur Landwirtschaft, Berlin.
- DBV, VDF, HDE (Deutscher Bauernverband, Verband der Fleischwirtschaft e.V., Hauptverband des Deutschen Einzelhandels) (2008) Gemeinsame Erklärung zur Ferkelkastration, Düsseldorf. <https://www.dgfz-bonn.de/services/files/dokumente/Gemeinsame%20Erklärung.pdf> (letzter Zugriff: 10.01.2020).
- Debbeler L, Wahl DR, Villinger K, Renner B (2020) Die Bedeutung der Gesundheitskommunikation in der Prävention und Gesundheitsförderung. In: Tiemann M, Mohokum M (Hrsg.) *Prävention und Gesundheitsförderung*. Springer, Berlin. Doi: 10.1007/978-3-662-55793-8.
- Debbeler LJ, Gamp M, Blumenschein M, Keim D, Renner B (2018) Polarized but illusory beliefs about tap and bottled water: A product- and consumer-oriented survey and blind tasting experiment. *Science of The Total Environment* 643: 1400-1410. Doi: 10.1016/j.scitotenv.2018.06.190.
- De Boer J, de Witt A, Aiking H (2016) Help the climate, change your diet: A cross-sectional study on how to involve consumers in a transition to a low-carbon society. *Appetite* 98: 19-27. Doi: 10.1016/j.appet.2015.12.001.
- De Castro JM (1994) Family and friends produce greater social facilitation of food intake than other companions. *Physiology & Behavior* 56(3): 445-455. Doi: 10.1016/0031-9384(94)90286-0.
- De Castro JM (1997) Socio-cultural determinants of meal size and frequency. *British Journal of Nutrition* 77(1): 39-55. Doi: 10.1079/bjn19970103.
- De Castro JM (2000) Eating behavior: Lessons from the real world of humans. *Nutrition* 16(10): 800-813. Doi: 10.1016/s0899-9007(00)00414-7.
- De Ponti T, Rijk B, van Ittersum MK (2012) The crop yield gap between organic and conventional agriculture. *Agricultural Systems* 108: 1-9. Doi: 10.1016/j.agsy.2011.12.004.
- De Saint Pol T, Ricoch L (2012) *Le temps de l'alimentation en France*. Insee première No 1417. Institut national de la statistique et des études économiques. <https://www.insee.fr/fr/statistiques/1281016> (letzter Zugriff: 05.12.2019).
- De Schutter O (2017) The political economy of food systems reform. *European Review of Agricultural Economics* 44(4): 705-731. Doi: 10.1093/erae/jbx009.
- De van der Schueren MA, Wijnhoven HA, Kruijenga, Visser M (2016) A critical appraisal of nutritional intervention studies in malnourished, community dwelling older persons. *Clinical Nutrition* 35: 1008-1014. Doi: 10.1016/j.clnu.2015.12.013.

- DeFries R, Franzo J, Mondal P, Remans R, Wood SA (2017) Is voluntary certification of tropical agricultural commodities achieving sustainability goals for small-scale producers? A review of the evidence. *Environmental Research Letters* 12(3): 033001. Doi: 10.1088/1748-9326/aa625e.
- DeFries R, Franzo J, Remans R, Palm C, Wood S, Anderman TL (2015) Metrics for land-scarce agriculture. *Science* 349(6245): 238-240. Doi: 10.1126/science.aaa5766.
- Deininger K, Byerlee D (2011) Rising global interest in farmland – Can it yield sustainable and equitable benefits? World Bank, Washington, D.C.
- Del Borghi A, Gallo M, Strazza C, Del Borghi M (2014) An evaluation of environmental sustainability in the food industry through life cycle assessment. The case study of tomato products supply chain. *Journal of Cleaner Production* 78: 121-130. Doi: 10.1016/j.jclepro.2014.04.083.
- Depa J, Gyngell F, Müller A, Eleraky L, Hilzendegen C, Stroebele-Benschop N (2018) Prevalence of food insecurity among food bank users in Germany and its association with population characteristics. *Preventive Medicine Reports* 9: 96-101. Doi: 10.1016/j.pmedr.2018.01.005.
- Der Paritätische Gesamtverband (2018) Expertise Regelbedarfe 2018. Herleitung und Bestimmung der Regelbedarfe in der Grundsicherung. [https://www.paritaetischer.de/uploads/media/Expertise\\_Regelbedarfe-2018.pdf](https://www.paritaetischer.de/uploads/media/Expertise_Regelbedarfe-2018.pdf) (letzter Zugriff: 07.12.2019).
- Der Spiegel (1985) Strahlende Zukunft: Später als Japaner und Amerikaner entdecken die Deutschen ein neues Küchengerät: Mikrowellen-Herde kommen in Mode. 14. Januar 1985. <https://www.spiegel.de/spiegel/print/d-13511493.html> (letzter Zugriff: 05.12.2019).
- Deter A (2017) NRW: Protest gegen Düngeverordnung zeigt Wirkung. *TopAgrar*, 27.03.2017. <https://www.topagrar.com/acker/news/nrw-protest-der-bauern-gegen-duengeverordnung-zeigt-wirkung-9856334.html> (letzter Zugriff: 19.12.2019).
- Deter A (2018) Breites Aktionsbündnis für nachhaltige Nährstoffkreislaufwirtschaft. *TopAgrar*, 21.03.2018. <https://www.topagrar.com/acker/news/breites-aktionsbuenndnis-fuer-nachhaltige-naehrstoffkreislaufwirtschaft-9844866.html> (letzter Zugriff: 10.01.2020).
- Detzel A, Kauertz B, Grahl B, Heinisch J (2016) Prüfung und Aktualisierung der Ökobilanzen für Getränkeverpackungen. *Texte 19/2016*, Umweltbundesamt, Dessau-Roßlau.
- Deutscher Bundestag (1998) Abschlußbericht der Enquete-Kommission „Schutz des Menschen und der Umwelt – Ziele und Rahmenbedingungen einer nachhaltig zukunftsverträglichen Entwicklung“. <http://dipbt.bundestag.de/doc/btd/13/112/1311200.pdf> (letzter Zugriff: 05.12.2019).
- Deutscher Bundestag (2016a) Antrag der Abgeordneten Karin Binder, Caren Lay, Herbert Behrens, Heidrun Bluhm, Eva Bulling-Schröter, Nicole Gohlke, Dr. Rosemarie Hein, Sigrid Hupach, Kerstin Kassner, Katja Kipping, Sabine Leidig, Ralph Lenkert, Dr. Gesine Löttsch, Thomas Lutze, Birgit Menz, Norbert Müller (Potsdam), Harald Petzold (Havelland), Dr. Kirsten Tackmann, Katrin Werner, Birgit Wöllert, Jörn Wunderlich, Sabine Zimmermann (Zwickau), Hubertus Zebel und der Fraktion DIE LINKE. Bundesprogramm Kita- und Schulverpflegung – Für alle Kinder und Jugendlichen eine hochwertige und unentgeltliche Essensversorgung sicherstellen. BT-Drucksache 18/8611.
- Deutscher Bundestag (2016b) Wortprotokoll der 64. Sitzung, Ausschuss für Ernährung und Landwirtschaft, Berlin, den 17. Oktober. Öffentliche Anhörung zum Antrag der Abgeordneten Karin Binder, Caren Lay, Herbert Behrens, weiterer Abgeordneter und der Fraktion DIE LINKE. Bundesprogramm Kita- und Schulverpflegung – Für alle Kinder und Jugendlichen eine hochwertige und unentgeltliche Essensversorgung sicherstellen. BT-Drucksache 18/8611, Protokoll-Nr. 18/64.

- Deutscher Bundestag (2016c) Siebter Bericht zur Lage der älteren Generation in der Bundesrepublik Deutschland. Sorge und Mitverantwortung in der Kommune – Aufbau und Sicherung zukunftsfähiger Gemeinschaften und Stellungnahme der Bundesregierung. BT-Drucksache 18/10210.
- Deutscher Bundestag (2017a) Beschlussempfehlung und Bericht des Ausschusses für Ernährung und Landwirtschaft (10. Ausschuss) zu dem Antrag der Abgeordneten Karin Binder, Caren Lay, Herbert Behrens, weiterer Abgeordneter und der Fraktion DIE LINKE. – Drucksache 18/8611 – Bundesprogramm Kita- und Schulverpflegung – Für alle Kinder und Jugendlichen eine hochwertige und unentgeltliche Essensversorgung sicherstellen. BT-Drucksache 18/12178.
- Deutscher Bundestag (2017b) Kleine Anfrage der Abgeordneten Nicole Maisch, Özcan Mutlu, Dr. Wolfgang Strengmann-Kuhn, Matthias Gastel, Sylvia Kotting-Uhl, Oliver Krischer, Stephan Kühn (Dresden), Christian Kühn (Tübingen), Steffi Lemke, Peter Meiwald, Dr. Valerie Wilms und der Fraktion BÜNDNIS 90/DIE GRÜNEN. Bessere Verpflegung in Schulen und Kitas. BT-Drucksache 18/13385.
- Deutscher Bundestag (2018a) Bericht über die Höhe des steuerfrei zu stellenden Existenzminimums von Erwachsenen und Kindern für das Jahr 2020 (12. Existenzminimumbericht). Unterrichtung durch die Bundesregierung. BT-Drucksache 19/5400.
- Deutscher Bundestag (2018b) Antwort der Bundesregierung auf die Kleine Anfrage der Abgeordneten Beate Müller-Gemmeke, Friedrich Ostendorff, Markus Kurth, weiterer Abgeordneter und der Fraktion BÜNDNIS 90/DIE GRÜNEN. Arbeits- und Entlohnungsbedingungen in der Fleischwirtschaft – Drucksache 19/5834. Deutscher Bundestag, 19. Wahlperiode. BT-Drucksache 19/6323.
- Deutscher Bundestag (2018c) Kleine Anfrage der Abgeordneten Nicole Bauer, Frank Sitta, Grigorios Aggelidis, Renata Alt, Jens Beeck, Nicola Beer, Dr. Jens Brandenburg (Rhein-Neckar), Karlheinz Busen, Bijan Djir-Sarai, Hartmut Ebbing, Dr. Marcus Faber, Otto Fricke, Thomas Hacker, Katrin Helling-Plahr, Markus Herbrand, Katja Hessel, Ulla Ihnen, Olaf in der Beek, Dr. Christian Jung, Thomas L. Kemmerich, Daniela Kluckert, Carina Konrad, Ulrich Lechte, Oliver Luksic, Hagen Reinhold, Matthias Seestern-Pauly, Judith Skudelny, Benjamin Strasser, Katja Suding, Michael Theurer, Stephan Thomae, Sandra Weeser, Nicole Westig und der Fraktion der FDP. Gesunde Ernährung in Kitas und Schulen. BT-Drucksache 19/6533.
- Deutscher Bundestag (2019) Antwort der Bundesregierung auf die Kleine Anfrage der Abgeordneten Nicole Bauer, Frank Sitta, Grigorios Aggelidis, weiterer Abgeordneter und der Fraktion der FDP – Drucksache 19/6533 – Gesunde Ernährung in Kitas und Schulen. BT-Drucksache 19/6864.
- Deutscher Werberat (2016) Coca-Cola-Werbung zur Fußball-EM mit Spielern der Nationalmannschaft (Print/Plakat/Online). Schreiben des Deutschen Werberates an FoodWatch vom 11.06.2016.  
<https://www.foodwatch.org/de/informieren/zucker-fett-co/aktuelle-nachrichten/deutscher-werberat-schuetzt-die-junkfood-industrie/> (letzter Zugriff: 10.01.2020).
- Development Initiatives (2018) Global nutrition report 2018: Shining a light to spur action on nutrition, Bristol, UK.
- DGE (Deutsche Gesellschaft für Ernährung) (2014) Lebensmittelbezogene Ernährungsempfehlungen in Deutschland. 1. Auflage, Bonn.
- DGE (Deutsche Gesellschaft für Ernährung) (2016) 13. DGE-Ernährungsbericht, Bonn.
- DGE (Deutsche Gesellschaft für Ernährung) (2019) DGE Jahresbericht 2018, Bonn.

- DGE, ÖGE, SGE (Deutsche Gesellschaft für Ernährung, Österreichische Gesellschaft für Ernährung, Schweizerische Gesellschaft für Ernährung) (2019) D-A-CH-Referenzwerte für die Nährstoffzufuhr. Loseblattsammlung, laufende Aktualisierung, zuletzt 2019, Bonn.
- DGG (Deutsche Gesellschaft für Geriatrie) (2017) Muskelabbau und funktionelle Einschränkungen: „Mit guter Ernährung lässt sich Sarkopenie bremsen“. Pressemitteilung, Frankfurt.  
[https://www.dggeriatrie.de/images/Dokumente/170726\\_PM\\_Mit\\_guter\\_Ernaehrung\\_laest\\_sich\\_Sarkopenie\\_bremsen.pdf](https://www.dggeriatrie.de/images/Dokumente/170726_PM_Mit_guter_Ernaehrung_laest_sich_Sarkopenie_bremsen.pdf) (letzter Zugriff: 07.12.2019).
- Diakonie Deutschland (2016) Stellungnahme der Diakonie Deutschland – Evangelischer Bundesverband zum Referentenentwurf des Bundesministeriums für Arbeit und Soziales: Entwurf eines Gesetzes zur Ermittlung von Regelbedarfen sowie zur Änderung des Zweiten und Zwölften Buches Sozialgesetzbuch.  
[https://www.bmas.de/SharedDocs/Downloads/DE/PDF-Gesetze/Stellungnahmen/regelbedarfsermittlungsgesetz-diakonie.pdf?\\_\\_blob=publicationFile&v=3](https://www.bmas.de/SharedDocs/Downloads/DE/PDF-Gesetze/Stellungnahmen/regelbedarfsermittlungsgesetz-diakonie.pdf?__blob=publicationFile&v=3) (letzter Zugriff: 07.12.2019).
- Dias GM, Ayer WA, Khosla S, van Acker R, Young SB, Whitney S, Hendricks P (2017) Life cycle perspectives on the sustainability of Ontario greenhouse tomato production: Benchmarking and improvement opportunities. *Journal of Cleaner Production* 140(2): 831-839. Doi: 10.1016/j.jclepro.2016.06.039.
- Die Linke (2017) Sozial, Gerecht, Frieden für alle: Die Zukunft für die wir kämpfen. Langfassung des Wahlprogramms zur Bundestagswahl 2017, Berlin.  
[https://www.bundestagswahl-bw.de/wahlprogramme\\_btwahl2017.html](https://www.bundestagswahl-bw.de/wahlprogramme_btwahl2017.html) (letzter Zugriff: 19.12.2019).
- Die Linke Baden-Württemberg (o.J.) Baden-Württemberg Plus Sozial - Wahlprogramm Landtagswahl 2016.  
<https://www.landtagswahl-bw.de/wahlprogramme.html> (letzter Zugriff: 19.12.2019).
- Die Linke Mecklenburg-Vorpommern (2016) Aus Liebe zu M-V – Programm zur Landtagswahl 2016.  
<https://www.abgeordnetenwatch.de/mecklenburg-vorpommern/wahlprogramme> (letzter Zugriff: 19.12.2019).
- Diekmann A, Preisendörfer P (1998) Umweltbewußtsein und Umweltverhalten in Low-und High-Cost-Situationen: Eine empirische Überprüfung der Low-Cost-Hypothese. *Zeitschrift für Soziologie* 27: 438-453.
- Diepenbrock W, Kaltschmitt M, Nieberg H, Reinhardt G (1997) Umweltverträgliche Pflanzenproduktion: Indikatoren, Bilanzierungsansätze und ihre Einbindung in Ökobilanzen. Zeller-Verlag, Osnabrück.
- Diepeveen S, Ling T, Suhrcke M, Roland M, Marteau TM (2013) Public acceptability of government intervention to change health-related behaviours: A systematic review and narrative synthesis. *BMC Public Health* 13: 756. Doi: 10.1186/1471-2458-13-756.
- Dietrich J (2009) Die Kraft der Konkretion oder: Die Rolle deskriptiver Annahmen für die Anwendung und Kontextsensitivität ethischer Theorie. *Ethik in der Medizin* 21(3): 213-221. Doi: 10.1007/s00481-009-0022-y.
- Diggles BK, Cooke SJ, Rose JD, Sawynok W (2011) Ecology and welfare of aquatic animals in wild capture fisheries. *Reviews in Fish Biology and Fisheries* 21(4): 739-765. Doi: 10.1007/s11160-011-9206-x.
- Dinu M, Pagliai G, Casini A, Sofi F (2018) Mediterranean diet and multiple health outcomes: An umbrella review of meta-analyses of observational studies and randomised trials. *European Journal of Clinical Nutrition* 72(1): 30-43. Doi: 10.1038/ejcn.2017.58.

- DLG (Deutsche Landwirtschaftsgesellschaft) (2017) Landwirtschaft 2030. <https://www.dlg.org/de/landwirtschaft/themen/landwirtschaft-2030/> (letzter Zugriff: 20.12.2019).
- Donaldson EA, Cohen JE, Rutkow L, Villanti AC, Kanarek NF, Barry CL (2015) Public support for a sugar-sweetened beverage tax and pro-tax messages in a mid-atlantic US state. *Public Health Nutrition* 18(12): 2263-2273. Doi: 10.1017/S1368980014002699.
- Donnelly GE, Zatz LY, Svirsky D, John LK (2018) The effect of graphic warnings on sugary-drink purchasing. *Psychological Science* 29(8): 1321-1333. Doi: 10.1177/0956797618766361.
- Donovan J, Adams C (eds.) (1996) *Beyond animal rights. A feminist caring ethic for the treatment of animals.* Continuum, Cassell, New York, London.
- Dontas AS, Zerefos NS, Panagiotakos DB, Valis DA (2007) Mediterranean diet and prevention of coronary heart disease in the elderly. *Clinical Interventions in Aging* 2(1): 109-115. Doi: 10.2147/cia.2007.2.1.109.
- Doyle W, Srivastava A, Crawford MA, Bhatti R, Brooke Z, Costeloe KL (2001) Inter-pregnancy folate and iron status of women in an inner city population. *British Journal of Nutrition* 86(1): 81-87. Doi: 10.1079/bjn2001376.
- Drabsch T, Gatzemeier J, Pfenhauer L, Hauner H, Holzapfel C (2018) Associations between single nucleotide polymorphisms and total energy, carbohydrate, and fat intakes: A systematic review. *Advances in Nutrition* 9(4): 425-453. Doi: 10.1093/advances/nmy024.
- Dräger de Teran T (2019) Hintergrundpapier Blick auf die Politik. Dialogforum „Zu gut für die Tonne! – Dialogforum zur Vermeidung von Lebensmittelabfällen in der Außer-Haus-Verpflegung“. WWF Deutschland, Berlin.
- Drebes J (2017) Bundesregierung lehnt höhere Mehrwertsteuer auf Fleisch ab. *Rheinische Post (RP) Online*, 6. Januar 2017. [https://rp-online.de/politik/deutschland/bundesregierung-lehnt-hoehere-mehrwertsteuer-auf-fleisch-ab\\_aid-19082995](https://rp-online.de/politik/deutschland/bundesregierung-lehnt-hoehere-mehrwertsteuer-auf-fleisch-ab_aid-19082995) (letzter Zugriff: 19.12.2019).
- Drewnowski A (2010) The cost of US foods as related to their nutritive value. *The American Journal of Clinical Nutrition* 92: 1181-1188. Doi: 10.3945/ajcn.2010.29300.
- Drewnowski A (2018) Nutrient density: Addressing the challenge of obesity. *British Journal of Nutrition* 120(S1): S8-S14. Doi: 10.1017/S0007114517002240.
- Drewnowski A, Darmon N (2005) The economics of obesity: Dietary energy density and energy cost. *The American Journal of Clinical Nutrition* 82(1): 265-273. Doi: 10.1093/ajcn/82.1.265S.
- Drewnowski A, Dwyer J, King JC, Weaver CM (2019) A proposed nutrient density score that includes food groups and nutrients to better align with dietary guidance. *Nutrition Reviews* 77(6): 404-416. Doi: 10.1093/nutrit/nuz002.
- Drewnowski A, Popkin BM (1997) The nutrition transition: New trends in the global diet. *Nutrition Reviews* 55(2): 31-43. Doi: 10.1111/j.1753-4887.1997.tb01593.x.
- Drewnowski A, Rehm CD, Martin A, Verger EO, Voinnesson M, Imbert P (2015) Energy and nutrient density of foods in relation to their carbon footprint. *The American Journal of Clinical Nutrition* 101(1): 184-191. Doi: 10.3945/ajcn.114.092486.
- Drewnowski A, Specter S (2004) Poverty and obesity: The role of energy density and energy costs. *The American Journal of Clinical Nutrition* 79(1): 6-16. Doi: 10.1093/ajcn/79.1.6.

- Drichoutis AC, Vassilopoulos A, Lusk JL, Nayga RM (2017) Consumer preferences for fair labour certification. *European Review of Agricultural Economics* 44(3): 455-474. Doi: 10.1093/erae/jbx002.
- Dube K, Schwartz J, Mueller MJ, Kalhoff H, Kersting M (2010) Iron intake and iron status in breastfed infants during the first year of life. *Clinical Nutrition* 29: 773-778. Doi: 10.1016/j.clnu.2010.05.002.
- Dubois L, Diasparra M, Bédard B, Kaprio J, Fontaine-Bisson B, Tremblay R, Boivin M, Pérusse D (2013) Genetic and environmental influences on eating behaviors in 2.5- and 9-year-old children: A longitudinal twin study. *International Journal of Behavioral Nutrition and Physical Activity* 10(1): 134-146. Doi: 10.1186/1479-5868-10-134.
- Dubois P, Griffith R, O'Connell M. (2018) The effects of banning advertising in junk food markets. *The Review of Economic Studies* 85(1): 396-436. Doi: 10.1093/restud/rdx025.
- Ducrot P, Méjean C, Julia C, Kesse-Guyot E, Touvier M, Fezeu LK, Hercberg S, Péneau S (2015) Objective understanding of front-of-package nutrition labels among nutritionally at-risk individuals. *Nutrients* 7(8): 7106-7125. Doi: 10.3390/nu7085325.
- Duerksen SC, Elder JP, Arredondo EM, Ayala GX, Slymen DJ, Campbell NR, Baquero B (2007) Family restaurant choices are associated with child and adult overweight status in Mexican-American families. *Journal of the Academy of Nutrition and Dietetics* 107: 849-853. Doi: 10.1016/j.jada.2007.02.012.
- EAT-Lancet Commission (2019) Healthy diets from sustainable food systems. Summary Report of the EAT-Lancet Commission. <https://eatforum.org/eat-lancet-commission/eat-lancet-commission-summary-report/> (letzter Zugriff: 23.02.2020).
- Eberle U, Fels J (2016) Environmental impacts of German food consumption and food losses. *The International Journal of Life Cycle Assessment* 21(5): 759-772. Doi: 10.1007/s11367-015-0983-7.
- ECDC (European Centre for Disease Prevention and Control), EFSA (European Food Safety Authority), EMA (European Medicines Agency) (2017) Second joint report on the integrated analysis of the consumption of antimicrobial agents and occurrence of antimicrobial resistance in bacteria from humans and food-producing animals. *EFSA Journal* 15(7): 4872. Doi: 10.2903/j.efsa.2017.4872.
- Eckert H, Breitschuh G (1994) Kritische Umweltbelastungen Landwirtschaft (KUL) – Eine Methode zur Analyse und Bewertung der ökologischen Situation von Landwirtschaftsbetrieben. *Archives of Agronomy and Soil Science* 38(3): 149-163. Doi: 10.1080/03650349409365848.
- ECSIP (European Competitiveness and Sustainable Industrial Policy Consortium) (2014) Food taxes and their impact on competitiveness in the agri-food sector. Final report for DG Enterprise and Industry, Rotterdam.
- Edenbrandt AK, Gamborg C, Thorsen BJ (2017) Consumers' preferences for bread: Transgenic, cisgenic, organic or pesticide-free? *Journal of Agricultural Economics* 69(1): 121-141. Doi: 10.1111/1477-9552.12225.
- Edwards-Jones G (2010) Does eating local food reduce the environmental impact of food production and enhance consumer health? *Proceedings of the Nutrition Society* 69(4): 582-591. Doi: 10.1017/S0029665110002004.
- Effertz T (2015) Rolle und Akzeptanz der Prävention von schädlichen Lifestyle-Einflüssen in der Bevölkerung. In: Böcken J, Braun B, Meierjürgen R (Hrsg.) (2015) *Gesundheitsmonitor 2015: Bürgerorientierung im Gesundheitswesen*. Bertelsmann Stiftung, Gütersloh: 193-210.

- Effertz T (2017) Die Auswirkungen der Besteuerung von Lebensmitteln auf Ernährungsverhalten, Körpergewicht und Gesundheitskosten in Deutschland. <https://www.deutsche-diabetes-gesellschaft.de/fileadmin/Redakteur/Studie-gesunde-MwSt.pdf> (letzter Zugriff: 10.01.2020).
- Effertz T, Adams M (2014) Effektive Prävention von Adipositas durch Kindermarketingverbote und Steuerstrukturveränderungen. *Präventive Gesundheitsforschung* 10: 55-61.
- Effertz T, Engel S, Verheyen F, Linder R (2016) The costs and consequences of obesity in Germany: A new approach from a prevalence and life-cycle perspective. *The European Journal of Health Economics* 17(9): 1141-1158. Doi: 10.1007/s10198-015-0751-4.
- Effertz T, Wilcke AC (2012) Do television food commercials target children in Germany? *Public Health Nutrition* 15(8): 1466-1473. Doi: 10.1017/S1368980011003223.
- EFSA (European Food Safety Authority) (2017) Dietary reference values for nutrients: Summary report. EFSA supporting publication 14(12). Doi: 10.2903/sp.efsa.2017.e15121.
- EFSA CONTAM Panel (EFSA Panel on Contaminants in the Food Chain) (2016) Statement: Presence of microplastics and nanoplastics in food, with particular focus on seafood. *EFSA Journal* 14(6): 4501.
- EFSA Panel on Dietetic Products, Nutrition and Allergies (2011) Scientific opinion on the substantiation of health claims related to intense sweeteners and contribution to the maintenance or achievement of a normal body weight (ID 1136, 1444, 4299), reduction of post-prandial glycaemic responses (ID 4298), maintenance of normal blood glucose concentrations (ID 1221, 4298), and maintenance of tooth mineralisation by decreasing tooth demineralisation (ID 1134, 1167, 1283) pursuant to Article 13(1) of Regulation (EC) No 1924/2006 1. *EFSA Journal* 9(6): 2229. Doi: 10.2903/j.efsa.2011.2229.
- Egeberg R, Olsen A, Christensen J, Halkjær J, Jakobsen MU, Overvad K, Tjønneland A (2013) Associations between red meat and risks for colon and rectal cancer depend on the type of red meat consumed. *Journal of Nutrition* 143(4): 464-472. Doi: 10.3945/jn.112.168799.
- Eggenberger S, Jungbluth N (2015) Die Umweltauswirkungen unterschiedlicher Ernährungsweisen. ESU-Services Ltd., Zürich. <http://esu-services.ch/de/publications/foodcase/> (letzter Zugriff: 13.12.2019).
- Eggersdorfer M, Akobundu U, Bailey RL, Shlisky J, Beaudreault AR, Bergeron G, Blancato RB, Blumberg JB, Bourassa MB, Gomes F, Jensen G, Johnson MA, Mackay D, Marshall K, Meydani SN, Tucker KL (2018) Hidden hunger: Solutions for America's aging populations. *Nutrients* 10(9): 1210. Doi: 10.3390/nu10091210.
- Egnell M, Talati Z, Hercberg S, Pettigrew S, Julia C (2018) Objective understanding of front-of-package nutrition labels: An international comparative experimental study across 12 countries. *Nutrients* 10(10): 1542. Doi: 10.3390/nu10101542.
- Egnell M, Talati Z, Pettigrew S, Galan P, Hercberg S, Julia C (2019) Comparison of front-of-pack labels to help German consumers understand the nutritional quality of food products. Color-coded labels outperform all other systems. *Ernährungsumschau* 66(5): 76-84. Doi: 10.4455/eu.2019.020.
- EHI Retail Institute (2014) Handelsdaten aktuell 2014. <https://www.ehi.org/de/studien/handelsdaten-aktuell-2014/> (letzter Zugriff: 04.12.2019).
- Eidner MB, Lund AS, Harboe BS, Clemmensen IH (2013) Calories and portion sizes in recipes throughout 100 years: An overlooked factor in the development of overweight and obesity? *Scandinavian Journal of Public Health* 41(8): 839-845. Doi: 10.1177/1403494813498468.

- Eisenhauer L, Breidenassel C, Arms E, Stehle P (2018) Ernährungsbildung in der Grundschule – Eine bundesweite Bestandsaufnahme. *Aktuelle Ernährungsmedizin* 43(01): 34-40. Doi: 10.1055/s-0044-10148.
- Eisenhut A (2018) Mikroplastik – Ein genauer Blick auf ein wachsendes Problem. *Aqua viva: Die Zeitschrift für Gewässerschutz* 3: 4-9.  
<http://www.aquaviva.ch/aktuell/zeitschrift> (letzter Zugriff: 13.12.2019).
- Ejebu OZ, Whybrow S, Mckenzie L, Dowler E, Garcia AL, Ludbrook A, Barton KL, Wrieden WL, Douglas F (2019) What can secondary data tell us about household food insecurity in a high-income country context? *International Journal of Environmental Research and Public Health* 16(1): 82. Doi: 10.3390/ijerph16010082.
- Ejlervskov KT, Sharp SJ, Stead M, Adamson AJ, White M, Adams J (2018) Supermarket policies on less-healthy food at checkouts: Natural experimental evaluation using interrupted time series analyses of purchases. *PLoS Medicine* 15(12): e1002712. Doi: 10.1371/journal.pmed.1002712.
- Elder RS, Mohr GS (2016) The crunch effect: Food sound salience as a consumption monitoring cue. *Food Quality and Preference* 51: 39-64. Doi: 10.1016/j.foodqual.2016.02.015.
- Ello-Martin JA, Ledikwe JH, Rolls BJ (2005) The influence of food portion size and energy density on energy intake: Implications for weight management. *The American Journal of Clinical Nutrition* 82(suppl): 236-241. Doi: 10.1093/ajcn/82.1.236S.
- Elmqvist T, Maltby E, Barker T, Mortimer M, Perrings C, Aronson J, de Groot RS, Fitter A, Mace G, Norberg J, Pinto S, Ring I (2010) Biodiversity, ecosystems and ecosystem services. In: Kumar P (ed.) *The economics of ecosystems and biodiversity: Ecological and economic foundations*. Taylor and Francis, London: 41-112. Doi: 10.4324/9781849775489.
- Emond JA, Longacre MR, Drake KM, Titus LJ, Hendricks K, MacKenzie T, Harris JL, Carroll JE, Cleveland LP, Langeloh G, Dalton MA (2019) Exposure to child-directed TV advertising and preschoolers' intake of advertised cereals. *American Journal of Preventive Medicine* 56(2): e35-e43. Doi: 10.1016/j.amepre.2018.09.015.
- Engelmann T, Speck M, Rohn H, Biengen K, Langen N, Howell E, Göbel C, Friedrich S, Teitscheid P, Bowry J, Liedtke C, Monetti S (2018) Sustainability assessment of out-of-home meals: potentials and challenges of applying the indicator sets NAHGAST meal-basic and NAHGAST meal-pro. *Sustainability* 10: 562. Doi: 10.3390/su10020562.
- English DR, MacInnis RJ, Hodge AM, Hopper JL, Haydon AM, Giles GG (2004) Red meat, chicken and fish consumption and risk of colorectal cancer. *Cancer Epidemiology, Biomarkers & Prevention* 13: 1509-1514.
- Epstein LH, Jankowiak N, Nederkoorn C, Raynor HA, French SA, Finkelstein E (2012) Experimental research on the relation between food price changes and food-purchasing patterns: A targeted review. *The American Journal of Clinical Nutrition* 95: 789-809. Doi: 10.3945/ajcn.111.024380.
- Epstein LH, Leddy JJ, Temple JL, Faith MS (2007) Food reinforcement and eating: A multilevel analysis. *Psychological Bulletin* 133(5): 884-906. Doi: 10.1037/0033-2909.133.5.884.
- Epstein S (1994) Integration of the cognitive and the psychodynamic unconscious. *American Psychologist* 49(8): 709-724. Doi: 10.1037//0003-066x.49.8.709.
- Erb KH, Lauk C, Kastner T, Mayer A, Theurl MC, Haberl H (2016) Exploring the biophysical option space for feeding the world without deforestation. *Nature Communications* 7: 11382. Doi: 10.1038/ncomms11382.

- Ericksen PJ (2008) What is the vulnerability of a food system to global environmental change? *Ecology and Society* 13(2): 14. Doi: 10.5751/ES-02475-130214.
- Ermgassen EKJ zu, Ayre B, Godar J, Bastos Lima MG, Bauch S, Garrett R, Green J, Lathuilière MJ, Löfgren P, MacFarquhar C, Meyfroidt P, Suavet C, West C, Gardner T (2019) Using supply chain data to monitor zero deforestation commitments: An assessment of progress in the Brazilian soy sector. Doi: 10.31220/osf.io/xb3nk.
- Ernst JB, Arens-Azevêdo U, Bitzer B, Bosy-Westphal A, de Zwaan M, Egert S, Fritsche A, Gerlach S, Hauner H, Heseke H, Koletzko B, Müller-Wieland D, Schulze M, Virmani K, Watzl B, Buyken AE (2018) Quantitative Empfehlung zur Zuckerzufuhr in Deutschland. Konsensuspapier Deutsche Adipositas-Gesellschaft, Deutsche Diabetes Gesellschaft und Deutsche Gesellschaft für Ernährung, Bonn.
- ESD Expert Net (2018) Die Ziele für Nachhaltige Entwicklung im Unterricht. Ein Beitrag zum UNESCO-Weltaktionsprogramm Bildung für Nachhaltige Entwicklung. Engagement Global gGmbH, Bonn.
- Esnouf C, Russel M, Bricas N (eds.) (2013) Food system sustainability. Insights from duALLne. Cambridge University Press, Cambridge. Doi: 10.1017/CBO9781139567688.
- Esping-Andersen G. (1990a) The three worlds of welfare capitalism. Princeton University Press, Princeton, New Jersey.
- Esping-Andersen G (1990b) The three political economies of the welfare state. *International Journal of Sociology* 20(3): 92-123. <https://www.jstor.org/stable/20630041>.
- EU KOM (Europäische Kommission) (o. J.) School food policy country factsheets: Germany. [https://ec.europa.eu/jrc/sites/jrcsh/files/jrc-school-food-policy-factsheet-germany\\_en.pdf](https://ec.europa.eu/jrc/sites/jrcsh/files/jrc-school-food-policy-factsheet-germany_en.pdf) (letzter Zugriff: 19.12.2019).
- EU KOM (Europäische Kommission) (2006) Soil Thematic Strategy, 2006. Thematic Strategy for Soil Protection (COM2006.231). Communication from the Commission to the Council, the European Parliament, the European Economic and Social Committee and the Committee of Regions, Brussels.
- EU KOM (Europäische Kommission) (2013) Commission Recommendation of 9 April 2013 on the use of common methods to measure and communicate the life cycle environmental performance of products and organisations (2013/179/EU). *Official Journal of the European Union*, Volume 56, 4 May 2013.
- EU KOM (Europäische Kommission) (2015) Commission Staff Working Document: Better Regulation Guidelines, EC, Brussels. [https://ec.europa.eu/info/law/law-making-process/planning-and-proposing-law/better-regulation-why-and-how/better-regulation-guidelines-and-toolbox\\_en](https://ec.europa.eu/info/law/law-making-process/planning-and-proposing-law/better-regulation-why-and-how/better-regulation-guidelines-and-toolbox_en) (letzter Zugriff: 10.12.2019).
- EU KOM (Europäische Kommission) (2016) Mitteilung der Kommission an das Europäische Parlament, den Rat und den Europäischen Wirtschafts- und Sozialausschuss über einen Aktionsplan im Bereich der Mehrwertsteuer: Auf dem Weg zu einem einheitlichen europäischen Mehrwertsteuerraum: Zeit für Reformen, COM (2016) 148 final. <https://ec.europa.eu/transparency/regdoc/rep/1/2016/DE/1-2016-148-DE-F1-1.PDF> (letzter Zugriff: 19.12.2019).

- EU KOM (Europäische Kommission) (2018a) The Rapid Alert System for Food and Feed 2017 Annual Report. Luxembourg: Publications Office of the European Union 2018.  
[https://ec.europa.eu/food/sites/food/files/safety/docs/rasff\\_annual\\_report\\_2017.pdf](https://ec.europa.eu/food/sites/food/files/safety/docs/rasff_annual_report_2017.pdf)  
(letzter Zugriff: 07.12.2019).
- EU KOM (Europäische Kommission) (2018b) Supporting the mid-term evaluation of the EU Action Plan on Childhood Obesity. The Childhood Obesity Study. Final report written by the EPHORT consortium: Jolanda Boer, Jeanine Driesenaar, Anneke Blokstra, Francy Vennemann, Nikolai Pushkarev, Johan Hansen. Directorate-General for Health and Food Safety, Brussels.
- EU KOM (Europäische Kommission) (2019a) Agri-food trade statistical factsheet: European Union – Extra EU 28.  
[https://ec.europa.eu/agriculture/sites/agriculture/files/trade-analysis/statistics/outside-eu/regions/agrifood-extra-eu-28\\_en.pdf](https://ec.europa.eu/agriculture/sites/agriculture/files/trade-analysis/statistics/outside-eu/regions/agrifood-extra-eu-28_en.pdf) (Letzter Zugriff: 23.12.2019).
- EU KOM (Europäische Kommission) (2019b) Agri-food trade statistical factsheet: European Union – Sub-Saharan Africa.  
[https://ec.europa.eu/info/sites/info/files/food-farming-fisheries/farming/documents/agrifood-sub-saharan-countries\\_en.pdf](https://ec.europa.eu/info/sites/info/files/food-farming-fisheries/farming/documents/agrifood-sub-saharan-countries_en.pdf) (Letzter Zugriff: 23.12.2019).
- EU KOM (Europäische Kommission) (2019c) Environmental and health risks of microplastic pollution. Group of Chief Scientific Advisors, Scientific Opinion 6/2019, Luxembourg.
- EU KOM (Europäische Kommission) (2019d) Health promotion and disease prevention. Knowledge gateway: Sugars and sweeteners. The European Commission's science and knowledge service.  
<https://ec.europa.eu/jrc/en/health-knowledge-gateway/promotion-prevention/nutrition/sugars-sweeteners> (letzter Zugriff: 14.01.2020).
- EU Pledge (2018) EU Pledge Nutrition White Paper – Updated October 2018.  
[http://www.eu-pledge.eu/sites/eu-pledge.eu/files/releases/EU\\_Pledge\\_Nutrition\\_White\\_Paper.pdf](http://www.eu-pledge.eu/sites/eu-pledge.eu/files/releases/EU_Pledge_Nutrition_White_Paper.pdf) (letzter Zugriff: 19.12.2019).
- Euler M, Krishna V, Schwarze S, Siregar H, Qaim M (2017) Oil palm adoption, household welfare, and nutrition among smallholder farmers in Indonesia. *World Development* 93: 219-235.  
Doi: 10.1016/j.worlddev.2016.12.019.
- Eurofound (2017) European quality of life survey 2016: Quality of life, quality of public services, and quality of society. Publications Office of the European Union, Luxembourg.  
[https://www.eurofound.europa.eu/sites/default/files/ef\\_publication/field\\_ef\\_document/ef1733en.pdf](https://www.eurofound.europa.eu/sites/default/files/ef_publication/field_ef_document/ef1733en.pdf) (letzter Zugriff: 07.12.2019).
- Europäischer Rat (1985) Beschluss des Rates vom 19. Dezember 1984 über gezielte Maßnahmen zur Bekämpfung der Armut auf Gemeinschaftsebene. *Amtsblatt der Europäischen Gemeinschaften (ABLEG)* Nr. L 2/24 vom 03.01.1985: (85/8/EWG).
- Eurostat (2019) Number of healthy years of life: countries compared.  
<https://ec.europa.eu/eurostat/web/products-eurostat-news/-/DDN-20190204-1>  
(letzter Zugriff: 13.12.2019).
- Evans DK, Popova A (2014) Cash transfers and temptation goods: A review of global evidence. World Bank Policy Research Working Paper 6886.  
<https://openknowledge.worldbank.org/bitstream/handle/10986/18802/WPS6886.pdf?sequence=1#> (letzter Zugriff: 19.12.2019).
- Evans GW, English K (2003) The environment of poverty: Multiple stressor exposure, psychophysiological stress, and socioemotional adjustment. *Child Development* 73(4): 1238-1248.  
Doi: 10.1111/1467-8624.00469.

- Evans GW, Schamberg MA (2009) Childhood poverty, chronic stress, and adult working memory. *PNAS* 106(16): 6545-6549. Doi: 10.1073/pnas.0811910106.
- Evans NJ, Hoy MG, Childers CC (2018) Parenting “YouTube Natives”: The impact of pre-roll advertising and text disclosures on parental responses to sponsored child influencer videos. *Journal of Advertising* 47(4): 326-346. Doi: 10.1080/00913367.2018.1544952.
- Evenson RE, Gollin D (2003) Assessing the impact of the green revolution, 1960 to 2000. *Science* 300(5620): 758-762. Doi: 10.1126/science.1078710.
- Evers A, Hämel K (2010) Essensangebote an Schulen. Unterschiedliche Konzepte, unterschiedliche Akzeptanz? Arbeitspapier 192. Hans-Böckler-Stiftung, Düsseldorf.
- Eykelenboom M, van Stralen MM, Olthof MR, Schoonmade LJ, Steenhuis IHM, Renders CM (2019) Political and public acceptability of a sugar-sweetened beverages tax: A mixed-method systematic review and meta-analysis. *International Journal of Behavioral Nutrition and Physical Activity* 16: 78. Doi: 10.1186/s12966-019-0843-0.
- Fairtrade International (2011) Fairtrade Standard for Contract Production (Version 01.05.2011\_v1.4), Bonn. [https://files.fairtrade.net/standards/CP\\_EN.pdf](https://files.fairtrade.net/standards/CP_EN.pdf) (letzter Zugriff: 22.12.2019).
- Fairtrade International (2014) Fairtrade Standard Für Lohnabhängig Beschäftigte (Version 15.01.2014\_v1.1), Bonn. [https://www.fairtrade-deutschland.de/fileadmin/DE/01\\_was\\_ist\\_fairtrade/03\\_standards/fairtrade\\_standard\\_fuer\\_lohnabhaengig\\_beschaeftigte.pdf](https://www.fairtrade-deutschland.de/fileadmin/DE/01_was_ist_fairtrade/03_standards/fairtrade_standard_fuer_lohnabhaengig_beschaeftigte.pdf) (letzter Zugriff: 22.12.2019).
- Fairtrade International (2019) Fairtrade-Standard Für Kleinbauernorganisationen (Version 03.04.2019\_v2.0), Bonn. [https://www.fairtrade-deutschland.de/fileadmin/DE/01\\_was\\_ist\\_fairtrade/03\\_standards/fairtrade\\_standard\\_fuer\\_kleinbauernorganisationen.pdf](https://www.fairtrade-deutschland.de/fileadmin/DE/01_was_ist_fairtrade/03_standards/fairtrade_standard_fuer_kleinbauernorganisationen.pdf). (letzter Zugriff: 22.12.2019).
- Falbe J, Thompson HR, Becker CM, Rojas N, McCulloch CE, Madsen KA (2016) Impact of the Berkeley excise tax on sugar-sweetened beverage consumption. *American Journal of Public Health* 106(10): 1865-1871. Doi: 10.2105/AJPH.2016.303362.
- Fanzo J, Davis C (2019) Can diets be healthy, sustainable, and equitable? *Current Obesity Reports* 8: 495-503. Doi: 10.1007/s13679-019-00362-0.
- FAO (Food and Agriculture Organization of the United Nations) (2007) Tropical crop-livestock systems in conservation agriculture. The Brazilian experience. *Integrated Crop Management*, Vol. 5-2007, Rome.
- FAO (Food and Agriculture Organization of the United Nations) (2011) Global food losses and food waste - Extent, causes and prevention, Rome.
- FAO (Food and Agriculture Organization of the United Nations) (2013) Food wastage footprint. Impacts on natural resources. Summary report. FAO Global Perspective Studies Unit, Rome.
- FAO (Food and Agriculture Organization of the United Nations) (2014) SAFA – Sustainability assessment of food and agriculture systems. Guidelines, Version 3.0, Rome. <http://www.fao.org/3/a-i3957e.pdf> (letzter Zugriff: 14.12.2019).
- FAO (Food and Agriculture Organization of the United Nations) (2015a) The second report on the state of the world’s animal genetic resources for food and agriculture, Rome.
- FAO (Food and Agriculture Organization of the United Nations) (2015b) The second international conference on nutrition: Committing to a future free of malnutrition, Rome.

- FAO (Food and Agriculture Organization of the United Nations) (2016) Methods for estimating comparable rates of food insecurity experienced by adults throughout the world, Rome.
- FAO (Food and Agriculture Organization of the United Nations) (2017) Livestock solutions for climate change, Rome.
- FAO (Food and Agriculture Organization of the United Nations) (2018a) The future of food and agriculture – Alternative pathways to 2050, Rome.
- FAO (Food and Agriculture Organization of the United Nations) (2018b) The state of world fisheries and aquaculture 2018 – Meeting the sustainable development goals, Rome.
- FAO (Food and Agriculture Organization of the United Nations) (2019a) The state of food security and nutrition in the world. Safeguarding against economic slowdowns and downturns, Rome.
- FAO (Food and Agriculture Organization of the United Nations) (2019b) The state of food and agriculture. Moving forward on food loss and waste reduction, Rome.
- FAO, AUC (Food and Agriculture Organization of the United Nations, African Union Commission) (2018) Sustainable agricultural mechanization – A framework for Africa, Addis Ababa. <http://www.fao.org/3/CA1136EN/ca1136en.pdf> (letzter Zugriff: 21.01.2020).
- FAO, WHO (Food and Agriculture Organization of the United Nations, World Health Organization) (2019) Managing pesticides in agriculture and public health – An overview of FAO and WHO guidelines and other resources. Rome. <http://www.fao.org/3/ca5201en/ca5201en.pdf> (letzter Zugriff: 14.12.2019).
- Farmer N, Touchton-Leonard K, Ross A (2018) Psychosocial benefits of cooking interventions: A systematic review. *Health Education & Behavior* 45(2): 167-180. Doi: 10.1177/1090198117736352.
- Fávaro-Moreira NC, Krausch-Hofmann S, Matthys C, Vereecken C, Vanhauwaert E, Declercq A, Bekkering GE, Duyck J (2016) Risk factors for malnutrition in older adults: A systematic review of the literature based on longitudinal data. *Advances in Nutrition* 7(3): 507-522. Doi: 10.3945/an.115.011254.
- FCRN (Food Climate Research Network) (2015) FCRN foodsource. A free and evolving resource to empower informed discussion on sustainable food systems. <https://foodsource.org.uk/> (letzter Zugriff: 13.12.2019).
- FDP (o. J.) Denken wir neu: Das Programm der Freien Demokraten zur Bundestagswahl 2017, Berlin. [https://www.bundestagswahl-bw.de/wahlprogramme\\_btwahl2017.html](https://www.bundestagswahl-bw.de/wahlprogramme_btwahl2017.html) (letzter Zugriff: 19.12.2019).
- FDP Baden-Württemberg (2015) Der nächste Schritt für unser Land. Das Wahlprogramm der Freien Demokraten Baden-Württemberg zur Landtagswahl 2016, Stuttgart. <https://www.landtagswahl-bw.de/wahlprogramme.html> (letzter Zugriff: 19.12.2019).
- FDP Mecklenburg-Vorpommern (o.J.) Land der Chancen – Landtagswahlprogramm Mecklenburg-Vorpommern 2016. <https://www.abgeordnetenwatch.de/mecklenburg-vorpommern/wahlprogramme> (letzter Zugriff: 19.12.2019).
- Feagan R, Henderson A (2009) Devon Acres CSA: Local struggles in a global food system. *Agriculture and Human Values* 26(3): 203-21. Doi: 10.1007/s10460-008-9154-9.
- Feichtinger E (1995) Armut und Ernährung im Wohlstand: Topographie eines Problems. In: Barlösius E, Feichtinger E, Köhler BM (Hrsg.) Ernährung in der Armut – Gesundheitliche, soziale und kulturelle Folgen in der Bundesrepublik Deutschland. *sigma*, Berlin: 291-305.

- Fekete C, Weyers S (2016) Soziale Ungleichheit im Ernährungsverhalten: Befundlage, Ursachen und Interventionen. *Bundesgesundheitsblatt* 59(2): 197-205. Doi: 10.1007/s00103-015-2279-2.
- Felber C (2018) *Gemeinwohl-Ökonomie*. Aktualisierte und erweiterte Taschenbuchausgabe, Piper Verlag, München.
- Femenia F (2019) A meta-analysis of the price and income elasticities of food demand. *German Journal of Agricultural Economics* 68(2): 77-92.
- Fernández-Barrés S, García-Barco M, Basora J, Martínez T, Pedret R, Arija V (2017) The efficacy of a nutrition education intervention to prevent risk of malnutrition for dependent elderly patients receiving Home Care: A randomized controlled trial. *International Journal of Nursing Studies* 70: 131-141. Doi: 10.1016/j.ijnurstu.2017.02.020.
- Feucht Y, Zander K (2017) Consumers' attitudes on carbon footprint labelling Results of the SUSDIET project, Thünen Working Paper 78, Johann Heinrich von Thünen-Institut, Braunschweig.
- Filimonau V, Gherbin A (2017) An exploratory study of food waste management practices in the UK grocery retail sector. *Journal of Cleaner Production* 167: 1184-1194. Doi: 10.1016/j.jclepro.2017.07.229.
- Finkbeiner M (2014) Product environmental footprint – Breakthrough or breakdown for policy implementation of life cycle assessment? *The International Journal of Life Cycle Assessment* 19: 266-271. Doi: 10.1007/s11367-013-0678-x.
- Finkbeiner M, Schau E, Lehmann A, Traverso M (2010) Towards life cycle sustainability assessment. *Sustainability* 2: 3309-3322. Doi: 10.3390/su2103309.
- Fischer C, Griebhammer R (2013) Mehr als nur weniger. Suffizienz: Begriff, Begründung und Potenziale. *Öko-Institut Working Paper 2/2013*. <http://www.oeko.de/oekodoc/1836/2013-505-de.pdf> (letzter Zugriff: 05.12.2019).
- Fischler C (2011) Commensality, society and culture. *Social Science Information* 50(3-4): 528-548. Doi: 10.1177/0539018411413963.
- FIZ (Fisch-Informationszentrum e. V.) (2018) *Fischwirtschaft: Daten und Fakten 2018*, Hamburg.
- Flegal KM, Kit BK, Orpana H, Graubard BI (2013) Association of all-cause mortality with overweight and obesity using standard body mass index categories: a systematic review and meta-analysis. *JAMA* 309(1): 71-82. Doi: 10.1001/jama.2012.113905.
- Fleige H, Mordhorst A, Burbaum B, Cordsen E, Filipinski M, Horn R (2017) Natürliche und anthropogene Bodenverdichtungen in Schleswig-Holstein: Nachweis von schädlichen Bodenveränderungen. Beitrag zur Jahrestagung der DBG „Horizonte des Bodens“, 2.-7.9.2017, Göttingen.
- Flick S, Rose L (2012) Bilder zur Vergeschlechtlichung des Essens. Ergebnisse einer Untersuchung zur Nahrungsmittelwerbung im Fernsehen. *Gender* 2: 48-65.
- Flint L, Kuhnert H, Laggner B, Lassen B, Nieberg H, Strohm R (2016) Prozess nachhaltige Milcherzeugung - Entwicklung eines Nachhaltigkeitsmoduls zur Erfassung und Bewertung von Nachhaltigkeitskriterien auf milchviehhaltenden Betrieben. Thünen Working Paper 54, Johann Heinrich von Thünen-Institut, Braunschweig. Doi: 10.3220/WP1459335513000.
- Fong GT, Hyland A, Borland R, Hammond D, Hastings G, McNeill A, Anderson S, Cummings KM, Allwright S, Mulcahy M, Howell F, Clancy L, Thompson ME, Connolly G, Driezen P (2006) Reductions in tobacco smoke pollution and increases in support for smoke-free public places following the implementation of comprehensive smoke-free workplace legislation in the Republic of Ireland: Findings from the ITC Ireland/UK Survey. *Tobacco Control* 15(Suppl III): iii51-iii58. Doi: 10.1136/tc.2005.013649.

- Food and Land Use Coalition (2019) Growing better: Ten critical transitions to transform food and land Use. Global Consultation Report of the Food and Land Use Coalition. <https://www.foodandlandusecoalition.org/global-report/> (letzter Zugriff: 04.12.2019).
- Food Marketing Institute (2013) FMI Foundation Annual Report 2013. Food Marketing Institute, Washington DC.
- Foodwatch (2018a) Im Kakao-Sumpf – der Schulmilch-Report. Von gekauften Studien bis zur wundersamen Partnerschaft von Milchwirtschaft und Politik: Ein Lehrstück über die Macht des Lobbyismus, Berlin.
- Foodwatch (2018b) So zuckrig sind unsere „Erfrischungsgetränke“ in Deutschland – Immer noch. Marktstudie 2018, Berlin.
- Foreman KJ, Marquez N, Dolgert A, Fukutaki K, Fullman N, McGaughey M, Pletcher MA, Smith AE, Tang K, Yuan CW, Brown JC, Friedman J, He J, Heuton KR, Holmberg M, Patel DJ, Reidy P, Carter A, Cercy K, Chapin A, Douwes-Schultz D, Frank T, Goettsch F, Liu PY, Nandakumar V, Reitsma MB, Reuter V, Sadat N, Sorensen RJD, Srinivasan V, Updike RL, York H, Lopez AD, Lozano R, Lim SS, Mokdad AH, Vollset SE, Murray CJL (2018) Forecasting life expectancy, years of life lost, and all-cause and cause-specific mortality for 250 causes of death: Reference and alternative scenarios for 2016-40 for 195 countries and territories. *The Lancet* 392(10159): 2052-2090. Doi: 10.1016/S0140-6736(18)31694-5.
- Forman J, Silverstein J (2012) Organic foods. Health and environmental advantages and disadvantages. *Pediatrics* 130(5): e1406-e1415. Doi: 10.1542/peds.2012-2579.
- Forssell S, Lankoski L (2015) The sustainability promise of alternative food networks: An examination through „alternative“ characteristics. *Agriculture and Human Values* 32(1): 63-75. Doi: 10.1007/s10460-014-9516-4.
- Forstner B, Zavyalova E (2017) Betriebs- und Unternehmensstrukturen in der deutschen Landwirtschaft: Workshop zu vorläufigen Ergebnissen und methodischen Ansätzen. Thünen Working Paper 80, Johann Heinrich von Thünen-Institut, Braunschweig. Doi: 10.3220/WP1510569554000.
- Forum Ökologisch-Soziale Marktwirtschaft (2019) Hintergrundpapier zur Pressekonferenz des BMU: Lenkungs- und Verteilungswirkungen einer klimaschutzorientierten Reform der Energiesteuern. Forschungsvorhaben „Künftige Finanzierung der Energieversorgung aus erneuerbaren Energien“ (FKZ UM 17433160). Auftraggeber: Bundesministerium für Umwelt, Naturschutz und nukleare Sicherheit, Berlin.
- Forum Ökologisch-Soziale Marktwirtschaft (2020) Tierwohl fördern, Klima schützen, Studie des Forums Ökologisch-Soziale Marktwirtschaft im Auftrag von Greenpeace, Berlin.
- Foster C, Green K, Bleda M, Dewich P, Evans B, Flynn A, Mylan J (2006) Environmental impacts of food production and consumption. A research report completed for the Department for Environment, Food and Rural Affairs (DEFRA). Manchester Business School, DEFRA, London.
- Fraginière A (2014) Climate change, neutrality and the harm principle. *Ethical Perspectives* 21(1): 73-99. Doi: 10.2143/EP.21.1.3017287.
- Francis N, Marron D, Rueben K (2016) The pros and cons of taxing sweetened beverages based on sugar content. Research report, Urban Institute. <https://ncdalliance.org/fr/node/8991> (letzter Zugriff: 19.12.2019).
- Frankowska A, Jeswani HK, Azapagic A (2019) Environmental sustainability issues in the food-energy-water nexus in the UK vegetables sector: Energy and water consumption. *Energy Procedia* 161: 150-156. Doi: 10.1016/j.egypro.2019.02.074.

- Franz A, Deimel I, Spiller A (2012) Concerns about animal welfare: A cluster analysis of German pig farmers. *British Food Journal* 114(10): 1445-1462. Doi: 10.1108/00070701211263019.
- Frazier WC, Harris J (2017) Trends in television advertising to young people: 2016 update. Rudd Centre for Food Policy and Obesity, Harford, CT.
- French SA, Mitchell NR, Wolfson J, Harnack LJ, Jeffery RW, Gerlach AF, Blundell JE, Pentel PR (2014) Portion size effects on weight gain in a free living setting. *Obesity* 22(6): 1400-1405. Doi: 10.1002/oby.20720.
- Frewer LJ, Howard C, Hedderley D, Shepherd R (1996) What determines trust in information about food-related risks? Underlying psychological constructs. *Risk Analysis* 16(4): 473-86. Doi: 10.1111/j.1539-6924.1996.tb01094.x.
- Frieden TR (2013) Government's role in protecting health and safety. *The New England Journal of Medicine* 368: 1857-1859. Doi: 10.1056/NEJMp1303819.
- Friedman M (1953) The methodology of positive economics. In: Friedman M (ed.): *Essays in positive economics*. University of Chicago Press, Chicago: 3-43.
- Frieling D, Stricks V, Wildenberg M, Schneider F (2013) The beauty and the beast – How quality management criteria at supermarkets create food waste. In: CPM – The Swedish Life Cycle Center (ed.) *Perspectives on Managing Life Cycles*. 6th International Conference on Life Cycle Management, Gothenburg, Sweden, Aug 25-28, 2013.
- Frischknecht R, Büsser Knöpfel S (2013) *Ökofaktoren Schweiz 2013 gemäss der Methode der ökologischen Knappheit. Methodische Grundlagen und Anwendung auf die Schweiz*. Umwelt-Wissen Nr. 1330. Bundesamt für Umwelt, Bern.
- Fritsche UR, Eberle U (2009) Greenhouse-gas emissions from the production and processing of food. Working Paper. Öko-Institut e. V., Darmstadt.
- Fulkerson JA, Larson N, Horning M, Neumark-Sztainer D (2014) A review of associations between family or shared meal frequency and dietary and weight status outcomes across the lifespan. *Journal of Nutrition Education and Behavior* 46(1): 2-19. Doi: 10.1016/j.jneb.2013.07.012.
- Gagnebin M, Graichen P, Lenck T (2019) *Die Gelbwesten-Proteste: Eine (Fehler-)Analyse der französischen CO2-Preispolitik, Hintergrund*. Agora Energiewende, Berlin.
- Gahagan S (2012) The development of eating behavior-biology and context. *Journal of Developmental and Behavioral Pediatrics* 33(3): 261-271. Doi: 10.1097/DBP.0b013e31824a7baa.
- Gaillard G, Nemecek T (2009) Swiss agricultural life cycle assessment (SALCA): An integrated environmental assessment concept for agriculture. International Conference "Integrated Assessment of Agriculture and Sustainable Development, Setting the Agenda for Science and Policy", Egmond aan Zee, Niederlande.
- Galatola M, Pant R (2014) Reply to the editorial „Product environmental footprint - breakthrough or breakdown for policy implementation of life cycle assessment?“ written by Prof. Finkbeiner (*Int J Life Cycle Assess* 19(2): 266-271). *International Journal of Life Cycle Assessment* 19(6): 1356-1360. Doi: 10.1007/s11367-014-0740-3.
- Gamp M, Debbeler LJ, Renner B (2016) Risikokommunikation im Internet. In: Fischer F, Krämer A (eds.) *eHealth in Deutschland*. Springer Verlag, Berlin, Heidelberg: 421-440.
- Garfí M, Cadena E, Sanchez-Ramos D, Ferrer I (2016) Life cycle assessment of drinking water: Comparing conventional water treatment, reverse osmosis and mineral water in glass and plastic bottles. *Journal of Cleaner Production* 137: 997-1003. Doi: 10.1016/j.jclepro.2016.07.218.

- Garming (2016) Auswirkungen des Mindestlohns in Landwirtschaft und Gartenbau: Erfahrungen aus dem ersten Jahr und Ausblick. Thünen Working Paper 53, Johann Heinrich von Thünen-Institut, Braunschweig. Doi: 10.3220/WP1456999876000.
- Garnett T (2011) Where are the best opportunities for reducing greenhouse gas emissions in the food system (including the food chain)? *Food Policy* 36: S23-S32. Doi: 10.1016/j.foodpol.2010.10.010.
- Garnett T (2013) Food sustainability. Problems, perspectives and solutions. *The Proceedings of the Nutrition Society* 72(1): 29-39. Doi: 10.1017/S0029665112002947.
- Garnett T, Godfray C (2012) Sustainable intensification in agriculture. Navigating a course through competing food system priorities, Food Climate Research Network and the Oxford Martin Programme on the Future of Food, University of Oxford, UK.
- Garnett T, Mathewson S, Angelides P, Borthwick F (2015) Policies and actions to shift eating patterns: What works. A review of the evidence of the effectiveness of interventions aimed at shifting diets in more sustainable and healthy directions. Food Climate Research Network – FCRN, University of Oxford.
- Gase L, Dunning L, Kuo T, Simon P, Fielding JE (2014) Restaurant owners' perspectives on a voluntary program to recognize restaurants for offering reduced-size portions, Los Angeles County, 2012. *Preventing Chronic Disease* 11: 130310. Doi: 10.5888/pcd11.130310.
- Gassler B, Spiller A (2018) Is it all in the mix? Consumer preferences for segregated and mass balance certified sustainable palm oil. *Journal of Cleaner Production* 195: 21-31. Doi: 10.1016/j.jclepro.2018.05.039.
- Gatti CR, Liang J, Zhou M (2019) Sustainable palm oil may not be so sustainable. *Science of The Total Environment* 652: 48-51. Doi: 10.1016/j.scitotenv.2018.10.222.
- Gaugler T, Michalke A (2018) „How much is the dish?“ – Was kosten uns Lebensmittel wirklich? Studie für Tollwood GmbH und Schweißfurth Stiftung. [https://www.tollwood.de/wp-content/uploads/2018/09/20180914\\_how\\_much\\_is\\_the\\_dish\\_-\\_was\\_kosten\\_uns\\_lebensmittel\\_langfassungfinal-2.pdf](https://www.tollwood.de/wp-content/uploads/2018/09/20180914_how_much_is_the_dish_-_was_kosten_uns_lebensmittel_langfassungfinal-2.pdf) (letzter Zugriff: 03.12.2019).
- GBD (Global Burden of Disease) (2018) Global, regional, and national comparative risk assessment of 84 behavioural, environmental and occupational, and metabolic risks or clusters of risks for 195 countries and territories, 1990-2017: A systematic analysis for the Global Burden of Disease Study 2017. *The Lancet* 392(10159): 1923-1994. Doi: 10.1016/S0140-6736(18)32225-6.
- Gechert S, Rietzler K, Schreiber S, Stein U (2019) Wirtschaftliche Instrumente für eine klima- und sozialverträgliche CO<sub>2</sub>-Bepreisung. LOS 2: Belastungsanalyse. Gutachten im Auftrag des Bundesministeriums für Umwelt, Naturschutz und nukleare Sicherheit. Institut für Makroökonomie und Konjunkturforschung (IMK) der Hans-Böckler-Stiftung, Düsseldorf.
- Gedrich K (2016) Trendanalysen zum Lebensmittelverbrauch auf der Basis der Agrarstatistik. In: DGE (Hrsg.) 13. DGE-Ernährungsbericht, Bonn: 19-40.
- Geels FW (2004) From sectoral systems of innovation to socio-technical systems. Insights about dynamics and change from sociology and institutional theory. *Research Policy* 33(6-7): 897-920. Doi: 10.1016/j.respol.2004.01.015.
- Geier A, Wansink B, Rozin P (2012) Red potato chips: Segmentation cues can substantially decrease food intake. *Health Psychology* 31(3): 398-401. Doi: 10.1037/a0027221.

- Gensch KO, Liu R, Prieß R, Stratmann B, Teufel J, Finkbeiner M, Bach V, Berger M, Grimm D (2017) Product carbon footprint und water footprint: Möglichkeiten zur methodischen Integration in ein bestehendes Typ-1 Umweltzeichen (Blauer Engel) unter besonderer Berücksichtigung des Kommunikationsaspektes. Texte 39/2017, Umweltbundesamt, Berlin.
- Gernand AD, Schulze KJ, Stewart CP, West KP Jr, Christian P (2016) Micronutrient deficiencies in pregnancy worldwide: Health effects and prevention. *Nature Reviews Endocrinology* 12(5): 274-289. Doi: 10.1038/nrendo.2016.37.
- Gesualdo N, Yanovitzky I (2019) Advertising susceptibility and youth preference for and consumption of sugar-sweetened beverages: Findings from a national survey. *Journal of Nutrition Education and Behavior* 51(1): 16-22. Doi: 10.1016/j.jneb.2018.10.007.
- Geyer R, Jambeck JR, Law KL (2017) Production, use, and fate of all plastics ever made. *Science Advances* 3: e1700782. Doi: 10.1126/sciadv.1700782.
- GfK (Gesellschaft für Konsumforschung) (2017) Systematische Erfassung von Lebensmittelabfällen der privaten Haushalte in Deutschland. Schlussbericht zur Studie, durchgeführt für das Bundesministerium für Ernährung und Landwirtschaft, Nürnberg.
- Giebel S, Peinelt V, Feis C (2017) Nudging in der Betriebsgastronomie: Das gastronomische Ampelsystem. *Ernährung im Fokus* 7-8: 202-209.
- Giese H, König LM, Täut D, Ollila H, Băban A, Absetz P, Schupp H, Renner B (2015) Exploring the association between television advertising of healthy and unhealthy foods, self-control, and food intake in three European countries. *Applied Psychology: Health and Well-Being* 7(1): 41-62. Doi: 10.1111/aphw.12036.
- Gigerenzer G, Gaissmaier W, Kurz-Milcke E, Schwartz LM, Woloshin S (2007) Helping doctors and patients make sense of health statistics. *Psychological Science in the Public Interest* 8(2): 53-96. Doi: 10.1111/j.1539-6053.2008.00033.x.
- Girgis S, Neal B, Prescott J, Prendergast J, Dumbrell S, Turner C, Woodward M (2003) A one-quarter reduction in the salt content of bread can be made without detection. *European Journal of Clinical Nutrition* 57: 616-620. Doi: 10.1038/sj.ejcn.1601583.
- GIZ (Gesellschaft für Internationale Zusammenarbeit) (2018a) Milchwirtschaft in Burkina Faso: Potenzial und Auswirkungen europäischer Milchpulverexporte. Sektorvorhaben Agrarhandel und landwirtschaftliche Wertschöpfungsketten, Policy Brief 02, Eschborn.
- GIZ (Gesellschaft für Internationale Zusammenarbeit) (2018b) Hähnchenproduktion in Kamerun: Wirkungen der Importbeschränkung auf die kamerunische Geflügelbranche. Sektorvorhaben Agrarhandel und landwirtschaftliche Wertschöpfungsketten, Policy Brief 03, Eschborn.
- Glasgow RE, Klesges LM, Dzewaltowski DA, Estabrooks PA, Vogt TM (2006) Evaluating the impact of health promotion programs: Using the RE-AIM framework to form summary measures for decision making involving complex issues. *Health Education Research* 21(5): 688-694. Doi: 10.1093/her/cyl081.
- Global Panel on Agriculture and Food Systems for Nutrition (2016) Food systems and diets: Facing the challenges of the 21st century, London. <http://glopan.org/sites/default/files/ForesightReport.pdf> (letzter Zugriff: 05.12.2019).
- GlobalG.A.P. (2014) GlobalG.A.P. Risk-Assessment on Social Practice (GRASP) Risiko-Einschätzung Für Soziale Belange von Arbeitern GRASP Modul – Interpretation für Deutschland. <https://www.globalgap.org/de/for-producers/globalg.a.p.-add-on/grasp/> (letzter Zugriff: 23.12.2019).

- Göbel C, Scheiper ML, Teitscheid P, Müller V, Friedrich S, Engelmann T, Neundorf D, Speck M, Rohn H, Langen N (2017) Nachhaltig wirtschaften in der Außer-Haus-Gastronomie. Status-Quo-Analyse – Struktur und wirtschaftliche Bedeutung. Nahgast Arbeitspapier 1, Münster. [https://www.nahgast.de/wp-content/uploads/2017/09/NAHGAST\\_APap1\\_Au%C3%9Fer\\_Haus-Gastronomie.pdf](https://www.nahgast.de/wp-content/uploads/2017/09/NAHGAST_APap1_Au%C3%9Fer_Haus-Gastronomie.pdf) (letzter Zugriff: 10.12.2019).
- Gödecke T, Stein AJ, Qaim M (2018) The global burden of chronic and hidden hunger: Trends and determinants. *Global Food Security* 17: 21-29. Doi: 10.1016/j.gfs.2018.03.004.
- Gollust SE, Barry CL, Niederdeppe J (2014) Americans' opinions about policies to reduce consumption of sugar-sweetened beverages. *Preventive Medicine* 63: 52-57. Doi: 10.1016/j.ypmed.2014.03.002.
- Gollust SE, Tang X, White JM, French SA, Runge CF, Rothman AJ (2017) Young adults' responses to alternative messages describing a sugar-sweetened beverage price increase. *Public Health Nutr.* 2017 20(1): 46–52. Doi: 10.1017/S1368980016001816.
- Gollwitzer PM (1999) Implementation intentions: Strong effects of simple plans. *American Psychologist* 54(7): 493-503. Doi: 10.1037/0003-066X.54.7.493.
- Golsong N, Nowak N, Schweter A, Lindtner O (2017) KiESEL – die Kinder- Ernährungsstudie zur Erfassung des Lebensmittelverzehr als Modul in KiGGS Welle 2. *Journal of Health Monitoring* 2(S3): 29-37. Doi: 10.17886/RKI-GBE-2017-100.
- Gómez MI, Barrett CB, Raney T, Pinstrip-Andersen P, Meerman J, Croppenstedt A, Carisma B, Thompson B (2013) Post-green revolution food systems and the triple burden of malnutrition. *Food Policy* 42: 129-138. Doi 10.1016/j.foodpol.2013.06.009.
- Gortmaker SL, Swinburn BA, Levy D, Carter R, Mabry PL, Finegood DT, Huang T, Marsh T, Moodie ML (2011) Changing the future of obesity: Science, policy, and action. *The Lancet* 378(9793): 838-847. Doi: 10.1016/S0140-6736(11)60815-5.
- Goryakin Y, Monsivais P, Suhrcke M (2017) Soft drink prices, sales, body mass index and diabetes: Evidence from a panel of low-, middle- and high-income countries. *Food Policy* 73: 88-94. Doi: 10.1016/j.foodpol.2017.09.002.
- Gose M, Krems C, Heuer T, Hoffmann I (2016) Trends in food consumption and nutrient intake in Germany between 2006 and 2012: Results of the German national nutrition monitoring (NEMONIT). *British Journal of Nutrition* 115(8): 1498-1507. Doi: 10.1017/S0007114516000544.
- Grabka MM, Goebel J (2018) Einkommensverteilung in Deutschland: Realeinkommen sind seit 1991 gestiegen, aber mehr Menschen beziehen Niedrigeinkommen. *DIW Wochenbericht* 21: 449-459. Doi: 10.18723/diw\_wb:2018-21-1.
- Grabs J (2015) The rebound effects of switching to vegetarianism. A microeconomic analysis of Swedish consumption behavior. *Ecological Economics* 116: 270-279. Doi: 10.1016/j.ecolecon.2015.04.030.
- Graça P, Gregório MJ, de Sousa SM, Brás S, Penedo T, Carvalho T, Bandarra NM, Lima RM, Simão AP, Goiana-da-Silva F, Freitas MG, Araújo FF (2018) A new interministerial strategy for the promotion of healthy eating in Portugal: Implementation and initial results. *Health Research Policy and Systems* 16(1): 102. Doi: 10.1186/s12961-018-0380-3.
- Graichen P, Lenc T (2018) Eine Neuordnung der Abgaben und Umlagen auf Strom, Wärme, Verkehr: Optionen für eine aufkommensneutrale CO<sub>2</sub>-Bepreisung von Energieerzeugung und Energieverbrauch, Agora Energiewende Positionspapier. [https://www.agora-energiewende.de/fileadmin2/Projekte/2017/Abgaben\\_Umlagen/147\\_Reformvorschlag\\_Umlagen-Steuern\\_WEB.pdf](https://www.agora-energiewende.de/fileadmin2/Projekte/2017/Abgaben_Umlagen/147_Reformvorschlag_Umlagen-Steuern_WEB.pdf) (letzter Zugriff: 19.12.2019).

- Grant CA, Hicks AL (2018) Comparative life cycle assessment of milk and plant-based alternatives. *Environmental Engineering Science* 35(11). Doi: 10.1089/ees.2018.0233.
- Greenhouse Gas Protocol (2011) Product life cycle accounting and reporting standard. World Resources Institute (WRI) and World Business Council for Sustainable Development (WBCSD), Washington, DC.
- Greenpeace (2017) Jahresbericht 2017, Hamburg.
- Greer A (2017) Post-exceptional politics in agriculture: An examination of the 2013 CAP reform. *Journal of European Public Policy* 24(11): 1585-1603. Doi: 10.1080/13501763.2017.1334080.
- Greer SL, Wismar M, Kosinska M (2015) Towards intersectoral governance: Lessons learned from health system governance. *Public Health Panorama* 1(2): 128-132.
- Grenz JH (2017) Nachhaltigkeitsanalyse von Landwirtschaftsbetrieben. *Agrarforschung Schweiz* 8(10): 410-413.
- Grethe H (2017) The economics of farm animal welfare. *Annual Review of Resource Economics* 9(1): 75-94. Doi: 10.1146/annurev-resource-100516-053419.
- Grimm H, Camenzind S, Aigner A (2016) Tierethik. In: Borgards R (Hrsg.) *Tiere. Kulturwissenschaftliches Handbuch*. Metzler, Stuttgart: 78-97.
- Groos T, Jehles N (2015) Der Einfluss von Armut auf die Entwicklung von Kindern. Ergebnisse der Schuleingangsuntersuchung. Arbeitspapiere wissenschaftliche Begleitforschung „Kein Kind zurücklassen!“ Werkstattbericht, Gütersloh.
- Groß S, Brümmer N, Christoph-Schulz I, Roosen J (2019) Verbraucherpräferenzen – Paradoxien, Dilemmata, neue Wege. In: Christoph-Schulz I (Hrsg.) *SocialLab – Nutztierhaltung im Spiegel der Gesellschaft*. Braunschweig: 55-60.
- Gruber J, Mullainathan S (2002) Do cigarette taxes make smokers happier? NBER Working Paper No. 8872, April 2002, National Bureau of Economic Research, Cambridge, MA, <https://www.nber.org/papers/w8872.pdf> (letzter Zugriff: 19.12.2019).
- Gruber LM, Brandstetter CP, Bos U, Lindner JP, Albrecht S (2016) LCA study of unconsumed food and the influence of consumer behavior. *The International Journal of Life Cycle Assessment* 21(5): 773-784. Doi: 10.1007/s11367-015-0933-4.
- Gundersen C, Tarasuk V, Cheng J, de Oliveira C, Kurdyak P (2018) Food insecurity status and mortality among adults in Ontario, Canada. *PLOS ONE* 13(8): e0202642. Doi: 10.1371/journal.pone.0202642.
- Gussow JD, Clancy KL (1986) Dietary guidelines for sustainability. *Journal of Nutrition Education* 18(1): 1-5. Doi: 10.1016/S0022-3182(86)80255-2.
- Gustafson D, Gutman A, Leet W, Drewnowski A, Fanzo J, Ingram J (2016) Seven food system metrics of sustainable nutrition security. *Sustainability* 8(3): 196. Doi: 10.3390/su8030196.
- Gutierrez NL, Valencia SR, Branch TA, Agnew DJ, Baum JK, Bianchi PL, Cornejo-Donoso J, Costello C, Defeo O, Essington TE, Hilborn R, Hoggarth DD, Larsen AE, Ninnis C, Sainsbury K, Selden RL, Sistla S, Smith ADM, Stern-Pirlot A, Teck SJ, Thorson JT, Williams NE (2012) Eco-label conveys reliable information on fish stock health to seafood consumers. *PLOS ONE* 7(8): e43765. Doi: 10.1371/journal.pone.0043765.

- Haak M (2016) Berücksichtigung von Nachhaltigkeitskriterien in der öffentlichen Beschaffung von Verpflegungsdienstleistungen. Eine Analyse von politischem Anspruch und administrativer Wirklichkeit in Berlin und Brandenburg. Bachelorarbeit, Hochschule für nachhaltige Entwicklung Eberswalde.
- Haber W (1991) Auswirkungen der Extensivierung auf die Umwelt einer Industriegesellschaft. Gedanken zu einer De-Intensivierung der Landwirtschaft. *Naturschutz und Landschaftsplanung* 23: 94-99.
- Haber W (2014) *Landwirtschaft und Naturschutz*. 1. Auflage. Wiley-VCH Verlag, Weinheim.
- Haber W (2016) Flächenansprüche – Wie erfüllt man wachsende Ansprüche an begrenzte Landflächen? *Schriftenreihe der Deutschen Landeskulturgesellschaft*, Heft 14: 23-37.
- Haber W, Salzwedel J (1992) *Umweltprobleme der Landwirtschaft*. Sachbuch Ökologie. Metzler-Poeschel, Stuttgart.
- HAFL (Hochschule für Agrar-, Forst- und Lebensmittelwissenschaften) (2017) Kurzbeschrieb RISE (Response-Inducing Sustainability Evaluation). Maßnahmenorientierte Nachhaltigkeitsanalyse landwirtschaftlicher Betriebe, aktualisiert am 09. Januar 2017. <https://www.bfh.ch/dam/jcr:a7cfa1ee-f429-4bbf-b711-f060e5219fb8/was-ist-rise.pdf> (letzter Zugriff: 22.12.2019).
- Hagedorn W, Wilts H (2019) Who should waste less? Food waste prevention and rebound effects in the context of the Sustainable Development Goals. *GAIA* 28/2: 119-125.
- Haines-Young R, Potschin M (2010) The links between biodiversity, ecosystem services and human well-being. In: Raffaelli DG, Frid CL (eds.) *Ecosystem Ecology*. Cambridge University Press, Cambridge: 110-139. Doi: 10.1017/CBO9780511750458.007.
- Hallmann AL (2014) Food advertising to children: A critical evaluation of public, governmental and corporate responsibilities in Germany. Anchor Academic Publishing, Hamburg.
- Hamilton SF, Richards TJ (2019) Food policy and household food waste. *American Journal of Agricultural Economics* 101(2): 600-614. Doi: 10.1093/ajae/aay109.
- Hamley S (2017) The effect of replacing saturated fat with mostly n-6 polyunsaturated fat on coronary heart disease: A meta-analysis of randomised controlled trials. *Nutrition Journal* 16(1): 30. Doi: 10.1186/s12937-017-0254-5.
- Hamulka J, Wadolowska L, Hoffmann M, Kowalkowska J, Gutkowska K (2018) Effects of an education program on nutrition knowledge, attitudes toward nutrition, diet quality, lifestyle, and body composition in Polish teenagers. The ABC of Healthy Eating Project: Design, protocol, and methodology. *Nutrients* 10(10): e1439. Doi: 10.3390/nu10101439.
- Hanks AS, Just DR, Smith LE, Wansink B (2012) Healthy convenience: Nudging students toward healthier choices in the lunchroom. *Journal of Public Health* 34: 370-376. Doi: 10.1093/pubmed/fds003.
- Hansjürgens B (Hrsg.) (2015) *Inwertsetzung biologischer Vielfalt. Naturschutzanliegen in andere Politikbereiche integrieren*. Metropolis-Verlag (Ökologie und Wirtschaftsforschung, Band 97), Marburg.
- Hanson KL, Garner J, Connor LM, Jilcott Pitts SB, McGuirt J, Harris R, Kolodinsky J, Wang W, Sitaker M, Ammerman A, Seguin RA (2019) Fruit and vegetable preferences and practices may hinder participation in community-supported agriculture among low-income rural families. *Journal of Nutrition Education and Behavior* 51(1): 57-67. Doi: 10.1016/j.jneb.2018.08.006.

- Hanson MA, Gluckman PD (2014) Early developmental conditioning of later health and disease: Physiology or Pathophysiology? *Physiological Reviews* 94(4): 1027-1076. Doi: 10.1152/physrev.00029.2013.
- Harding JL, Backholer K, Williams ED, Peeters A, Cameron AJ, Hare MJ, Shaw JE, Magliano DJ (2014) Psychological stress is positively associated with body mass index gain over 5 years: Evidence from the longitudinal AusDiab study. *Obesity* 22(1): 277-286. Doi: 10.1002/oby.20423.
- Hargreaves T, Nye M, Burgess J (2010) Making energy visible: A qualitative field study of how householders interact with feedback from smart energy monitors. *Energy Policy* 38(10): 6111-6119. Doi: 10.1016/j.enpol.2010.05.068.
- Harris JL, Pomeranz JL, Lobstein T, Brownell KD (2009) A crisis in the marketplace: How food marketing contributes to childhood obesity and what can be done. *Annual Review of Public Health* 30: 211-225. Doi: 10.1146/annurev.publhealth.031308.100304.
- Harris PR, Griffin DW, Murray S (2008) Testing the limits of optimistic bias: Event and person moderators in a multilevel framework. *Journal of Personality and Social Psychology* 95(5): 1225-1237. Doi: 10.1037/a0013315.
- Harrison K, Marske AL (2005) Nutritional content of foods advertised during the television programs children watch most. *American Journal of Public Health* 95(9): 1568-1574. Doi: 10.2105/AJPH.2004.048058.
- Hartmann A (2015) Entwicklung des Spargelanbaus in Baden-Württemberg. *Statistisches Monatsheft Baden-Württemberg* (4): 17-20.
- Hartmann C, Siegrist M (2017) Consumer perception and behaviour regarding sustainable protein consumption: A systematic review. *Trends in Food Science & Technology* 61: 11-25. Doi: 10.1016/j.tifs.2016.12.006.
- Haubach C, Held B (2015) Ist ökologischer Konsum teurer? Ein warenkorbbasierter Vergleich. *Statistisches Bundesamt Wirtschaft und Statistik* 1: 41-55. [https://www.destatis.de/DE/Methoden/WISTA-Wirtschaft-und-Statistik/2015/01/oekologischer-konsum-012015.pdf?\\_\\_blob=publicationFile](https://www.destatis.de/DE/Methoden/WISTA-Wirtschaft-und-Statistik/2015/01/oekologischer-konsum-012015.pdf?__blob=publicationFile) (letzter Zugriff: 20.12.2019).
- Hauff V (Hrsg.) (1987) *Unsere gemeinsame Zukunft. Der Brundtland-Bericht der Weltkommission für Umwelt und Entwicklung*. Eggenkamp Verlag, Greven.
- Hauschild MZ, Goedkoop M, Guinée J, Heijungs H, Huijbregts M, Jolliet O, Margni M, de Schryver A, Humbert S, Laurent A, Sala S, Pant R (2013) Identifying best existing practice for characterization modeling in life cycle impact assessment. *The International Journal of Life Cycle Assessment* 18: 683-697. Doi: 10.1007/s11367-012-0489-5.
- Haushofer J, Fehr E (2014) On the psychology of poverty. *Science* 344(6186): 862-867. Doi: 10.1126/science.1232491.
- Havers K (2008) *Die Rolle der Luftfracht bei Lebensmitteltransporten. Aktuelle Entwicklungen in Deutschland und deren ökologische Folgen*. Öko-Institut, Berlin.
- Hawley KL, Roberto CA, Bragg MA, Liu PJ, Schwartz MB, Brownell KD (2013) The science on front-of-package food labels. *Public Health Nutrition* 16(3): 430-439. Doi: 10.1017/S1368980012000754.
- Haynes A, Hardman CA, Makin AD, Halford JC, Jebb SA, Robinson E (2019) Visual perceptions of portion size normality and intended food consumption: A norm range model. *Food Quality and Preference* 72: 77-85. Doi: 10.1016/j.foodqual.2018.10.003.

- HBS, BUND, Le Monde Diplomatique (Heinrich-Böll-Stiftung, BUND, Le Monde Diplomatique) (Hrsg.) (2019) Agrar-Atlas. Daten und Fakten zur europäischen Landwirtschaft, Berlin.
- HBSC Studienverbund Deutschland (2015a) Faktenblatt zur Studie Health Behaviour in School Aged Children 2013/2014: Konsum von Softdrinks bei Kindern und Jugendlichen. [http://www.gbe-bund.de/pdf/Faktenbl\\_softdrinks\\_2013\\_14.pdf](http://www.gbe-bund.de/pdf/Faktenbl_softdrinks_2013_14.pdf) (letzter Zugriff: 09.12.2019).
- HBSC Studienverbund Deutschland (2015b) Faktenblatt zur Studie Health Behaviour in School Aged Children 2013/2014: Gemüsekonsum von Kindern und Jugendlichen. [http://www.gbe-bund.de/pdf/Faktenbl\\_gemuesekonsum\\_2013\\_14.pdf](http://www.gbe-bund.de/pdf/Faktenbl_gemuesekonsum_2013_14.pdf) (letzter Zugriff: 09.12.2019).
- HBSC Studienverbund Deutschland (2015c) Faktenblatt zur Studie Health Behaviour in School Aged Children 2013/2014: Häufigkeit des Frühstücks bei Kindern und Jugendlichen. [http://www.gbe-bund.de/pdf/Faktenbl\\_fruehstueck\\_2013\\_14.pdf](http://www.gbe-bund.de/pdf/Faktenbl_fruehstueck_2013_14.pdf) (letzter Zugriff: 09.12.2019).
- HDE (Handelsverband Deutschland) (2019) Zahlenspiegel 2019, Berlin. <https://einzelhandel.de/publikationen-hde/zahlenspiegel> (letzter Zugriff: 10.12.2019).
- He X, Lopez R, Liu Y (2017) Are online and offline advertising substitutes or complements? Evidence from U.S. food industries. *Journal of Agricultural & Food Industrial Organization* 15(2). Doi: 10.1515/jafio-2017-0031.
- Headey DD, Alderman HH (2019) The relative caloric prices of healthy and unhealthy foods differ systematically across income levels and continents. *The Journal of Nutrition* 149(11): 2020-2033. Doi: 10.1093/jn/nxz158.
- Heide K, Brettschneider AK, Lehmann F, Lage Barbosa C, Haftenberger M, Perlitz H, Frank M, Patelakis E, Richter A, Mensink GBM (2019) Inanspruchnahme der Mittagsverpflegung an Schulen, Ergebnisse der bundesweiten Ernährungsstudie EsKiMo II. *Ernährungsumschau* 6: M324-331.
- Heißenhuber A, Haber W, Krämer C (2015) 30 Jahre SRU-Sondergutachten „Umweltprobleme der Landwirtschaft“ – eine Bilanz. *Texte* 28/2015. Umweltbundesamt, Dessau-Roßlau.
- Heller M (2017a) Food product environmental footprint. Literature summary: Packaging and Wasted Food. A report by the Center for Sustainable Systems, University of Michigan, State of Oregon, Department of Environmental Quality. <https://www.oregon.gov/deq/FilterDocs/PEF-Packaging-FullReport.pdf> (letzter Zugriff: 13.12.2019).
- Heller M (2017b) Food Product Environmental Footprint. Literature summary: Pork. A report by the Center for Sustainable Systems, University of Michigan, State of Oregon, Department of Environmental Quality. <https://www.oregon.gov/deq/FilterDocs/PEF-Pork-FullReport.pdf> (letzter Zugriff: 13.12.2019).
- Heller M (2017c) Food Product Environmental Footprint. Literature Summary: Beer. A report by the Center for Sustainable Systems, University of Michigan, State of Oregon, Department of Environmental Quality. <https://www.oregon.gov/deq/FilterDocs/PEF-Beer-FullReport.pdf> (letzter Zugriff: 13.12.2019).
- Heller M (2017d) Food Product Environmental Footprint. Literature Summary: Food transportation. A report by the Center for Sustainable Systems, University of Michigan, State of Oregon, Department of Environmental Quality. <https://www.oregon.gov/deq/FilterDocs/PEF-FoodTransportation-FullReport.pdf> (letzter Zugriff: 13.12.2019).

- Heller MC, Keoleian GA (2014) Greenhouse gas emissions of the U.S. diet: Aligning nutritional recommendations with environmental concerns. In: Schenk R, Huizenga D (eds.) Proceedings of the 9th International Conference on Life Cycle Assessment in the Agri-Food Sector (LCA Food 2014), 8-10 October 2014, San Francisco: 539-548.
- Heller MC, Selke SE, Keoleian GA (2019) Mapping the influence of food waste in food packaging environmental performance assessments. *Journal of Industrial Ecology* 23: 480-495. Doi: 10.1111/jiec.12743.
- Heller MC, Willits-Smith A, Meyer R, Keoleian GA, Rose D (2018) Greenhouse gas emissions and energy use associated with production of individual self-selected US diets, *Environmental Research Letters* 13: 044004. Doi: 10.1088/1748-9326/aab0ac.
- Hemler EC, Hu FB (2019) Plant-based diets for cardiovascular disease prevention: All plant foods are not created equal. *Current Atherosclerosis Reports* 21(5): 18. Doi: 10.1007/s11883-019-0779-5.
- Hemmerling S, Asioli D, Spiller A (2016a) Core organic taste: Preferences for naturalness-related sensory attributes of organic food among European consumers. *Journal of Food Products Marketing* 22(7): 824-850. Doi: 10.1080/10454446.2015.1121428.
- Hemmerling S, Canavari M, Spiller A (2016b) Preference for naturalness of European organic consumers. First evidence of an attitude-liking gap. *British Food Journal* 118(9): 2287-2307. Doi: 10.1108/BFJ-11-2015-0457.
- Hemmerling S, Hamm U, Spiller A (2015) Consumption behavior regarding organic food from a marketing perspective – A literature review. *Organic Agriculture* 5(4): 277-313. Doi: 10.1007/s13165-015-0109-3.
- Hempel C, Will S, Zander K (2019) Bioökonomie aus Sicht der Bevölkerung. Thünen Working Paper 115, Johann Heinrich von Thünen-Institut, Braunschweig. Doi: 10.3220/WP1545134625000.
- Henke S, Theuvsen L (2014) Social life cycle assessment: Socioeconomic evaluation of biogas plants and short rotation coppices. *Proceedings in Food Systems Dynamics*. Doi: 10.18461/pfsd.2014.1433.
- Herman CP, Polivy J (2005) Normative influences on food intake. *Physiology & Behavior* 86(5): 762-772. Doi: 10.1016/j.physbeh.2005.08.064.
- Herman CP, Polivy J, Vartanian LR, Pliner P (2016) Are large portions responsible for the obesity epidemic? *Physiology & Behavior* 156: 177-181. Doi: 10.1016/j.physbeh.2016.01.024.
- Hermansen JE, Kristensen T, Sonesson U, Woodhouse A, Pulkkinen H, Møller H (2017) Life cycle inventory data from farms. Need for secondary and life cycle inventory data for use in Product Environmental Footprint (PEF) of livestock products in the Nordic Countries. Working Paper for the Nordic Council of Ministers. Doi: 10.6027/NA2017-921.
- Herrero M, Thornton PK, Power B, Bogard JR, Remans R, Fritz S, Gerber JS, Nelson G, See L, Waha K, Watson RA, West PC, Samberg LH, van de Steeg J, Stephenson E, van Wijk M, Havlík P (2017) Farming and the geography of nutrient production for human use: A transdisciplinary analysis. *The Lancet Planetary Health* 1(1): e33-e42. Doi: 10.1016/S2542-5196(17)30007-4.
- Herrmann L (2018) *Bodenkunde Xpress*. 1. Aufl., UTB Band-Nr. 4943. Verlag Eugen Ulmer, Stuttgart.
- Herrmann R, Bissinger K, Busl L, Dudenhöfer C, Fast D, Heil E, Jordan I, Pfisterer A (2018) Repräsentative Markterhebung zur Verwendung von Jodsalz in handwerklich und industriell gefertigten Lebensmitteln. Abschlussbericht zum Forschungsprojekt zur Bereitstellung wissenschaftlicher Entscheidungshilfe für das Bundesministerium für Ernährung und Landwirtschaft (BMEL), Universität Gießen.

- Hersey JC, Wohlgenant KC, Arsenault JE, Kosa KM, Muth MK (2013) Effects of front-of-package and shelf nutrition labeling systems on consumers. *Nutrition Reviews* 71(1): 1-14. Doi: 10.1111/nure.12000.
- Heseker H (2005) REVIS Modellprojekt. Reform der Ernährungs- und Verbraucherbildung in Schulen, 2003 - 2005. Schlussbericht für das Bundesministerium für Verbraucherschutz, Ernährung und Landwirtschaft, Paderborn.
- Heseker H (2012) Ernährungssituation in Deutschland. In: Deutsche Gesellschaft für Ernährung (Hrsg.) *Ernährungsbericht 2012*, Bonn: 19-136.
- Heseker H (2016) Ernährungssituation in Deutschland. In: Deutsche Gesellschaft für Ernährung (Hrsg.) *Ernährungsbericht 2016*, Bonn: 17-102.
- Heseker H, Dankers R, Hirsch J (2019) Ernährungsbezogene Bildungsarbeit in Kitas und Schulen (ErnBildung). Schlussbericht für das Bundesministerium für Ernährung und Landwirtschaft (BMEL), Universität Paderborn, Institut für Ernährung, Konsum und Gesundheit, Paderborn.
- Hess T, Sutcliffe C (2018) The exposure of a fresh fruit and vegetable supply chain to global water-related risks. *Water International* 43(6): 746-761. Doi: 10.1080/02508060.2018.1515569.
- Heuer T, Krems C, Moon K, Brombach C, Hoffmann I (2015) Food consumption of adults in Germany: Results of the German National Nutrition Survey II based on diet history interviews. *The British Journal of Nutrition* 113(10): 1603-1614. Doi: 10.1017/S0007114515000744.
- HHS, USDA (U.S. Department of Health and Human Services, U.S. Department of Agriculture) (2015) 2015–2020 Dietary Guidelines for Americans. 8th edition. Washington. [https://health.gov/dietaryguidelines/2015/resources/2015-2020\\_Dietary\\_Guidelines.pdf](https://health.gov/dietaryguidelines/2015/resources/2015-2020_Dietary_Guidelines.pdf) (letzter Zugriff: 13.12.2019).
- Hieke S, Wilczynski P (2012) Colour me in – An empirical study on consumer responses to the traffic light signposting system in nutrition labelling. *Public Health Nutrition* 15(5): 773-782. Doi: 10.1017/S1368980011002874
- Hielscher H (2019) Doch nicht nur „faire“ Bananen: Wie Fairtrade trotz Lidl's Bananen-Flop weiter wachsen soll. *WirtschaftsWoche*, 22.05.2019, <https://www.wiwo.de/unternehmen/handel/doch-nicht-nur-faire-bananen-wie-fairtrade-trotz-lidls-bananen-flop-weiter-wachsen-soll/24368982.html> (letzter Zugriff: 19.12.2019).
- Hilbig A, Drossard C, Kersting M, Alexy U (2015) Nutrient adequacy and associated factors in a nationwide sample of German toddlers. *Journal of Pediatric Gastroenterology and Nutrition*. 61(1): 130-137. Doi: 10.1097/MPG.0000000000000733.
- Hilborn R, Banobi J, Hall SJ, Pucylowski T, Walsworth TE (2018) The environmental cost of animal source foods. *Frontiers in Ecology and the Environment* 16(6): 329-335. Doi: 10.1002/fee.1822.
- Hilger J, Goerig T, Weber P, Hoeft B, Eggersdorfer M, Costa Carvalho N, Goldberger U, Hoffmann K (2015) Micronutrient intake in healthy toddlers: A multinational perspective. *Nutrients* 7(8): 6938-6955. Doi: 10.3390/nu7085316.
- Hinrichs CC (2000) Embeddedness and local food systems: Notes on two types of direct agricultural market. *Journal of Rural Studies* 16(3): 295-303. Doi: 10.1016/S0743-0167(99)00063-7.
- HLPE (High Level Panel of Experts on Food Security and Nutrition) (2014) Food losses and waste in the context of sustainable food systems. A report by the High Level Panel of Experts on Food Security and Nutrition of the Committee on World Food Security, Rome.

- HLPE (High Level Panel of Experts on Food Security and Nutrition) (2017) Nutrition and food systems. A report by the High Level Panel of Experts on Food Security and Nutrition of the Committee on World Food Security, Rome.
- Hoch T, Kreitz S, Gaffling S, Pischetsrieder M, Hess A (2015) Fat/carbohydrate ratio but not energy density determines snack food intake and activates brain reward areas. *Scientific Reports* 5: 10041. Doi: 10.1038/srep10041.
- Hodder RK, Stacey FG, Wyse RJ, O'Brien KM, Clinton-McHarg T, Tzelepis F, Nathan NK, James EL, Bartlem KM, Sutherland R, Robson E, Yoong SL, Wolfenden L (2018) Interventions for increasing fruit and vegetable consumption in children aged five years and under. *Cochrane Database of Systematic Reviews* 1: CD008552. Doi: 10.1002/14651858.CD008552.pub3.
- Hodgkins CE, Raats MM, Fife-Schaw C, Peacock M, Gröppel-Klein A, Koenigstorfer J, Wasowicz G, Stysko-Kunkowska M, Gulcan Y, Kustepeli Y, Gibbs M, Shepherd R, Grunert KG (2015) Guiding healthier food choice: Systematic comparison of four front-of-pack labelling systems and their effect on judgements of product healthiness. *British Journal of Nutrition* 113(10): 1652-1663. Doi: 10.1017/S0007114515000264.
- Hoffmann I, Spiller A (Hrsg.) (2010) Auswertung der Daten der Nationalen Verzehrsstudie II (NVS II): Eine integrierte verhaltens- und lebensstilbasierte Analyse des Bio- Konsums. Abschlussbericht des Bundesprogramm-Ökolandbau-Projektes, Karlsruhe, Göttingen.
- Hoffrage U (2003) Risikokommunikation bei Brustkrebsfrüherkennung und Hormonersatztherapie. *Zeitschrift für Gesundheitspsychologie* 11(3): 76-86. Doi: 10.1026//0943-8149.11.3.76.
- Hofmann W, Vohs KD, Baumeister RF (2012) What people desire, feel conflicted about, and try to resist in everyday life. *Psychological Science* 23(6): 582-588. Doi: 10.1177/0956797612437426.
- Holben DH, Marshall MB (2017) Position of the Academy of Nutrition and Dietetics: Food insecurity in the United States. *Journal of the Academy of Nutrition and Dietetics* 117(12): 1991-2002. Doi: 10.1016/j.jand.2017.09.027.
- Hölker S, von Meyer-Höfer M, Spiller A (2019) Animal ethics and eating animals: Consumer segmentation based on domain-specific values. *Sustainability* 11: 3907. Doi: 10.3390/su11143907.
- Hollands GJ, Shemilt I, Marteau TM, Jebb SA, Lewis HB, Wei Y, Higgins JP, Ogilvie D (2015) Portion, package or tableware size for changing selection and consumption of food, alcohol and tobacco. *The Cochrane Database of Systematic Reviews* 9: CD011045. Doi: 10.1002/14651858.CD011045.pub2.
- Holst C, Hess S, von Cramon-Taubadel S (2008) Betrachtungen zum Saisonarbeitskräfteangebot in der deutschen Landwirtschaft. *Berichte über Landwirtschaft* 86(3): 361-384.
- Holz G, Laubstein C, Sthamer E (2012) Lebenslagen und Zukunftschancen von (armen) Kindern und Jugendlichen in Deutschland. 15 Jahre AWO-ISS-Studie. ISS-Aktuell 23, Institut für Sozialarbeit und Sozialpädagogik e. V., Frankfurt am Main.  
<https://www.awo.org/sites/default/files/2017-07/AWO-ISS-Studie.pdf> (letzter Zugriff: 09.12.2019).
- Honrath K, Wagner MG, Rhee Y (2018) Does nutrition education with fruit and vegetable supplementation increase fruit and vegetable intake and improve anthropometrics of overweight and obese people of varying socioeconomic status? *Ecology of Food and Nutrition* 57(1): 32-49. Doi: 10.1080/03670244.2017.1406854.
- Hooper L, Martin N, Abdelhamid A, Davey Smith G (2015) Reduction in saturated fat intake for cardiovascular disease. *Cochrane Database of Systematic Reviews* 6: CD011737. Doi: 10.1002/14651858.CD011737.

- Hörstermann K (2016) Konsumausgaben als Wohlstandsindikator – was können sie uns über Armut und Ungleichheit berichten? Ein Vergleich einkommens- und konsumbasierter Armuts- und Ungleichheitsmaße mit Hilfe der Einkommens- und Verbrauchsstichprobe. *Zeitschrift für Soziologie* 45(3): 181-199. Doi: 10.1515/zfsoz-2015-1011.
- Hradil S (2015) Die wachsende soziale Ungleichheit in der Diskussion, eine Einführung. In: Bundeszentrale für politische Bildung (Hrsg.) *Oben – Mitte – Unten. Zur Vermessung der Gesellschaft. Schriftenreihe Band 1576*. Bonn: 10-29.
- Hradil S (2010) Der deutsche Armutsdiskurs. *Aus Politik und Zeitgeschichte* 51-52: 3-8.
- Hu L, Zheng Y (2019) The impacts of food safety certification on producer's safety outcomes. Selected Paper prepared for presentation at the 2019 Agricultural & Applied Economics Association Annual Meeting, Atlanta, GA, July 21-23.
- Huckfeldt PJ, Lakdawalla DN, Philipson TJ (2012) Economics of obesity. In: Jones AM (ed.) *The Elgar companion to health economics*. 2. ed., Edward Elgar, Cheltenham UK, Northampton MA USA: 70-80.
- Hülsbergen KJ (2003) Entwicklung und Anwendung eines Bilanzierungsmodells zur Bewertung der Nachhaltigkeit landwirtschaftlicher Systeme. Shaker-Verlag, Aachen.
- Hülsbergen KJ (2015) Nachhaltige Ertragssteigerung im Öko-Landbau – Grundlage für eine erfolgreiche Entwicklung. In: Bayerische Agrarprodukte im Spannungsfeld neuer Märkte. 10. Marktforum der LfL. Schriftenreihe der Bayerischen Landesanstalt für Landwirtschaft 2/2015. Freising-Weihenstephan: 18-29.
- Hülsbergen KJ, Rahmann G (Hrsg.) (2015) Klimawirkungen und Nachhaltigkeit ökologischer und konventioneller Betriebssysteme – Untersuchungen in einem Netzwerk von Pilotbetrieben: Forschungsergebnisse 2013-2014. *Thünen Report 29*, Johann Heinrich von Thünen-Institut, Braunschweig. Doi: 10.3220/REP\_29\_2015.
- Hunger B, Kwasniewski N (2013) Gemüse ist mein Fleisch. Spiegel Online. <https://www.spiegel.de/wirtschaft/service/quiz-wie-viel-co2-und-wie-viel-geld-spart-ein-veggie-day-a-923387.html> (letzter Zugriff: 19.12.2019).
- Hunt GE (1990) Waste reduction techniques and technologies. In: Freeman H (ed.) *Hazardous waste minimization*. McGraw-Hill, New York: 25-54.
- Hursthouse R (2011) Virtue ethics and the treatment of animals. In: Beauchamp TL, Frey RG (Hrsg.) *The Oxford handbook of animal ethics*. Oxford University Press, Oxford, New York: 119-143.
- Huyse H, Verbrugge B (2018) Belgium and the sustainable supply chain agenda: Leader or laggard. Review of human right due diligence initiatives in the Netherlands, Germany, France and EU, and implications for policy work by Belgian civil society, Leuven. KU Leuven HIVA Research Institute for Work and Society, Leuven, Belgium.
- Hyland C, Bradman A, Gerona R, Patton S, Zakharevich I, Gunier RB, Klein K (2019) Organic diet intervention significantly reduces urinary pesticide levels in U.S. children and adults. *Environmental Research* 171: 568-575. Doi: 10.1016/j.envres.2019.01.024.
- IARC (International Agency for Research on Cancer) (2015) IARC monographs evaluate consumption of red meat and processed meat. Press release N° 240, 26 October 2015. <https://www.iarc.fr/featured-news/media-centre-iarc-news-redmeat/> (letzter Zugriff: 13.12.2019).
- iaw, NABU (Institut für Arbeit und Wirtschaft, Naturschutzbund Deutschland) (2019) Verflechtungen und Interessen des Deutschen Bauernverbandes (DBV). iaw, NABU, Bremen.

- Ibanez M, Blackman A (2016) Is eco-certification a win-win for developing country agriculture? Organic Coffee Certification in Colombia. *World Development* 82: 14-27. Doi: 10.1016/j.worlddev.2016.01.004.
- IFCN (International Farm Comparison Network) (2018) IFCN Dairy Report 2018, Kiel.
- IFEU (Institut für Energie- und Umweltforschung Heidelberg) (2010) Einweg und Mehrweg: Aktuelle Ökobilanzen im Blickpunkt. Handreichung des IFEU, Heidelberg.
- IFH (Institut für Handelsforschung) (2018) Handelsreport Lebensmittel. Fakten zum Lebensmitteleinzelhandel. Studie im Auftrag des Handelsverband Deutschland, Köln.
- IFOAM (International Federation of Organic Agriculture Movements) (o.J.) Prinzipien des Öko-Landbaus, Präambel, Bonn. [https://www.ifoam.bio/sites/default/files/poa\\_german\\_web.pdf](https://www.ifoam.bio/sites/default/files/poa_german_web.pdf) (letzter Zugriff: 20.12.2019).
- IFOAM (International Federation of Organic Agriculture Movements) (2014) The IFOAM Norms for Organic Production and Processing – Version 2014, Bonn. [https://www.ifoam.bio/sites/default/files/ifoam\\_norms\\_july\\_2014\\_t.pdf](https://www.ifoam.bio/sites/default/files/ifoam_norms_july_2014_t.pdf) (letzter Zugriff: 22.12.2019).
- Ilbery D, Maye D (2005) Alternative (shorter) food supply chains and specialist livestock products in the Scottish-English borders. *Environment and Planning A: Economy and Space* 37(5): 823-844. Doi: 10.1068/a3717.
- Illøkken KE (2015) Effects of a free school meal on lunch habits in Norwegian elementary school children. The School Meal Project in Aust-Agder. Master's thesis, University of Agder, Norway.
- Illøkken KE, Bere E, Øverby NC, Høiland R, Petersson KO, Vik FN (2017) Intervention study on school meal habits in Norwegian 10–12-year-old children. *Scandinavian Journal of Public Health* 45: 485-491. Doi: 10.1177/1403494817704108.
- ILO (International Labour Organization) (2017) Global estimates of child labour: Results and trends, 2012 - 2016, Geneva. [https://www.ilo.org/wcmsp5/groups/public/@dgreports/@dcomm/documents/publication/wcms\\_575499.pdf](https://www.ilo.org/wcmsp5/groups/public/@dgreports/@dcomm/documents/publication/wcms_575499.pdf) (letzter Zugriff: 05.12.2019).
- ILO (International Labour Organization) (2019) Rules of the Game – An Introduction to the standards-related work of the International Labour Organization, Centenary edition 2019, Geneva. [https://www.ilo.org/wcmsp5/groups/public/---ed\\_norm/---normes/documents/publication/wcms\\_672549.pdf](https://www.ilo.org/wcmsp5/groups/public/---ed_norm/---normes/documents/publication/wcms_672549.pdf) (letzter Zugriff: 22.12.2019).
- Imamura F, O'Connor L, Ye Z, Mursu J, Hayashino Y, Bhupathiraju SN, Forouhi NG (2015) Consumption of sugar sweetened beverages, artificially sweetened beverages, and fruit juice and incidence of type 2 diabetes: Systematic review, meta-analysis, and estimation of population attributable fraction. *BMJ* 351: h3576. Doi: 10.1136/bmj.h3576.
- Imig H, Jahn JE (2016) Zur Situation von zeitlich befristet Beschäftigten in der Landwirtschaft. Bericht 2015 der Initiative Faire Landwirtschaft. Peco Institut e. V., Berlin.
- INFO GmbH (2019) Evaluation von erweiterten Nährwertkennzeichnungs-Modellen. Ergebnisbericht der Repräsentativerhebung, im Auftrag des Bundesministeriums für Ernährung und Landwirtschaft. [https://www.bmel.de/SharedDocs/Downloads/Ernaehrung/Kennzeichnung/Ergebnisbericht-Repräsentativerhebung-TeilA\\_eNWK.pdf?\\_\\_blob=publicationFile](https://www.bmel.de/SharedDocs/Downloads/Ernaehrung/Kennzeichnung/Ergebnisbericht-Repräsentativerhebung-TeilA_eNWK.pdf?__blob=publicationFile) (letzter Zugriff: 10.01.2010).
- Inhetteen H, Blasche M (1983) Die Kleinbäuerin und ihr Hof. In: Frauen in der kleinbäuerlichen Landwirtschaft. Wiesbaden: VS Verlag für Sozialwissenschaften: 20-54. Doi: 10.1007/978-3-322-96993-4\_2.

- Initiative Tierwohl (2019) Unkompliziert, einheitlich, nachvollziehbar: Was die vier Stufen der Lebensmittelkennzeichnung Haltungsform bedeuten. <https://initiative-tierwohl.de/2019/02/08/unkompliziert-einheitlich-nachvollziehbar/> (letzter Zugriff: 13.12.2019).
- IOM (Institute of Medicine) (2006) Food marketing to children and youth: Threat or opportunity? The National Academies Press, Washington, DC. Doi: 10.17226/11514.
- IOM, NRC (Institute of Medicine and National Research Council) (2015) A framework for assessing effects of the food system. The National Academies Press, Washington, DC.
- IPBES (Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services) (2019) The global assessment report on biodiversity and ecosystem services. Summary for policymakers, Bonn. <https://ipbes.net/global-assessment> (letzter Zugriff: 16.03.2020).
- IPCC (Intergovernmental Panel on Climate Change) (2018) Global Warming of 1.5 °C. An IPCC special report on the impacts of global warming of 1.5 °C above pre-industrial levels and related global greenhouse gas emission pathways, in the context of strengthening the global response to the threat of climate change, sustainable development, and efforts to eradicate poverty. Summary for policymakers. <https://www.ipcc.ch/sr15/> (letzter Zugriff: 06.12.2019).
- IPCC (Intergovernmental Panel on Climate Change) (2019) Climate change and land. An IPCC Special Report on climate change, desertification, land degradation, sustainable land management, food security, and greenhouse gas fluxes in terrestrial ecosystems. Summary for policymakers. <https://www.ipcc.ch/report/srcl/> (letzter Zugriff: 04.12.2019).
- Iribarren D, Vázquez-Rowe I, Hospido A, Moreira MT, Feijoo G (2011) Updating the carbon footprint of the Galician fishing activity (NW Spain). *Science of the Total Environment* 409(8): 1609-1611. Doi: 10.1016/j.scitotenv.2011.01.007.
- ISO (International Organization for Standardization) (2003) ISO 9921 Ergonomics – Assessment of speech communication, Geneva.
- ITW (Initiative Tierwohl) (2019) Initiative Tierwohl: Einordnung und Ausblick der Initiative Tierwohl 2018. <https://initiative-tierwohl.de/wp-content/uploads/2019/01/20180503-ITW-Rechenschaftsbericht-1.pdf> (letzter Zugriff: 19.12.2019).
- IVA (Industrieverband Agrar e. V.) (2019) Perspektive Pflanzenbau: 15 Maßnahmen für eine zukunftsfähige Landwirtschaft, Positionspapier. <https://www.iva.de/iva-positionspapier-perspektive-pflanzenbau> (letzter Zugriff: 10.01.2020).
- Jacobs A, Flessa H, Don A, Heidkamp A, Prietz R, Dechow R, Gensior A, Poeplau C, Riggers C, Schneider F, Tiemeyer B, Vos C, Wittnebel M, Müller T, Säurich A, Fahrion-Nitschke A, Gebbert S, Hopfstock R, Jaconi A, Kolata H, Lorbeer M, Schröder J, Laggner A, Weise C, Freibauer A (2018) Landwirtschaftlich genutzte Böden in Deutschland – Ergebnisse der Bodenzustandserhebung. *Thünen Report* 64, Johann Heinrich von Thünen-Institut, Braunschweig. Doi: 10.3220/REP1542818391000.
- Jahn G, Schramm M, Spiller A (2005) The reliability of certification: Quality labels as a consumer policy tool. *Journal of Consumer Policy* 28(1): 53-73. Doi: 10.1007/s10603-004-7298-6.
- Jahnke M (2018) Ist Influencer-Marketing wirklich neu? In: Jahnke M (Hrsg.) *Influencer Marketing*. Springer Gabler, Wiesbaden: 1-13. Doi: 10.1007/978-3-658-20854-7\_1.
- Jambeck JR, Geyer R, Wilcox C, Siegler TR, Perryman M, Andrady A, Narayan R, Law KL (2015) Plastic waste inputs from land into the ocean. *Science* 347(6223): 768-771. Doi: 10.1126/science.1260352.

- Janker J, Mann S (2018) Understanding the social dimension of sustainability in agriculture: A critical review of sustainability assessment tools. *Environment, Development and Sustainability* 2018: 1-21. Doi: 10.1007/s10668-018-0282-0.
- Jans SD, Cauberghe V, Hudders L (2018) How an advertising disclosure alerts young adolescents to sponsored vlogs: The moderating role of a peer-based advertising literacy intervention through an informational vlog. *Journal of Advertising* 47(4): 309-325. Doi: 10.1080/00913367.2018.1539363.
- Jansen C, Schreiner-Koscielny J (2013) Schulverpflegung in Deutschland – Aktueller Stand, Vorgaben und Entwicklungen. *Ernährungsumschau* 3: M158-M164.
- Janssen H (2013) „Veggie Day“: Die Furcht vor der grünen Umerziehung, in: Spiegel-Online vom 09.08.2013. <http://www.spiegel.de/politik/deutschland/veggie-day-gruene-regen-fleischverzicht-an-a-915657.html> (letzter Zugriff: 19.12.2019).
- Janssen M, Busch C, Rödiger M, Hamm U (2016) Motives of consumers following a vegan diet and their attitudes towards animal agriculture. *Appetite* 105: 643-651. Doi: 10.1016/j.appet.2016.06.039.
- Janssen M, Heid A, Hamm U. (2009) Is there a promising market ‘in between’ organic and conventional food? Analysis of consumer preferences. *Renewable Agriculture and Food Systems*, 24(3): 205-213. Doi: 10.1017/S1742170509990056.
- Jarosz L (2008) The city in the country: Growing alternative food networks in Metropolitan areas. *Journal of Rural Studies* 24: 231-244. Doi: 10.1016/j.jrurstud.2007.10.002.
- Jasper U (2019) Finanzierung einer gesellschaftlich akzeptierten Nutztierhaltung. Positionspapier der ABL, unveröffentlicht.
- Jebb SA, Aveyard PN, Hawkes C (2013) The evolution of policy and actions to tackle obesity in England. *Obesity Reviews* 14: 42-59. Doi: 10.1111/obr.12093.
- Jepsen D, Vollmer A, Eberle U, Fels J, Schomerus T (2016) Entwicklung von Instrumenten zur Vermeidung von Lebensmittelabfällen. *Texte 85/2016*, Umweltbundesamt.
- Johnson DB, Bruemmer B, Lund AE, Evens CC, Mar CM (2009) Impact of school district sugar-sweetened beverage policies on student beverage exposure and consumption in middle schools. *Journal of Adolescent Health* 45(3): S30-S37. Doi: 10.1016/j.jadohealth.2009.03.008.
- Johnson SL (2016) Developmental and environmental influences on young children’s vegetable preferences and consumption. *Advances in Nutrition* 7(1): 220S-231S. Doi: 10.3945/an.115.008706.
- Jomaa LH, McDonnell E, Probart C (2011) School feeding programs in developing countries: Impacts on children’s health and educational outcomes. *Nutrition Reviews* 69(2): 83-98. Doi: 10.1111/j.1753-4887.2010.00369.x.
- Jones A, Rådholm K, Nea B (2018) Defining ‘unhealthy’: A systematic analysis of alignment between the Australian dietary guidelines and the health star rating system. *Nutrients* 10(4): E501. Doi: 10.3390/nu10040501.
- Jones NRV, Conklin, AI, Suhrcke M, Monsivais P (2014) The growing price gap between more and less healthy foods: Analysis of a novel longitudinal UK dataset. *PLOS ONE* 9(10): e109343. Doi: 10.1371/journal.pone.0109343.
- Joossens L, Feliu A, Fernandez E (2020) The Tobacco Control Scale 2019 in Europe. Association of European Cancer Leagues, Brussels. <https://www.tobaccocontrolscale.org/TCS2019.pdf> (letzter Zugriff: 02.03.2020).

- Jørgensen A, Le Bocq A, Nazarkina L, Hauschild M (2008) Methodologies for social life cycle assessment. *International Journal of Life Cycle Assessment* 13(2): 96-103. Doi: 10.1065/lca2007.11.367.
- Jörissen J, Meyer R, Priefer C, Bräutigam KR (2014) Future food systems: Challenges and perspectives. Introduction to the thematic focus. *Technikfolgenabschätzung – Theorie und Praxis* 23(3): 4-11. Doi: 10.14512/tatup.23.3.4.
- Joseph B, Hensgen F, Bühle L, Wachendorf M (2018) Solid fuel production from semi-natural grassland biomass – Results from a commercial-scale IFBB plant. *Energies* 11: 3011. Doi: 10.3390/en11113011.
- JP Morgan Global Equity Research (2006) Obesity – Re-Shaping the Food Industry. [http://www.unepfi.org/fileadmin/documents/materiality2/obesity\\_jpmorgan\\_2006.pdf](http://www.unepfi.org/fileadmin/documents/materiality2/obesity_jpmorgan_2006.pdf) (letzter Zugriff: 19.12.2019).
- Julia C, Hercberg S (2017) Nutri-Score: Evidence of the effectiveness of the French front-of-pack nutrition label. *Ernährungsumschau* 64(12): 181-187. Doi: 10.4455/eu.2017.048.
- Julia C, Méjean C, Vicari F, Péneau S, Hercberg S (2015) Public perception and characteristics related to acceptance of the sugar-sweetened beverage taxation launched in France in 2012. *Public Health Nutrition* 18(14): 2679-2688. Doi: 10.1017/S1368980014003231.
- Julia C, Péneau S, Buscail C, Gonzalez R, Touvier M, Hercberg S, Kesse-Guyot E (2017) Perception of different formats of front-of-pack nutrition labels according to sociodemographic, lifestyle and dietary factors in a French population: Cross-sectional study among the NutriNet-Santé cohort participants. *BMJ open* 7(6): e016108. Doi: 10.1136/bmjopen-2017-016108.
- Jungbluth N, Demmeler M (2005) “The Ecology of Scale: Assessment of Regional Energy Turnover and Comparison with Global Food” by Elmar Schlich and Ulla Fleissner. *The International Journal of Life Cycle Assessment* 10: 168-170. Doi: 10.1065/lca2004.11.191.
- Jungvogel A, Michel M, Bechthold A, Wendt I (2016) Die lebensmittelbezogenen Ernährungsempfehlungen der DGE. Wissenschaftliche Ableitung und praktische Anwendung der Modelle. *Ernährungs Umschau* 8/2016: M474-M481. Doi: 10.4455/eu.2016.037.
- Jürkenbeck K, Heumann A, Spiller, A (2019) Sustainability matters: Consumer acceptance of different vertical farming systems. *Sustainability* 11(15): 4052. Doi: 10.3390/su11154052.
- Just DR, Hanks AS (2015) The hidden cost of regulation: Emotional responses to command and control. *American Journal of Agricultural Economic* 97(5): 1385-1399. Doi: 10.1093/ajae/aav016.
- Kahneman D (2011) *Thinking, fast and slow*. Penguin Books, London.
- Kahneman D, Tversky A (1979) Prospect theory: An analysis of decision under risk. *Econometrica* 47: 263-292.
- Kallbekken S, Sælen H (2013) “Nudging” hotel guests to reduce food waste as a win-win environmental measure. *Economics Letters* 119(3): 325-327. Doi: 10.1016/j.econlet.2013.03.019.
- Kamensky J (2004) Ernährung und Sozialhilfe. Situation und Maßnahmen für die Gesundheitsförderung. Dokumentation 3. Bremer Forum Gesundheitlicher Verbraucherschutz 03. November 2003 in Bremen. Pizza, Pommes und Probleme- Ernährungsarmut heute. Schriftenreihe Umweltbezogener Gesundheitsschutz Band 18: 21-29.
- Kanie N, Biermann F (eds.) (2017) *Governing through goals. Sustainable Development Goals as governance innovation*. MIT Press, Cambridge, Massachusetts, London.

- Kanter R, Vanderlee L, Vandevijvere S (2018) Front-of-package nutrition labelling policy: Global progress and future directions. *Public Health Nutrition* 21(8): 1399-1408. Doi: 10.1017/S1368980018000010.
- Karunamoorthi K, Mohammed M, Wassie F (2012) Knowledge and practices of farmers with reference to pesticide management: Implications on human health. *Archives of Environmental & Occupational Health* 67(2): 109-115. Doi: 10.1080/19338244.2011.598891.
- Kauertz B, Bick C, Schlecht S, Busch M, Markwardt S, Wellenreuther F (2018) FKN Ökobilanz 2018. Ökobilanzieller Vergleich von Getränkeverbundkartons mit PET-Einweg- und Glas- Mehrwegflaschen in den Getränkesegmenten Saft/Nektar, H-Milch und Frischmilch. Abschlussbericht nach kritischer Prüfung. Institut für Energie- und Umweltforschung Heidelberg, Heidelberg.
- Kehl C (2014) Inwertsetzung von Biodiversität. Endbericht zum TA-Projekt. Büro für Technikfolgen-Abschätzung beim Deutschen Bundestag, Arbeitsbericht 161, Karlsruhe.
- Kehlbacher A, Tiffin R, Briggs A, Berners-Lee M, Scarborough P (2016) The distributional and nutritional impacts and mitigation potential of emission-based food taxes in the UK. *Climatic Change* 137: 121-141. Doi: 10.1007/s10584-016-1673-6.
- Kelly B, Vandevijvere S, Ng S, Adams J, Allemandi L, Bahena-Espina L, Barquera S, Boyland E, Calleja P, Carmona-Garcés IC, Castronuovo L, Cauchi D, Correa T, Corvalán C, Cosenza-Quintana EL, Fernández-Escobar C, González-Zapata LI, Halford J, Jaichuen N, Jensen ML, Karupaiah T, Kaur A, Kroker-Lobos MF, Mchiza Z, Miklavc K, Parker WA, Potvin Kent M, Pravst I, Ramírez-Zea M, Reiff S, Reyes M, Royo-Bordonada MÁ, Rueangsom P, Scarborough P, Tiscornia MV, Tolentino-Mayo L, Wate J, White M, Zamora-Corrales I, Zeng L, Swinburn B (2019) Global benchmarking of children's exposure to television advertising of unhealthy foods and beverages across 22 countries. *Obesity Reviews* 20(S2): 116-128. Doi: 10.1111/obr.12840.
- Kelm M, Loges R, Taube F (2007) Vergleichende Analyse konventioneller und ökologischer Anbausysteme: N-Bilanzsalden und N-Auswaschungsverluste – Ergebnisse aus dem Projekt COMPASS. *Mitteilungen der Gesellschaft für Pflanzenbauwissenschaften* 19: 250-251. [www.gpw.uni-kiel.de/de/jahrestagung/tagungsbaende/tagungsband\\_2007.pdf](http://www.gpw.uni-kiel.de/de/jahrestagung/tagungsbaende/tagungsband_2007.pdf) (letzter Zugriff: 20.12.2019).
- Kemper M, Lehmann S, Hein A (2017) Landwirtschaft, Tierarzneimittel, Umwelt. Wie kann die Tierhaltung Einträge vermindern? Umweltbundesamt (Für Mensch & Umwelt), Dessau-Roßlau.
- Kent MP, Pauzé E, Roy EA, de Billy N (2018a) Children's exposure to unhealthy food and beverage advertisements on smartphones and tablets in social media and gaming applications. Report. School of Epidemiology and Public Health Faculty of Medicine, University of Ottawa.
- Kent MP, Smith JR, Pauzé E, L'Abbé M (2018b) The effectiveness of the food and beverage industry's self-established uniform nutrition criteria at improving the healthfulness of food advertising viewed by Canadian children on television. *International Journal of Behavioral Nutrition and Physical Activity* 15: 57. Doi: 10.1186/s12966-018-0694-0.
- Kersting M, Alexy U, Schürmann S (2016) Critical dietary habits in early childhood – Principles and practice. In: Biesalski HK, Black RE (eds.) *Hidden hunger. Malnutrition and the first 1,000 days of life: Causes, consequences and solutions.* *World Review of Nutrition and Dietetics* 115: 24-35.
- Kersting M, Clausen K (2007) Wie teuer ist eine gesunde Ernährung für Kinder und Jugendliche. Die Lebensmittelkosten der Optimierten Mischkost als Referenz für sozialpolitische Regelleistungen. *Ernährungsumschau* 9/2007: 508-513.

- Key TJ, Appleby PN, Spencer EA, Travis RC, Roddam AW, Allen NE (2009) Cancer incidence in vegetarians: Results from the European Prospective Investigation into Cancer and Nutrition (EPIC-Oxford). *American Journal of Clinical Nutrition* 89(5): 1620-1626. Doi: 10.3945/ajcn.2009.26736M.
- Khan TH, Sievenpiper JL (2016) Controversies about sugars: Results from systematic reviews and meta-analyses on obesity, cardiometabolic disease and diabetes. *European Journal of Nutrition* 55(Suppl 2): 25-43. Doi: 10.1007/s00394-016-1345-3.
- Khoury CK, Bjorkman AD, Dempewolf H, Ramirez-Villegas J, Guarino L, Jarvis A, Rieseberg LH, Struik PC (2014) Increasing homogeneity in global food supplies and the implications for food security. *Proceedings of the National Academy of Science USA* 111(11): 4001-4006. Doi: 10.1073/pnas.1313490111.
- Kim CK, Kim HJ, Chung HK, Shin D (2018) Eating alone is differentially associated with the risk of metabolic syndrome in Korean men and women. *International Journal of Environmental Research and Public Health* 15(5): e1020. Doi: 10.3390/ijerph15051020.
- Kim HS, Patel KG, Orosz E, Kothari N, Demyen MF, Pirsopoulos N, Ahlawat SK (2016) Time trends in the prevalence of celiac disease and gluten-free diet in the US population: Results from the national health and nutrition examination surveys 2009-2014. *JAMA Internal Medicine* 176(11): 1716-1717. Doi: 10.1001/jamainternmed.2016.5254.
- Kim HC, Keoleian GA, Horie YA (2006) Optimal household refrigerator replacement policy for life cycle energy, greenhouse gas emissions, and cost. *Energy Policy* 34(15): 2310-2323. Doi: 10.1016/j.enpol.2005.04.004.
- Kingreen T (2016) Art. 34-36. In: Calliess C, Ruffert M (Hrsg.) EUV/AEUV. Das Verfassungsrecht der Europäischen Union mit Europäischer Grundrechtecharta. Kommentar. 5. Auflage 2016, C.H. Beck-Verlag, München.
- Kirchgässner G (2017) Soft paternalism, merit goods, and normative individualism. *European Journal of Law and Economics* 43: 125-152. Doi: 10.1007/s10657-015-9500-5.
- Kirchmann H (2019) Why organic farming is not the way forward. *Outlook on Agriculture* 48(1): 22-27. Doi: 10.1177/0030727019831702.
- Kitchen S, Tanner E, Brown V, Payne C, Crawford C, Dearden L, Greaves E, Purdon S (2012) Evaluation of the free school meals pilot – Impact Report. Research report DFE-RR227. UK: Department for Education. <https://www.gov.uk/government/publications/evaluation-of-the-free-school-meals-pilot-impact-report> (letzter Zugriff: 19.12.2019).
- Kivimäki M, Kuosma E, Ferrie JE, Luukkonen R, Nyberg ST, Alfredsson L, Batty GD, Brunner EJ, Fransson E, Goldberg M, Knutsson A, Koskenvuo M, Nordin M, Oksanen T, Pentti J, Rugulies R, Shipley MJ, Singh-Manoux A, Steptoe A, Suominen SB, Theorell T, Vahtera J, Virtanen M, Westerholm P, Westerlund H, Zins M, Hamer M, Bell JA, Tabak AG, Jokela M (2017) Overweight, obesity and risk of cardiometabolic multimorbidity: Pooled analysis of individual-level data for 120 813 adults from 16 cohort studies from the USA and Europe. *The Lancet Public Health* 2(6): e277-e285. Doi: 10.1016/S2468-2667(17)30074-9.
- Kjærnes U (2003a) Food and nutrition policies of Nordic countries. How have they been developed and what evidence substantiates the development of these policies? *Proceedings of the Nutrition Society* 62(2): 563-570. Doi: 10.1079/PNS2003269.
- Kjærnes U (2003b) Experiences with the Norwegian nutrition policy. *Appetite* 41(3): 251-257. Doi: 10.1016/S0195-6663(03)00130-2.

- Klärner A, Knabe A (2019) Social networks and coping with poverty in rural Areas. *Sociologia Ruralis* 59(3): 447-473. Doi: 10.1111/soru.12250.
- Klärner A, Knabe A, Land R, Berger PA (2015) Gesichter der Armut in der Stadt und im ländlichen Raum Mecklenburg-Vorpommerns. Ergebnisse eines qualitativen Forschungsprojekts. In: Arbeiterwohlfahrt Mecklenburg-Vorpommern e. V. (Hrsg.) Aspekte der Armut in Mecklenburg-Vorpommern, Schwerin: 25-90.
- Kleinhüchelkotten S, Neitzke HP, Moser S (2016) Repräsentative Erhebung von Pro-Kopf-Verbräuchen natürlicher Ressourcen in Deutschland (nach Bevölkerungsgruppen), Texte 39/2016, Umweltbundesamt, Dessau-Roßlau.
- Klemt S, Lenz S (2018) Verdienste. In: Statistisches Bundesamt (Destatis) und Wissenschaftszentrum Berlin für Sozialforschung (WZB) (Hrsg.) Datenreport 2018. Ein Sozialbericht für die Bundesrepublik Deutschland, Bonn: 166-176.
- Klocke A, Lampert T (2005) Armut bei Kindern und Jugendlichen. Gesundheitsberichterstattung des Bundes, Heft 4. [http://www.gbe-bund.de/pdf/Armut\\_bei\\_Kindern.pdf](http://www.gbe-bund.de/pdf/Armut_bei_Kindern.pdf) (letzter Zugriff: 09.12.2019).
- KMK (Sekretariat der Ständigen Konferenz der Kultusminister der Länder in der Bundesrepublik Deutschland) (Hrsg.) (2012) Empfehlung zur Gesundheitsförderung und Prävention in der Schule, Beschluss vom 15.11.2012, Bonn.
- KMK (Sekretariat der Ständigen Konferenz der Kultusminister der Länder in der Bundesrepublik Deutschland) (Hrsg.) (2013) Verbraucherbildung an Schulen, Beschluss vom 12.09.2013, Bonn.
- KMK (Sekretariat der Ständigen Konferenz der Kultusminister der Länder in der Bundesrepublik Deutschland) (Hrsg.) (2015) Empfehlungen zur Arbeit in der Grundschule, Beschluss vom 11.06.2015, Berlin.
- KMK (Sekretariat der Ständigen Konferenz der Kultusminister der Länder in der Bundesrepublik Deutschland) (Hrsg.) (2018) Allgemeinbildende Schulen in Ganztagsform in den Ländern in der Bundesrepublik Deutschland, Statistik 2012 bis 2016, Berlin.
- Knapp S, van der Heijden MGA (2018) A global meta-analysis of yield stability in organic and conservation agriculture. *Nature Communications* 9: 3632. Doi: 10.1038/s41467-018-05956-1.
- Kniss AR, Savage SD, Jabbour R (2016) Commercial crop yields reveal strengths and weaknesses for organic agriculture in the United States. *PLOS ONE* 11(11): e0165851. Doi: 10.1371/journal.pone.0161673.
- Knoepfel P (2011) Politikanalyse. 1. Aufl. Opladen, Budrich, UTB GmbH (UTB Politik, 3578), Stuttgart.
- Knoll KP (2010) Kosten der Adipositas in der Bundesrepublik Deutschland. Dissertation, Technische Universität München.
- Knudsen JS, Moon J, Slager R (2015) Government policies for corporate social responsibility in Europe: A comparative analysis of institutionalisation. *Policy & Politics* 43(1): 81-99. Doi: 10.1332/030557312X656016.
- Koester U (2012) Wegwerfen von Lebensmitteln einerseits, hungernde Bevölkerung andererseits: Ineffizient und unmoralisch? IAMO Policy Brief No. 7, Leibniz-Institut für Agrarentwicklung in Mittel- und Osteuropa (IAMO), Halle (Saale).
- Kofahl D, Weyand T (2016) Halb vegan, halb vegetarisch, aber auch mal Huhn – Soziologische Aspekte des Fleischessens und Fleischverzichts in der Gegenwartsgesellschaft. *Zeitschrift für Agrargeschichte und Agrarsoziologie* 2: 77-92.

- Köhler J, Geels FW, Kern F, Markard J, Onsongo E, Wieczorek A, Alkemade F, Avelino F, Bergek A, Boons F, Fünfschilling L, Hess D, Holtz G, Hyysalo S, Jenkins K, Kivimaa P, Martiskainen M, McMee-kin A, Mühlemeier MS, Nykvist B, Pel B, Raven R, Rohracher H, Sandén B, Schot J, Sovacool B, Turnheim B, Welch D, Wells P (2019) An agenda for sustainability transitions research: State of the art and future directions. *Environmental Innovation and Societal Transitions* 31: 1-32. Doi: 10.1016/j.eist.2019.01.004.
- Kompetenznetzwerk Nutztierhaltung (2020) Empfehlungen des Kompetenznetzwerks Nutztierhaltung, Berlin, 11.22020. [https://www.bmel.de/SharedDocs/Downloads/Tier/TierzuchtTierhaltung/empfehlungen-kompetenznetzwerk-nutztierhaltung.pdf?\\_\\_blob=publicationFile](https://www.bmel.de/SharedDocs/Downloads/Tier/TierzuchtTierhaltung/empfehlungen-kompetenznetzwerk-nutztierhaltung.pdf?__blob=publicationFile) (letzter Zugriff: 16.03.2020).
- König B, Janker J, Reinhardt T, Villarroel M, Junge R (2018) Analysis of aquaponics as an emerging technological innovation system. *Journal of Cleaner Production* 180: 232-243. Doi: 10.1016/j.jclepro.2018.01.037.
- König L, Renner B (2019) Boosting healthy food choices by meal colour variety: Results from two experiments and a just-in-time ecological momentary intervention. *BMC Public Health* 19: 975. Doi: 10.1186/s12889-019-7306-z.
- König L, Zieseimer K, Renner B (2019) Quantifying actual and perceived inaccuracy when estimating the sugar, energy content and portion size of foods. *Nutrients* 11(10): e2425. Doi: 10.3390/nu11102425.
- Königstorfer J, Gröppel-Klein A (2012) Wahrnehmungs- und Kaufverhaltenswirkungen von Nährwertkennzeichen auf Lebensmitteln. *Marketing ZfP* 34(3): 213-226.
- Kosner AW (2012) Hug me: Coca-Cola introduces gesture based marketing in Singapore. <https://www.forbes.com/sites/anthonykosner/2012/04/11/hug-me-coca-cola-introduces-gesture-based-marketing-in-singapore/#75afc9426fec> (letzter Zugriff: 10.01.2020).
- Kotler P, Armstrong G, Harris LC, Piercy N (2019) *Grundlagen des Marketings*, 7. Aufl., Pearson-Verlag, Hallbergmoos.
- Kovic Y, Noel JK, Ungemack JA, Burlison JA (2018) The impact of junk food marketing regulations on food sales: An ecological study. *Obesity Reviews* 19(6): 761-769. Doi: 10.1111/obr.12678.
- Kraak VI, Vandevijvere S, Sacks G, Brinsden H, Hawkes C, Barquera S, Lobstein T, Swinburn BA (2016) Progress achieved in restricting the marketing of high-fat, sugary and salty food and beverage products to children. *Bulletin of the World Health Organization* 94: 540-548. Doi: 10.2471/BLT.15.158667.
- Kranert M, Hafner G, Barabosz J, Schuller H, Leverenz D, Kölbig A, Schneider F, Lebersorger S, Scherhauser S (2012) Ermittlung der weggeworfenen Lebensmittelmengen und Vorschläge zur Verminderung der Wegwerfrate bei Lebensmitteln in Deutschland. Studie der Universität Stuttgart, Institut für Siedlungswasserbau, Wassergüte- und Abfallwirtschaft, und der Universität für Bodenkultur Wien, Institut für Abfallwirtschaft. [https://www.bmel.de/SharedDocs/Downloads/Ernaehrung/WvL/Studie\\_Lebensmittelabfalle\\_Langfassung.pdf?\\_\\_blob=publicationFile](https://www.bmel.de/SharedDocs/Downloads/Ernaehrung/WvL/Studie_Lebensmittelabfalle_Langfassung.pdf?__blob=publicationFile) (letzter Zugriff: 09.01.2020)
- Kratzer M, Kibele M, Akinli A, Porzner M, Boehm BO, Koenig W, Oeztuerk S, Mason RA, Mao R, Haenle MH (2013) Prevalence of celiac disease in Germany: A prospective follow-up study. *World Journal of Gastroenterology* 19(17): 2612-2620. Doi: 10.3748/wjg.v19.i17.2612.
- Krause CG, Beer-Borst S, Sommerhalder K, Hayoz S, Abel T (2018) A short food literacy questionnaire (SFLQ) for adults: Findings from a Swiss validation study. *Appetite* 120: 275-280. Doi: 10.1016/j.appet.2017.08.039.

- Krauss H (2019) Bundestagswahl 2017: So wählten Landwirte. *Agrarheute* vom 25.09.2017. <https://www.agrarheute.com/politik/bundestagswahl-2017-so-waehlten-landwirte-538763> (letzter Zugriff: 19.12.2019).
- Krebs A (2016) Sentientismus. In: Ott K, Dierks J, Voget-Kleschin L (Hrsg.) *Handbuch Umweltethik*. Metzler, Stuttgart: 157-160.
- Krebs-Smith SM, Pannucci TE, Subar AF, Kirkpatrick SI, Lerman JL, Tooze JA, Wilson MM, Reedy J (2018) Update of the healthy eating index: HEI-2015. *Journal of the Academy of Nutrition and Dietetics* 118(9): 1591-1602. Doi: 10.1016/j.jand.2018.05.021.
- Kreibe S, Pitschke T, Berkmüller R, Bokelmann M, Förster A, Stramm C, Pant A (2017) Umweltbezogene Bilanzierung von „intelligenten“ und „aktiven“ Verpackungen hinsichtlich der Recyclingfähigkeit und Durchführung eines Dialogs mit Akteuren der Entsorgungs- und Herstellungsbranchen. *Texte 22/2017*, Umweltbundesamt, Dessau-Roßlau.
- Krems C, Walter C, Heuer T, Hoffmann I (2012) Lebensmittelverzehr und Nährstoffzufuhr- Ergebnisse der Nationalen Verzehrsstudie II. In: DGE (Hrsg.) 12. DGE-Ernährungsbericht, Bonn: 40-85.
- Kreutz J (2012) Verpflegungssysteme in der Gemeinschaftsverpflegung – Eine Übersicht. *D&I* 4/2012: 10-14.
- Kropp C, Stinner S (2018) Wie weit reicht die transformative Kraft der urbanen Ernährungsbewegung? *Soziologie und Nachhaltigkeit – Beiträge zur sozial-ökologischen Transformationsforschung* 02/2018: 28-50.
- Krug G, Brandt S, Gamper M, Knabe A, Klärner A (2020) Arbeitslosigkeit, soziale Netzwerke und gesundheitliche Ungleichheiten. In: Klärner A, Gamper M, Keim S, Moor I, von der Lippe H, Nico V (Hrsg.) *Soziale Netzwerke und gesundheitliche Ungleichheiten. Eine neue Perspektive für die Forschung*. Springer VS, Wiesbaden: 308-321.
- Krumbiegel K, Maertens M, Wollni M (2018) The role of fairtrade certification for wages and job satisfaction of plantation workers. *World Development* 102: 195-212. Doi: 10.1016/j.worlddev.2017.09.020.
- Kühl S, Gassler B, Spiller A (2017) Labeling strategies to overcome the problem of niche markets for sustainable milk products: The example of pasture-raised milk. *Journal of Dairy Science* 100(6): 5082-5096. Doi: 10.3168/jds.2016-11997.
- Kühl S, Gauly S, Spiller A (2019) Analysing public acceptance of four common husbandry systems for dairy cattle using a picture-based approach. *Journal of Livestock Science* 220: 196-204. Doi: 10.1016/j.livsci.2018.12.022.
- Kühnen M, Hahn R (2017) Indicators in social life cycle assessment: A review of frameworks, theories, and empirical experience. *Journal of Industrial Ecology* 21(6): 1547-1565. Doi: 10.1111/jiec.12663.
- Kuhns A, Saxena M (2017) Food purchase decisions of millennial households compared to other generations. *Economic Information Bulletin Number 186*. U.S. Department of Agriculture, Economic Research Service.
- Kunkel DL, Castonguay JS, Filer CR (2015) Evaluating industry self-regulation of food marketing to children. *American Journal of Preventive Medicine* 49(2): 181-187. Doi: 10.1016/j.amepre.2015.01.027.
- Küpper C (2010) Mangelernährung im Alter. Teil 2: Ursachen und Folgen, Therapie und Prävention. *Ernährungsumschau* 5/10: 256-262.

- Kupsala S, Jokinen P, Vinnari M (2013) Who cares about farmed fish? Citizen perceptions of the welfare and the mental abilities of fish. *Journal of Agricultural and Environmental Ethics* 26: 119-135. Doi: 10.1007/s10806-011-9369-4.
- Kurth BM, Schaffrath Rosario A (2010) Übergewicht und Adipositas bei Kindern und Jugendlichen in Deutschland. *Bundesgesundheitsblatt* 53(7): 643-652. Doi: 10.1007/s00103-010-1083-2.
- Kurzer P, Cooper A (2013) Biased or not? Organized interests and the case of EU food information labeling. *Journal of European Public Policy* 20(5): 722-740. Doi: 10.1080/13501763.2012.751703.
- Kusche D, Hoppe J, Hupe A, Heß J (2019) Wasserschutz. In: Sanders J, Heß J (Hrsg.) Leistungen des ökologischen Landbaus für Umwelt und Gesellschaft. Thünen Report 65. 2. überarbeitete und ergänzte Auflage, Johann Heinrich von Thünen-Institut, Braunschweig: 25-57. Doi: 10.3220/REP1576488624000.
- Kuschel S, Varelmann K (2018) Bericht 2018 – Bundesweite Aktionswochen Saisonarbeit in der Landwirtschaft. IG BAU und PECO Institut. [https://www.peco-ev.de/docs/2018\\_Bundesweite\\_Aktionswochen\\_Saisonarbeit\\_Landwirtschaft.pdf](https://www.peco-ev.de/docs/2018_Bundesweite_Aktionswochen_Saisonarbeit_Landwirtschaft.pdf) (letzter Zugriff: 14.12.2019).
- Kusumaningtyas R, van Gelder JW (2019) Setting the bar for deforestation-free soy in Europe. A benchmark to assess the suitability of voluntary standard systems. <https://www.iscc-system.org/wp-content/uploads/2019/03/Deforestation-Free-Benchmark-of-FEFAC-Compliant-Standard-190312.pdf> (letzter Zugriff: 20.12.2019).
- Lambin EF, Meyfroidt P (2011) Global land use change, economic globalization, and the looming land scarcity. *Proceedings of the National Academy of Sciences of the United States of America* 108(9): 3465-3472. Doi: 10.1073/pnas.1100480108.
- Lampert T, Hoebel J, Kuntz B, Müters S, Kroll LE (2018a) Messung des sozioökonomischen Status und des subjektiven sozialen Status in KiGGS Welle 2. *Journal of Health Monitoring* 3(1): 114-133. Doi: 10.17886/RKI-GBE-2018-016.
- Lampert T, Kroll LE (2009) Die Messung des sozioökonomischen Status in sozialepidemiologischen Studien. In: Richter M, Hurrelmann K (Hrsg.) *Gesundheitliche Ungleichheit: Grundlagen, Probleme, Perspektiven*. 2. aktualisierte Auflage. VS Verlag für Sozialwissenschaften, Wiesbaden: 309-334.
- Lampert T, Kroll LE, Kuntz B, Hoebel J (2018b) Gesundheitliche Ungleichheit in Deutschland und im internationalen Vergleich: Zeitliche Entwicklungen und Trends. *Journal of Health Monitoring* 3(S1): 1-26. Doi: 10.17886/RKI-GBE-2018-019.
- Lampert T, Kroll LE, von der Lippe E, Müters S, Stolzenberg H (2013) Sozioökonomischer Status und Gesundheit. Ergebnisse der Studie zur Gesundheit Erwachsener in Deutschland (DEGS1). *Bundesgesundheitsblatt* 56(5-6): 814-821. Doi: 10.1007/s00103-013-1695-4.
- Lampert T, Richter M, Schneider S, Spallek J, Dragano N (2016) Soziale Ungleichheit und Gesundheit. Stand und Perspektiven der sozialepidemiologischen Forschung in Deutschland. *Bundesgesundheitsblatt* 59(2): 153-165. Doi: 10.1007/s00103-015-2275-6.
- Lamprecht A, Schauf O, Cämmerer B (2017) Zweite Studie zur Qualität des schulischen Mittagessens im Land Berlin. TU Berlin, Studie im Auftrag der Senatsverwaltung für Bildung, Jugend und Familie Berlin, Berlin.
- Lange C, Finger JD (2017) Gesundheitsverhalten in Europa-Vergleich ausgewählter Indikatoren für Deutschland und die europäische Union. *Journal of Health Monitoring* 2(2): 3-19. Doi: 10.17886/RKI-GBE-2017-024.

- Lange S, Probst C, Gmel G, Rehm J, Burd L, Popova S (2017) Global prevalence of alcohol spectrum disorder among children and youth: A systematic review and meta analysis. *JAMA Pediatrics* 171(10): 948-956. Doi: 10.1001/jamapediatrics.2017.1919.
- Lappé FM (1991) *Diet for a small planet*. Twentieth anniversary edition. Ballantine Books.
- Larsen J, Stegger M, Andersen P, Petersen A, Larsen AR, Westh H, Agersø Y, Fetsch A, Kraushaar B, Käsbohrer A, Feßler AT, Schwarz S, Cuny C, Witte W, Butaye P, Denis O, Haenni M, Madec JY, Jouy E, Laurent F, Battisti A, Franco A, Alba P, Mammina C, Pantosti A, Monaco M, Wagenaar JA, de Boer E, van Duijkeren E, Heck M, Domínguez L, Torres C24, Zarazaga M, Price LB, Skov RL (2016) Evidence for human adaptation and foodborne transmission of live-stock-associated methicillin-resistant staphylococcus aureus. *Clinical Infectious Diseases* 63(10): 1349-1352. Doi: 10.1093/cid/ciw532.
- Laschet H (2018) Fehlernährung und Adipositas: Ärzte machen Druck. *Pädiatrie* 30(3): 61. Doi: 10.1007/s15014-018-1357-y.
- Laubstein C, Holz G, Seddig N (2016) *Armutfolgen für Kinder und Jugendliche. Erkenntnisse aus empirischen Studien in Deutschland*. Bertelsmann Stiftung.  
[https://www.bertelsmann-stiftung.de/fileadmin/files/BSt/Publikationen/GrauePublikationen/Studie\\_WB\\_Armutfolgen\\_fuer\\_Kinder\\_und\\_Jugendliche\\_2016.pdf](https://www.bertelsmann-stiftung.de/fileadmin/files/BSt/Publikationen/GrauePublikationen/Studie_WB_Armutfolgen_fuer_Kinder_und_Jugendliche_2016.pdf) (letzter Zugriff: 11.12.2019).
- Lauby-Secretan B, Scoccianti C, Loomis D, Grosse Y, Bianchini F, Straif K (2016) Body fatness and cancer – Viewpoint of the IARC Working group. *The New England Journal of Medicine* 375(8): 794-798. Doi: 10.1056/NEJMSr1606602.
- Lebensmittelchemische Gesellschaft (2018) *Grundlagenpapier: Nanotechnologie im Lebensmittelbereich*, Lebensmittelchemische Gesellschaft, Fachgruppe in der Gesellschaft Deutscher Chemiker, Arbeitsgruppe Nanomaterialien. *Lebensmittelchemie* 72(4): 77-79.  
Doi: 10.1002/lemi.201870405.
- Lebensmittelverband Deutschland (2019) *Nutri-Score-Rahmenbedingungen müssen stimmen*. Positionspapier. <https://www.lebensmittelverband.de/de/verband/positionen/20191203-nutri-score-rahmenbedingungen-anpassungen> (letzter Zugriff: 10.01.2020).
- Lefebvre M, Langrell SRH, Gomez-y-Paloma S (2015) Incentives and policies for integrated pest management in Europe: A review. *Agronomy for Sustainable Development* 35: 27-45.  
Doi: 10.1007/s13593-014-0237-2.
- Lehmkuhler SH (2002) *Die Gießener Ernährungsstudie über das Ernährungsverhalten von Armutshaushalten (GESA): Qualitative Fallstudien*. Dissertation, Justus-Liebig-Universität Göttingen.
- Lemken D (2019) *Key Food Choices and Climate Change*, unveröffentlichter Projektantrag bei der DFG, Göttingen.
- Lemken D, Kraus K, Nitzko S, Spiller A (2018) Staatliche Eingriffe in die Lebensmittelwahl. Welche klimapolitischen Instrumente unterstützt die Bevölkerung? *GAIA* 27(4): 363-372. Doi: 10.14512/gaia.27.4.8.
- Leos-Urbel J, Schwartz AE, Weinstein M, Corcoran S (2013) Not just for poor kids: The impact of universal free school breakfast on meal participation and student outcomes. *Economics of Education Review* 36: 88-107. Doi: 10.1016/j.econedurev.2013.06.007.
- Leucht S, Hierl S, Kissling W, Dold M, Davis JM (2012) Putting the efficacy of psychiatric and general medicine medication into perspective: Review of meta-analyses. *The British Journal of Psychiatry* 200(2): 97-106. Doi: 10.1192/bjp.bp.111.096594.

- Leverenz D, Moussawel S, Maurer C, Hafner G, Schneider F, Schmidt T, Kranert M (2019) Quantifying the prevention potential of avoidable food waste in households using a self-reporting approach. *Resources, Conservation & Recycling* 150: 104417. Doi: 10.1016/j.resconrec.2019.104417.
- Levy DT, Currie L, Clancy L (2013) Tobacco control policy in the UK: Blueprint for the rest of Europe? *European Journal of Public Health* 23(2): 201-206. Doi: 10.1093/eurpub/cks090.
- Lewis RA, Rao JM (2015) The unfavorable economics of measuring the returns to advertising. *The Quarterly Journal of Economics* 130(4): 1941-1973. Doi: 10.1093/qje/qjv023.
- Lewit EM, Kerrebrock N (1997) Population based growth stunting. *The Future of Children* 7(2): 149-156. Doi: 10.2307/1602393.
- LI (Landesinstitut für Lehrerbildung und Schulentwicklung) (Hrsg.) (2011) Handreichung – Auf dem Weg zum schulinternen Curriculum. Ein Leitfaden. Hamburg.
- Li S, Linn J, Muehlegger E (2012) Gasoline taxes and consumer behavior. HKS Faculty Research Working Paper Series RWP12-006, John F. Kennedy School of Government, Harvard University.
- Li Y, Hruby A, Bernstein AM, Ley SH, Wang DD, Chiuve SE, Sampson L, Rexrode KM, Rimm EB, Willett WC, Hu FB (2015) Saturated fats compared with unsaturated fats and sources of carbohydrates in relation to risk of coronary heart disease: A prospective cohort study. *Journal of the American College of Cardiology* 66(14): 1538-1548. Doi: 10.1016/j.jacc.2015.07.055.
- Li Y, Pan A, Wang D, Liu X, Dhana K, Franco OH, Kaptoge S, di Angelantonio E, Stampfer M, Willett W, Hu FB (2018) Impact of healthy lifestyle factors on life expectancies in the US population. *Circulation* 138(4): 345-355. Doi: 10.1161/CIRCULATIONAHA.117.032047.
- Libuda L, Alexy U, Buyken AE, Sichert-Hellert W, Stehle P, Kersting M (2009) Consumption of sugar-sweetened beverages and its association with nutrient intakes and diet quality in German children and adolescents. *British Journal of Nutrition* 101(10): 1549-1557. Doi: 10.1017/S0007114508094671.
- Licciardello F (2017) Packaging, blessing in disguise. Review on its diverse contribution to food sustainability. *Trends in Food Science & Technology* 65: 32-39. Doi: 10.1016/j.tifs.2017.05.003.
- Lidl (2018) 100 Prozent faire Bananen: Lidl stellt als erster Händler sein Sortiment um. Pressemitteilung vom 26.09.2018. [https://unternehmen.lidl.de/pressreleases/180926\\_fairtrade-bananen](https://unternehmen.lidl.de/pressreleases/180926_fairtrade-bananen) (letzter Zugriff: 19.12.2019).
- Lin JY, Arthurs J, Reilly S (2017) Conditioned taste aversions: From poisons to pain to drugs of abuse. *Psychonomic Bulletin & Review* 24(2): 335-351. Doi: 10.3758/s13423-016-1092-8.
- Lippi G, Mattiuzzi C, Sanchis-Gomar F (2015) Red meat consumption and ischemic heart disease. A systematic literature review. *Meat Science* 108: 32-36. Doi: 10.1016/j.meatsci.2015.05.019.
- Litman EA, Gortmaker SL, Ebbeling CB, Ludwig DS (2018) Source of bias in sugar-sweetened beverage research: A systematic review. *Public Health Nutrition* 21(12): 2345-2350. Doi: 10.1017/S1368980018000575.
- Liu J, Rehm CD, Micha R, Mozaffarian D (2020) Quality of meals consumed by US adults at full-service and fast-food restaurants, 2003-2016: Persistent low quality and widening disparities. *The Journal of Nutrition* 150(4): 873-883. Doi: 10.1093/jn/nxz299.
- Liu Y, Rosten TW, Henriksen K, Hognes ES, Summerfelt S, Vinci B (2016a) Comparative economic performance and carbon footprint of two farming models for producing Atlantic salmon (*Salmo salar*): Land-based closed containment system in freshwater and open net pen in seawater. *Aquacultural Engineering* 71: 1-12. Doi: 10.1016/j.aquaeng.2016.01.001.

- Liu T, Wang Q, Su B (2016b) A review of carbon labeling: Standards, implementation, and impact. *Renewable and Sustainable Energy Reviews* 53: 68-79. Doi: 10.1016/j.rser.2015.08.050.
- Liu Q, Steenburgh TJ, Gupta S (2015) The cross attributes flexible substitution logit: Uncovering category expansion and share impacts of marketing instruments. *Marketing Science* 34(1): 144-159. Doi: 10.1287/mksc.2014.0886.
- Livingstone MB, Pourshahidi LK (2014) Portions size and obesity. *Advances in Nutrition* 5(6): 829-834. Doi: 10.3945/an.114.007104.
- Lloyd SJ, Bangalore M, Chalabi Z, Kovats SR, Hallegatte S, Rozenberg J, Valin H, Havlík P (2018) A global-level model of the potential impacts of climate change on child stunting via income and food price in 2030. *Environmental Health Perspectives* 126(9): 097007. Doi: 10.1289/EHP2916.
- Lobb R, Colditz GA (2013) Implementation science and its application to population health. *Annual Review of Public Health* 34: 235-251. Doi: 10.1146/annurev-publhealth-031912-114444.
- Lobstein T, Jackson-Leach R, Moodie ML, Hall KD, Gortmaker SL, Swinburn BA, James WP, Wang Y, McPherson (2015) Child and adolescent obesity: Part of a bigger picture. *The Lancet* 385(9986): 2510-2520. Doi: 10.1016/S0140-6736(14)61746-3.
- Lock I, Seele P, Heath RL (2016) Where grass has no roots: The concept of 'shared strategic communication' as an answer to unethical astroturf lobbying. *International Journal of Strategic Communication* 10(2): 87-100. Doi: 10.1080/1553118X.2015.1116002.
- Long MW, Gortmaker SL, Ward ZJ, Resch SC, Moodie ML, Sacks G, Swinburn BA, Carter RC, Claire Wang Y (2015) Cost effectiveness of a sugar-sweetened beverage excise tax in the U.S. *American Journal of Preventive Medicine* 49(1): 112-123. Doi: 10.1016/j.amepre.2015.03.004.
- Lopez CN, Martinez-Gonzalez MA, Sanchez-Villegas A, Alonso A, Pimenta AM, Bes-Rastrollo M (2009) Costs of mediterranean and western dietary patterns in a Spanish cohort and their relationship with prospective weight change. *Journal of Epidemiology & Community Health* 63: 920-927. Doi: 10.1136/jech.2008.081208.
- Lorenz BA, Hartmann M, Hirsch S, Kanz O, Langen N (2017) Determinants of plate leftovers in one German catering company. *Sustainability* 9: 807. Doi: 10.3390/su9050807.
- Lorenz H, Reinsch T, Hess S, Taube F (2019) Is low-input dairy farming more climate friendly? A meta-analysis of the carbon footprints of different production systems. *Journal of Cleaner Production* 211: 161-170. Doi: 10/gfxf3b.
- Löser Chr (2010): Malnutrition in hospitals – the clinical and economic implications. *Deutsches Ärzteblatt International* 107(51-52): 911-917. Doi: 10.3238/arztebl.2010.0911.
- Loudon K, Treweek S, Sullivan F, Donnan P, Thorpe KE, Zwarenstein M (2015) The PRECIS-2 tool: Designing trials that are fit for purpose. *BMJ* 350: h2147. Doi: 10.1136/bmj.h2147.
- Loughnan S, Haslam N, Bastian B (2010) The role of meat consumption in the denial of moral status and mind to meat animals. *Appetite* 55(1): 156-159. Doi: 10.1016/j.appet.2010.05.043.
- Lowder S K, Jakob S, Raney T (2016) The number, size, and distribution of farms, smallholder farms, and family farms worldwide. *World Development* 87: 16-29. Doi: 10.1016/j.worlddev.2015.10.041.
- Lowe MR, Butryn ML (2007) Hedonic hunger: A new dimension of appetite? *Physiology & Behavior* 91(4): 432-439. Doi: 10.1016/j.physbeh.2007.04.006.

- Ludwig A, Nolten R (2006) Bis der Tod sie scheidet: Alterssicherung der Bäuerinnen im Wandel. In: Reberg KS (Hrsg.) Soziale Ungleichheit, kulturelle Unterschiede: Verhandlungen des 32. Kongresses der Deutschen Gesellschaft für Soziologie in München. Teilbd. 1 und 2, Campus Verlag, Frankfurt am Main: 1842-1851.
- Lukas M, Scheiper ML, Ansorge J, Rohn H, Liedtke C, Teitscheid P (2014) Der Nutritional Footprint – Ein Instrument zur Bewertung von Gesundheits- und Umweltwirkungen der Ernährung. *Ernährungsumschau* 11/14: 164-170.
- Lusk JL, Norwood FB. (2016) Some vegetarians spend less money on food, others don't. *Ecological Economics* 130: 232-242. Doi: 10.1016/j.ecolecon.2016.07.005.
- Lustria MLA, Noar SM, Cortese J, van Stee SK, Glueckauf RL, Lee J (2013). A meta-analysis of web-delivered tailored health behavior change interventions. *Journal of Health Communication* 18(9): 1039-1069. Doi: 10.1080/10810730.2013.768727.
- Mace P (2001) A new role for MSY in single-species and ecosystem approaches to fisheries stock assessment and management. *Fish and Fisheries* 2: 2-32. Doi: 10.1046/j.1467-2979.2001.00033.x.
- Macrae F (2011) What's for dinner? Rainbow coloured carrots and super broccoli that's healthier and sweeter. *The Daily Mail*, 15.10.2011.  
<https://www.dailymail.co.uk/health/article-2044695/Purple-carrots-sale-Tesco-supermarket-Orange-year.html> (letzter Zugriff: 05.12.2019).
- Mai M (2013). Regieren mit organisierten Interessen – Lobbyismus im Wandel. In: Korte KR, Grunden T (Hrsg.) *Handbuch Regierungsforschung*. Springer VS, Wiesbaden: 308-315.
- Maillot M, Darmon N, Vieux F, Drewnowski A (2007) Low energy density and high nutritional quality are each associated with higher diet costs in French adults. *The American Journal of Clinical Nutrition* 86(3): 690-696. Doi: 10.1093/ajcn/86.3.690.
- Malik VS, Li Y, Pan A, de Koning L, Schernhammer E, Willett WC, Hu FB (2019) Long-term consumption of sugar-sweetened and artificially sweetened beverages and risk of mortality in US adults. *Circulation* 139: 2113-2125. Doi: 10.1161/CIRCULATIONAHA.118.037401.
- Malik VS, Pan A, Willett WC, Hu FB (2013) Sugar-sweetened beverages and weight gain in children and adults: A systematic review and meta-analysis. *American Journal of Clinical Nutrition* 98: 1084-1102. Doi: 10.3945/ajcn.113.058362.
- Malik VS, Popkin BM, Bray GA, Després JP, Willett WC, Hu FB (2010) Sugar-sweetened beverages and risk of metabolic syndrome and type 2 diabetes: A meta-analysis. *Diabetes Care* 33(11): 2477-2483. Doi: 10.2337/dc10-1079.
- Mammana I (2014) Concentration of market power in the EU seed market. Study commissioned by the Greens/EFA Group in the European Parliament, Brussels.
- Mani A, Mullainathan S, Shafir E, Zhao J (2013) Poverty impedes cognitive function. *Science* 341(6149): 976-980. Doi: 10.1126/science.1238041.
- Mantilla Herrera AM, Crino M, Erskine HE, Sacks G, Ananthapavan J, Mhurchu CN, Lee YY (2018) Cost-effectiveness of product reformulation in response to the health star rating food labelling system in Australia. *Nutrients* 10(5): e614. Doi: 10.3390/nu10050614.
- Marahrens S, Schmidt S, Frauenstein J, Mathews J, Bussian B-M, Penn-Bressel G, Utermann J, Eberhardt E, Freibauer A, Bechthold M, Tiemeyer B, Wellbrock N, Böttcher F, Glante F (2015) Bodenzustand in Deutschland zum „Internationalen Jahr des Bodens“ 2015. Umweltbundesamt, Dessau-Roßlau.

- Marette S, Nabec L, Durieux F (2019) Improving nutritional quality of consumers' food purchases with traffic-lights labels: An experimental analysis. *Journal of Consumer Policy* 42(3): 377-395. Doi: 10.1007/s10603-019-09420-5.
- Marsden T, Morley A (eds.) (2014) *Sustainable food systems. Building a new paradigm*. Taylor and Francis (Earthscan Food and Agriculture), Hoboken.
- Marteau TM (2017) Towards environmentally sustainable human behaviour: Targeting non-conscious and conscious processes for effective and acceptable policies. *Philosophical Transactions of the Royal Society A: Mathematical, Physical and Engineering Sciences* 375(2095): 20160371. Doi: 10.1098/rsta.2016.0371.
- Marteau TM, Hollands GJ, Shemilt I, Jebb SA (2015) Downsizing: Policy options to reduce portion sizes to help tackle obesity. *British Medical Journal* 351: h5863. Doi: 10.1136/bmj.h5863.
- Marteau TM, Hollands GJ, Fletcher PC (2012) Changing human behavior to prevent disease: The importance of targeting automatic processes. *Science* 337(6101): 1492-1495. Doi: 10.1126/science.1226918.
- Martin A, Booth JN, Laird Y, Sproule J, Reilly JJ, Saunders DH (2018) Physical activity, diet and other behavioural interventions for improving cognition and school achievement in children and adolescents with obesity or overweight. *Cochrane Database of Systematic Reviews* 3: CD009728. Doi: 10.1002/14651858.CD009728.pub4.
- Martin AA (2016) Why can't we control our food intake? The downside of dietary variety on learned satiety responses. *Physiology & Behavior* 162: 120-129. Doi: 10.1016/j.physbeh.2016.04.010.
- Martin J, Geisel T, Maresch C, Krieger K, Stein J (2013) Inadequate nutrient intake in patients with celiac disease: Results from a German survey. *Digestion* 87(4): 240-246. Doi: 10.1159/000348850.
- Martin L, Gerlai R (2018) Sentience: All or none or matter of degree? Commentary on Sneddon et al. on Sentience Denial. *Animal Sentience*. <https://animalstudiesrepository.org/animalsent/vol3/iss21/9/>.
- Martin W, Laborde D (2018) The free flow of goods and food security and nutrition. In: IFPRI (ed.) *Global Food Policy Report 2018*. International Food Policy Research Institute, Washington, DC: 20-29.
- Martinez Soria J (2005) Das Recht auf Sicherung des Existenzminimums unter europäischem und innerstaatlichen Druck. *Juristenzeitung*: 644-652.
- Martins CIM, Galhardo L, Noble C, Damsgård B, Spedicato MT, Zupa W, Beauchaud M, Kulczykowska E, Massabuau JC, Carter T, Rey Planellas S, Kristiansen T (2012) Behavioural indicators of welfare in farmed fish. *Fish Physiology and Biochemistry* 38: 17-41. Doi: 10.1007/s10695-011-9518-8.
- Maschkowski G, Hartmann M, Hoffmann J (2014) Health-related on-pack communication and nutritional value of ready-to-eat breakfast cereals evaluated against five nutrient profiling schemes. *BMC Public Health* 14: 1178. Doi: 10.1186/1471-2458-14-1178.
- Masharani U, Sherchan P, Schloetter M, Stratford S, Xiao A, Sebastian A, Nolte Kennedy M, Frassetto L (2015) Metabolic and physiologic effects from consuming a hunter-gatherer (Paleolithic)-type diet in type 2. *European Journal of Clinical Nutrition* 69(8): 944-948. Doi: 10.1038/ejcn.2015.39.
- Mason P, Lang T (2017) *Sustainable diets: How ecological nutrition can transform consumption and the food system*. Routledge, London.

- Massey M, O'Casey A, O'tahal P (2018) A meta-analytic study of the factors driving the purchase of organic food. *Appetite* 125: 418-427. Doi: 10.1016/j.appet.2018.02.029.
- Masters R, Anwar E, Collins B, Cookson R, Capewell S (2017) Return on investment of public health interventions: A systematic review. *Journal of Epidemiology & Community Health* 71(8): 827-834. Doi: 10.1136/jech-2016-208141.
- Mata J, Hertwig R (2018) Public beliefs about obesity relative to other major health risks: Representative cross-sectional surveys in the USA, the UK, and Germany. *Annals of Behavioral Medicine* 52(4): 273-286. Doi:10.1093/abm/kax003.
- Mattes RD (2010) Hunger and thirst: Issues in measurement and prediction of eating and drinking. *Physiology & Behavior* 100(1): 22-32. Doi: 10.1016/j.physbeh.2009.12.026.
- Mausser W, Klepper G, Zabel F, Delzeit R, Hank T, Putzenlechner B, Calzadilla A (2015) Global biomass production potentials exceed expected future demand without the need for cropland expansion. *Nature Communications* 6: 8946. Doi: 10/f74b7h.
- Max-Neef M (1992) Development and human needs. In: Ekins P, Max-Neef M (eds.) *Real life economics. Understanding wealth creation*. Routledge, London: 197-214.
- Max-Planck-Institut für Bildungsforschung (2015) Unstatistik des Monats: Wursthysterie. <https://www.mpib-berlin.mpg.de/unstatistik-fleischkonsum-erhoeht-darmkrebsrisiko> (letzter Zugriff: 12.12.2019).
- May S, Sidali KL, Spiller A, Tschöfen B (eds.) (2017) *Taste | Power | Tradition – Geographical Indications as Cultural Property*. Göttingen Studies in Cultural Property, Volume 10, Göttingen.
- Mazur A, Caroli M, Radziewicz-Winnicki I, Nowicka P, Weghuber D, Neubauer D, Dembinski L, Crawley FP, White M, Hadjipanayis A (2017) Reviewing and addressing the link between mass media and the increase in obesity among European children: The European Academy of Paediatrics (EAP) and The European Childhood Obesity Group (ECOG) consensus statement. *Acta Paediatrica* 107: 568-576. Doi: 10.1111/apa.14136.
- McAfee T, Davis KC, Alexander RL Jr, Pechacek TF, Bunnell R (2013) Effect of the first federally funded US antismoking national media campaign. *The Lancet* 382(9909): 2003-2011. Doi: 10.1016/S0140-6736(13)61686-4.
- McAuliffe GA, Chapman DV, Sage CL (2016) A thematic review of life cycle assessment (LCA) applied to pig production. *Environmental Impact Assessment Review* 56: 12-22. Doi: 10.1016/j.eiar.2015.08.008.
- McIlveen S, Schnurr R, Auld G, Arnold S, Flett K, Bailey M (2019) The path to credibility for the Marine Stewardship Council. In: Vogt M (ed.) *Sustainability certification schemes in the agricultural and natural resource sectors: Outcomes for society and the environment*. Routledge, London, New York: 199-212.
- McKendree MG, Croney CC, Widmar NJ (2014) Effects of demographic factors and information sources on United States consumer perceptions of animal welfare. *Journal of Animal Science* 92(7): 3161-3173. Doi: 10.2527/jas.2014-6874.
- McKenna M (2019) Antibiotics hit the orchard. *Nature* 567(7748): 302-303. Doi: 10.1038/d41586-019-00878-4.
- Meadows DH, Randers J, Meadows DL (2005) *Limits to growth. The 30-year update*. Earthscan, London.
- Meemken EM, Qaim M (2018a) Organic agriculture, food security, and the environment. *Annual Review of Resource Economics* 10: 39-63. Doi 10.1146/annurev-resource-100517-023252.

- Meemken EM, Qaim M (2018b) Can private food standards promote gender equality in the small farm sector? *Journal of Rural Studies* 58: 39-51. Doi: 10.1016/j.jrurstud.2017.12.030.
- Meemken E, Sellare J, Kouame CN, Qaim M (2019) Effects of fairtrade on the livelihoods of poor rural Workers. *Nature Sustainability* 2: 635-642. Doi: 10.1038/s41893-019-0311-5.
- Mehta NK, Myrskylä M (2017) The population health benefits of a healthy lifestyle: Life expectancy increased and onset of disability delayed. *Health Affairs* 36(8): 1495-1502. Doi: 10.1377/hlthaff.2016.1569.
- Meier T (2014) *Umweltschutz mit Messer und Gabel – Der ökologische Rucksack der Ernährung in Deutschland*. Oekom-Verlag, München.
- Meier T, Gräfe K, Senn F, Sur P, Stangl GI, Dawczynski C, März W, Kleber ME, Lorkowski S (2019) Cardiovascular mortality attributable to dietary risk factor in 51 countries in the WHO European Region from 1996 to 2016: A systematic analysis of the Global Burden of Disease Study. *European Journal of Epidemiology* 34(1): 37-55. Doi: 10.1007/s10654-018-0473-x.
- Meier T, Grauwinkel U, Forner F, Volkhardt I, Gabriele I, Stangl GI, Christen O (2018) Ökologische und gesundheitliche Auswertungen von 610 Rezepturen in der Außer-Haus-Verpflegung. Analyseergebnisse der Bilanzierungsmethode susDISH. In: Teitscheid P, Langen N, Speck M, Rohn H (2018) *Nachhaltig außer Haus essen – Von der Idee bis auf den Teller*. Oekom-Verlag, München: 242-262.
- Méjean C, Lampuré A, Si Hassen W, Gojard S, Péneau S, Hercberg S, Castetbon K (2018) Influence of food preparation behaviors on 5-year weight change and obesity risk in a French prospective cohort. *International Journal of Behavioral Nutrition and Physical Activity* 15: 120. Doi: 10.1186/s12966-018-0747-4.
- Mendonca RD, Pimenta AM, Gea A, de la Fuente-Arrillaga C, Martinez-Gonzalez MA, Lopes AC, Bes-Rastrollo M (2016) Ultraprocessed food consumption and risk of overweight and obesity: the University of Navarra Follow-Up (SUN) cohort study. *The American Journal of Clinical Nutrition* 104(5): 1433-1440. Doi: 10.3945/ajcn.116.135004.
- Mensink GBM, Haftenberger M, Brettschneider AK, Lage-Barbosa C, Perlitz H, Patelakis E, Heide K, Frank M, Lehmann F, Krause L, Houben R, Butschalowski H, Richter A, Kamtsiuris P (2017) *EsKi-Mo II – Die Ernährungsstudie als Modul in KiGGS Welle 2*. *Journal of Health Monitoring* 2(S3): 38-46. Doi: 10.17886/RKI-GBE-2017-101.
- Mensink GBM, Lage Barbosa C, Brettschneider AK (2016) Verbreitung der vegetarischen Ernährungsweise in Deutschland. *Journal of Health Monitoring* 1(2): 2-15. Doi: 10.17886/RKI-GBE-2016-033.
- Mensink GBM, Schienkiewitz A, Haftenberger M, Lampert T, Ziese T, Scheidt-Nave C (2013a) Übergewicht und Adipositas in Deutschland. Ergebnisse der Studie zur Gesundheit Erwachsener in Deutschland (DEGS1). *Bundesgesundheitsblatt* 56(5-6): 786-794. Doi: 10.1007/s00103-012-1656-3.
- Mensink GBM, Schienkiewitz A, Rabenberg M, Borrmann A, Richter A, Haftenberger M (2018) Konsum zuckerhaltiger Erfrischungsgetränke bei Kindern und Jugendlichen in Deutschland – Querschnittergebnisse aus KIGGS Welle 2 und Trends. *Journal of Health Monitoring* 3(1): 31-37. Doi: 10.25646/5554.
- Mensink GBM, Truthmann J, Rabenberg M, Heidemann C, Haftenberger M, Schienkiewitz A, Richter A (2013b) Obst- und Gemüsekonsum in Deutschland. Ergebnisse der Studie zur Gesundheit Erwachsener in Deutschland (DEGS1). *Bundesgesundheitsblatt* 56(5-6): 779-785. Doi: 10.1007/s00103-012-1651-8.

- Methfessel B, Höhn K, Miltner-Jürgensen B (2016) Essen und Ernährungsbildung in der KiTa. Entwicklung-Versorgung-Bildung, Stuttgart.
- Meyer CH, Hamer M, Frieling D, Oertzen G (2018) Lebensmittelverluste von Obst, Gemüse, Kartoffeln zwischen Feld und Ladentheke: Ergebnisse einer Studie in Nordrhein-Westfalen, LANUV-Fachbericht 85, Landesamt für Natur, Umwelt und Verbraucherschutz Nordrhein-Westfalen, Recklinghausen.
- Meyer-Aurich A, Osinski E, Matthes U, Weinfurter K, Gerl G (2000) Ein Ziel- und Indikatoren-System zur Entwicklung von Handlungsempfehlungen für eine nachhaltige Landwirtschaft im Forschungsverbund Agrarökosysteme München (FAM). Beitrag zum 112. VDLUFA-Kongress (18.-22. September 2000 in Stuttgart-Hohenheim). VDLUFA-Schriftenreihe 53/2000, Teil VI: 31-38.
- Meyerding SGH, Schaffmann AL, Lehberger M (2019) Consumer preferences for different designs of carbon footprint labelling on tomatoes in Germany – Does design matter? *Sustainability* 11: 1587. Doi: 10.3390/su11061587.
- Meyer-Hamme SEK, Lambertz C, Gauly M (2016) Does group size have an impact on welfare indicators in fattening pigs? *Animal* 10(1): 142-149. Doi: 10.1017/S1751731115001779.
- Mhurchu CN, Eyles H, Jiang Y, Blakely T (2018) Do nutrition labels influence healthier food choices? Analysis of label viewing behaviour and subsequent food purchases in a labelling intervention trial. *Appetite* 121: 360-365. Doi: 10.1016/j.appet.2017.11.105.
- Micha R, Karageorgou D, Bakogianni I, Trichia E, Whitsel LP, Story M, Peñalvo JL, Mozaffarian D (2018) Effectiveness of school food environment policies on children's dietary behaviors: A systematic review and meta-analysis. *PLOS ONE* 13(3): e0194555. Doi: 10.1371/journal.pone.0194555.
- Michie S, Richardson M, Johnston M, Abraham C, Francis J, Hardeman W, Eccles MP, Cane J, Wood CE (2013) The behavior change technique taxonomy (v1) of 93 hierarchically clustered techniques: Building an international consensus for the reporting of behavior change interventions. *Annals of Behavioral Medicine* 46(1): 81-95. Doi: 10.1007/s12160-013-9486-6.
- Micklitz HW, Oehler A, Piorkowsky MB, Reisch LA, Strünck C (2010) Der vertrauende, der verletzte oder der verantwortungsvolle Verbraucher? Plädoyer für eine differenzierte Strategie in der Verbraucherpolitik. Stellungnahme des Wissenschaftlichen Beirats Verbraucher- und Ernährungspolitik beim BMELV. Dezember 2010, Berlin.
- Mie A, Andersen HR, Gunnarsson S, Kahl J, Kesse-Guyot E, Rembiałkowska E, Quaglio G, Grandjean P (2017) Human health implications of organic food and organic agriculture: A comprehensive review. *Environmental Health* 16: 111. Doi: 10.1186/s12940-017-0315-4.
- Milani C, Lorini C, Baldasseroni A, Dellisanti C, Bonaccorsi G (2019) An umbrella review and narrative synthesis of the effectiveness of interventions aimed at decreasing food prices to increase food quality. *International Journal of Environmental Research and Public Health* 16(13): e2346. Doi: 10.3390/ijerph16132346.
- Milchindustrieverband (2019a) Beilage zum Geschäftsbericht 2018/2019 Zahlen – Daten – Fakten. [https://milchindustrie.de/wp-content/uploads/2019/09/ZahlenDatenFakten\\_2019.pdf](https://milchindustrie.de/wp-content/uploads/2019/09/ZahlenDatenFakten_2019.pdf) (letzter Zugriff: 24.01.2020).
- Milchindustrieverband (2019b) Beitrag der Milchindustrie zur nationalen Reduktions- und Innovationsstrategie. <https://milchindustrie.de/wp-content/uploads/2020/12/Beitrag-der-Milchindustrie-zur-Reduktions-und-Innovationsstrategie-Stand-17.07.2019.pdf> (letzter Zugriff: 25.02.2020).

- Milestad R, Westberg L, Geber U, Björklund J (2010) Enhancing adaptive capacity in food systems: Learning at farmers' markets in Sweden. *Ecology and Society* 15(3): 29. Doi: 10.5751/ES-03543-150329.
- Mill, John Stuart (2008 [1859]) *On liberty and other essays*. Oxford University Press, Oxford, New York.
- Miller D, Harkins C (2010) Corporate strategy, corporate capture: Food and alcohol industry lobbying and public health. *Critical Social Policy* 30: 564-589. Doi: 10.1177/0261018310376805.
- Miller LJ, Lu W (2019) These are the world's healthiest nations. Bloomberg Healthiest Country Index. <https://www.bloomberg.com/news/articles/2019-02-24/spain-tops-italy-as-world-s-healthiest-nation-while-u-s-slips?tag=MSF0951a18> (letzter Zugriff: 12.12.2019).
- Mills S, White M, Brown H, Wrieden W, Kwasnicka D, Halligan J, Robalino S, Adams J (2017) Health and social determinants and outcomes of home cooking: A systematic review of observational studies. *Appetite* 111: 116-134. Doi: 10.1016/j.appet.2016.12.022.
- Mindestlohnkommission (2018) Zweiter Bericht zu den Auswirkungen des gesetzlichen Mindestlohns. Bericht der Mindestlohnkommission an die Bundesregierung nach § 9 Abs. 4 Mindestlohngesetz, Berlin.
- Minten B, Dereje M, Engida E, Tamru S (2018) Tracking the quality premium of certified coffee: Evidence from Ethiopia. *World Development* 101: 119-132. Doi: 10.1016/j.worlddev.2017.08.010.
- Mirtcheva DM, Powell LM (2009) Participation in the national school lunch program: Importance of school-level and neighborhood contextual factors. *Journal of School Health* 79(10): 485-494. Doi: 10.1111/j.1746-1561.2009.00438.x.
- Misereor (2017) EU-Agrarhandel in Westafrika: Wie können Kleinbauern überleben? <https://blog.misereor.de/2017/03/22/eu-agrarhandel-in-westafrika-wie-koennen-kleinbauern-ueberleben/> (letzter Zugriff: 14.12.2019).
- Misra S, Huang CL, Ott SL (1991) Consumer willingness to pay for pesticide free fresh produce. *Western Journal of Agricultural Economics* 16: 218-227.
- MLR (Ministerium für Ländlichen Raum und Verbraucherschutz Baden-Württemberg) (2018) Jahresbericht 2017 Überwachung, Lebensmittel, Bedarfsgegenstände, Kosmetika, Trinkwasser, Futtermittel. Stuttgart.
- Moberg E, Walker Andersson M, Säll S, Hansson PA, Rös E (2019) Determining the climate impact of food for use in a climate tax – Design of a consistent and transparent model. *The International Journal of Life Cycle Assessment* 24(9): 1715-1728. Doi: 10.1007/s11367-019-01597-8.
- Mohareb EA, Heller MC, Guthrie PM (2018) Cities' role in mitigating United States food system greenhouse gas emissions. *Environmental Science & Technology* 52(10): 5545-5554. Doi: 10.1021/acs.est.7b0260052: 5545-5554.
- Möhlenbruch D (1994) *Sortimentspolitik im Einzelhandel*. Gabler-Verlag, Wiesbaden.
- Molina-Besch K, Wikström F, Williams H (2019) The environmental impact of packaging in food supply chains – Does life cycle assessment of food provide the full picture? *The International Journal of Life Cycle Assessment* 24(1): 37-50. Doi: 10.1007/s11367-018-1500-6
- Mondelaers K, Aertsens J, van Huylenbroeck G (2009) A meta-analysis of the differences in environmental impacts between organic and conventional farming. *British Food Journal* 111(10): 1098-1119. Doi: 10.1108/00070700910992925.
- Monopolkommission (2012) *Stärkung des Wettbewerbs bei Handel und Dienstleistungen*, 19. Hauptgutachten der Monopolkommission, Bonn.

- Monteiro CA, Moubarac JC, Cannon G, Ng SW, Popkin B (2013). Ultra-processed products are becoming dominant in the global food system. *Obesity Reviews* 14: 21-28. Doi: 10.1111/obr.12107.
- Montgomery DR, Biklé A (2015) *The hidden half of nature: The microbial roots of life and health*. W. W. Norton Company, New York, London.
- Moog K, Gebhardt B (2017) Bekanntheit von Herkunftszeichen bei Schweinefleisch in den DACH-Staaten. In: Heinschink K, Kandelhardt J, Kirner L, Stern T (Hrsg.) *Jahrbuch der Österreichischen Gesellschaft für Agrarökonomie*, Band 26. facultas Universitätsverlag, Wien: 23-32. Doi: 10.24989/OEGA.JB.26.
- Moor I (2016) *Gesundheitliche Ungleichheiten im Kindes- und Jugendalter: Trends und Mechanismen*. Dissertation zur Erlangung des Doctor of Public Health, Universität Bielefeld. <https://pub.uni-bielefeld.de/record/2906755> (letzter Zugriff: 05.12.2019).
- Moorhead SA, Hazlett DE, Harrison L, Carroll JK, Irwin A, Hoving C (2013) A new dimension of health care: Systematic review of the uses, benefits, and limitations of social media for health communication. *Journal of Medical Internet Research* 15(4): e85. Doi: 10.2196/jmir.1933.
- Moynihan PJ, Kelly SAM (2014) Effect on caries of restricting sugars intake: Systematic review to inform WHO guidelines. *Journal of Dental Research* 93(1): 8-18. Doi: 10.1177/0022034513508954.
- Mozaffarian D (2016) Dietary and policy priorities for cardiovascular disease, diabetes, and obesity: A comprehensive review. *Circulation* 133: 187-225. Doi: 10.1161/CIRCULATIONAHA.115.018585.
- Mozaffarian D, Angell SY, Lang T, Rivera JA (2018) Role of government policy in nutrition – Barriers to and opportunities for healthier eating. *British Medical Journal* 361: k2426. Doi: 10.1136/bmj.k2426.
- Mozaffarian D, Fahimi S, Singh GM, Micha R, Khatibzadeh S, Engell RE, Lim S, Danaei G, Ezzati M, Powles J (2014) Global sodium consumption and death from cardiovascular causes. *The New England Journal of Medicine* 371: 624-634. Doi: 10.1056/NEJMoa1304127.
- Mozaffarian D, Micha R, Wallace S (2010) Effects on coronary heart disease of increasing polyunsaturated fat in place of saturated fat: A systematic review and meta-analysis of randomized controlled trials. *PLoS Medicine* 7(3): e1000252. Doi: 10.1371/journal.pmed.1000252.
- MRI (Max Rubner-Institut) (2008) *Nationale Verzehrsstudie II, Ergebnisbericht, Teil 1*, Karlsruhe. [https://www.mri.bund.de/fileadmin/MRI/Institute/EV/NVS\\_II\\_Abschlussbericht\\_Teil\\_1\\_mit\\_Ergaenzungsbericht.pdf](https://www.mri.bund.de/fileadmin/MRI/Institute/EV/NVS_II_Abschlussbericht_Teil_1_mit_Ergaenzungsbericht.pdf) (letzter Zugriff: 20.02.2020).
- MRI (Max Rubner-Institut) (2016) *Reformulierung von verarbeiteten Lebensmitteln – Bewertung und Empfehlung zur Reduktion des Zuckergehaltes*, Karlsruhe.
- MRI (Max Rubner-Institut) (2017) *Max Rubner Conference Nutrition Monitoring – Challenges and Developments*, Karlsruhe.
- MRI (Max Rubner-Institut) (2018) *Zuckergehalte von zuckergesüßten Erfrischungsgetränken: Differenzierung von Produktuntergruppen und Berechnung von Quartilen*, Karlsruhe.
- MRI (Max Rubner-Institut) (2019a) *Entwurf des MRI für ein „Front-of-Pack“- Nährwertkennzeichnungs-Modell: Fachliche Basis. Ergänzung zum vorläufigen Bericht „Beschreibung und Bewertung ausgewählter „Front-of-Pack“-Nährwertkennzeichnungs-Modelle“*, Mai 2019, Karlsruhe.

- MRI (Max Rubner-Institut) (2019b) Entwurf des MRI für ein „Front-of-Pack“- Nährwertkennzeichnungs-Modell: Grafische Umsetzung. Ergänzung zum vorläufigen Bericht „Beschreibung und Bewertung ausgewählter „Front-of-Pack“-Nährwertkennzeichnungs-Modelle“, Mai 2019, Karlsruhe.
- MRI (Max Rubner-Institut) (2019c) Beschreibung und Bewertung des Entwurfs des BLL für ein „Front-of-Pack“- Nährwertkennzeichnungs-Modell, Ergänzung zum vorläufigen Bericht „Beschreibung und Bewertung ausgewählter „Front-of-Pack“-Nährwertkennzeichnungs-Modelle“, Mai 2019, Karlsruhe.
- MRI (Max Rubner-Institut) (2019d) Beschreibung und Bewertung ausgewählter „Front-of-Pack“- Nährwertkennzeichnungs-Modelle: Vorläufiger Bericht, Stand: August 2019.  
[https://www.bmel.de/SharedDocs/Downloads/Ernaehrung/Kennzeichnung/MRI-Bericht-Naehrwertkennzeichnungs-Modelle.pdf?\\_\\_blob=publicationFile](https://www.bmel.de/SharedDocs/Downloads/Ernaehrung/Kennzeichnung/MRI-Bericht-Naehrwertkennzeichnungs-Modelle.pdf?__blob=publicationFile) (letzter Zugriff: 20.02.2020).
- MRI (Max Rubner-Institut) (2019e) Konzept: Produktmonitoring-Folgerhebung 2019, Juni 2019.  
[https://www.mri.bund.de/fileadmin/MRI/Veroeffentlichungen/191219\\_MRI\\_Produktmonitoring\\_Konzept\\_\\_002\\_.pdf](https://www.mri.bund.de/fileadmin/MRI/Veroeffentlichungen/191219_MRI_Produktmonitoring_Konzept__002_.pdf) (letzter Zugriff: 20.02.2020).
- Mrotzek M (2008) „Und wenn man nicht ständig dagegen hält...“ Die Erfahrungen von Frauen und Männern mit der Umsetzung des SGB II in Nordrhein-Westfalen. Studie im Auftrag des Industrie- und Sozialpfarramtes des Evangelischen Kirchenkreises Gelsenkirchen und Wattenscheid, Ev. Industrie- und Sozialpfarramt ISPA, Gelsenkirchen.
- MSC (Marine Stewardship Council) (2019) MSC-Rückverfolgbarkeits-Standard 2019. Zusammenfassung der Änderungen.  
[https://www.msc.org/docs/default-source/de-files/standards-prozesse/unternehmen/leitfaeden/msc-rueckverfolgbarkeits-standard-2019-zusammenfassung-der-aenderungen.pdf?sfvrsn=9cd0d724\\_10](https://www.msc.org/docs/default-source/de-files/standards-prozesse/unternehmen/leitfaeden/msc-rueckverfolgbarkeits-standard-2019-zusammenfassung-der-aenderungen.pdf?sfvrsn=9cd0d724_10) (letzter Zugriff: 13.12.2019).
- Muhammad A, Meade B, Marquardt DR, Mozaffarian D (2019) Global patterns in price elasticities of sugar-sweetened beverage intake and potential effectiveness of tax policy: A cross-sectional study of 164 countries by sex, age and global-income decile. *BMJ Open* 9: e026390. Doi: 10.1136/bmjopen-2018-026390.
- Muller A, Schader C, Scialabba NE, Brüggemann J, Isensee A, Erb KH, Smith P, Klocke P, Leiber F, Stolze M, Niggli U (2017) Strategies for feeding the world more sustainably with organic agriculture. *Nature Communications* 8: 1290. Doi: 10.1038/s41467-017-01410-w.
- Muller L, Lacroix A, Lusk JL, Ruffieux B (2016) Distributional impacts of fat taxes and thin subsidies. *The Economic Journal* 127(604): 2066-2092. Doi: 10.1111/eoj.12357.
- Muller L, Lacroix A, Ruffieux B (2019) Environmental labelling and consumption changes: A food choice experiment. *Environmental and Resource Economics* 73(3): 871-897. Doi: 10.1007/s10640-019-00328-9.
- Müller S, Piontek D, Pabst A, Baumeister S, Kraus L (2010) Changes in alcohol consumption and average preference among adolescents after the introduction of the alcopops tax in Germany. *Addiction* 105(7): 1205-1213. Doi: 10.1111/j.1360-0443.2010.02956.x.
- Müller-Lindenlauf M, Cornelius C, Gärtner S, Reinhardt G, Schmidt T (2014) Klima- und Energierechner für die Deutsche Milchwirtschaft: Begleitheft, Heidelberg.  
[https://ressourcenrechner.de/Milchrechner/assets/Begleitheft\\_Milch-Rechner\\_IFEU\\_2014.pdf](https://ressourcenrechner.de/Milchrechner/assets/Begleitheft_Milch-Rechner_IFEU_2014.pdf) (letzter Zugriff: 20.02.2020).

- Müller-Lindenlauf M, Zipfel G, Rettenmaier N, Gärtner S, Münch J, Paulsch D, Reinhardt G (2013) CO<sub>2</sub>-Fußabdruck und weitere Umweltwirkungen von Gemüse aus Baden-Württemberg. Endbericht des ifeu-Instituts im Auftrag der Marketinggesellschaft Baden-Württemberg mbH (MBW), Heidelberg.
- Munita JM, Arias CA (2016) Mechanisms of antibiotic resistance. *Microbiology Spectrum* 4(2): 1-24. Doi: 10.1128/microbiolspec.VMBF-0016-2015.
- Murimi MW, Moyeda-Carabaza AF, Nguyen B, Saha S, Amin R, Njike V (2018) Factors that contribute to effective nutrition education interventions in children: A systematic review. *Nutrition Reviews* 76(8): 553-580. Doi: 10.1093/nutrit/nuy020.
- Mußhoff O, Tegtmeier A, Hirschauer N (2012) Attraktivität einer landwirtschaftlichen Tätigkeit: Einflussfaktoren und Gestaltungsmöglichkeiten. Diskussionsbeitrag, No. 1213. Georg-August-Universität Göttingen, Department für Agrarökonomie und Rural Entwicklung (DARE), Göttingen.
- Mytton OT, Clarke D, Rayner M (2012) Taxing unhealthy food and drinks to improve health. *BMJ* 344: e2931. Doi: 10.1136/bmj.e2931.
- nak (Nationale Armutskonferenz) (2018) Armut stört – Schattenbericht der Nationalen Armutskonferenz. <https://www.nationale-armutskonferenz.de/veroeffentlichungen/schattenbericht/> (letzter Zugriff: 12.12.2019).
- Nakamura K, Bishop L, Ward T, Pramod G, Thomson DC, Tungpuchayakul P, Srakaew S (2018a) Seeing slavery in seafood supply chains. *Science Advances* 4(7): e1701833. Doi: 10.1126/sciadv.1701833.
- Nakamura R, Mirelman AJ, Cuadrado C, Silva-Illanes N, Dunstan J, Suhrcke M (2018b) Evaluating the 2014 sugar-sweetened beverage tax in Chile: An observational study in urban areas. *PLoS Medicine* 15(7): e1002596. Doi: 10.1371/journal.pmed.1002596.
- Naspetti S, Mandolesi S, Buysse J, Latvala T, Nicholas P, Padel S, van Loo EJ, Zanolli R (2017) Determinants of the acceptance of sustainable production strategies among dairy farmers: Development and testing of a modified technology acceptance model. *Sustainability* 9(10): 1805. Doi: 10.3390/su9101805.
- Nath J (2010) Gendered fare? A qualitative investigation of alternative food and masculinities. *Journal of Sociology* 47(3): 261-278. Doi: 10.1177/1440783310386828.
- Nationale Akademie der Wissenschaften Leopoldina, Deutsche Forschungsgemeinschaft, Union der deutschen Akademien der Wissenschaften (2019) Wege zu einer wissenschaftlich begründeten, differenzierten Regulierung genomeditierter Pflanzen in der EU/Towards a scientifically justified, differentiated regulation of genome edited plants in the EU. Halle (Saale).
- Nationale Akademie der Wissenschaften Leopoldina, acatech – Deutsche Akademie der Technikwissenschaften, Union der deutschen Akademien der Wissenschaften (2018) Artenrückgang in der Agrarlandschaft: Was wissen wir und was können wir tun? Halle (Saale).
- Nationale Plattform Bildung für nachhaltige Entwicklung (Hrsg.) (2017) BNE-Nationaler Aktionsplan Bildung für nachhaltige Entwicklung. Der deutsche Beitrag zum Unesco Weltaktionsprogramm, Berlin.
- Nationale Präventionskonferenz (2018) Bundesrahmenempfehlungen der Nationalen Präventionskonferenz nach § 20d Abs. 3 SGB V. [https://www.bundesgesundheitsministerium.de/fileadmin/Dateien/3\\_Downloads/P/Präventionsgesetz/BRE\\_Fassung\\_vom\\_29.08.2018.pdf](https://www.bundesgesundheitsministerium.de/fileadmin/Dateien/3_Downloads/P/Präventionsgesetz/BRE_Fassung_vom_29.08.2018.pdf) (letzter Zugriff: 12.12.2019).

- NCHS (National Center for Health Statistics) (2015) What we eat in America? National Health and Nutrition Examination Survey (NHANES) 2013-2014, U.S.-Department of Agriculture, Center for nutrition Policy and Promotion.  
<https://www.ars.usda.gov/nea/bhnrc/fsrg> (letzter Zugriff: 19.12.2019).
- Neal B, Crino M, Dunford E, Gao A, Greenland R, Li N, Ngai J, Mhurchu CN, Pettigrew S, Sacks G, Webster J, Wu JHY (2017) Effects of different types of front-of-pack labelling information on the healthiness of food purchases – A randomised controlled trial. *Nutrients* 9(12): 1284. Doi: 10.3390/nu9121284.
- Nemecek T, Jungbluth N, Milà i Canals L, Schenck R (2016) Environmental impacts of food consumption and nutrition: Where are we and what is next? *The International Journal of Life Cycle Assessment* 21(5): 607-620. Doi: 10.1007/s11367-016-1071-3.
- Nestlé Deutschland AG (2009) So is(s)t Deutschland: Nestlé Studie 2009, Kurzfassung.  
[https://www.nestle.de/asset-library/documents/medien/broschueren/unternehmen/so\\_isst\\_deutschland\\_nestle\\_studie\\_2009.pdf](https://www.nestle.de/asset-library/documents/medien/broschueren/unternehmen/so_isst_deutschland_nestle_studie_2009.pdf) (letzter Zugriff: 19.12.2019).
- Nestle M (2013) Food Politics – How the Food Industry Influences Nutrition and Health, revised and expanded 10th anniversary edition. University of California Press, Berkeley, Los Angeles, London.
- Nettleton JA, Brouwer IA, Mensink RP, Diekman C, Hornstra G (2018) Fats in foods: Current evidence for dietary advice. *Annals of Nutrition & Metabolism* 72: 248-254. Doi: 10.1159/000488006.
- Neu C (2014) Demographischer Wandel und ausdünnende ländliche Räume. In: Niephaus Y, Kreyenfeld M, Sackmann R (Hrsg.) *Handbuch Bevölkerungssoziologie*. Springer VS, Wiesbaden: 697-711.
- Neumark-Sztainer D, Wall M, Fulkerson JA, Larson N (2013) Changes in the frequency of family meals from 1999 to 2010 in the homes of adolescents: Trends by sociodemographic characteristics. *Journal of Adolescent Health* 52(2): 201-206. Doi: 10.1016/j.jadohealth.2012.06.004.
- Neumayer E (2010) Weak versus strong sustainability. Exploring the limits of two opposing paradigms. 3. Aufl., Edward Elgar, Cheltenham [u.a.].
- Neumeier S (2014) Modellierung der Erreichbarkeit von Supermärkten und Discountern. Untersuchung zum regionalen Versorgungsgrad mit Dienstleistungen der Grundversorgung. Thünen Working Paper 16, Johann Heinrich von Thünen-Institut, Braunschweig. Doi: 10.3220/WP\_16\_2014.
- Neumeier S (2015) Regional accessibility of supermarkets and discounters in Germany – A quantitative assessment. *Landbauforschung Bd. 65(1)*: 29-46. Doi: 10.3220/LBF1439880683000.
- Nguyen KH, Glantz SA, Palmer CA, Schmidt LA (2019) Tobacco industry involvement in children's sugary drinks market. *BMJ* 364: l736. Doi: 10.1136/bmj.l736.
- Niebylski ML, Reburn KA, Duhaney T, Campbell NR (2015) Healthy food subsidies and unhealthy food taxation: A systematic review of the evidence. *Nutrition* 31(6): 787-795. Doi: 10.1016/j.nut.2014.12.010.
- Nieder R, Köster W, Kersebaum KC (2010) Beitrag der Landwirtschaft zu diffusen N-Einträgen. *JOT-International Surface Technology* 3(2): 53-57. Doi: 10.1007/BF03224880.
- Nielsen B, Dybkjær L, Herskin M (2011) Road transport of farm animals: Effects of journey duration on animal welfare. *Animal* 5(3): 415-427. Doi: 10.1017/S1751731110001989
- Niggli U (2015) Sustainability of organic food production: Challenges and innovations. *Proceedings of the Nutrition Society* 74(1): 83-88. Doi: 10.1017/S0029665114001438.

- Nikolova H, Inman J (2015) Healthy choice: The effect of simplified point-of-sale nutritional information on consumer food choice behavior. *Journal of Marketing Research* 52(6): 817-835. Doi: 10.1509/jmr.13.0270.
- Niles MT, Ahuja R, Barker T, Esquivel J, Gutterman S, Heller MC, Mango N, Portner D, Raimond R, Tirado C, Vermeulen S (2018) Climate change mitigation beyond agriculture: A review of food system opportunities and implications. *Renewable Agriculture and Food Systems* 33(3): 297-308. Doi: 10.1017/S1742170518000029.
- Noar SM (2012) An audience-channel-message-evaluation (ACME) framework for health communication campaigns. *Health Promotion Practice* 13(4): 481-488. Doi: 10.1177/1524839910386901.
- Noble C, Gismervik K, Iversen MH, Kolarevic J, Nilsson J, Stien LH, Turnbull JF (eds.) (2018) Welfare indicators for farmed Atlantic salmon: Tools for assessing fish welfare. [www.nofima.no/fishwell/english](http://www.nofima.no/fishwell/english) (letzter Zugriff: 02.02.2020).
- Noble KG, Houston SM, Brito NH, Bartsch H, Kan E, Kuperman JM, Akshoomoff N, Amaral DG, Bloss CS, Libiger O, Schork NJ, Murray SS, Casey BJ, Chang L, Ernst TM, Frazier JA, Gruen JR, Kennedy DN, van Zijl P, Mostofsky S, Kaufmann WE, Kenet T, Dale AM, Jernigan TL, Sowell ER (2015) Family income, parental education and brain structure in children and adolescents. *Nature Neuroscience* 18(5): 773-778. Doi: 10.1038/nn.3983.
- Noleppa S, Carlsburg M (2015) Das Große Wegschmeißen. Vom Acker bis zum Verbraucher: Ausmaß und Umwelteffekte der Lebensmittelverschwendung in Deutschland. Studie für den WWF Deutschland. [https://www.wwf.de/fileadmin/fm-wwf/Publikationen-PDF/WWF\\_Studie\\_Das\\_grosse\\_Wegschmeissen.pdf](https://www.wwf.de/fileadmin/fm-wwf/Publikationen-PDF/WWF_Studie_Das_grosse_Wegschmeissen.pdf) (letzter Zugriff: 10.12.2019).
- Norat T, Bingham S, Ferrari P, Slimani N, Jenab M, Mazuir M, Overvad K, Olsen A, Tjønneland A, Clavel F, Boutron-Ruault MC, Kesse E, Boeing H, Bergmann MM, Nieters A, Linseisen J, Trichopoulos A, Trichopoulos D, Tountas Y, Berrino F, Palli D, Panico S, Tumino R, Vineis P, Bueno-de Mesquita HB, Peeters PH, Engeset D, Lund E, Skeie G, Ardanaz E, González C, Navarro C, Quirós JR, Sanchez MJ, Berglund G, Mattisson I, Hallmans G, Palmqvist R, Day NE, Khaw KT, Key TJ, San Joaquin M, Hémon B, Saracci R, Kaaks R, Riboli E (2005) Meat, fish and colorectal cancer risk: The European prospective investigation into cancer and nutrition. *Journal of the National Cancer Institute* 97(12): 906-916. Doi: 10.1093/jnci/dji164.
- Norman J, Kelly B, McMahon AT, Boyland E, Baur LA, Chapman K, King L, Hughes C, Bauman A (2018) Sustained impact of energy-dense TV and online food advertising on children's dietary intake: A within-subject, randomised, crossover, counter-balanced trial. *International Journal of Behavioral Nutrition and Physical Activity* 15(1): 37. Doi: 10.1186/s12966-018-0672-6.
- Notarnicola B, Tassielli G, Renzulli PA, Castellani V, Sala S (2017) Environmental impacts of food consumption in Europe. *Journal of Cleaner Production* 140: 753-765. Doi: 10.1016/j.jclepro.2016.06.080.
- Nowack W (2017) Ernährungspolitik in Europa. Recherche für den WBAE. Unveröffentlichtes Manuskript.
- Nowack W, Schmid JC, Grethe H (2019) Wachsen oder weichen!? – Eine qualitative Analyse der agrarstrukturellen Debatte in Deutschland im Kontext der EU-Agrarpolitik nach 2020. *GAIA* 28/4: 356-364. Doi: 10.14512/gaia.28.4.7.
- Nuffield Council on Bioethics (2007) Public health: Ethical issues. November 2017, London.
- Nussbaum MC (2007) *Frontiers of justice. Disability, nationality, species membership*. The Belknap Press, Cambridge/Massachusetts.

- o.V. (2019a) Fairtrade erhitzt die Gemüter. Lebensmittelzeitung vom 17.05.2019, S. 18.
- o.V. (2019b) Handel will Plastikverpackungen reduzieren, Lebensmittelzeitung vom 01.03.2019, S. 26.
- Oakes ME (2005) Stereotypical thinking about foods and perceived capacity to promote weight gain. *Appetite* 44(3): 317-324. Doi: 10.1016/j.appet.2005.03.010.
- Obert J, Pearlman M, Obert L, Chapin S (2017) Popular weight loss strategies: A review of four weight loss techniques. *Current Gastroenterology Reports* 19: 61. Doi: 10.1007/s11894-017-0603-8.
- Öchsner T (2016) Zu wenig Geld, zu viel Bürokratie. <http://www.sueddeutsche.de/politik/hartz-iv-zu-wenig-geld-zuviel-buerokratie-1.2938695> (letzter Zugriff: 19.12.2019).
- OECD (Organization for Economic Cooperation and Development) (2018a) Concentration in seed markets: Potential effects and policy responses. OECD Publishing, Paris. Doi: 10.1787/9789264308367-en.
- OECD (Organization for Economic Cooperation and Development) (2018b) Agricultural policy monitoring and evaluation 2018. OECD Publishing, Paris. Doi: 10.1787/agr\_pol-2018-en.
- OECD (Organization for Economic Cooperation and Development) (2018c) Chapter 6 Policy implementation and evaluation: Learning from experience and evidence. In: OECD (ed.) *Education Policy Outlook 2018: Putting student learning at the centre*. OECD Publishing, Paris. Doi: 10.1787/9789264301528-10-en.
- OECD (Organization for Economic Cooperation and Development) (2019a) The heavy burden of obesity. The economics of prevention. OECD Health Policy Studies, OECD Publishing, Paris. Doi: 10.1787/67450d67-en.
- OECD (Organization for Economic Cooperation and Development) (2019b) Health at a glance 2019: OECD Indicators. OECD Publishing, Paris. Doi: 10.1787/4dd50c09-en.
- OECD, FAO (Organization for Economic Cooperation and Development, Food and Agriculture Organization of the United Nations) (2019) *OECD-FAO Agricultural Outlook 2019-2028*. OECD Publishing, Paris and FAO, Rome. Doi: 10.1787/agr\_outlook-2019-en.
- Oehler A, Wendt S (2016) Good consumer information: The information paradigm at its (dead) end? *Journal of Consumer Policy* 40(2): 179-191. Doi: 10.1007/s10603-016-9337-5.
- Offermann F (2003) *Quantitative Analyse der sektoralen Auswirkungen einer Ausdehnung des ökologischen Landbaus in der EU*. Berliner Schriften zur Agrar- und Umweltökonomik, Band 5. Shaker Verlag, Aachen.
- Offermann F, Nieberg H (2000) Economic performance of organic farms in Europe. *Organic Farming in Europe: Economics and Policy*. Volume 5. Universität Hohenheim, Hohenheim. <https://projekte.uni-hohenheim.de/i410a/ofeurope/organicfarmingineurope-vol5.pdf> (letzter Zugriff: 20.12.2019).
- Okin GS (2017) Environmental impacts of food consumption by dogs and cats. *PLOS ONE*. Doi: 10.1371/journal.pone.0181301.
- Öko-Institut, dti (2012) *Ergebnisbericht. Vergleich von Angebotsformen und Identifikation der Optimierungspotentiale für ausgewählte Tiefkühlprodukte*. Öko-Institut e. V., Deutsches Tiefkühlinstitut e. V. (dti), Freiburg, Berlin.
- Ökotest (2017) 21 Reismarken im Test. Voll Korn, voll Arsen. *Jahrbuch für 2018, Kategorie: Essen und Trinken*, 19.10.2017. [https://www.oekotest.de/essen-trinken/21-Reismarken-im-Test\\_110267\\_1.html](https://www.oekotest.de/essen-trinken/21-Reismarken-im-Test_110267_1.html) (letzter Zugriff: 13.12.2019).

- Okrent AM, Kumcu A (2016) U.S. households' demand for convenience foods, ERR-211, U.S. Department of Agriculture, Economic Research Service. <https://www.ers.usda.gov/webdocs/publications/80654/err-211.pdf?v=42668> (letzter Zugriff: 19.12.2019).
- Ölander F, Thøgersen J (2014) Informing versus nudging in environmental policy. *Journal of Consumer Policy* 37(3): 341-356. Doi: 10.1007/s10603-014-9256-2.
- Oostindjer M, Aschemann-Witzel J, Wang Q, Skuland SE, Egelanddal B, Amdam GV, Schjøll A, Pachucki MC, Rozin P, Stein J, Lengard Almli V, van Kleef E (2017) Are school meals a viable and sustainable tool to improve the healthiness and sustainability of children's diet and food consumption? A cross-national comparative perspective. *Critical Reviews in Food Science and Nutrition* 57(18): 3942-3958. Doi: 10.1080/10408398.2016.1197180.
- Opitz S, Hoffmann J, Quaas M, Matz-Lück N, Binohlan C, Froese R (2016) Assessment of MSC-certified fish stocks in the Northeast Atlantic. *Marine Policy* 71: 10-14. Doi: 10.1016/j.marpol.2016.05.003.
- Oré Barrios C, Mäurer E, Lippert C, Dabbert S (2017) Eine ökonomische Analyse des Imkereisektors in Deutschland. BÖLN Abschlussbericht. <https://www.orgprints.org/32437> (letzter Zugriff: 13.12.2019).
- Orset C, Barret N, Lemaire A (2017) How consumers of plastic water bottles are responding to environmental policies? *Waste Management* 61: 13-27. Doi: 10.1016/j.wasman.2016.12.034.
- Ossmann B, Sarau G, Hotmannspötter H, Pischetsrieder M, Christiansen SH, Dicke W (2018) Small-size microplastics and pigmented particles in bottled mineral water. *Water Research* 141: 307-316. Doi: 10.1016/j.watres.2018.05.027.
- Ostfeld R, Howarth D, Reiner D, Krasny P (2019) Peeling back the label – Exploring sustainable palm oil ecolabelling and consumption in the United Kingdom. *Environmental Research Letters* 14: 014001. Doi: 10.1088/1748-9326/aaf0e4.
- Ott K (1997) *Ipsa facto. Zur ethischen Begründung normativer Implikate wissenschaftlicher Praxis*. Suhrkamp, Frankfurt am Main.
- Ott K (2003) Zum Verhältnis von Tier- und Naturschutz. In: Brenner A (Hrsg.) *Tiere beschreiben*. Fischer, Erlangen: 124-152.
- Ott K, Dierks J, Voget-Kleschin L (2016) Einleitung. In: Ott K, Dierks J, Voget-Kleschin L (Hrsg.) *Handbuch Umweltethik*. Metzler, Stuttgart: 1-18.
- Ott K, Döring R (2008) *Theorie und Praxis starker Nachhaltigkeit*. 2. Aufl., Metropolis-Verlag (Band 1), Marburg.
- Ott SL (1990) Supermarket shoppers' pesticide concerns and willingness to purchase certified pesticide residue-free fresh produce. *Agribusiness: An International Journal* 6(6): 593-602. Doi: 10.1002/1520-6297(199011)6:6<593::AID-AGR2720060606>3.0.CO;2-Z.
- Owen L, Morgan A, Fischer A, Ellis S, Hoy A, Kelly MP (2012) The cost-effectiveness of public health interventions. *Journal of Public Health* 34(1): 37-45. Doi: 10.1093/pubmed/fdr075.
- Oxfam (2018) *Ripe for Change: Methodological Note*. [https://www.oxfamamerica.org/static/media/files/Ripe\\_for\\_Change\\_Methodology\\_Note.pdf](https://www.oxfamamerica.org/static/media/files/Ripe_for_Change_Methodology_Note.pdf) (letzter Zugriff: 14.12.2019).
- Oxfam (2019) *Supermärkte im Check. Weiter schlechte Noten für deutsche Supermarkt-Ketten*. <https://www.oxfam.de/ueber-uns/aktuelles/2019-07-03-supermaerkte-check-schlechte-noten-deutsche-supermarkt-ketten> (letzter Zugriff: 04.12.2019).

- Oya C, Schaefer F, Skalidou D, McCosker C, Langer L (2017) Effects of certification schemes for agricultural production on socio-economic outcomes in low- and middle-income countries: A systematic review. *Campbell Systematic Reviews* 13(1): 1-346. Doi: 10.4073/csr.2017.3.
- Padilla-Bravo C, Villanueva Ramirez I, Neuendorff J, Spiller A (2013) Assessing the impact of unannounced audits on the effectiveness and reliability of organic certification. *Organic Agriculture* 3(2): 95-109. Doi.org/10.1007/s13165-013-0048-9.
- Palmer C (2010) *Animal Ethics in Context*. Columbia University Press, New York.
- Palumbo R (2016) Sustainability of well-being through literacy. The effects of food literacy on sustainability of well-being. *Agriculture and Agricultural Science Procedia* 8: 99-106. Doi: 10.1016/j.aaspro.2016.02.013.
- Parfitt J, Barthel M, MacNaughton S (2010) Food waste within food supply chains: Quantification and potential for change to 2050. *Philosophical Transactions of the Royal Society B* 365(1554): 3065-3081. Doi: 10.1098/rstb.2010.0126.
- Parker RWR, Tyedmers PH (2015) Fuel consumption of global fishing fleets: Current understanding and knowledge gaps. *Fish and Fisheries* 16(4): 684-696. Doi: 10.1111/faf.12087.
- Parvathi P, Waibel H (2016) Organic agriculture and fair trade: A happy marriage? A case study of certified smallholder black pepper farmers in India. *World Development* 77: 206-220. Doi: 10.1016/j.worlddev.2015.08.027.
- Paul C, Techen AK, Robinson JS, Helming K (2019) Rebound effects in agricultural land and soil management: Review and analytical framework. *Journal of Cleaner Production* 227: 1054-1067. Doi: 10.1016/j.jclepro.2019.04.115.
- Pauly D, Zeller D (2016) Catch reconstructions reveal that global marine fisheries catches are higher than reported and declining. *Nature Communications* 7: 10244. Doi: 10.1038/ncomms10244.
- Petrescu DC, Hollands GJ, Couturier DL, Ng YL, Marteau TM (2016) Public acceptability in the UK and USA of nudging to reduce obesity: The example of reducing sugar-sweetened beverages consumption. *PLOS ONE* 11(6): e0155995. Doi: 10.1371/journal.pone.0155995.
- Pettigrew S, Talati Z, Miller C, Dixon H, Kelly B, Ball K (2017) The types and aspects of front-of-pack food labelling schemes preferred by adults and children. *Appetite* 109: 115-123. Doi: 10.1016/j.appet.2016.11.034.
- Pfeiffer S, Ritter T, Oestreicher E (2015) Food insecurity in German households: Qualitative and quantitative data on coping, poverty consumerism and alimentary participation. *Social Policy & Society* 14(3): 483-495. Doi: 10.1017/S147474641500010X.
- Pfeiffer S, Ritter T, Oestreicher E (2016) Armutskonsum: Ernährungsarmut, Schulden und digitale Teilhabe. In: Forschungsverbund Sozioökonomische Berichterstattung (Hrsg.) Berichterstattung zur sozioökonomischen Entwicklung in Deutschland. Exklusive Teilhabe – ungenutzte Chancen. Dritter Bericht. W. Bertelsmann Verlag, Bielefeld. Doi: 10.3278/6004498w020.
- Pförtner TK, Schmidt-Catran A (2018) Lebensstandard und Gesundheit. Ein längsschnittlicher Blick in die individuelle Wohlfahrtsproduktion vor dem Hintergrund gesundheitlicher Ungleichheit. In: Giesselmann M, Golsch K, Lohmann H, Schmidt-Catran A (Hrsg.) Lebensbedingungen in Deutschland in der Längsschnittperspektive. Springer VS, Wiesbaden: 17-32.
- Pham NM, Mizoue T, Tanaka K, Tsuji I, Tamakoshi A, Matsuo K, Wakai K, Nagata C, Inoue M, Tsugane S, Sasazuki S (2014) Meat consumption and colorectal cancer risk: An evaluation based on a systematic review of epidemiologic evidence among the Japanese population. *Japanese Journal of Clinical Oncology* 44(7): 651-650. Doi: 10.1093/jjco/hyu061.

- Phillips CM, Harrington JM, Perry IJ (2018) Relationship between dietary quality, determined by DASH score and cardiometabolic health biomarkers: A cross-sectional analysis in adults. *Clinical Nutrition* 38(4): 1620-1628. Doi: 10.1016/j.clnu.2018.08.028.
- Pickles J, Zhu S (2013) The California Transparency in Supply Chains Act. University of Manchester Working Paper 15. <http://www.capturingthegains.org/pdf/ctg-wp-2013-15.pdf> (letzter Zugriff: 13.12.2019).
- Picot A (1986) Transaktionskosten im Handel. Zur Notwendigkeit einer flexiblen Strukturentwicklung in der Distribution. *Betriebs-Berater*, Beilage 13 zu Heft 27: 1-16.
- Piernas C, Popkin BM (2011) Increased portion sizes from energy-dense foods affect total energy intake at eating occasions in US children and adolescents: patterns and trends by age group and sociodemographic characteristics, 1977-2006. *The American Journal of Clinical Nutrition* 94(5): 1324-32. Doi: 10.3945/ajcn.110.008466.
- Pingali P (2015) Agricultural policy and nutrition outcomes – Getting beyond the preoccupation with staple grains. *Food Security* 7: 583-591. Doi: 10.1007/s12571-015-0461-x.
- Pirlich M, Schütz T, Norman K, Gastell S, Lübke HJ, Bischoff SC, Bolder U, Frieling T, Güldenzoph H, Hahn K, Jauch KW, Schindler K, Stein J, Volkert D, Weimann A, Werner H, Wolf C, Zürcher G, Bauer P, Lochs H (2006) The German hospital malnutrition study. *Clinical Nutrition* 25(4): 563-572. Doi: 10.1016/j.clnu.2006.03.005.
- Piwoz E, Sundberg S, Rooke J (2012) Promoting healthy growth: What are the priorities for research and action? *Advances in Nutrition* 3(2): 234-241. Doi: 10.3945/an.111.001164.
- Planck U (1970) *Landjugend im sozialen Wandel*. Juventa Verlag, München.
- Pollan M (2009). *Food rules: An eater's manual*. Penguin Books, London.
- Ponisio CP, M'Gonigle LK, Mace KC, Palomino J, de Valpine P, Kremen C (2015) Diversification practices reduce organic to conventional yield gap. *Proceedings of the Royal Society B* 282: 20141396. Doi: 10.1098/rspb.2014.1396.
- Ponte S (2012) The Marine Stewardship Council (MSC) and the making of a market for 'sustainable fish'. *Journal of Agrarian Change* 12(2-3): 300-315. Doi: 10.1111/j.1471-0366.2011.00345.x.
- Poore J, Nemecek T (2018) Reducing food's environmental impacts through producers and consumers. *Science* 360(6392): 987-992. Doi: 10.1126/science.aag0216.
- Popkin BM, Adair LS, Ng SW (2012) Global nutrition transition and the pandemic of obesity in developing countries. *Nutrition Reviews* 70(1): 3-21. Doi: 10.1111/j.1753-4887.2011.00456.x.
- Popkin BM, Hawkes C (2016) Sweetening of the global diet, particularly beverages: Patterns, trends and policy responses for diabetes prevention. *The Lancet Diabetes & Endocrinology* 4(2): 174-186. Doi: 10.1016/S2213-8587(15)00419-2.
- Porter ME, Kramer MR (2011) Creating shared value. How to reinvent capitalism – and unleash a wave of innovation and growth. *Harvard Business Review* 89(1/2): 62-77.
- Powell LM, Shermbeck RM, Chaloupka FJ (2013) Nutritional content of food and beverage products in television advertisements seen on children's programming. *Childhood Obesity* 9(6): 524-531. Doi: 10.1089/chi.2013.0072.
- Poyda A, Reinsch T, Kluß C, Loges R, Taube F (2016) Greenhouse gas emissions from fen soils for forage production in northern Germany. *Biogeosciences* 13: 5221-5244. Doi: 10.5194/bg-13-5221-2016.

- Pretty J, Bharucha ZP (2018) Sustainable intensification of agriculture. Greening the world's food economy. Earthscan Food and Agriculture, Routledge.
- Priefer C, Jörissen J (2012) ITA-Monitoring „Frisch auf den Müll“. Verringerung der Lebensmittelverluste als Ansatz zur Verbesserung der Welternährungssituation. ITAS Pre-Print: 22.11.2012. <http://www.itas.fzk.de/deu/lit/epp/2012/prjo12-pre01.pdf> (letzter Zugriff: 20.01.2020).
- Probst L (2015) Bündnis 90/Die Grünen: Absturz nach dem Höhenflug. In: Niedermayer O (Hrsg.) Die Parteien nach der Bundestagswahl 2013. Springer VS, Wiesbaden: 135-158.
- Prowse R (2017) Food marketing to children in Canada: A settings-based scoping review on exposure, power and impact. *Health Promotion and Chronic Disease Prevention in Canada: Research, Policy and Practice* 37(9): 274-292. Doi: 10.24095/hpcdp.37.9.03.
- Purkayastha D, Chakraborti R, Qumer SM (2011) Coca-Cola's 'Open Happiness' Campaign: A Model for Global Marketing? IBS Center for Management Research. <https://www.thecasecentre.org/educators/products/view?id=101578> (letzter Zugriff: 10.01.2020).
- Qaim M (2017) Globalisation of agrifood systems and sustainable nutrition. *Proceedings of the Nutrition Society* 76(1): 12-21. Doi: 10.1017/S0029665116000598.
- Qaim M, Klümper W (2013) Landwirtschaft für die Hungerbekämpfung. *Chemie in unserer Zeit* 47(5): 318-326. Doi: 10.1002/ciuz.201300615.
- Qizilbash M (2002) Development, common foes and shared values. *Review of Political Economy* 14(4): 463-480. Doi: 10.1080/0953825022000009906.
- Quirnbach D, Cornelsen L, Jebb SA, Marteau T, Smith R (2018) Effect of increasing the price of sugar-sweetened beverages on alcoholic beverage purchases: An economic analysis of sales data. *Journal of Epidemiology & Community Health* 72: 324-330. Doi: 10.1136/jech-2017-209791.
- Rabenberg M, Scheidt-Nave C, Busch MA, Rieckmann N, Hintzpeter B, Mensink GB (2015) Vitamin D status among adults in Germany – Results from the German Health Interview and Examination Survey for Adults (DEGS1). *BMC public health* 15(641): 1-15. Doi: 10.1186/s12889-015-2016-7.
- Radisch F, Klemm K, Tillmann KJ (2017) Gelingensfaktoren guter Ganztagschulen: Eine qualitative Studie bewährter Schulpraxis. In: Bertelsmann Stiftung, Robert Bosch Stiftung, Stiftung Mercator, Vodafone Stiftung Deutschland (Hrsg.) Mehr Schule wagen. Empfehlungen für guten Ganztags: 20-38.
- Radkau J (2011) Die Ära der Ökologie Eine Weltgeschichte. C.H.Beck-Verlag, München.
- Raghoobar S, Haynes A, Robinson E, Kleef EV, Vet ED (2019) Served portion sizes affect later food intake through social consumption norms. *Nutrients* 11(12): 2845. Doi: 10.3390/nu11122845.
- Raghunathan R, Naylor RW, Hoyer WD (2006) The unhealthy = tasty intuition and its effects on taste inferences, enjoyment, and choice of food products. *Journal of Marketing* 70: 170-184. Doi: 10.1509/jmkg.70.4.170.
- Raine K, McIntyre Lynn, Dayle JB (2003) The failure of charitable school- and community-based nutrition programmes to feed hungry children. *Critical Public Health* 13(2): 155-169. Doi: 10.1080/0958159031000097634.
- Rajcic de Rezende T, el-Atma O, Lachenmeier D, Walch S (2019) Internethandel: Verbotene Stoffe in Schlankheitsmitteln. *Lebensmittelchemie* 73: 11.

- Rao M, Afshin A, Singh G, Mozaffarian D (2013) Do healthier foods and diet patterns cost more than less healthy options? A systematic review and meta-analysis. *British Medical Journal* 3(12): e004277. Doi: 10.1136/bmjopen-2013-004277.
- Rasmussen NML, Belqaid K, Lugnet K, Nielsen AL, Rasmussen HH, Beck AM (2018) Effectiveness of multidisciplinary nutritional support in older hospitalised patients: A systematic review and meta-analysis. *Clinical Nutrition Espen* 27: 44-52. Doi: 10.1016/j.clnesp.2018.07.002.
- Rat der Europäischen Union (2017) Empfehlung des Rates vom 22. Mai 2017 über den europäischen Qualifikationsrahmen für lebenslanges Lernen. *Amtsblatt der Europäischen Union* 2017/C189/03:15-27, Brüssel.
- Rawls J (1973) *A theory of justice*. Oxford University Press, Oxford.
- Rawls J (1988) The priority of right and ideas of the good. *Philosophy & Public Affairs* 17(4): 251-276. <http://www.jstor.org/stable/2265400>.
- Raynor HA (2014) What to do about portion sizes? Roundtable discussion at the forefronts in portion size conference. *International Journal of Obesity* 38: S34-S36. Doi:10.1038/ijo.2014.87.
- Recke G, Strüve H (2014) Einzelbetriebliche Bewertung von Tierwohlmaßnahmen. Vortrag auf dem Präkonferenz-Workshop im Rahmen der GEWISOLA-Jahrestagung 2014, Göttingen. <http://www.uni-goettingen.de/de/workshop-zur-gewisola-tagung/511030.html> (letzter Zugriff: 10.01.2020).
- Reckmann K, Krieter J (2015) Environmental impacts of the pork supply chain with regard to farm performance. *The Journal of Agricultural Science* 153: 411-421. Doi: 10.1017/S0021859614000501.
- Reckmann K, Traulsen I, Krieter J (2013) Life cycle assessment of pork production: A data inventory for the case of Germany. *Livestock Science* 157(2-3): 586-596. Doi: 10.1016/j.livsci.2013.09.001.
- Redondo M, Hernández-Aguado I, Lumbreras B (2018) The impact of the tax on sweetened beverages: A systematic review. *The American Journal of Clinical Nutrition* 108(3): 548-563. Doi: 10.1093/ajcn/nqy135.
- Reedy J, Lerman JL, Krebs-Smith SM, Kirkpatrick SI, Pannucci TE, Wilson MM, Subar AF, Kahle LL, Tooze JA (2018) Evaluation of the Healthy Eating Index-2015. *Journal of the Academy of Nutrition and Dietetics* 118(9): 1622-1633. Doi: 10.1016/j.jand.2018.05.019.
- Rees K, Takeda A, Martin N, Ellis L, Wijesekara D, Vepa A, Das A, Hartley L, Stranges S (2019) Mediterranean-style diet for the primary and secondary prevention of cardiovascular disease. *Cochrane database Syst Review* 13(3): CD009825. Doi: 10.1002/14651858.CD009825.pub3.
- Regan T (2003) *Animal rights, human wrongs. An introduction to moral philosophy*. Rowman & Littlefield Publishers, Lanham.
- Rehm CD, Monsivais P, Drewnowski A (2015) Relation between diet cost and healthy eating index 2010 scores among adults in the United States 2007-2010. *Preventive Medicine* 73: 70-75. Doi: 10.1016/j.ypmed.2015.01.019.
- Reicks M, Kocher M, Reeder J (2018) Impact of cooking and home food preparation interventions among adults: A systematic review (2011-2016). *Journal of Nutrition Education and Behavior* 50(2): 148-172. Doi: 10.1016/j.jneb.2017.08.004.
- Reicks M, Trofholz, AC, Stang JS, Laska MN (2014) Impact of cooking and home food preparation interventions among adults: Outcomes and implications for future programs. *Journal of Nutrition Education and Behavior* 46(4): 259-276. Doi: 10.1016/j.jneb.2014.02.001.

- Reinecke J, Ansari S (2016) Taming wicked problems: The role of framing in the construction of corporate social responsibility. *Journal of Management Studies* 53(3): 299-329. Doi: 10.1111/joms.12137.
- Reinhardt G, Gärtner S, Münch J, Häfele S (2009) Ökologische Optimierung regional erzeugter Lebensmittel: Energie und Klimagasbilanzen. IFEU, Heidelberg. [http://www.ifeu.de/landwirtschaft/pdf/Langfassung\\_Lebensmittel\\_IFEU\\_2009.pdf](http://www.ifeu.de/landwirtschaft/pdf/Langfassung_Lebensmittel_IFEU_2009.pdf) (letzter Zugriff: 19.12.2019).
- Reinsch T, Loges R, Kluß C, Taube F (2018) Effect of grassland ploughing and reseeded on CO2 emissions and soil carbon stocks. *Agriculture, Ecosystems & Environment* 265: 374-383. Doi: 10.1016/j.aee.2018.06.020.
- Reisch L, Eberle U, Lorek S (2013) Sustainable food consumption: An overview of contemporary issues and policies. *Sustainability: Science, Practice and Policy* 9(2): 7-25. Doi: 10.1080/15487733.2013.11908111.
- Reisch LA, Sunstein CR, Gwozdz W (2017) Viewpoint: Beyond carrots and sticks: Europeans support health nudges. *Food Policy* 69: 1-10. Doi: 10.1016/j.foodpol.2017.01.007.
- Reisinger A, Clark H (2018) How much do direct livestock emissions actually contribute to global warming? *Global Change Biology* 24: 1749-1761. Doi: 10/gfzm2g.
- Rempe HM, Sproesser G, Gingrich A, Spiegel A, Skurk T, Brandl B, Hauner H, Renner B, Volkert D, Sieber CC, Freiberger E, Kiesswetter E (2019) Measuring eating motives in older adults with and without functional impairments with The Eating Motivation Survey (TEMS). *Appetite* 137: 1-20. Doi: 10.1016/j.appet.2019.01.024.
- Ren C, Liu S, van Grinsven H, Reis S, Jin S, Liu H, Gu B (2019) The impact of farm size on agricultural sustainability. *Journal of Cleaner Production* 220: 357-67. Doi: 10.1016/j.jclepro.2019.02.151.
- Ren H, Han G, Ohm M, Schönbach P, Gierus M, Taube F (2013) Do sheep grazing patterns affect ecosystem functioning in steppe grassland ecosystems in Inner Mongolia? *Agriculture, Ecosystems & Environment* 213: 1-10. Doi: 10.1016/j.agee.2015.07.015.
- RENN (Regionale Netzstellen Nachhaltigkeitsstrategien) (Hrsg.) (2019) Besser essen und trinken. Der Nachhaltige Warenkorb: Ratgeber für umweltbewussten und sozialen Konsum. Themenflyer. <https://www.nachhaltiger-warenkorb.de/material-und-aktionen/> (letzter Zugriff: 20.12.2019).
- Renner B (2015) Ernährungsverhalten 2.0. Veränderungen durch explizite und implizite Interventionen. *Ernährungsumschau* 01/2015: M36-M46.
- Renner B (2017) Was unsere täglichen 200 Essensentscheidungen beeinflusst: Eine psychologische Perspektive. Vortrag auf dem 1. BZfE-Forum „Vom Wissen zum Handeln. Herausforderung für die Ernährungskommunikation“, 19. September 2017, Bonn.
- Renner B (2018) Mobile Technologien und Interventionen im Bereich Ernährung. Vortrag auf der 12. Diabetes Herbsttagung, 34. Jahrestagung der Deutschen Adipositas Gesellschaft (DAG e.V.), 09. - 10. November 2018, Wiesbaden.
- Renner B (2019) Mobile Technologien und Ernährungsverhalten. Vortrag auf der Jahrestagung der Österreichischen Gesellschaft für Ernährung (ÖGE), 14. - 15. November 2019, Wien.
- Renner B, Gamp M (2014) Krisen- und Risikokommunikation. *Prävention und Gesundheitsförderung* 9: 230-238. Doi: 10.1007/s11553-014-0456-z.
- Renner B, Schupp H (2011) The perception of health risks. In: Friedman HS (ed.) *The Oxford Handbook of Health Psychology*. Oxford University Press, New York.

- Renner B, Sproesser G, Strohbach S, Schupp HT (2012) Why we eat what we eat. The Eating Motivation Survey (TEMS). *Appetite* 59(1): 117-128. Doi: 10.1016/j.appet.2012.04.004.
- Renting H, Marsden TK, Banks J (2003) Understanding alternative food networks: Exploring the role of short food supply chains in rural development. *Environment and Planning A* 35: 393-411. Doi: 10.1068/a3510.
- Reusch J, Kuhn J, Moritz B, Lenhardt U (2017) Die Arbeitswelt von heute: Daten, Schwerpunkte, Trends. In: Schröder L, Urban HJ (Hrsg.) *Gute Arbeit. Streit um Zeit – Arbeitszeit und Gesundheit*. Bund-Verlag, Frankfurt: 355-384.
- Reynolds C, Goucher L, Quested T, Bromley S, Gillick S, Wells VK, Evans D, Koh L, Carlsson Kanyama A, Katzzeff C, Svenfelt Å, Jackson P (2019) Review: Consumption-stage food waste reduction interventions – What works and how to design better interventions. *Food Policy* 83: 7-27. Doi: 10.1016/j.foodpol.2019.01.009.
- Reynolds CJ, Buckley JD, Weinstein P, Boland J (2014) Are the dietary guidelines for meat, fat, fruit and vegetable consumption appropriate for environmental sustainability? A Review of the literature. *Nutrients* 6: 2251-2265. Doi: 10.3390/nu6062251.
- Richards C, Kjærnes U, Vik J (2016) Food security in welfare capitalism: Comparing social entitlements to food in Australia and Norway. *Journal of Rural Studies* 43: 61-70. Doi: 10.1016/j.jrurstud.2015.11.010.
- Richtel M (2012) Putting the squeeze on a family ritual. *The New York Times*, 20 Juni 2012. <https://www.nytimes.com/2012/06/21/garden/food-pouches-let-little-ones-serve-themselves.html> (letzter Zugriff: 04.12.2019).
- Richter A (2017) Ernährungsmuster von Jugendlichen in Deutschland sowie ihre Determinanten und gesundheitliche Implikationen. Dissertation, Technische Universität München.
- Richter M, Boeing H, Grünewald-Funk D, Hesecker H, Kroke A, Leschik-Bonnet E, Oberritter H, Strohm D, Watzl B (2016) Vegane Ernährung – Position der Deutschen Gesellschaft für Ernährung e. V. *Ernährungsumschau* 4: M220-231.
- Riepe C, Arlinghaus R (2014) Einstellungen der Bevölkerung in Deutschland zum Tierschutz in der Angelfischerei. *Berichte des IGB Heft 27/2014*, Berlin.
- Rindel JH (2012) Verbal communication and noise in eating establishments. *Applied Acoustics* 71(12): 1156-1161. Doi: 10.1016/j.apacoust.2010.07.005.
- Rioja-Lang FC, Brown JA, Brockhoff EJ, Faucitano L (2019) Review of swine transportation research on priority welfare issues: A Canadian perspective. *Frontiers in Veterinary Science* 6: 36. Doi: 10.3389/fvets.2019.00036.
- Rivard C, Smith D, McCann SE, Hyland A (2012) Taxing sugar-sweetened beverages: A survey of knowledge, attitudes and behaviours. *Public Health Nutrition* 15(8): 1355-1361. Doi: 10.1017/S1368980011002898.
- RKI (Robert Koch-Institut) (2013) Die Gesundheit von Kindern und Jugendlichen in Deutschland 2013. aktualisierte Fassung April 2014. Berlin. [https://www.kiggs-studie.de/fileadmin/KiGGS-Dokumente/kiggs\\_tn\\_broschuere\\_web.pdf](https://www.kiggs-studie.de/fileadmin/KiGGS-Dokumente/kiggs_tn_broschuere_web.pdf) (letzter Zugriff: 13.12.2019).
- RKI (Robert Koch-Institut) (2015) Gesundheit in Deutschland. Gesundheitsberichterstattung des Bundes gemeinsam getragen von RKI und Destatis, Berlin. Doi: 10.17886/rkipubl-2015-003.

- RKI (Robert Koch-Institut) (2018a) *AdiMon-Themenblatt: Stillen* (Stand: 5. November 2018). [https://www.rki.de/DE/Content/Gesundheitsmonitoring/Studien/Adipositas\\_Monitoring/Vor\\_und\\_nach\\_Geburt/PDF\\_Themenblatt\\_Stillen.pdf?\\_\\_blob=publicationFile](https://www.rki.de/DE/Content/Gesundheitsmonitoring/Studien/Adipositas_Monitoring/Vor_und_nach_Geburt/PDF_Themenblatt_Stillen.pdf?__blob=publicationFile) (letzter Zugriff: 22.12.2019).
- RKI (Robert Koch-Institut) (2018b) *Kindliche Adipositas: Einflussfaktoren im Blick. Das AdiMon Indikatorensystem*, Berlin. Doi: 10.17886/rkipubl-2018-006.
- RKI (Robert Koch-Institut) (2019) *Legionellose*, RKI-Ratgeber. [https://www.rki.de/DE/Content/Infekt/EpidBull/Merkblaetter/Ratgeber\\_Legionellose.html](https://www.rki.de/DE/Content/Infekt/EpidBull/Merkblaetter/Ratgeber_Legionellose.html) (letzter Zugriff: 10.01.2020).
- RKI, MRI (Robert Koch-Institut, Max Rubner-Institut) (2018) *Informationen zur Vorstudie. Gesundheits- und Ernährungsstudie in Deutschland*. <https://docplayer.org/106666392-Informationen-zur-vorstudie-gesundheits-und-ernaehrungsstudie-in-deutschland.html> (letzter Zugriff: 13.12.2019).
- Roberson LL, Aneni EC, Maziak W, Agatston A, Feldman T, Rouseff M, Tran T, Blaha MJ, Santos RD, Sposito A, Al-Mallah MH, Blankstein R, Budoff MJ, Nasir K (2014) Beyond BMI: The "Metabolically healthy obese" phenotype & its association with clinical/subclinical cardiovascular disease and all-cause mortality – A systematic review. *BMC Public Health* 14: 14. Doi: 10.1186/1471-2458-14-14.
- Roberto CA, Baik J, Harris JL, Brownell KD (2010) Influence of licensed characters on children's taste and snack preferences. *Pediatrics* 126(1): 88-93. Doi: 10.1542/peds.2009-3433.
- Roberto CA, Wong D, Musicus A, Hammond D (2016) The influence of sugar-sweetened beverage health warning labels on parents' choices. *Pediatrics* 137: e20153185. Doi: 10.1542/peds.2015-3185.
- Robinson SM, Reginster JY, Rizzoli R, Shaw SC, Kanis JA, Bautmans I, Bischoff-Ferrari H, Bruyère O, Cesari M, Dawson-Hughes B, Fielding RA, Kaufman JM, Landi F, Malafarina V, Rolland Y, van Loon LJ, Vellas B, Visser M, Cooper C, Al-Daghri N, Allepaerts S, Bauer J, Brandi ML, Cederholm T, Cherubini A, Cruz Jentoft A, Laviano A, Maggi S, McCloskey EV, Petermans J, Roubenoff R, Rueda R (2018) Does nutrition play a role in the prevention and management of sarcopenia? *Clinical Nutrition* 37(4): 1121-1132. Doi: 10.1016/j.clnu.2017.08.016.
- Rockström J, Steffen W, Noone K, Persson Å, Chapin FS, Lambin EF, Lenton TM, Scheffer M, Folke C, Schellnhuber HJ, Nykvist B, de Wit CA, Hughes T, van der Leeuw S, Rodhe H, Sörlin S, Snyder PK, Costanza R, Svedin U, Falkenmark M, Karlberg L, Corell RW, Fabry VJ, Hansen J, Walker B, Liverman D, Richardson K, Crutzen P, Foley JA (2009) A safe operating space for humanity. *Nature* 461: 472-475. Doi: 10/bjgw48.
- Roe BE, Teisl MF, Deans CR (2014) The economics of voluntary versus mandatory labels. *Annual Review of Resource Economics* 6(1): 407-427. Doi: 10.1146/annurev-resource-100913-012439.
- Roesch A, Gaillard G, Isenring J, Jurt C, Keil N, Nemecek T, Rufener C, Schüpbach B, Umstätter C, Waldvogel T, Walter T, Werner J, Zorn J (2017) Comprehensive farm sustainability assessment. *Agroscope Science* 47. Doi: 10.13140/RG.2.2.21590.65602.
- Rogge CBE, Lichtenberg L, Becker T (2009) Rückverfolgbarkeit und das Eating-Out-Paradoxon. *Schriften der Gesellschaft für Wirtschafts- und Sozialwissenschaften des Landbaues e. V.*, Band 44: 515-516.
- Rohm H, Oostindjer M, Aschemann-Witzel J, Symmank C, L Almlí V, de Hooge IE, Normann A, Karantininis K (2017) Consumers in a sustainable food supply chain (COSUS): Understanding consumer behavior to encourage food waste reduction. *Foods* 6(12): e104. Doi: 10.3390/foods6120104.

- Rohrmann S, Overvad K, Bueno-de-Mesquita HB, Jakobsen MU, Egeberg R, Tjønneland A, Nailler L, Boutron-Ruault MC, Clavel-Chapelon F, Krogh V, Palli D, Panico S, Tumino R, Ricceri F, Bergmann MM, Boeing H, Li K, Kaaks R, Khaw KT, Wareham NJ, Crowe FL, Key TJ, Naska A, Trichopoulou A, Trichopoulos D, Leenders M, Peeters PH, Engeset D, Parr CL, Skeie G, Jakszyn P, Sánchez MJ, Huerta JM, Redondo ML, Barricarte A, Amiano P, Drake I, Sonestedt E, Hallmans G, Johansson I, Fedirko V, Romieux I, Ferrari P, Norat T, Vergnaud AC, Riboli E, Linseisen J (2013) Meat consumption and mortality – Results from the European prospective investigation into cancer and nutrition. *BMC Medicine* 11: 63-75. Doi: 10.1186/1741-7015-11-63.
- Rolls BJ, Roe LS, Meengs JS (2006) Larger portion sizes lead to a sustained increase in energy intake over 2 days. *Journal of the American Dietetic Association* 106(4): 543-549. Doi: 10.1016/j.jada.2006.01.014.
- Rolls BJ, Roe LS, Meengs JS (2007) The effect of large portion sizes on energy intake is sustained for 11 days. *Obesity* 15(6): 1535-1543. Doi: 10.1038/oby.2007.182.
- Román S, Sánchez-Siles LM, Siegrist M (2017) The importance of food naturalness for consumers: Results of a systematic review. *Trends in Food Science & Technology* 67: 44-57. Doi: 10.1016/j.tifs.2017.06.010.
- Römer B, Steffensen B (2008) Kinder als Adressaten von Werbung – Neue Herausforderungen an den Kinder- und Jugendschutz? *Kinder- und Jugendschutz in Wissenschaft und Praxis* 53(4): 106-109.
- Ronit K, Jensen JD (2014) Obesity and industry self-regulation of food and beverage marketing: A literature review. *European Journal of Clinical Nutrition* 68(7): 753-759. Doi: 10.1038/ejcn.2014.60.
- Roodenburg AJC (2017) Nutrient profiling for front of pack labelling: How to align logical consumer choice with improvement of products? *Proceedings of the Nutrition Society* 76(3): 247-254. Doi: 10.1017/S0029665117000337.
- Röös E, Bajželj B, Smith P, Patel M, Little D, Garnett T (2017) Greedy or needy? Land use and climate impacts of food in 2050 under different livestock futures. *Global Environmental Change* 47: 1-12. Doi: 10.1016/j.gloenvcha.2017.09.001
- Röös E, Mie A, Wivstad M, Salomon E, Johansson B, Gunnarsson S, Wallenbeck A, Hoffmann R, Nilsson U, Sundberg C, Watson C (2018) Risks and opportunities of increasing yields in organic farming. A review. *Agronomy for Sustainable Development* 38: 14. Doi: 10.1007/s13593-018-0489-3.
- Roose G, Geuens M, Vermeir I (2018) From informational towards transformational advertising strategies? A content analysis of Belgian food magazine advertisements. *British Food Journal* 120(6): 1170-1182. Doi: 10.1108/BFJ-10-2017-0559.
- Rose D, Heller MC, Roberto CA (2019b) Position of the Society for Nutrition Education and Behavior: The importance of including environmental sustainability in dietary guidance. *Journal of Nutrition Education and Behavior* 51(1): 3-15. Doi: 10.1016/j.jneb.2018.07.006.
- Rose D, Heller MC, Willits-Smith AM, Meyer RJ (2019a) Carbon footprint of self-selected US diets: Nutritional, demographic, and behavioral correlates. *The American Journal of Clinical Nutrition* 109(3): 526-534. Doi: 10.1093/ajcn/nqy327.
- Rose JD, Arlinghaus R, Cooke SJ, Diggles BK, Sawynok W, Stevens ED, Wynne CD (2014) Can fish really feel pain? *Fish and Fisheries* 15: 97-133. Doi: 10.1111/faf.12010.

- Rosenblatt DH, Summerell P, Ng A, Dixon H, Murawski C, Wakefield M, Bode S (2018) Food product health warnings promote dietary self-control through reductions in neural signals indexing food cue reactivity. *NeuroImage: Clinical* 18: 702-712. Doi: 10.1016/j.nicl.2018.03.004.
- Roth N, Käsbohrer A, Mayrhofer S, Zitz U, Hofacre C, Doming K (2019) The application of antibiotics in broiler production and the resulting antibiotic resistance in *Escherichia coli*: A global overview. *Poultry Science* 98(4): 1791-1804. Doi: 10.3382/ps/pey539.
- Rothgang M, Dehio J, Janßen-Timmen R (2017) Ökonomische Perspektiven des Kunststoffrecyclings: Die Rolle des dualen Systems, RWI Materialien No. 118, RWI – Leibniz-Institut für Wirtschaftsforschung. <https://www.econstor.eu/bitstream/10419/167318/1/895098393.pdf> (letzter Zugriff: 10.12.2019).
- Rotz CA, Taube F, Russelle MP, Oenema J, Sanderson MA, Wachendorf M (2005) Whole-farm perspectives of nutrient flows in grassland agriculture. *Crop Science* 45(6): 2139-2159. Doi: 10/c3ds44.
- Rozin P (1990) Acquisition of stable food preferences. *Nutrition Reviews* 48(2): 106-113. Doi: 10.1111/j.1753-4887.1990.tb02912.x.
- Rozin P (1996) The socio-cultural context of eating and food choice. In: Meiselman HL, MacFie HJH (eds.) *Food choice, acceptance and consumption*. Springer, Boston, MA: 83-104. Doi: 10.1007/978-1-4613-1221-5\_2.
- Rozin P (2006) Naturalness judgments by lay Americans: Process dominates content in judgments of food or water acceptability and naturalness. *Judgment and Decision Making* 1(2): 91-97.
- Rozin P (2007) Food and eating. In: Kitayama S, Cohen D (eds.) *Handbook of cultural psychology*. Guilford, New York: 391-416.
- Rozin P, Hormes JM, Faith MS, Wansink B (2012) Is meat male? A quantitative multi-method framework to establish metaphoric relationships. *Journal of Consumer Research* 39(3): 629-643. Doi: 10.1086/664970.
- Ruby MB (2012) Vegetarianism. A blossoming field of study. *Appetite* 58: 141-150. Doi: 10.1016/j.appet.2011.09.019.
- Rudloff B, Brüntrup M (2018) *Allen Behauptungen zum Trotz: Die Gemeinsame Agrarpolitik hat kaum Entwicklungswirkungen*. SWP-Aktuell 27. Stiftung Wissenschaft und Politik, Berlin.
- Ruini LF, Ciati R, Pratesi CA, Marino M, Principato L, Vannuzzi E (2015) Working toward healthy and sustainable diets: The “Double Pyramid Model” developed by the Barilla Center for Food and Nutrition to raise awareness about the environmental and nutritional impact of foods. *Frontiers in Nutrition* 2: 9. Doi: 10.3389/fnut.2015.00009.
- Runge F, Lang H (2016) Lebensmittelverluste in der Landwirtschaft durch Ästhetik-Ansprüche an Obst und Gemüse – Gründe, Ausmaß und Verbleib. *Berichte über Landwirtschaft* 94(3): 1-12. Doi: 10.12767/buel.v94i3.135.
- Russell SJ, Croker H, Viner RM (2019) The effect of screen advertising on children's dietary intake: A systematic review and meta-analysis. *Obesity Reviews* 20(4): 554-568. Doi: 10.1111/obr.12812.
- Russelle MP, Entz MH, Franzluebbbers AJ (2007) Reconsidering integrated crop-livestock systems in North America. *Agronomy Journal* 99(2): 325-334. Doi: 10.2134/agronj2006.0139.
- Rutter H, Savona N, Glonti K, Bibby J, Cummins S, Finegood DT, Greaves F, Harper L, Hawe P, Moore L, Petticrew M, Rehfuss E, Shiell A, Thomas J, White M (2017) The need for a complex systems model of evidence for public health. *The Lancet* 390(10112): 2602-2604. Doi: 10.1016/S0140-6736(17)31267-9.

- Rydén P, Hagfors L (2011) Diet cost, diet quality and socio-economic position: How are they related and what contributes to differences in diet costs? *Public Health Nutrition* 14(9): 1680-1692. Doi: 10.1017/S1368980010003642.
- Sabatier P, Jenkins-Smith H (1993) *Policy change and learning – An Advocacy Coalition Approach*. Westview Press, Boulder, CO.
- Sachverständigenrat zur Begutachtung der gesamtwirtschaftlichen Entwicklung (2019) *Aufbruch zu einer neuen Klimapolitik. Sondergutachten, Juli 2019, Wiesbaden*.
- Sackett DL, Rosenberg WM, Gray JA, Haynes RB, Richardson WS (1996) Evidence based medicine: What it is and what it isn't. *BMJ* 312: 71-72. Doi: 10.1136/bmj.312.7023.71.
- SACN (Scientific Advisory Committee on Nutrition) (2015) *SACN carbohydrates and health report. The Scientific Advisory Committee on Nutrition recommendations on carbohydrates, including sugars and fibre*. <https://www.gov.uk/government/publications/sacn-carbohydrates-and-health-report> (letzter Zugriff: 13.12.2019).
- Sadeghirad B, Duhaney T, Motaghipisheh S, Campbell NR, Johnston BC (2016) Influence of unhealthy food and beverage marketing on children's dietary intake and preference: A systematic review and meta-analysis of randomized trials. *Obesity Reviews* 17(10): 945-959. Doi: 10.1111/obr.12445.
- Sadegholvad S, Yeatman H, Parrish AM, Worsley A (2017) What should be taught in secondary schools' nutrition and food systems education? Views from prominent food-related professionals in Australia. *Nutrients* 9(11): e1207. Doi: 10.3390/nu9111207.
- Säll S, Gren IM (2012) *Green consumption taxes on meat in Sweden. Working Paper 10/2012, Swedish University of Agricultural Sciences, Economic Department, Uppsala*.
- Salvia L (2019) The restructuring of Italian agriculture and its impact upon capital-labour relations: Labour contracting and exploitation in the fresh fruit and vegetable supply chain of the Lazio Region, Central Italy. *Journal of Agrarian Change* 20(1): 98-112. Doi: 10.1111/joac.12340.
- Samson O (o. J.) 11 Tipps, wie ihr nachhaltiger essen und Lebensmittel einkaufen könnt. <https://mitvergnuegen.com/2017/11-tipps-wie-ihr-nachhaltiger-lebensmittel-einkaufen-koennt/> (letzter Zugriff: 10.12.2019).
- Samuel-Fitwi B, Nagel F, Meyer S, Schroeder JP, Schulz C (2013) Comparative life cycle assessment (LCA) of raising rainbow trout (*Oncorhynchus mykiss*) in different production systems. *Aquacultural Engineering* 54: 85-92. Doi: 10.1016/j.aquaeng.2012.12.002.
- Sander M, Heim N, Kohnle Y (2016) Label-Awareness: Wie genau schaut der Konsument hin? Eine Analyse des Label-Bewusstseins von Verbrauchern unter besonderer Berücksichtigung des Lebensmittelbereichs. *Berichte über Landwirtschaft* 94(2): 1-20.
- Sanders J (2019) *Analyse der wirtschaftlichen Lage ökologisch wirtschaftender Betriebe im Wirtschaftsjahr 2017/18*. Johann Heinrich von Thünen-Institut, Braunschweig. [https://www.thuenen.de/media/institute/bw/Downloads/Bericht\\_Oeko\\_WJ1718.pdf](https://www.thuenen.de/media/institute/bw/Downloads/Bericht_Oeko_WJ1718.pdf) (letzter Zugriff: 20.12.2019).
- Sanders J, Heß J (Hrsg.) (2019) *Leistungen des ökologischen Landbaus für Umwelt und Gesellschaft*. Thünen Report 65, 2. überarbeitete und ergänzte Auflage, Johann Heinrich von Thünen-Institut, Braunschweig. Doi: 10.3220/REP1576488624000.
- Sanderson Bellamy A, Svensson O, van den Brink PJ, Tedengren M (2016) What is in a label? Rainforest-Alliance certified banana production versus non-certified conventional banana production. *Global Ecology and Conservation* 7: 39-48. Doi: 10.1016/j.gecco.2016.05.002
- Sandler RL (2015) *Food ethics. The basics*. Routledge Taylor & Francis Group, London, New York.

- Santos I, Sniehotta F, Marques MM, Carraça EV, Teixeira PJ (2017) Prevalence of personal weight control attempts in adults: A systematic review and meta-analysis. *Obesity Reviews* 18(1): 32-50. Doi: 10.1111/obr.12466.
- Satija A, Bhupathiraju SN, Spiegelman D, Chiuve SE, Manson JE, Willett W, Rexrode KM, Rimm EB, Hu FB (2017) Healthful and unhealthful plant-based diets and the risk of coronary heart disease in U.S. adults. *Journal of the American College of Cardiology* 70(4): 411-422. Doi: 10.1016/j.jacc.2017.05.047.
- Schächtele K, Hertle H (2007) Die CO<sub>2</sub> Bilanz des Bürgers. Recherche für ein internetbasiertes Tool zur Erstellung persönlicher CO<sub>2</sub> Bilanzen. Forschungsprojekt im Auftrag des Umweltbundesamtes, Berlin. <https://www.umweltbundesamt.de/sites/default/files/medien/publikation/long/3327.pdf> (letzter Zugriff: 06.12.2019).
- Schader C, Baumgart L, Landert J, Muller A, Ssebunya B, Blockeel J, Weisshaidinger R, Petrusek R, Mészáros D, Padel S, Gerrard C, Smith L, Lindenthal T, Niggli U, Stolze M (2016) Using the sustainability monitoring and assessment routine (SMART) for the systematic analysis of trade-offs and synergies between sustainability dimensions and themes at farm level. *Sustainability* 8(3): 274. Doi: 10.3390/su8030274.
- Schader C, Grenz J, Meier MS, Stolze M (2014) Scope and precision of sustainability assessment approaches to food systems. *Ecology and Society* 19(3): 42. Doi: 10.5751/ES-06866-190342.
- Schäfer R, Liess M, Altenburger R, Filser J, Hollert H, Roß-Nicoll M, Schäffer A, Scheringer M (2019) Future pesticide risk assessment: Narrowing the gap between intention and reality. *Environmental Science Europe* 31: 21. Doi: 10.1186/s12302-019-0203-3.
- Schaller K, Effertz T, Gerlach S, Grabfelder M, Müller MJ (2016) Prävention nichtübertragbarer Krankheiten – Eine gesamtgesellschaftliche Aufgabe. Grundsatzpapier der Deutschen Allianz Nichtübertragbare Krankheiten (DANK), Berlin.
- Schaller K, Mons U (2018) Tax on sugar sweetened beverages and influence of the industry to prevent regulation. *Ernährungsumschau* 65(2): 34-41. Doi: 10.4455/eu.2018.007.
- Schanes K, Dobernig K, Gözet B (2018) Food waste matters – A systematic review of household food waste practices and their policy implications. *Journal of Cleaner Production* 182: 978-991. Doi: 10.1016/j.jclepro.2018.02.030.
- Schanz H, Baur K, Biro B (2018) Frauen in der Landwirtschaft. Ergebnisse einer explorativen Online-Befragung zur aktuellen Situation von Frauen in der Landwirtschaft in Baden-Württemberg. Forschungsbericht 11/2018, Band I und II, im Auftrag des Ministeriums für Ländlichen Raum und Verbraucherschutz Baden-Württemberg. Institut für Umweltsozialwissenschaften und Geographie, Universität Freiburg. Doi: 10.6094/UNIFR/16804.
- Schienkiewitz A, Brettschneider AK, Damerow A, Schaffrath Rosario A (2018a) Übergewicht und Adipositas im Kindes- und Jugendalter in Deutschland – Querschnittergebnisse aus KiGGS Welle 2 und Trends. *Journal of Health Monitoring* 3(1): 16-23. Doi: 10.17886/RKI-GBE-2018-005.2.
- Schienkiewitz A, Damerow S, Schaffrath Rosario A (2018b) Prävalenz von Untergewicht, Übergewicht und Adipositas bei Kindern und Jugendlichen in Deutschland – Einordnung der Ergebnisse aus der KGGG Welle 2 nach internationalen Referenzsystemen. *Journal of Health Monitoring* 3(3): 56-69. Doi: 10.17886/RKI-GBE-2018-087.
- Schlender M, Schwarz O, Schaefer R (2017) An update on the economic value of a statistical life year in Europe. <https://www.dkfz.de/de/gesundheitsoekonomie/Download/Schlender-et-al-VSLY-Europe-HTAi-Rome-170620-FVc-HO.pdf> (letzter Zugriff: 19.12.2019).

- Schlich EH, Fleissner U (2005) The ecology of scale: Assessment of regional energy turnover and comparison with global food. *The International Journal of Life Cycle Assessment* 10(3): 219-223. Doi: 10.1065/lca2004.09.180.9.
- Schmacker R (2018) Softdrinksteuer: Proportionale Steuer ist der vielversprechendste Ansatz. *DIW aktuell* 10. [https://www.diw.de/de/diw\\_01.c.583817.de/publikationen/diw\\_aktuell/2018\\_0010/softdrinksteuer\\_proportionale\\_steuer\\_ist\\_der\\_vielversprechendste\\_ansatz.html](https://www.diw.de/de/diw_01.c.583817.de/publikationen/diw_aktuell/2018_0010/softdrinksteuer_proportionale_steuer_ist_der_vielversprechendste_ansatz.html) (letzter Zugriff: 19.12.2019).
- Schmid O (2007) Development of standards for organic farming. In: Lockeretz W (Hrsg.) *Organic farming. An international history*. CAB International, Wallingford: 152-174.
- Schmidt T, Schneider F, Leverenz D, Hafner G (2019a) Lebensmittelabfälle in Deutschland – Baseline 2015. *Thünen Report 71*, Johann Heinrich von Thünen-Institut, Braunschweig. Doi: 10.3220/REP1563519883000.
- Schmidt FT, Baumgardt S, Blumenthal A, Burdick B, Claupein E, Dirksmeyer W, Hafner G, Klockgether K, Koch F, Leverenz D, Lörchner M, Ludwig-Ohm S, Niepagenkemper L, Owusu-Sekyere K, Waskow F (2019b) Wege zur Reduzierung von Lebensmittelabfällen – Pathways to reduce food waste (REFOWAS). Maßnahmen, Bewertungsrahmen und Analysewerkzeuge sowie zukunftsfähige Ansätze für einen nachhaltigen Umgang mit Lebensmitteln unter Einbindung sozio-ökologischer Innovationen, Volume 1. *Thünen Report 73*, Volume 1, Johann Heinrich von Thünen-Institut, Braunschweig. Doi: 10.3220/REP1569247044000.
- Schmidt TG, Schneider F, Claupein E (2018) Lebensmittelabfälle in privaten Haushalten in Deutschland: Analyse der Ergebnisse einer repräsentativen Erhebung 2016/2017 von GfK SE. *Thünen Working Paper 92*, Johann Heinrich von Thünen-Institut, Braunschweig. Doi: 10.3220/WP1523264518000.
- Schneidewind U, Zahrnt A (2013) *Damit gutes Leben einfacher wird. Perspektiven einer Suffizienzpolitik*. Oekom-Verlag, München.
- Schopenhauer A (1977) *Preisschrift über die Grundlage der Moral*. Einmalige Sonderausgabe. Pawlak, Herrsching.
- Schouten G, Leroy P, Glasbergen P (2012) On the deliberative capacity of private multi-stakeholder governance: The roundtables on responsible soy and sustainable palm oil. *Ecological Economics* 83: 42-50. Doi: 10.1016/j.ecolecon.2012.08.007.
- Schröck R (2013) Analyse der Preiselastizitäten der Nachfrage nach Biolebensmitteln unter Berücksichtigung nicht direkt preisrelevanten Verhaltens der Verbraucher. Abschlussbericht zum BÖLN-Projekt 2808 OE 148, Justus-Liebig-Universität Giessen, Giessen.
- Schulte EM, Avena NM, Gearhardt AN (2015) Which foods may be addictive? The roles of processing, fat content, and glycemic load. *PLOS ONE* 10(2): e0117959. Doi: 10.1371/journal.pone.0117959.
- Schultheiß U, Zapf R, Wulf S (2014) Nachhaltigkeit in der Landwirtschaft. Gegenüberstellung verschiedener Bewertungssysteme. *Forschung Themenheft 2*: 14-19. [https://bmel-forschung-prered.ble.de/fileadmin/SITE\\_MASTER/content/bilder/Brosch%C3%BCren\\_Flyer/Themenheft\\_Nachhaltigkeit\\_web.pdf](https://bmel-forschung-prered.ble.de/fileadmin/SITE_MASTER/content/bilder/Brosch%C3%BCren_Flyer/Themenheft_Nachhaltigkeit_web.pdf) (letzter Zugriff: 20.12.2019).
- Schultz TJ, Roupas P, Wiechula R, Krause D, Gravier S, Tuckett A, Hines S, Kitson A (2016) Nutritional interventions for optimizing healthy body composition in older adults in the community: An umbrella review of systematic reviews. *JBISIRIR-2016-003063*. Doi: 10.11124/JBISIRIR-2016-003063.

- Schulz C, Engel U, Kreienberg R, Biesalski HK (2007) Vitamin A and beta-carotene supply of women with gemini or short birth intervals: A pilot study. *European Journal of Nutrition* 46(1): 12-20. Doi: 10.1007/s00394-006-0624-9.
- Schulze H, Albersmeier F, Spiller A, Jahn G (2007) Checklist Governance? Zur Prüfungsqualität von Zertifizierungssystemen im Agribusiness. In: Kuhlmann F, Schmitz PM (Hrsg.) *Good Governance in der Agrar- und Ernährungswirtschaft*. Schriften der Gesellschaft für Wirtschafts- und Sozialwissenschaften des Landbaues e. V., Band 42: 215-225.
- Schulze H, Jahn G, Neuendorff J, Spiller A (2008) Die Öko-Zertifizierung in Deutschland aus Sicht der Produzenten: Handlungsvorschläge zur politischen Weiterentwicklung. *Berichte über Landwirtschaft* 86(3): 502-534.
- Schulze M, Spiller A, Risius A (2019) Food retailers as mediating gatekeepers between farmers and consumers in the supply chain of animal welfare meat – Studying retailers’ motives in marketing pasture-based beef. *Food Ethics* 3(1-2): 41-52. Doi: 10.1007/s41055-019-00040-w.
- Schulze MB (2007) Methoden der epidemiologischen Ernährungsforschung. *Ernährungsumschau* 2/07: 268-274.
- Schulze MB, Martínez-González MA, Fung TT, Lichtenstein AH, Forouhi NG (2018) Food based dietary patterns and chronic disease prevention. *BMJ* 361: k2396. Doi: 10.1136/bmj.k2396.
- Schupp HT, Renner B (2011) Food deprivation: A neuroscientific perspective. In: Preedy V (ed.) *Handbook of behavior, food and nutrition*. Springer, New York, NY: 2239-2257. Doi: 10.1007/978-0-387-92271-3\_142.
- Schürmann S, Kersting M, Alexy U (2017) Vegetarian diets in children: A systematic review. *European Journal of Nutrition* 56(5): 1797-1817. Doi: 10.1007/s00394-017-1416-0.
- Schüz B, Bower J, Ferguson SG (2015) Stimulus control and affect in dietary behaviours. An intensive longitudinal study. *Appetite* 87: 310-317. Doi: 10.1016/j.appet.2015.01.002.
- Schwartz AE, Rothbart MW (2017) Let them eat lunch: The impact of universal free meals on student performance. Working Paper No. 203, Center for Policy Research, <https://surface.syr.edu/cpr/235>.
- Schweitzer JP, Gionfra S, Pantzar M, Mottershead D, Watkins E, Petsinaris F, ten Brink P, Ptak E, Lacey C, Janssens C (2018) Unwrapped: How throwaway plastic is failing to solve Europe’s food waste problem (and what we need to do instead). A study by Zero Waste Europe and Friends of the Earth Europe for the Rethink Plastic Alliance. Institute for European Environmental Policy (IEEP), Brussels.
- Schwingshackl L, Bogensberger B, Hoffmann G (2018) Diet quality as assessed by the healthy eating index, alternate healthy eating index, dietary approaches to stop hypertension score and health outcomes: An updated systematic review and meta-analysis of cohort studies. *Journal of the Academy of Nutrition and Dietetics* 118(1): 74-100.e11. Doi: 10.1016/j.jand.2017.08.024.
- Searchinger T, Waite R, Hanson C, Ranganathan J, Dumas P (2019) Creating a sustainable food future: A menu of solutions to feed nearly 10 billion people by 2050. World Resource Institute, Washington DC, USA. <https://wrr-food.wri.org> (letzter Zugriff: 19.12.2019).
- Sebastiani G, Herranz Barbero A, Borrás-Novell C, Alsina Casanova M, Aldecoa-Bilbao V, Andreu-Fernández V, Pascual Tutusaus M, Ferrero Martínez S, Gómez Roig MD, García-Algar O (2019) The effects of vegetarian and vegan diet during pregnancy on the health of mothers and offspring. *Nutrients* 11(3): e557. Doi: 10.3390/nu11030557.

- Seidel C, Heckelei T, Lakner S (2019) Conventionalization of organic farms in Germany: An empirical investigation based on a composite indicator approach. *Sustainability* 11(10): 2934. Doi: 10.3390/su11102934.
- Selke S (Hrsg.) (2011) *Tafeln in Deutschland. Aspekte einer sozialen Bewegung zwischen Nahrungsmittelumverteilung und Armutsintervention*. 2. durchgesehene Auflage, Springer VS, Wiesbaden.
- Sen A (1990) *Gender and Cooperative Conflicts*. In: Tinker I (ed.) *Persistent inequalities*. Oxford University Press, New York, Oxford: 123-150.
- Sen A (2007) *Development as freedom*. 13. Aufl., Oxford University Press, New York, Oxford.
- Sengstschmid H, Sprong N, Schmid O, Stockebrand N, Stolz H, Spiller A (2011) EU ecolabel for food and feed products – Feasibility study (ENV.C.1/ETU/2010/0025). A report for DG Environment, European Commission. [http://ec.europa.eu/environment/ecolabel/documents/Ecolabel\\_for\\_food\\_final\\_report.pdf](http://ec.europa.eu/environment/ecolabel/documents/Ecolabel_for_food_final_report.pdf) (letzter Zugriff: 10.12.2019).
- Setzwein M (2004) *Ernährung – Körper – Geschlecht. Zur sozialen Konstruktion von Geschlecht im kulinarischen Kontext*. VS Verlag für Sozialwissenschaften, Wiesbaden.
- Seufert V, Ramankutty N (2017) Many shades of gray – The context-dependent performance of organic agriculture. *Science Advances* 3(3): e1602638. Doi: 10.1126/sciadv.1602638.
- Seufert V, Ramankutty N, Foley JA (2012) Comparing the yields of organic and conventional agriculture. *Nature* 485: 229-232. Doi: 10.1038/nature11069.
- Shah AK, Mullainathan S, Shafir E (2012) Some consequences of having too little. *Science* 338(6107): 682-685. Doi: 10.1126/science.1222426.
- Sharma LL, Teret SP, Brownell KD (2010) The food industry and self-regulation: Standards to promote success and to avoid public health failures. *American Journal of Public Health* 100(2): 240-246. Doi: 10.2105/AJPH.2009.160960.
- Sharpe KM, Staelin R, Huber J (2008) Using extremeness aversion to fight obesity: Policy implications of context dependent demand. *Journal of Consumer Research* 35(3): 406-422. Doi: 10.1086/587631.
- Shepherd R (1999) Social determinants of food choice. *Proceedings of the Nutrition Society* 58(4): 807-812. Doi: 10.1017/S0029665199001093.
- Sherry B, Mei Z, Scanlon KS, Mokdad AH, Grummer-Strawn LM (2004) Trends in state-specific prevalence of overweight and underweight in 2-through 4-year-old children from low-income families from 1989 through 2000. *Archives of Pediatrics & Adolescent Medicine* 158(12): 1116-1124. Doi: 10.1001/archpedi.158.12.1116.
- Shi J, Visschers VHM, Bumann N, Siegrist M (2018) Consumers' climate-impact estimations of different food products. *Journal of Cleaner Production* 172: 1646-1653. Doi: 10.1016/j.jclepro.2016.11.140.
- Sibhatu KT, Krishna VV, Qaim M (2015) Production diversity and dietary diversity in smallholder farm households. *PNAS* 112(34): 10657-10662. Doi: 10.1073/pnas.1510982112.
- Signal LN, Stanley J, Smith M, Barr MB, Chambers TJ, Zhou J, Duane A, Guttin C, Smeaton, AF, McKerchar C, Pearson AL, Hoek J, Jenkin GLS, Ni Mhurchu C (2017) Children's everyday exposure to food marketing: An objective analysis using wearable cameras. *International Journal of Behavioral Nutrition and Physical Activity* 14(1): 137. Doi: 10.1186/s12966-017-0570-3.

- Silver LD, Ng SW, Ryan-Ibarra S, Taillie LS, Induni M, Miles DR, Poti JM, Popkin BM (2017) Changes in prices, sales, consumer spending, and beverage consumption one year after a tax on sugar-sweetened beverages in Berkeley, California, US: A before-and-after study. *PLoS Medicine* 14(4): e1002283. Doi: 10.1371/journal.pmed.1002283.
- Simoneit C, Burow E, Tenhagen BA, Käsbohrer A (2015) Oral administration of antimicrobials increase antimicrobial resistance in *E. coli* from chicken – A systematic review. *Preventive Veterinary Medicine* 118(1): 1-7. Doi: 10.1016/j.prevetmed.2014.11.010.
- Singer P (1975) *Animal liberation. A new ethics for our treatment of animals.* New York Review, New York.
- Singer-Brodowski M (2017) Executive Summary. Verankerung von Bildung für nachhaltige Entwicklung in der frühkindlichen Bildung. Freie Universität Berlin, Institut Futur, Arbeitsstelle beim Wissenschaftlichen Berater des Weltaktionsprogramms „Bildung für nachhaltige Entwicklung“, Berlin.
- Singh RB, Saboo B, Maheshwari A, Singh P, Verma NS, Singhal S, Sharma ZP (2015) Can prevention of low birthweight in newborn may be associated with primordial prevention of cardiovascular diseases and type 2 diabetes in adult life? *Journal of Cardiology and Therapy* 2(5): 425-429. Doi: 10.17554/j.issn.2309-6861.2015.02.90.
- Siniver E, Mealem Y, Yaniv G (2013) Overeating in all-you-can-eat buffet: Paying before versus paying after. *Applied Economics* 45(35): 4940-4948. Doi: 10.1080/00036846.2013.808309.
- Siri-Tarino PW, Sun Q, Hu FB, Krauss RM (2010) Meta-analysis of prospective cohort studies evaluating the association of saturated fat with cardiovascular disease. *The American Journal of Clinical Nutrition* 91(3): 535-546. Doi: 10.3945/ajcn.2009.27725.
- Sisnowski J, Street JM, Merlin T (2017) Improving food environments and tackling obesity: A realist systematic review of the policy success of regulatory interventions targeting population nutrition. *PLOS ONE* 12: e0182581. Doi: 10.1371/journal.pone.0182581.
- Sixsmith J, Fox KA, Doyle P, Barry MM (2014) A literature review on health communication campaign evaluation with regard to the prevention and control of communicable diseases in Europe, Stockholm.
- Smith J, Barling D (2014) Social impacts and life cycle assessment: Proposals for methodological development for SMEs in the European food and drink sector. *The International Journal of Life Cycle Assessment* 19: 944-949. Doi: 10.1007/s11367-013-0691-0.
- Smith-Spangler C, Brandeau ML, Hunter GE, Bavinger JC, Pearson M, Eschbach PJ, Sundaram V, Liu H, Schirmer P, Stave C, Olkin I, Bravata DM (2012) Are organic foods safer or healthier than conventional alternatives? A systematic review. *Annals of Internal Medicine* 157(5): 348-366. Doi: 10.7326/0003-4819-157-5-201209040-00007.
- Sneddon LU, Elwood RW, Adamo SA, Leach MC (2014) Defining and assessing animal pain. *Animal Behaviour* 97: 201-212. Doi: 10.1016/j.anbehav.2014.09.007.
- SOFI, IAB (Soziologisches Forschungsinstitut Göttingen e. V., Institut für Arbeitsmarkt- und Berufsforschung der Bundesagentur für Arbeit) (2016) Evaluation der bundesweiten Inanspruchnahme und Umsetzung der Leistungen für Bildung und Teilhabe. Schlussbericht. Göttingen, Nürnberg, Mai 2016.
- Soltani S, Chitsazi MJ, Salehi-Abargouei A (2018) The effect of dietary approaches to stop hypertension (DASH) on serum inflammatory markers: A systematic review and meta-analysis of randomized trials. *Clinical Nutrition* 37(2): 542-550. Doi: 10.1016/j.clnu.2017.02.018.

- Sommerfeldt EJ, Yang A (2017) Relationship networks as strategic issues management: An issue- stage framework of social movement organization network strategies. *Public Relations Review* 43(4): 829-839. Doi: 10.1016/j.pubrev.2017.06.012.
- Sonntag D, Ali S, de Bock F (2016) Long-term social costs of today's overweight and obesity in adolescence and prevention potential in Germany. *Adipositas* 10(1): 1-13. Doi: 10.1055/s-0037-1617689.
- Sonntag W, Martinez J, Spiller A (2017) Prozessqualitäten in der WTO: Ein Vorschlag für die reliable Messung von moralischen Bedenken am Beispiel des Tierschutzes. *Agrar- und Umweltrecht* 47(3): 81-88.
- Sonntag WI, Spiller A (2018) Measuring public concerns? Developing a moral concerns scale regarding non-product related process and production methods. *Sustainability* 10(5): 1-16. Doi: 10.3390/su10051375.
- Späth J, Brändle T, Reiner M, Boockmann B (2018) Auswirkungen des Mindestlohns im Bereich Saisonarbeit. Studie im Auftrag der Mindestlohnkommission. Abschlussbericht. Institut für Angewandte Wirtschaftsforschung – IAW, Tübingen.
- SPD (2017) Es ist Zeit für mehr Gerechtigkeit: Zukunft sichern, Europa stärken. Das Regierungsprogramm 2017 bis 2021, Berlin. [https://www.bundestagswahl-bw.de/wahlprogramme\\_btwahl2017.html](https://www.bundestagswahl-bw.de/wahlprogramme_btwahl2017.html) (letzter Zugriff: 19.12.2019).
- SPD Baden-Württemberg (o.J.) Baden-Württemberg leben – Regierungsprogramm der SPD Baden-Württemberg 2016 – 2021, Stuttgart. <https://www.landtagswahl-bw.de/wahlprogramme.html> (letzter Zugriff: 19.12.2019).
- SPD Mecklenburg-Vorpommern (o.J.) Gemeinsam auf Kurs. Regierungsprogramm für ein modernes und sozial gerechtes Mecklenburg-Vorpommern. <https://www.abgeordnetenwatch.de/mecklenburg-vorpommern/wahlprogramme> (letzter Zugriff: 19.12.2019).
- Speck M, Rohn H, Engelmann T, Schweißinger J, Neundorf D, Teitscheid P, Langen N, Bienge K (2017) Nahgast: Entwicklung von integrierten Methoden zur Messung und Bewertung von Speisenangeboten in den Dimensionen Ökologie, Soziales, Ökonomie und Gesundheit. Arbeitspapier 2, Wuppertal Institut für Klima, Umwelt, Energie GmbH, Wuppertal.
- Spence C (2015) Multisensory flavor perception. *Cell* 161(1): 24-35. Doi: 10.1016/j.cell.2015.03.007.
- Spence C (2016) Gastrodiplomacy: Assessing the role of food in decision-making. *Flavour* 5(1): 4. Doi: 10.1186/s13411-016-0050-8.
- Spence C, Okajima K, Cheok AD, Petit O, Michel C (2016) Eating with our eyes: From visual hunger to digital satiation. *Brain and Cognition* 110: 53-63. Doi: 10.1016/j.bandc.2015.08.006
- Spencer M, Cienfuegos C, Guinard JX (2018) The Flexitarian Flip™ in university dining venues: Student and adult consumer acceptance of mixed dishes in which animal protein has been partially replaced with plant protein. *Food Quality and Preference* 68: 50-63. Doi: 10.1016/j.foodqual.2018.02.003.
- Spiller A (1996) Ökologieorientierte Produktpolitik: Forschung, Medienberichte, Marktsignale. Metropolis-Verlag, Marburg.
- Spiller A (2001) Preispolitik für ökologische Lebensmittel: Eine neoinstitutionalistische Analyse. *Agrarwirtschaft* 50(7): 451-461.

- Spiller A (2006) Zielgruppen im Markt für Bio-Lebensmittel: Ein Forschungsüberblick. Diskussionsbeitrag des Departments für Agrarökonomie und RURALE ENTWICKLUNG der Georg-August-Universität Göttingen, Nr. 0608, Göttingen.
- Spiller A, Knierim U (2015) Leitlinien für eine gesellschaftlich akzeptierte Tierhaltung im Jahr 2030. Rundschau für Fleischhygiene und Lebensmittelüberwachung 9: 324-327.
- Spiller A, Nitzko S (2019) Welchen Mehrwert haben Agrarprodukte ohne cPSM, die dennoch nicht öko sind? Landinfo 2/2019: 15-18.
- Spiller A, Zühlsdorf, A (2012) Lebensmittelzusatzstoffe und Clean Labelling: Der Verbraucher im Spannungsfeld zwischen Information und Erwartung. In: H. Wilhelm Schaumann Stiftung (Hrsg.) 24. Hülseberger Gespräche 2012, Lübeck 06. bis 08. Juni 2012: 180-191.
- Spiller A, Zühlsdorf A (2018) Haltungskennzeichnung und Tierschutzlabel in Deutschland. Anforderungen und Entwicklungsperspektiven. Wissenschaftliches Gutachten im Auftrag von Greenpeace Deutschland e. V., Göttingen.
- Spiller A, Zühlsdorf A, Nitzko S (2014) Lebensmittelkennzeichnung und Verbrauchervertrauen – Zugleich eine Erwiderung auf den Beitrag von Dr. Almut Pflüger in ZLR 2/2014. Zeitschrift für das gesamte Lebensmittelrecht (ZLR) 5/2014: 523-539.
- Springmann M, Wiebe K, Mason-D'Croz D, Sulser TB, Rayner M, Scarborough P (2018) Health and nutritional aspects of sustainable diet strategies and their association with environmental impacts: A global modelling analysis with country-level detail. *The Lancet Planetary Health* 2 (10): 451-461. Doi: 10.1016/S2542-5196(18)30206-7.
- Sproesser G, Klusmann V, Schupp HT, Renner B (2015) Comparative optimism about healthy eating. *Appetite* 90: 212-218. Doi: 10.1016/j.appet.2015.03.008.
- Sproesser G, Ruby MB, Arbit N, Akotia CS, Alvarenga dos Santos M, Bhangaokar R, Furumitsu I, Hu X, Imada S, Kaptan G, Kaufer-Horwitz M, Menon U, Fischler C, Rozin P, Schupp HT, Renner B (2019) Understanding traditional and modern eating: The TEP10 framework. *BMC Public Health* 19: 1606. Doi: 10.1186/s12889-019-7844-4.
- Sproesser G, Ruby MB, Arbit N, Rozin P, Schupp HT, Renner B (2018) The Eating Motivation Survey: Results from the USA, India and Germany. *Public Health Nutrition* 21(3): 515-525. Doi: 10.1017/S1368980017002798.
- SRU (Sachverständigenrat für Umweltfragen) (1985) Sondergutachten „Umweltprobleme der Landwirtschaft“. W. Kohlhammer GmbH, Stuttgart Mainz.
- Stamler J, Chan Q, Daviglius ML, Dyer AR, van Horn L, Garside DB, Miura K, Wu Y, Ueshima H, Zhao L, Elliott P (2018) Relation of dietary sodium (salt) to blood pressure and its possible modulation by other dietary factors. *Hypertension* 71(4): 631-637. Doi: 10.1161/HYPERTENSIONAHA.117.09928.
- Stanhope KL (2016) Sugar consumption, metabolic disease and obesity: The state of the controversy. *Critical Reviews in Clinical Laboratory Sciences* 53(1): 52-67. Doi: 10.3109/10408363.2015.1084990.
- Statistik der Bundesagentur für Arbeit (2018) Tabellen, Kinder in Bedarfsgemeinschaften (Monatszahlen). Nürnberg, April 2018.
- Statistik der Bundesagentur für Arbeit (2019a) Berichte: Blickpunkt Arbeitsmarkt – Die Arbeitsmarktsituation von langzeitarbeitslosen Menschen. Nürnberg, Juni 2019.
- Statistik der Bundesagentur für Arbeit (2019b) Berichte: Blickpunkt Arbeitsmarkt – Situation schwerbehinderter Menschen. Nürnberg, April 2019.

- Statistisches Bundesamt (2016) Wirtschaftsrechnungen. Einkommens- und Verbrauchsstichprobe. Aufwendungen privater Haushalte für Nahrungsmittel, Getränke und Tabakwaren, Fachserie 15, Heft 3, Wiesbaden.
- Statistisches Bundesamt (2017a) Land- und Forstwirtschaft, Fischerei. Arbeitskräfte und Berufsbildung der Betriebsleiter/Geschäftsführer – Agrarstrukturerhebung. Fachserie 3, Reihe 2.1.8, Destatis.
- Statistisches Bundesamt (2017b) Nachhaltige Entwicklung in Deutschland. Indikatorenbericht 2016, Destatis.
- Statistisches Bundesamt (2018a) Mikrozensus 2017 – Fragen zur Gesundheit. Körpermaße der Bevölkerung, Wiesbaden.
- Statistisches Bundesamt (2018b) Statistisches Jahrbuch. Deutschland und Internationales, Destatis.
- Statistisches Bundesamt (2018c) Land- und Forstwirtschaft, Fischerei. Bodenfläche nach tatsächlicher Nutzung. Fachserie 3, Reihe 5.1, Destatis.
- Statistisches Bundesamt (2018d) Nachhaltige Entwicklung in Deutschland. Indikatorenbericht 2018, Destatis.
- Statistisches Bundesamt (2018e) Statistiken der Kinder und Jugendhilfe. Ausgaben und Einnahmen. [https://www.destatis.de/DE/Themen/Gesellschaft-Umwelt/Soziales/Kinderhilfe-Jugendhilfe/Publikationen/Downloads-Kinder-und-Jugendhilfe/ausgaben-einnahmen-jugendhilfe-5225501177004.pdf?\\_\\_blob=publicationFile](https://www.destatis.de/DE/Themen/Gesellschaft-Umwelt/Soziales/Kinderhilfe-Jugendhilfe/Publikationen/Downloads-Kinder-und-Jugendhilfe/ausgaben-einnahmen-jugendhilfe-5225501177004.pdf?__blob=publicationFile) (letzter Zugriff: 20.12.2019).
- Statistisches Bundesamt (2018f) Schulen auf einen Blick. Ausgabe 2018. [https://www.destatis.de/GPStatistik/servlets/MCRFileNodeServlet/DEHeft\\_derivate\\_00035140/Schulen\\_auf\\_einen\\_Blick\\_2018\\_Web\\_bf.pdf;jsessionid=5BBFAA19E06C8B05F31D4EF0E0326230](https://www.destatis.de/GPStatistik/servlets/MCRFileNodeServlet/DEHeft_derivate_00035140/Schulen_auf_einen_Blick_2018_Web_bf.pdf;jsessionid=5BBFAA19E06C8B05F31D4EF0E0326230) (letzter Zugriff: 20.12.2019).
- Statistisches Bundesamt (2018g) Bildung und Kultur. Private Schulen. Fachserie 11, Reihe 1.1., Destatis.
- Statistisches Bundesamt (2019a) Sterbefälle und Lebenserwartung. [https://www.destatis.de/DE/Themen/Gesellschaft-Umwelt/Bevoelkerung/Sterbefaelle-Lebenserwartung/\\_inhalt.html](https://www.destatis.de/DE/Themen/Gesellschaft-Umwelt/Bevoelkerung/Sterbefaelle-Lebenserwartung/_inhalt.html) (letzter Zugriff: 13.12.2019).
- Statistisches Bundesamt (2019b) Volkswirtschaftliche Gesamtrechnungen – Private Konsumausgaben und Verfügbares Einkommen – 3. Vierteljahr 2019, Wiesbaden.
- Statistisches Bundesamt (2019c) Erträge ausgewählter landwirtschaftlicher Feldfrüchte – Jahressumme – Regionale Tiefe: Kreise und krfr. Städte, Verfügbarer Zeitraum: 1999 – 2018. Statistische Ämter des Bundes und der Länder, Deutschland, 2019.
- Statistisches Bundesamt (2019d) Kindertagesbetreuung nach ausgewählten Merkmalen. <https://www.destatis.de/DE/Themen/Gesellschaft-Umwelt/Soziales/Kindertagesbetreuung/Tabellen/kita-betreuung-merkmale-2018.html> (letzter Zugriff: 20.12.2019).
- STECF (Scientific, Technical and Economic Committee for Fisheries) (2018) Monitoring the performance of the Common Fisheries Policy (STECF-Adhoc-18-01). Publications Office of the European Union, Luxembourg. Doi: 10.2760/329345.
- Steele S, Ruskin G, Sarcevic L, Mckee M, Stuckler D (2019) Are industry-funded charities promoting “advocacy-led studies” or “evidence-based science”? A case study of the International Life Sciences Institute. BMC 15: 36. Doi: 10.1186/s12992-019-0478-6.
- Steenhuis I, Poelman M (2017) Portion Size: Latest developments and interventions. Current Obesity Reports 6: 10-17. Doi: 10.1007/s13679-017-0239-x.
- Steeves EA, Martins PA, Gittelsohn J (2014) Changing the food environment for obesity prevention: Key gaps and future directions. Current Obesity Reports 3(4): 451-458. Doi: 10.1007/s13679-014-0120-0.

- StEG-Konsortium (2019) Ganztagschule 2017/2018. Deskriptive Befunde einer bundesweiten Befragung. Studie zur Entwicklung von Ganztagschulen. Frankfurt am Main, Dortmund, Gießen, München.
- Steinberg D, Bennett GG, Svetkey L (2017) The DASH diet – 20 years later. *JAMA* 317(15): 1529-1530. Doi: 10.1001/jama.2017.1628.
- Steinmann HH, Theuvsen L, Gerowitt B (2018) Zum künftigen Umgang mit Glyphosat im Ackerbau – Ein Diskussionsbeitrag. *Julius-Kühn-Archiv* 458: 252-259. Doi: 10.5073/jka.2018.458.036.
- Stenmarck A, Jensen C, Quested T, Moates G (2016) Estimates of European food waste levels. IVL Swedish Environmental Research Institute, Stockholm.
- Stifterverband für die deutsche Wissenschaft e. V. (2018) Forschung und Entwicklung in der Wirtschaft 2017, Essen.
- Stockburger J, Weike AI, Hamm AO, Schupp HT (2008) Deprivation selectively modulates brain potentials to food pictures. *Behavioral Neuroscience* 122(4): 936-942. Doi: 10.1037/a0012517.
- Stok FM, Hoffmann S, Volkert D, Boeing H, Ensenauer R, Stelmach-Mardas M, Kiesswetter E, Weber A, Rohm H, Lien N, Brug J, Holdsworth M, Renner B (2017) The DONE framework: Creation, evaluation, and updating of an interdisciplinary, dynamic framework 2.0 of determinants of nutrition and eating. *PLOS ONE* 12(2): e0171077. Doi: 10.1371/journal.pone.0171077.
- Stok M, Mollen S, Verkooijen KT, Renner B (2018) Unravelling social norm effects: How and when social norms affect eating behavior. *Frontiers in Psychology* 9: 738. Doi: 10.3389/fpsyg.2018.00738.
- Stoll-Kleemann S, Schmidt UJ (2017) Reducing meat consumption in developed and transition countries to counter climate change and biodiversity loss: A review of influence factors. *Regional Environmental Change* 17: 1261-1277. Doi: 10.1007/s10113-016-1057-5.
- Storcksdieck genannt Bonsmann S, Kardakis T, Wollgast J, Nelson M, Caldeira S (2014) Mapping of national school food policies across the EU28 plus Norway and Switzerland. JRC Science and Policy Reports. Publications Office of the European Union 2014, Luxembourg.
- Storey P, Chamberlin R (2001) Improving the take up of free school meals. Research Report RR270, Thomas Coram Research Unit, Institute of Education. <https://dera.ioe.ac.uk//4657/> (letzter Zugriff: 19.12.2019).
- Story M, Kaphingst KM, Robinson-O'Brien R, Glanz K (2008) Creating healthy food and eating environments: Policy and environmental approaches. *Annual Review of Public Health* 29: 253-272. Doi: 10.1146/annurev.publhealth.29.020907.090926.
- Strack F, Deutsch R (2004) Reflective and impulsive determinants of social behavior. *Personality and Social Psychology Review* 8(3): 220-247. Doi: 10.1207/s15327957pspr0803\_1.
- Strand R, Freeman RE, Hockerts K (2015) Corporate social responsibility and sustainability in Scandinavia: An overview. *Journal of Business Ethics* 127(1): 1-15. Doi: 10.1007/s10551-014-2224-6.
- Strickhouser S, Wright JD, Donley M (2014) Food insecurity among older adults. [https://www.aarp.org/content/dam/aarp/aarp\\_foundation/2015-PDFs/AF-Food-Insecurity-2015Update-Final-Report.pdf](https://www.aarp.org/content/dam/aarp/aarp_foundation/2015-PDFs/AF-Food-Insecurity-2015Update-Final-Report.pdf) (letzter Zugriff: 13.12.2019).
- Stringer C, Whittaker DH, Simmons G (2016) New Zealand's turbulent waters: The use of forced labour in the fishing industry. *Global Networks* 16: 3-24. Doi: 10.1111/glob.12077.

- Stroh D, Boeing H, Leschik-Bonnet E, Heseker H, Arens-Azevêdo U, Bechthold A, Knorpp L, Kroke A (2016) Speisesalzzufuhr in Deutschland, gesundheitliche Folgen und resultierende Handlungsempfehlungen. Wissenschaftliche Stellungnahme der Deutschen Gesellschaft für Ernährung e. V. (DGE). *Ernährungsumschau* 63(03): 62-70. Doi: 10.4455/eu.2016.012.
- Stuth S, Schels B, Promberger M, Jahn K, Allmendinger J (2018) Prekarität in Deutschland?! Discussion Paper P 2018-004. Wissenschaftszentrum Berlin für Sozialforschung gGmbH. <https://bibliothek.wzb.eu/pdf/2018/p18-004.pdf> (letzter Zugriff: 13.12.2019).
- Suher J, Raghunathan R, Hoyer WD (2016) Eating healthy or feeling empty? How the "healthy=less filling" intuition influences satiety. *Journal of the Association for Consumer Research* 1(1): 26-40. Doi: 10.1086/684393.
- Sullivan S, McCann E, Young RD, Erickson D (1996) Farmers' attitudes about farming and the environment: A survey of conventional and organic farmers. *Journal of Agricultural and Environmental Ethics* 9(2): 123-143. Doi: 10.1007/BF03055298.
- Sunstein CR (2017) 'They ruined popcorn': On the costs and benefits of mandatory labels. Harvard Public Law Working Paper No. 18-06. Doi: 10.2139/ssrn.3091789.
- Sustainable Food Trust (2017) The hidden cost of UK food. Report, November 2017. <http://sustainablefoodtrust.org/wp-content/uploads/2013/04/HCOF-Report-online-version-1.pdf> (letzter Zugriff: 20.12.2019).
- Sutton MA, Oenema O, Erisman JW, Leip A, van Grinsven H, Winiwarter W (2011) Too much of a good thing. *Nature* 472: 159-61. Doi: 10.1038/472159a.
- Swinburn BA, Kraak VI, Allender S, Atkins VJ, Baker PI, Bogard JR (2019) The global syndemic of obesity, undernutrition, and climate change: The Lancet Commission report. *The Lancet* 393(10173): 791-846. Doi: 10.1016/S0140-6736(18)32822-8.
- Swindle T, Curran GM, Johnson SL (2019) Implementation science and nutrition education and behavior: Opportunities for integration. *Journal of Nutrition Education and Behavior* 51(6): 763-774. Doi: 10.1016/j.jneb.2019.03.001.
- Szabo de Edelenyi F, Egnell M, Galan P, Druesne-Pecollo N, Hercberg S, Julia C (2019) Ability of the Nutri-Score front-of-pack nutrition label to discriminate the nutritional quality of foods in the German food market and consistency with nutritional recommendations. *Archives of Public Health* 77: 28. Doi: 10.1186/s13690-019-0357-x.
- Taber DR, Chriqui JF, Vuillaume R, Chaloupka FJ (2014) How state taxes and policies targeting soda consumption modify the association between school vending machines and student dietary behaviors: A cross-sectional analysis. *PLOS ONE* 9(8): e98249. Doi: 10.1371/journal.pone.0098249
- Tafel Deutschland e. V. (2018) 25 Jahre Tafel in Deutschland. Auch in Zukunft: Lebensmittel retten und Menschen helfen, Jahresbericht 2018, Berlin.
- Tafel Deutschland e. V. (2019) Dramatischer Anstieg der Tafel-Nutzer – Besonders Rentnerinnen und Rentner suchen Unterstützung. Pressemappe. [https://www.tafel.de/fileadmin/media/Presse/Pressemitteilungen/PDF/2019/2019-09-17\\_Digitale\\_Pressemappe.pdf](https://www.tafel.de/fileadmin/media/Presse/Pressemitteilungen/PDF/2019/2019-09-17_Digitale_Pressemappe.pdf) (letzter Zugriff: 10.01.2020).
- Täger M, Peltner J, Thiele S (2016) Evaluation of diet quality by means of the healthy eating index and its modified variants. *Ernährungsumschau* 63(05): 110-118. Doi: 10.4455/eu.2016.023.

- Talati Z, Pettigrew S, Neal B, Dixon H, Hughes C, Kelly B, Miller C (2017) Consumers' responses to health claims in the context of other on-pack nutrition information: A systematic review. *Nutrition Reviews* 75(4): 260-273. Doi: 10.1093/nutrit/nuw070.
- Tani Y, Kondo N, Takagi D, Saito M, Hikichi H, Ojima T, Kondo K (2015) Combined effects of eating alone and living alone on unhealthy dietary behaviors, obesity and underweight in older Japanese adults: Results of the JAGES. *Appetite* 95: 1-8. Doi: 10.1016/j.appet.2015.06.005.
- Tannenbaum MB, Hepler J, Zimmerman RS, Saul L, Jacobs S, Wilson K, Albarracín D (2015) Appealing to fear: A meta-analysis of fear appeal effectiveness and theories. *Psychological Bulletin* 141(6): 1178-204. Doi: 10.1037/a0039729.
- Tapinfluence (2019) 7 key influencer marketing strategies for food brands. [https://www.tapinfluence.com/wp-content/uploads/2015/02/Tapinfluence-FoodBrands\\_eBook\\_Finalv3.pdf](https://www.tapinfluence.com/wp-content/uploads/2015/02/Tapinfluence-FoodBrands_eBook_Finalv3.pdf) (letzter Zugriff: 10.01.2020).
- Taube F (2016) Emissionen, Ressourceneffizienz und Betriebsgröße. In: Lange J (Hrsg.). *Small is beautiful? Betriebsgrößen und multifunktionale Landwirtschaft*. Loccumer Protokoll 05/16: 81-103.
- Taube F (2017) Besser 100 % Ökologisierung der Landwirtschaft als 20 % Ökolandbau? Festvortrag anlässlich der Verabschiedung von Prof. Dr. Ulrich Köpke, Bonn, 08.09. 2017. <https://www.iol.uni-bonn.de/besser-100-festvortrag-koepke-08092017-bonn-final-1.pdf> (letzter Zugriff: 20.12.2019).
- Taube F, Gierus M, Hermann A, Loges R, Schönbach P (2014) Grassland and globalization – Challenges for north-west European grass and forage research. *Grass and Forage Science* 69: 2-16. Doi: 10/f5n82m.
- Taube F, Kelm M, Loges R, Wachendorf M (2006) Ressourceneffizienz als Steuergröße für die Förderung nachhaltiger Produktionssysteme: Gibt es Vorrang-/Eignungsflächen für den ökologischen Landbau? *Berichte über Landwirtschaft* 84(1): 73-105.
- Taube F, Loges R, Kelm M, Lactacz-Lohmann U (2005) Vergleich des ökologischen und konventionellen Ackerbaus im Hinblick auf Leistungen und ökologische Effekte auf Hohertragsstandorten Norddeutschlands. *Berichte über Landwirtschaft* 83: 165-176.
- Taylor (2000) *Ökologische Bewertung von Ernährungsweisen anhand ausgewählter Indikatoren*. Dissertation. Justus-Liebig-Universität, Gießen.
- Te Morenga L, Mallard S, Mann J (2012) Dietary sugars and body weight: Systematic review and meta-analyses of randomised controlled trials and cohort studies. *BMJ* 346: e7492. Doi: 10.1136/bmj.e7492.
- Tecklenburg E, Arens-Azevedo A, Papenheim-Tockhorn H, Belke L, Klein S (2019) *KuPS – Studie zu Kosten- und Preisstrukturen in der Schulverpflegung*. Abschlussbericht. Deutsche Gesellschaft für Ernährung (Hrsg.), Bonn.
- Tegut (2015) Was ist Nachhaltigkeit? Nachhaltige Lebensmittel – Woran erkenne ich diese und was kann ich als Verbraucher für Nachhaltigkeit tun? <https://www.tegut.com/aktuell/artikel/was-ist-nachhaltigkeit.html> (letzter Zugriff: 10.12.2019).
- Teller C, Holweg C, Reiner G, Kotzab H (2018) Retail store operations and food waste. *Journal of Cleaner Production* 185: 981-997. Doi: 10.1016/j.jclepro.2018.02.280.
- Temple NJ, Nowrouzi B (2013). Buffets and obesity. *Clinical Nutrition* 32(4): 664-665. Doi: 10.1016/j.clnu.2012.07.005.

- Tenhagen BA, Werner N, Kasbohrer A, Kreienbrock L (2018) Übertragungswege resistenter Bakterien zwischen Tieren und Menschen und deren Bedeutung – Antibiotikaresistenz im One-Health-Kontext. *Bundesgesundheitsblatt* 61(5): 515-521. Doi: 10.1007/s00103-018-2717-z.
- ter Borg S, Verlaan S, Hemsworth J, Mijnders DM, Schols JMGA, Luiking YC, de Groot LCPGM (2015) Micronutrient intakes and potential inadequacies of community dwelling older adults: A systematic review. *British Journal of Nutrition* 113(8): 1195-1206. Doi: 10.1017/S0007114515000203.
- Tesco (2012) Product Carbon Footprint Summary. [https://www.tescopl.com/assets/files/cms/Tesco\\_Product\\_Carbon\\_Footprints\\_Summary\(1\).pdf](https://www.tescopl.com/assets/files/cms/Tesco_Product_Carbon_Footprints_Summary(1).pdf) (letzter Zugriff: 10.01.2020).
- Textor MR, Bostelmann A (2018) Aktuelle statistische Daten zur Kindertagesbetreuung. <https://www.kindergartenpaedagogik.de/fachartikel/kita-politik/bildungspolitik/1650> (letzter Zugriff: 10.01.2020).
- Thaler RH, Sunstein CR (2008) *Nudge: Improving Decisions about health, wealth, and happiness*. Yale University Press, New Haven & London.
- The Food Foundation (2017) UK's restrictions on junk food advertising to children. International Learning Series, No. 3. [https://foodfoundation.org.uk/wp-content/uploads/2017/07/3-Briefing-UK-Junk-Food\\_vF.pdf](https://foodfoundation.org.uk/wp-content/uploads/2017/07/3-Briefing-UK-Junk-Food_vF.pdf) (letzter Zugriff: 10.01.2020).
- The Montpellier Panel (2013) Sustainable Intensification: A New Paradigm for African Agriculture, London. <https://ag4impact.org/wp-content/uploads/2014/07/Montpellier-Panel-Report-2013-Sustainable-Intensification-A-New-Paradigm-for-African-Agriculture-1.pdf> (letzter Zugriff: 20.12.2019).
- The Royal Society (2009) Reaping the benefits: Science and the sustainable intensification of global agriculture. London. <https://royalsociety.org/topics-policy/publications/2009/reaping-benefits/> (letzter Zugriff: 20.12.2019).
- Thiele S (2014) Neuer Ansatz zur Ermittlung eines ALG-II-Mehrbedarfs für eine vollwertige Ernährung. *Ernährungsumschau* 61(2): 32-37. Doi: 10.4455/er.2014.
- Thiele S, Roosen J (2018) Obesity, fat taxes and their effects on consumers. In: Bremmers H, Purnhagen K (eds.) *Regulating and managing food safety in the EU. Economic Analysis of Law in European Legal Scholarship* 6: 169-193. Doi: 10.1007/978-3-319-77045-1\_9.
- Thießen F, Fischer C (2008) Die Höhe der sozialen Mindestsicherung – Eine Neuberechnung „bottom up“. *Zeitschrift für Wirtschaftspolitik* 57(2): 145-173. Doi: 10.1515/zfwp-2008-0203.
- Thøgersen J, Nielsen K (2016) Better carbon footprint label. *Journal of Cleaner Production* 125: 86-94. Doi: 10.1016/j.jclepro.2016.03.098.
- Thöne M, Gierkink M, Pickert L, Kreuter H, Decker H (2019) CO<sub>2</sub>-Bepreisung im Gebäudesektor und notwendige Zusatzinstrumente. Studie im Auftrag des ZIA, Zentraler Immobilien Ausschuss e. V., Universität zu Köln, Energiewirtschaftliches Institut und Finanzwissenschaftliches Forschungsinstitut, Köln.
- Thow AM, Downs S, Jan S (2014) A systematic review of the effectiveness of food taxes and subsidies to improve diets: Understanding the recent evidence. *Nutrition Reviews* 72(9): 551-565. Doi: 10.1111/nure.12123.
- Tilman D, Clark M (2014) Global diets link environmental sustainability and human health. *Nature* 515: 518-522. Doi: 10.1038/nature13959.

- Timmermans B, Achten WMJ (2018) From value-added tax to a damage and value-added tax partially based on life cycle assessment: Principles and feasibility. *The International Journal of Life Cycle Assessment* 23: 2217-2247. Doi: 10.1007/s11367-018-1439-7.
- Timpson H, Lavin R, Hughes L (2013) Exploring the acceptability of a tax on sugar-sweetened beverages. Insight work. Liverpool John Moores University, Centre for Public Health, Liverpool.
- Tobler C, Visschers VHM, Siegrist M (2011) Eating green. Consumers' willingness to adopt ecological food consumption behaviors. *Appetite* 57(3): 674-682. Doi: 10.1016/j.appet.2011.08.010.
- Tobsch V, Becker I (2017) Regelsätze in Hartz IV – Kritik und Hinweise zu einer sachgerechten Regelsatzermittlung. *Armutskongress 2017*. [https://www.armutskongress.de/fileadmin/files/Dokumente/AK\\_Dokumente/VortragTobsch\\_27062017.pdf](https://www.armutskongress.de/fileadmin/files/Dokumente/AK_Dokumente/VortragTobsch_27062017.pdf) (letzter Zugriff: 13.12.2019).
- Toepel U, Knebel JF, Hudry J, le Coutre J, Murray MM (2009) The brain tracks the energetic value in food images. *Neuroimage* 44(3): 967-974. Doi: 10.1016/j.neuroimage.2008.10.005.
- Toews I, Lohner S, Küllenberg de Gaudry D, Sommer H, Meerpohl JJ (2019) Association between intake of non-sugar sweeteners and health outcomes: Systematic review and meta-analyses of randomised and non-randomised controlled trials and observational studies. *BMJ* 364: k4718. Doi: 10.1136/bmj.k4718.
- Tönnies T, Röckl S, Hoyer A, Heidemann C, Baumert J, Du Y, Scheidt-Nave C, Brinks R (2019) Projected number of people with diagnosed Type 2 diabetes in Germany in 2040. *Diabetic Medicine* 36(10): 1217-1225. Doi: 10.1111/dme.13902.
- Tørris C, Mobekk H (2019) Improving cardiovascular health through nudging healthier food choices: A systematic review. *Nutrients* 11: e2520. Doi: 10.3390/nu11102520.
- Tovey M (2017) Obesity and the public purse: Weighing up the true cost to the taxpayer. IEA Discussion Paper No. 80. <https://iea.org.uk/publications/obesity-and-the-public-purse/> (letzter Zugriff: 10.01.2020).
- Travaille KLT, Lindley J, Kendrick GA, Crowder LB, Clifton J (2019) The market for sustainable seafood drives transformative change in fishery social-ecological systems. *Global Environmental Change* 57: 101919. Doi: 10.1016/j.gloenvcha.2019.05.003.
- Tregear A (2011) Progressing knowledge in alternative and local food networks: Critical reflections and a research agenda. *Journal of Rural Studies* 27(4): 419-430. Doi: 10.1016/j.jrurstud.2011.06.003.
- Tremmel M, Gerdtham UG, Nilsson PM, Saha S (2017) Economic burden of obesity: A systematic literature review. *International Journal of Environmental Research and Public Health* 14(4): e435. Doi: 10.3390/ijerph14040435.
- Treu H, Nordborg M, Cederberg C, Heuer T, Claupein E, Hoffmann H, Berndes G (2017) Carbon footprints and land use of conventional and organic diets in Germany. *Journal of Cleaner Production* 161: 127-142. Doi: 10.1016/j.jclepro.2017.05.041.
- Trott H, Wachendorf M, Ingwersen B, Taube F (2004) Performance and environmental effects of forage production on sandy soils. Impact of defoliation system and nitrogen input on performance and N balance of grassland. *Grass and Forage Science* 59(1): 41-55. Doi: 10.1111/j.1365-2494.2004.00405.x.
- Trübswasser U, Branca F (2009) Nutrition policy is taking shape in Europe. *Public Health Nutrition* 12(3): 295-306. Doi: 10.1017/S1368980009004753.

- Truman E, Elliott C (2019) Barriers to food literacy: A conceptual model to explore factors inhibiting proficiency. *Journal of Nutrition Education and Behavior* 51: 107-111. Doi: 10.1016/j.jneb.2018.08.008.
- Truman E, Lane D, Elliott C (2017) Defining food literacy: A scoping review. *Appetite* 116: 365-371. Doi: 10.1016/j.appet.2017.05.007.
- Trummer M (2015) Die kulturellen Schranken des Gewissens – Fleischkonsum zwischen Tradition, Lebensstil und Ernährungswissen. In: Hirschfelder G, Ploeger A, Rückert-John J, Schönberger G (Hrsg.) *Was der Mensch essen darf*. Springer Fachmedien, Wiesbaden: 63-79.
- Trumpff C, de Schepper J, Tafforeau J, van Oyen H, Vanderfaeillie J, Vandevijvere S (2013) Mild iodine deficiency in pregnancy in Europe and its consequences for cognitive and psychomotor development of children: A review. *Journal of Trace Elements in Medicine and Biology* 27(3): 174-183. Doi: 10.1016/j.jtemb.2013.01.002.
- Tscharntke T, Milder JC, Schroth G, Clough Y, DeClerck F, Waldron A, Rice R, Ghazoul J (2015) Conserving biodiversity through certification of tropical agroforestry crops at local and landscape scales. *Conservation Letters* 8: 14-23. Doi: 10.1111/conl.12110.
- Tselengidis A, Östergren PO (2018) Lobbying against sugar taxation in the European Union: Analysing the lobbying arguments and tactics of stakeholders in the food and drink industries. *Scandinavian Journal of Public Health* 47(5): 565-575. Doi: 10.1177/1403494818787102.
- Tuck SL, Winqvist C, Mota F, Ahnström J, Turnbull LA, Bengtsson J (2014) Land-use intensity and the effects of organic farming on biodiversity. A hierarchical meta-analysis. *Journal of Applied Ecology* 51(3): 746-755. Doi: 10.1111/1365-2664.12219.
- Tuomisto HL, Hodge ID, Riordan P, Macdonald DW (2012) Does organic farming reduce environmental impacts? A meta-analysis of European research. *Journal of Environmental Management* 112: 309-320. Doi: 10.1016/j.jenvman.2012.08.018.
- Turner L, Guthrie JF, Ralston K (2019) Community eligibility and other provisions for universal free meals at school: Impact on student breakfast and lunch participation in California public schools. *Translational Behavioral Medicine* 9(5): 931-941. Doi: 10.1093/tbm/ibz090.
- UBA (Umweltbundesamt) (1999) *Bewertung in Ökobilanzen. Methode des Umweltbundesamtes zur Normierung von Wirkungsindikatoren, Ordnung (Rangbildung) von Wirkungskategorien und zur Auswertung nach ISO 14042 und 14043*. Texte 92/99, Berlin.
- UBA (Umweltbundesamt) (2012) *Daten zum Verkehr*, Ausgabe 2012. <https://www.umweltbundesamt.de/sites/default/files/medien/publikation/long/4364.pdf> (letzter Zugriff: 10.12.2019).
- UBA (Umweltbundesamt) (2013) *Plastiktüten*. <https://www.umweltbundesamt.de/sites/default/files/medien/479/publikationen/4453.pdf> (letzter Zugriff: 10.12.2019).
- UBA (Umweltbundesamt) (2017) *Umweltschutz in der Landwirtschaft. 2. aktualisierte Fassung*, April 2017, Dessau-Roßlau.
- UBA (Umweltbundesamt) (2018a) *Aufkommen und Verwertung von Verpackungsabfällen in Deutschland im Jahr 2016*. [https://www.umweltbundesamt.de/sites/default/files/medien/2546/publikationen/aufkommen\\_und\\_verwertung\\_von\\_verpackungsabfaellen\\_in\\_deutschland\\_im\\_jahr\\_2016\\_final.pdf](https://www.umweltbundesamt.de/sites/default/files/medien/2546/publikationen/aufkommen_und_verwertung_von_verpackungsabfaellen_in_deutschland_im_jahr_2016_final.pdf) (letzter Zugriff: 13.12.2019).

- UBA (Umweltbundesamt) (2018b) Verpackungsabfälle.  
<https://www.umweltbundesamt.de/daten/ressourcen-abfall/verwertung-entsorgung-ausgewaehlter-abfallarten/verpackungsabfaelle> (letzter Zugriff: 10.12.2019).
- UBA (Umweltbundesamt) (2018c) Umwelt und Landwirtschaft. Daten zur Umwelt. Ausgabe 2018, Dessau-Roßlau.  
<https://www.umweltbundesamt.de/publikationen/daten-zur-umwelt-2018-umwelt-landwirtschaft> (letzter Zugriff: 10.12.2019).
- UBA (Umweltbundesamt) (2019a) Stickstoff.  
<https://www.umweltbundesamt.de/themen/boden-landwirtschaft/umweltbelastungen-der-landwirtschaft/stickstoff> (letzter Zugriff: 13.12.2019).
- UBA (Umweltbundesamt) (2019b) Grundwasserbeschaffenheit.  
<https://www.umweltbundesamt.de/daten/wasser/grundwasserbeschaffenheit> (letzter Zugriff: 13.12.2019).
- UBA (Umweltbundesamt) (2019c) Siedlungs- und Verkehrsfläche.  
<https://www.umweltbundesamt.de/daten/flaeche-boden-land-oekosysteme/flaeche/siedlungs-verkehrsflaeche> (letzter Zugriff: 13.12.2019).
- UBA (Umweltbundesamt) (2019d) Treibhausgas-Emissionen in der Europäischen Union.  
<https://www.umweltbundesamt.de/daten/klima/treibhausgas-emissionen-in-der-europaeischen-union> (letzter Zugriff: 13.12.2019).
- UBA (Umweltbundesamt) (2019e) Konsum und Umwelt: Zentrale Handlungsfelder, 20.05.2019.  
<https://www.umweltbundesamt.de/themen/wirtschaft-konsum/konsum-umwelt-zentrale-handlungsfelder> (letzter Zugriff: 13.12.2019).
- UBA (Umweltbundesamt) (2019f) Lachgas und Methan.  
<https://www.umweltbundesamt.de/themen/boden-landwirtschaft/umweltbelastungen-der-landwirtschaft/lachgas-methan> (letzter Zugriff: 13.12.2019).
- UK Health Forum (2018) Public health and the food and drinks industry: The governance and ethics of interaction. Lessons from research, policy and practice, London.
- UN (United Nations) (1982) United Nations Convention on the Law of the Sea (UNCLOS).  
[http://www.un.org/Depts/los/convention\\_agreements/convention\\_overview\\_convention.htm](http://www.un.org/Depts/los/convention_agreements/convention_overview_convention.htm) (letzter Zugriff: 13.12.2019).
- UN (United Nations) (1992) Convention on Biological Diversity, CBD.  
<https://www.cbd.int/convention/text/> (letzter Zugriff: 19.12.2019).
- UN (United Nations) (2002) The Johannesburg Declaration on Sustainable Development. A/CONF.199/L.6/Rev.2.  
[http://www.un.org/ga/search/view\\_doc.asp?symbol=A/CONF.199/L.6/Rev.2&Lang=E](http://www.un.org/ga/search/view_doc.asp?symbol=A/CONF.199/L.6/Rev.2&Lang=E) (letzter Zugriff: 13.12.2019).
- UN (United Nations) (2015) Transforming our world: The 2030 agenda for sustainable development. A/Res/70/1, resolution adopted by the General Assembly on 25 September 2015.  
[http://www.un.org/ga/search/view\\_doc.asp?symbol=A/RES/70/1&Lang=E](http://www.un.org/ga/search/view_doc.asp?symbol=A/RES/70/1&Lang=E) (letzter Zugriff: 20.12.2019).
- UNCTAD (United Nations Conference on Trade and Development) (2013) World Investment Report 2013. Global Value Chains: Investment and Trade for Development. New York and Geneva.
- UNEP (United Nations Environment Programme) (2009) Guidelines for social life cycle assessment of products.  
<https://wedocs.unep.org/handle/20.500.11822/7912> (letzter Zugriff: 13.12.2019).

- UNESCO (United Nations Educational, Scientific and Cultural Organization) (2017) Education for Sustainable Development Learning Objectives, Paris.
- UNICEF (World Health Organization, International Bank for Reconstruction and Development/The World Bank) (2019) Levels and trends in child malnutrition: Key findings of the 2019 edition of the Joint Child Malnutrition Estimates, Geneva.
- USDA (U.S. Department of Agriculture) (2017) USDA Agricultural Projections to 2026. Office of the Chief Economist, World Agricultural Outlook Board, U.S. Department of Agriculture. Prepared by the Interagency Agricultural Projections Committee. Long-term Projections Report OCE-2017-1, Washington, D.C.
- Utter J, Denny S, Lucassen M, Dyson B (2016) Adolescent cooking abilities and behaviors: Associations with nutrition and emotional well-being. *Journal of Nutrition Education and Behavior* 48(1): 35-41. Doi: 10.1016/j.jneb.2015.08.016.
- Uusitupa M, Hermansen K, Savolainen MJ, Schwab U, Kolehmainen M, Brader L, Mortensen LS, Cloetens L, Johansson-Persson A, Onning G, Landin-Olsson M, Herzig KH, Hukkanen J, Rosqvist F, Iggman D, Paananen J, Pulkki KJ, Siloaho M, Dragsted L, Barri T, Overvad K, Bach Knudsen KE, Hedemann MS, Arner P, Dahlman I, Borge GI, Baardseth P, Ulven SM, Gunnarsdottir I, Jónsdóttir S, Thorsdóttir I, Orešič M, Poutanen KS, Risérus U, Akesson B (2013) Effects of an isocaloric healthy nordic diet on insulin sensitivity, lipid profile and inflammation markers in metabolic syndrome – a randomized study (SYSDIET). *Journal of Internal Medicine* 274(1): 52-66. Doi: 10.1111/joim.12044.
- Vallgård S, Holm, L, Jensen JD (2015) The Danish tax on saturated fat: Why it did not survive. *European Journal of Clinical Nutrition* 69(2): 223-226. Doi: 10.1038/ejcn.2014.224.
- van den Broeck G, Maertens M (2016) Horticultural exports and food security in developing countries. *Global Food Security* 10: 11-20. Doi: 10.1016/j.gfs.2016.07.007.
- van der Ven H, Rothacker C, Cashore B (2018) Do eco-labels prevent deforestation? Lessons from non-state market driven governance in the soy, palm oil, and cocoa sectors. *Global Environmental Change* 52: 141-151. Doi: 10.1016/j.gloenvcha.2018.07.002.
- van Dooren C, Doouma A, Aikung H, Vellinga P (2017) Proposing an novel index reflecting both climate impact and nutritional impact of food products. *Ecological Economics* 131: 389-398. Doi: 10.1016/j.ecolecon.2016.08.029.
- van Grinsven HJM, Tiktak A, Rougoor CW (2016) Evaluation of the Dutch implementation of the nitrates directive, the water framework directive and the national emission ceilings directive. *NJAS – Wageningen Journal of Life Sciences* 78: 69-84. Doi: 10.1016/j.njas.2016.07.002.
- van Grinsven HJM, Holland M, Jacobsen BH, Klimont Z, Sutton MA, Willems WJ (2013) Costs and Benefits of Nitrogen for Europe and Implications for Mitigation. *Environmental Science & Technology* 47(8): 3571-3579. Doi: 10.1021/es303804g.
- van Hulst M, Yanow D (2016) From policy “frames” to “framing”: Theorizing a more dynamic, political approach. *The American Review of Public Administration* 46(1): 92-112. Doi: 10.1177/0275074014533142.
- van Passel S (2013) Food miles to assess sustainability: A revision. *Sustainable Development* 21(1): 1-17. Doi: 10.1002/sd.485.
- van Rijsbergen B, Elbers W, Ruben R, Njuguna SN (2016) The ambivalent impact of coffee certification on farmers’ welfare: A matched panel approach for cooperatives in central Kenya. *World Development* 77: 277-292. Doi: 10.1016/j.worlddev.2015.08.021.

- van Rossum CTM, Fransen HP, Verkaik-Kloosterman J, Buurma-Rethans EJM, Ocké MC (2011) Dutch National Food Consumption Survey 2007-2010. National Institute for Public Health and the Environment, Den Haag.
- van Wart J, Kersebaum KC, Peng S, Milner M, Cassman KG (2013) Estimating crop yield potential at regional to national scales. *Field Crops Research* 143: 34-43. Doi: 10/gf2ppf.
- van Zanten HHE, Meerburg BG, Bikker P, Herrero M, de Boer IJM (2015) Opinion paper: The role of livestock in a sustainable diet: A land-use perspective. *Animal* 10(4): 547-549. Doi: 10.1017/S1751731115002694.
- Vanderhaegen K, Akoyi KT, Dekoninck W, Jocqué R, Muys B, Verbist B, Maertens M (2018) Do private coffee standards 'walk the talk' in improving socio-economic and environmental sustainability? *Global Environmental Change* 51: 1-9. Doi: 10.1016/j.gloenvcha.2018.04.014.
- Vandevijvere S, Chow CC, Hall KD, Umali E, Swinburn BA (2015) Increased food energy supply as a major driver of the obesity epidemic: A global analysis. *Bulletin of the World Health Organization* 93: 446-456. Doi: 10.2471/BLT.14.150565.
- Vandevijvere S, Mackay S, D'Souza E, Swinburn B (2018) How healthy are New Zealand food environments? A comprehensive assessment 2014-2017. The University of Auckland, Auckland, New Zealand.
- VanEpps EM, Roberto CA (2016) The influence of sugar-sweetened beverage warnings: A randomized trial of adolescents' choices and beliefs. *American Journal of Preventive Medicine* 51: 664-672. Doi: 10.1016/j.amepre.2016.07.010.
- Vanhonacker F, van Loo EJ, Gellynck X, Verbeke W (2013) Flemish consumer attitudes towards more sustainable food choices. *Appetite* 62: 7-16. Doi: 10.1016/j.appet.2012.11.003.
- Vanhonacker F, Verbeke W (2014) Public and consumer policies for higher welfare food products: Challenges and opportunities. *Journal of Agricultural and Environmental Ethics* 27: 153-171. Doi: 10/f5sjq3.
- Vartanian LR, Schwartz MB, Brownell KD (2007) Effects of soft drink consumption on nutrition and health: A systematic review and meta-analysis. *American Journal of Public Health* 97: 667-675. Doi: 10.2105/AJPH.2005.08378.
- Vázquez-Rowe I, Moreira MT, Feijoo G (2012) Inclusion of discard assessment indicators in fisheries life cycle assessment studies. Expanding the use of fishery-specific impact categories. *The International Journal of Life Cycle Assessment* 17(5): 535-549. Doi: 10.1007/s11367-012-0395-x.
- VDFD (Verband Deutscher Fischereiverwaltungsbeamter und Fischereiwissenschaftler e. V.) – Arbeitskreis Tierschutzindikatoren (2016) Leitfaden „Tierschutzindikatoren“ mit Empfehlungen für die Durchführung betrieblicher Eigenkontrollen gemäß § 11 Absatz 8 des Tierschutzgesetzes in Aquakulturbetrieben.  
[http://www.vdff-fischerei.de/fileadmin/daten/Leitfaden\\_Tierschutzindikatoren\\_Aquakultur\\_V1\\_final\\_Maerz\\_2016.pdf](http://www.vdff-fischerei.de/fileadmin/daten/Leitfaden_Tierschutzindikatoren_Aquakultur_V1_final_Maerz_2016.pdf) (letzter Zugriff: 13.12.2019).
- VDM (Verband Deutscher Mineralbrunnen e.V.) (2019) Branchendaten 2018.  
[https://www.vdm-bonn.de/index.php?eID=tx\\_nawsecuredl&u=0&g=0&t=1576077285&hash=dc1de74f379eed8d09b31f92ea2328a10d553179&file=fileadmin/user\\_upload/Mineralwasserfakten/Marktdaten/Branchendaten\\_2018.pdf](https://www.vdm-bonn.de/index.php?eID=tx_nawsecuredl&u=0&g=0&t=1576077285&hash=dc1de74f379eed8d09b31f92ea2328a10d553179&file=fileadmin/user_upload/Mineralwasserfakten/Marktdaten/Branchendaten_2018.pdf) (letzter Zugriff: 10.12.2019).
- Velasco I, Bath SC, Rayman MF (2018) Iodine as an essential nutrient during the first 1000 days of life. *Nutrients* 10(3): e290. Doi: 10.3390/nu10030290.

- Verband Deutscher Mineralbrunnen (2019) Pro-Kopf-Verbrauch von Mineral- und Heilwasser. <https://www.mineralwasser.com/nc/presse/marktdaten.html> (letzter Zugriff: 04.12.2019).
- Vereinte Nationen (2015) Resolution der Generalversammlung, verabschiedet am 25. September 2015. Transformation unserer Welt: Die Agenda 2030 für nachhaltige Entwicklung. <https://www.un.org/Depts/german/gv-70/band1/ar70001.pdf> (letzter Zugriff: 05.12.2019).
- Verjans-Janssen SRB, van de Kolk I, van Kann DHH, Kremers SPJ, Gerards SMPL (2018) Effectiveness of school-based physical activity and nutrition interventions with direct parental involvement on children`s BMI and energy balance related behaviors – A systematic review. *PLOS ONE* 13(9): e0204560. Doi: 10.1371/journal.pone.0204560.
- Verkaik-Kloosterman J, Buurma-Rethans EJM, Dekkers ALM, van Rossum CTM (2017) Decreased, but still sufficient, iodine intake of children and adults in the Netherlands. *The British Journal of Nutrition* 117(7): 1020-1031. Doi: 10.1017/S0007114517000733.
- Vermeir I, Verbeke W (2006) Sustainable food consumption: Exploring the consumer „attitude – behavioral intention“ gap. *Journal of Agricultural and Environmental Ethics* 19: 169-194. Doi: 10.1007/s10806-005-5485-3.
- Vieira FCB, Bayer C, Mielniczuk J, Zanatta J, Bissani CA (2008) Long-term acidification of a Brazilian Acrisol as affected by no till cropping systems and nitrogen fertilizer. *Australian Journal of Soil Research* 46(1): 17-26. Doi: 10.1071/SR07088.
- Villanueva T (2011) European nations launch tax attack on unhealthy foods. *CMAJ* 183(17): e1229-e1230. Doi: 10.1503/cmaj.109-4031.
- Villinger K, Wahl DR, Boeing H, Schupp HT, Renner B (2019) The Effectiveness of app-based mobile interventions on nutrition behaviors and nutrition-related health outcomes: A Systematic review and meta-Analysis. *Obesity Reviews* 20(10): 1465-1484. Doi: 10.1111/obr.12903.
- Voget-Kleschin L (2015) Reasoning claims for more sustainable food consumption: A capabilities perspective. *Journal of Agricultural and Environmental Ethics* 28(3): 455-477 Doi: 10.1007/s10806-014-9503-1.
- Voget-Kleschin L, Hampicke U (2016) Landwirtschaft und Ernährung. In: Ott K, Dierks J, Voget-Kleschin L (Hrsg.) *Handbuch Umweltethik*. Metzler, Stuttgart, s.l.: 247-256.
- Voget-Kleschin L, Meisch S (2015) Concepts and conceptions of sustainable development: A comparative perspective. In: Meisch S, Lundershausen J, Bossert L, Rockoff M (eds.) *Ethics of science in the research for sustainable development*. 1. Aufl. Nomos, Baden-Baden: 45-72.
- Volkert D (Hrsg.) (2015) *Ernährung im Alter*. Walter De Gruyter, Berlin.
- Volkert D, Bollwein J, Diekmann R, Sieber C (2011) Die Rolle der Ernährung bei der Entstehung von Sarkopenie und Frailty. *Ernährungsumschau* 9/2011: 486-493. Doi: 10.4455/eu.2011.957.
- Volkert D, Chourdakis M, Faxen-Irving G, Frühwald T, Landi F, Suominen MH, Vandewoude M, Wirth R, Schneider SM (2015) Espen guidelines on nutrition in dementia. *Clinical Nutrition* 34(6): 1052-1073. Doi: 10.1016/j.clnu.2015.09.004.
- Volkert D, Heseker H, Stehle P (2012) Ernährungssituation von Seniorinnen und Senioren mit Pflegebedarf in Privathaushalten (ErnSiPP-Studie). In: DGE (Hrsg.) *Ernährungsbericht 2012*, Bonn: 137-187.

- Volkert D, Weber J, Kiesswetter E, Sulz I, Hiesmayr M (2019) Ernährungssituation in Krankenhäusern und Pflegeheimen – Auswertung der nutritionDay-Daten für Deutschland. In: Deutsche Gesellschaft für Ernährung (DGE) (Hrsg.) 14. DGE-Ernährungsbericht – Vorveröffentlichung Kapitel 2, Bonn 2019: V6-V65.  
<https://www.dge.de/fileadmin/public/doc/ws/dgeeb/14-dge-eb/14-DGE-EB-Vorveroeffentlichung-Kapitel2.pdf> (letzter Zugriff: 13.12.2019).
- Volpe R, Messineo S, Volpe M, Messineo A (2015) Carbon footprint of tree nuts based consumer products. *Sustainability* 7(11): 14917-14934. Doi: 10.3390/su71114917.
- von Braun J, Díaz-Bonilla E (eds.) (2007) *Globalization of Food and Agriculture and the Poor*. Oxford University Press, New York. Doi: 10.22004/ag.econ.46012.
- von Flotow P, Schmidt J (2001) Evaluation von Selbstverpflichtungen der Verbände der chemischen Industrie Oestrich-Winkel. *Arbeitspapiere des Instituts für Ökologie und Unternehmensführung e. V.*, Bd. 36, Oestrich-Winkel.
- von Gleich A, Kursawe F, Nachtigall W (2001) *Bionik. Ökologische Technik nach dem Vorbild der Natur?* 2. Aufl., B.G. Teubner Verlag, Leipzig.
- von Körber K, Männle T, Leitzmann C (2012) *Vollwert-Ernährung. Konzeption einer zeitgemäßen und nachhaltigen Ernährung*. 11. Auflage, Thieme-Verlag, Stuttgart.
- von Meyer-Höfer M (2016) Small is beautiful? Zum Zusammenhang von Betriebsgröße und Tierwohl. In: Lange J (Hrsg.) *Small is beautiful? Betriebsgrößen und multifunktionale Landwirtschaft*. *Loccumer Protokoll* 05/16: 107-120.
- von Meyer-Höfer M, Nitzko S, Spiller A (2015) Is there an expectation gap? Consumers' expectations towards organic. *British Food Journal* 117(5): 1527-1546.
- von Meyer-Höfer M, Spiller A (2013) Anforderungen an eine nachhaltige Land- und Ernährungswirtschaft: Die Rolle des Konsumenten. In: Kuratorium für Technik und Bauwesen in der Landwirtschaft e.V. (KTBL) (Hrsg.) *Steuerungsinstrumente für eine nachhaltige Land- und Ernährungswirtschaft – Stand und Perspektiven*, KTBL-Schrift 500, Darmstadt: 7-15.
- von Normann K (2008) Ernährungsarmut und „Tafelarbeit“ in Deutschland. Distributionspolitische Hintergründe und nonprofit-basierte Lösungsstrategien. In: Selke S (Hrsg.) *Tafeln in Deutschland*. VS Verlag für Sozialwissenschaften, Wiesbaden: 91-112. Doi: 10.1007/978-3-531-92808-1\_4.
- von Philipsborn P, Stratil JM, Burns J, Busert LK, Pfadenhauer LM, Polus S, Holzapfel C, Hauner H, Rehfues E (2019) Environmental interventions to reduce the consumption of sugar-sweetened beverages and their effects on health. *Cochrane Database of Systematic Reviews* 6: CD012292. Doi: 10.1002/14651858.CD012292.pub2.
- Voss H, Davis M, Sumner M, Waite L, Ras IA, Singhal D, Jog D (2019) International supply chains: Compliance and engagement with the Modern Slavery Act. *Journal of the British Academy* 7(s1): 61-76. Doi: 10.5871/jba/007s1.061.
- vzbv (2014) *Lebensmittel mit Gesundheitsversprechen - Wirklich gesünder? Gesundheitsbezogene Aussagen – Bundesweite Markterhebung, Bericht Dezember 2014*, Berlin.
- Wackernagel M, Cranston G, Morales JC, Galli A (2014) Ecological footprint accounts. In: Atkinson G, Dietz S, Neumayer E, Agarwala M (Hrsg.) *Handbook of Sustainable Development*. Elgar, Cheltenham [u.a.]: 371-396.
- Wackernagel M, Rees W (1997) Perceptual and structural barriers to investing in natural capital: economics from an ecological footprint perspective. *Ecological Economics* 20(3): 3-24. Doi: 10.1016/S0921-8009(96)00077-8.

- wafg (Wirtschaftsvereinigung Alkoholfreie Getränke) (2019) Entwicklung des Pro-Kopf-Verbrauchs von Alkoholfreien Getränken nach Getränkearten 2012-2018. <https://www.wafg.de/fileadmin/dokumente/pro-kopf-verbrauch.pdf> (letzter Zugriff: 19.12.2019).
- Wagner MG, Rhee Y, Honrath K, Blodgett Salafia EH, Terbizan D (2016) Nutrition education effective in increasing fruit and vegetable consumption among overweight and obese adults. *Appetite* 100: 94-101. Doi: 10.1016/j.appet.2016.02.002.
- Wahl DR, Villinger K, Blumenschein M, König L, Ziesemer K, Sproesser G, Schupp HT, Renner B (2019) Why we eat what we eat: Dispositional and in-the-moment eating motives. *JMIR mHealth and uHealth*. Doi: 10.2196/13191.
- Wahl DR, Villinger K, Blumenschein M, König L, Ziesemer K, Sproesser G, Schupp HT, Renner B (2020) Why we eat what we eat: Assessing dispositional and in-the-moment eating motives by using ecological momentary assessment. *JMIR mHealth and uHealth* 8(1): e13191. Doi: 10.2196/13191.
- Wahl DR, Villinger K, König LM, Ziesemer K, Schupp HT, Renner B (2017) Healthy food choices are happy food choices: Evidence from a real life sample using smartphone based assessments. *Scientific Reports* 7(1): 17069. Doi: 10.1038/s41598-017-17262-9.
- Waiguny M (2011) *Entertaining Persuasion: Die Wirkungen von Advergames auf Kinder*. Gabler-Verlag, Springer Fachmedien, Wiesbaden.
- Wakefield MA, Loken B, Hornik RC (2010) Use of mass media campaigns to change health behaviour. *The Lancet* 376(9748): 1261-1271. Doi: 10.1016/S0140-6736(10)60809-4.
- Wall S (2012) Perfectionism in Moral and Political Philosophy. In: *The Stanford Encyclopedia of Philosophy* (Winter 2012 edition), zuletzt geprüft am 19.07.2017.
- Wang EY (2015) The impact of soda taxes on consumer welfare: Implications of storability and taste heterogeneity. *The RAND Journal of Economics* 46(2): 409-441. Doi: 10.1111/1756-2171.12090.
- Wang YC, Coxson P, Shen YM, Goldman L, Bibbins-Domingo K (2012) A penny-per-ounce tax on sugar-sweetened beverages would cut health and cost burdens of diabetes. *Health Affairs* 31(1): 199-207. Doi: 10.1377/hlthaff.2011.0410.
- Wansink B, Payne CR (2009) The joy of cooking too much: 70 Years of calorie increases in classic recipes. *Annals of Internal Medicine* 150(4): 291-292. Doi: 10.7326/0003-4819-150-4-200902170-00028.
- Wansink B, Sobal J (2007) Mindless eating: The 200 daily food decisions we overlook. *Environment and Behavior* 39(1): 106-123. Doi: 10.1177/0013916506295573.
- Waskow F, Blumenthal A (2018) *Abfallarme Schulverpflegung. Ein Ratgeber für Verpflegungsanbieter, Schulen und Träger*. Verbraucherzentrale Nordrhein-Westfalen, Düsseldorf.
- Waterlander WE, de Boer MR, Schuit AJ, Seidell JC, Steenhuis IH (2013) Price discounts significantly enhance fruit and vegetable purchases when combined with nutrition education: A randomized controlled supermarket trial. *American Journal of Clinical Nutrition* 97: 886-895. Doi: 10.3945/ajcn.112.041632.
- Waterlander WE, de Haas WE, van Amstel I, Schuit AJ, Twisk JW, Visser M, Seidell JC, Steenhuis IH (2010) Energy density, energy costs and income – How are they related? *Public Health Nutrition* 13(10): 1599-1608. Doi: 10.1017/S1368980009992989.

- Watson WL, Lau V, Wellard L, Hughes C, Chapman K (2017) Advertising to children initiatives have not reduced unhealthy food advertising on Australian television. *Journal of Public Health* 39(4): 787-792. Doi: 10.1093/pubmed/fox004.
- WBA (Wissenschaftlicher Beirat für Agrarpolitik) (2010) Koexistenz Gentechnik in der Land- und Ernährungswirtschaft. Stellungnahme, Berlin.
- WBA (Wissenschaftlicher Beirat für Agrarpolitik) (2011) Einführung eines Tierschutzlabels in Deutschland. Kurzstellungnahme, Berlin.
- WBA (Wissenschaftlicher Beirat für Agrarpolitik) (2012) Ernährungssicherung und nachhaltige Produktivitätssteigerung. Stellungnahme, Berlin.
- WBA (Wissenschaftlicher Beirat für Agrarpolitik) (2015) Wege zu einer gesellschaftlich akzeptierten Nutztierhaltung. Gutachten, Berlin.
- WBA, WBD, SRU (Wissenschaftlicher Beirat für Agrarpolitik, Wissenschaftlicher Beirat für Düngungsfragen, Sachverständigenrat für Umweltfragen der Bundesregierung) (2013) Novellierung der Düngeverordnung: Nährstoffüberschüsse wirksam begrenzen. Kurzstellungnahme, Berlin.
- WBAE (Wissenschaftlicher Beirat für Agrarpolitik, Ernährung und gesundheitlichen Verbraucherschutz) (2018) Für eine gemeinwohlorientierte Gemeinsame Agrarpolitik der EU nach 2020: Grundsatzfragen und Empfehlungen. Stellungnahme, Berlin.
- WBAE (Wissenschaftlicher Beirat für Agrarpolitik, Ernährung und gesundheitlichen Verbraucherschutz) (2019) Zur effektiven Gestaltung der Agrarumwelt- und Klimaschutzpolitik im Rahmen der Gemeinsamen Agrarpolitik der EU nach 2020. Stellungnahme, Berlin.
- WBAE, WBW (Wissenschaftlicher Beirat für Agrarpolitik, Ernährung und gesundheitlichen Verbraucherschutz, Wissenschaftlicher Beirat für Waldpolitik) (2016) Klimaschutz in der Land- und Forstwirtschaft sowie den nachgelagerten Bereichen Ernährung und Holzverwendung. Gutachten, Berlin.
- WBGU (Wissenschaftlicher Beirat der Bundesregierung Globale Umweltveränderungen) (2011) Welt im Wandel. Gesellschaftsvertrag für eine Große Transformation. Gutachten, Berlin.
- WBVE (Wissenschaftlicher Beirat für Verbraucher- und Ernährungspolitik) (2005) Grundsatzpapier Ernährungspolitik, Witzhausen, Berlin.
- WBVE, WBA (Wissenschaftlicher Beirat für Verbraucher- und Ernährungspolitik, Wissenschaftlicher Beirat für Agrarpolitik) (2011) Politikstrategie Food Labelling. Stellungnahme, Berlin.
- WDR (Westdeutscher Rundfunk) (2019) 6.000 Bauern protestieren in Münster gegen neue Düngeverordnung. <https://www1.wdr.de/nachrichten/westfalen-lippe/demo-landwirte-duengeverordnung-muenster-100.html> (letzter Zugriff: 19.12.2019).
- Webb TL, Sheeran P (2006) Does changing behavioral intentions engender behavior change? A meta-analysis of the experimental evidence. *Psychological Bulletin* 132(2): 249-268. Doi: 10.1037/0033-2909.132.2.249.
- Weber CL, Matthews HS (2008) Food-Miles and the relative climate impacts of food choices in the United States. *Environmental Science & Technology* 42(10): 3508-3513. Doi: 10.1021/es702969f.
- Weed DL, Althuis MD, Mink PJ (2011) Quality of reviews on sugar-sweetened beverages and health outcomes: A systematic review. *American Journal of Clinical Nutrition* 94: 1340-1347. Doi: 10.3945/ajcn.111.015875.

- Weible D, Salamon P, Christoph-Schulz IB, Peter G (2013) How do political, individual and contextual factors affect school milk demand? Empirical evidence from primary schools in Germany. *Food Policy* 43: 148-158. Doi: 10.1016/j.foodpol.2013.08.015.
- Weingarten P (2018) Agrarpolitik. In: Akademie für Raumforschung und Landesplanung - ARL (Hrsg.) *Handwörterbuch der Stadt- und Raumentwicklung*: Band 1; A-F. Hannover: 55-68.
- Weinrich R, Kühl S, Zühlsdorf A, Spiller A (2014) Consumer attitudes in Germany towards different dairy housing systems and their implications for the marketing of pasture raised milk. *International Food and Agribusiness Management Review* 17(4): 205-222. Doi: 10/gf744t.
- Weinrich R, Nitzko S, Spiller A, Zühlsdorf A (2015) Verbraucherverständnis von Verkehrsbezeichnungen. *Journal für Verbraucherschutz und Lebensmittelsicherheit* 10(1): 13-22. Doi: 10.1007/s00003-014-0905-9.
- Weiß C, Klein B, Schauff A, Löbel J (2016) *Lebensmittel-Lügen: Wie die Food-Branche trickst und tarnt*. 3. Auflage, Verbraucherzentrale NRW, Düsseldorf.
- Whalen R, Harrold J, Child S, Halford J, Boyland E (2018) The health halo trend in UK television food advertising viewed by children: The rise of implicit and explicit health messaging in the promotion of unhealthy foods. *International Journal of Environmental Research and Public Health* 15(3): 561- 568. Doi: 10.3390/ijerph15030560.
- Wheatley J (1973) Putting colour into marketing. *Marketing* 67: 24-29.
- WHO (World Health Organization) (2010) *Set of recommendations on the marketing of foods and non-alcoholic beverages to children*, Geneva, Switzerland.
- WHO (World Health Organization) (2016a) *Growing up unequal: Gender and socioeconomic differences in young people's health and well-being. Health behaviour in school aged children (HBSC) study: International report from the 2013/2014 survey.* [http://www.euro.who.int/\\_\\_data/assets/pdf\\_file/0003/303438/HSBC-No.7-Growing-up-unequal-Full-Report.pdf](http://www.euro.who.int/__data/assets/pdf_file/0003/303438/HSBC-No.7-Growing-up-unequal-Full-Report.pdf) (letzter Zugriff: 13.12.2019).
- WHO (World Health Organization) (2016b) *Fiscal policies for diet and prevention of noncommunicable diseases. Technical Meeting Report 5–6 May 2015*, Geneva, Switzerland.
- WHO (World Health Organization) (2016c) *Tackling food marketing to children in a digital world: trans-disciplinary perspectives. Children's rights, evidence of impact, methodological challenges, regulatory options and policy implications for the WHO European Region*. Copenhagen, Denmark.
- WHO (World Health Organization) (2017) *Sugars and dental caries. WHO technical information Note, WHO/NMH/NHD/17.12.* [https://www.who.int/oral\\_health/publications/sugars-dental-caries-keyfacts/en/](https://www.who.int/oral_health/publications/sugars-dental-caries-keyfacts/en/) (letzter Zugriff: 31.12.2019).
- WHO (World Health Organization) (2018) *Global status report on alcohol and health*, Geneva. <https://apps.who.int/iris/bitstream/handle/10665/274603/9789241565639-eng.pdf?ua=1> (letzter Zugriff: 13.12.2019).
- WHO, FAO (World Health Organization, Food and Agriculture Organization of the United Nations) (2007) *Food labelling. Codex Alimentarius, fifth ed.*, Rome.
- WHO (World Health Organization), International Agency for Research on Cancer (2015a) *IARC Monographs evaluate consumption of red meat and processed meat. Press release N° 240, 26 October 2015.* [https://www.iarc.fr/wp-content/uploads/2018/07/pr240\\_E.pdf](https://www.iarc.fr/wp-content/uploads/2018/07/pr240_E.pdf) (letzter Zugriff: 13.12.2019).

- WHO (World Health Organization), Regional Office for Europe (2015b) WHO Regional Office for Europe nutrient profile model, Copenhagen.
- Wiegmann K, Eberle U, Fritsche UR, Hünecke K (2005) Umweltauswirkungen von Ernährung - Stoffstromanalysen und Szenarien. Ernährungswende-Diskussionspapier 7. Öko-Institut e. V., Darmstadt, Hamburg. <http://www.oeko.de/oekodoc/328/2007-011-de.pdf> (letzter Zugriff: 13.12.2019).
- Wiese A (2018) Analysen zur Glyphosatanwendung im Ackerbau – Ertragseffekte, Anwendungsmuster und Bestimmungsfaktoren, Dissertation, Universität Göttingen.
- Wikström F, Williams H, Verghese K, Clune S (2014) The influence of packaging attributes on consumer behaviour in food-packaging LCA studies e a neglected topic. *Journal of Cleaner Production* 73: 100-108. Doi: 10.1016/j.jclepro.2013.10.042.
- Wilbois KP, Schmidt JE (2019) Reframing the debate surrounding the yield gap between organic and conventional farming. *Agronomy* 9(2): 82. Doi: 10.3390/agronomy9020082.
- Wild M (2012) Fische. Kognition, Bewusstsein und Schmerz. Eine philosophische Perspektive. Eidgenössische Ethikkommission für die Biotechnologie im Außerhumanbereich (EKAH), Bern.
- Wilkinson JM (2009) Re-defining efficiency of feed use by livestock. *Animal* 5(7): 1014-1022. Doi: 10.1017/S175173111100005X.
- Willer H, Lernoud J (2019) *The World of Organic Agriculture: Statistics and Emerging Trends 2019*; FiBL, Frick, Switzerland.
- Willet W, Rockström J, Loken B, Springmann M, Lang T, Vermeulen S, Garnett T, Tilman D, DeClerck F, Wood A, Jonell M, Clark M, Gordon LJ, Franco J, Hawkes C, Zurayk R, Rivera JA, de Vries W, Sibanda LM, Afshin A, Chaudhary A, Herrero M, Agustina R, Branca F, Lartey A, Fan S, Crona B, Fox E, Bignet V, Troell M, Lindahl T, Singh S, Cornell SE, Reddy KS, Narain S, Nishtar S, Murray CJL (2019) Food in the anthropocene: The EAT–Lancet Commission on healthy diets from sustainable food systems. *The Lancet* 393(10170): 447-492. Doi: 10.1016/S0140-6736(18)31788-4.
- Williams KA, Patel H (2017) Healthy plant based diets: What does it really mean? *Journal of the American College of Cardiology* 70(4): 423-425. Doi: 10.1016/j.jacc.2017.06.006.
- Wilson RD, Désilets V, Wyatt P, Langlois S, Gagnon A, Allen V, Blight C, Johnson JA, Audibert F, Brock JA, Koren G, Goh I, Nguyen P, Kapur B (2007) Pre-conceptional vitamin/folic acid supplementation 2007: The use of folic acid in combination with a multivitamin supplement for the prevention of neural tube defects and other congenital anomalies. *Journal of Obstetrics and Gynaecology Canada* 29(12): 1003-1013. Doi: 10.1016/S1701-2163(16)32685-8.
- Wissenschaftlicher Dienst des Bundestages (2019) Finanzhilfen des Bundes im Bereich der Bildungsinfrastruktur der Bundesländer nach dem Kommunalinvestitionsförderungsgesetz II. Dokumentation WD 8 – 3000 - 064/19 vom 26.04.2019, Fachbereich Umwelt, Naturschutz, Reaktorsicherheit, Wissenschaft und Bildung, Berlin.
- WLLV, RhLV (Westfälisch-Lippischer LandFrauenverband e. V., Rheinischer LandFrauenverband e. V.) (2016) *Frauen in der Landwirtschaft in Nordrhein-Westfalen. Antworten 2016*. Landwirtschaftskammer Nordrhein-Westfalen, Münster.
- Wognum PM, Bremmers H, Trienekens JH, van der Vorst JGAJ, Bloemhof JM (2011) Systems for sustainability and transparency of food supply chains – Current status and challenges. *Advanced Engineering Informatics* 25(1): 65-76. Doi: 10.1016/j.aei.2010.06.001.

- Wojzischke J, Diekmann R, Bauer JM (2016) Adipositas im Alter und ihre Bedeutung für Funktionalität und Frailty. *Zeitschrift für Gerontologie und Geriatrie* 49: 573-580.
- Wolf D (2001) Deutscher Bauernverband: Einfluss und Rechtsbefolgung. In: Zimmer A, Weßels B (Hrsg.) *Verbände und Demokratie in Deutschland. Bürgerschaftliches Engagement und Nonprofit-Sektor*, Vol. 5. VS Verlag für Sozialwissenschaften, Wiesbaden: 183-208.
- Wolfenden L, Nathan NK, Sutherland R, Yoong SL, Hodder RK, Wyse RJ, Delaney T, Grady A, Fielding A, Tzelepis F, Clinton-McHarg T, Parmenter B, Butler P, Wiggers J, Bauman A, Milat A, Booth D, Williams CM (2017) Strategies for enhancing the implementation of school-based policies or practices targeting risk factors for chronic disease. *Cochrane Database of Systematic Reviews* 11: CD011677. Doi: 10.1002/14651858.CD011677.pub2.
- Woods SC (1991) The eating paradox: How we tolerate food. *Psychological Review* 98(4): 488-505.
- Woods SC (2009) The control of food intake: Behavioral versus molecular perspectives. *Cell Metabolism* 9(6): 489-498. Doi: 10.1016/j.cmet.2009.04.007.
- Woods SC, Ramsay DS (2011) Food intake, metabolism and homeostasis. *Physiology & Behavior* 104(1): 4-7. Doi: 10.1016/j.physbeh.2011.04.026.
- World Bank (2007) *World Development Report 2008: Agriculture for Development*, Washington, DC.
- World Bank, FAO, IFAD (2018) *Gender in Agriculture Sourcebook*, Washington, DC.  
<http://siteresources.worldbank.org/INTGENAGRLIVSOUBOOK/Resources/CompleteBook.pdf> (letzter Zugriff: 14.12.2019).
- World Cancer Research Fund International (2017) *NOURISHING* database.  
<https://www.wcrf.org/int/policy/nourishing-database> (letzter Zugriff: 04.12.2019).
- World Food Summit (1996) *Rome Declaration on World Food Security*.  
<http://www.fao.org/3/w3613e/w3613e00.htm> (letzter Zugriff: 05.12.2019).
- World Obesity Federation, WHO (2018) *Taking action on childhood obesity*. WHO, Geneva, Switzerland.
- WRAP (Waste and Resources Action Programme) (2017) *Household food waste in the UK, 2015, final report*. <https://www.wrap.org.uk/content/household-food-waste-uk-2015-0> (letzter Zugriff: 10.01.2020).
- Wuepper D, Wimmer S, Sauer J (2020) Is small family farming more environmentally sustainable? Evidence from a spatial regression discontinuity design in Germany. *Land Use Policy* 90: 104360. Doi: 10.1016/j.landusepol.2019.104360.
- Wünsche J, Lambert C, Gola U, Biesalski HK (2018) Consumption of gluten free products increases heavy metal intake. *NFS Journal* 12: 11-15. Doi: 10.1016/j.nfs.2018.06.001.
- Wunder S (2018) *Regionale Ernährungssysteme und nachhaltige Landnutzung im Stadt-Land-Nexus*. Arbeitspapier im Rahmen des Rural-Urban-Nexus Projekts.  
<https://rural-urban-nexus.org/de/news> (letzter Zugriff: 20.12.2019).
- WVZ (Wirtschaftliche Vereinigung Zucker) (2019) *Stellungnahme zum Konsensuspapier zur quantitativen Empfehlung zur Zuckerzufuhr in Deutschland*, 30. April 2019, Berlin.
- WWF (2018) *Einkaufsratgeber Fisch und Meeresfrüchte*, Berlin.  
[https://www.wwf.de/fileadmin/fm-wwf/Publikationen-PDF/WWF\\_Einkaufsratgeber\\_Fische\\_und\\_Meeresfruechte.pdf](https://www.wwf.de/fileadmin/fm-wwf/Publikationen-PDF/WWF_Einkaufsratgeber_Fische_und_Meeresfruechte.pdf) (letzter Zugriff: 13.12.2019).
- WWF Deutschland (2015) *Positionspapier des WWF Deutschland zu Nachhaltige Ernährung*. Stellungnahme, Berlin.

- WWF, UaW, INL (World Wide Fund for Nature, United Against Waste e. V., Institut für nachhaltige Land- und Ernährungswirtschaft e. V.) (2019) Essen in Hessen – Handlungsempfehlungen an Politik und Wirtschaft, Berlin.
- Wynes S, Nicholas KA (2017) The climate mitigation gap: Education and government recommendations miss the most effective individual actions. *Environmental Research Letters* 12: 074024. Doi: 10.1088/1748-9326/aa7541.
- Yates N, Teuner CM, Hunger M, Holle R, Stark R, Laxy M, Hauner H, Peters A, Wolfenstetter SB (2016) The economic burden of obesity in Germany: Results from the population-based KORA studies. *Obesity Facts* 9(6): 397-409. Doi: 10.1159/000452248.
- Yildiz J (2014) Auswirkungen eines verringerten Haushaltsbudgets auf den Lebensmittelkonsum – Eine empirische Untersuchung zu den finanziell bedingten Veränderungen am Lebensmitteleinkauf und beim Ernährungsverhalten. Dissertation, Justus-Liebig-Universität Gießen.
- Young LR, Nestle M (2012) Reducing portion sizes to prevent obesity. A call to action. *American Journal of Preventive Medicine* 43(5): 565-568. Doi: 10.1016/j.amepre.2012.07.024.
- Yu JH (2012) Mothers' perceptions of the negative impact on TV food ads on children's food choices. *Appetite* 59(2): 372–376. Doi: 10.1016/j.appet.2012.05.017.
- Zander K, Hamm U (2010) Consumer preferences for additional ethical attributes of organic food. *Food Quality and Preference* 21(5): 495-503. Doi: 10.1016/j.foodqual.2010.01.006.
- Zapf R, Schultheiß U (2013) Bewertung der Nachhaltigkeit landwirtschaftlicher Betriebe. KTBL Fachartikel. Kuratorium für Technik und Bauwesen in der Landwirtschaft e. V., Darmstadt. [https://www.researchgate.net/publication/311739836\\_Bewertung\\_der\\_Nachhaltigkeit\\_landwirtschaftlicher\\_Betriebe](https://www.researchgate.net/publication/311739836_Bewertung_der_Nachhaltigkeit_landwirtschaftlicher_Betriebe) (letzter Zugriff: 20.12.2019).
- Zapf R, Schultheiß U, Oppermann R, van den Weghe H, Döhler H, Doluschitz R (2009) Bewertung der Nachhaltigkeit landwirtschaftlicher Betriebe – Eine vergleichende Beurteilung von Betriebsbewertungssystemen. *KTBL-Schrift* 473, KTBL, Darmstadt.
- Zentralverband des Deutschen Bäckerhandwerks e. V. (2017) Zahlen und Fakten. <https://www.baeckerhandwerk.de/baeckerhandwerk/zahlen-fakten/diagramme> (letzter Zugriff: 13.12.2019).
- Zerle P (2004) Ökologische Effektivität und ökonomische Effizienz von umweltbezogenen Selbstverpflichtungen, *Volkswirtschaftliche Diskussionsreihe* Nr. 262. Institut für Volkswirtschaftslehre der Universität Augsburg, Augsburg.
- Zhang B, Zhao Q, Guo W, Bao W, Wang X (2018) Association of whole grain intake with all-cause, cardiovascular, and cancer mortality: A systematic review and dose-response meta-analysis from prospective cohort studies. *European Journal of Clinical Nutrition* 72(1): 57-65. Doi: 10.1038/ejcn.2017.149.
- Zhen C, Finkelstein EA, Nonnemaker JM, Karns S, Todd JE (2013) Predicting the effects of sugar-sweetened beverage taxes on food and beverage demand in a large demand system. *American Journal of Agricultural Economics* 96 (1): 1-25. Doi: 10.1093/ajae/aat049.
- Zheng Y, Zhen C, Nonnemaker J, Dench D (2016) Advertising, habit formation, and U.S. tobacco product demand. *American Journal of Agricultural Economics* 98(4): 1038-1054. Doi: 10.1093/ajae/aaw024.
- Zimmer A (2012) Die verschiedenen Dimensionen der Zivilgesellschaft. <http://www.bpb.de/politik/grundfragen/deutsche-verhaeltnisse-eine-sozialkunde/138713/dimensionen> (letzter Zugriff: 19.12.2019).

- Zinöcker MK & Lindseth IA (2018) The Western Diet-microbiome-host interaction and its role in metabolic disease. *Nutrients* 10(3): 365. Doi: 10.3390/nu10030365.
- Zlatevska N, Dubelaar C, Holden SS (2014) Sizing up the effect of portion size on consumption: a meta-analytic review. *Journal of Marketing* 78(3): 140-154. Doi: 10.1509/jm.12.0303.
- Zühlsdorf A (2019) Front-of-Package Labelling – Möglichkeiten und Grenzen der Lebensmittelkommunikation. Vortrag im Rahmen des 54. Diabetes Kongresses der Deutschen Diabetes Gesellschaft (DGG) am 31.05.2019 in Berlin. <https://www.zuehlsdorf-und-partner.de/publikationen-beratungsergebnisse/> (letzter Zugriff: 19.12.2019).
- Zühlsdorf A, Jürkenbeck K, Spiller A (2018) Lebensmittelmarkt und Ernährungspolitik 2018: Verbrauchereinstellungen zu zentralen lebensmittel- und ernährungspolitischen Themen. Studie im Auftrag des vzbv, Göttingen.
- Zühlsdorf A, Jürkenbeck K, Spiller A (2019) Gesundheits- und Zutatenmarketing im Marktsegment Brot und Kleingebäck. Verbrauchererwartungen an Brotnamen und Nährwertclaims sowie Kennzeichnungspräferenzen in Bäckereien (Chartbook zur Umfrage). Studie im Auftrag des vzbv, Göttingen.
- Zühlsdorf A, Kühl S, Gaulty S, Spiller A (2016) Wie wichtig ist Verbrauchern das Thema Tierschutz? Präferenzen, Verantwortlichkeiten, Handlungskompetenzen, Politikoptionen. Kommentiertes Chartbook zur repräsentativen Umfrage im Auftrag des vzbv, Göttingen.
- Zühlsdorf A, Spiller A (2015) Verbraucherwahrnehmung von Lebensmittelverpackungen. Ergebnisbericht des Projekts: Repräsentative Verbraucherbefragungen im Rahmen des Projektes ‚Lebensmittelklarheit 2.0‘, Göttingen.



## List of figures

Figure 1-1:	The four central goals of greater sustainability in food consumption (“Big Four”)	2
Figure 1-2:	Phases of the behavioural process	4
Figure 2-1:	Three ways of harming people through one’s own consumption of food, beverages and tobacco	18
Figure 3-1:	Chronological sequence of the relative popularity of Google queries for the search term “losing weight”, 2004–2018 in Germany	36
Figure 3-2:	Basic motives of normal food consumption regarding younger and older respondents in Germany (left side) and regarding respondents from the USA, India and Germany (right side).	40
Figure 3-3:	Exemplary developments and innovations in the food sector	41
Figure 3-4:	Phases of the behavioural process	45
Figure 3-5:	Examples of exposures in the everyday life of children, recorded with Kids’Cam	46
Figure 3-6:	Distribution of mealtimes during the day in France in 1986 and 2010 and in the USA in 2010	48
Figure 3-7:	Assessment of tap and “bottled water” by consumers who prefer to consume “bottled water”.	51
Figure 3-8:	Percentage of judicial probation decisions in favour of the prisoner depending on the meal break according to the Israeli study	54
Figure 3-9:	Changes in portion sizes since 1950 in the USA and Great Britain	55
Figure 3-10:	Trends in overweight/obesity, calorie supply/per capita, number of product launches with large portion sizes in the USA between 1965 and 2009	56
Figure 3-11:	Relationship between portion size and amount consumed, N = 109 studies	57
Figure 4-1:	Development of the proportion and number of people affected by calorie deficit (hunger) worldwide	62
Figure 4-2:	Global health problems caused by different forms of malnutrition over time	64
Figure 4-3:	Proportion of different food groups in global calorie consumption	65
Figure 4-4:	DGE dietary circle and three-dimensional DGE food pyramid	70
Figure 4-5:	Absolute and relative risk of developing colorectal cancer due to the consumption of processed meat	72
Figure 4-6:	Healthy life years at birth in the EU Member States (2016)	76

Figure 4-7:	Overweight and obesity in the female and male population by age groups	77
Figure 4-8:	Consumption of sugar-sweetened soft drinks by girls and boys	86
Figure 4-9:	Percentage of risk of inadequate vitamin intake in older people (meta-analysis, n = 37 studies, OECD countries)	91
Figure 4-10:	Percentage of older people at risk of inadequate mineral intake (meta-analysis, n = 37, OECD countries)	92
Figure 4-11:	Concern about 14 selected health and consumer topics (representative population survey, N = 1,016, August 2019)	103
Figure 4-12:	Income development in the German agricultural sector (2001-2018)	120
Figure 4-13:	Average profit per unpaid worker and labour costs per worker across all full-time farms	121
Figure 4-14:	Profit of full-time farms per unpaid worker according to farm size (three-year average of marketing years 2015/16 until 2017/18)	122
Figure 4-15:	Profit per unpaid worker according to type of farm	123
Figure 4-16:	Reportable, work-related accidents in the agricultural sector compared with other sectors	127
Figure 4-17:	Perceived burden regarding different tasks of women in family farms	129
Figure 4-18:	Problems experienced as distress by women in the agricultural sector	130
Figure 4-19:	Family members and external workers in the agricultural sector (in 2016), per 1000 man-work units, broken down according to the legal structure	132
Figure 4-20:	Family members and external workers in the agricultural sector (in 2016), per 1000 man-work units, broken down according to the legal structure	133
Figure 4-21:	Development of cropping areas for vegetables in Baden-Württemberg from 1951 to 2014	134
Figure 4-22:	Gross monthly wages for different occupations in the agricultural sector	135
Figure 4-23:	Employees working on Saturdays and Sundays, broken down according to business sectors (in 2016), in percent	137
Figure 4-24:	Percentage distribution of child labour by sector and age groups	144
Figure 4-25:	Oxfam analysis of business practices in the food retail sector with regard to social problems along the value chains	147
Figure 4-26:	Main environmental impacts along the value chain	154
Figure 4-27:	Scenarios for global demand for farmland and estimated loss of farmland due to urbanisation, land degradation and climate change	156

Figure 4-28:	The key global environmental problems and their boundaries	158
Figure 4-29:	Scenarios of future development of GHG emissions from global agriculture	159
Figure 4-30:	GHG emissions per kilogram of energy-corrected milk yield (ECM) depending on system and performance	162
Figure 4-31:	GHG emissions per kilocalorie for different foods	163
Figure 4-32:	Development of nitrate levels in the new EU nitrate monitoring network	166
Figure 4-33:	Biodiversity and landscape quality	169
Figure 4-34:	Food waste in Germany 2015 and share of avoidable losses (1,000 t/a)	174
Figure 4-35:	Average greenhouse gas emissions of pig production compiled from various literature sources (left-hand side) and CO <sub>2</sub> balance of beer (right-hand side)	175
Figure 4-36:	Environmental strain of a food basket – Relative contribution of the six life cycle stages to the effect of the whole basket	176
Figure 4-37:	Causes of waste generation in the food processing industry based on a company survey	177
Figure 4-38:	Development of packaging waste generated in Germany	179
Figure 4-39:	Average GHG emissions from production (agriculture), manufacturing and packaging for different food groups	181
Figure 4-40:	Per capita emissions of greenhouse gases in the EU 2017	191
Figure 4-41:	Greenhouse gas emissions broken down by food consumed in Germany (2006) in t CO <sub>2</sub> eq per person/year	192
Figure 5-1:	Effects of a conversion on the intensities of organic farming	227
Figure 5-2:	Work steps necessary to generate an LCA	278
Figure 5-3:	Selected environmental effects of different food groups (I)	287
Figure 5-4:	Selected environmental effects of different food groups (II)	288
Figure 5-5:	Selected environmental effects of various groups of foodstuffs of animal origin	289
Figure 5-6:	GHG emissions of various dietary patterns compared with current average dietary patterns	290
Figure 5-7:	Husbandry-system label introduced by German grocery retailers	305
Figure 5-8:	Relation between the relative nutrient density (SNRF index) and GHG emissions of 39 foodstuffs	307

Figure 5-9:	Four-quadrant matrix for the concise categorisation of dietary patterns according to health and environmental impact for country groups, adapted from FCRN (2015)	309
Figure 5-10:	The recommended composition of meals for achieving a healthier and more environmentally sustainable diet (recommendations according to the EAT-Lancet Commission)	311
Figure 6-1:	Direct and indirect effects of demand-driven policies	352
Figure 6-2:	Gross spending on advertising by different food-industry sectors in Germany in 2017 (in million euro).	362
Figure 6-3:	Operating profit margin for different product groups in the global food industry	363
Figure 6-4:	General attitude in Germany toward food policy	367
Figure 6-5:	Approval of food-policy instruments in Germany	368
Figure 6-6:	Food-policy intervention ladder	369
Figure 7-1:	Governance of the food system – analytical framework	375
Figure 7-2:	Production values in the food system in 2017	377
Figure 7-3:	2017 pro forma sales of leading firms after mergers and divestitures	379
Figure 7-4:	Structure of the German Nutrition Society (DGE)	408
Figure 7-5:	Positioning of labels in terms of sustainability progress and market penetration	458
Figure 8-1:	Systematic representation of policy instruments based on what phase of the behavioural process they primarily address	477
Figure 8-2:	Mention of the terms “agricultural policy”, “food policy” and “healthy diet” in speeches held in the Bundestag	479
Figure 8-3:	Elements of a food policy concept	480
Figure 8-4:	Five decision-making fields regarding the strategic policy orientation	484
Figure 8-5:	Lunch Rooms und Cafeterias of tech firms Google (A), SAS (B) and Pixar (C). In contrast, examples of school canteens in Germany (D & E)	491
Figure 8-6:	Examples of school catering schemes worldwide	494
Figure 8-7:	Underestimation of supersizing depending on the type of packaging	511
Figure 8-8:	Outcome of a Cochrane review and meta-analysis on portion-size effects	512
Figure 8-9:	Support to restrict the marketing of branded high-fat, salty and/or sugary food and beverage products to children and adolescents (2010-2016)	528

Figure 8-10:	Price increase of various meat segments in the case of harmonisation of VAT with the standard rate	551
Figure 8-11:	Simple causal model on the effect of information and emotional appeals	558
Figure 8-12:	The three goals (or effects) of information communication	560
Figure 8-13:	Overview of different labelling systems for assessing the health-promoting characteristics of foodstuffs	575
Figure 8-14:	Overview of provisions of the EU Health Claims Regulation	576
Figure 8-15:	Overview of types of health-related interpretative labels	578
Figure 8-16:	The French Nutri-Score label for foods and beverages	580
Figure 8-17:	Policy instruments to safeguard minimum social standards in international supply chains	588
Figure 9.-1:	Nine key recommendations for an integrated policy to promote more sustainable food consumption	626
Figure 9-2:	Realignment of food policies along five decision areas	665

## List of tables

Table 2-1:	Structural and contingent challenges of operationalising sustainable development	29
Table 4-1:	Example of a selection of foods based on the DGE dietary circle	71
Table 4-2:	Overview of studies that allow conclusions to be drawn about the food-consumption and health situation of individual population groups in Germany	73
Table 4-3:	Standard needs rates of basic income support for the year 2019	96
Table 4-4:	Selected sustainability assessment systems used as a basis to identify social criteria	111
Table 4-5:	Social criteria in the six assessment systems selected	114
Table 4-6:	Structural data of agricultural holdings in the German network of test farms according to legal form and type of farming (2017/18)	118
Table 4-7:	Direct payments and subsidies per holding in the German network of test farms according to legal form and type of farming (2017/18, in euro)	124
Table 4-8:	Gross monthly wages of full-time employees in the producing industry and the service sector in 2017 (broken down according to qualification)	135
Table 4-9:	Low-income employees (in 2014) in percent	136
Table 4-10:	Number and proportion of jobs with a minimum wage under 8.50 euros in 2014 in sectors with transitional arrangements	139
Table 5-1:	Examples of recommendations for sustainable food consumption addressed to consumers	208
Table 5-2:	Systems for measuring and assessing sustainability within the context of a sustainable diet	209
Table 5-3:	Yield differences between organic and conventional farming (results of global meta-analyses)	220
Table 5-4:	Analysis levels for assessing the sustainability of food consumption using dietary patterns and the product-range structure of grocery retailers for products and foodstuffs	248
Table 5-5:	Estimated intake of free sugars as a percentage of the total energy intake among men and women according to the second national food consumption survey (NVS II)	257
Table 5-6:	Vegetarian and vegan diets and critical nutrients	262

Table 5-7:	Correlation between the consumption of various food groups and important non-communicable diseases (direction of arrows), including the degree of evidence (number of arrows)	268
Table 5-8:	Efficiency of measures for climate protection as perceived by consumers	284
Table 5-9:	Greenhouse gas emissions of different product groups, consumption of these product groups in Germany (2013) and absolute greenhouse gas burden of these product groups	285
Table 5-10:	GHG emissions of foodstuffs (figures based on an international review)	291
Table 5-11:	Guidelines for viable animal husbandry from the animal protection angle	301
Table 5-12:	Recommended amounts of food for achieving a health-promoting and environmentally sustainable diet (recommendations according to the EAT-Lancet Commission)	310
Table 5-13:	A summarised and heavily simplified assessment of socially widespread recommendations for action that recommend eating either more or fewer products from a certain food group in the interests of more sustainable food consumption	328
Table 5-14:	A summarised and heavily simplified assessment of socially widespread recommendations for action that recommend preferring certain product variants, the production of which is viewed as more sustainable	332
Table 5-15:	A summarised and heavily simplified assessment of socially widespread recommendations for action for more sustainable food consumption that advise further behavioural changes beyond consumption decisions	335
Table 7-1:	Market shares of the four largest seed manufacturing companies	378
Table 7-2:	Leading food producers (worldwide, 2017)	380
Table 7-3:	Overview of the four leading company groups of food retailing in Germany 2018	381
Table 7-4:	Importance of food and nutrition in the 2017 general election programmes of the parties represented in the German Bundestag	389
Table 7-5:	Importance of food and nutrition in the parties' state election programmes Example of Baden-Württemberg in 2016	390
Table 7-6:	Importance of food and nutrition in the parties' state election programmes Example of Mecklenburg-Western Pomerania in 2016	391
Table 7-7:	Professional background of the members of the Bundestag Committee on Food and Agriculture	415

Table 7-8:	Price ratios of different food groups compared with starch-containing staple foods internationally	437
Table 7-9:	Own-price elasticities of the demand volume as a result of a meta-analysis	441
Table 7-10:	Acceptance of different steering tax concepts: Results of a representative survey	445
Table 8-1:	Sustainability goals and indicators of the Federal Government relevant to food consumption and nutrition	482
Table 8-2:	Indicators along the impact chain using the example of the “non-contributory school meals” and “subsidies for fruit and vegetables” measures	487
Table 8-3:	Estimation of public expenditure for the full financing of high-quality and free preschool and school catering (full costs)	499
Table 8-4:	Investment needs in school kitchens and canteens	502
Table 8-5:	Measures aimed at modifying portion sizes	510
Table 8-6:	Changes in the sales of junk food depending on policy measures for advertising restrictions based on an analysis of the international literature	529
Table 8-7:	Attitude of the German population towards restricting advertising for products with a high sugar, fat and salt content aimed at children	531
Table 8-8:	Development of the per capita consumption of soft drinks, fruit juices/nectars and water (in litres) in Germany 2012-2018	537
Table 8-9:	Calculation of possible tax revenues of a tax on sugar-sweetened soft drinks and juices	545
Table 8-10:	Climate tax surcharge on selected foods at different tax rates	549
Table 8-11:	Use of the additional tax revenues in the event of abolition of the reduced VAT rate for animal products – options and arguments for and against	553
Table 8-12:	A possible evaluation matrix for a comprehensive sustainability tax on food	556
Table 8-13:	Process stages and four standards for the evaluation of information campaigns run by the Center of Disease Control and Prevention (CDC), USA	564
Table 9-1:	Range of the additional annual governmental revenue and expenditure associated with the most budget-relevant food and nutrition policy measures	669

## List of text boxes

Text box 1:	Basic needs	16
Text box 2:	"Dietary guidelines"	67
Text box 3:	Absolute and relative risk	72
Text box 4:	Indicators of increased body weight	78
Text box 5:	(Additional) costs of health-promoting food consumption	98
Text box 6:	In-depth concepts using the example of the Economy for the Common Good (ECG)	115
Text box 7:	Calculation of income for family farms and legal persons in the Federal Government's Agricultural Policy Report (BMEL 2019c)	118
Text box 8:	Delisting of non-Fairtrade bananas at Lidl and withdrawal of the measure in 2018/2019	146
Text box 9:	Environmental impacts of pets	197
Text box 10:	Consumer preferences for naturalness and their significance for sustainability policies	239
Text box 11:	Country boycotts and sustainable consumption	271
Text box 12:	The economic costs of unhealthy food consumption	342
Text box 13:	Consumer–citizen gap	350
Text box 14:	Informational impact of demand-side policy instruments	352
Text box 15:	Individualisation of dietary responsibility through financial incentives in the health system?	358
Text box 16:	Food-policy intervention ladder ("Nuffield ladder")	369
Text box 17:	The DGE quality standards for catering	429
Text box 18:	Sustainable public procurement for preschool and school catering	432
Text box 19:	Long-term impact of agricultural support on food consumption	438
Text box 20:	Promoting tap water consumption – Are the last metres a health issue?	544
Text box 21:	Nutrition counselling	568
Text box 22:	Safeguarding minimum social standards in supply chains	587
Text box 23:	Green Button for social standards in textiles as a comparative case	589
Text box 24:	Regional label	591
Text box 25:	On the failure of an integrated farming label	593
Text box 26:	Lebensmittelwarnung.de (food alert website) as an example of missed technological options	609

## Abbreviations

AbL	Arbeitsgemeinschaft bäuerliche Landwirtschaft e. V. (German Small Farmers' Association)
AdiMon	Bevölkerungsweites Monitoring adipositasrelevanter Einflussfaktoren im Kindesalter (population-wide system to monitor the factors relevant to childhood obesity)
AdL	Alterssicherung der Landwirte (old-age security for farmers)
AFN	Alternative Food Networks
AFOLU	Agriculture, Forestry and Other Landuse
AGÖL	Arbeitsgemeinschaft Ökologischer Landbau (Association of Organic Farming Organizations in Germany)
AGRI	Committee on Agriculture and Rural Development
AK	Arbeitskraft (MWU: man-work unit)
ALG	Arbeitslosengeld (unemployment benefits)
AMK	Agrarministerkonferenz des Bundes und der Länder (Conference of Federal Government and Länder Ministers of Agriculture)
AÖL	Assoziation ökologischer Lebensmittelhersteller e. V. (Association of Organic Food Producers)
ARQ	Armutrisikoquote (at-risk-of-poverty rate)
ASC	Aquaculture Stewardship Council
AVN	Allgemeine Vermarktungsnormen (general marketing standards)
AWO-ISS	Langzeitstudie zur Lebenssituation und Lebenslage (armer) Kinder (long-term study on the living conditions and life situations of (poor) children)
BAGSO	Bundesarbeitsgemeinschaft der Senioren (German National Association of Senior Citizens' Organisations)
BCTs	Behavior Change Techniques
BDM	Bundesverband Deutscher Milchviehhalter e. V. (German Federal Association of Dairy Farmers)
BDP	Bundesverband Deutscher Pflanzenzüchter e. V. (Federal Association of German Plant Breeders)
BdS	Bundesverband der Systemgastronomie e. V. (System Catering Federation)
BfR	Bundesinstitut für Risikobewertung (Federal Institute for Risk Assessment)

BGMA	Bündnis gegen Menschenhandel zur Arbeitsausbeutung (alliance against human trafficking for the purpose of labour exploitation)
BIP	Bruttoinlandsprodukt (gross domestic product)
BLE	Bundesanstalt für Landwirtschaft und Ernährung (Federal Office for Agriculture and Food)
BLL	Lebensmittelverband Deutschland e. V. (Federation of Food Law and Food Science)
BLS	Bundeslebensmittelschlüssel (Federal Food Code)
BMAS	Bundesministerium für Arbeit und Soziales (Federal Ministry of Labour and Social Affairs)
BMBF	Bundesministerium für Bildung und Forschung (Federal Ministry of Education and Research)
BMEL	Bundesministerium für Ernährung und Landwirtschaft (Federal Ministry of Food and Agriculture)
BMFSFJ	Bundesministerium für Familie, Senioren, Frauen und Jugend (Federal Ministry of Family Affairs, Senior Citizens, Women and Youth)
BMG	Bundesministerium für Gesundheit (Federal Ministry of Health)
BMI	body mass index
BMUB	Bundesministerium für Umwelt, Naturschutz und nukleare Sicherheit (German Federal Ministry for the Environment, Nature Conservation and Nuclear Safety)
BMWi	Bundesministerium für Wirtschaft und Energie (Federal Ministry of Economics and Technology)
BMZ	Bundesministerium für wirtschaftliche Zusammenarbeit und Entwicklung (Federal Ministry for Economic Cooperation and Development)
BNatSchG	Bundesnaturschutzgesetz (German Federal Nature Conservation Act)
BNE	Bildung für nachhaltige Entwicklung (education for sustainable development)
BNN	Bundesverband Naturkost Naturwaren e. V. (German Association for Natural Food and Products)
BÖLN	Bundesprogramm Ökologischer Landbau (Federal Organic Farming Scheme)
BÖLW	Bund Ökologische Lebensmittelwirtschaft e. V. (Organic Food Industry Federation)
BUND	Umwelt und Naturschutz Deutschland e. V. (Association for Nature and Environmental Protection)
BuT	Bildung und Teilhabe (education and participation)

BVE	Bundesvereinigung der Deutschen Ernährungsindustrie e. V. (Federation of German Food and Drink Industries)
BVL	Bundesamt für Verbraucherschutz und Lebensmittelsicherheit (Federal Office of Consumer Protection and Food Safety)
BVLH	Bundesverband des Deutschen Lebensmittelhandels e. V. (Federal Association of the German Retail Grocery Trade)
BZfE	Bundeszentrum für Ernährung (Federal Centre for Food and Nutrition)
BZgA	Bundeszentrale für gesundheitliche Aufklärung (Federal Centre for Health Education)
CDC	Centers for Disease Control and Prevention
CFBAI	Children's Food and Beverage Advertising Initiative
CFS	Committee on World Food Security
CGIAR	Consultative Group on International Agricultural Research
Charismha	Chancen und Risiken von Gesundheits-Apps (Opportunities and Risks of Health Apps)
COROS	Common Objectives and Requirements of Organic Standards
CSA	Community Supported Agriculture
CSR	Corporate Social Responsibility
D-A-CH	Deutschland-Österreich-Schweiz (Germany-Austria-Switzerland)
DAG	Deutsche Adipositas Gesellschaft e. V. (German Obesity Society)
DALY	Disability-adjusted life years
DANK	Deutsche Allianz Nichtübertragbare Krankheiten (German Alliance on Non-communicable Diseases)
DASH	Dietary approaches to stop hypertension
DASoL	Deutsche Arbeitsgemeinschaft soziale Landwirtschaft (German Working Group on Social Farming)
DBB	Deutscher Bauernbund e. V. (German Farmers' Union)
DBV	Deutscher Bauernverband e. V. (German Farmers' Association)
DDG	Deutsche Diabetes Gesellschaft e. V. (German Diabetes Society)
DEAS	Deutscher Alterssurvey (German Ageing Survey)
DEGS	Studie zur Gesundheit Erwachsener in Deutschland (German Health Interview and Examination Survey for Adults)

DEHOGA	Deutscher Hotel- und Gaststättenverband (German Hotel and Restaurants Association)
DFV	Deutscher Fleischerverband e. V. (German Butchers' Association)
DG AGRI	Directorate-General for Agriculture and Rural Development
DG ENV	Directorate-General Environment
DG SANTE	Directorate-General for Health and Food Safety
DGB	Deutscher Gewerkschaftsbund (German Trade Union Confederation)
DGE	Deutsche Gesellschaft für Ernährung e. V. (German Nutrition Society)
DGEM	Deutsche Gesellschaft für Ernährungsmedizin e. V. (German Society for Nutritional Medicine)
DGG	Deutsche Gesellschaft für Geriatrie e. V. (German Geriatric Society)
DLG	Deutsche Landwirtschafts-Gesellschaft e. V. (German Agricultural Society)
Donald	Dortmund Nutritional and Anthropometric Longitudinally Designed
DQR	Deutscher Qualifikationsrahmen für lebenslanges Lernen (German Qualifications Framework for Lifelong Learning)
DRI	Dietary Reference Intakes
DRV	Deutscher Raiffeisenverband e. V. (German Raiffeisen Association)
EAR	Estimated Average Requirement
ECDC	European Centre for Disease Prevention and Control
ECM	Energy corrected Milk
ECS	Eligibility Checking System
EFFAT	European Federation of Trade Unions in the Food
EFSA	European Food Safety Authority
EFTA	European Free Trade Association
EHIS	European Health Interview Survey
EAFRD	European Agricultural Fund for Rural Development
ENVI	Committee on Environment, Public Health and Food Safety
EPIC	European Prospective Investigation into Cancer and Nutrition
EQLS	European Quality of Life Survey
ErnSipp	Ernährungssituation pflegebedürftiger Senioren (nutritional situation of senior citizens in need of long-term care)
EsKiMo	Ernährungsstudie als KiGGS-Modul (nutrition study as a „KiGGS“ module)

EU	European Union
EEA	European Environment Agency
EUFIC	European Food Information Council
ECJ	European Court of Justice
EU-SILC	European Union Statistics on Income and Living Conditions
EVS	Einkommens- und Verbrauchsstichprobe (sample survey of income and expenditure)
EVW	Europäischer Verein für Wanderarbeiter e. V. (European Migrant Workers Union)
R&D	Research and development
FAO	Food and Agriculture Organization of the United Nations
FAS	Fetal alcohol syndrome
FCRN	Food Climate Research Network
FFH	Fauna-Flora-Habitat (Habitats)
FIAN	Food First Informations- und Aktions-Netzwerk e. V. (Food First Information and Action Network)
FiBL	Forschungsinstitut für Biologischen Landbau (Research Institute of Organic Agriculture)
FKS	Finanzkontrolle Schwarzarbeit (monitoring unit for undeclared work)
Food-EPI	Healthy Food Environment Policy Index
FoP	Front-of-Pack
FSA	Food Standards Agency UK
G.A.P.	Good Agricultural Practice
CAP	Common Agricultural Policy
GATT	General Agreement on Tariffs and Trade
GDA	Guided Daily Amounts
GEDA	Gesundheit in Deutschland Aktuell (German health update)
Gern	Gesundheits- und Ernährungsstudie in Deutschland (health and nutrition study in Germany)
GfK	Gesellschaft für Konsumforschung (Consumer Research Association)
GGO	Gemeinsame Geschäftsordnung der Bundesministerien (Joint Rules of Procedure of the Federal Ministries)

GIZ	Deutsche Gesellschaft für Internationale Zusammenarbeit (German Agency for International Cooperation)
GKV	Spitzenverband der Gesetzlichen Krankenkassen (central association of health insurance companies)
GRASP	GLOBALG.A.P. Risk Assessment on Social Practice
GMOs	Genetically modified organisms
HBSC	Health Behaviour in School Aged Children
HDE	Handelsverband Deutschland (Main Association of German Retail Trade)
HEI	Healthy Eating Index
HLPE	High Level Panel of Experts on Food Security and Nutrition
IARC	International Agency for Research on Cancer
ICN2	Second International Conference on Nutrition
IFAD	International Fund for Agricultural Development
IFOAM	International Federation of Organic Agriculture Movements
IFPRI	International Food Policy Research Institute
IG BAU	Industriegewerkschaft Bauen Agrar Umwelt (Building, Agricultural and Environmental Workers' Trade Union)
ILO	International Labor Organization
ILSI	International Life Sciences Institute
IMAG	Interministerielle Arbeitsgruppe (inter-ministerial working group)
IOM	Institute of Medicine
IPBES	Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services
IPCC	Intergovernmental Panel on Climate Change
IPM	Integrated Pest Management
ISN	Interessengemeinschaft der Schweinehalter Deutschlands e. V. (German association of pig keepers)
ITW	Initiative Tierwohl (Animal Welfare Initiative)
IVA	Industrieverband Agrar e. V. (Industrial Association of Agriculture)
IZBB	Investitionsprogramm "Zukunft Bildung und Betreuung" (Investment Programme "Future Education and Child Care")
JMStV	Jugendmedienschutz-Staatsvertrag (Interstate Treaty on the Protection of Minors from Harmful Media)

JuSchG	Jugendschutzgesetz (Act to Protect Young People at Work)
KHK	Koronare Herzkrankheiten (coronary heart diseases)
KiGGS	Studie zur Gesundheit von Kindern und Jugendlichen in Deutschland (The German Health Survey for Children and Adolescents)
KMK	Kultusministerkonferenz (German Standing Conference of the Education Ministers)
KrWG	Kreislaufwirtschaftsgesetz (Circular Economy Act)
KSNL	Kriteriensystem nachhaltige Landwirtschaft (criteria system for sustainable agriculture)
KUL	Kriterien umweltverträglicher Landbewirtschaftung (criteria for environmentally sound land management)
LCA	Life cycle assessment
LEH	Lebensmitteleinzelhandel (food retail sector)
LMIV	Lebensmittelinformationsverordnung (Regulation on Food Information)
LPG	Landwirtschaftliche Produktionsgenossenschaft (agricultural producer cooperative)
LSV	Landwirtschaftliche Sozialversicherung (agricultural social security system)
LU	Land use
LUC	Land use change
LUV	Landwirtschaftliche Unfallversicherung (agricultural accident insurance)
MDGs	Millenium Development Goals
MHD	Mindesthaltbarkeitsdatum (best-before date)
MIV	Milchindustrieverband e. V. (Association of the German Dairy Industry)
MLR	Ministerium für Ländlichen Raum und Verbraucherschutz (Ministry for Rural Areas and Consumer Protection)
MRI	Max Rubner Institute
MSC	Marine Stewardship Council
MSY	Maximum Sustainable Yield
MUFAs	Monounsaturated fatty acids
NABU	Naturschutzbund Deutschland e. V. (German Nature and Biodiversity Conservation Union)
NAKO	NAKO Gesundheitsstudie, ehemals Nationale Kohorte (NACO health study, formerly national cohort)

NAP	Nationaler Aktionsplan Wirtschaft und Menschenrechte (national action plan „Business and Human Rights)
NDC	Non Communicable Disease
NGG	Gewerkschaft Nahrung-Genuss-Gaststätten (Union of Workers in the Food, Beverages and Tobacco Industry and in the Hotel and Catering Trade)
NGO	Non-governmental organization
NHS	National Health Service
NQZ	Nationales Qualitätszentrum für Ernährung in Kita und Schule (National Quality Centre for Healthy Nutrition in Schools and Childcare Facilities)
NÜK	Nicht übertragbare Krankheiten (non-communicable diseases)
NVS	Nationale Verzehrsstudie (National Food Consumption Survey)
OECD	Organisation for Economic Co-operation and Development
PAL	Physical activity level
PASS	Panel Arbeitsmarkt und soziale Sicherung (Panel Study Labour Market and Social Security)
PCF	Product Carbon Footprint
PEF	Product Environmental Footprint
PEFCR	Product Environmental Footprint Category Rules
PRAI	Principles for Responsible Agricultural Investment that Respects Rights, Livelihood and Resources
PRECIS	Pragmatic Explanatory Continuum Indicator Summary
PUFAs	Polyunsaturated fatty acids
RASFF	Rapid Alert System for Food and Feed
RBEG	Regelbedarfs-Ermittlungsgesetz (Standard Requirements Determination Act)
RCP	Representative Concentration Pathways
RCT	Randomised Controlled Trial
REVIS	Reform der Ernährungs- und Verbraucherbildung in Schulen (reforming nutrition and consumer education in schools)
RISE	Response-Inducing Sustainability Assessment
RKI	Robert Koch Institute
RNE	Rat für Nachhaltige Entwicklung der deutschen Bundesregierung (German Council for Sustainable Development)
RSPO	Roundtable on Sustainable Palm Oil

RStV	Rundfunkstaatsvertrag (Interstate Broadcasting Treaty)
RTRS	Round Table on Responsible Soy
RTRS	Roundtable on Sustainable Soy
SACN	Scientific Advisory Committee on Nutrition
SAFA	Sustainability Assessment of Food and Agricultural Systems
SAI	Sustainable Agricultural Initiative
SD	Standard deviation
SDGs	Sustainable Development Goals
SES	Sozioökonomischer Status (socioeconomic status)
SFAs	Saturated fatty acids
SGB	Sozialgesetzbuch (Social Code)
SMART	Sustainability Monitoring and Assessment Routine
SMD	Standardized Mean Difference
SNAP	Supplemental Nutrition Assistance Program
SNRF	Sustainable Nutrient-Rich Foods
SOC	Soil Organic Carbon
SOEP	Sozioökonomisches Panel (Socio-Economic Panel)
SOFA	State of Food and Agriculture
SoLaWi	Solidarische Landwirtschaft (community-supported agriculture)
SPSÜ	Übereinkommen über die Anwendung gesundheitspolizeilicher und pflanzenschutzrechtlicher Maßnahmen (Agreement on the Application of Sanitary and Phytosanitary Measures)
SRU	Sachverständigenrat für Umweltfragen (German Advisory Council on the Environment)
SSB	Sugar sweetened beverages
StVZO	Straßenverkehrs-Zulassung-Ordnung (Road Traffic Registration Regulations)
SVN	Spezielle Vermarktungsnormen (Specific Marketing Standards)
TAPIC	Transparency, Accountability, Participation, Integrity and Capacity
TBTÜ	Übereinkommen über technische Handelshemmnisse (Agreement on Technical Barriers to Trade)
THG	Treibhausgas (greenhouse gas)
TierWKG	Tierwohlkennzeichnungsgesetz (Animal Welfare Labelling Act)

UBA	Umweltbundesamt (Federal Environmental Agency)
UFAs	Unsaturated fatty acids
UGB	Verband für Unabhängige Gesundheitsberatung e. V. (Association for Independent Health Consultation)
UN	United Nations
UNECE	United Nations Economic Commission for Europe
UNEP	United Nations Environment Programme
USA	United States of America
VO	Verordnung (regulation/ordinance)
VZ	Verbraucherzentrale (consumer advice centre)
vzbv	Verbraucherzentrale Bundesverband (Federation of German Consumer Organisations)
wafg	Wirtschaftsvereinigung Alkoholfreie Getränke e. V. (Association of the German Non-Alcoholic Beverage Industry)
WBA	Wissenschaftlicher Beirat für Agrarpolitik (Scientific Advisory Board on Agricultural Policy)
WBAE	Wissenschaftlicher Beirat für Agrarpolitik, Ernährung und gesundheitlichen Verbraucherschutz (Scientific Advisory Board on Agricultural Policy, Food and Consumer Health Protection)
WBD	Wissenschaftlicher Beirat für Düngungsfragen (Scientific Advisory Board on Fertiliser Issues)
WBGU	Wissenschaftlicher Beirat der Bundesregierung Globale Umweltveränderungen (German Advisory Council on Global Change)
WBVE	Wissenschaftlicher Beirat für Verbraucher- und Ernährungspolitik (Scientific Advisory Board on Consumer and Food Policies)
WBW	Wissenschaftlicher Beirat für Waldpolitik (Scientific Advisory Board on Forest Policy)
WEA	Wireless Emergency Alerts
WHO	World Health Organisation
WIE-Programm	Wissenschaftliches Implementierungs- und Evaluierungsprogramm (scientific implementation and evaluation programme)
WVZ	Wirtschaftliche Vereinigung Zucker e. V. (Sugar Industry Association)
WWF	World Wildlife Fund for Nature

ZDH	Zentralverband des Deutschen Handwerks e. V. (German Confederation of Skilled Crafts)
ZVDB	Zentralverband des Deutschen Bäckerhandwerks e. V. (umbrella organisation of the German bakery trade)

## Publications by the Scientific Advisory Board on Agricultural Policy, Food and Consumer Health Protection (since 2012)

**On making effective agri-environmental and climate-stewardship policies under the EU's post-2020 Common Agricultural Policy**, opinion, May 2019.

**Opportunities, approaches and limitations of administrative simplification of the EU Common Agricultural Policy**, opinion, April 2019.

**For a post-2020 EU Common Agricultural Policy that serves the public good: Fundamental questions and recommendations**, opinion, April 2018.

**Climate change mitigation in agriculture and forestry and in the downstream sectors of food and timber use**, joint expertise by the Scientific Advisory Board on Agricultural Policy, Food and Consumer Health Protection (WBAE) and the Scientific Advisory Board on Forest Policy (WBW), November 2016.

**Pathways to socially accepted livestock husbandry in Germany**, expertise, March 2015.

**Amendment of the Fertiliser Application Ordinance: Limiting nutrient surpluses effectively**, joint expertise by the Scientific Advisory Boards on Agricultural Policy (WBA) and on Fertiliser Issues (WBD) and the German Advisory Council on the Environment (SRU), August 2013.

**Food security and sustainable productivity growth**, opinion, January 2012.

## Information about the WBAE

The Scientific Advisory Board on Agricultural Policy, Food and Consumer Health Protection (WBAE) is an interdisciplinary committee that advises the BMEL on policy development in these areas. The Advisory Board operates independently and on a voluntary basis, and produces expertises and opinions on topics of its choosing. It focuses primarily on reviewing the objectives and principles of agricultural and food policy, analysing and evaluating societal requirements and developments in the agricultural and food system, and submitting proposals for the further development of agricultural and food policy.

## Contact persons

The Advisory Board office is located within BMEL, Division 721  
Office

Phone: 030 / 18 529 - 48 23

Fax: 030 18 529 31 11

E-mail: [WBAE@bmel.bund.de](mailto:WBAE@bmel.bund.de)

Web: [https://www.bmel.de/DE/Ministerium/Organisation/Beiraete/\\_Texte/AgrOrganisation.html](https://www.bmel.de/DE/Ministerium/Organisation/Beiraete/_Texte/AgrOrganisation.html)