A SUSTAINABLE FOOD SYSTEM FOR THE EUROPEAN UNION

SAPEA

Science Advice for Policy by European Academies

Evidence Review Report No. 7

This Evidence Review Report has been produced under the auspices of the SAPEA consortium, as a deliverable under Grant Agreement 737432 "Science Advice for Policy by European Academies" that was signed by the consortium and the European Commission on 22 November 2016.

The text of this work is licensed under the terms of the Creative Commons Attribution licence which permits unrestricted use, provided the original author and source are credited. The licence is available at http://creativecommons.org/licenses/by/4.0. Images reproduced from other publications are not covered by this licence and remain the property of their respective owners, whose licence terms may be different. Every effort has been made to secure permission for reproduction of copyright material. The usage of images reproduced from other publications has not been reviewed by the copyright owners prior to release, and therefore those owners are not responsible for any errors, omissions or inaccuracies, or for any consequences arising from the use or misuse of this document.

In accordance with Article 35, paragraph 1 of the aforementioned Grant Agreement, the consortium identified all relevant interests of the experts requested to contribute to this Evidence Review Report, assessed whether an interest constituted a conflict of interests, and took — where relevant — measures to exclude that an interest could compromise or be reasonably perceived as compromising the impartiality or objectivity of the report. Further information about SAPEA's quality guidelines and working processes is available at www.sapea.info.

The information, facts and opinions set out in this report are those of the authors and do not necessarily reflect the opinion of the European Commission. The SAPEA Consortium is not responsible for the use which may be made of the information contained in this report by anyone, including the European Union institutions and bodies or any person acting on their behalf.

- ISBN 978-3-9820301-7-3
- DOI 10.26356/sustainablefood
- Downloadable from www.sapea.info/food

Publisher

SAPEA
c/o acatech
Pariser Platz 4a
10117 Berlin, Germany

Contact

SAPEA Communications Office
Rue d'Egmont 13
1000 Brussels, Belgium
contact@sapea.info

SAPEA, Science Advice for Policy by European Academies. (2020). *A sustainable food system for the European Union*. Berlin: SAPEA. https://doi.org/10.26356/sustainablefood

Version history

Version	Date	Summary of changes
1.0	9 April 2020	First published version
1.1	9 October 2020	First printed version; some typos corrected
1.2	22 February 2021	Typos corrected

SAPEA

Science Advice for Policy by European Academies

A sustainable food system for the European Union

Informs the Scientific Opinion
of the European Commission Group of Chief Scientific Advisors

This Evidence Review Report went to press before the outbreak of coronavirus (COVID-19) in Europe. While the pandemic has had an immediate effect on the food supply system across Europe, it has not been possible to provide an evidence-based analysis of its full implications here. Our discussion of unpredictable events and future scenarios (section 2.4, p.47) takes on renewed significance in the current context as well as our exploration of food system resilience (section 1.1 and throughout the Report). Further research will, however, be needed before the long-term effects of the virus can be adequately assessed.

Table of contents

Foreword 9

Preface 10

Executive summary 13

Chapter 1. Introduction: a global challenge 19

1.1. Scoping the problem 20
1.2. The evidence review process 22
1.3. Scope of the review 24
1.4. Defining our terms 27
1.5. Structure of the Report 30
1.6. Key messages and policy implications 32

Chapter 2. Critical challenges facing the food system 33

2.1. Introduction 33
2.2. Major global transformations affecting the food system 35
2.3. Territorial imbalances and other contextual challenges of European food systems 42
2.4. Future scenarios 47
2.5. Key messages and policy implications 50

Chapter 3. Theoretical perspectives and alternative framings of food 51

3.1. Theoretical perspectives on sustainable food transitions 52
3.2. Alternative framings of contemporary food systems 56
3.3. Social movements around food 62
3.4. Conclusion 64
3.5. Key messages and policy implications 65

Chapter 4. Understanding sustainable food systems 66

4.1. Introduction 66
4.2. Definition of a sustainable food system 67
4.3. Food systems as complex adaptive systems 69
4.4. Food systems in the transition from a mass consumption to a circular economy 71
4.5. Governance of sustainable food systems 80
4.6. Conclusion 86
4.7. Key messages and policy implications 86

Chapter 5. Current and recent policy initiatives 88

5.1. Global level 88
5.2. EU level 92
5.3. National level 97
5.4. Local level 101
5.5. Key messages and policy implications 103

Chapter 6. Non-governmental agents of change 104

6.1. Producers 105
6.2. Storage, distribution, processing and packaging actors 107
6.3. Retail chains and networks 112
6.4. Educators, influencers and information providers 114
6.5. Individuals as food consumers and citizen-consumers 116
6.6. Non-governmental, civil society and grassroots actors 123
6.7. Science and researchers 124
6.8. Conclusions 126
6.9. Key messages and policy implications 127

Chapter 7. Good practice and lessons learned 129

7.1. The Fat Tax, Hungary 130
7.2. Consumer cooperatives, Poland 132
7.3. FoodCloud, Ireland 134
7.4. The organic food market, Denmark 136
7.5. The RETHINK project, Latvia and Lithuania 138
7.6. A bakery sustainability project, France 140
7.7. The Danish wholegrain partnership 143
7.8. The Sustainable Food Cities Network, UK 145
7.9. Key messages and policy implications 148

Chapter 8. Summary and conclusions 150

8.1. (Re-)framing the issue 150
8.2. Food system transitions 152
8.3. Food system governance 155
8.4. Ways forward 157

References 160

Annex 1. Working Group members 198

Annex 2. Systematic literature review 199

Annex 3a. Long list of good practice examples 204

Annex 3b. Indicative list of other European initiatives 209

Annex 4. Expert workshop 212

Annex 5. Peer review 214

Annex 6. Acronyms 216

Annex 7. Acknowledgements 218

List of figures

Figure 1. Mapping the food system **30**

Figure 2. Planetary boundaries according to Rockström et al. (2009) and Steffen et al. (2015) **36**

Figure 3. Planetary boundaries and the doughnut model **37**

Figure 4. Trends in global warming: Evolution of global mean surface temperature (GMST) over the period of instrumental observations **38**

Figure 5. Percentage employed in agriculture across the EU **44**

Figure 6. Gross value added per farm across EU-27 for period 2007–2011 **46**

Figure 7. Future food scenarios **48**

Figure 8. The waste hierarchy, post-consumerism and the circular economy **76**

Figure 9. Food governance and food co-management **104**

Figure 10. FoodCloud in numbers **136**

Figure 11. Determinants of organic food consumption **138**

Figure 12. Partner contributions and relations in the Danish wholegrain partnership **144**

Figure 13. Wholegrain intake for the Danish population **145**

List of tables

Table 1. Food-related issues in the UN's SDGs **22**

Table 2. Four narratives of food system failure **57**

Table 3. Summary of links between different framings and possible policy interventions **60**

Table 4. Framework: five principles for food system governance (Termeer et al., 2018) **85**

Table 5. The effectiveness of different types of interventions (adapted from European Commission, 2018) **99**

List of boxes

Box 1. Key definitions **19**

Box 2. Community-supported agriculture **63**

Box 3. Example questions to gain insight into complex food systems and workable pathways **69**

Box 4. Food waste and food sharing **73**

Box 5. Dilemmas in the transition towards a sustainable food system **79**

Box 6. Consumer attitudes and perceptions of food technologies **118**

Foreword

Living sustainably on our planet is perhaps one of the greatest challenges of our century, and the way we produce and consume food plays a major role in addressing this challenge. Food lies at the heart of our lives; it is vital for our survival, and links us to our natural and social environment in a very unique way. There is no doubt that our present food system is unsustainable, so as Europeans we must ask ourselves how to rethink and drive a 'just' (fair) and speedy transformation.

SAPEA was delighted to be asked by the European Commission's Group of Chief Scientific Advisors to produce an Evidence Review Report on such a crucial issue. This Report informs a corresponding Scientific Opinion, and both the present Evidence Review Report and the Scientific Opinion will inform policymakers, in these important times where Europe strives to be a global leader on sustainability issues through its Green Deal. We have particularly welcomed the holistic and interdisciplinary approach requested for this report, with particular emphasis on issues to which the social sciences can respond. The complexity of such questions can only be addressed by drawing on a broad range of expertise and many different sources of evidence, characteristics that form the cornerstones of SAPEA.

As a member of the SAPEA consortium, the European Federation of Academies of Sciences and Humanities (ALLEA) was in charge of delivering this review. In drafting this report, SAPEA brought together an outstanding working group of European scientists from eleven different European countries and covering a broad range of disciplinary backgrounds. The report reflects the passion and determination of its authors to present the best up-to-date evidence in an impartial way. This first-class evidence review presents a thorough set of evidence-based key messages with important policy implications that can help Europe move towards a more sustainable food system in a fair and timely manner. We thank all contributing experts warmly for their time and dedication, and especially the Chair of the SAPEA Working Group, Professor Peter Jackson of the British Academy.

We would also like to express our sincere gratitude to the science academies across Europe, thanks to whom SAPEA can bring together the best available science, and to our consortium partners, particularly Academia Europaea for supporting this work with the provision of a systematic literature review.

Professor Reinhard Hüttl
Chair of the SAPEA board

Professor Antonio Loprieno
President of ALLEA

Preface

Food insecurity and sustainability are widely recognised as among the most significant global challenges facing humanity in the 21st century, linked to a range of other challenges including malnutrition, biodiversity loss, climate change, soil degradation and water quality. Ensuring sufficient, safe and nutritious food for all is a major issue for the European Union, both internally and in terms of its wider international responsibilities. These challenges, which require an interdisciplinary approach, are exacerbated by the current conditions of rapid population growth, increasing urbanisation and political instability across the world.

In April 2019, a Working Group was established with the invitation to use social science insights to map and analyse the various components of the food system and their dynamics in relation to sustainability objectives. The Working Group was asked to answer the following question:

> What are workable paths to deliver an inclusive, 'just' and timely transition to an EU sustainable food system, considering 'co-benefits' for health, the environment, and socio-economic aspects, including the socio-economic situation of the farming sector, and addressing territorial imbalances, the rural-urban divide, food waste as well as responsible consumer behaviour?

The question was put by the European Commission's Group of Chief Scientific Advisors, who requested the assistance of SAPEA in setting up a Working Group to undertake a review of the available scientific evidence and compile this Evidence Review Report.

The Working Group was asked to consider how a socially just and sustainable food system for the EU is best defined and described, based on the best available scientific evidence and covering the societal, economic and environmental dimensions of sustainability. Focusing on issues that were within the sphere of influence of the European Commission, the Working Group was also asked how best to develop a just and sustainable food system at a range of scales (the EU and globally, member states, communities, cities and rural areas), including how examples of good practice can be stimulated, supported and spread.

Accepting these terms of reference, the Working Group set about its task, determined to provide the Advisors and the Commission with the practical, evidence-based advice they required. We were ably supported by colleagues in the SAM unit and in SAPEA, among whom I particularly want to thank Gerjon Ikink and Céline Tschirhart. Systematic reviews of the literature supporting our work were undertaken by Louise Edwards, Alison Weightman and colleagues in the Specialist Unit for Review Evidence at Cardiff University, with an advisory panel chaired by Professor Terry Marsden.

Our report focuses on policies and practices whose efficacy has been scrutinised in the peer-reviewed academic literature. We have attempted to identify what works in terms of policy and practice, including the barriers and enablers of change towards a more sustainable and socially just food system. Each section of the report concludes with a list of key messages and policy implications.

I would like to conclude by thanking the members of the Working Group (listed in Annex 1, p.198) for the thoughtfulness, creativity and commitment with which they approached the task. We hope our report will contribute to the development of a more just and sustainable food system for the benefit of present and future generations within and beyond the European Union.

Professor Peter Jackson FBA
Chair of the Working Group

Executive summary

The Working Group was asked to identify 'workable paths' to deliver an inclusive, 'just' and timely transition to an EU sustainable food system. In delivering this objective, we were also asked to consider 'co-benefits' for health, the environment, and socio-economic aspects, adressing the socio-economic situation of the farming sector, territorial imbalances, the rural-urban divide and food waste, as well as responsible consumer behaviour. Our Report addresses all of these issues, taking an integrated systems-based approach rather than treating each issue separately.

A global challenge

Sustainability and food security are amongst the greatest challenges facing the world today. The evidence we reviewed confirms the view that radical system-wide change is required, with 'business as usual' no longer a viable option.

Insofar as evidence allows, this Report attempts to identify workable paths towards a more socially just and sustainable food system, adopting a social science perspective to ask 'What works and why?'. Evidence is taken from peer-reviewed scientific papers, as well as reports from international organisations, government agencies, and other relevant advisory bodies, maintaining a clear division between academic research and policymaking. Expert judgement has been used to identify the highest quality and most reliable evidence available from the social sciences.

Adopting a systems-based approach helps recognise synergies and trade-offs, moving beyond linear 'farm-to-fork' approaches, to more circular, inclusive systems. The approach also seeks connections across the food system, including waste reduction and stimulating healthier diets. Power asymmetries, complex governance arrangements and regulatory challenges are also identified as hindering the development of more joined-up systems thinking.

The Report moves past dominant narratives of food as a tradeable commodity or means of survival, to acknowledge its deep social and cultural significance.

Advances towards a sustainable food system require actors at many levels to address several interrelated challenges, including malnutrition, population growth and urbanisation, biodiversity, globalisation, territorial imbalances and geopolitical uncertainties, as well as the social and environmental consequences of intensive farming and industrialised food-production practices.

Scenario analysis offers a promising means of imagining future food systems including their turbulent, uncertain, novel and ambiguous (TUNA) character, also highlighting the need for alternative metrics of social and environmental impact.

Theoretical perspectives and alternative framings

The social sciences offer a stock of diverse theories which can be used to frame, understand and synthesise actions that contribute to sustainability transitions, addressing both structural and individual-level concerns.

Prominent theories regarding sustainablility transitions in the agri-food literature include:

- Multi-level Perspective
- Transition Management
- Strategic Niche Management
- Social Practice Approaches
- Technological Innovation Systems

Behavioural science approaches focus on decision-making by individuals and groups and include:

- Reasoned Action Theories (e.g. the Theory of Planned Behaviour)
- Dual Process Models (e.g. the Elaboration Likelihood Model)
- Choice Architecture approaches
- Social Norms Theories

The social sciences offer a powerful means for revealing the implict framings of different policy options, helping to make their underlying premises more open and transparent.

Understanding sustainable food systems

The Report understands food as part of a dynamic, complex system involving human-environment processes with high levels of uncertainty.

While there is no universal definition of food sustainability, it is widely recognised that the current food system is unsustainable, requiring attention to its social, economic and ecological components.

Approaching food via complex adaptive systems thinking can aid coherent policymaking by acknowledging interactions between subsystems and providing a pathway from ideation to iteration, allowing both a common EU approach and regionally specific ones.

The Report favours a move from linear 'farm-to-fork' approaches towards a more circular approach. This formulation helps move thinking beyond mass consumption and food waste, towards approaches that build reuse into product design, minimising food loss and waste to deliver environmental and economic benefits.

The financial burden of wasted food is estimated to be €900 billion in economic costs with an additional €800 billion in social costs. Circular economy models also favour the re-valorisation of unpreventable waste, redirecting it back into the supply chain and helping to meet the Sustainable Development Goals. Governance is an important part of food system transitions and fragmentation of governance systems is common. While this may benefit institutional diversity, adaptability and innovation, it can ultimately hinder efficiency and performance.

Food is a complex socio-ecological and economic system that requires different governance arrangements at different levels, to account for framing, connectivity, adaptability, inclusiveness and transformative capacity.

Trade-offs between competing objectives are common, underlining the complexity of the very notion of 'sustainable food systems'.[1]

Current and recent policy initiatives

Effective policy measures are key in transitioning to a sustainable food system, with many existing policies having the potential to help or hinder progress, while acknowledging that accurate assessment of policy outcomes can be difficult due to system complexity.

At a global level, agriculture, fisheries and food are subject to a large number of binding agreements designed to maintain global trade. Trade liberalisation's compatibility with sustainability goals remains disputed.

The 2015 Paris Agreement sought to limit global warming to 1.5˚C, leading the EU to aim for a 40% reduction of greenhouse gas emissions compared to 1990 levels, which places climate change mitigation policy as a key concern for future food systems. Food systems

1 We have tried to be consistent in referring to 'food systems' in the plural where we are considering their operation at different scales and to 'food system' in the singular where we are referring to a single scale such as the EU.

are inherently linked to climate change, currently responsible for up to 37% of global greenhouse gas emissions.

The Sustainable Development Goals represent an important policy initiative that carries considerable moral and political weight. Global organisations such as the Food and Agriculture Organisation, the World Health Organisation and the World Bank also contribute to providing policy direction.

Private schemes, such as accreditation and food labelling, also contribute to the 'hybridisation' of food governance and work best when there are clear market incentives, plus a legislative 'threat'.

Food policy within the EU is fragmented with no overarching framework. However, several policies provide potential leverage points towards sustainable food systems. These include the Common Agricultural Policy, food safety legislation, the Common Fisheries Policy, environmental legislation, health and energy policy, research and innovation policy, and trade and competition laws. Food security and sustainability goals could be advanced by greater policy coherence.

National-level food policies within member states are sporadic and often mostly symbolic. Recent sector-specific initiatives, including public procurement policies, can be a powerful contributor to sustainable food systems and are currently underutilised in many countries.

Public health policy can be approached in various ways. 'Hard' instruments such as taxes, standards or bans are shown to be effective, while 'softer' policies which attempt to nudge consumers by adjusting the architecture of choice can also be effective. Information-based approaches have shown limited efficacy unless used as part of a wider policy mix. Some examples of local food policy have attracted wide attention, such as the Milan Urban Food Policy Pact, though evidence of impact is sparse. Localised policies provide experimental opportunities for new approaches, to be repackaged or scaled up nationally if proved successful.

Non-governmental agents of change

Actors outside of government can be drivers or inhibitors of change within the food system, requiring careful consideration.

The pace of change is exacerbated by power differences among system actors and varying influence across domains and sectors, representing many different interests and

motives. Social change usually results in winners and losers, with 'win-wins' being the exception.

Experimental approaches, where innovations are trialled and evaluated, often at the local level, appear powerful in this context. They offer a means of identifying specific leverage points within a complex system, allowing adjustments to be made and conflicts to be addressed.

Notable non-governmental actors include:

- food producers and post-production food enterprises
- retail chains and networks
- out-of-home and food-service providers (restaurants, cafés, canteens)
- educators, influencers and information providers
- individuals as citizen-consumers; non-governmental organisations, civil society and grassroots actors
- scientists and researchers

Good practice and lessons learned

Recent initiatives across Europe provide examples where actors, issues and contexts of transformation have been successfully coordinated. These include:

- taxation schemes
- consumer cooperatives
- technological initiatives
- labelling and governance intiatives
- socio-economic intiatives
- health and sustainability initiatives
- multilevel collaborations to promote sustainable food cities

Collectively, these examples allow us to think about the institutional arrangements that are necessary to promote successful transitions, the combination of stakeholders, the challenge they pose to prominent system actors and the potential for non-market-based solutions.

Summary and conclusions

The EU food system faces a number of fundamental challenges that require system-wide change. Environmental, health and socio-economic issues are interconnected and do not exist in separate silos. Strong leadership is required to integrate actors across all parts of the food system, highlighting the need for better-coordinated governance. Coordination and adaptability are vital, including support and guidance for bottom-up activities, necessitating polycentric and adaptive governance.

Accepting collective responsibility is paramount, as it is unlikely that any single actor can achieve even modest steps towards sustainability, while local policy action has the power to provide potential seeds of transformative change.

Providing information is unlikely to create change unless combined with 'harder' measures such as taxation and legislation.

Agricultural contributions to greenhouse gas emissions and food waste are fundamental concerns that need to be addressed; animal products, particularly red meat, use unsustainable levels of input at the current level of production. Excessive meat consumption is also having a negative impact on public health. Alignment of environmental (food, energy and water) and health goals is therefore required across all sectors.

Meeting the global demand for food in 2050 will require significant dietary change as well as large reductions in food waste, as technology or yield increases are unlikely to meet demand alone. Evidence of 'what works' requires strengthening, including further research on the public understanding of science and consumer acceptance of new technologies.

Chapter 1. Introduction: a global challenge

Food security and sustainability are widely recognised as among the most significant challenges facing humanity today, alongside associated issues such as climate change, biodiversity loss, urbanisation and population growth. This Report addresses these important challenges, reviewing the best available scientific evidence while seeking to to chart a course towards a more just and sustainable food system, capable of providing safe, nutritious and affordable food for all.

Food is fundamental to life, as vital as the air we breathe and the water we drink.[2] Yet many people lack access to sufficient, safe and nutritious food, a situation which scientists and policymakers describe in terms of food insecurity. Besides its value in supporting human life, food also has enormous social, economic and cultural significance. Indeed (as we show in Chapter 3), how we 'frame' food — as a tradable commodity, a human right or a source of social meaning associated with identity, pleasure or anxiety — has implications for how policies are formulated and how pathways to a more just and sustainable food system are identified.

Box 1. Key definitions

Food security is conventionally defined as "when all people, at all times, have physical and economic access to sufficient, safe and nutritious food to meet their dietary needs and food preferences for an active and healthy life" (FAO, 1996).

Sustainability is an equally complex term with multiple dimensions (social, economic, environmental), generally discussed in terms of meeting the needs of the current generation without compromising the needs of future generations. Further definitions are provided in Chapter 3, while the implications of these different approaches in framing policy initiatives are discussed in Chapter 5.

A recent report by the European Commission's Standing Committee on Agricultural Research reviewed over 50 studies of food system challenges and solutions, assessing the merits of a systems-based approach across the combined domains of agriculture,

2 Though we acknowledge that food and drink are in many ways inseparable, our report focuses on food per se rather than other forms of bodily consumption such as alcohol or tobacco. The boundaries of the edible are ultimately arbitrary (Jackson & the CONANX Group, 2013) and we have made our choice on pragmatic grounds rather than as a matter of principle. We also make only passing reference to animal feed.

fisheries, food, environment, nutrition and health (European Commission, 2019b). It concluded that a **systems-based approach** contributes to a better understanding of the interdependencies between key parts of food systems at various scales, helping to avoid overlooking trade-offs and possible synergies. It identified a range of places to intervene in the system, starting with the mindset or paradigm from which the view of the food system arose.[3] We adopt a systems approach in this Report, seeking to address the issues in an integrated and holistic manner.

1.1. Scoping the problem

Conservative estimates suggest that the global population is set to increase to around 9.7 billion by 2050 from its current level of 7.7 billion (UN, 2019b). Unless significant changes in food systems are achieved, addressing food waste and consumption patterns, this increase in population means that 50–70% more food will need to be produced to keep pace with the anticipated level of demand (FAO, 2009; UN, 2019b). Demand is also likely to increase as countries whose diet is currently based on rice and vegetables go through a "nutrition transition" (Popkin, 2006) towards diets that are more heavily dependent on meat and dairy products.[4] Globally, at current population levels, over 800 million people are chronically undernourished, facing daily food shortages, while more than 1.9 billion adults are overweight, of whom over 650 million are defined as obese — a paradox that is sometimes described as the "double burden" of malnutrition (WHO, 2018).[5]

According to the Scoping Paper that formed the basis for the current Evidence Review Report (SAM, 2019a),[6] the availability of food is not perceived as an immediate, major concern in Europe — but access to safe and nutritious food is still problematic for significant parts of the population in many European countries. The food system (which includes all the actors and institutions involved in producing, distributing, consuming and disposing of food) is beset by multiple problems, from unacceptable levels of food waste to the growing ecological footprint of agriculture, from chronic soil depletion to recurrent food scares (see Chapter 2). The need for a more holistic and interdisciplinary

3 Malhi et al. (2009) also seek to identify places to intervene in complex food systems to make them "healthy, green, fair, and affordable". They propose an intervention framework that focuses on the paradigm, goals, system structure, feedback and delays, and structural elements of such systems.

4 The recent EAT-Lancet Commission report on healthy diets from sustainable food systems describes a universal healthy reference diet, based on an increase in consumption of vegetables, fruits, whole grains, legumes and nuts, and a decrease in consumption of red meat, sugar, and refined grains (Willett et al., 2019).

5 Indeed, some refer to the 'triple burden' of malnutrition, including micro-nutrient deficiency in the definition.

6 In more formal terms, the Scoping Paper is an agreement between the College of Commissioners and the Group of Chief Scientific Advisors. The full text is available to download at www.sapea.info/food.

approach to food systems is now widely recognised (see, for example, Doherty et al., 2019; Horton et al., 2017; Moscatelli et al., 2016). In the past decade, special attention has been given to the characteristics and boundaries of complex food systems (Springmann et al., 2018; Zurek et al., 2018), the links between resilience and policy (Bristow & Healy, 2014), transitions in niches (Geels, 2011), and interactions between actors and exchange of learning (Meynard et al., 2017). Moving from a linear ('farm-to-fork') approach towards a more holistic, systems-based approach also helps advance a more circular, balanced and inclusive view with the intention of providing sufficient, safe and nutritious food for all.

The Scoping Paper outlines what is at stake in terms of the transition to a more just and sustainable food system, including the ecological challenges facing agriculture, the social challenges of accessing food by vulnerable groups and the lack of resilience to potential economic shocks that characterise the current system.[7] It highlights the geopolitical issues facing the EU, which currently imports around half its food, and the often competing demands for food resources for producing biofuels and plant-based chemicals as well as for feeding the population.

Modern food production makes significant demands on water and energy resources and has important consequences for public health. Food systems also contribute significantly to greenhouse gas emissions and play a key role in driving climate change (Mbow et al., 2019; Vermeulen et al., 2012).[8]

The situation is sufficiently urgent that most commentators agree 'business as usual' is no longer a viable option and radical change is required. This is reflected in the growing attention paid by international and European institutions to food system challenges. Several initiatives, including the recently created European Food Forum, are promoting a system shift. Similar concerns are acknowledged in the United Nations' Sustainable Development Goals (SDGs), many of which are directly or indirectly related to food production and consumption (see Table 1, p.22). For example, SDG2 sets the goal of ending hunger, while SDG12 refers to more responsible modes of consumption and production. SDG5 highlights the persistence of gender inequalities in access to safe drinking water and nutritious food in many parts of the world, as well as gendered inequities in access to land and other resources. SDG13 highlights the need for urgent action to combat climate change in which intensive modes of agricultural production and current levels of consumption play a significant role, while SDG14 and SDG15 highlight the need to conserve land and marine resources, promoting biodiversity and sustainable development.

7 'Resilience' is a contested concept in the context of environmental sustainability, particularly where it refers to a system's ability to bounce back to a previous steady-state. For further discussion of the concept, see Doherty et al. (2019).

8 The implications of intensive agricultural production methods for climate change adaptation were the focus of a recent report by the European Environment Agency (2019) and are a central concern of the IPCC's special report on climate change and land (IPCC, 2019a).

Table 1. Food-related issues in the UN's SDGs

SDG2: Zero hunger	End hunger, achieve food security and improved nutrition and promote sustainable agriculture
SDG3: Health and welfare	Ensure healthy lives and promote well-being for all at all ages
SDG5: Gender equity	Achieve gender equality and empower all women and girls
SDG10: Reduction of inequities	Reduce inequality within and among countries
SDG12: Responsible consumption and production	Ensure sustainable consumption and production patterns
SDG13: Climate change	Take urgent action to combat climate change and its impacts
SDG14: Life below water	Conserve and sustainably use the oceans, seas and marine resources for sustainable development
SDG15: Life on land	Protect, restore and promote sustainable use of terrestrial ecosystems, sustainably manage forests, combat desertification, halt and reverse land degradation and halt biodiversity loss

This Report sets out to identify workable paths towards a more socially just and environmentally sustainable food system. We focus on policies and practices for which there is reliable, peer-reviewed evidence of their effectiveness, including specific, concrete, actionable suggestions based mainly in the social scientific literature, identifying examples of how best to achieve uptake, implementation and impact of these policies. Our Report highlights a significant gap in knowledge regarding the effectiveness of policy interventions where a rich body of systematic evaluations of proposed interventions are often not available in sufficient numbers. A recent report on existing food system studies and research projects in Europe reached similar conclusions. Having reviewed over 50 European and global studies of food system challenges and solutions, the report found few documented examples of real-life changes, suggesting that the literature on food systems was still in its infancy (European Commission, 2019b).

The next section describes the process we followed to achieve the goals of this Report.

1.2. The evidence review process

Under the working title *Towards an EU sustainable food system*, the Working Group was set up in response to a request from the European Commission's Group of Chief Scientific Advisors. A Scoping Paper was produced under the auspices of the Scientific Advice Mechanism. The formation of the Working Group was coordinated by SAPEA. Working Group members were proposed by their respective national academies and selected according to their academic expertise and a number of other criteria, including gender balance and diversity of member states represented. The Working Group met three times in 2019 (in London, Berlin and Amsterdam) and its members had numerous online interactions between each face-to-face meeting.

Our Report identifies the policy implications of the evidence we reviewed, but does not offer specific recommendations. The evidence review is designed to inform a Scientific Opinion from the Advisors. This then feeds into the political process of policymaking, from which the Working Group is several steps removed. This division of responsibilities ensures that the Working Group's academic integrity and independence are maintained.

As part of this process, Working Group members disclosed any risk of Conflicts of Interest, which were carefully reviewed under the terms set by the SAPEA Board. These 'due diligence' measures were followed in order to ensure that our findings are fully independent and not subject to external influence, commercial interest or political pressure.

Our Report is based on published, peer-reviewed evidence and on a consensus of the whole Working Group. The Report has also been subject to detailed discussion in a workshop involving external experts (see Annex 4, p.214), as part of a rigorous process of external peer review. It has also been officially endorsed by the Academy Networks which form the SAPEA consortium.

To avoid misunderstanding, we reiterate that it is the role of social scientists (and the Working Group in particular) to provide robust and independent evidence that can be deployed in the formulation of policy. In this role, we have contributed to the *evaluation* of policies, reviewing various options, assessing their outcomes and evaluating their costs and benefits. Through the systematic review process, coupled with the Working Group's expert knowledge, our work is based on an analysis of evidence published in the peer-reviewed academic literature. We offer evidence-based insights, drawn from social science research. This is quite separate from the process of policy formulation, where specific recommendations are advanced, based on normative judgements and political objectives. Reviewing the available evidence regarding the effectiveness of different policy initiatives is very different from making specific policy recommendations, where academic judgement blurs into advocacy — a line which we have been at great pains not to cross in writing this Report.

The Review aims to bring together information and knowledge from all relevant academic sources and social science disciplines. Our work has also been informed by a systematic review of selected issues (SAPEA, 2020; see Annex 2, p.199), supplementing the expert knowledge of Working Group members.

This raises important questions about the nature of social science knowledge and what counts as evidence in different kinds of study. It is important to note that evidence in social science research, both in general and specifically in relation to our focus on the EU food system, is rarely the outcome of randomised controlled trials which are often considered the 'gold standard' for research in the human sciences (see also SAPEA, 2019a). Most of the evidence we reviewed would not meet the criteria applied, for

example, in medical science (Goldet & Howick, 2013). Many of the important policy-relevant questions dealt with in the social sciences are not amenable to this kind of approach (Whitty, 2015). Broad and complex problems such as the ones targeted here demand cross-disciplinary research, which requires a broader, less hierarchical approach to evidence quality than applied in some disciplines (Game et al., 2018). Without belittling the relevance of high-quality quantitative academic research for demonstrating causality (for example, the effects of a particular drug on a disease), case studies and other types of qualitative evidence are useful to inform more complex societal debates (Royal Society & The Academy of Medical Sciences, 2018). Still, the quality of research obviously varies, irrespective of whether quantitative or qualitative methods are used (Goldet & Howick, 2013; Munn et al., 2014).

In undertaking this review, the Working Group have taken these issues into account, using our expert judgement to focus on the most reliable evidence currently available.

1.3. Scope of the review

The Scoping Paper referred to above (SAM, 2019a), which set out the European Commission's request to the Group of Chief Scientific Advisors, identified the need for an integrated view of the food system, also noting a **"social science deficit"** in existing work. It urged the Working Group to identify potential co-benefits for food security, health and the environment; to ensure that the implications for rural livelihoods were respected; and to address the need for coordinated EU action.

The Scoping Paper suggested that a broad consensus exists on the actions that are required to move towards a more sustainable food system.[9] These include:

- the promotion of 'sustainable intensification' and/or scaling up agro-ecological approaches[10]
- reducing food loss and waste
- stimulating dietary change towards healthier, less resource-intensive and more plant-based diets
- improving the resilience and robustness of the food system
- increasing the awareness, accountability and stewardship of producers and consumers to better inform their choices

These recommended actions involve a wide range of actors operating at different scales — from communities and cities to member states, including businesses and governments at the EU and wider (global) scales.

This broad consensus is acknowledged in the European Commission's Food 2030 strategy, which has been embedded in relevant European and international policies.[11] It is also implicit in many of the societal challenges within Horizon 2020, notably in societal challenge 2: "Food security, sustainable agriculture and forestry, marine and maritime and inland water research and the bioeconomy".[12] In the SAM Unit's initial Scoping Review of the grey literature (SAM, 2019b), twelve reports were highlighted as most closely related to our work:

- EASAC (European Academies Science Advisory Council), 2017. *Opportunities and challenges for research on food and nutrition security and agriculture in Europe*.
- EC FOOD2030 (European Commission, Directorate-General for Research and Innovation), 2018. *FOOD2030: Recipe for change*.
- EEA (European Environment Agency), 2017. *Food in a green light: A systems approach to sustainable food*.
- FAO (Food and Agriculture Organisation of the United Nations), 2018. *The future of food and agriculture: Alternative pathways to 2050*.
- Fresco & Poppe (Wageningen University & Research), 2016. *Towards a common agricultural and food policy.*
- GO Science (UK Government Office for Science), 2011. *The future of food and farming*.
- IIASA (International Institute for Applied Systems Analysis), 2018. *The world in 2050 transformations to achieve the SDGs*.
- iPES-Food (International Panel of Experts on Sustainable Food Systems), 2019. *Towards a common food policy for the EU*.
- STOA (Science and Technology Options Assessment), 2013. *Technology options for feeding 10 billion people: Sustainable food and agriculture in the EU*.
- WRI (World Resources Institute, in partnership with the World Bank, UN Environment, UN Development Programme, CIRAD & INRA), 2018. *World Resources Report, synthesis report: Creating a sustainable food future: A menu of solutions to feed nearly 10 billion people by 2050.*
- WRR (The Netherlands Scientific Council for Government Policy), 2015. *Towards a food policy*.

11 These include the UN SDGs, COP21 Climate Change, WHO Health policies, and the EU's Blue Growth Strategy, Common Agricultural Policy, Common Fisheries Policy, conservation policies, development cooperation, environment policies (Marine Strategy Framework Directive, Water Framework Directive, Circular Economy Package), European Fund for Strategic Investment, European Structural and Investment Funds, Food Safety Policy, Global Food Security Policy, Health Policy, and Rural Development Fund. Full references to these sources can be found in the Scoping Review (SAM, 2019b).

12 The Societal Challenges are detailed here: https://ec.europa.eu/programmes/horizon2020/en/h2020-section/societal-challenges

- Opinion of the EESC (European Economic and Social Committee), 2017, *Civil society contribution to the development of a comprehensive food policy in the EU*.

In producing our Report, the Working Group has drawn on these and other studies, as well as using our own expert knowledge and outputs from the systematic reviews that were commissioned as part of our work. These reviews covered recent policy initiatives, theoretical perspectives and examples of good practice. Further details of the review process are included in Annex 2, p.199.

The European Commission's reflection paper *Towards a sustainable Europe by 2030* expresses the need for "a comprehensive approach entailing a genuine change in the way we produce, transform, consume and distribute food by accelerating the transition to a sustainable food system based on circular economy principles and making innovative, healthy, environment and animal welfare-friendly, safe and nutritious food production one of our key European trademarks" (European Commission, 2019a). It also calls for "a socially fair transition", raising important ethical issues of equity and justice that this Report seeks to address. Similarly, European Commission President von der Leyen highlighted the need for a comprehensive new farm-to-fork strategy for a sustainable food system along the whole value chain[13] as well as "a just transition for all".[14] The strategy aims to design a fair, healthy and environmentally friendly food system as part of the European Green Deal, working across three Commission directorates-general, AGRI, SANTE and MARE.[15] We welcome these indications of a more joined-up approach to the EU's food system.[16]

There may be a broad consensus regarding the changes required to achieve a more just and sustainable food system. But there is much less agreement about how to achieve the desired changes, sometimes defined in terms of barriers to action or resistance to change. These include a lack of coordination based on complex governance structures and a complicated regulatory environment which hinders the development of joined-up thinking, together with potential conflicts of interest where powerful actors can block change (Daugbjerg, 1999; Morgan et al., 2006). As we argue in Chapter 6, radical change is also hampered by vested interests, strong cultural determinants and the prevalence of short-term over longer-term time horizons. Identifying 'what works' in terms of specific policy instruments is, therefore, more than a narrowly-defined technical exercise in identifying the appropriate levers to change behaviour or suggestions for how to address the knowledge-action gap. While our Report seeks to identify what policy instruments have been most effective in promoting change towards more just and sustainable food

13 https://ec.europa.eu/commission/commissioners/sites/comm-cwt2019/files/commissioner_mission_letters/mission-letter-stella-kyriakides_en.pdf

14 *A Union that strives for more: my agenda for Europe* https://ec.europa.eu/commission/sites/beta-political/files/political-guidelines-next-commission_en.pdf

15 A roadmap of the 'farm to fork' strategy for a sustainable food system is available at https://ec.europa.eu/food/farm2fork_en

16 Some might, however, criticise the conception of 'farm-to-fork' as too linear and bounded.

systems, we also seek to understand the wider environment in which these specific policies are cast.

We are not, therefore, simply working towards a planned transformation involving an agreed shift from a relatively stable system, which is perceived as untenable, through a period of more or less rapid change to a new and different system that is known to be more sustainable (Rotmans & Loorbach, 2009). Rather, we seek to establish where broad academic consensus and reliable knowledge exists, where conflicting ideas persist and where knowledge gaps remain to be addressed.

While the scope of this Report is mostly confined to food, we also considered research in other domains such as energy and water where there are lessons to be learned in terms of transitioning to more just systems and more sustainable practices. Indeed, the concept of a 'nexus' of food, water and energy is increasingly used to describe the complex and interrelated challenges of managing our global resources (FAO, 2014). The One Health agenda also offers a potential model for more integrated cross-sector thinking (Craddock & Hinchliffe, 2015).

1.4. Defining our terms

Food security

Much of the debate about food system thinking is couched in terms of food security and sustainability. We provided a brief definition of 'food security' on p.19, but it is important to recognise the term's long and complex history.

Since the World Food Summit in 1996, food security has become the conventional way in international policy circles of addressing the inadequacies of contemporary food systems. It is concerned with managing the consequences of an imbalance between food supply and demand, exacerbated by conditions of climate change, population increase, political instability, international conflict and urbanisation (among other concurrent social, economic and environmental changes). But 'security' is a loaded way of thinking about food supply and demand, prompting concerns about transnational food trade and the need to regulate borders and boundaries. The parallels with other securitisation issues can be readily discerned, linking biopolitics and sovereignty, international development and corporate power (McMichael, 2005).

The definition of food security has shifted significantly since its introduction in the 1970s. Starting with a discursive focus on the adequacy and availability of food supplies, with an emphasis on the fluctuation of food production and commodity prices, the concept took on new meaning in the 1980s, associated with food preferences and lifestyles,

and connections to dietary health and wellbeing (FAO, 2003, pp.25–26). Midgley (2013) provides a detailed unpacking of these discursive shifts, describing the concept of food security as "chaotic and contested" (p.436). Midgley argues that the political debate about food security has intensified during periods of crisis when acute food shortages arise following natural disasters or short-term price spikes. This affects the way food insecurity is measured and how it is experienced at different geographical scales. Critics have referred to food security as a "consensus frame behind which considerable dissensus lays hidden" (see also Maye & Kirwan, 2013; Mooney & Hunt, 2009). This was demonstrated empirically in Candel et al.'s (2014) analysis of the post-2013 reform of the Common Agricultural Policy that distilled six different framings of the relationship between that policy and food security which fundamentally conflicted with each other.

Food justice

Besides its focus on food security and sustainability, the Working Group was also asked to consider the transition towards a fairer and more socially just food system. The idea of 'food justice' is complex and contested, involving debate about the foundational concepts of justice, fairness and equity. These terms raise normative ideas about how we should live, by what ethical and moral precepts our actions should be guided, and what it means to do the right thing. Moral philosophers have debated these issues, distinguishing between utilitarian theories of justice (where justice is defined in terms of the most beneficial outcome for wider society), egalitarian theories (where justice involves the meeting of individuals' needs) and libertarian theories (where justice has to be earned and merited). As a result of these competing perspectives, Sen (2009) argued for a goal of reducing manifest injustice rather than seeking a notion of perfect justice. He suggests a central role for capabilities in this endeavour, enumerated by Nussbaum (2000) to include life, bodily health, bodily integrity, senses, imagination and thought, emotions, practical reason, affiliation, other species, play, and control over one's environment.

Emerging from these ideas, the concept of 'just sustainabilities' has been used to refer to "[t]he need to ensure a better quality of life for all, now and into the future, in a just and equitable manner, whilst living within the limits of supporting ecosystems" (Agyeman et al., 2003, p.5; see also Alkon & Agyeman, 2011). Reviewing this literature, Castán Broto & Westman (2017) identify four policy principles within a just sustainabilities approach:

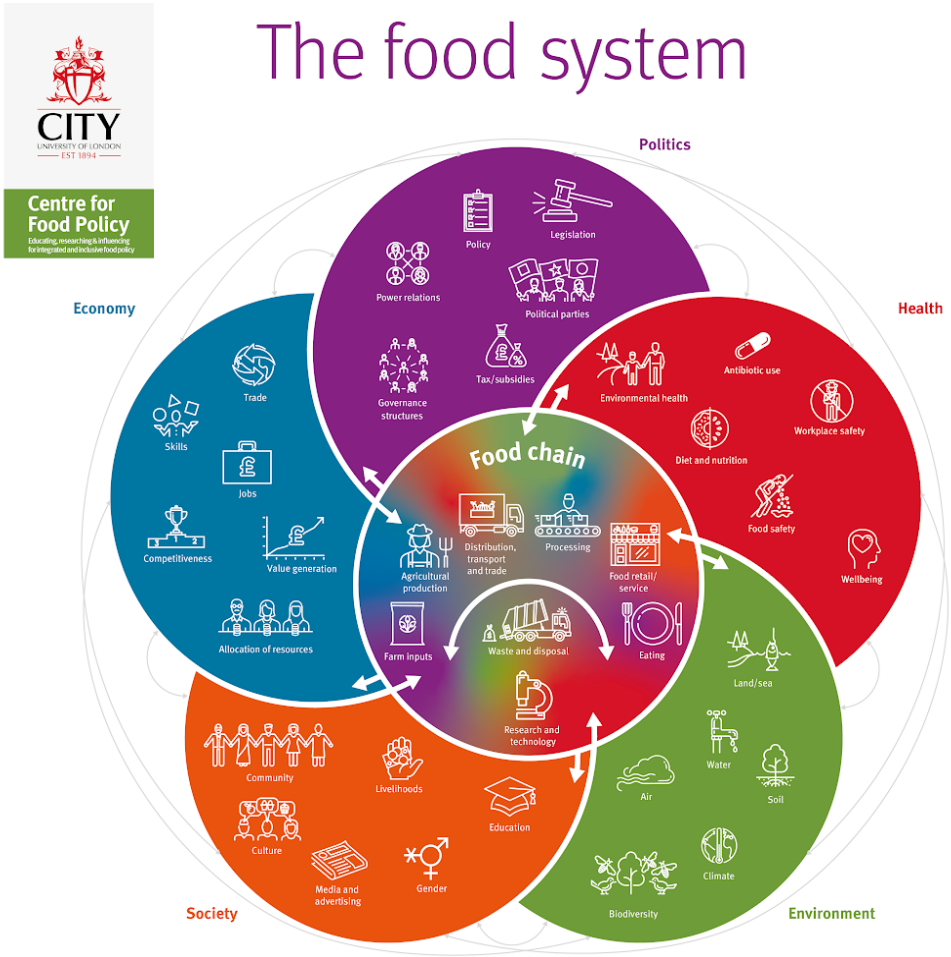
- addressing well-being and quality of life
- meeting the needs of present and future generations
- enabling justice and equity in terms of recognition, process, procedure and outcome
- living within ecosystem limits

Food justice can also be defined in distributive terms (Loo, 2014), as a matter of improving wages and conditions for those working in the food system and ensuring fairness in

the way fresh and healthy food is distributed. However, evidence also suggests that participative inequalities are at the root of the most important distributional disparities. For example, Lang & Heasman (2004) define food injustice in terms of the maldistribution of food, poor access to a good diet, inequities in the labour process and unfair returns for key suppliers along the food chain. This definition focuses on who gets what food and how those producing food share earnings and profits.[17]

We propose a more detailed working definition of just and sustainable food systems in chapter 4. But some of the initial complexities of the system are demonstrated in the SAM unit's Scoping Review Report (SAM, 2019b), which includes a visual representation of the food system, encompassing socio-economic and environmental drivers, the activities and actors that comprise the food system and a range of food system outcomes including their implications for food security. Other attempts at mapping the complexities of the contemporary food system draw attention to its location within a series of interlocking political, societal, health and environmental systems (see Figure 1 below).

Figure 1. Mapping the food system (Parsons et al., 2019)



17 Here, as elsewhere in this Report, access to clean and safe drinking water should be regarded as a key component of food justice and security.

Transition, transformation

Finally, we were asked to identify workable paths to deliver this transition to an EU sustainable food system. The terms 'transition' and 'transformation' have become increasingly, if loosely, used particularly in political and scientific discourses around sustainability (Davies, 2013). Reviewing the scientific literature, Hölscher et al. (2018) found that transition and transformation are not mutually exclusive concepts. Both have been used to describe, interpret and support desirable, radical and non-linear societal change. However, 'transition' has tended to be employed in analysis of changes in societal sub-subsystems (e.g. food, mobility, energy), with a focus on social, technological and institutional interactions (Loorbach et al., 2017; Rotmans et al., 2001). 'Transformation', meanwhile, is more commonly used when large-scale changes in whole societies are being interrogated (Brand, 2016; Folke et al., 2010). Transformation towards sustainability under this reading suggests radical change requiring a new "global social contract" (WBGU, 2011) that supports "innovations for more sustainable use of resources" (UNEP, 2011, p.51), but also requiring a "global remodelling of economy and society towards sustainability" — a process that itself will depend on "societal shaping and support" (WBGU, 2011). Hölscher et al. (2018) conclude that the two concepts might usefully enrich each other, for example with a transformation lens able to address broad ideas of power dynamics and justice, while a transitions focus can explore how matters of agency and governance might lead to disruptions supporting desirable societal change.

1.5. Structure of the Report

This chapter has outlined the scope of our Report, the questions it seeks to address and the process that was followed in order to provide a robust review of the available evidence.

- Chapter 2 reviews the critical issues facing the current food system.
- Chapter 3 outlines the various theoretical perspectives that can be brought to bear on the analysis of food systems and the significance of how food system issues are framed.
- Chapter 4 presents a definition of sustainability and food justice, viewed in terms of complex adaptive systems, the drive towards a more circular economy, and the governance challenges posed by this approach.
- Chapter 5 provides an analysis of current and recent policy initiatives, examining the question of 'what works' and why.
- Chapter 6 outlines the various non-governmental actors and institutions involved in the food system and the interests that they represent.

- Chapter 7 identifies some examples of good practice in the transition towards more just and sustainable food systems.
- Chapter 8 summarises the Report and presents our conclusions, including the case for greater coordination between different policies and levels of government, the role of private sector initiatives and the scope for grassroots innovation.

1.6. Key messages and policy implications

- The urgency of the issues facing the current food system reinforces the view that 'business as usual' is no longer a viable option and that more fundamental system-wide change is required.
- Food security has been the conventional framing for addressing food systems, but other framings (outlined in more detail in Chapter 3) should be envisaged to drive the system towards more just and sustainable outcomes
- The social sciences are well equipped to approach complex issues such as food systems and to contribute to our understanding of paths towards transitional change, but currently the evidence on intervention effectiveness is sparse and more research is needed.
- Collaboration across the natural and social sciences is also required in order to address the complexity of food systems
- As well as focusing specifically on the food system, lessons might also be drawn from other domains such as energy and water research and wider debates about transition theory.

Chapter 2. Critical challenges facing the food system

This chapter outlines the major global forces shaping the future of the food system, incuding demographic change, climate change and globalisation. It also provides a discussion of the contemporary context of the European food system, including complex legislative frameworks, food safety concerns, the diversity of rural territories and specificities of the farming sector in Europe.

2.1. Introduction

One of the great human achievements of the last half century is that advances in food production have largely kept pace with demand on a global basis. Today, around 6 billion people do not go hungry, a considerable improvement upon the situation 50 years ago when a larger share of the world population was starving. But we should not be complacent. Data on malnutrition are a strong indicator of how unfair and socially unjust our food system still is. Despite the successes of the last half-century, more than 800 million people are still hungry, and at least 3 billion more lack sufficient nutrients (FAO et al., 2019). Paradoxically, at least 2.5 billion people consume excess calories, many of whom also suffer from inadequate nutrients. People in all these categories are therefore malnourished, as 'malnutrition' (often taken to mean only 'under-nutrition') really means 'bad nutrition'. They are all also, by definition, subject to food insecurity according to the definition in the previous chapter (p.19).

Many of these people live in Europe. About half of the European population suffers some form of micronutrient deficiency.[18] Problems of overweight and obesity are increasing rapidly in most EU member states, with estimates of 51.6% of the EU's population (18 and over) overweight in 2014.[19] This can have a significant impact on healthcare systems.

18 http://www.euro.who.int/en/health-topics/disease-prevention/nutrition/activities/technical-support-to-member-states/micronutrient-deficiencies

19 https://ec.europa.eu/eurostat/statistics-explained/index.php/Overweight_and_obesity_-_BMI_statistics

For example, in EU countries about 20 million people are affected by disease-related malnutrition, costing EU governments up to €120 billion annually (Freijer et al., 2013).

Why is this? Essentially, it is determined by our access to food, coupled with a range of other factors. In addition to the paramount issue of affordability, other determinants include preference, convenience, cultural norms and other factors, and the prevailing 'food environment'. The price and quality of food available to consumers is set by a wide range of policies, actors and activities comprising the food value chain, i.e. the array of processes and people that convert the biomass coming from the farm, forest or ocean into the food we eat.

There are multiple drivers and feedback loops in food systems, spanning a number of different scales (e.g. spatial, temporal, jurisdictional, institutional, managerial) and a number of levels along each of these scales (e.g. national, regional; days, seasons) (Cash et al., 2006; Gibson et al., 2000).

The food system is known to be a main driver of environmental impacts, including climate change (IPCC, 2019a; Notarnicola et al., 2017; Westhoek et al., 2016). The recent EAT-Lancet report (Willett et al., 2019) notes the importance of a "healthy diet from a sustainable food system" that can contribute to the mitigation of climate change. But sustainability means that the food system needs to be sustainable not only in terms of environmental impact, but also for social and economic aspects related to the wide range of interconnected enterprises which operate across the scales and levels discussed above. This is also reflected in Sustainable Development Goal 2: Zero Hunger, which aims to end hunger and ensure access to safe, nutritious and sufficient food for all by 2030.[20]

Diets are known to change with increased wealth (Tilman et al., 2011), and much interest is devoted to changes in consumers' preferences and expectations, as well as to the analysis of food innovations and their impact on the global market (Santeramo et al., 2018). Steering the EU food system towards a sustainability transition requires a vast and actionable knowledge base available to a range of public and private actors. Few have captured this complexity by assessing food systems from a multi-dimensional and multi-level perspective, including nutrition and diet, environmental and economic outcomes together with social equity dimensions, and system interactions across country, EU and global levels (cf. Zurek et al., 2018).

20 https://www.un.org/sustainabledevelopment/hunger/

2.2. Major global transformations affecting the food system

From a global perspective, food systems are affected by numerous drivers of change. At a fundamental level, demographic change and climatic conditions as well as globalisation are critical determinants of food systems, defining our need for food on the one hand, and the conditions for producing food on the other.

Population growth and urbanisation

Rapid global population growth is a recent phenomenon (Karabell, 2019). From year 1 to 1800, the world population went from 200 million to 1 billion. After that, population growth took off; by 1930 it had passed 2 billion, and the 4 billion mark was reached in the mid-1970s. Since the 1950s, the world population has been growing by >1% per year, and by 2020 it had almost doubled again to 7.6 billion. Conservative estimates suggest that there will be around 9.7 billion people on the planet by 2050 (UN, 2019a).

However, populations in European countries are declining (UN, 2019a) and ageing. The total EU population is 513 million people.[21] There were nearly 100 million people aged 65 or over in 2016, and the proportion of older people in the total population is set to increase in the coming decades. This brings a number of challenges relating to promotion of healthy lifestyles as well as provision of health and social care (SAPEA, 2019b).

Food production has not only kept up with a growing world population, but since the early 1960s it has actually outpaced population growth, increasing by more than 30% (IPCC, 2019a). But this does not translate into food security for all (as discussed in section 1.1, p.20). With continued global population growth as predicted, the food system is coming under increasing stress as demand for food is likely to increase (FAO, 2018a). Most of this increase will have to come from land, but there is also potential for increasing food from the oceans (Costello et al., 2019; SAPEA, 2017). As pointed out in Chapter 1, unless consumption patterns change, the increase in population means that 50–70% more food will need to be produced to keep pace with the anticipated growth in demand (UN, 2019b). However, about one third of global food production is currently wasted (Nature Editorial, 2019), and reducing waste may partially offset the need to increase production.

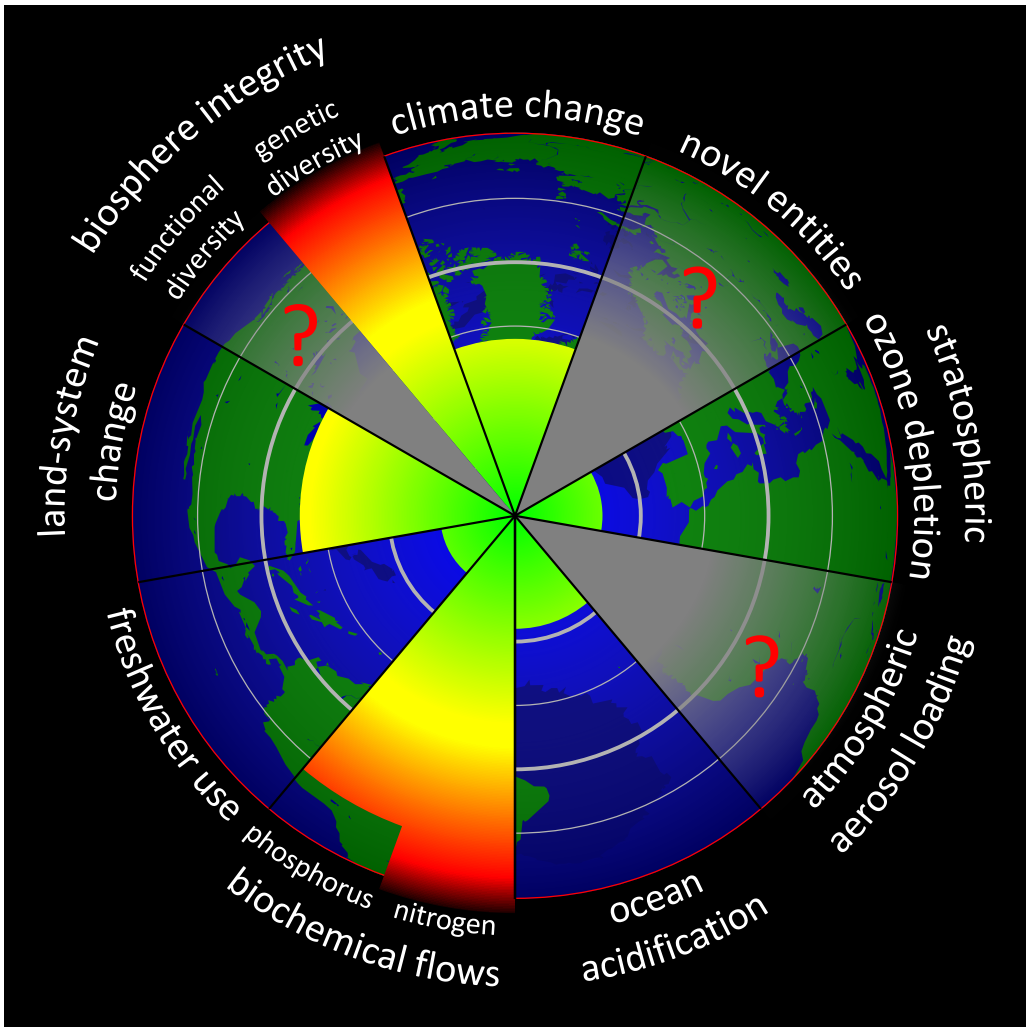
The rapid pace of urbanisation also poses a threat to the sustainability of the global food system, with more people living in large cities at growing distances from where their food is produced. The expansion of cities reduces the space for agricultural production, particularly in peri-urban areas, as well as being correlated with changes in human diets towards the consumption of more processed, more energy-dense and less healthy food.

21 https://europa.eu/european-union/about-eu/figures/living_en

As Carolyn Steel (2013) points out, cities cover just 2% of the world's surface, but consume 75% of the world's resources. Urbanisation also decreases the sense of connection that people have with the source of their food (where and how it is grown).

Humanity faces a challenge to meet the food demand of a growing population within Earth's planetary boundaries while ensuring human rights (see Figure 2). Based on scientific evidence that human actions since the Industrial Revolution have become the main driver of global environmental change, a group of international scientists defined a "safe operating space for humanity" as a precondition for sustainable development (Rockström et al., 2009). The green zone is the safe operating space, the yellow represents the zone of uncertainty (increasing risk), and the red is a high-risk zone. The grey areas with red question marks represent boundaries not yet quantified.

Figure 2. Planetary boundaries according to Rockström et al. (2009) and Steffen et al. (2015) (Source: Wikipedia)

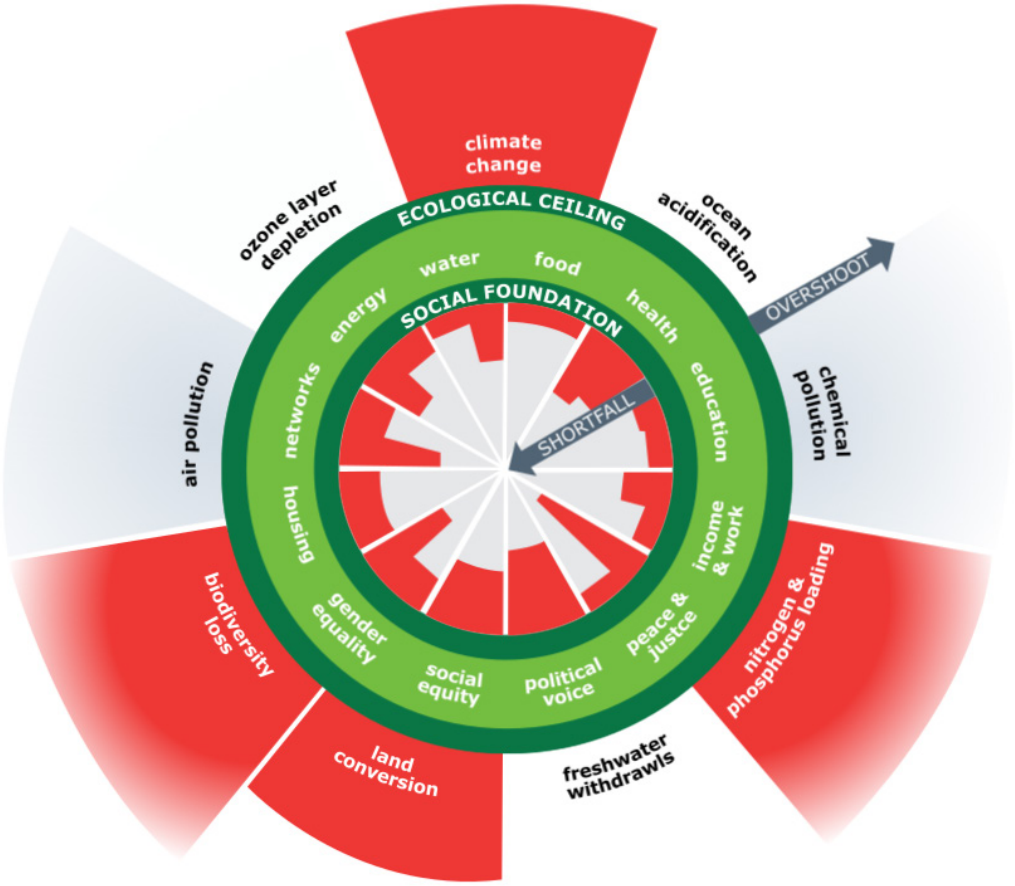


The way we use natural resources and fertiliser for food production plays an important role with respect to three issues, which the authors consider as already exceeding safe

margins: the loss of biodiversity and the leaking of nitrogen and scarce phosphorus into ground water, lakes, rivers and the sea (Steffen et al., 2015).

Based on the idea of planetary boundaries, Raworth (2017) proposed the 'doughnut' economy to create a safe and just operating space for humanity combining both the social and ecological boundaries.

Figure 3. Planetary boundaries and the doughnut model (Raworth, 2017)



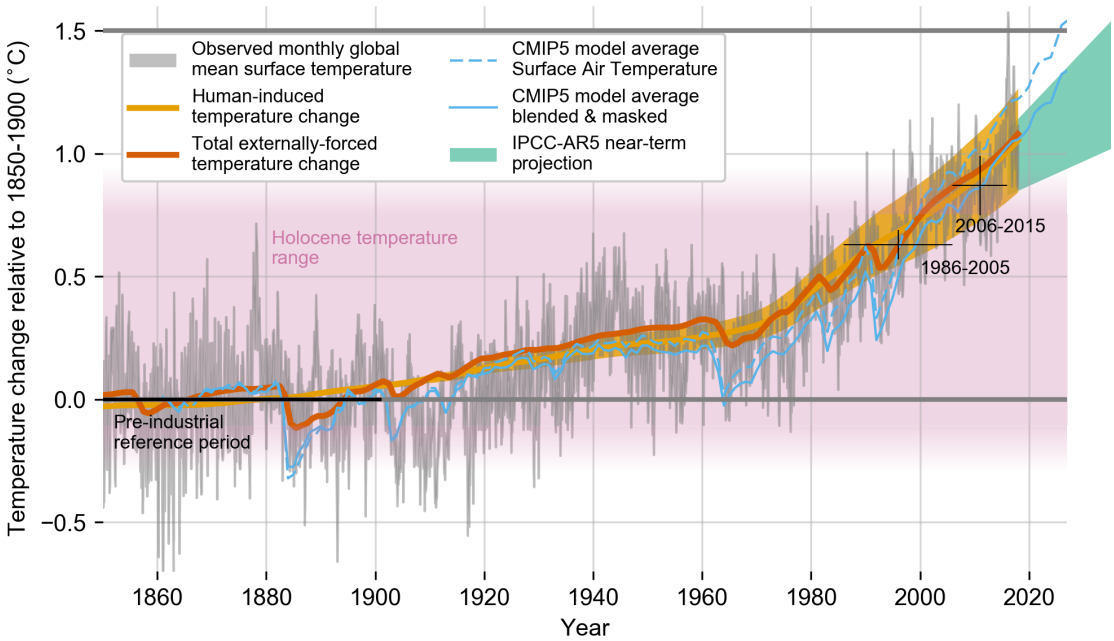
Climate change and biodiversity

Human activities have caused approximately 1˚C of warming of observed mean surface air temperatures above pre-industrial levels (IPCC, 2018), and observed mean land surface temperatures have increased even more, about 1.5˚C on average (IPCC, 2019a). Some regions experience more warming (e.g. the Arctic) than this global average, others less so. The global mean surface temperature (both land and ocean) is set to increase by 1.5˚C by mid-century if warming continues at the current rates (see Figure 4). A warmer climate will persist for centuries or millennia, but net zero growth of emissions of CO_2 (carbon dioxide) now or in the near future could limit warming to 1.5˚C (IPCC, 2018).

The ramifications of warming include altered weather patterns, sea level rise, impacts on ecosystems such as shifting geographic distribution of species, and changing conditions for human activities (IPCC, 2014). In the oceans, the productivity of ecosystems will be affected, and a polewards shift of fish species is predicted (Cheung et al., 2010) with implications for global distribution of access to living marine resources.

Global warming is one of the biggest threats to food systems (Little, 2019), and the IPCC adopted a food systems approach for its fifth assessment report published in 2014. Since then, other IPCC reports address food systems and food security in the context of climate change, notably the 2019 *Land Use and Oceans* reports (IPCC, 2019a, 2019b).

Figure 4. Trends in global warming: Evolution of global mean surface temperature (GMST) over the period of instrumental observations (IPCC, 2018)



Climate change has implications for food production globally, including in Europe. In the IPCC's 2019 *Special report on land degradation, desertification, food security and climate change* (chapter 5 in particular), the IPCC predicts with high confidence that "food security will increasingly be affected by projected future climate change" (IPCC, 2019a). Changing precipitation patterns, frequency of extreme weather events, and changing temperatures are already affecting food systems, with some regions experiencing increased production and others — including southern Europe — experiencing declines. Production, processing, distribution and storage will all be affected. Moreover, projected climate change is highly likely to be increasingly detrimental to food security in the future, including through reduced nutritional content of food and food prices, which will affect poor populations in particular (Mbow et al., 2019).

Food safety will also be affected, including by changes in contaminating organisms and vulnerabilities related to these. In water, there are risks related to growth in marine pathogenic bacteria, parasites and foodborne viruses (Barange et al., 2018).

Unless consumption and food waste patterns change, the growth in the world population will drive a 50–70% increase in the demand for food by mid-century. Such an increase in food production would engender significant increases in greenhouse gas emissions and other environmental impacts, including loss of biodiversity (IPCC, 2019a). Up to 37% of global greenhouse gas emissions can be attributed to the food system, including crop and livestock production, transportation, changing land use (including deforestation) and food loss and waste. In a business-as-usual scenario, emissions from food systems are likely to increase by 30–40% by 2050, due to the increase in food demand stemming from population growth and changing diets. The combined environmental costs of food production is estimated to amount to some $12 trillion per year, increasing to $16 trillion by 2050 (Nature Editorial, 2019).

A 2019 study concluded that there are major differences in the environmental footprint of different types of animal food production: "The lowest impact production methods were small pelagic fisheries and mollusk aquaculture, whereas the highest impact production methods were beef production and catfish aquaculture" (Hilborn et al., 2018).

As for the marine realm, it is estimated that climate change will bring significant changes in the availability and trade of fish and fish products (Barange et al., 2018). Scenarios used by the IPCC indicate reductions in maximum catch potential, with the biggest reductions in the tropics and potential increases at higher latitudes (IPCC, 2019b). This has potentially important consequences for those depending on living marine resources for food and income. Such dependencies are particularly acute in developing countries, where populations in some regions rely on food from the sea for protein and essential nutrients. Also, aquaculture can be negatively affected, including through increased risk of diseases, algal blooms and weather-related events (Barange et al., 2018).

The IPCC (2019a) land report also includes options for adaptation of food systems to climate change. These include supply-side options such as increased soil organic matter and erosion control; improved cropland, livestock, and grazing land management; use of neglected and underutilised species; and genetic improvements for tolerance to heat and drought. The report also discusses options for demand-side adaptation, such as more healthy and sustainable diets and reduction in food loss and waste. Healthy and sustainable diets have potential for reducing emissions from food systems and improving public health. Also, reduction of food loss and waste — representing up to 10% of emissions — could contribute to lower emissions and improve food security (Mbow et al., 2019).

As regards biodiversity, the Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services report presents alarming figures (IPBES, 2019). A substantial proportion of assessed species are threatened with extinction and overall trends are deteriorating, with extinction rates increasing sharply in the past century (IPBES, 2019, figure 3). In addition, the report gives examples of global declines in biodiversity that have been and are being caused by various drivers of change, including both direct drivers (such as climate change and pollution) and indirect drivers (societal causes like demographics and conflicts). A unique example of the impact of biodiversity loss on the functioning of ecosystems on islands in Sweden is presented by Fanin et al. (2018). Thanks to numerous indicators measured on the plants and soil, the authors highlighted the importance of considering all ecosystem services and the need to preserve biodiversity in highly contrasting ecosystems.[22]

The importance of nature for quality of life has been categorised including the extent of suitable habitats, regulation of air quality, and especially quality and availability of food and feed (IPBES, 2019).

Globalisation and geopolitical instability

The changing scale and intensity of agricultural production methods and associated agri-food systems have increasingly been recognised within the framework of globalisation (Goodman & Watts, 1997; Inglis & Gimlin, 2009; Nuetzenadel & Trentmann, 2008). This process, though far from complete or uncontested, has been driven by a transformation in the political economy of agriculture. Its key features include the intensification and industrialisation of agricultural production, the rise of integrated 'agri-business' and multinational manufacturers, the process of retail concentration, and the increasing distance between producers and consumers. At the same time, the international division of labour and global trade have improved access to food and improved livelihoods in developing countries through fair trade and related practices. These changes have been accompanied by shifts in the regulatory environment and in systems of governance, described by Friedmann and McMichael in terms of a succession of "food regimes" (Friedmann & McMichael, 1989; McMichael, 2009).

In contrast to the increasing standardisation of globally traded food, the re-embedding of food production in local contexts has received growing attention (e.g. Fendrychová & Jehlička, 2018; Murdoch et al., 2000; Penker, 2006). Renting et al. (2003) specified that spatial embeddedness is less about the geographical proximity between producer and consumer and more about communicating value-laden information about the place of production to consumers. European and particularly Mediterranean countries have a long tradition of communicating origin and place-based food quality to consumers.

22 For a wider argument about mainstreaming ecosystem services into future farming systems, see Sandhu et al. (2016).

An EU-wide regulatory system for the protection of geographical indications (PGI) and designations of origin (PDO) was implemented by Council Regulation (EEC) No. 2081/92 in 1992, and by Council Regulation (EEC) No. 2082/92 on certificates of Traditional Speciality Guaranteed (TSG) for agricultural products and foodstuffs. Agricultural products and foodstuffs registered as PGI, PDO and TSG are currently regulated by Regulation (EU) No. 1151/2012. This collective intellectual property right cannot be sold or delocalised; it supports local food producers in defending product names from misuse and provides consumers with reliable information on food origin and associated quality characteristics (Quiñones-Ruiz et al., 2016).

In contrast to centrally-defined quality standards of organic or fair trade labels, local producers themselves define and adapt their specific rules for using the EU geographical indication label (Quiñones-Ruiz et al., 2018). 640 registered Protected Designations of Origin and 752 registered Protected Geographical Indications document the bio-cultural diversity of European food heritage (DOOR, 2019).[23] This diversity of locally-defined quality standards, each of them specifically linking food to bio-physical contexts, local livestock breeds or plant varieties and local farming and food processing practices, is regarded as 'resistance' against the standardising effects of 'placeless' food production systems (Mancini, 2013).

A further step in relocalisation of food systems and empowerment of both small-scale farmers and consumers is the Participatory Guarantee System (PGS), developed as an alternative to third-party certification process of organic labeling (Cuéllar-Padilla & Ganuza-Fernandez, 2018) and as a tool to build local organic markets (Kirchner, 2015). PGSs are defined as "locally focused quality assurance systems that certify producers based on the active participation of stakeholders and are built on a foundation of trust, social networks, and knowledge exchange" (IFOAM, 2008). PGS certification is officially recognised in some countries, such as Brazil, but this is not the case in the EU. The legal framework for the certification, labelling and control of organic food production in the EU is a major barrier for the development of PGSs here, but they exist in some countries, including France and Spain. In France, it was estmated that 708 producers were certified within a PGS system in 2014.

One of the implications of globalisation is that the international food system has become increasingly vulnerable to geopolitical instability. In 2007–2008, for example, pronounced volatility in international food markets led to increased food prices, exacerbating existing geopolitical tensions. Sudden price spikes led to political tensions, with widespread food riots and popular unrest (Sommerville et al., 2014). The relationship between food

23 EU Database of Origin and Registration (DOOR), listing all agricultural products and foods registered or awaiting possible registration as PDO (Protected Designations of Origin), PGI (Protected Geographical Indications) or TSG (Traditional Specialities Guaranteed) https://ec.europa.eu/agriculture/quality/door/list.html

prices and politial unrest was particularly noticeable in the case of the Arab Spring, where the effects of climate change on the food supply exacerbated underlying tensions throughout the Middle East and North Africa. A scarcity of arable land and a paucity of water supplies combined with severe droughts in other food-producing countries to increase existing political tensions. Under the heading "Climate change and rising food prices heightened Arab Spring", an article in *Scientific American* concluded that the 2010 global food crisis helped drive the region over the edge (Perez & Stecker, 2013).

While the connection between food markets and political tensions is rarely uncontested, international food security is, in future, likely to be driven by geopolitical instabilities within Europe and across the world. This is likely to include the implications of Britain's withdrawal from the EU and its consequences in terms of new trading arrangements, which have been linked with the potential for lower food quality and standards (Lang et al., 2017).

2.3. Territorial imbalances and other contextual challenges of European food systems

European Union agricultural and fisheries policies have been developed in the pursuit of laudable goals such as a competitive economy and regulatory harmony across the union. However, some critics have described the resultant legislative framework as fragmented, contradictory and unworkable (Masip et al., 2013). On the other hand, in recent years, as global food chains have expanded, many academic, policy, technical and civil debates have taken place over possible innovative reorganisations of food supply chains to reconnect producers and consumers, to re-localise food production and to address imbalances along the supply chain as well as between rural and urban areas. These include short supply chains, alternative food networks, local farming systems and direct sales. On the policy side, several EU member states have developed legal frameworks and incentives to support such innovations (Kneafsey et al., 2013).

Nonetheless, at the EU level of governance there is a perception of policy failure over the safety of the final food product emerging from the supply chain. Safety concerns reach back along the supply chain to the production inputs on the farm, such as animal feed, and to processing and manufacturing practices. The response at both EU and national levels has been to bring forward a phase of institutional change with regard to food safety and standards with an emphasis on the safety and health of the consumer (Barling, 2018). The foresight study *Delivering on EU food safety and nutrition in 2050: future challenges and policy preparedness* aims to aid policymakers in their assessment of the resilience of current food policy and regulatory framework with a time horizon to 2050 (Mylona et al.,

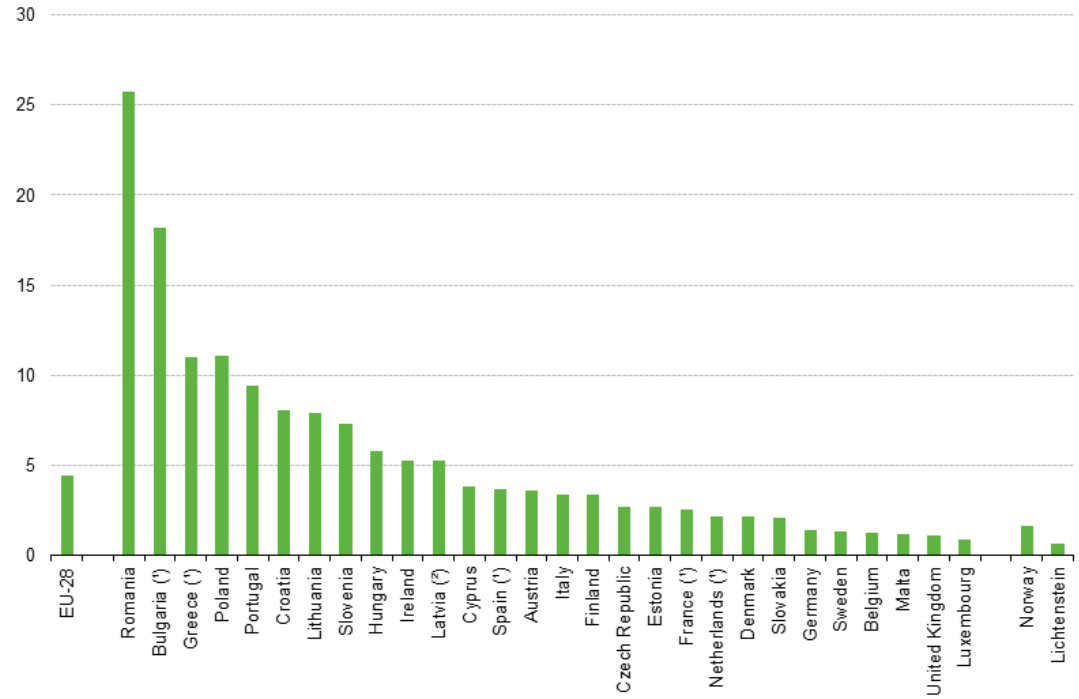
2016). Some are now advocating an overarching European food and nutrition policy (iPES Food, 2019; van't Veer et al., 2017).

Globally and in Europe, the vast majority of food is produced on rural land and much of the infrastructure for food processing, storing and transportation is located in rural areas. The EU's rural areas are diverse in culinary heritage and in natural and climatic conditions. Some areas are more suitable for food production, whereas others are considered as less-favoured areas, due to difficult climatic conditions, steep slopes, low soil productivity, outmigration or low population density. While intensification and specialisation have resulted in environmental damage in the more productive areas, less-favoured areas are often confronted with land abandonment, under-use and yield gaps that have to be compensated elsewhere (Mauerhofer et al., 2018).

Albeit a minority, the rural population is still numerically significant and highly variable across Europe. In 2015, the share of rural population ranged from below 1% in Malta and 15% in the Netherlands to 56% in Lithuania; on average, 28% of the EU's population lives in rural areas (Eurostat, 2018). The share of population working in food production and processing is even lower (Figure 5, p.44). Many rural areas — which have usually been considered as places of food production — paradoxically have become "food deserts" (Furey et al., 2001), in the sense that disadvantaged groups cannot access fresh, quality, nutritious foods at an affordable price.[24]

24 Other areas have been described as "food swamps" because of the high level of fast food outlets found there (HLPE, 2017).

Figure 5. Percentage employed in agriculture across the EU (Eurostat)[25]



(¹) Provisional.
(²) 2014 data instead of 2015.

In 2015, the share of young people aged 18–24 living in rural areas of the EU who were neither in employment nor in further education or training was 3.7 percentage points higher than in cities.[26] Generally, rural areas are disadvantaged regarding job opportunities, health care, digitalisation and education. While rural disadvantage and deprivation in the traditional sense decreased, new forms of exploitation of migrant agricultural workers have occurred in southern Europe and elsewhere (Bock et al., 2016).

The EU food and drink industry employs 4.72 million people, and generates a turnover of €1.2 trillion and €236 billion in value added, making it the largest manufacturing industry in the EU.[27] The EU farming sector is diverse in terms of farm size, percentage employment in agriculture and share of agricultural subsidies (among other factors). Farmers in less favoured areas — such as in mountain areas or on islands — face particular challenges. The amount of land dedicated to agriculture is shrinking through conversion to non-agricultural (mainly urban) land use. Through a process of

25 https://ec.europa.eu/eurostat/statistics-explained/index.php/Farmers_and_the_agricultural_labour_force_-_statistics

26 https://ec.europa.eu/eurostat/statistics-explained/index.php/Statistics_on_rural_areas_in_the_EU

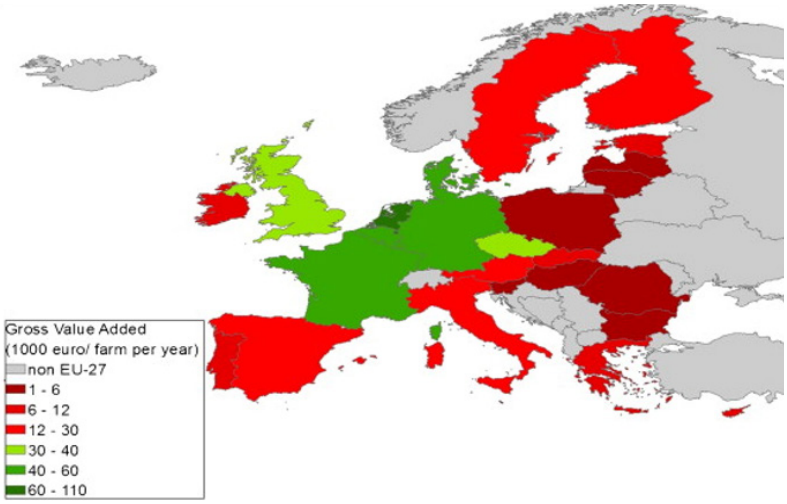
27 For statistical data on the structure of the European food sector, see https://www.fooddrinkeurope.eu/publication/data-trends-of-the-european-food-and-drink-industry-2019/

consolidation, the number of farms is decreasing and the average farm size is increasing.[28] The agricultural sector is declining in terms of its contribution to GDP, facing problems in farm succession and reductions in farm subsidies as well as decreasing influence as a political force. Nevertheless, support for agriculture still accounts for a high proportion of the EU budget, with recent reforms placing more emphasis on environmental performance and contributions to climate targets.

European agriculture is characterised by huge diversity at national and regional levels. Some authors suggest such diversity follows a centre-periphery differentiation between the North European core and a continental periphery, also with distinct differences among Mediterranean, Eastern (marked by Socialist policies), Northern Scandinavian and Celtic (Ireland) (Arnalte-Alegre & Miranda, 2013; Giannakis & Bruggeman, 2015). Portugal, Italy, Spain and Greece are the main representatives of the Mediterranean model, with similar ecological conditions and socio-economic characteristics. These are acknowledged in the literature as the Southern model (European Commission, 1997). North-South differences are clear through basic indicators such as Utilised Agricultural Area (hectares); Livestock Units; Economic Size Units; the percentage of full-time holders; the share of farmers older than 55 years; and the orientation of crops (Arnalte-Alegre & Miranda, 2013). Northern-central agriculture performs better in general economic indicators (Giannakis & Bruggeman, 2015). See also Figure 6, p.46: the cluster with low farm economic performance appears in red and the high-performing cluster in green. In general, it could be stated that farming systems in the South have not followed the productivist modernisation pattern of transformation of Northern Europe, which explains the lack of competitiveness of these farms, particularly when compared with Northern farms once they accessed the European Union in the 1980s. Some authors suggest that this characteristic puts these farming systems in a better position to adapt to new approaches based on multifunctionality and the diverse services provided by agriculture (Arnalte-Alegre & Miranda, 2013).

28 According to Eurostat, the average farm size increased from 14.4 hectares in 2010 to 16.1 hectares in 2013 (https://ec.europa.eu/eurostat/statistics-explained/pdfscache/1191.pdf)

Figure 6. Gross value added per farm across EU-27 for period 2007–2011 (Giannakis and Bruggeman, 2015)



A report by the European Commission (2017) on the economic challenges facing EU agriculture identified three key issues: pressure on farm income, weaknesses in productivity and competition, and imbalances in value chains. It highlighted the fact that incomes in the farming sector are generally low (around 40% of average EU wages) and markets are volatile (as demonstrated by the 2008 spike in agricultural commodity prices). The farm population is ageing, with younger people facing significant barriers to entering the sector. Investment in research and development has historically been low, leading to low levels of productivity growth in a context of high production costs. The report also pointed to asymmetries in the bargaining power of farmers compared to those further along the supply chain, with evidence of persistent unfair trading practices and high levels of indebtedness mong farmers. Increased concentration and vertical integration across the sector was said to be exacerbating these trends.

Extensive differences continue to exist across Europe regarding food preferences and meanings (Darnhofer et al., 2019). To be successful, policy tools and interventions must respect these differences and acknowledge the local socio-institutional context. For example, according to Sonnino and Marsden (2006), food quality in Northern countries such as Germany, Holland, Denmark, and the UK is defined in terms of different types of agriculture, food habits, and ways of perceiving food quality, through the lens of public health and hygiene rather than organoleptic properties. Food issues in Southern countries are framed around taste, linking food to local tradition and culture. This has resulted in a much larger number of geographical indications in Southern European countries, registered and amended under EU law. These data suggest that terroir, food quality reputation linked to biophysical contexts, local food expertise and local food tradition are much more relevant in Southern EU member states (Quiñones-Ruiz et al., 2018).

There are also significant differences across Europe in terms of obesity rates and areas under organic farming. In the case of obesity, a line can be drawn between so-called

'old' and 'new' EU countries. In general, the citizens of 'old enlargement' countries have a lower Body-Mass Index than those from Central and Eastern European countries, which can be explained by their lower GDP and by different consumption models and lifestyles. In the case of organic farming, although all EU countries had similar instruments at their disposal, they were apparently used differently. Poland, for example, has experienced a very small increase in the organic farming area, due among other factors to the interpretation of EU regulations, the poor organisation of farmers and weak Agricultural Advisory Centers (Śpiewak & Jasiński, 2019), while at the same time Latvia, Estonia and Slovakia have achieved a tremendous increase in organic production.

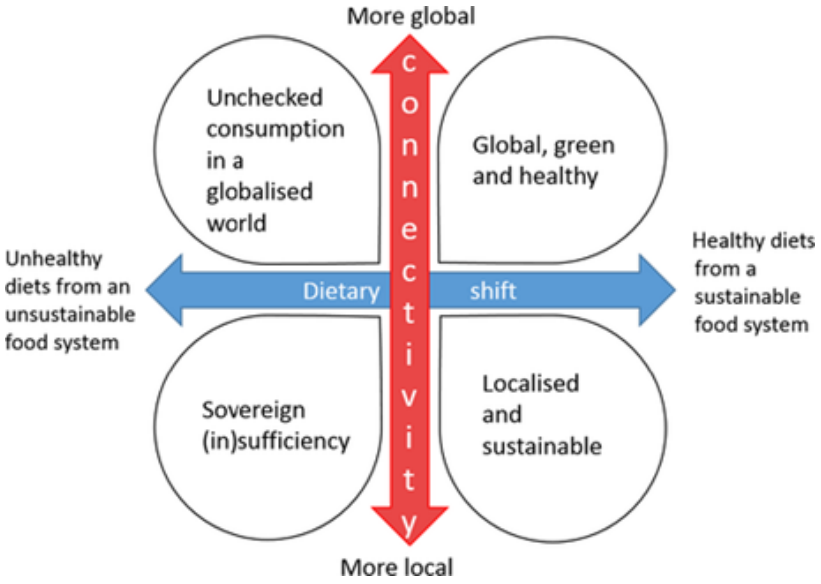
Territorial differences, which have been addressed by cohesion policy as disparities and imbalances, have also created culinary diversity. Over centuries or longer, territorial dissimilarities in soils, climate, ecosystems, farming styles and food cultures have shaped the diversity of European culinary heritage. The diversity of traditional foods and regional cuisines has been identified as an important foundation of European identity as well as a key asset for tourism (Bessière, 1998).

Food policy changes will only be sustainable if they effectively address territorial imbalances, less-favoured areas, disadvantaged groups and sectors.

2.4. Future scenarios

The range and complexity of challenges facing the food system have led several commentators to advocate using scenario analysis to help understand the future of food. For example, Benton (2019) highlights the fragility of the food sytem in the face of environmental uncertainties and future economic shocks. He proposes scenario analysis as a way of imagining a range of plausible futures, including changing patterns of trade and changing dietary patterns. Drawing on a range of sources, he identifies a series of 'mega-trends' including urbanisation, climate change and resource security, shifting global power, demographic and social change, changing technologies, poverty, inequality, financial shocks and economic crises. Moving beyond 'business as usual', Benton suggests that we need to model unpredictable events and future scenarios that are Turbulent, Uncertain, Novel and Ambiguous (TUNA) (Ramírez & Wilkinson, 2016). He refers to a compilation of recent foresight studies and forecasts from the World Economic Forum (2017). Combining dietary shifts and changing trade arrangements along two axes yields four future scenarios which Benton labels: unchecked consumption in a globalised worlds; sovereign (in)sufficiency; global, green and healthy; and localised and sustainable (see Figure 7, p.48).

Figure 7. Future food scenarios (Benton, 2019)



While the Working Group has not been able to undertake this kind of analysis for the EU food system with the time and resources that were available, such an exercise could allow the European Commission to decide what kind of food future it imagines for Europe, including, in Benton's terms, what food is grown, where it is grown, how it is grown and how it is used. Other sources would also be worth further exploration, including the work of Foresight4food,[29] Hubert et al. (2010), le Mouël et al. (2018), and World Economic Forum (2017).

Each scenario also calls for different metrics as ways of measuring progress, where Benton and Bailey (2019) recommend a change in emphasis from yields per unit input (in conventional approaches to 'sustainable intensification', for example) towards a measure of the number of people that can be fed healthily and sustainably per unit input. These alternative metrics would require the internalisation of externalities, such as the health costs associated with the production and consumption of unbalanced diets.

The Agrimonde-Terra report (le Mouël et al., 2018) performed a foresight exercise and developed five potential future scenarios for 2050 based on internal (urban-rural relationships, farm structures, cropping systems, livestock systems and forest systems) and external drivers of land use change (global context, food diets, and climate change).

29 https://www.foresight4food.net

Three scenarios, named "Metropolisation", "Regionalisation" and "Households", are based on current competing trends identified in most world regions:

- **Metropolisation** links the development of megacities at global level with a nutrition transition led by global agri-food companies retailing highly-processed foods, in a global context of development and climate change.
- **Regionalisation** links the increase of medium-size cities and their networking with rural areas to the emergence of regional food systems based on family farming and traditional foods.
- **Households** links individual mobility between rural and urban areas and a development of on-farm and off-farm employment to the emergence of hybrid diets based on traditional and modern value chains, in a globalised world where family farms and cooperatives play a major role.

The other two scenarios, entitled "Healthy" and "Communities", involve potential breaks that could change the entire land use and food security system. The Healthy scenario implies a move towards healthy diets stimulated by global cooperation and public policies in a context of climate change stabilisation, accompanied by a strong reconfiguration of the agricultural system. The fifth scenario, Communities, is based on the development of small towns and rural communities focusing on managing common property in agriculture for food security. From these scenarios, Metropolisation and Communities ones cannot ensure sustainable world food and nutrition security in 2050, an objective achieved only in the Healthy scenario. The other two provide uncertain results. The report concludes that changing the course of ongoing trends in favour of sustainable land uses and healthy food systems will require systemic transformation, strong and coherent public policies across sectors and scales, and consistent actions from a wide range of actors.

2.5. Key messages and policy implications

- Food systems play a central role in broader transitions including climate change which pose a significant threat to food production, processing, distribution, storage and consumption worldwide as well as in the EU.
- Unless consumption patterns and levels of food waste change, the world's growing population will lead to a 50% increase in the demand for food by 2050. This will be a significant driver of climate change.
- Disease-related malnutrition is estimated to cost the EU €120 billion annually. Malnourishment and obesity are on the rise, which could lead to higher costs.
- There are increasing calls for an overarching food and nutrition policy across the EU, corresponding to the global call for sustainable food systems in the SDGs.
- While food systems are increasingly globalised, significant variations exist within and between EU states.
- Sustainability policies need to address the diversity of the EU's farming sector and territorial imbalances between urban and rural areas
- Food scenario analysis may offer a valuable way of modelling different food futures, requiring different metrics for measuring preferred system outcomes.

Chapter 3. Theoretical perspectives and alternative framings of food

This chapter reviews a range of theoretical perspectives on transitions to a more just and sustainable food system, highlighting the relevance of social science thinking on these issues. The chapter discusses the similarities and differences between these theories, examining what each contributes to our understanding of sustainability transitions. The chapter also suggests that the way these issues are framed can lead to very different conclusions, and that different theoretical approaches may be more suitable for different purposes. Rooting our review in the appropriate theoretical literature also adds to the robustness of our analysis of the evidence.

Theories can be distinguished by the level at which they operate (e.g. individual psychology vs. social structure), by the discipline with which they are associated, and by the research traditions or schools within which they are located. Here, we take a pragmatic approach, focusing on the theoretical perspectives that are most prevalent in studying the transition towards more just and sustainable food systems, including institutional theories, psychological theories, discursive theories, social practice theories and governance theories, highlighting some key issues and common themes that cut across the different approaches.

In preparing this Report, we present a wide variety of theoretical perspectives that focus on charting the shift towards more just and sustainable food systems. Many of these theories address the tension between structure and agency: whether explanations are sought at a structural, institutional and collective level or at the level of individual human agency and personal choice. The one does not exclude the other, however, and, in addressing sustainable food systems, both perspectives have their merits.

The wide range of theories reviewed in this chapter should not be taken as evidence of intellectual confusion or analytical incoherence but as an indication of the 'wickedness' of the issue.[30] Rather, we suggest, different theories are appropriate for different ways of

30 'Wicked' problems are usually defined as those that are challenging to solve because of incomplete or contradictory data or where no easy single solution exists (Peters, 2017).

framing the complex issue of transitioning to a more just and sustainable food system. Different theories are based on different epistemological assumptions which can influence what counts as evidence. Social scientists have an important role to play in making visible the theoretical framing and epistemological assumptions that underpin different policy options but which may not always be explicit. It is also possible to draw inspiration from a range of theoretical perspectives providing their epistemological assumptions and underlying premises are compatible.

3.1. Theoretical perspectives on sustainable food transitions

This section is informed by a recently published systematic review of agro-food research frameworks that focused specifically on transition theories (El Bilali, 2018).[31] The paper identifies which theories have attracted most support from academics with an interest in sustainability transitions. El Bilali concludes that the majority (more than three-fifths) of the 127 papers he reviewed used one or more of five theoretical frameworks:[32]

- In the **multi-level perspective approach** (MLP), transitions are defined as shifts from one regime to another and result from the interaction between processes at niche, regime and landscape levels (Geels, 2006; Grin et al., 2010; Markard & Truffer, 2008). This approach emphasises that processes at niche, regime and landscape levels should be aligned for a transition to be successful (Geels, 2011).
- **Transition management theories** (TM) focus on the key processes involved in establishing a niche (e.g. promoting learning based on experiments, developing rules, stabilising networks). They emphasise the importance of creating visions in so-called transition arenas before starting niche experiments (Kemp et al., 2007; Loorbach, 2007; Rotmans et al., 2001). TM follows a cyclical path consisting of problem structuring and envisioning (strategic level), agenda building and networking (tactical level), experimenting and diffusing (operational level), all subject to a process of evaluating and adjusting (Loorbach, 2007, 2010; Loorbach et al., 2008).

31 El Bilali's paper highlights the challenges of establishing adequate search terms for such a broad subject as sustainable food transitions. For example, the review was restricted to papers that included "transition" in the search string. It also overlooked the large corpus of research within the behavioural science tradition. While this limits the usefulness of the paper for our current purposes, it provides a useful baseline of papers that explicitly address the concept of food system transitions.

32 In a later paper, the same author undertook a systematic review of more than 100 papers on agri-food sustainability research (El Bilali, 2019). Identifying seven research themes (power and politics; governing and managing transitions; civil society, culture and social movements; the role of firms and industries; sustainable consumption; geography of transitions; and modelling transitions), El Bilali found that transition management and sustainable consumption were well-served in the literature, while the role of civil society and firms, and the variable geography of transitions, were relatively under-served.

- **Strategic niche management** (SNM) aims to bridge the gap between niche development and market exploitation, focusing on the early adoption of innovations and the processes that determine successful niche development as well as niche-regime interactions. SNM promotes reflexive management of niche experiments and initiatives to create momentum for niches to break through (Schot & Geels, 2008). The core idea behind SNM is experiential and social learning (Raven & Geels, 2010).
- **Social practice approaches** (SPA) attempt to bridge individual lifestyles and socio-technical systems (Hargreaves, 2011; Moore et al., 2015). They investigate the social relations between producers and consumers, embedded in infrastructures (Hargreaves et al., 2013; Reckwitz, 2002; Shove & Walker, 2010; Southerton et al., 2004; Spaargaren & Van Vliet, 2000; Warde, 2005). Some practice theorists (e.g. Shove & Pantzar, 2005) see practices as made up of skills (know-how, competencies), images (meaning, symbols), and materials that are recursively and actively integrated through everyday life. Changing social practices (in food-related or other domains) is seen as a collective accomplishment.
- **Technological innovation systems** (TIS) theory is defined as "a dynamic network of agents interacting in a specific economic/industrial area under a particular institutional infrastructure and involved in the generation, diffusion and utilisation of a technology" (Carlsson & Stankiewicz, 1991, p.93). A TIS approach considers all the activities that contribute to the development, diffusion and use of innovations as system functions.

These approaches are not mutually exclusive, and different theories each have their strengths and weaknesses. Valuable inferences can be drawn from appropriate combinations of different approaches. From the **multi-level perspective** and **polycentric governance theory**, for example, the inference can be drawn that radical and path-breaking change requires multiple conditions to be satisfied at the same time, technological change being just one part of the story[33] (see also section 4.5, p.80 on modes of governance). Societal and institutional changes need to occur simultaneously and all such changes have to point in the same direction. Socio-technical transitions require changes in user practices and institutional structures, in addition to a technological dimension.

33 'Polycentric governance' refers to the way that multiple governing bodies interact to make and enforce rules within a specific policy arena or location. According to Ostrom (2010), polycentricity is a concept that connotes a complex form of governance with multiple centres of semi-autonomous decision-making. If decision-making centres take each other into account in competitive and cooperative relationships and have recourse to conflict resolution mechanisms, they may be regarded as a polycentric governance system.

Meanwhile, work in transition studies[34] (e.g. Markard et al., 2012) has highlighted four prominent frameworks:

- transition management
- strategic niche management
- technological innovation systems
- the multi-level perspective on socio-technical transitions (MLP)

While considering the transition towards greater sustainability, the MLP literature allows for a holistic and systemic view of the many complex and intertwined elements characterising food systems. These theoretical traditions are not entirely isolated from one another, of course, with both SNM and TM theories drawing on similar concepts, positioning themselves in opposition to narrow, linear or top-down theories of social or technological innovation. There are complementarities and differences (over the subject of study, the level of aggregation, the research approach and the prescriptive implications of different theories), as discussed, for example, by Rut and Davies (2018).

Social practice theory suggests that food consumption is shaped by a combination of cultural norms and habits, rules and regulations, modes of provision and infrastructures that together determine the ways in which people eat. A social practice approach links the socialised performance of eating to wider architectures of provisioning and provenance. This is particularly significant in the context of governing processes of change towards more sustainable food systems (Devaney & Davies, 2017). Social practice approaches with regards to food have been operationalised in different ways (e.g. Sahakian & Wilhite, 2014; Warde, 2016). For example, Delormier et al. (2009) focus on obesity prevention and nutrition intervention, criticising the dominant individualised approach to these issues for its limited impact. Fonte (2013) focuses on how personal and collective motivations interconnect with normative, social and material factors to generate and sustain alternative models of food acquisition. Devaney and Davies (2017) test the efficacy of interventions derived from a practice-oriented 'back-casting' method for promoting more sustainable food consumption, while Wills et al. (2015) adopt a practice-based approach to understand foodborne disease that originates in the domestic environment.

As with all such approaches, it is challenging to translate social practice theory into specific policy recommendations (Foden et al., 2018), though there have been some exemplary efforts to reframe policy approaches to consumer behaviour through interventions based on a social practice approach (e.g. Spurling et al., 2013). Theories of practice have been used to identify actors and organisations which have the capacity and

34 Transition studies address the question of how socio-technical transitions come about, identifying patterns and mechanisms in transition processes involving changes in technology and in social practices, regulation, networks, infrastructure and symbolic meaning (Geels, 2002).

influence to align and combine supportive regulations and social norms (rules), devices and technologies (tools), norm-disrupting skills (practical knowledge) and understandings (socio-cultural worldviews). There have also been attempts to combine elements of transition thinking with social practice approaches (e.g. Davies, 2014; Davies & Doyle, 2015; Davies et al., 2015).

Though largely absent from El Bilali's (2018) review, **behavioural science perspectives** are used in a range of disciplines, including psychology, sociology, anthropology, economics and decision-making research, all of which have proposed theories of individual and group decision-making. Like several of the other approaches discussed above, they use both qualitative and quantitative methods with many overlaps and similarities in conceptualisation and approach. There are also important differences, including whether the main focus is on the individual (psychology and economics) or on smaller or larger groups (sociology and anthropology). Behavioural science approaches include reasoned action approaches such as the theory of planned behaviour (TPB) (Ajzen, 1991), which proposes that important actions are intentional and that the intention to act in a certain way is the immediate antecedent and cause of the behaviour. Further, the theory of planned behaviour proposes three distinct sources of behavioural intentions: personal, social, and efficacy or control. The TPB is an open framework, in the sense that it is open for additional predictors and moderators if they have a documented effect (Ajzen, 1991), which may be part of the reason for its popularity. Among many areas of application, different versions of the TPB have been applied to the consumer purchase of organic food (Scalco et al., 2017), vegetables (Stranieri et al., 2017), and other types of more sustainable food products (Dowd & Burke, 2013; Vermeir & Verbeke, 2008). Most of these are survey studies and therefore mute about causal relationships. However, the TPB has also been used as a framework for field experiments, for example, to reduce food waste (Manomaivibool et al., 2016).

Other behavioural science approaches assume that most everyday behaviours (including food-related choices and behaviour) involve little conscious reasoning, but are carried out by impulse or in a semi-automatic way. Cognitive psychology explains this with reference to our limited cognitive capacity for deliberate decision-making, which is generally reserved for important and difficult decisions (Kahneman, 2011). In other cases, we just repeat what we usually do (through habit) or act on cues, feelings or impulses. Kahneman (2011) refers to the cognitive system we use for deliberate decision-making as System 2 and the cognitive system we use for (semi-)automatic and spontaneous decisions as System 1. He argues that System 1 is involved in all decisions and actions, whereas we only involve System 2 when needed. This basic insight has been integrated into a number of 'dual process' models of decision-making, behaviour, and behaviour change, especially Fazio's (1990) MODE-model, Chaiken's (1980) heuristic-systematic model, and Petty and Cacioppo's (1986) elaboration likelihood model. These models assume that consumers and other decision-makers use a deliberate, systematic approach to decision-making

only when they are sufficiently motivated (i.e. the decision is sufficiently important), possess the required abilities (i.e. knowledge, skills and other resources) and in the absence of serious contextual and situational constraints (i.e. sufficient opportunity).

This is also the foundation of the emphasis on **choice architecture** in behavioural economics (e.g. Thaler & Sunstein, 2008) and for a large number of intervention studies in the food domain. The popularity of this approach is illustrated by a recent 'review of reviews' of behavioural science-based interventions and the scientific evidence regarding their efficacy in nudging people towards healthier food choices, which covered 39 systematic literature reviews and meta-analyses published between 2010 and 2017 (Bauer & Reisch, 2019). Most nudging interventions are quite subtle, so it is unsurprising that they do not always work as intended. Therefore, it is extremely important to test and, if necessary, adjust interventions before full-scale implementation (Service et al., 2014).

Social norms are considered in both reasoned and spontaneous or automatic accounts of behaviour and behaviour change. The **social norm theories** that have been applied to food-related decision-making and behaviour include Festinger's (1954) social comparison theory, Bandura's (1977) social learning theory, Schwartz's norm-activation theory (Schwartz, 1977; Schwartz & Howard, 1981), and Cialdini and colleagues' (1990) focus theory of normative conduct. The increasing number of studies testing norm interventions with regard to behaviours that are relevant to food sustainability include interventions to reduce meat consumption (Sparkman & Walton, 2017; Thomas et al., 2017) and food waste (Manomaivibool et al., 2016; Stöckli et al., 2018) in a restaurant setting. Many of these studies found the expected effect of the social norm intervention, while some did not, including Stöckli et al.'s (2018) study of the effectiveness of adding a norm message to information aiming to reduce food waste in a restaurant. Hence, the effect of targeted social norm interventions seems to depend on contextual, design-related and other factors.

This section has reviewed a range of theoretical perspectives on transitions to a more just and sustainable food system, showing how they contribute to different understandings of sustainability transitions. In the next section, we outline our argument that the way food issues are framed can lead to very different understandings and radically different policy implications.

3.2. Alternative framings of contemporary food systems

In recent decades, scholars from diverse disciplines have focused on how to increase food system sustainability. These laudable efforts, however, respond to different

framings and particular disciplinary narratives (Eakin et al., 2017; Foran et al., 2014). These alternative framings reflect underlying values which shape the problems to be solved and potential policy responses (Béné et al., 2019; Rivera-Ferre, 2012). For instance, Béné et al. (2019) outline four different narratives that account for why food systems fail to be sustainable. Yet, while there was general agreement regarding the failure of food systems and the need to do something about it, they found different perspectives on what that failure actually entails, what needs to be fixed and the priorities for action:[35]

Table 2. Four narratives of food system failure (Béné et al, 2019)

The state of play	What is the failure about?	What is threatened and needs to be fixed?	Where do the priorities for action stand?
"our food system is failing us"	Inability of the system to feed the future world population	Food security	Closing the yield gap
	Inability of the system to deliver a healthy diet	Nutrition security and health	Closing the nutrient gap and ensuring the quality of diet
	Inability of the system to produce equal and equitable benefits	Social justice, democratic process, small-scale actors	Decentralization, grass-roots autonomy
	Unsustainability of the system and its impact on the environment	Natural resources, agrobiodiversity, energy-water-carbon efficiency	Reducing the food-print of the system on the environment

Rivera-Ferre (2012) suggests that the different existing narratives respond to different ideas about the role of agriculture (and food) in society; and different understandings of what is or should be defined as 'development'. In reviewing the literature, we identify numerous ways of framing food, besides its core nutritional value in supporting human life. We also highlight the important role of the social sciences in making these (often implicit) framings visible.

Westengen and Banik (2016) suggest that food security discourses have followed pendulum movements, from the modernisation perspective of the Green Revolution in the 1950–1970s, through a period characterised by multiple and diverse perspectives such as nutrition, access and rights, to a postmodern perspective of food security refuting 'meta-narratives'. Maxwell (1996) argued for the adoption of a "postmodern perspective" following three principles for the formulation of food security policies (in Westengen & Banik, 2016):

- avoid an emphasis on overarching theories such as modernisation or 'meta-narratives' applicable to all situations

35 Béné et al. (2019)'s identification of failures should be set alongside the achievements of contemporary food production systems in securing safe, hygienic and convenient food for a rapidly growing population. The intensification of food production has, however, had a series of negative environmental and social consequences which this Report seeks to address.

- provide individuals and communities with choices that contribute to self-determination and autonomy in strengthening livelihood strategies
- borrow good ideas from many fields and avoid central planning and implementation of master plans

Food as a commodity

Within contemporary societies, and more strongly since the 1970s, this is the oldest narrative in the policy arena and the one used to develop food regime theory within a political economy perspective (Friedmann & McMichael, 1989; McMichael, 2009). According to food regime theory, food as a commodity has evolved since colonial times to different forms, but they all highlight food as a tradable good, based on the tradable features that can be valued and priced in the market (Vivero-Pol, 2017) and with a clear productivist focus. This narrative is linked to the industrial food system and considered to be the dominant discourse regarding the valuation of food (UNCTAD, 2013). Some authors state that, in this narrative, the use value (feeding people) of food is dissociated from its exchange value (price in the market) (McMichael, 2009; Timmer et al., 1983).

Food as a human right

In this framing, food is considered a human right as part of the *Universal Declaration of Human Rights* of 1948 and the *International Convenant on Economic, Social and Cultural Rights* of 1966. The main objective of the Covenant is food and nutrition security, and this is well developed in terms of legal obligations at state level (Oshaug et al., 1994). The main focus is on the social dimensions of food. This conception of food provided the basis for developing rights-based food systems, including (Anderson, 2008):

- democratic participation in food system choices affecting more than one sector
- fair, transparent access by producers to all necessary resources for food production and marketing
- multiple independent buyers
- absence of human exploitation
- absence of resource exploitation
- no impingement on the ability of people in other locales to meet this set of criteria

Approaching food as a human right provides the basis for different framings of the food system such as food sovereignty (Claeys, 2015; Wittman, 2011) or food as commons (Rundgren, 2016). It also provides a moral basis for the idea of 'good food', understood in terms of access to healthy, nutritious food but also to the positive cultural values associated with food, such as identity, taste and pleasure.

Food as commons

This narrative has deep historical roots but has been subject to recent revival. It puts sustainability at the centre of the debate and aims to provide an alternative to the 'food as a commodity' narrative (Rundgren, 2016; Vivero-Pol, 2017; Vivero-Pol et al., 2018). Here, food is framed as having multiple dimensions, both social and environmental, being all equally and properly valued and requiring different governance structures and institutions (Vivero-Pol et al., 2018).

Food as identity and culture

Territorial diversity in soils, climate, ecosystems, farming styles and food cultures have shaped the diversity of European culinary heritage. This diversity of traditional foods is seen as an important foundation of European culture and identity (Guerrero et al., 2009). Building on Bourdieu's demonstration of how taste is in some respects an expression of cultural capital, Wright et al. (2001) explore the roots of certain national and sub-cultural food taste preferences. The adage 'Tell me what kind of food you eat (or more precisely what you do not eat), and I will tell you who you are' also applies in a globalised and postmodern world, where people bring their food cultures to new places, and use particular food styles to distinguish themselves from their parents' generation or other groups.

Food as humans' closest link to nature

When eating, humans incorporate a piece of nature, such as plant or animal parts, into their body. Through food, humans literally, symbolically and metaphorically 'consume' flora and fauna and 'digest' the planet. Thus, the complex relationship between humans and nature manifests in culinary trends and can be observed on platters and buffets, in ingredients and recipes (Shapiro, 2010). Due to the fact that all humans have to eat, usually several times a day, food — as our closest link to nature — also provides an ideal object to reflect and reconsider the human-nature relationship and to establish more sustainable ways of living.

Whereas the productivist turn after the world wars was guided by a clear narrative of providing affordable food to all, current generations are confronted with multiple economic, ecological and social goals and their trade-offs: see, for example, the multiple Sustainable Development Goals, or the goals for CAP or EU regional policies extending from narrowly-focused economic goals to much broader socio-economic and ecological goals. These multiple and often conflicting goals do not provide a clear narrative, nor do they suggest a single development path that addresses the diversity of agri-food systems across member states, or the diverging needs of sectors and groups.

Table 3 summarises some key elements of the foregoing discussion, which might point at possible development paths that are promising to provide healthy, ecologically

sustainable and affordable food, while contributing to a post-carbon society, biodiversity conservation, new jobs, and farm income.

Table 3. Summary of links between different framings and possible policy interventions

Framing	Narrative components	Possible policy interventions	Evidence
Food as a commodity	European food products can better compete on world markets based on their unique qualities rather than on lowest price Product differentiation Early mover advantage Meeting the needs of a growing number of environmentally conscious consumers Sustainable intensification	Business and civil society support for sustainability innovation (including technical, social and institutional innovations) Sustainable food innovation hubs Support for on-farm product differenciation (organic, animal welfare and other sustainability improvements) Flexibility in administrative procedures and legislation Support for newcomers in farming and food processing Nudging initiatives to change consumer behaviour	The landscape of post-production enterprises that trade, process, package, store, prepare, and sell food for consumers is broad and provides opportunities to contribute to a more sustainable food system and a greening of the supply chain (de Oliveira et al., 2018). Research has begun to interrogate the role of the private sector in designing sustainable food packaging (Wang et al., 2016), food processing (Miranda-Ackerman et al., 2017), restaurants (Kwok et al., 2016; Perramon et al., 2014), and retail (Petljak, 2018), including the role of food retailers in reducing food waste (Hermsdorf, 2017).
Food as a human right	Access to healthy and culturally appropriate food for everyone Access to means of food production No exploitation Coherent with other human rights Sustainable farming practices State as main guarantor of the right to food	Shifting financial resources from pillar I to farm labour and vulnerable consumer groups (e.g., by supporting healthy and organic food at schools or retirement homes) Facilitating access to means of production by farmers	Several studies draw attention to the way that capitalisation of CAP payments in land values and rental prices favours landowners rather than tenant farmers and do not support farm succession or new entrants (Ciaian et al., 2018; di Corato & Brady, 2019; Feichtinger & Salhofer, 2016; Raymond et al., 2016). The right to food implies the "availability of food in a quantity and quality sufficient to satisfy the dietary needs of individuals, free from adverse substances, and acceptable within a given culture [and] the accessibility of such food in ways that are sustainable and do not interfere with the enjoyment of other human rights" (Mechlem, 2004).[36]

36 The Right to Food Guideline 8.1 asserts that "States should facilitate sustainable, non-discriminatory and secure access and utilisation of resources consistent with their national law and with international law and protect the assets that are important for people's livelihoods. States should respect and protect the rights of individuals with respect to resources such as land, water, forests, fisheries and livestock without any discrimination. Where necessary and appropriate, States should carry out land reforms and other policy reforms consistent with their human rights obligations and in accordance with the rule of law in order to secure efficient and equitable access to land and to strengthen pro-poor growth. Special attention may be given to groups such as pastoralists and indigenous people and their relation to natural resources". (FAO, 2006b)

Framing	Narrative components	Possible policy interventions	Evidence
Food as commons Food as humans' closest link to nature	Sustainability at the centre Provide alternative solutions to food production Multiple social, economic, cultural and ecological dimensions negotiated in new governance structures and institutions Food democracy and strong participation of citizen-consumers through social organisations	New decentralised and polycentric governance structures (e.g. agri-environmental collaboratives, Food Councils, Milan Urban Food Policy Pact) Regional food strategies, legitimised by broad civil society and business participation Emphasis on food embedded in regional terroir/contexts/needs Rural-urban food coalitions directly linking producers and consumers (Community Supported Agriculture, direct marketing, box schemes) Co-financed from LEADER and other Rural Development funds, Regional Policies Coordination on (supra-) national level to consider EU and national priorities and to foster learning across regions and countries Support to small-scale faming systems and local food	In relation to biodiversity, conservation within the CAP can be enabled through collaborative governance (Penker, 2017; Prager, 2015; Prager et al., 2012), for which stakeholders expressed a preference (Velten et al., 2018). Better governance by taking account of social networks, information flows, regulations and social pressure (Hauck et al., 2016). In a polycentric governance setting, multiple semi-autonomous decision-making centres interact across scales and sectors, while taking each other into account in competitive and cooperative relationships and having recourse to conflict resolution mechanisms (Ostrom, 2010).
Food as identity and culture	Acknowledging culinary and territorial diversity No top-down solutions interfering in cultural traditions Regionalisation as reaction to globalisation Context and group-specific solutions tailored to culture, terroir and individual needs	Pushing geographical indications and origin food Support for ethnic food and traditional food Supporting innovative farm and food businesses producing sustainable lifestyle food	This diversity of traditional foods is seen as an important foundation of European culture and identity (Guerrero et al., 2009). Building on Bourdieu's demonstration of how taste is an expression of cultural capital, Wright et al. (2001) explore the roots of national and sub-cultural food taste preferences. In contrast to the increasing standardisation of globally traded food, the re-embedding of food production in local contexts has received growing attention (e.g. Fendrychová & Jehlička, 2018; Murdoch et al., 2000; Penker, 2006). Renting et al. (2003) specify that spatial embeddedness is about communicating value-laden information about the place of production to consumers. European and particularly Mediterranean countries have a long tradition of communicating origin and place-based food quality to consumers (e.g. Quiñones-Ruiz et al., 2018).

Because of these varied impacts, policymakers should weigh carefully the pros and cons of each development path to assess potential socio-cultural, economic, health, environmental and land use impacts. Furthermore, a successful transition needs to consider benefit and burden-sharing between potential winners and losers of a shift in the food system towards greater sustainability and the differences between Old and New member states, the challenges of sustainability trade-offs, socio-economic disparities between regions that are better off and less-favoured rural areas, worker welfare, and inequities due to size of operation. The effects of EU policies and changed food provison practices on the wider world, particularly on the Global South also have to be considered.

Regarding the pace of change, we might learn from the history of CAP. This shows the limitations of the 'big bang' reform approach, and the difficulty of radically altering its principal mechanisms and vested interests (Germond, 2015). A gradual change through new integrated policies and structures and layering may create a sustainability dynamic that can result in lasting reform trajectories (Daugbjerg & Swinbank, 2016).

3.3. Social movements around food

Besides the different framings of food in the previous section, this section considers a number of social movements that have developed around notions of food democracy and food sovereignty. These could also be considered alongside other framings of food security and food justice considered in Chapter 1. Concepts such as food democracy and food sovereignty may not be social movements in themselves, but framings or narratives that provide support to social movements.

Food democracy

Food democracy is a relatively recent term, following the landmark publication by Hassanein (2003). Hassanein's paper built on earlier work about the aspiration to 'eat adequately, affordably, safely, humanely, and in ways one considers civil and culturally appropriate' (Lang, 1999: 218). Although expressed in various ways across the food democracy literature, the consensus is that people should have enhanced opportunities to participate actively in "shaping the food system" (Hassanein, 2003, p.79), including opportunities to participate at a variety of scales and at every stage of the food system from growing to cooking (Levkoe, 2006; Welsh & MacRae, 1998). Food democracy raises questions about the causes and effects of inequities in the food system and about the nature of food poverty, justice, sovereignty and sustainability.

Linked to narratives around active participation and the 'right to food' are calls for reorientating control within the food system (Anderson, 2008). This is sometimes

articulated in terms of shortening supply chains and connecting producers and consumers more directly (Johnston et al., 2009). In other cases, it is more explicitly about people having the capacity and capabilities to exercise power to shape the way food is produced, prepared, eaten and redistributed, beyond acting as a consumer (Levkoe, 2006; Murphy, 2019).

The concept of food democracy provides a critique of the global food system and suggests alternative configurations of participation, power and control that would be beneficial for sustainability. Attempts to achieve greater food democracy have tended to take place in particular locations using specific mechanisms (cf. Hassanein, 2008). For example, community-supported agriculture organisations, urban land committees, Food Policy Councils, and food cooperatives provide models of enhanced community control and more active participation in food systems (see Box 2). However, few studies have been conducted which evaluate the direct impacts of these initiatives in particular places or their consequences at the wider system level (cf. Michel-Villarreal et al., 2019).

Box 2. Community-supported agriculture

Initiatives changing the contractual agreements between producers and consumers under the umbrella of a social and solidarity economy deserve special attention. One such example is community-supported agriculture (CSA). CSA is a form of direct marketing of agricultural products connecting producers and consumers under some shared principles based on community values and solidarity. CSA has been described as an approach that needs to adapt its principles to the particular local context and circumstances, rather than as a single fixed method.

The essence of CSA is a group of people that agrees to purchase, in advance, shares of a farmer's harvest of food grown in an environmentally-friendly manner. The first known CSA in Europe, Les Jardins de Cocagne, was founded in 1978 near Geneva, Switzerland (Volz et al., 2016) as a response to concerns about food safety and the urbanisation of agricultural land (Dyck, 1994). Groups of consumers and farmers in Europe formed cooperative partnerships to fund farming and pay the full costs of ecologically sound, socially equitable agriculture.

Despite the huge diversity in existing forms and projects of CSA, three basic values are manifest in their structures and daily operations (Dyck, 1994):

- CSAs practise environmentally-friendly agriculture, adopt a long-term perspective, de-commodify food and land, and reject monoculture and chemical additives.
- CSAs strive to foster trust and to build socially just communities. They seek to provide an opportunity for city and country people to work together and build relationships with one another.

- CSAs have mechanisms to ensure that risks associated with farming are not borne by the farmer alone and try to ensure that food is available to people of all income levels.

By creating open and democratic spaces of active and direct producer-consumer cooperation, CSAs have been proposed to present a model for rethinking the food system (Balázs et al., 2016). Benefits of CSA are also diverse, ensuring healthy and environmentally friendly food at affordable prices to urban consumers, helping semi-subsistence farmers to escape from the trap of market failure, and providing them with a fair income (Möllers & Bîrhală, 2014).

However, scaling up these experiences is the main challenge today. Using a narrow definition of CSA, the sector estimates 2783 CSAs were operating in Europe in 2015 (the highest number found in France) producing food for around 475 000 people; and by broadening the definition (e.g. including Italian Gruppo di Acquisto Solidale)[37] the number increases to approximately 6300 CSA initiatives and one million people (Volz et al., 2016).

Food sovereignty

The food sovereignty approach is distinguished in the literature as "an 'epistemic shift' in which value relations, approaches to rights, and a shift from an economic to an ecological calculus concurrently challenge the rules and relations of a corporate food regime" (Wittman, 2011, p.90). Probably, the unique characteristic of this framing is that it emerges not from intellectual or academic institutions, but from the peasant movement, particularly La Via Campesina.[38] From a disciplinary perspective, it can be argued that food sovereignty is developed through a political ecology analysis of food in which power, culture, social justice and the ecological dimension of food are put at the centre of the debate. Food sovereignty has been proposed as a framework to assess food systems sustainability (Levkoe & Blay-Palmer, 2018; Ruiz-Almeida & Rivera-Ferre, 2019). To some authors, it addresses food systems from a holistic perspective that encompasses environmental, social and economic aspects to find a political answer that guides the system towards the more general goal of sustainability (McMichael, 2011).

3.4. Conclusion

In this chapter we have reviewed a range of theoretical approaches, including the multi-level perspective, transition management, social practice approaches, behavioural

37 http://www.economiasolidale.net

38 https://viacampesina.org/eng

science approaches, strategic niche management, and technological innovation system theory. We have drawn on a systematic review of the literature to consider the most prevalent theories, arguing that different approaches may be better suited to addressing different kinds of questions. Hence, the presented approaches are complementary, rather than competing. The chapter has also considered the challenges of translating theory into practice, arguing that many theories are better suited to understanding how changes in policy and practice might be (re-)framed or (re-)imagined rather than being translated directly into specific policy measures. The chapter has reviewed different ways of framing the problem and the theoretical and policy implications of these different framings. Finally, the chapter has outlined a range of social movements including food democracy and food sovereignty, illustrated respectively by community-supported agriculture and La Via Campesina.

3.5. Key messages and policy implications

- **A wide range of theoretical perspectives is available, providing a series of insights for studying transitions towards more just and sustainable food systems.**
- **Some of these perspectives address system-level changes while others focus on individual-level behavioural change.**
- **The social sciences have an important role to play in making the underlying premises of different approaches explicit, making the implications of policy framing more open and transparent.**
- **From a social science perspective, many theoretical approaches offer a way of framing issues and a conceptual language for informing analysis rather than ideas that can be immediately translated into policy options or specific recommendations.**
- **Alongside the definitions of food justice and food security provided in Chapter 1, this chapter has identified a number of social movements associated with food democracy and food sovereignty.**
- **How issues of food justice and sustainability are framed, theoretically and conceptually, has profound implications for the development of policy initiatives. It is therefore important that these framings are made explicit in debates about policy and practice relating to food.**

Chapter 4. Understanding sustainable food systems

This chapter seeks to define the nature of a socially just and sustainable food system, including the idea of food systems as complex adaptive systems. The chapter provides a critique of the current system, defined in terms of intensive, highly industrialised, modes of production and unsustainable levels of mass consumption. Endorsing the need for a transition and recognising that diverse options exist in developing sustainable food systems, we focus on the development of a more circular food system where food waste is identified as a key issue. The chapter concludes with an outline of the challenging issues of food system governance.

4.1. Introduction

As detailed in Chapter 2, there is increasing recognition that the prevailing food system is environmentally unsustainable and socially unjust. This has prompted different initiatives around the world to propose, reinvent or institutionalise more sustainable practices, from individual to global levels, and to develop more sustainable food systems (Allen, 2014). A key problem is the lack of an agreed definition of what constitutes a sustainable food system. A good starting point is provided by the HLPE (2014) definition:

> A sustainable food system is a food system 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.

However, different actors (e.g. producers, retailers, consumers, governments, civil society organisations) define sustainable food systems in different ways, depending on their starting point (Allen, 2013; Eakin et al., 2017) and on their own narratives and scales of analysis (Béné et al., 2019; Rivera-Ferre et al., 2013; Thompson & Scoones, 2009) (see also section 3.2 on alternative framings). As a result, different goals and ambitions are pursued and trade-offs between system objectives are also likely to occur (Ruben et al., 2018). As well as encouraging more sustainable modes of production, policymakers must deal with the cultural dimensions of consumption, short- and long-term public health and environmental considerations, and different national and regional contexts of consumption (Rayner et al., 2008). Definitions of sustainable food systems have also changed over time together with the social and environmental contexts, from an initial emphasis on quantity (e.g. as the basis of the EU's Common Agricultural Policy)

to the inclusion of other considerations, including health and environmental issues, in subsequent policy developments (see Chapter 5).

The concept of food system goes back several decades (Kneen, 1989; Sobal, 1978), and the need to rely on a systems approach was also formulated decades ago both in agriculture and ecology (Getz & Gutierrez, 1982; Huffaker & Croft, 1978). However, it is in the context of the evolution of food security narratives (e.g. Foran et al., 2014; Lang & Barling, 2012; Rivera-Ferre, 2012; Westengen & Banik, 2016) that a systems approach to food has gained prominence. A systems approach introduces a complex socio-ecological system perspective in the research and decision-making processes of food. This means that it is acknowledged that food systems are characterised by far-from-equilibrium states, co-evolution of system components, self-organising properties, non-linear dynamics, multivariable structures, high levels of uncertainty, control of limited factors and cross-scale relationships in time and space (Rivera-Ferre et al., 2013). It also means that food systems are expressions of certain human-environment interactions in a dynamic process shaped by uncertainty, errors, learning and adaptation (Rivera-Ferre et al., 2013). In developing this line of argument, several authors have suggested that, to promote sustainable food systems, different frameworks and a paradigm shift are needed that acknowledge food as a complex socio-ecological system (McKenzie & Williams, 2015; Rivera-Ferre et al., 2013; Rockström et al., 2016).

In a highly-cited paper, Ericksen (2008) emphasised the relevance of analysing "the interactions of the food system with global environmental change and evaluating the major societal outcomes affected by these interactions: food security, ecosystem services, and social welfare". This approach included the social and environmental components as fundamental drivers that affect the potential outcomes (in terms of food security). After Ericksen's work, the number of studies analysing food from a complex systems perspective has substantially increased (e.g. Doherty et al., 2019; Horton et al., 2017; Ingram, 2011). This includes systemic approaches to the study and management of food systems in order to achieve food and nutritional security. In line with the latest research, our departing point in defining sustainable food systems is to address food as a complex system, attending to its social, economic and ecological components and subcomponents, and focusing on delivering sustainability.

4.2. Definition of a sustainable food system

Accepting that there is no settled, universally agreed, definition of the nature of a sustainable food system, the Working Group deliberately adopted a pragmatic approach. Based on the many reports studied within their scoping review (SAM, 2019b), the SAM Unit drafted a working definition of a sustainable food system which they shared with the

Working Group. The Working Group adopted it, with some caveats and reservations. From this perspective, a sustainable food system for the EU is one that:

> provides and promotes safe, nutritious and healthy food of low environmental impact for all current and future EU citizens in a manner that itself also protects and restores the natural environment and its ecosystem services, is robust and resilient, economically dynamic, just and fair, and socially acceptable and inclusive. It does so without compromising the availability of nutritious and healthy food for people living outside the EU, nor impairing their natural environment.
>
> *(SAM, 2019b)*

The Working Group endorsed this definition, with the understanding that it is not a final description but rather an understanding and orientation towards sustainability. Our preferred approach is to focus on expected outcomes, as outlined below:

- The main objective of a sustainable food system is to provide safe, nutritious and healthy food for all current and future citizens in a given territory without compromising the availability of and access to safe, nutritious and healthy food for current and future people living outside that territory.
- A sustainable food system also provides food security without harming the environment. In recent years there has been a growing concern about the environmental impact of the food system (see p.34). New research suggests that appropriate agricultural management practices can help restore the natural environment and its ecosystem services by, for example, restoring degraded soils or sequestering atmospheric CO_2 (IPCC, 2019a). This outcome also integrates the spatial and temporal dimensions by ensuring a healthy environment in other territories and to future generations. Thus, the provision of food cannot be done at the expense of other territories by generating social and environmental problems elsewhere (Oteros-Rozas et al., 2019).
- Finally, a sustainable food system needs to be robust and resilient in order to produce food, in a wider context that is itself not sustainable, but is challenged by environmental degradation, climate change, biodiversity losses and resources scarcity. Food systems also need to be sustainable in social and economic terms, resilient to price shocks and other crises, and responsive to social inequalities and other forms of injustice.

With a particular focus on outcomes, this definition points towards the need to move from a linear understanding of food systems to a more circular approach, based on an understanding of food systems as complex adaptive systems. It is also important to consider that these are general principles for building a sustainable food system in Europe, while also acknowledging that many different food subsystems exist in diverse European contexts, including the marine environment, and that all of them need to shift towards sustainability by adopting these general principles at all scales.

4.3. Food systems as complex adaptive systems

Contemporary food systems are characterised by high and unsustainable levels of consumption, the ever-increasing nature of which can be likened to a pile of sand to which we continuously add extra grains. As Bak et al. (1988) have shown, those added grains will lead to sudden collapses at certain moments in time, from very small disruptions to major disruptions that disturb the whole (food) system. Theories from thermodynamics explain that systems following either continuous growth or steady decline (linear, non-linear and even exponential) end up in deep chaos or highly rigid states (Prigogine & Stengers, 1985). Therefore, trends for greenhouse gas emissions, overweight and other disorders (e.g. diabetes, cardiovascular diseases), exploitation of resources, biodiversity and so on are all sources of concern (e.g. de Vries et al., 2018; FAO et al., 2015). Like other systems, future-proof, sustainable food systems should balance at the edge of order and chaos in order to be sustainable (Holland, 1998; Kauffman, 1995).

Due to critical issues such as climate change (see section 2.2, p.35), the lack of sustainability of the current food system has received much attention in recent years and first propositions for change have been put forward. To ensure policy coherence, the SCAR Food Systems Working Group (2019) recommends adopting an overall systems approach and avoiding food system fragmentation. However, major scientific institutes specialising in complex systems (e.g. Santa Fé, New England, Paris, Juelich, Rome and Barcelona complex systems institutes) do not identify the food domain as a target area. Therefore, at present there is too little evidence to demonstrate the usefulness of a complex adaptive systems approach. However, there is evidence pointing to the need for (i) deeper insights in complex adaptive food systems and (ii) a new methodology for food systems to assess options for new policymaking.

Box 3. Example questions to gain insight into complex food systems and workable pathways

Science-oriented questions for policymaking:

- Are we able to understand when food systems remain either sustainable or become chaotic or rigid, even under destabilising events?
- Which emerging properties could we follow in case of sustainable outcomes?
- Can we intelligently divide the European food system in sustainable subsystems (cultural, geographic etc.)?
- How can one deal with uncertainties in food systems for policymaking, regionally and transnationally?
- How will clusters of actors evolve in subsystems facing different conditions (regulations, incentives etc.) either in food or at the crossroads of sectors (energy, health, ICT etc.)?

- What are the roles and (direct and indirect) influences of human beings (as consumers of food, citizens, actors etc.) on the sustainability of food systems?
- How can we deal with the fact of non-linear outcomes, and hence unpredictability, in policy communication?

Workable pathway-oriented questions for policymaking:

- Will scenarios help policymakers and experts to communicate images of future-proofing food systems?
- What are appropriate food system sustainability indicators and which reveal unpredictable minor events?
- Will a better understanding of the complexity of the European food system and all of its interacting subsystems (regional, cultural, geographical etc.) help to resolve conflicting interests and favour best outcomes?
- How will those insights help policymakers to set up a prioritised research and innovation agenda?
- How could innovations be fairly and meaningfully monitored, taking into account unpredictability?
- What policy tools could be developed to follow this (evolutionary) process and its gradual impact?

Understanding complex adaptive food systems for policymaking and coherence

A basic understanding of complex adaptive systems enables deeper insights into the complexity of food systems and the behaviour of actors. This holds for European and global scales as well as for subsystems at national and subnational scales, where the complexity is reduced but still huge (de Besi & McCormick, 2015). Also, at the intermediate (e.g. European) scale, the interactions between subsystems in the food domain and their co-evolution behaviour should be understood in order to provide a coherent basis for policymaking. Knowledge about complex adaptive food systems is relevant for posing appropriate research questions, developing research projects and methodologies and elaborating relevant key characteristics of complex adaptive food systems (Carbonara et al., 2010). Consequently, policymaking in food will be confronted with non-predictable outcomes of processes and hence may not reach desired outcomes without integrating a complex adaptive systems approach (e.g. Bosch et al., 2015; de Vries et al., 2018; Ford, 2011; Rivera-Ferre & Ortega, 2011). In this line of argument, policymaking may still define food scenarios, set the boundaries for all agri-food activities and follow overall emergent system properties in order to guide next steps. The detailing of processes in the food domain is then left to the systems themselves. This may require a cultural change in food policymaking, and a new methodology to guide major steps based on analysing overall emergent properties.

A potential workable pathway that allows options for new policymaking

Gaining deeper insights into the complexity of food systems and the behaviour of its actors should enable the transition towards more sustainable food systems. However, this also asks for a workable pathway consisting of the following steps:

1. imagining what sustainable food systems could look like
2. selecting appropriate indicators to follow actions in the food sector
3. analysing the evolution of the overall European food system and of its (territorial) subsystems[39]
4. identifying appropriate interventions and innovation strategies in food and inter-connected sectors (such as energy, health, transport and tourism)
5. monitoring their impacts
6. guiding the full process in an iterative manner (the INCAS approach, de Vries, 2017; e.g. GECAFS concept, Ericksen et al., 2009).

Such a workable pathway allows options for policymaking, (1) by following the logical order of steps and established scenarios about the future; (2) by guiding the process in an iterative manner following transparent indicators; (3) by providing the incentives and playing fields for a diversity of players to find the most creative solutions based on sound science; (4) by guaranteeing both a common European food system approach and a mosaic of interconnected regional-specific food system approaches.

4.4. Food systems in the transition from a mass consumption to a circular economy

Bearing in mind the major global transformations and challenges discussed in section 2.2, p.35, urgent changes are needed to the global food system to make it sustainable in the long term. As discussed, current population trends, coupled with income growth, will inevitably lead to an increase in world food demand. This in turn will add pressure to the food system and the environment through at least three channels: greenhouse gas emissions, uneven consumption patterns, and waste management. These three channels are interlinked and characterised by reinforcing feedback loops. Many commentators therefore endorse a change from a linear food model based on principles of 'take, make, consume, waste', which assumes an abundance of resources and unlimited waste capacity, to a more circular model based on principles of waste reduction, bio-refining

39 Scientific questions regarding the understanding of the complexity of food matrices (e.g. Mezzenga et al., 2005), also from the food chain and the consumer perspective (van Mil et al., 2014), are excluded from consideration in this report. However, they are highly challenging to address in future food research.

unpreventable losses, closing nutrient loops, improving efficiency, utilising byproducts, creating higher-quality food, and favouring changes in unhealthy diets (Jurgilevich et al., 2016), while at the same time including the social and human rights aspects (just, fair, inclusive and socially acceptable) as expressed in some of the different narratives and paradigms discussed in this report (see Chapter 3, p.51).

Limits of the linear mass consumption model

The productivist model that was inherited from the last century is characterised by two main aspects: mass production and linearity. As Cohen (2013) observes, the dominant mode of production evolved from agrarianism to industrialism to consumerism. In Europe, the consumerist model, at its origin, was characterised by the Taylorist-Fordist mode of production, able to generate regular increases in productivity and prompting mass consumption in the aftermath of the Second World War including the great post-war boom (Kumar, 2005). This model then evolved along the Keynesian trajectory, with growing worker/consumer buying power ensured by the growing number of relatively well-paid jobs (Cohen, 2003). It culminated with the globalisation of the consumer society and the rapid spread of the capitalist market around the world, linking the affluent Global North to poorer regions in the Global South, with richer areas characterised by over-consumption and poorer areas by under-consumption (McCoid, 2004).[40]

The rise of contemporary mass consumption society rested on two underlying assumptions: wellbeing is a function of growing goods accumulation and natural resources are virtually unlimited, promoting and perpetuating the linear model of production-consumption.

These trends characterised the European manufacturing sector, and since the mid-twentieth century they have also expanded to the food system, as discussed in Friedmann and McMichael's (1989) food-regime theory. The negative consequences of the mass consumption model are amplified in food systems by the difficoulties incurred in including negative externalities in food prices. As argued by the UN Food and Agriculture Organisation, in current food systems, it is of utmost importance to "achieve prices and fees that reflect the full environmental costs, including all externalities [...] economic and environmental externalities should be built into prices by selective taxing and/or fees for resource use, inputs and wastes" (FAO, 2006a, pp. xxiii-xxiv). This would allow us to reduce market distortions and encourage an efficient use of scarce resources, ultimately including the cost of externalities into the food price paid by consumers.

40 In referring to the Global North and Global South, we recognise the contested nature of the terminology and the dangers of simplifying complex geographical and historical processes. Alternative classifications refer to specific organisational structures (such as OECD and non-OECD countries), levels of income (such as Low or Middle Income countries) or to 'stages' of economic development (less developed, developing etc.) — each of which have their own problems.

Missing this target would lead, eventually, to two important additional considerations in food systems (Willett et al., 2019):

- the enormous production of food loss and waste, in the context of widespread food insecurity at the global level
- the negative impact of unhealthy diets on public health and the environment

The FAO Food Loss Index estimates that 13.8% of food produced in 2016 was lost "from the farm up to, but excluding, the retail stage" (FAO, 2019, p.8).[41] This waste is generated throughout the supply chain. Several studies underline the fact that, in low-income countries, most waste occurs in the early stages of the supply chain, mostly due to inefficient harvesting systems, poor technology, or inefficient storage and transportation. Meanwhile, in high-income countries, as much as 50% of food wastage occurs at the household level (Stenmarck et al., 2016). Food waste, along with the costs of disposal, is associated with unnecessary inputs of land, water and energy that in their turn generate 8–10% of all global greenhouse gas emissions (Mbow et al., 2019). Moreover, it incurs social and economic costs: the yearly burden of wasted food is estimated by the FAO to be equal to €900 billion in economic costs and around €800 billion in social costs.[42] For further information on food waste, including an example of the type of initiatives that have been implemented to reduce food waste, see Box 4.

These figures are a particular concern in relation to current levels of under- and over-nutrition (as discussed in Chapter 1 and Chapter 2). This reinforces the need for an immediate change in the food system, to deliver social, economic and environmental improvements at local and global level. We identify the characteristics of a circular food system with a particular focus on the key issue of food waste. The concept of circular food system has been developed in the literature by various scholars (see among others de Boer & van Ittersum, 2018; Van Zanten et al., 2018). Following Jurgilevich et al. (2016), a circular food system can be defined as a system including three interconnected stages: food production, food consumption, and food surplus and waste management. Circular economy principles applied to the food system would require reducing waste, reusing food as much as possible, utilising byproducts and food waste, and recycling nutrient. These actions should occur at each of the three mentioned interconnected stages, involving producers and consumers as well as waste management actors.

Box 4. Food waste and food sharing

Food waste occurs at all levels of the supply chain and has significant environmental, social and economic impacts — including global greenhouse gas emissions, wasted

41 See also http://www.fao.org/food-loss-and-food-waste/flw-data

42 http://www.fao.org/policy-support/policy-themes/food-loss-food-waste/en/

resources, losses of income at household level, and food insecurity issues. The main drivers of food waste have been classified by Canali et al. (2014) into three key categories:

- Those associated with **functional and technological issues**. This category refers to chemical composition and biological food characteristics as well as its applied technological processes (including packaging), which impact directly on the product's shelf life.
- Those associated with **regulatory aspects** of the issues of food waste and the circular economy, and how these fit together. Issues like food donation (and associated health and safety regulations) and food waste management (including the way in which waste is produced, collected and redistributed) require appropriate and harmonised regulations and strategies across all European countries.
- Those associated with **consumer behaviour** and expectations with respect to food quality and safety. Issues like overbuying, poor cooking skills as well as misperceived product quality (including, for instance, aesthetic characteristics of fruit and vegetables) are largely associated with increase of food waste occurring at the household level.

Several initiatives have been implemented in order to tackle issues associated with the above-mentioned categories. Here, we refer to food-sharing practices as one way of reducing food waste. The sharing of food production, preparation and products has been documented across societies past and present as a mechanism through which food waste might be reduced (Morone et al., 2018), sustenance secured, and familial and friendship networks cemented (Davies & Legg, 2018). International research has demonstrated how new forms of information and communication technologies (ICT), including websites, apps, interactive platforms and social media are stretching the territories over which people can share food, increasing the numbers of people who can be brought into sharing initiatives and bringing new forms of sharing between strangers into focus (Ciulli et al., 2019; Davies & Evans, 2019; Edwards & Davies, 2018; Marovelli, 2019; Michelini et al., 2018; Morrow, 2019; Rut & Davies, 2018; Weymes & Davies, 2019). This research reveals that, while there is no single archetypal food-sharing initiative and the context in which food-sharing initiatives emerge remains crucial, the goals of many such initiatives are aligned with sustainability objectives (Davies et al., 2019).

Quantifying the sustainability impact of ICT-mediated food sharing initiatives is, however, currently not possible, particularly in relation to social sustainability, where impacts are hard to quantify but are nonetheless important (Mackenzie & Davies, 2019). Impact data collected by food sharing initiatives are rarely shared openly, and the data tend to focus on simple outputs rather than outcomes or impacts.

Concerns have been raised that some food-sharing, for example surplus food redistribution initiatives, while seeking to reduce waste and feed those in need, may be facilitating the upstream causes of food waste by (a) providing consumers and retailers with a mechanism to get rid of their waste rather than preventing its creation in the first place (Davies, 2019a) and (b) acting as a short-term sticking plaster obscuring entrenched issues of food poverty and upstream drivers of food insecurity and depoliticising hunger (Caraher & Furey, 2017). While these redistribution initiatives are hopeful that the data they produce for donors will have upstream effects, there is little evidence of this occurring to date (Weymes & Davies, 2019) and better systems for identifying such trends are required. Social concerns have also been flagged, with the inclusivity of sharing practices questioned (Fitzmaurice & Schor, 2018). Major tensions exist between food-sharing initiatives and regulators, particularly around health and hygiene, food safety and risk (Morrow, 2019) but also with respect to access to land and spaces to share food (Davies, 2019a).

Hence, food-sharing initiatives are not a silver bullet for developing a more sustainable global food system. They are too diverse in constitution and dynamic in nature to make such a generic statement. Food-sharing initiatives operate with, alongside, underneath and beyond the dominant global commercial food system, depending on their goals and the context in which they are operating. However, they do provide demonstration effects of innovation from below, with sustainability goals at the core (Davies et al., 2017). The potential of ICT-mediated food sharing activities for sustainability impacts needs to be more thoroughly researched before they are promoted as positive food system disruptors or dismissed as too small-scale to contribute significantly to system change towards sustainability.

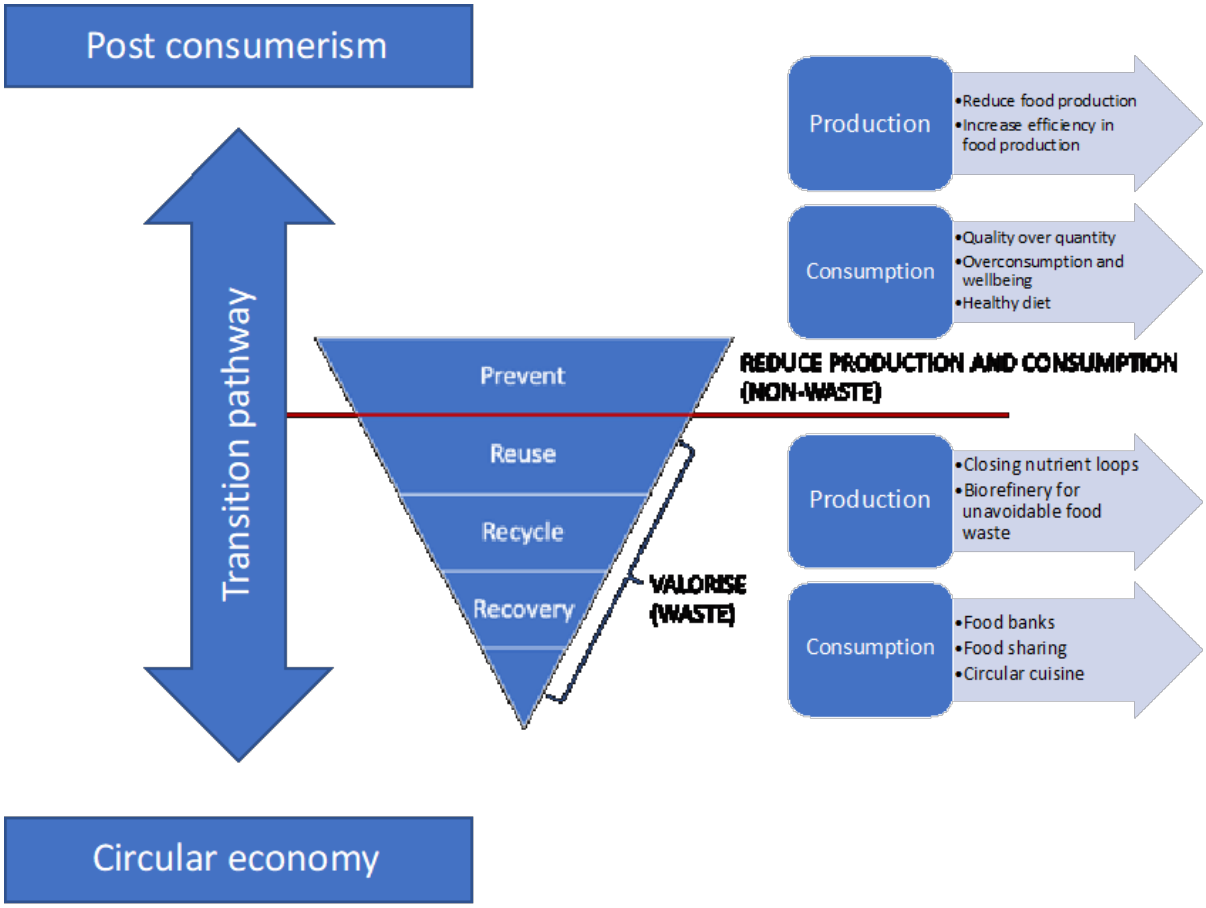
An example of a food-sharing initiative (FoodCloud) is presented on p.134.

Towards a circular food system: a food waste approach

As shown in Figure 8, the waste pyramid (Directive 2008/98/EC) distinguishes between actions undertaken before waste is generated, and actions undertaken afterwards. Such actions would contribute to the implementation of a circular food system, as described above. Specifically:

- **Reduction** (also referred to as prevention) aims to lower production and consumption levels in order to meet specific challenges posed by the scarcity of resources, and to reduce the negative effect on the environment and human health of over-consumption of low-quality food.
- **Valorisation** aims to reintroduce unpreventable food wastage into the production circuit at all levels of the supply chain, aiming to reduce landfill to zero.

Figure 8. The waste hierarchy, post-consumerism and the circular economy (adapted from European Commission)[43]



We acknowledge the usefulness of this two-step approach and apply it as follows on the current food system.

Reduce: a transition out of mass consumption

The growing demand for nutrients from meat-based Western food production and consumption patterns is acknowledged to exert enormous pressure on the environment (Willett et al., 2019). The livestock sector is a major stressor on many ecosystems and on the planet as a whole. Globally, it is one of the largest sources of greenhouse gases (Mbow et al., 2019) and, if not well managed, one of the leading causal factors in the loss of biodiversity, while in developed and emerging countries it is one of the leading sources of water pollution (Gerber et al., 2013). Springmann et al. (2018) observed how, without significant social or technological changes and specific measures to mitigate adverse impacts, the environmental pressure of the food system is bound to increase, reaching an unsustainable level. Major areas of impact would include greenhouse gas emissions, demand for cropland, water, phosphorus and nitrogen applications. Hence, if no change

43 https://ec.europa.eu/environment/legal/law/6/pdf/02_aile_eU_waste_legal_framework_speakers_notes.pdf

occurs, humanity will soon approach the planetary boundaries for global freshwater use, change in land use, and ocean acidification (Springmann et al., 2018). Levels of nutrient overload and biodiversity loss have already surpassed tolerable levels (Rockström et al., 2009).

Along with the above-mentioned impact on the environment, Western diets also have significant impact on human health (see also chapter 2). Since the early 1970s, the number of obese people has been on the rise in Western countries, impacting negatively on food and public health systems (Di Cesare et al., 2016). Specifically, over-eating — i.e. food consumption above a person's energy requirement, also referred to as 'metabolic food waste' — represents an avoidable environmental burden as well as one of the main causes of health disease, including an increased risk of cardiovascular disease, stroke, certain cancers and type II diabetes (Mbow et al., 2019; Tanumihardjo et al., 2007).

Health problems linked to Western diets also stem from the nature of food consumed. Over recent decades, a common trend has been the significant increase in the consumption of industrially processed ready-made food, which has progressively replaced home-cooked meals (Poti et al., 2017), with adverse health consequences claimed by some (e.g. Monteiro et al., 2017). Such foods are gaining popularity among European consumers, impacting on the environment through, among other things, the excessive use of food packaging (bottles, containers, wrappers, plastic bags etc.) and associated waste issues (Moubarac et al., 2013). As discussed in section 2.2, p.35, the IPCC land report presents sustainable diets as an important option to mitigate climate change, improve public health and reduce food loss (IPCC, 2019a).

A food system characterised by overeating and excessive waste production in the Global North, and at the same time food insecurity, undernourishment and malnutrition in the Global South, poses questions of justice, fairness, inclusiveness, and social acceptability. There are, therefore, clear links between the need for a more circular food economy and the achievement of the SDGs (Fassio & Tecco, 2019). These issues have been described in more detail in Chapter 3.

This leads to the second aspect of the needed transition, leading the food system out of a linear model into a circular one, based on reduce, reuse, recycling, nutritional recovery, cascading effects and waste valorisation.

Valorise: a transition out of a linear food system

The UN SDGs have set the target of halving per capita food waste by 2030 at retail and consumer levels, and reducing losses along production and supply chains in order to move towards responsible consumption and production. Food waste valorisation would help to fulfil this goal by redirecting waste into value chains, creating more cost-competitive processes which would affect other SDGs (e.g. no poverty; zero hunger;

industry, innovation and infrastructure; sustainable cities and communities; and climate action).

Some research points to the value of embracing and implementing circular economy principles to sustainable food systems, such as rethinking food systems by closing nutrient loops, improving their efficiency, creating higher-quality food, or bio-refining of unpreventable losses (de Boer & van Ittersum, 2018).[44]

Food waste and food losses can be classified as preventable or non-preventable. Preventable waste is the fraction of food waste occurring along the entire food supply chain (from harvest to processing, distribution and consumption) that can be reduced or avoided through improved management practices, changes in legislation (e.g. labelling), enhanced processing, changes in consumption behaviours and changes in education (e.g. about the seasonality of food and aesthetic appearance). Non-preventable waste is food waste that cannot be avoided and can be used as feedstock to produce bio-based products (Morone, 2019). Reuse, recycle and recovery of preventable food waste and losses should occur at all levels of the food supply chain: from early phases of production, to processing, transport and consumption. Recycling should also be considered in terms of the consumption of extra energy, water and investment costs, as not all recycling is sustainable.

Along with environmental benefits, adopting a circular food system could also deliver significant economic advantages. As estimated by the Ellen MacArthur Foundation (2015), introducing circular principles in the food system could lead to savings of up to €420 billion in Europe by 2030. €60 billion would be direct savings by the food industry, while the remaining €360 billion would be in related cost savings and externalities — e.g. lower levels of malnutrition leading to decreased pressure on healthcare.

The Circular Economy Package adopted by the European Commission in 2015 sets out a framework to enable producers and retailers to embrace practices aimed at supporting the achievement of the UN SDGs, designating 'food waste' as a priority area. To this end, several measures are encouraged, including an assessment of existing EU relevant legislation (concerning waste, food and feed), actions to facilitate food donation by suppliers and retailers, and the use of by-products and food waste in food and feed applications. However, as mentioned earlier, the bulk of food waste in European countries occurs at household level (Stenmarck et al., 2016). This means that urgent actions are required also at the consumption level, where new and improved consumption patterns need to be adopted.

44 Closing the nutrient loop refers to a wide range of efforts to ensure that nutrients are applied efficiently in relation to plant needs. It also includes efforts to recover nutrients in usable form from places in the food system where nutrients concentrate — including wastewater treatment plants, livestock production facilities, compost operations, and food processing plants — and recycle them to cropping systems (http://csanr.wsu.edu/closing-the-nutrient-loop/).

In a recent review of extant research, Reynolds et al. (2019) found that information campaigns were effective with up to 28% food waste reduction in a small sample size intervention. 'Nudging' interventions that changed the size or type of plates were even more effective (up to 57% food waste reduction) in restaurant-type environments. Changing nutritional guidelines in schools were reported to reduce vegetable waste by up to 28%, indicating that healthy diets can be part of food waste reduction strategies. A number of specific interventions, such as cooking classes, fridge cameras, food sharing apps, advertising and information sharing were also reported to be effective, but with little or no robust evidence provided in the original studies. These studies also highlight some of the dilemmas associated with food waste and the transition towards a more sustainable food system (see Box 5). Furthermore, it has been shown that food waste at household level is lower whenever household members possess basic skills related to cooking, food storing, re-use of food surplus etc. In a recent study, Morone et al. (2018) identified some key enablers to prompt food waste reduction, including environmentally friendly behaviours; economic awareness; food competences and skills; and collaborative attitudes.

Box 5. Dilemmas in the transition towards a sustainable food system

The need to transition towards a sustainable food system in Europe brings into the discussion some dilemmas that need to be addressed. Two obvious ones are the following:

- On the **production** side of the food chain, a reduction in meat consumption may have serious implications for the economic vitality of the livestock sector. Thus, transitioning to a sustainable food system also necessitates consideration of the potential consequences for those raising livestock and calls for developing just options within the agricultural sector that ensure that farmers can make a living from their activity.
- On the **consumption** side of the food chain, high prices harm poor people who cannot access food, however, low prices are bad for the environment being one of several factors favouring increasing food waste. Hence, efforts by policymakers are required to guarantee healthy and sustainable food for the 20 million people in Europe suffering from undernourishment.

Food waste at household level is related to the price of food, such that it can be expected that more expensive food will be wasted less. This presents policymakers with a paradox between food affordability and food waste. However, the relationship between food price, household income and food waste turns out to be less straightforward (Hebrok & Boks, 2017).

Ethnographic work by David Evans (2014) has illustrated the many practical reasons why even the most environmentally-conscious consumers end up wasting food despite their best intentions. Food enters the domestic waste stream for a wide variety of reasons. Family routines may be disrupted by a change in the weather (prompting a barbecue or trip to the pub rather than the planned meal at home). Unanticipated changes to household schedules may have similar consequences, such as a delayed return from work, while a desire for novelty and dietary variation may challenge the intention to eat food that has been cooked in bulk for later consumption. As Evans (2011) suggests, an emphasis on the social practices that underpin individual decisions about what to cook and eat challenges the tendency to blame consumers for making 'bad' choices, supporting a more distributed model of responsibility for food waste.

Food sharing (discussed in Box 3, p.69) is attracting interest among scholars and policymakers, with a growing number of initiatives arising across Europe (Farr-Wharton et al., 2014; Ganglbauer et al., 2014), taking the form of donating (Michelini et al., 2018) as well as selling and bargaining (Falcone & Imbert, 2017). However, sharing practices are often motivated by economic reasons rather than environmental awareness (e.g. Barnes & Mattsson, 2016). Hence, it is not clear whether consumers are becoming aware of the economic burden associated with over-consumption and are turning to post-consumerism models predicated on "mindful spending" and "collaborative consumption" (Bennett & O'Reilly, 2010). But at least some consumers are questioning and reassessing the budget they allocate to food consumption, redirecting their purchasing behaviours to "less and higher quality" (Gallar et al., 2019).

The discussion so far has taken a holistic view of sustainable food systems, focusing on desirable outcomes. Linear mass consumption models produce unsustainable outcomes, leading to calls for a different approach. Taking the example of food waste, a circular food system approach offers opportunities to support the transition to a more sustainable food system, highlighting the need for more joined-up thinking, linking production and consumption, to complete the transition.[45] The large number of heterogeneous actors involved in the transition and in the governance of sustainable food systems reflects the complex nature of the problem, as presented in the next section.

4.5. Governance of sustainable food systems

Food systems governance is an umbrella term for the broad range of steering efforts that affect the food system intentionally or unintentionally, including activities in supply chains (producing, distributing, trading, consuming of food), food security (access,

45 The geographical dimensions of circular economies are elaborated elsewhere. See, for example: http://www.fao.org/3/ca6048en/ca6048en.pdf

availability, utilisation, stability) and various socio-economic, cultural and environmental outcomes. Governance has been defined in many different ways (see overview in Kjaer, 2004), but principally refers to the ensemble of rules, processes, and instruments that structure the interactions between public and/or private entities to realise collective goals for a specific domain (Kooiman, 2003). This broad definition comprises the activities of governments, businesses and civil society actors; economic, communicative and juridical steering mechanisms; the structures and processes through which decisions are made. It varies from hierarchical steering to forms of self-organisation, and stretches from the local up to the global level (Kjaer, 2004; Knill & Tosun, 2012; Peters & Pierre, 2016). Food governance is thus more than government and governmental policies (Liverman & Kapadia, 2010).

Governance and transformative change

The concept of governance is often preoccupied with institutional change, and combines agency with structures and rule systems (Kjaer, 2004). This is reflected in the increasing amount of literature on the governance of transitions or transformative change (Field et al., 2012; Grin et al., 2010; Hekkert et al., 2007; Loorbach et al., 2017; Termeer et al., 2016). Actors who try to govern transitions often encounter tensions or even contradictions between their ambitions and the existing formal and informal rules and values of the governance systems in which they are operating. Hence, changing or even fundamentally reviewing the governance system itself may be necessary to enable, or at least tolerate, alternative strategies of governing transitions (Hendriks & Grin, 2007). In their systematic literature review, van Bers et al. (2016) investigated the interplay between transformations in food governance systems and the governance of food system transformations. They found that institutions (50%), actor-networks (59%), and cooperation/coordination structures (62%) were the main elements of governance that were transformed. Changes in power structures and societal norms were crucial for successful transformations (Gillard et al., 2016). They also paid explicit attention to champions of change — people who promote new ways of thinking and acting — to initiate transformative large-scale collective action (Straith et al., 2014).

Specific challenges of food system governance

Despite its popularity, the concept of food systems is poorly reflected in institutional terms (van Bers et al., 2016; Fresco, 2009; Hospes & Brons, 2016; Kennedy & Liljeblad, 2016). Food governance systems are fragmented and cut across the usual boundaries between sectors, administrative levels, temporal and spatial scales, public and private spheres, science and policy, and diverse normative frameworks (Termeer et al., 2018). It is an attractive proposition for actors with a change agenda to emphasise that food cannot be dealt with effectively by the current fragmented institutional architecture, and that therefore "the governance system should be made more coherent and harmonised,

better integrated and coordinated, and more inclusive" (Candel, 2014, p.596). The food system literature also contains many pledges for a reduction of policy fragmentation and suggested strategies such as top-down integration, new coordination structures or mandatory mainstreaming. These strategies reflect an optimistic philosophy of governance (Candel, 2014, p.596; Biesbroek et al., 2013), a philosophy that is often regarded as less effective in situations with controversial issues, uncertainties and high politics (Hajer et al., 2015).

Other scholars argue that institutional fragmentation is framed too readily as a negative context that hinders concerted collective action. For example, Biermann et al. (2009) distinguish between synergistic, cooperative and conflictive fragmentation, and between fragmentations that have advantages and disadvantages for performance of governance. Whereas some degree of fragmentation may increase the innovativeness and adaptability of the system, too much (conflicting) fragmentation can result in bad performance (Biermann et al., 2009; Folke et al., 2005). Ostrom (2012) even argued that institutional diversity is as important as biodiversity. In the context of food, various authors argue that the interdependencies of actors, activities and problems within the food system challenge the efficacy of traditional modes and strategies of governance (Siddiki et al., 2015).

Various modes of governance for addressing complex food problems

To address complex or wicked food system problems, various modes of governance are suggested:

- **Reflexive governance** facilitates learning, adaptation and collaboration between actors at different scales and stages of the food system (Sonnino et al., 2014). This requires structures for collective reflection (van Bers et al., 2016).
- **Polycentric governance** provides more opportunities for experimentation and learning across levels (van Bers et al., 2016; Cole, 2015) , entails many policy experiments from which policymakers at various levels of governance can learn (Ostrom, 2009), and contributes to building trust among stakeholders (e.g. nation states, public and private sectors, civil society).
- **Global experimentalist governance** is suggested for the SDGs (Monkelbaan, 2019) and relevant for food systems, and is already implemented in global atmospheric and marine agreements (Armeni, 2015; de Búrca et al., 2014). Global experimentalist governance is an institutionalised process of participatory and multi-level collective problem-solving, in which the problems (and the means of addressing them) are framed in an open-ended way, and subjected to periodic revision by peer review in the light of locally generated knowledge (de Búrca et al., 2014). This favours learning, participation and cooperation (Armeni, 2015). This form of governance can establish processes that enable otherwise unimagined alternatives.

- **Multi-level governance** in food systems governance is important (van Bers et al., 2016). It considers structures and interactions between a variety of actors involved at all levels (international bodies, civil society organisations, nation states, public sector groups, and private sector entities, such as those presented in Chapter 6), with different agendas and values. The EU's Common Agricultural and Fisheries Policies inherently show many characteristics of multi-level governance, including a dynamic interplay between the European Commission, member states and regional authorities. The level of regionalisation within the European policy frameworks is criticised. The Common Fisheries Policy, for example, does not meet criteria for effective multi-level governance resource policy and the large variation in performance across regions and member states provides an argument for further development of regionalisation and regulation which better accounts for different decision-making contexts (Belschner et al., 2019). Regionalisation is only facilitated to a limited degree by present application of Article 18 and narrow interpretations of stakeholder involvement by High-Level Groups, with the Commission functioning top-down and detached from the Advisory Councils (Eliasen et al., 2015).
- **Participatory governance** aims to involve various stakeholders. Despite its advantages, studies of fisheries policies, for example, show problems with representation, particularly due to conflicting understandings by different stakeholder groups (Linke & Jentoft, 2014; Linke & Jentoft, 2016). The high level of public interest does not always result in active public engagement (Norton & Hynes, 2014).
- **Adaptive governance** focuses on the challenge of food systems to deal with uncertainties and volatility, and remains feasible and optimal under a dynamic environment of changing social, economic, political and climatic conditions (Drimie et al., 2011; Kate, 2014; Pereira & Ruysenaar, 2012). It is often applied in the context of the governance of social-ecological systems (Folke et al., 2005; Karpouzoglou et al., 2016).
- **Self-governance** is often mentioned, in particular at the local or regional level (van Bers et al., 2016). Wiskerke et al. (2003), for example, investigated environmental cooperatives in the Netherlands that began emerging in the early 1990s as a new form of rural development and governance based on self-organisation and self-regulation. An example of such cooperatives, in Poland, is presented on p.132.

In practice, governance arrangements often combine various modes of governance. Van Bers et al. (2016) mention many examples, such as private fair trade certification schemes. In this regard, an example to address food systems governance challenges arises within the UN Committee on World Food Security (CFS), where diverse actors, voices and narratives are integrated in global food security governance. The Global Strategy Framework for Food Security and Nutrition (CFS, 2017) provides a new overarching framework for food security and nutrition strategies, policies and actions that includes environmental concerns within a food system approach and a broad vision of food and nutrition security. To address different narratives regarding food security (Lang & Barling,

2012; Rivera-Ferre, 2012; see also p.51), a first step is to agree on basic principles and values (Margulis, 2013), which can be described in terms of reflexive governance. This framework also fits within the 'governance through goals' provided by the SDGs (Biermann et al., 2017). The CFS could provide the basis to develop global experimentalist governance in global food systems (de Schutter, 2014; Duncan, 2015; Duncan & Barling, 2012) providing a combination of bottom-up and top-down initiatives (Lambek, 2018) that could be replicated at the EU level.

Subnational governance at the level of cities and communities is also becoming relevant in terms of responses. Efficient food systems require subnational governments to include food policy councils (Feenstra, 2002; Schiff, 2008) and city networks to address food systems challenges (see, for example, the UK Sustainable Food Cities Network on p.145, or the Network of Cities for Agroecology in Spain).[46]

Good governance for food systems

A parallel debate involves the normative question of what can be considered good governance for food systems. In general, the debate on good governance leads to a broader concern than just effectiveness and efficiency; it also includes elements of democracy, legitimacy, accountability and inclusiveness (Kjaer, 2004). Various food scholars have been concerned with the question of what sorts of principles or attributes enable us to deal with the complexity of food systems in a suitable way. For example, Rivera-Ferre et al. (2013) proposed seven principles for food systems management considering them as complex socio-ecological systems: learning, flexibility, adaptation, scale-matching, participation, diversity enhancement, and precaution. They identified existing management strategies which rely on those principles and that could be adopted in food systems governance.

Related research is focused on barriers towards good food system governance. A Delphi survey of 45 European experts on food security identified five food system governance deficiencies that impinge on food security in Europe (Moragues-Faus et al., 2017):

- a failure to deal with cross-scale dynamics
- the inability to address issues related to persistent inequalities in food rights and entitlements
- increasing geopolitical and sectorial interdependencies
- power imbalances and low institutional capacities
- conflicting values and interpretations of 'food security'

46 https://www.ciudadesagroecologicas.eu

Termeer et al. (2018) developed a diagnostic framework with five principles to assess governance options appropriate to food systems:

- system-based problem framing
- connectivity across boundaries to span siloed governance structures and include non-state actors
- adaptability to flexibly respond to inherent uncertainties and volatility
- inclusiveness to facilitate support and legitimacy
- transformative capacity to overcome path dependencies and create conditions to foster structural change (see Table 4)

Table 4. Framework: five principles for food system governance (Termeer et al., 2018)

Principles	Challenges	Indicators	Literature (in Termeer et al., 2018)
System-based problem framing	To deal with interlinked issues, drivers, and feedback loops	beyond one-dimensional problem definition feedback mechanisms integrative narrative room for reflexivity	Schut et al. (2015) Sonnino et al. (2014) Duncan (2015) Hospes & Brons (2016) Ericksen (2008)
Boundary-spanning structures	To organise connectivity across boundaries of subsystems involved	interactions across levels and sectors spanning siloed governance structures public-private partnerships multistakeholder workshops	Bizikova et al. (2014) Drimie et al. (2011a) Hospes & Brons (2016) Holmes et al. (2010) Ingram et al. (2013) Biermann et al. (2009) Folke et al. (2005)
Adaptability	To respond flexibly to inherent uncertainties and volatility in non-linear systems	monitoring systems decentralisation and self-organisation flexibility learning while doing	Boyd & Folke (2011) Folke et al. (2005) Galaz (2005) Clancy (2014) Pereira & Ruysenaar (2012)
Inclusiveness	To involve actors who are affected by the problem and the proposed policies	involvement of marginalised voices social differentiation amongst participants involvement of local communities and networks	Hospes & Brons (2016) Biermann et al. (2012) Siddiki et al. (2015) Clancy (2014) Koliba et al. (2016)
Transformative capacity	To overcome path dependencies and create adequate conditions to foster structural change	addressing path dependencies and lock-ins leadership resources political will	Sehring (2009) Jayne et al. (2006) Purdon (2014) Drimie et al. (2011) Glasbergen & Schouten (2015)

4.6. Conclusion

This chapter has presented an evidence-based understanding of a sustainable food system. It is now widely accepted that envisaging food as a social-ecological system helps embrace its complexity, steering the system towards more just and sustainable outcomes. Taking a pragmatic approach, the Working Group adopted a broad definition of a sustainable food system, reaching consensus on the fact that such a defintion cannot be final but should indicate a desired orientation and expected outcomes. A complex adaptive systems approach may also be helpful in understanding sustainable food systems, although little research has yet been carried out in this domain.

Evidence shows that our current linear mass consumption model is not sustainable, and that circular economy principles (based on valorising food production and reducing consumption), such as those applied to food waste management, could help with the transition to a more sustainable food system.

Understanding sustainable food systems also means understanding its governance, and the roles played by the very large number and diversity of stakeholders involved in the food sustainability transition. Food governance systems are characterised by a high degree of fragmentation, which is largely viewed as an obstacle to change. Various modes of governance exist for addressing complex food problems, and in reality these are often combined. Food scholars have carried out research on what could be appropriate principles for food system governance, barriers to good food governance, or to assess appropriate food governance options. Good governance for food systems should not only concern itself with effectiveness and efficiency, but also with principles such as democracy, legitimacy, accountability and inclusiveness.

4.7. Key messages and policy implications

- **Definitions of sustainable food systems are complex and contested, reflecting the interests of the different actors involved in the system.**
- **Gaining deeper insights into the complexity of food systems and the behaviour of food-system actors helps identify workable transition pathways based on a logical framework with clearly defined steps.**
- **There is a growing consensus that agri-food systems are complex socio-ecological systems. In scientific and policy terms, this implies major changes in how we assess and manage food systems.**

- The inherited productivist model of the 20th century, based on mass production and consumption and linearity, has raised issues that can be addressed through a change towards a circular economy based on waste reduction and valorisation.
- Governing transitions often requires reviewing the governance systems in which they are operating. Food system governance often transcends the boundaries of traditional jurisdictions, levels of government, policy domains, and public-private spheres, making diversity recognition, coordination and integrative leadership key. Transforming the food system requires transformation of food governance.
- Good food systems governance require system-based problem framing, boundary-spanning structures, adaptability, inclusiveness and transformative capacity. Different governance arrangements will be required to govern food systems (reflexive, polycentric, global experimentalist, multilevel, participatory, adaptive, self-governance).
- Food governance combines various modes of governance: bottom-up and top-down; public and private; and local, regional, national and global.
- Norms for evaluating good food system governance include effectiveness, legitimacy, adaptiveness and inclusiveness.
- In a transition from linear to circular, sustainable food systems, the interface between science, technology and society is likely to become increasingly significant in policy debates about the future of food, including consumer responses to novel technologies. This is a key area for future discussion between science and policy.

Chapter 5. Current and recent policy initiatives

Following the discussion of food system governance in section 4.5, p.80, this chapter reviews the wide range of public policy initiatives that have been directed at influencing the sustainability of food systems at a range of scales, recognising that the coordination and integration of food policy efforts have been a central concern of food policy scholarship.

Importantly, policies may already contribute to, or provide potential for, a sustainable EU food system, but may also impede such a transition. For example, a recent analysis of the Horizon2020 SURE-Farm project shows that the Common Agricultural Policy is better capable of ensuring farming systems' robustness than of enabling transformability (Feindt et al., 2019).

From a methodological point of view, the precise effects of policies remain subject to uncertainty due to attribution problems: how does one know that changes result from a specific policy intervention (cf. Jordan and Lenschow, 2010)? Assessing policy effects is especially difficult in complex systems, in which relationships are non-linear and affected by a multi-layered configuration of policy interventions. Additionally, sustainable food policy interventions suffer from a dependent variable problem, as sustainability is a multi-dimensional policy concept, addressing a broad range of environmental, social and economic dimensions (Candel & Daugbjerg, 2019). Policy performance across these dimensions may vary significantly. This chapter therefore synthesises the most prominent social science debates and insights about food system policy influences as these emerge from the literature, but does not provide an exhaustive toolkit for which policies are most effective in a given context for a given sustainability dimension since these are context-specific and specific research would be required.

5.1. Global level

Due to the high level of globalisation of food value chains (Oosterveer, 2007; Phillips, 2006), the EU's food system is increasingly affected by deliberations and decisions taken in global policy arenas. Whereas global governance arrangements in general have been criticised for relatively high levels of symbolism and implementation deficits (Dupuis & Knoepfel, 2013; Haas, 2004), the agricultural, fisheries, and food domains are somewhat

exceptional for the large number of binding agreements and associated standards that apply.

A large part of these serve to maintain the smooth functioning of global trade flows under the World Trade Organisation (WTO) regime. From an economic perspective, four links between food security and trade can be conceptualised (Martin, 2017):

- countries increase overall income through trade by exploiting their comparative advantage
- trade increases productivity through the exchange of knowledge and technology
- price volatility may be reduced through international diversification
- trade may increase the diversity and quality of food consumed

An important caveat, however, is that these benefits may not be well distributed within a country (for instance between sectors), leading to distorting policy interventions that undermine some of these benefits.

The terms under which international trade is conducted, within and beyond the EU, are clearly vital to the development of a more just and sustainable food system. Since such trade is dominated by major agri-food businesses and subject to rules set by international trade organisations, such as the WTO and the General Agreement on Tariffs and Trade, there is a limit to what can be achieved within the EU. Particularly relevant in the framework of the WTO are the *Agreement on Agriculture* and the *Agreement on the Application of Sanitary and Phytosanitary Measures*, both of which came into force in 1995. The former lays down the general rules of the game for agricultural trade by regulating domestic support, market access, and export subsidies. The latter has the aim of protecting human, animal and plant health by mandating governments to align their sanitary and phytosanitary frameworks with standards set by the Codex Alimentarius Commission, World Organisation for Animal Health, and the Secretariat of the International Plant Protection Convention (Livermore, 2006). While these agreements include clear rules on governing well-known risks, there is debate about the extent to which they — as well as the Technical Barriers to Trade Agreement — allow for newer, relatively interventionist, types of legislation to promote public health or climate action, such as the EU Ecolabelling programme or bans on the import of unsustainable products (Swinbank, 2006; Vranes, 2011). The existence of these agreements, as well as the relatively large number of food-related disputes settled by the WTO dispute settlement mechanism, show that food, agriculture and fisheries are central sensitive issues within the multilateral trade agenda (see, for example, Daugbjerg & Swinbank, 2008; Josling, 2006), a position which is further underlined by the important role of food security concerns in the deadlock of the WTO Doha Round negotiations (Farsund et al., 2015). An underlying, more fundamental, question is whether or not global trade liberalisation has, or can have, a positive impact on food security and sustainability more generally. There is

considerable polarisation between discourse coalitions on the compatibility of free trade and sustainability gains (Lee, 2013).

Trade and globalisation have a further large impact on nutrition by shaping the food environment in both positive and negative ways (Hawkes, 2006; HLPE, 2017). Trade improves year-round access to healthy foods, thus contributing to the diversity of supply sources and of diets. However, with rising incomes, diets are converging on Western-style consumption of energy-dense and highly processed foods — thus contributing to obesity and other diseases (Friel et al., 2013; Stuckler et al., 2012) — and this often displaces locally-produced foods and traditions.

- The management and utilisation of **living marine resources**, and thereby seafoods, are regulated under the 1982 UN Convention on the Law of the Sea, as well as a number of other global and regional agreements constituting a body of international law regulating the conservation of living resources (Matz-Lück & Fuchs, 2015). The EU is a party to the Law of the Sea Convention, as well as other global instruments pertaining to fisheries. In addition, the EU is a contracting party to many regional organisations for fisheries management as well as to a significant number of bilateral fisheries agreements.
- Within the **environmental domain**, the most important binding global agreement pertains to the United Nations Framework Convention on Climate Change (UNFCCC), most recently amended under the 2015 Paris Agreement. The Paris Agreement aims to limit global warming to 1.5°C compared to pre-industrial times. Consequently, the EU has committed to a 40% reduction of greenhouse gas emissions by 2030 compared to 1990. Due to the food system's large contributions to climate change, the Paris Agreement implies a major mitigation challenge for the food chain and human diet more generally (Meadu et al., 2015; Willett et al., 2019). This has resulted in an increased emphasis on climate change mitigation and adaptation in debates on the future of the global as well as the EU food system (EC FOOD 2030 Expert Group, 2018; EEA, 2017; IPCC, 2019a).
- From a **human rights** perspective, the most ambitious and far-reaching international commitment is the right to food, part of the 1966 International Covenant on Economic, Social and Cultural Rights (ICESCR). The ICESCR defines this right in the following way: "the right to adequate food is realised when every man, woman and child, alone or in community with others, have the physical and economic access at all times to adequate food or means for its procurement". In spite of the fact that most countries, including all EU member states, have ratified the ICESCR, both its legal transposition into national law and its practical application continue to fall short (Dowler & O'Connor, 2012; Hospes & van der Meulen, 2009), and large numbers of people continue to suffer from food insecurity and rely on food aid, both globally and in Europe (FAO et al., 2018; Pettoello-Mantovani et al., 2018).

- Apart from these formal agreements, there is a broad range of '**soft' forms of policy** set at global level. Although most of these are not legally enforceable, they can carry considerable political weight. A particularly important example in this respect are the SDGs, agreed upon in 2015. SDG2 aims to 'end hunger, achieve food security and improved nutrition and promote sustainable agriculture' by 2030 (see also Table 1, p.22). Recent years have witnessed a prolific academic debate on the implementation of the SDGs, e.g. conceptualising how the SDGs can be integrated across policies (e.g. Meuleman, 2018; Stafford-Smith et al., 2017) or measuring progress towards goal achievement. A majority of these studies observe considerable implementation gaps and stagnating progress in relation to SDG2 (e.g. FAO et al., 2018; Fullman et al., 2017; Spangenberg, 2017).
- Apart from the SDGs, **global organisations** such as the Food and Agriculture Organisation, the World Health Organisation, the Committee on World Food Security and the World Bank have produced a wide array of programmes, norms and guidelines. Together, these institutions play important roles in the diffusion of policy ideas and the (re)allocation of resources to crisis management and development initiatives. For example, the UN Decade of Action on Nutrition (2016–2025) aims to facilitate the sustained and coherent implementation of policies and investments to eliminate malnutrition in all its forms. That said, global governance scholars have also pointed to considerable implementation deficits as well as overlaps, incoherencies and conflicts between global institutions in governing food security, whereby some institutions, e.g. the Committee on World Food Security, have been argued to be more inclusive than others, such as the G8/G20 (Clapp & Murphy, 2013; Margulis, 2013). The active involvement of transnational actors such as NGOs, social movements and advocacy networks may also help to address this democratic deficit, though this also has potential democratic pitfalls if not managed carefully (Bexell et al., 2010; Scholte, 2002). A good example of a system to manage stakeholder participation is the Committee on World Food Security's Civil Society Mechanism, which allows for the involvement of a broad range of stakeholders, primarily those affected by food insecurity, to participate in setting global norms (Duncan & Barling, 2012).
- Beside these public institutions, a range of **private schemes and arrangements** have emerged internationally. These schemes are sometimes developed with the active involvement of governments, which Verbruggen and Havinga (2017) have referred to as the "hybridisation of food governance". Most of these initiatives serve to strengthen the transparency of value chains and to steer these chains towards desired sustainability, food safety and quality, or human rights outcomes. Notable examples of such schemes include Fair trade, GlobalGAP (good agricultural practice), the Marine Stewardship Council (MSC), REDD+ (reducing emissions from deforestation and forest degradation), and the Roundtable on Sustainable Palm Oil (RSPO). While becoming increasingly popular means of steering complex international supply

chains, their effectiveness and legitimacy are subject to scholarly debate, e.g. for their — sometimes lacking — democratic potential or the contestations over sovereignty that occur within public-private governance schemes (e.g. Schouten & Hospes, 2018; Schouten et al., 2012). In this respect, Lambin et al. (2014) conclude that "[p]rivate regulation cannot substitute for weak governance", but may have "the potential to address regulatory gaps and improve land uses practices and contribute to broader changes in governance, under appropriate policy mixes". Research suggests that (effective) private self-regulation is most likely in the 'shadow of hierarchy', i.e. when there is a legislative 'threat', as well as when there are clear market incentives for companies involved (Héritier & Eckert, 2008).

5.2. EU level

In spite of emerging calls for the development of an EU food policy (e.g. Fresco & Poppe., 2016; iPES Food, 2016), the Union currently does not possess an overarching framework for governing the European food system in a holistic manner (Candel, 2016). Instead, EU food governance is characterised by a fragmented landscape of policies that, either intentionally or non-intentionally, affect the functioning of the EU food system (for overviews, see: Galli et al. 2018; Ana Moragues-Faus et al., 2017; Parsons & Hawkes 2018; see also section 3.4 of this Report). The proposal from the new von der Leyen Commission to develop a 'farm to fork' strategy for a sustainable food system may indicate a push towards strengthened policy integration. In principle, the high degree of harmonisation of food-related legislation under the single market allows the Commission to draw on Article 114 paragraph 3 of the Treaty of the Functioning of the European Union to take "a high level of protection" of health, safety, environment, and consumers as a base.

This section on EU-level policy initiatives discusses those policies and domains that prove the clearest leverage points for steering the EU food system towards more sustainable outcomes. As most of these domains and their relation to health and sustainability have been subject to extensive academic debate, the most important debates and critiques emerging from the literature will be summarised.

Agriculture

The Common Agricultural Policy (CAP) has been a central pillar of the European integration project since its beginning. Agriculture is one of the few domains that are an almost exclusive EU competence, making this the level at which to foster increased sustainability of agricultural production. Compared to other economic sectors, agriculture has traditionally been characterised by its 'exceptionalist' mode of policymaking, both

in terms of the high degrees of market intervention and income support (Skogstad, 1998). Critics highlight the persistence of a closed policy community of farmer interest groups, the DG Agriculture and Rural Development of the European Commission, and the Agriculture Committee of the European Parliament (Roederer-Rynning, 2015; Skogstad, 1998). While the CAP has gradually broadened to the inclusion of post-materialist values and interests (Daugbjerg & Feindt, 2017; Feindt, 2010), as shown by the inclusion of the second pillar for rural development in 2000 and the greening of the first pillar in 2013, changes have been incremental, slowly paced, and criticised for high levels of symbolism (Alons, 2017; Greer, 2017; Lynggaard & Nedergaard, 2009). There is considerable agreement amongst CAP analysts that the main reason for including cross-compliance and greening in the first pillar was to legitimise the continuation of income support (Swinnen, 2015). Additionally, the CAP's shift towards decoupled payments has resulted in a leakage of resources towards non-farming landowners, with the highest leakages occurring in Slovakia, Malta, Czech Republic and Bulgaria (Ciaian et al., 2018). Many commentators have therefore called for a better targeting of support, e.g. by moving funds from the first pillar to the second pillar of the CAP (e.g. House of Commons, 2012; Matthews, 2013), and/or shifting towards results-based rather than means-based payments (Rli, 2019). Moreover, the CAP's contributions to food security have been contested: while some commentators argue that the CAP has been vital to achieving European self-sufficiency, others criticise the policy's effect on the longer term or outside of the Union (Candel et al., 2014).

Food safety

Since the early 2000s, and following the BSE (mad cow disease) crisis of the 1990s, the EU has developed an elaborate food safety governance architecture as part of the General Food Law. This system has been relatively successful in enhancing and maintaining EU food safety, but has also been subject to scholarly critiques. Points of criticism involve the precautionary principle's hampering of innovation, including novel foods and techniques (Purnhagen et al., 2018; van der Meulen & van der Velde, 2010), and the types of evidence that are considered by the European Food Safety Authority (EFSA) for its scientific advice (Myers et al., 2009).

Apart from food safety in a narrow sense, the EU has also developed elaborate legislative frameworks on plant and animal health, and on food information to consumers. The latter has been criticised by behavioural consumer researchers for the false assumption that consumers can make healthy food choices in a rational manner, based on objective information, and have suggested nudging approaches as more promising ways of steering consumer choices towards healthier or more sustainable outcomes (Purnhagen et al., 2016; Purnhagen & van Herpen, 2017).

Fisheries

The Common Fisheries Policy, first introduced in the 1970s, aims to develop the industry while at the same time conserving fish resources. The EU has set total quotas for fish stocks in EU waters and has allocated these among the member states according to a fixed formula. In doing so, the EU seeks to balance environmental, economic and social concerns (Froese et al., 2018). Its success in this respect is disputed, as rebuilding fish stocks often requires short-term economic sacrifices and social costs (Alexander & Houghton, 2012; Hadjimichael, 2018; Raakjær, 2009). However, significant progress has been made in terms of conservation due to the introduction of management plans, landing obligations, and more stringent management generally. Current EU landings of fish amount to some 5 million tonnes and the aquaculture production is about 1.3 million tonnes (2015). At the same time, imports of fish to the EU were about the same order of magnitude (6 million tonnes). Also, a significant part of the EU landings is caught in the waters of other countries as part of international fisheries agreements. The fisheries under these agreements are subject to debate, mainly because of impacts on local communities in the developing countries where the fisheries take place (Le Manach et al., 2013).

Environment

EU environmental policy has traditionally given much attention to regulating the externalities of food production, e.g. through the nitrate and water framework directives. That said, environmental policy has witnessed a shift from a regulatory modus operandi in the 1980s and 1990s, towards an increased emphasis on coordination and policy integration, improvement of implementation, and new modes of governance in recent decades (Lenschow, 2015). This is evident in approaches to emerging environmental issues, such as promoting a circular economy and reducing food waste, which largely rely on collaboration, benchmarking, and the exchange of good practices, with few binding targets or standards. Soil quality has been argued to be of key importance for realising a shift towards a more sustainable EU food system, but currently remains largely unaddressed in EU legislation (EASAC, 2018; Stam, 2018). Concerns about biodiversity losses are another major area of food system-related environmental policy. The 2011 Biodiversity Strategy has provided a framework for integrating these biodiversity concerns in adjacent sectors, such as agriculture and fisheries. In addition, water scarcity (droughts) and the availability of quality drinking water have in recent years become priorities of environmental policy at both EU and member state level (Estrela & Vargas, 2012; Tsakiris, 2015).

Human health

While the EU has strong legislative competences for some areas of human health policy (e.g. medicinal products and health claims on food labels) and plays an important role in coordinating cross-border health emergencies, the functioning of national health systems and services remains largely within the realm of member states (Randall, 2000; The Lancet, 2017). The EU's role in malnutrition and tackling overweight lies primarily in agenda-setting and coordination, for which it adopted the 2007 strategy on nutrition, overweight, and obesity-related health issues. The EU action plan on childhood obesity followed in 2014.

Energy

Energy policy has become an increasingly important domain for governing food systems. Due to the food system's heavy reliance on fossil fuels (Pfeiffer, 2006; Woods et al., 2010), transition of the food system is intrinsically linked with transforming the energy system. The EU's 2030 Energy Strategy (European Commission, 2014b) aims to increase the share of renewable energy to at least 32% compared to 1990. While these goals are generally welcomed in academic circles, the EU's energy policy has at the same time been criticised for excluding agriculture from the Emissions Trading Scheme (de Cara & Vermont, 2011; Pérez Domínguez et al., 2009), and for the health impacts of the increased use of biomass (Sigsgaard et al., 2015), inter alia. A second, related issue concerns the debate on biofuels, where there is a clear tension between the production of crops to address issues of energy security and ther production for human consumption to increase food security. In spite of EU efforts to reduce the negative side-effects of biofuels production, such as indirect land use change (Ahlgren & Di Lucia, 2014; Hellmann & Verburg, 2010), neither private nor EU standards have so far been able to overcome sustainability concerns, e.g. resulting in a recent move of the European institutions to ban the use of biofuels derived from palm oil (Stattman et al., 2018).

Research and innovation

Research and innovation policy is a domain in which the EU has considerable distributive powers. Through its multiannual research and innovation framework programmes, the EU provides funding for a broad range of research themes and activities. The most recent framework programme, Horizon 2020 (2014–2020), has a budget of almost €80 billion (current prices). Approximately 5% of this budget has been allocated to research related to the 'societal challenge' of food security, sustainable agriculture and forestry, marine, maritime and inland water research, and the bioeconomy, making EU research policy a powerful tool for producing and applying new knowledge about food system transformations. As part of Horizon2020, the FIT4FOOD2030 framework has been

launched, encompassing a range of multi-stakeholder activities specifically aimed at developing suggestions for 'future-proofing European food systems'.

Trade

Following the deadlock of the multilateral Doha trade negotiations, EU trade policy has seen a shift towards the prioritisation of bilateral trade agreements with other countries or regional organisations. Food and agriculture have proven to be central and controversial concerns in these agreements. For example, disagreements about issues such as geographical indications or the acceptance of hormones in beef have resulted in major transatlantic trade conflicts in the relatively recent past (Ansell & Vogel, 2006; Josling, 2006). In principle, bilateral agreements could enable the EU to diffuse its relatively high environmental, food safety and other standards internationally, but commentators and civil society organisations have criticised these agreements for exactly the opposite. For example, in the case of the Transatlantic Trade and Investment Partnership, de Ville and Siles-Brügge (2017, p.1498) argued that its horizontal regulatory provisions "can restrict future regulation on either side of the Atlantic", as it would "depoliticise regulatory politics, empowering those who see ambitious levels of protection against socioeconomic and environmental risks as irksome non-tariff barriers (NTBs) requiring elimination". More recently, voices of concern have been raised about the possible impacts of the Mercosur agreement on land use in third countries.[47]

Competition

Recent academic debate has focused on the role of EU competition policy in enabling a food system sustainability transition. In an insightful case study of a Dutch retailer initiative to increase animal welfare standards for poultry, Lelieveldt (2018) shows how the Dutch government's instructions to the national competition authority to be more lenient toward private regulation were blocked twice by the European Commission. This ultimately resulted in the collapse of the scheme. Lelieveldt concludes that "the regulatory constellation of EU competition law and its execution by non-majoritarian agencies pose clear constraints on the way in which governments can orchestrate sustainability". This is also underlined by Ferrando and Lombardi (2019), Gerbrandy (2019), and Gerbrandy and de Vries (2011), who ask in particular for an evolution of European competition law in light of sustainable food systems, and for a better engagement with today's societal challenges (see also: Chirita, 2010; Monti & Mulder, 2017).

47 See, for example, https://naukadlaprzyrody.pl/2019/08/28/scientists-appeal-to-eu-to-reject-mercosur-trade-deal

Global food security

From a global food security perspective, the EU has traditionally been one of the biggest providers of humanitarian assistance and has made food security one of its main development priorities. Policy Coherence for Development has become an important mechanism in EU policymaking, though it has been criticised for being mostly symbolic (Carbone 2008), as many of the EU's policies, such as the CAP, continue to have detrimental effects on third countries (Boysen et al., 2016; Matthews, 2008). In a recent comprehensive analysis of the EU's governance of global food security, Candel & Biesbroek (2018) conclude that, in the years following on the global food price spikes of 2007–2008 and 2010, policy integration vis-à-vis global food security slightly increased in terms of the alignment of goals, the involvement of relevant sectors, and the expansion of existing and design of new policy instruments. At the same time, they found that various key domains, such as agriculture, remained unaligned, and that policy integration stagnated after 2014.

Policy Coherence for Development could also be considered of importance while discussing the consequences of digitalisation and artificial intelligence in food systems (also relevant for other policies concerning trade, energy, health etc.) which go beyond the objectives of the current report.

5.3. National level

At national level, considerable differences exist between the EU member states' governments in terms of prioritising food (systems) as a political objective. While some governments, such as those of Finland (2017) and Sweden (2017), have already adopted explicit overarching food strategies, in other member states food is hardly on the political agenda (Candel & Pereira, 2017). Those food strategies that do exist so far are largely symbolic documents, setting out general directions; food policy has not yet developed as a separate policy domain with distinct instruments and institutions (Candel & Pereira, 2017). Due to this low level of institutionalisation, national food policies are particularly vulnerable to political changes. The UK is a case in point: the integrated Food2030 Strategy that was adopted by the Labour government in 2010 (Marsden, 2010) was swiftly abandoned after the Conservatives took over office later that year. The UK government is currently in the process of developing a new National Food Strategy.

In spite of the absence of overarching policy frameworks in most countries, recent years have witnessed the adoption of a variety of sector-specific instruments and interventions that are promising for a food systems transition. The remainder of this section discusses

these, grouped by policy domain. It should be noted, however, that many of these interventions are too recent to have been studied in much depth.

Public health

Various member state governments have taken considerable steps in tackling the food system's public health externalities, albeit in very diverse ways (Lloyd-Williams et al., 2014). While governments such as the UK and Denmark have employed a relatively muscular policy style, adopting coercive instruments to steer food production, retail and consumption, others, such as the Netherlands, have favoured more consensual approaches and the use of information-based and nudging instruments. Examples of relatively imposing instruments that have become increasingly popular include the use of fiscal instruments (e.g. sugar and fat taxes), standard-setting (e.g. on the maximum amount of salt allowed in products), and outright bans (e.g. on trans fats). Studies performed on these three types of interventions show relatively univocally — depending on the precise calibrations and targeting — that they are effective in terms of reducing the consumption of food products or ingredients that are considered unhealthy. For example, in a comparative study of eleven cases of fiscal policy interventions, the WHO (2016) found that "[f]iscal policies that lead to at least a 20% increase in the retail price of sugary drink would result in proportional reductions in consumption of such products" (see also Colchero et al., 2016 on Mexico; Lee et al., 2019 on Berkeley). The introduction of a sugar tax in the UK in 2018 resulted in a major decrease of sugar amounts in sodas already before it came into force (BDJ, 2018). Even the Danish saturated fat tax, introduced in 2011 and abolished again only 15 months later for economic reasons and due to poor design, proved to have had a small but significant effect on consumption (Bødker et al., 2015). An example of a fat tax in Hungary is presented on p.130.

Quite a large number of studies have tested the efficacy of various nudging approaches for promoting healthier food choices (Bauer & Reisch, 2019). A meta-analysis of 42 nudging interventions found that they produced an average 15.3% increase in healthier choices (Arno & Thomas, 2016). Another meta-analysis found a modestly significant positive effect of nudging interventions altering placement and properties of food choice, sales, and servings on the choice of fruit and vegetables (Broers et al., 2017). A third systematic review found a positive effect in 33 out of the 40 identified studies testing interventions that nudge children to healthier choices (Lycett et al., 2017).

Studies on the effectiveness of more information-based or educational instruments provide a more mixed picture. In a comparative review, Hawkes (2013) concluded that "all [nutrition education] actions have the potential to be effective, but that the design and context can have a significant impact on the effectiveness of the action, meaning that some actions are rendered ineffective. One emerging possibility is that actions are most effective when they involve multiple components; e.g. information provision, behaviour

change communication (including skills training), and policies to change the food environment". She also reported mixed results for public awareness campaigns in all their forms.

Most people are not willing to invest effort in understanding overly complicated information. Therefore, information is more effective when it is simple, unambiguous and specific about what exactly should be done (Sunstein, 2013), including nutrition education (Dickson-Spillmann & Siegrist, 2011). For example, interventions aiming to improve consumer understanding of nutritional fact labels have shown positive effects among high-risk groups (Campos et al., 2011). Also, adding a reference point, such as traffic-light labelling, has been found to increase the effectiveness of both nutritional and 'carbon footprint' information (Cecchini & Warin, 2016; Thøgersen & Nielsen, 2016).

A recent review of the scientific evidence ordered by the European Commission found similar and additional findings for different types of diet-related interventions (European Commission, 2018), summarised below.

Table 5. The effectiveness of different types of interventions (adapted from European Commission, 2018)

Type(s) of intervention	Conclusion
Fiscal measures	Very cost-effective and particularly effective for targeting individuals of lower socio-economic status.
Mass media campaigns	Successfully increasing the awareness of the importance of nutrition and physical activity; may impact behaviour when combined with environmental changes. However, may be less effective among disadvantaged groups.
Nutrition and menu labelling in retail settings	There is strong evidence that labelling can improve nutritional awareness of consumers. There is some evidence that front-of-pack traffic light labels and the provision of additional contextual information may also drive consumer behaviour, although effectiveness may vary by consumer group.
School fruit and vegetables	Strong evidence that these can lead to increased consumption, although increases in vegetable consumption were found to be smaller than for fruit. Reducing access to foods high in fats, sugar or salt, and promoting the consumption of alternative 'healthier' foods, were also identified as effective strategies for improving the dietary intake of school students.

A common denominator across these reviews and the studies on which they are based is that, although mixes of instruments are considered most promising, the precise interactions between instruments, as well as with surrounding contextual factors, remain uncertain, which is for a large part explained by the relatively recent emergence of this field of research.

Food environments

An emerging subfield in public health studies focuses on the role of food environments in influencing consumption choices. Food environments refer to the "collective physical, economic, policy and sociocultural surroundings, opportunities and conditions that influence people's food and beverage choices and nutritional status", whereby "unhealthy food environments foster unhealthy diets" (Swinburn et al., 2013). The International Network for Food and Obesity/Non-communicable Diseases Research, Monitoring and Action Support (INFORMAS) facilitates knowledge exchanges about these food environments and associated policy interventions. INFORMAS has developed a healthy food environment policy index that has been used to compare national government policies with international best practices (e.g. Vandevijvere et al., 2015).

Agriculture

Although agricultural policy is largely set at the EU level, the role of national governments has grown in recent years. This is due in large part to the increased emphasis on national flexibility in the most recent and upcoming CAP reforms (Matthews, 2019). For the post-2020 CAP reform, national governments are required to draft national strategic plans in which they set out how they aim to use and calibrate CAP instruments to achieve nine EU-wide objectives. This provides considerable scope for national governments prioritising environmental objectives to move beyond the lowest common denominator at EU level, as a result of which it may become more challenging to increase the bottom line.

Some member states have complemented the CAP with national agricultural programmes. For example, the French government launched a national Projet Agro-Écologique in 2012, and a more holistic Programme National de l'Alimentation in 2010 and 2014, which was translated into legislation.[48] So far, the precise role, effects, and potential of these national programmes vis-à-vis the CAP remain largely unexplored.

On the interface of agricultural and public health policy, the prevention of zoonoses and antimicrobial resistance have received high priority in most EU member states in recent years.

Public procurement

Public procurement policy has raised high expectations for its assumed potential to contribute to a food system transition by increasing demand for sustainable and/or healthy food products (Neto & Gama Caldas, 2018; Soldi, 2018). Depending on specific objectives and calibrations, public procurement can also provide a source of income for

48 https://www.gouvernement.fr/action/la-loi-d-avenir-pour-l-agriculture-l-alimentation-et-la-foret

rural householders, particularly for smallholder farmers with limited market access (FAO, 2018b).

That said, this potential differs considerably across countries. While some countries, such as France, have a long tradition of centrally organised or legislated food procurement for schools, healthcare institutions and governmental canteens, others do not.

Food waste

The prevention and reuse of food waste has become another resonating objective for national governments and policy stakeholders. As approximately 50% of wasted food in Europe comes from households (Stenmarck et al., 2016), many efforts of governments as well as private actors target consumers.

A recent review of interventions aimed at preventing household food waste found that a significant evidence gap remains for many of these efforts (Reynolds et al., 2019). Other systematic reviews of psychology-based and social practice theory-based approaches concluded that food waste is a complex and multi-faceted issue that involves both socio-cultural and material factors that cannot be reduced to a single variable (Hebrok & Boks, 2017; Schanes et al., 2018). This calls for an integration of different disciplinary perspectives to effectively prevent food waste.

Interventions that have proven effective include changing the size or type of plates in hospitality environments, changing nutritional guidelines in schools, and information campaigns (Reynolds et al., 2019). Various social norm communication approaches have also proven effective both regarding the prevention of food waste (e.g. Hamerman et al., 2018; Stöckli et al., 2018), recycling (Abrahamse & Steg, 2013) and on food choice and quantity eaten (Robinson et al., 2014).

5.4. Local level

Local food policy has rapidly gained popularity across much of the European Union in recent years. Although food has traditionally not been an area of concern to most municipalities (or similar local level authorities), food system approaches have now entered local political agendas and, in some cases, resulted in comprehensive local food policy strategies (e.g. Blay-Palmer, 2009; Ilieva, 2017; iPES Food, 2017; Moragues-Faus & Morgan, 2015; Rocha & Lessa, 2009; Sonnino et al., 2019). Well-known European examples of the latter include the food policies of London (Greater London Authority, 2018; London Development Agency, 2006), Ghent (Ghent Food Policy Council, 2016), Ede (Community of Ede, 2015) and Milan (Comune Milano, 2015). The adoption of the latter food strategy coincided with the creation of the Milan Urban Food Policy Pact, which was signed by 197

cities as of November 2019. By signing the pact, local authorities commit to developing sustainable food systems that are "inclusive, resilient, safe and diverse, that provide healthy and affordable food to all people in a human rights-based framework, that minimise waste and conserve biodiversity while adapting to and mitigating impacts of climate change" by investing in cross-sectoral policy design and implementation.[49]

Apart from themes and interventions that recur in most of these local food policies, e.g. investments in urban agriculture, food waste programmes, and food information or education campaigns, local food policy efforts differ considerably in terms of the objectives that governments prioritise as well as the competences that local authorities have across countries.[50] While American cities, for example, can decide to raise taxes on certain (e.g. sugary) food products, most European local authorities do not have jurisdiction over such taxes. So far, comparative research on European local governments' choices and possibilities in policy design has only started to emerge very recently.

That said, small-sample studies of local food policies outside of Europe suggest that there are reasons to be hopeful about local food policy initiatives. For example, the Brazilian city of Belo Horizonte's integrated food security approach (encompassing subsidised food sales, food and nutrition assistance, the creation of local food markets, support to local agriculture, and education programmes) has been praised for its effectiveness in reducing food insecurity and promoting regional economic growth (Rocha & Lessa, 2009). The programme was later scaled up to the national level under the Fome Zero programme, which has even been exported to Sub-Saharan African contexts (Marcondes & de Bruyn, 2015).

Furthermore, local food policy has been an experimental ground for collaborative governance approaches and democratic innovation, e.g. through the creation of 'food policy councils' in which different groups of stakeholders engage in deliberations about the local food system (Koski et al., 2016; Schiff, 2008). These collaborative governance approaches have the potential to improve policy design and implementation by drawing on different sources of knowledge and involving relevant stakeholders from the start. At the same time, the conditions under which these approaches prove more effective or legitimate compared to traditional top-down or private modes of governance remain an open question. Recently, these experiments with 'food democracy' have also been initiated at other governmental levels in Europe, e.g. in the case of the Food 1000 Summit in the Dutch province of North-Brabant or the Etats généraux de l'alimentation in France.

49 For an assessment of the factors that underlie the sucess of the Milan Urban Food Pact, including their incentivising impact, see http://www.milanurbanfoodpolicypact.org/2019/10/10/food-policy-the-key-factor-for-the-sustainability-agenda-of-cities-and-mayors/

50 Urban agriculture is a generic term for a range of innovative methods of growing food including hydroponics, aquaponics and vertical farming all of which have the potential to improve the efficiency of agriculture, with or without the use of soil. They are particularly suited to urban and peri-urban areas where land is scarce and demand is high.

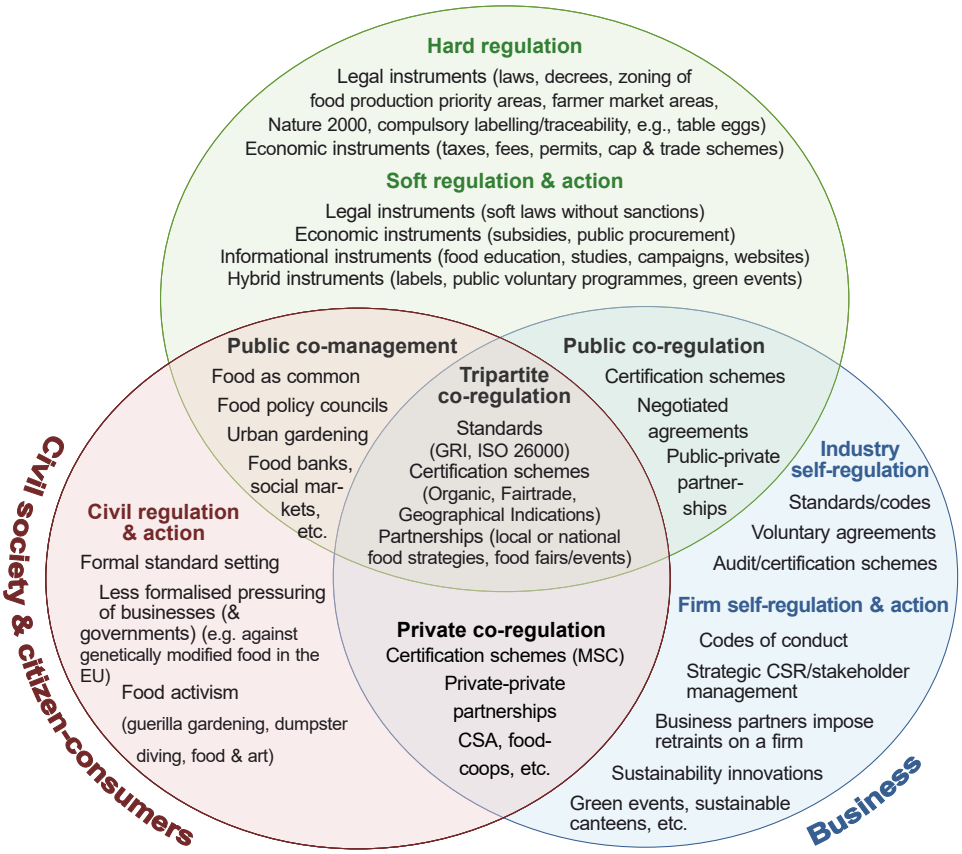
5.5. Key messages and policy implications

- Food system governance transcends the boundaries of traditional jurisdictions, levels of government, policy domains, and public-private spheres, making coordination and integrative leadership key.
- As many food system challenges occur at a global scale, existing global governance arrangements need to be strengthened to allow for more decisive responses to identified deficiencies of food systems.
- The EU is well placed to act in domains that are almost exclusively an EU competence, such as agriculture and fisheries. Other food system dimensions, such as public health, remain largely within national governments' spheres of influence. Integrated food strategies have been put forward as a promising way of aligning food system interventions within and across levels of government.
- Research on individual interventions suggests that coercive instruments, such as taxation and legislation, are more effective than information campaigns that raise awareness but may not lead to effective behavioural change. Ultimately, well-designed instrument mixes are likely to be most effective, although much remains unknown about the interactions between instruments.
- Local food policy initiatives have raised high expectations and have proven an experimental ground for democratic innovation.

Chapter 6. Non-governmental agents of change

Understanding existing system dynamics, particularly identifying which elements have or could develop the capacity to enact changes, is pivotal when seeking to move towards a more just and sustainable food system. Addressing the complexity of the food system in its entirety is, however, a daunting task given the multiplicity of actors and structures involved, as illustrated by Steurer (2013):.

Figure 9. Food governance and food co-management (adaptation for food based on the heuristic provided by Steurer, 2013)



As a result of the complexity of the food system, research has tended to focus on particular agents of change. While recognising that no single group of actors will be able to ensure more sustainable food futures on their own, this chapter reviews the state of knowledge with regards to specific non-governmental actors and sectors as drivers

of change within the food system. The role of governmental actors has already been considered in Chapter 5, although, as will be discussed, many non-governmental actors inevitably engage with governmental actors and the governing frameworks they create. While the focus here is on human agents as key drivers of change, food systems are also deeply influenced by non-human ecological and climatic conditions (Smith & Gregory, 2013) and the non-human products of scientific and technological innovation (Hinrichs, 2014). The intersection between these human and non-human drivers deserves greater attention in future analyses (FAO, 2018a).

As discussed in Chapter 3, social scientists have long sought to develop theories of change that are appropriate for complex food systems. These address matters of power, politics, space, place and scale in the governance and management of transitions, the role of individuals and civil society in shaping socio-cultural movements, as well as the role of the private sector (Abrahamse & Steg, 2013; Broers et al., 2017; Thøgersen, 2010). This work has revealed the significance of framing, for example whether food is seen as commons, right or commodity, in terms of identifying and shaping interventions.

This chapter addresses concerns about the lack of progress towards sustainability (Loos et al., 2014; Marsden, 2016) and reiterates how different practices can bring about positive change (Forssell & Lankoski, 2015). It considers key change agents while acknowledging that actors and sectors are heterogeneous, interconnected and have fuzzy boundaries. It examines emerging arenas and mechanisms of change (such as social media influencers, bloggers and vloggers) and new forms of partnership (e.g. triple helix collaborations).[51] While challenges remain, some positive developments can be identified and these are further explored in Chapter 7. This chapter then identifies where change towards a more just and sustainable food system may come from, and how such change can be facilitated and governed.

6.1. Producers

Producers of the raw materials that are, or can become, food are key agents of change in the food system, whether they are farmers (of land or water) or fishers. However, there are many barriers to the adoption of more sustainable agricultural, aquaculture and seafood production practices (Iles, 2007; Klinger & Naylor, 2012; Rodriguez et al., 2009). The food production sector, including farming and fishing, is extremely diverse, both within Europe and in terms of the global community of food producers on which European consumers depend. As reported by Eurostat (2017),[52] the European Union imports at least half of its

51 Triple helix collaborations are collaborations between academia, industry and governments to foster change.

52 https://ec.europa.eu/eurostat/web/products-eurostat-news/-/EDN-20171016-1

food from abroad — mainly from Brazil, the US, Norway, Argentina, China and Turkey. Producers must comply with the rules of export and import and any change towards more sustainable food production practices is shaped by the prevailing rules of trade.

Despite the visibility of agricultural conglomerates and the growth of a consolidated food sector, small farms account for more than half of all global agricultural production and in Europe more than 50% of farms still have less than 5 hectares (Lowder et al., 2016). Many European farmers face issues of inadequate infrastructure and limited access to land, natural resources, knowledge and technology, feed, fertilisers, seeds and capital, as well as limited opportunities to regenerate or preserve natural resources. However, transnational networks such as La Via Campesina (Martínez-Torres & Rosset, 2010) are emerging to give greater voice and representation to small-scale producers, pastoralists, migrant workers, fisher folk, landless peasants and indigenous peoples. One of the most important bottlenecks for transforming the food system lies with the weakness of most food producers in three very common food supply-chain scenarios. In globalised food production, the second link in the food chain is often large food trade companies. They constitute a kind of monopsony,[53] where traders impose prices and specify products (Sivramkrishna & Jyotishi, 2008). Second, as noted by FAO (2017), critical elements of the food system are becoming concentrated in the hands of fewer and larger companies, with small producers unable to compete in the market. Finally, the financialisation of agri-food chains has reinforced the position of food retailers as key actors within the agri-food system and introduced new actors such as commodity traders, venture capitalists and financial institutions, with some even buying supermarkets (Burch & Lawrence, 2013). Research has found that this has exposed small-farmers in particular to increased price volatility and livelihood uncertainty (Clapp, 2014; Isakson, 2014; Vander Stichele, 2015).

The extent to which producers can help move towards a more sustainable and just food system depends on the correction of unbalanced power relationships within it. Hence, when food is traded internationally, any transformation toward sustainability is contingent on international trade rules and global governance (Oosterveer & Sonnenfeld, 2012). As an example, Brazil is the single largest exporter of agricultural products to the EU worldwide, but large producers and traders dominate, with food products treated as commodities negotiated in the financial market (Mercure et al., 2019). This leads to multiple conflicts: small farmers and indigenous people suffer from the exploitation of their land (Begotti & Peres, 2019); water, soil, forests and people endure the impact of the intensive use of natural resources and pesticide contamination; and production is highly automated, causing displacement from land to cities, leading to serious social and economic problems. These kinds of problems are domestic as well as transnational (Paulino, 2014). Ultimately, a healthy environment depends on a healthy global food chain that increases

53 A monopsony is a market situation in which there is only one buyer.

its awareness along with the accountability of all the links in the chain (Delaney et al., 2018).

Considering that approximately half of the food in the EU is imported, there are two different kinds of producers in this food system, the domestic and the foreign. Domestic producers are all subject to the same legal order and they are particularly sensitive to domestic policies for sustainability. As a result, the remedies to increase equity through the food chain are easier to implement. Conversely, foreign producers conform to different legal rules and policies. They are part of another social context with many disparities: geographical, historical, economic, cultural and environmental. As a result, international environmental and trade law are vital instruments for fishing and farming industries (Gutierrez et al., 2011; Klinger & Naylor, 2012).

Reliance on imported food also raises questions about the EU's responsibility for those with whom we trade abroad. This includes issues of solidarity versus protectionism. Changes to European trade policy can impact significantly on foreign producers (as occurred in relation to the EU sugar regime) and support for 'local' producers in the EU could have similar repercussions in terms of the lives of producers located elsewhere.

When food is framed primarily as a marketable good, a prevalent approach within global food trade, the way to promote a fair food system is through the correction of market failures such as negative environmental and social externalities (Hayes, 2016; Steier, 2011). Further global policy instruments will be required in order to promote food, environmental and social justice, such as environmental taxes, subsidies and incentive reform (Pretty et al., 2001).

When food is framed as a human right, then feeding the local population is imperative and legal instruments are directed towards the realisation of the right. In 2004 the FAO adopted *Voluntary guidelines to support the progressive realisation of the right to food* that propose practical steps for national implementation of the right to food, including all legal mechanisms to provide producers with the means of production, such as land and seeds (FAO, 2005).

6.2. Storage, distribution, processing and packaging actors

The landscape of post-production enterprises that take the raw materials and food products from farmers and fishers and store, distribute, process, package and prepare them for consumers is broad, diverse and complex. Each element provides potential opportunities to contribute to a more sustainable food system and a greening of the supply chain (de Oliveira et al., 2018). Research has begun to interrogate the role of the

private sector in designing sustainable food packaging (Wang et al., 2016) and food processing (Miranda-Ackerman et al., 2017). However, this research tends to focus on specific case studies rather than providing a landscape-level analysis.

Acknowledging the diversity of private self-regulation, corporate social responsibility (Hartmann, 2011) and sustainability activities, as well as private-public or multi-stakeholder partnerships (Steurer, 2013), this section focuses on two promising approaches to improving food sustainability. The first is where post-production enterprises actively contribute to a food sustainability transition by experimenting with sustainability innovations and the second is the use of certification and labels to support sustainable consumption practices. Innovations within retail chains and networks which play a central role in the food system are considered in section 6.3, p.112.

Post-production food enterprises experiment with a wide range of technical, institutional and social innovations, from the development of meat substitutes and waste-free food retail to supermarkets and green restaurants (see also good practice examples in Chapter 7). One particularly high-profile area of innovation has been packaging, in light of concerns regarding plastic pollution.[54] In 1950, 1.5 million tonnes of plastics were produced. In 2016 this had risen to over 320 million tonnes, of which over 8 million tonnes are estimated to be entering the ocean annually. In 2014 alone, 25.8 million tonnes of post-consumer plastics was generated in Europe, of which food packaging has a major share.[55] Food packaging is, however, important for food preservation and to reduce food loss and waste (Guillard et al., 2018). In order not to solve one problem (food waste) while creating another (plastic pollution), there has been a focus on developing more sustainable packaging (FUSIONS, 2016),[56] with particular attention on biodegradable materials (EcoBioCAP, 2015) and new (nanocomposite) materials, with enhanced packaging properties and a safe-by-design approach tackling consumer exposure (Dudefoi et al., 2018). However, the food packaging debate remains complex, not least due to consumer perception of different packaging materials, the need for tracing and tracking of fresh packed food across supply chains, and the current use of food packaging as information carrier about the food itself (Lindh et al., 2016).[57]

Another potentially transformative change concerns the role of innovation hubs, often involving the promotion of linkages between urban and rural areas. Innovation hubs tend to be located in areas with high skill concentrations and favourable demographic age structures. These concentration patterns seem to be persistent over time and

54 https://ec.europa.eu/info/news/commission-announces-top-experts-shape-horizon-europe-missions-2019-jul-30_en

55 https://ec.europa.eu/environment/circular-economy/

56 See also WFP (2019) https://insight.wfp.org/rethinking-packaging-reducing-waste-43be4a82eeff

57 The evidence surrounding the biodegradability of new forms of plastic packaging will be the subject of a forthcoming SAPEA Evidence Review Report.

polarise rural and urban areas (Gregory & Patuelli, 2015). Consequently, an ageing and shrinking population, which characterises many rural areas in Europe, might negatively affect the transformative capacity needed for a food sustainability transition. Mayer et al. (2016) highlight the role of entrepreneurs bridging the rural-urban divide by accessing some of the urban features, such as knowledge and markets, while at the same time valorising rural assets. The innovative power of agglomerations and the rising share of the population living in cities — 30% in 1950, 55% in 2018 and 68% by 2050 (UN DESA, 2019) — underline the strategic role urban areas play in food system transformation (see also Milan Urban Food Policy Pact, section 5.4, p.101). However, whatever the transformation pathways might be, urban areas will also in future depend on resilient farming and food provision systems and food will remain the prime connection between humans and nature, between people and planet (FAO, 2018c).

The emerging food transition literature analyses the transformative capacity and transition pathways of such innovations (El Bilali, 2019). Some of these endogenous sustainability innovations grow via scaling upwards and outwards, seeking to reconfigure the regime (Bui et al., 2016). Even if innovative niches stay small, they can have a big impact by suggesting different innovation pathways (Brunori et al., 2011). But innovative ideas alone do not suffice. Transformation critically depends on entrepreneurship, green banking, and venture capital for new sustainability solutions, as well as a supportive co-evolution of behavioural, technical, political and economic subsystems of society (Geels, 2005). Purposeful transition management and public support can help to establish innovation-oriented businesses and stakeholders that are willing to invest in learning processes for sustainability solutions (Duru et al., 2015).

Action from the post-production enterprise sector is illustrated by the more than 400 voluntary sustainability standards currently in operation across the planet,[58] many of which are in the food system (Giovannucci, 2008; Lernoud et al., 2018; von Hagen et al., 2010). For example, it is estimated that the number of private, voluntary standards for organic agriculture is higher than the number of national organic standards (over 80), and increasing (Willer & Lernoud, 2019). Some production standards (e.g. the ISO system, HACCP and GlobalGAP) are directed to other businesses for use in their sourcing decisions, while others are also directed towards consumers (such as organic, fair trade or Rainforest Alliance). In the latter cases, the primary way to communicate production standards and certification to consumers is by means of labels on products (the Fair trade label, the Rainforest Alliance label, organic labels, carbon footprint labels etc.), while labelling plays a smaller role in business-to-business communication. The aim of certification and labelling is to guarantee the compliance of products and production processes with the defined standards and to reduce 'information asymmetry' between producers and consumers (Zander et al., 2017). However, the large and increasing number

58 https://www.iisd.org/topic/voluntary-sustainability-standards

of sustainability standards, with new private standards continuing to be launched (e.g. Regenerative Organic, introduced in March 2018), adds to certification complexity (Willer & Lernoud, 2019) and risks consumer confusion (Gruère, 2015).[59] Therefore, the European Commission launched the PEF/OEF initiative to develop a harmonised methodology to calculate the environmental footprint of products (PEF = product environmental footprint) and organisations (OEF = organisation environmental footprint) in the framework of the Commission's communication *Building the single market for green products*. A pilot phase ran from 2013 to 2016, testing the approach for a set of products, including dairy products, olive oil, wine and pasta. The initiative is currently in a transition phase towards the development of policies implementing the new PEF/OEF standards.

Agricultural products complying with internationally recognised sustainable standards are increasing their market share and their share of agricultural land (Lernoud et al., 2018). The biggest and most successful category of standards is 'certified organic', with more than 69.8 million hectares of organic farmland worldwide in 2017, representing 1.4% of agricultural land (Willer & Lernoud, 2019). In the European Union, standards for organic food are defined by law and mandatory for all organic food offered for sale (EU Regulation 2018/848). A similar development has occurred beyond Europe, leading to the development and diversification of national or regional organic policies over the last 20 years (Willer & Lernoud, 2019). On-going research is required to increase the percentage of organic production and to measure and track the sustainability credentials of organic agriculture compared with other forms of agriculture (Brzezina et al., 2017; Brzezina et al., 2016).

Governments in Europe and beyond have also begun to introduce public standards to replace those developed by private organisations with regard to measuring and communicating carbon footprint (Liu et al., 2016) through carbon labels. A carbon label communicates the carbon footprint of a product or service over its entire life cycle and after converting other greenhouse gas emissions, such as CH_4 (methane) and N_2O (nitrous oxide), to CO_2 equivalents (Schaefer & Blanke, 2014). Carbon labels that have been implemented or field-tested to date typically report a single numeric CO_2 value, but some communicate carbon reduction compared to an earlier situation and some use traffic-light colours to signal the relative performance of the labelled product (Liu et al., 2016). There are currently both private voluntary and public carbon labelling standards on the market (Schaefer & Blanke, 2014), although a recent review of the field suggests that carbon labelling has mostly been introduced by public agencies (Liu et al., 2016).

In order to be credible and effective, it is important that certification and control of the compliance with standards is reliable, transparent and independent from the certified companies (Caswell & Anders, 2011; Jahn et al., 2005; Janssen & Hamm, 2012). In general,

59 For an introduction to the principles and practices of regenerative agriculture, see Jeffries (2019).

consumers trust third-party certification more than first-party schemes (Brach et al., 2018) and some sponsors of sustainability standards (governments and some environmental NGOs) more than others (Darnall et al., 2018).

Compliance with sustainability standards and certification is usually communicated to consumers by means of labels and logos, which can be quite simple and easy to recognise (Zander et al., 2017). Research suggests that, when consumers have had good experiences with products carrying a sustainability label, they may start using the label as a simplifying choice heuristic (Thøgersen et al., 2012) leading to an increased likelihood of repurchasing products with this label, also in other product categories (Juhl et al., 2017).

It is increasingly common to use the term 'sustainability labelling' as a superordinate category for labels certifying that the production of the labelled product complied with various environmental, social or management standards (Grunert et al., 2014; Vermeir & Verbeke, 2006). Sustainability labelling of food products abounds. There are now more than 200 food labels representing sustainability or ethical attributes (Willer & Lernoud, 2019), mostly the result of private initiatives (Liu et al., 2016; Willer & Lernoud, 2019), creating confusion for consumers, who may find it difficult to verify claims or identify the most sustainable choice (Godin & Sahakian, 2018). While sustainability labels alone will not ensure sustainability transitions (Grunert et al., 2014) and it is important to be aware of the moral economy of standards (Busch, 2000), some have had substantial impact. Organic labelling, Fair trade labelling (Lernoud et al., 2018) and the Marine Stewardship Council (MSC) label for sustainable seafood, for example, have created particular visibility for these production processes (Lim et al., 2018).

Some newer labelling types have not yet been able to demonstrate a significant impact, but show potential. These include carbon labelling schemes, which have begun to be implemented or are being considered in many countries (Liu et al., 2016). Organic labelling is currently the most impactful sustainability labelling (Lernoud et al., 2018) with global sales of organic food products estimated at US$97 billion in 2017 (Willer & Lernoud, 2019). The principles of organic production contain standards regarding soil management, the use of GMO and chemical substances, and animal husbandry aiming to protect the soil, water and biodiversity and the welfare of farm animals.[60]

The Fair trade label only appears on products from developing countries. The biggest labelled products (by volume) are bananas, coffee, cane sugar and cocoa (Fair trade International, 2018), which is one of the reasons why the global market for fair trade products is only about 10% of the organic market (Willer & Lernoud, 2016). The MSC sustainable seafood label has also had substantial impact, covering about 10% of total seafood catch globally (Lim et al., 2018).

60 For example, https://www.ifoam.bio

Food products sometimes have multiple sustainability labels. For example, the Fair trade label is often combined with an organic label, especially for bananas (59%) and coffee (57%) (Fair trade International, 2018). Research investigating the impact of multiple quality cues on consumer choices generally finds a decreasing marginal effect of adding more, consistent cues (e.g. Thøgersen et al., 2019), for example when combining two sustainability labels on a product (Rousseau, 2015). However, a sustainability label can compensate for an attribute that is perceived to be negative, such as origin in a developing country (Lim et al., 2018; Rashid & Byun, 2018; Thøgersen et al., 2019) or lack of a recognised brand name (Larceneux et al., 2012).

Innovation within the post-production sector is necessary, but insufficient on its own, to move towards a sustainable food system. Innovation around sustainable food products, processes, standards and labels needs to occur alongside the development and design of appropriate systems of regulation, information and education. Retail chains and networks will play such a significant role in supporting both producers and consumers in transitions towards a more sustainable food system that they are considered separately in the following section.

6.3. Retail chains and networks

Retail chains and networks have the potential to provide a unifying perspective on several of the key actors in the supply chain, also focusing attention on the differential distribution of power along the chain. Since Gereffi's (1996) pioneering work on commodity chains, academic work has provided significant insights into the operation of retail chains and networks. The terminology varies between those who emphasise (more or less linear) chains, with clear start and end points, to those who focus on (more complex) networks or circuits. Some studies are designed for economic analysis, aiming to identify the points at which value is added and profit extracted. Others are designed for political purposes, to identify where labour is exploited and where trade union organisation might be targeted. Still others have a more cultural emphasis, examining how the meanings of food are transformed as it moves along the supply chain 'from farm to fork' (see Jackson et al., 2006, for a discussion of these competing metaphors and how they have been mobilised in the analysis of food and farming). These different metaphors also respond to different framings of food (see Chapter 3). Nonetheless, research examining sustainability issues is emerging in relation to restaurants (Kwok et al., 2016; Perramon et al., 2014) and retail (Petljak, 2018), including the role of food retailers in reducing food waste (Hermsdorf, 2017).

The significance of these studies in the present context is that retail chains and networks are exerting increasing influence along the supply chain as power is concentrated in

fewer and fewer hands. Retail concentration has led to a rapid decline in the number of independent food retailers as the supermarket sector has grown to the point where, for example, over 70% of UK grocery purchasing is concentrated in the four main supermarket chains: Tesco, Sainsbury's, Asda and Morrisons.[61] The level of retail concentration in the UK prompted investigation by the Competition Commission and has been described as a form of 'asymmetric oligopsonistic' power, where the number of buyers is small while the number of sellers is large (Hollingsworth, 2004). Retail concentration and consolidation has continued to rise across the EU, with modern grocery retailing (covering hypermarkets, supermarkets and discount stores) accounting for an estimated 54% of total grocery sales in 2012 (European Commission, 2014a).

While some have argued that the development of modern food retailing across Europe has led to an increase in consumer choice (in terms of the range of products available), others have argued that the restructuring of the food retail sector has led to a distortion of the retail market. In particular, the increase in buyer power among the major retailers has adversely affected manufacturers and suppliers when setting the terms of trade (European Commission, 2014a). The increase in private label goods (such as supermarket own brands) has led to a further increase in the power of retailers compared to their suppliers. The emergence of buying groups and alliances among the major retailers has also been a cause of concern (European Commission, 2014a).

Changes in retail concentration have been accompanied by changes in household composition (with increasing numbers of single-person households), an ageing population and changing consumer lifestyles (including increased environmental awareness and health concerns). There has also been a growth in the convenience food sector, selling ready meals and other prepared foods (Jackson et al., 2018), strong growth in the discount sector (with the rise of firms such as Aldi and Lidl), and a rapid increase in online retailing.

Food retail is a highly competitive sector, driving down prices for consumers but with significant implications for farmers, food manufacturers and suppliers. The asymmetrical distribution of power along the supply chain remains a significant area of concern, given the European Commission's stated aim of ensuring that EU wholesalers, retailers and consumers enjoy an integrated retail market which is also competitive and innovative. New legislation on unfair trading practices is of particular interest in this area, as is the European Economic and Social Committee's recent promotion of short and alternative supply chains.[62]

61 In January 2015, the top four supermarkets accounted for 73.7% of UK market share: Tesco 29.0%, Asda 16.9%, Sainsbury's 16.7% and Morrisons 11.1% (Statista, 2019).

62 On 17 April 2019, new legislation on unfair trading practices was adopted: *Directive (EU) 2019/633 on unfair trading practices in business-to-business relationships in the agricultural and food supply chain*. The directive contains new rules that are designed to improve the position of businesses and farmers in the food supply chain. See also the recent Opinion of the European Economic and Social Committee

6.4. Educators, influencers and information providers

Formal educators play an important role in improving food literacy across the food system, from mainstream education about food production processes through to communicating what makes a healthy and sustainable diet. Knowledge and skills about food are influenced by factors outside the classroom, passed on through family and friendship networks, gardening and cooking clubs, recipe books and televised cooking shows. Contemporary channels for acquiring knowledge and skills about food increasingly feature digital media platforms, celebrity chefs and social media influencers.

Teachers and schools are a popular vehicle to foster responsible consumption and promote sustainable production by influencing individuals' food-related decisions and actions. However, research evaluating educational interventions demonstrates that fact-based teaching about food sustainability is rarely sufficient to induce behaviour change (Redman & Redman, 2014). Children and young people are especially exposed to teaching and have different motivations, ability and opportunities than adults to effect change. Research on what makes children and youth behave in a (more) sustainable way points at the influence of parents and friends (Grønhøj & Thøgersen, 2017; Pedersen et al., 2015).

In general, evidence shows that it is not enough that people know the facts about food production and consumption (Thøgersen, 2010). They also need to have the skills and opportunities to act on those facts, and time to adapt to new knowledge and update prevailing norms, values and beliefs (Devaney & Davies, 2017; Grønhøj & Thøgersen, 2009; Thøgersen, 2014). While it is feasible for educators and other influencers to address these different forms of knowledge in different ways, in the classroom (Meek & Tarlau, 2016) and outside (Grønhøj & Thøgersen, 2009; Pedersen et al., 2012), they are rarely in a position themselves to provide infrastructure, influence product availability or alter 'choice architectures' in ways that facilitate sustainable choices (Broers et al., 2017; Vringer et al., 2017). The role of corporations is therefore critical in shaping the food system's choice architecture.

As in many other policy areas seeking sustainability transitions, combinations of interventions have proven more effective than formal education alone. For example, a study combining education and feedback on a smartphone found a positive effect on fruit and vegetable consumption among pupils who were engaged in the intervention (Pedersen et al., 2016). Others found that an intervention combining education with social information and goal-setting led to a reduction in meat consumption (Amiot et al., 2018). Positive behaviour change has been found when combining education with activities

on *Promoting short and alternative food supply chains in the EU* https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=OJ:C:2019:353:FULL&from=EN

beyond the classroom, for example, in the home kitchen or a school garden (Davis et al., 2015; Jones et al., 2012; Song et al., 2016). Research has also shown that school gardens provide additional benefits beyond food and nutrition, creating spaces for building social skills and improving connections with classmates, teachers and non-human nature (Moore et al., 2015). Similar results emerge from analysis of university courses combining experiential, empirical and theoretical components (Galt et al., 2013; Hilimire et al., 2014). Further research is required to understand the longevity of such changes on behaviour, but establishing systems to secure support for, and extend the availability of, spaces for experiential learning about sustainable food systems are required.

Given the money that food companies put into advertising, it is unsurprising that research has found a correlation between advertising and consumption patterns (Andreyeva et al., 2011; Buijzen et al., 2007, 2008; Chandon & Wansink, 2012), indicating that media communication might also be able to help consumers eat better and more sustainably. The ways that people access information have changed rapidly over the last decade, with the rise in availability and accessibility of digital social media channels, apps and platforms. However, while research on formal education about food is plentiful, there is less research on the impacts of social media-driven channels. Social media provide a new means for exchanging information about food, particularly in relation to food risk, nutrition and food waste reduction (Rousseau, 2012; Rutsaert et al., 2013; Tobey & Manore, 2014; Young et al., 2017). By using their knowledge, experience, contacts, and access to media and money, chefs, food bloggers and other social media influencers can affect the way people think about aspects of the food system such as food waste (Bottura, 2017) and food safety (Maughan et al., 2017) and propose new norms for ethical and tasty eating (Barber, 2014). Jonsson (2013), for example, found that chefs' work on local traditional ways of cooking can promote more sustainable cuisine and farming. In other cases, chefs seek to empower communities to fight food waste through social inclusion, build community cohesion and highlight possibilities for improving infrastructures of food provision for the most vulnerable in society (Edwards & Davies, 2018; Marovelli, 2019; Murphy, 2019). The food industry is also recognising the role of chefs through the Food Made Good awards, which have been given out since 2013 to restaurants that demonstrate the highest level of environmental and social responsibility across three pillars of sourcing, environment and society.[63]

There has also been limited research on whether impacts from social media influencers or channels are experienced evenly across all sectors of society. For example, Leer (2016) highlights the risk that these kind of innovations may disproportionately affect the well-educated and wealthier parts of the society, favouring whiteness and gastronationalism, or reinforcing gendered hierarchies between men's and women's cooking. Furthermore, people may find it challenging to adopt influencers' actions in their everyday practices

63 https://awards.thesra.org

(Micheelsen et al., 2013), potentially being counterproductive (Slocum et al., 2011) and leading to negative impacts such as apathy or inaction amongst followers. Hence, potential impacts of social media should not be overestimated (Chen & Yang, 2014). Using social media channels for pro-environmental messaging on food without also changing other elements of the food system is likely to have limited effects (Hynes & Wilson, 2016).

Other important actors that function as information providers or assessors of information in the food system include management consultants, auditors and certifiers, referred to earlier with respect to the attainment of standards and establishing the veracity of claims made on food labels (Friedmann, 2007; Tanner, 2000). While such standards themselves are under increasing scrutiny, the role of consultants and auditors has received limited consideration to date, with the exception of food safety (Bar & Zheng, 2019). The finding of Hatanaka and Busch (2008) that little is known about the functions, structures and practices of third party certification, still holds and there is a growing body of work exploring different models for establishing food qualities. Montefrio and Johnson (2019), for example, investigate participatory guarantee systems, which may have potential to promote food sovereignty, inclusivity and grassroots empowerment. While participatory guarantee systems create possibilities for greater autonomy amongst farmers than third party certification models, they do not dissolve tensions and their success will ultimately depend on how others view the control and guarantee systems in place.

6.5. Individuals as food consumers and citizen-consumers

Research has shown how modified diets, if widely adopted, could reduce global agricultural greenhouse gas emissions, reduce land clearing and resultant species extinctions, and help prevent diet-related chronic non-communicable diseases (Tilman & Clark, 2014). As a result, food retailers, governments and some academic studies suggest that individuals have considerable power to shape the sustainability of the food system through their purchasing practices as consumers (Vittersø & Tangeland, 2015). In policy documents, individuals' contributions to sustainable food systems are often referred to as a matter of consumer choice and calls are made for stimulating responsible consumer choices in relation to health and sustainability. Here, 'responsible choices' means choices that are consistent with SDGs, but which may conflict with the consumer's short-term hedonic, convenience or economic goals (Thøgersen, 2011) and with established social and cultural norms for 'proper' eating (Halkier & Jensen, 2011; Holm, 2013). The focus on individuals in this way places significant responsibility on them to make changes to their everyday practices. At the same time, individuals are diverse, with differing capacity and willingness to drive change towards a more sustainable food system through their food purchases (Davies et al., 2017; Niva & Jallinoja, 2018; Verain et

al., 2012). So, while individuals can exert power within market economies and be a driver for sustainability when they purchase food (Jaffry et al., 2004; Kearney, 2010), individual behaviour is complex and can be influenced by a multitude of factors, including ethical or moral values (Johnston, 2008), cultural norms and socio-economic situations, cost, convenience, and habit (HLPE, 2017; Vermeir & Verbeke, 2006). Evidence that individuals may practice consumption not as passive consumers but as more active agents, considering the ethical, social, trade and ecological impacts of the food they purchase (where information is available), led to the development of the term 'citizen-consumers' (Chaudhury & Albinsson, 2015; Johnston, 2008; Livingstone et al., 2007).

Moreover, people are not only individuals who act on a market, they are also social beings, sisters, brothers, sons, daughters, grandparents, friends and colleagues (Grønhøj & Thøgersen, 2012; Hamerman et al., 2018). In most European countries, people increasingly live alone or in smaller familial units, but the household remains a major focus of research on consumption, including food (Tukker et al., 2010). Food represents nourishment for the body, keeping people healthy, supporting growth and development. It also plays a central role in processes of caring for others, for families, friends and wider communities (Davies, 2019b). Food provides energy to sustain daily activities; it represents a daily cost and workload in the form of food provisioning and preparation, a source of joy and pleasure, and in many social contexts it is a medium through which social relations are managed and where social interaction takes place (Goodman, 2016). The daily practices related to food are often routinised and take place in conjunction with other practices, such as working, commuting, engaging in leisure activities, caring for children and significant others, socialising and celebrating, and involve specific skills and competences (Warde, 2016). There are social norms and conventions guiding how to eat, which vary between cultures and within cultures in different contexts (Niva et al., 2014). How one eats can be an expression of social and cultural belonging (Holm, 2013). Thus, the multidimensional social character of food and eating means that food consumption is not driven by unambiguous motives or simple concerns (Halkier, 2001; Krüger & Strüver, 2017; Paddock, 2017b). Interventions in the food system which recognise this have been shown to be effective in affecting change towards sustainable food practices (Chaudhury & Albinsson, 2015; MacRae et al., 2012).

Therefore, individual choices when provisioning food are not formed in a vacuum, but are shaped by a range of forces (Thøgersen, 2010, 2014). For example, food acquisition is shaped by the marketing and advertising of food retailers (Andreyeva et al., 2011; Buijzen et al., 2008; Chandon & Wansink, 2012) and the design and delivery of food offerings in shops, restaurants, schools and workplaces affects food choices (Broers et al., 2017; Filimonau et al., 2017). Individual familiarity with, understanding of, and trust in sustainable food messaging affects which interventions gain traction (Sirieix et al., 2013; van Amstel et al., 2008; Vittersø & Tangeland, 2015). Research into public perceptions of emerging food technologies, including high-pressure processing and pulsed electric

field technologies and the products they produce (Olsen et al., 2010), found that people had some reservations, asking for greater transparency about the process and its impacts, but were generally supportive of innovations which have positive ecological benefits. Research conducted in Ireland exploring the role of smart, digital technologies in food futures found people were generally ambiguous about expanding such technologies in a quest for more sustainable food, recognising potential benefits (e.g. reduced food waste) but also potential negatives from increased automation (e.g. deskilling) and surveillance (e.g. privacy and freedom) (Davies, 2014).

More research is needed to understand the public acceptance and consumer understanding of such developments in order to pave the way for more eco-friendly technologies (see also Box 6):

Box 6. Consumer attitudes and perceptions of food technologies

The transition from 'take, make, consume, dispose' chains towards sustainable and circular food systems is highly dependent on organisational and social innovations, intertwined with technological and social innovations that might support or hamper this transition. Sustainable and circular food system innovations range from mild processing of fresh products, new nutritious and functional foods, alternative proteins, exploiting the rich microbial flora in food systems, intelligent sensors and system controls for guaranteeing food safety and eco-friendly processing (in terms of waste reduction as well as water and energy savings), novel packaging concepts to avoid food and plastic waste, down-scaled technologies for local bio-refinery of resources, 3D printing, ICT-driven home appliances, other not-yet-foreseen numerical inventions in food, and so on.

The range of technological and social innovations in the area of food science and technology is rather broad, so a detailed discussion is beyond the scope of this report.[64] There has, however, been widespread interest in the potential of insects and other forms of alternative protein as sources of human food. The subject raises interesting questions of public acceptance as well as how best to incorporate such foods in existing diets, at reasonable cost and acceptable taste, as well as how to make them commercially viable and widely available (House, 2016; Sexton, 2018).

The success of sustainable and circular food system innovations depends on organisational (business) innovations and social factors including attitudes and perceptions of consumers towards new technologies and to products manufactured by new technologies as addressed here. Recent debates in the media and

64 See, for example, the annual conference programme of the European Federation of Food Science and Technology, 2019 http://www.effostconference.com/resources/updateable/pdf/Conference%20EFFoST%202019_HR-pages-61-72-12Nov.pdf

scientific literature about ultra-processed foods,[65] genetically modified foods, the use of nanotechnology and so on all show the need for understanding consumer attitudes towards food technology and how to properly inform the public of potential benefits and risks. A decade ago, studies highlighted the importance of considering consumer acceptance and attitudes early in technology development (Frewer et al., 2011; Lyndhurst, 2009). They concluded that consumer acceptance and attitudes depend on the technology, consumers being particulary resistant towards hi-tech interventions such as genetically modified foods, animal cloning, nutrigenomics, food irradiation, nanotechnology and synthetic biology, and to some extent also functional foods and novel food processes. They also underlined that technologies characterised as being 'bioactive' raise particular concerns — related to unpredictable effects, uncontrolled use, and ethical issues. Perceptions of 'unnaturalness' alone are unlikely to raise a food technology to high levels of public rejection. Trust in regulation and effective labelling are also important.

A particularly contested technology is genetic modification (GM) of crops, including CRISPR technology, which has been documented to offer advantages such as improved yields, lower pesticide and herbicide usage, decreased tillage, and reduced fossil fuel use (Baulcombe et al., 2014; National Academies of Sciences Engineering and Medicine, 2016). There is a consensus among scientists in the field that GM technologies, particularly more recent developments in gene editing, can increase the efficiency and sustainability of agriculture, but, especially in Europe, the adoption of these technologies has been met with popular resistance (Frewer et al., 2013). A recent thorough survey in the UK found that the resistance towards GM food is based on a mixture of rational and affective responses, the belief in the sanctity of food being most important (Mallinson et al., 2018). Acceptance of GM food also appears to depend on beliefs about the value of science and trust in the integrity of government and big companies, in addition to assessment of the benefits-to-risk ratio of this technology. Most of these findings are broadly consistent with earlier research on consumer acceptance of GM foods (Frewer et al., 2013).[66]

A five-year study on high pressure and pulsed electrical field processing — two novel mild processing technologies for pasteurisation or sterilisation of food products such as orange or apple juice (Matser et al., 2010; Olsen et al., 2011) — revealed the importance of transparency and communication (Nielsen et al., 2009). Sometimes, small adjustments in communication, linking to consumers' prior knowledge,

65 The concept of 'ultra-processing' as used in health debates is a contested area. It is not based on the food engineering literature where, for example, authors refer to "ultra-high pressure processing" to maintain fresh product characteristics (NovelQ, 2011).

66 There is further discussion of these issues in the European Commission's updated bioeconomy strategy which sets out an agenda for strengthening the connection between economy, society and the environment: https://ec.europa.eu/research/bioeconomy/pdf/ec_bioeconomy_strategy_2018.pdf

can have a big effect on acceptance, such as rephrasing 'pulsed electrical field processing' to 'micro pulse pasteurisation,' which appeared to provide sufficient clarity and increase acceptance by consumers (NovelQ, 2011).

Whereas communication and transparency about the technological features are of prime importance, cultural background and situational factors may also play a role, as has been demonstrated by studies in Hungary, Slovenia, Denmark and Norway (NovelQ, 2011). Studies using a mixture of methods were carried out on consumer attitudes and actual behaviour towards products produced via novel technologies. Later, these studies were repeated in Germany, Spain, Czech Republic and Sweden. It appeared from these studies that written information regarding the new technologies had the strongest impact (HighTech Europe, 2013). This detailed research on consumer acceptance paved the way for the acceptance of a range of novel processing technologies currently present in the market.

It should be noted that the complexity of food matrices — and of the full food system — makes it far from easy to translate consumer perception and demands into a recipe for food manufacturing (Perrot et al., 2011). Aceves Lara et al. (2018) suggest the use of artificial intelligence (decision support tools, argumentation models, virtual design tools etc.) for this purpose. Hence, developing sustainable food concepts that not only build on consumers' short and long-term needs and wants, but also on consumer understanding and acceptance, remains a challenging scientific task at the edge of social and natural sciences for the future.

In sum, more research is needed on the balance between consumers' positive and negative annotations of the food 'making' process, and the emotions related to food consumption (Köster & Mojet, 2015), as well as other bio-based products that consumers are confronted with (Sijtsema et al., 2016).

Individuals are often unaware of or misperceive the sustainability challenges associated with different foods and therefore need help to make sustainable choices when shopping (e.g. Camilleri et al., 2019; Vandenbergh & Nielsen, 2019). Practical experience and field experiments show that people do value some sustainability labels and that some are willing to pay a quite substantial price premium for labelled products (e.g. Hainmueller et al., 2015). However, research also shows that many are unwilling to adopt innovations that may conflict with cultural norms even if they are shown to be sustainable (Niva et al., 2014). Further research is required to explore how cultural differences and socio-economic situations affect both willingness and ability to pay for sustainable food chices (Evans et al., 2012; García Villar & Quintana-Domenque, 2009) and how everyday practices and cultural norms related to food may need to change in order to accommodate sustainability (Davies & Doyle, 2015; Paddock, 2017a).

A key challenge is that people doing their everyday shopping, often quickly and habitually, may not notice a sustainability label amongst the large number of other product labels and information (Sorensen, 2016; Thøgersen, 2000). However, when this challenge is overcome, they may use the label as a 'choice heuristic', which allows them to choose labelled products as quickly and habitually as they choose other products (Thøgersen et al., 2012). People do, however, need to understand the label's meaning (sufficiently), value the process characteristics that it communicates, and trust its message (Liu et al., 2016; Nuttavuthisit & Thøgersen, 2017; Zander et al., 2017). Trust is key, as there is a fundamental information asymmetry between producers, who know the production processes, and those who are in a position to purchase them who do not. Claims of sustainability are then often not verifiable after purchase and consumption, making them 'credence characteristics' (Zander et al., 2017). Research has also found that individuals can be uncertain about or misperceive the meaning of sustainability labels (Harbaugh et al., 2011; Hemmerling et al., 2015). Their confusion about food labelling is increased by the many different packet sizes and units that are used and by the natural variation in environmental impacts between different farm production systems, and due to year-to-year variability in weather (Schaefer & Blanke, 2014). Hence, it is important to design sustainability labels that are intuitive and easy to process, such as 'traffic light' labelling (Meyerding et al., 2019; Ölander & Thøgersen, 2014; Osman & Thornton, 2019; Vanclay et al., 2011). The same has been found with regard to information about calorie content (VanEpps et al., 2016).

Overall, social science research addressing food consumption from either a practice-theoretical or an individual behaviour perspective (see Chapter 3) acknowledges structural impacts and constraints as well as consumer agency, but the focus is different. Practice-theoretical research perceives consumption as instituted and embedded in wider social, cultural, economic and material systems, and therefore highlights the need for change in systems (Devaney & Davies, 2017; Paddock, 2017a). What is important may not be (for instance) new efficient technologies or new products per se, but rather how they relate to norms, habits and routines. Pro-sustainable food practices can be supported by digital technologies, by governmental policies, by urban initiatives, or by local food initiatives where consumers are agents of change (El Bilali, 2019). However, seen from the perspective of households, complex sets of socio-cultural and material factors, such as location of home, available means of commuting, work hours, household composition and engagement in food form the context in which new food practices must be adopted and become sustained. Such factors may make new sustainable practices difficult to uphold, but when they alter during the life course, they may also open up as entry points for change (Paddock, 2017a).

By contrast, behavioural science research primarily focuses on individual behaviour and on their motivations, cognitive processes, decisions and choices around food consumption. From this perspective, a distinction can be made between deliberate

and automatic, spontaneous decision-making. In this tradition, calls for responsible consumption are often taken to entail changing individuals' deliberate decisions and policy interventions, focusing on empowering and enhancing their ability to make informed and rational choices. Education and information, including labelling, are central policies to this end. A large number of studies have investigated the effectiveness of policies aiming to increase individuals' motivation, knowledge, values and self-efficacy for making healthier and more sustainable choices and change their behaviour accordingly (Steg et al., 2014). According to this research, effective policy intervention depends on: (1) identifying the right behaviour to change, i.e. the behaviour that makes the biggest difference; (2) identifying the main factors underlying this behaviour; and (3) designing interventions targeting (some of) these factors.

Research focusing on automated and spontaneous decisions often draws on behavioural economics to target routine behaviour that is inconsistent with current understanding of sustainability and health goals. A large number of intervention studies have deployed nudging techniques, such as, for example, default rules, simplification, use of social norms, goal activating cues in food-choice environments, changes in the visual positioning and presentation of food and in portion sizes. Studies and reviews conclude that nudges hold promise with respect to promoting healthier food choices (Bauer & Reisch, 2019), encouraging people to contribute voluntarily to environmental protection (Ferrari et al., 2019, p. 191) and reducing meat consumption in cafeterias (Byerly et al., 2018) but there is also a need to consider changes at a wider scale than nudges which operate predominantly on micro-practices.

In Europe, most food provisioning is based on the market, and increasingly foods are provisioned from supermarkets and large retailers, or as meals prepared outside private households. Much of the research about how to promote sustainable and healthy food consumption addresses market-based activities and practices in modern Western households. However, it should be noted that household food self-provisioning may still make important contributions to sustainable food systems in some parts of Europe (Jehlička & Smith, 2011), and there is growing attention to collective activities within communities around food, such as community gardens, kitchens and surplus food redistribution activities (Davies, 2019b). As measures and interventions to promote more sustainable food practices need to be adapted to the specific context in which they are supposed to work (Lehner et al., 2016; Secondi et al., 2015), more social science research focused on food consumption in diverse contexts is needed.

6.6. Non-governmental, civil society and grassroots actors

Many civil society and non-governmental organisations (NGOs) are actively engaged in shaping the food system and the natural resources on which it is based. They act at and across different scales from the hyper-local to the global through campaigning for public policies, collaborating with other organisations such as national governments, or highlighting damaging practices and alternative, more sustainable, ones (Halloran et al., 2014). Their goals are diverse. Some have a socio-economic focus (e.g. strengthening the position of smallholders or women), others educational (Śpiewak, 2016), others still seek a change of health or environmental policies or fostering food democracy (Lamine et al., 2012). Whatever their specific focus, they are often initial drivers for raising issues for vulnerable people and places, and form a key site of activism for changing practices (Goodman et al., 2012; Kirwan et al., 2013; Maye, 2019).

Organised citizen-consumers are emerging as an important collection of actors in a suite of food-related actions, such as community-supported agriculture, food co-ops, farmers' markets, and self-harvest gardens, often referred to under the umbrella term 'alternative food networks' (AFNs). AFNs are co-ordinated and collective attempts to move away from the status quo within the food system (Goodman et al., 2012). This includes citizen-consumers coming together around matters of ethical food production (Sbicca, 2015), consumption (Dubuisson-Quellier et al., 2011), particularly local and organic food consumption (Hayes-Conroy & Hayes-Conroy, 2013) as well as around the redistribution of surplus food (Davies, 2019a; Weymes & Davies, 2019) and food waste (Halloran et al., 2014). AFNs are often perceived as a response to growing civil distress connected with the social and environmental attributes of food, but they represent a variety of structures based on very different values and aims (Bilewicz & Śpiewak, 2018).

A systematic review of AFNs by Forssell and Lankoski (2015) revealed that, while they often provide different mechanisms to acquire food, the 'alternatives' examined are not comprehensive with respect to the sustainability of food systems. Nonetheless, there are positive linkages between characteristics of AFNs and sustainability. In particular, the focus on connecting people with food has been identified as a significant area of impact, and it is also valuable to create demonstration effects that things can be done differently (Davies, 2012; Kirwan et al., 2013; Seyfang & Smith, 2007).

The most important limitation to these movements identified by Forssell and Lankoski (2015) was that goals of these movements do not materialise as expected or they materialise, but at a relatively small scale without disrupting wider system dynamics. The authors note, for example, that while developments such as fair trade or community-supported agriculture schemes have led to higher incomes, they still may not be high enough to be considered a living wage (Brown & Miller, 2008; Lyon, 2006).

A downside of organic production is that it may lead to smaller yields and thus increased use of farmland per product (Gomiero et al., 2011). However, there are dimensions of organic food production which are more efficient than conventional production, such as better overall soil quality and smaller nutrient surpluses than in conventional farms, reducing the risk of nutrient pollution to rivers, lakes, wetlands, and coastal oceans (National Research Council, 2010). Similarly, while eating more locally-produced food has reduced environmental impacts from transporting food, it does not necessarily mean that overall net environmental impacts are reduced unless it is accompanied by changing food habits (e.g. consumption of seasonal food), because the impacts of food production vary in different locales and local food distribution and storage may be inefficient (Coley et al., 2009; Edwards-Jones et al., 2008; Mariola, 2008).

Research demonstrates the difficulties AFNs face in articulating political action and economic engagement within the constraints of the prevailing food system and the governing arrangements that have developed to support it (Dubuisson-Quellier et al., 2011; Fuchs et al., 2011; Goodman et al., 2013; Myers & Sbicca, 2015). However, as Forssell and Lankoski (2015) conclude, more empirical work is needed to ascertain the sustainability impacts (both potential and real) that emerge from alternative food movements, food-based NGOs and grassroots initiatives.

6.7. Science and researchers

Humanity has never had before so much access to food-related knowledge. However, this knowledge and the collective capacities of the natural and social sciences are not yet fully mobilised to the benefit of a sustainability transition. As in practically all other areas, guiding principles and socio-cognitive processes in the established knowledge base are geared towards incremental knowledge development rather than paradigmatic shifts. Many scholars perceive disincentives to focus on path-breaking sustainability research, because of risk-averse funding organisations, lack of dedicated journals, conferences and research groups (Smith & Raven, 2012).[67] Sustainability challenges might even require new ways of knowledge production and decision-making, such as Mode 2 Science (Gibbons, 1994; Nowotny et al., 2001) or Post-Normal Science (Funtowicz & Ravetz, 1993) based on transdisciplinary, community-based, interactive, or participatory approaches. Triple helix partnerships involving industry, government and research institutions are being identified as potentially fruitful innovation mechanisms, and partnerships focused on food innovations are emerging (Betzold et al., 2018; Frykfors & Jönsson, 2010; Lee et al., 2009), although there is little explicit consideration of sustainability within these studies.

67 The situation has improved over the last decade with the advent of journals such as Nature Foods, Sustainability and the Journal of Cleaner Production providing new outlets for interdisciciplinary research on sustainable food systems.

An effective approach for sustainability science is the involvement of actors from outside academia in order to integrate the best available knowledge, reconcile values and preferences, and create ownership for problems and solution options (Lang & Barling, 2012). Thus, the transition towards more sustainable food systems can be supported by new processes of learning and more inclusive, flexible modes of governing the generation, integration and sharing of knowledge (Duru et al., 2015; Šūmane et al., 2018). Indeed, many research projects funded by the European Commission and other national and international research programmes have made progress in involving stakeholders from outside academia to help solve the social and ecological challenges of food production and consumption: see, for example, the multi-stakeholder platform FIT4FOOD2030 and other FOOD 2030 activities financed by DG Research and Innovation. Alongside practitioners from industry and government, researchers also contribute to initiatives such as the EU platform on food loss and waste, which seeks to co-produce knowledge about the issues and identify pathways for more sustainable responses. The mission-driven approach of Horizon Europe should also be acknowledged.[68]

While an increasing number of scientists contribute knowledge to better understand or support food sustainability transitions, the group of scholars who are actively involved in designing or implementing transition processes together with societal actors is much smaller. Several of these collaborative activities take place on a small-scale, integrating local and scientific knowledge (e.g. Duru et al., 2015). Most agri-food challenges, however, cannot be solved on the local scale and need broader consultation processes on the national or even transnational scale. It is important that they are not hampered by predefined goals in support of the current food regime and narrow invitation lists of actors supporting the status quo rather than being open to change (McInnes, 2019). Food sustainability transitions can benefit from broadening access to knowledge and knowledge production, which is not equally distributed along supply chains or between rural and urban areas (Amedzro St-Hilaire, 2018; Csurgó et al., 2008).

In the context of sustainability transitions, scientists have built new coalitions with society. For example, scientists published statements in support of the youth protesters of the 'Fridays for Future' movement,[69] verifying the scientific evidence that the young climate activists refer to, to which food makes a significant contribution (Hagedorn et al., 2019). However, challenges remain for scientists who, on the one hand, wish to remain independent and politically neutral, and, on the other hand, wish to inform and warn societies of the dangers that lie ahead based on scientific evidence (Hagedorn et al., 2019) as well as participating in profound transformation processess.

68 https://ec.europa.eu/info/sites/info/files/research_and_innovation/contact/documents/ec_rtd_mazzucato-report-issue2_072019.pdf

69 https://www.nature.com/articles/d41586-019-00861-z

6.8. Conclusions

As with other complex systems, there is no 'silver bullet' actor that will single-handedly transform the food system in a more sustainable direction. Rather, there are many forces and drivers of change with uneven power and influence, which intersect in dynamic ways across time and space. These differences in power and influence exist not only between actors but within actor categories, for example between large and small farmers. Equally, the complexities of food supply chains mean that certain actors (for example, food distributors) are not always visible to others (for example, citizen-consumers). There are also broad forces, such as global free trade policies, that surround the food system and which are hugely significant in terms of how it functions.

While identifying different roles in the food system is relatively easy (Steurer, 2013), identifying the balance of responsibilities for enacting change towards a more sustainable food system remains a contested matter, with actors using different logics of justification and actions (Boltanski & Thévenot, 2006). However, there are certain developments, such as establishing transparent, comparable and defensible systems of data collection about the food system, that would certainly provide a more solid foundation for allocating roles and responsibilities in the future.

Problems with complex systems are difficult to solve, not least because optimal solutions for one set of stakeholders threaten, or may appear to threaten, the interests of others (Young et al., 2010). Social change is characterised by conflicting views, winners and losers, dynamic coalitions and power structures (Marsden, 2013). Recent historical comparisons suggest that Europe's economic development leading up to the Industrial Revolution was enabled by the bottom-up collective action of businesses and self-organised collective action, such as craft guilds, fraternities, communes and rural commons — in other words, by a silent revolution propelled by a large number of ordinary people and businesses (de Moor, 2008). As this chapter has indicated, there are emergent sustainable food business networks, new rural-urban coalitions and producer-consumer alliances, and experimentation with new approaches to elements of the existing food system that are beginning to gain traction (Levidow, 2015). There is, however, limited evaluation of these positive developments and more investment is needed to set up agreed systems of reporting on progress.

To achieve a transition towards a more just and sustainable food system, and for interventions to gain traction, a range of actors will need to be involved in problem formulation and solution development. Research from other complex sectors, such as consumption, cities and climate change, suggests that the development of transition plans needs to be accompanied by a more experimental approach to system change where a range of smaller innovations are identified, trialled and evaluated (Bulkeley &

Castán Broto, 2013; Davies & Doyle, 2015; Voytenko et al., 2016) in order to learn from the results and adjust the next steps as necessary.

Rather than thinking of a singular change to fix a complex system, research will need to focus on the kinds of adjustments that could be made to a range of leverage points to improve system sustainability. This will involve changes in rules (including social rules, such as norms, as well as regulatory rules, laws and protocols) and changes in the tools (including devices, infrastructures, machinery and scientific systems) which are used to facilitate food practices, fostered by innovation and changes in skills and understandings relating to how information on impacts is collated and evaluated, and how conflicts resulting from changes are handled. Ongoing monitoring, reflection and collaboration will be needed across the food system.[70]

6.9. Key messages and policy implications

- **Agents of food system change are diverse and include non-human influences such as ecological and climatic conditions as well as human agents. Given the complexities of contemporary food systems, no one actor can single-handedly achieve a transition towards greater justice and sustainability. Experimental methods and collaborative approaches are potentially significant agents of change, as demonstrated by parallel research on other complex systems (such as cities and climate change).**
- **Power, knowledge and information is unevenly distributed across the food system but governments at all levels play an important leadership and enforcement role, particularly with regards to supporting innovation and measuring impacts of the food system.**
- **Movement towards sustainable food systems at the EU level is contingent on changes to the rules of international trade and governance at the global level also supporting such a transition.**
- **Product and process certification and standards involving a wide range of public and private initiatives can be influential strategies shaping food acquisition if they are reliable, transparent and independent. This requires ongoing development and robust methods for ensuring they are trusted. Simplified labelling systems**

70 We remind readers that our Report focuses on social science research and does not speak with equal authority about other areas of research such as science and technology. There are many other areas with potential for driving a change towards more sustainable food systems including developments in artificial intelligence, robotisation and sensors, insights from genetics and the valorization of co-products in a wider bioeconomy context. While not covered here, they may also be considered potential 'agents of change'.

(such as traffic lights) have the potential to provide a clear indication of product performance to consumers.

- Consumer power within the food system is potentially large at an aggregate level, but it is bounded and shaped by a range of dynamic forces and actors. A focus on 'consumer choice' and individual responsibility is likely to be insufficient given the fundamental information and power asymmetries across the food system. There are also emerging forces and actors shaping socio-cultural norms around food which need further scrutiny, particularly digital technologies, social media platforms and influencers.
- Education about the food system is an important part of creating a more sustainable food system. However, fact-based teaching, designed to enhance consumer knowledge and awareness of sustainability issues, is rarely sufficient to induce positive behaviour change unless combined with changes to the 'choice architecture' and other elements of the food system.
- There are increasing examples of novel approaches to food with sustainability as a key goal, often collectively called 'alternative food networks' (AFNs). The sustainability impacts of these activities need to be more clearly identified along with barriers and opportunities for scaling-up and out those with sustainability benefits.

Chapter 7. Good practice and lessons learned

The main goal of this chapter is to present examples of good practice and initiatives that tackle various aspects of change towards a more just and sustainable food system in Europe. We present eight examples in the form of vignettes, which describe key aspects of the chosen cases: which issues the case addresses, who is involved, which activities have been undertaken, and what the results are. We hope these short summaries will inspire reflections and further scrutiny about the lessons to be learned.

The examples were found through a systematic search process including a review of primarily social-science-informed literature about good examples of food sustainability policy and practice in Europe, at member state, local and community levels. Interest focused on the scope and impact of policies within member states, and questions of whether or not there was evidence for replicating or upscaling activities to other member states or to the EU level. We also sought information about enabling factors for local and community level initiatives, and whether there is evidence for replicating or upscaling initiatives in other contexts.[71] We limited searches to the last five years (for more details of the search process, see Annex 2, p.199). This initial search provided a first draft list of initiatives from across Europe, and in a second phase, cases were sought where critical reviews or assessments existed, which could add substance to the description of the cases and the claims asserted. Somewhat disappointingly, not many cases were supported by a sufficient level of academic and non-academic analysis. In all, we found 17 cases, which were assessed or analysed in various forms of publication, mostly in English. These cases are listed in Annex 3a, p.206, which provides a short overview of the cases and references for the reviews or assessments found.

From this list, eight cases were chosen to illustrate various scales of change (e.g. local or national), various agents of change (e.g. food producers, educators, public authorities, citizen-consumers), different types of governance and various geographical contexts, reflecting the diversity of EU countries and various local contexts. All of the chosen cases work across more than one part of the food system. However, our main criterion was that cases should have some evidence of success factors and of successful outcomes provided in published, peer-reviewed papers. As such data are scarce, the following selection of cases is not representative of all initiatives and projects taking place in

71 The selection of case studies is inevitably partial and was driven by the availability of the evidence. In future work, it would be valuable to include examples of agricultural cooperatives, and initiatives by major food manufacturers and retailers designed to improve the sustainability of their activities.

Europe. It should be noted that myriad new initiatives are constantly appearing across Europe, and more analyses and documentation is likely to emerge in the future. A list of initiatives for which we found insufficient reviewing literature can be found in Annex 3b, p.211.

The case studies can also be mapped against the food system framings we discuss in section 3.2, p.56. For example, the Hungarian fat tax can be considered as an example of framing food as a human right. The Polish consumer cooperatives and the Irish FoodCloud are examples of framing food as commons, while the development of the organic food market in Denmark combines elements of food as a commodity with food as a human right, and the RETHINK project in Latvia and Lithuania combines elements of three framings: food as a human right, as culture and as commons.

What can be learned from the examples? Case studies are often recommended when the research topic of interest is complex and needs to be studied in its context (Flyvbjerg, 2006; Yin, 2014). They allow the in-depth exploration of single cases, or the extensive analysis of multiple cases, in order to identify common patterns and characteristics (Aschemann-Witzel et al., 2017) and to establish new patterns of operation. Case study methods do not allow statistical generalisation and may risk overestimation of concrete knowledge. But, in order to learn about mechanisms of change, they offer ways to understand how configurations of actors, issues and contexts may operate in processes of transformation from which wider inferences may be possible.

In the present report, we do not claim to present full-blown case studies, as this would require further research which lies outside the scope of this report, and for which we lack data. Instead, we present the cases in short, semi-structured vignettes, which are designed to cover analytically important elements characterising the cases.

7.1. The Fat Tax, Hungary

What is the aim?

In 2011, a tax was introduced in Hungary, often called the 'chips tax' in the media, but whose official name is the 'Public Health Product Tax'. The tax applies to certain categories of pre-packed food which are high in salt, sugar or caffeine. The aim of the Hungarian government is to improve the health of the population. The income from the tax is used for health-improving policies, including wage increases of health workers. Since 2012, the income from the tax has been directed to the public health insurance fund, making up around 1% of the fund's income. This tax was followed by two other major regulations of the food industry, prohibiting the release of products which contain more

than 2% of trans fat within their total fat content, and ensuring that the food and drink offered in public canteens satisfy certain health requirements.

What was the process?

Hungary is one of the most obese nations in Europe. The worrying health status of the Hungarian population, and the insufficient results of voluntary programmes by government, manufacturers, NGOs and so on, encouraged the government to apply a legally binding tool to improve the situation. The introduction of the tax was followed by other initiatives (e.g. awareness-raising, education campaigns, regulations). The objectives of the tax are to restrict the consumption of foods that have no benefit from a public health perspective, to promote healthy nutrition, and to improve the financing of health services, including in particular programmes with public health objectives (ECORYS, 2014).

What were the outcomes?

A series of new laws, regulations and some educational actions followed the implementation of this tax.

From an economic point of view, 40% of companies that had sold unhealthy food products changed their recipes to reduce or eliminate unhealthy ingredients. The prices of products that were not changed rose by 29%, and sales of those products fell by 27%. Practically all companies in the sector are negatively affected by the tax. In general, domestic companies are more affected by the tax than multinationals whose products are also sold in other countries, since exports are exempt.

From a budgetary point of view, the tax achieved its aims, since the planned income has largely been realised (ECORYS, 2014).

Lessons learned

Policy actors need to be clear about the primary goal of any health tax and frame the tax accordingly — not doing so leaves taxes vulnerable to hostile lobbying (Wright et al., 2017). The tax is not the only factor influencing consumption trends and competitiveness of companies, although it is an important one (ECORYS, 2014).

Consumers were able to replace the taxed products with ones not containing the taxed ingredients. However, consumers were also able to substitute, in all product categories, products which contain those nutrients targeted by the tax (salt, sugar etc.) but do not have the tax levied on them.

Overall, there is some evidence of moderate improvements in the dietary habits especially among the poorer households as a result of the tax (Bíró, 2015).

Limitations

Dietary habits depend among others on cultural, environmental and socio-economic background, in addition to food-related regulations. Changing the dietary habits of the population requires a complex food policy which also puts emphasis on education related to healthy eating. The data on the effects of this measure are ambiguous and limited (Wright et al., 2017) and we have not identified up-to-date articles on the issue. It is therefore not possible to completely disentangle the effect of the fat tax from other possible reasons for changes in consumption patterns.

7.2. Consumer cooperatives, Poland

Initiatives aimed at establishing direct links between an organised group of consumers and producers

The Polish food distribution system is generally divided between traditional, informal networks and food self-provisioning, and the dominant, ever-growing supermarket and discount chains, gradually eliminating local corner shops and food markets. Cooperatives aim to create alternatives to unsustainable forms of mass consumption, promoting a more sustainable and just food system by establishing direct links between an organised group of consumers and producers.

Who are the partners?

Small or medium farmers, often organic; city dwellers; sometimes local authorities.

What is the aim?

Cooperatives are seen as one of the most popular forms of alternative food networks in urban areas, based on a simple idea of establishing direct links between an organised group of consumers and producers (Jaklin et al., 2015). Poland had a well-established consumer cooperative movement that originated in the middle of the 19th century and flourished in the inter-war period, but it was that was largely lost during the times of communism and forgotten or distorted after the system transition in 1989.

In the contemporary Polish context, consumer cooperatives are usually small, informal groups connecting people who buy food directly from farmers and local food processors. Because cooperatives bypass intermediaries, they can keep the prices of high-quality food lower than in regular shops.

What was the process?

The first informal grassroots cooperative in Poland was established in January 2010. This soon became a pattern for other cooperatives that emerged in other large Polish cities in the course of the next year. Overall, there were over 30 attempts to establish cooperatives all over Poland. They emerged in the largest cities as non-hierarchical, serving also redistributive purposes, and based (at least theoretically) on direct relationships with local farmers. Some of them evolved in the direction of Facebook groups organised to buy quality food from small farms and refined producers. As they are often informal bodies, it is difficult to determine the exact number, but it is estimated that there are around 30 food cooperatives across the country (Bilewicz & Śpiewak, 2015).

Activities

Consumer cooperatives are based on the regular, voluntary work of the cooperative members, usually 3–4 hours a month, as well as the regular presence of farmers in the cooperative.

What were the outcomes?

As local, high-quality food has become fashionable, this form of food distribution system has also gained media attention. Thanks to this, the number of cooperatives is slowly but steadily growing, including in smaller cities. Families involved in cooperatives gain knowledge about sustainable food production systems, while farmers learn about the needs and expectations of consumers, also trying to minimise food waste. Because the cooperatives bypass intermediaries, farmers get more benefit for their products, and consumers pay less than in stores for organic or other high-quality goods.

Lessons learned

Such activities should not be upscaled, but rather multiplied. In order to do so, there is a need for stronger cooperation with local authorities and acknowledgement of consumer cooperatives in local or state regulations (as, for example, in Italy). Small and medium farmers should be better informed about the cooperative system and the rules of cooperation.

Limitations

Being a member of a cooperative requires commitment of some of the members' time and a high level of trust from both farmers and consumers. Despite attempts to reduce costs, there is still the need to have sufficient income to be able to buy food products in cooperatives. In addition, it requires an adequate level of knowledge and readiness for development by farmers. Therefore, after 10 years of development, even though

the number of food cooperatives is growing, it is still a niche phenomenon (Bilewicz & Śpiewak, 2015).

7.3. FoodCloud, Ireland

Surplus food redistribution to reduce food waste

In Ireland, 1 in 11 people experience food poverty yet 1 million tonnes of food are thrown out by Irish consumers and businesses every year. In response, FoodCloud, an Irish-based social enterprise, developed an ICT-mediated system to connect retailers with surplus food to charitable groups in need of it. The technologies developed by FoodCloud ensure traceability data and provide opportunities for feeding information back to retailers on the nature and dynamics of the surplus food they generate. The retail juncture in the food system provides regular and suitably-sized volumes of food for redistribution which, with the assistance of information and communication technologies, can be rapidly and easily mapped and tracked, meeting current food safety requirements (Ciaghi & Villafiorta, 2016; Corbo & Fraticelli, 2015; Davies, 2019b; Farr-Wharton et al., 2014; Lipinski et al., 2013).

What is the aim?

FoodCloud aims to create solutions to redistribute surplus food that reduces food waste, increases social inclusion and inspires communities to take local actions that can create global change.

Who is involved?

FoodCloud is an Irish-based social enterprise. It has grown from six donors and six community groups in Dublin in 2013 to a national operation across Ireland in 2014, and an international operation active across Ireland and the UK in 2019, connecting more than 1000 retailers with more than 9000 charitable groups (Fox, 2016; Gibson, 2015).[72] It has grown from a start-up enterprise, established by three students from Trinity College Dublin and based on an MSc disssertation (O'Brien, 2012), into an SME with some 32 employees. FoodCloud is looking to further scale up, with the goal to redistribute 25% of Ireland's surplus food by 2030 and to increase its distribution of surplus in the UK by 10% each year.

FoodCloud founders used start-up incubation support within the university (e.g. Trinity LaunchBox incubator programme), and were awarded innovation funds and

72 See https://food.cloud/

entrepreneurship grants from philanthropic sources (e.g. The Guinness Foundation) as well as governmental support (e.g. Social Innovation Ireland).

Activities; What is the process?

FoodCloud uses a range of technology innovations, including a dedicated mobile app and integrated point-of-sales system (including 'donate' options on barcode scanners) to connect retailers with charities and facilitate the donation of surplus food (Shareable, 2017). This technological element is vital for sustainability and scalability (Midgley, 2014). FoodCloud provides retailers with a managed service with support, access to technology and reporting, while charities are supported via a contact centre (Davies, 2019a). It charges retailers a price per store to contribute to the costs associated with the service, with fundraising conducted to cover all remaining costs. Donated food is provided for free to charities. FoodCloud also licenses its technology to international food banks and food rescue organisations and charges an annual licensing fee to contribute to the costs associated with providing the technology. In 2018, the organisation began piloting its technology licensing solution in Australia, Poland, and the Czech Republic, and it is currently looking to scale further in these countries.

What were the outcomes?

In 2018, FoodCloud redistributed 1082 tonnes of surplus food, equivalent to 2.4 million meals and €3.2 million in food savings in Ireland. In partnership with FareShare, it redistributed 7167 tonnes of food in the UK, equivalent to 15 million meals to a value of €21 million (FoodCloud, 2019; Figure 10). Together, this is estimated to represent a reduction of over 30 000 tonnes of carbon dioxide emissions. Since being established, FoodCloud has diverted over 22 000 tonnes of food, which it estimates contributes 72 727 tonnes in carbon savings and 50 million meals, representing more than €68 million in savings to charities.

FoodCloud participates in the EU Platform on Food Loss and Food Waste (European Commission, 2016), in the sub-group on food donation, helping to shape policy on reducing food waste through surplus food redistribution.

Lessons learned

The technology behind FoodCloud is necessary but alone insufficient to sustain the redistribution social enterprise. Interpersonal relations and relationship management between donors and recipients is also essential (Davies, 2019b). Success for FoodCloud is linked to its first mover position, the strong ecosystem of support that the founders received — from start-up incubation supports within the university, to access to

innovation funds and entrepreneurship support from philanthropic and governmental sources.

There are concerns raised by FoodCloud itself that their impact on reducing the amount of surplus produced in the first place (prevention) is unclear, given a lack of data and reporting by retailers. There are also concerns that extending surplus food redistribution to address food insecure populations is effectively creating a sticking plaster response to a wider system-level issue (Carolan, 2018).

Figure 10. FoodCloud in numbers (https://food.cloud)

7.4. The organic food market, Denmark

The most successful organic food market in the world

The success of organic food in Denmark is to a large extent due to policy support for organic agriculture and market development, earlier, more persistently, and with a broader range of means than in other countries (Daugbjerg & Sønderskov, 2012). Denmark is one of the few countries where the government intervened from the outset, both on the supply side and the demand side, to facilitate the development of an organic food sector. A whole range of market factors, both on the supply and the demand side, played a supplementary role. In particular, conventional retail chains in Denmark took in and promoted organic food products early, which boosted the sale of organics, both because of increased accessibility and lower prices and because of the increased promotion of organic food.

Outcome

Nowhere in the world has organic food been better received than in Denmark, where its market share was 13.3% in 2017 (Willer & Lernoud, 2019). The success of organic food in Denmark has several causes, including both policy support and market factors (see Figure 11, p.138).

EU law

Standards for organic food are defined by law and mandatory for all organic food offered for sale in the EU (EU Regulation 2018/848). However, countries differ in how they implement organic farming policies. An important reason for the success of organic food in Denmark is an ambitious policy, emphasising both supply-side and demand-side instruments (Daugbjerg & Sønderskov, 2012).

Danish law

The Danish law on organic farming from 1987 was the first national law to define organic farming and support it financially (Padel et al., 1999). Later, when facing oversupply in some organic product groups, Denmark was also the first country to adjust its policy to focus more on demand strengthening, with its national action plans of 1995 and 1999 (Aschemann et al., 2007).

Market development activities

Next to the legal definition of organic farming, the most important market development activities are the establishment of credible control, certification, and labeling systems (Michelsen, 2001). A clearly-defined production system guaranteed by control and certification systems is a prerequisite for the segmentation of the market into organic versus conventional products (Aschemann et al., 2007). The organic label makes it possible for consumers to recognise a product as organic. The credibility of the certifying body, both in terms of commitment and ability, is essential for consumer trust in the label and in organic food products (Nuttavuthisit & Thøgersen, 2017). In general, consumers have more confidence in labels that are state-controlled, like the Danish 'Ø' label, than in labels that are not (Roosen et al., 2003). The Danish state-controlled organic label is known and trusted by practically everyone in Denmark.[73]

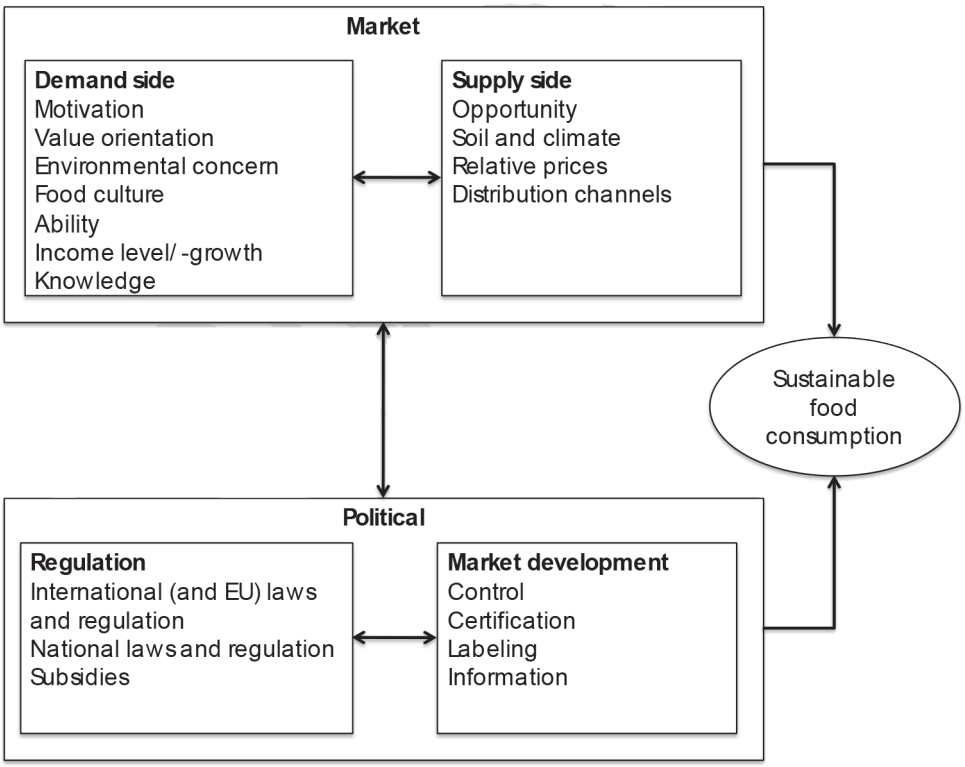
Market factors

Organic food products were initially sold directly by farmers to consumers, at the farm, through producer–consumer associations, or at farmers markets. Later, speciality health

73 https://www.organicdenmark.com/the-danish-organic-label

food stores played an increasing role, but now most organic food products in Europe are sold through conventional supermarkets (Willer & Lernoud, 2019). Conventional retail chains have played an especially active role in the most successful organic markets, including Denmark (Dabbert et al., 2004). Distribution through conventional retail chains means not only higher availability, but also more promotion activities, which increase the public's attention to and interest in organic food in general (Aschemann et al., 2007). Effective distribution channels also lead to lower costs and therefore lower prices. Economies of scale, in distribution as well as production, allow more competitive prices and lowering of the price when the sale of organic food goes up. Therefore, price premiums tend to be lower in countries with a higher turnover of organic food products (Dabbert et al., 2004). Hence, growth in the organic market tends to be self-reinforcing.

Figure 11. Determinants of organic food consumption (Thøgerson, 2010)



7.5. The RETHINK project, Latvia and Lithuania

Sustainable and resilient agriculture in Latvia and Lithuania

In Latvia and Lithuania in the 1990s, rural policy followed a modernisation paradigm based on specialisation, intensification and scale enlargement. One effect of this was the creation of a gap between large and small farms. The first type, existing worldwide, are generally less sustainable and resilient than the last (de Roest et al., 2018). The key

problem is to find a way to transition to more sustainable and resource-efficient practices on farms. Local farmers' knowledge is crucial in the process, as it has practical, personal and local relevance.

Who are the partners?

Small farmers and local institutions, some related to agriculture advisory bodies.

What is the aim?

The RETHINK action-research programme (conducted in 11 countries) explores structures and opportunities for small and medium-size agricultural holdings that are not well incorporated in the mainstream market (Šūmane et al., 2015). The resilience potential and trajectories of small farms is analysed in conjunction with innovation and valorisation of local knowledge. The main questions addressed by the research are:

- What are the distinctive ways in which small farms manage to balance autonomy and cooperation, economic goals and sustainability considerations?
- How can small-scale farming contribute to a higher quality of life in rural areas?
- What kind of knowledge (scientific, peer networks, own experimentation) is used, and where do blockages occur?
- What skills promote successful activity as a small-scale farmer?

What was the process?

Eleven case studies were carried out, including one in Latvia and Lithuania. Besides the general questions regarding the sustainability of farming, the specific questions asked in these countries were focused on the development strategies of small farms.

What were the outcomes?

A major outcome has been to highlight the importance of the development of sustainable, resilient farming based on multi-actor knowledge networks (Šūmane et al., 2018). Agricultural knowledge systems and agricultural policymakers need to increase their recognition of the value of informal knowledge in the transition process towards more sustainable farming and through sustainable food system. Direct knowledge-sharing helps disseminate sustainable practices and strengthens the social structures through which these practices are disseminated. Profitability is not the only parameter that influences farmers' choices: other factors, such as autonomy and quality of life, are also important.

Lessons learned

A report from this research (Šūmane et al., 2015) highlights that small farms perform important social and environmental functions in rural areas, and niche production protects them from shocks in mainstream product sectors and markets. They are operating in very dynamic but not very advantageous contexts. To ensure both farm development and resilience, small farmers are involved in constant learning and innovation or renovation processes. When analysing the successful small farms, it becomes evident that the capacity for learning and active learning attitude (curiosity and readiness to learn) are cornerstones of their resilience. In particular, small farms rely a lot on local knowledge and know-how which have been developed on the base of interactions with and within the specific local setting. Social networking through which new ideas and other farmers' tested knowledge are diffusing is important for resilience, especially for introducing more radical changes and ensuring transformability. Knowledge alone, without a supportive environment (technical infrastructure, regulatory frameworks, logistics, organisational structures etc.) and other necessary resources (funding, labour etc.), may not be sufficient to innovate and maintain resilience.

Limitations

The current financing system under the CAP supports the development of large farms, despite 'greening' declarations. The existence of small multi-functional farms should be accompanied by better institutional support, including financial support.

7.6. A bakery sustainability project, France

Diversity and interactions in a low-input agro-food ecosystem: toward a better understanding of bakery sustainability

This case study focuses on changes in breadmaking practices to increase microbial diversity and bread quality, linking scientists, farmers, bakers and consumers across the entire food chain in order to enhance the sustainability of breadmaking. There was a particular emphasis on the fungal diversity of yeast in sourdough fermentation and on the influence of terroir on the aromatic profile of the bread.

Global change has a critical effect on biological and socio-cultural diversity, leading to a strong demand for the development of a sustainable food-agro-ecosystem. In the fermented food chain, industrialisation led to the "selection and spread of specific fermenting microbial strains. However, there are still ongoing artisanal processes" that may allow the conservation of a higher microbial community diversity which can be beneficial to increase food quality and sustainability (ANR, 2018).

Who are the partners?

Farmers in traditional and modern cereal production, artisanal bakers, citizens and scientists in psychology, sociology, agronomy, bio-mathematics and microbiology.

What is the aim?

Understanding the diversity of human artisanal practices and their contribution to the sustainability of the breadmaking food chain via a participatory approach.

What was the process?

An interdisciplinary participatory research approach was used including bakers, psycho-sociologists, bio-mathematicians, agronomists and microbiologists, to analyse bread-making practices and their impact on microbial diversity and bread quality in the low-input French sourdough breadmaking food chain.

Sourdough bread is made of wheat flour, water and sourdough. The sourdough consists of a mixture of flour and water that is naturally fermented by yeasts and lactic acid bacteria.

Activities

First, the diversity of artisanal practices and sourdough microbiota was examined. It was found that the development of various low-input bakery food chains contributes to the diversity of bakery practices, which is itself beneficial for the conservation of yeast diversity. Surprisingly, the well-known baker's yeast Saccharomyces cerevisiae was found dominant only in one fourth of the sampled sourdoughs. By contrast, several species of the neighbouring genus Kazachstania (including one yet undescribed species) were detected at high frequency, revealing a major role for this mostly unknown genus in the study of fungal domestication and in bread making.

Second, an experiment of domestication in action was realised where farmers grew ancient wheat populations and modern varieties, and bakers made flours, initiated new sourdoughs and propagated them by adding flour and water, then made bread together with scientists.

It has been shown that the diversity of the sourdough microbiota mostly depends on the local environment of the bakery, i.e. the house microbiota. The organoleptic and sensory analysis of the experimental breads revealed that the aromatic profiles of breads change with the sourdoughs' 'baker terroir' but also with the terroir of wheat-growing. Finally, interviews with consumers revealed that, beyond health concerns, consumers are

looking for the social link with bakers by choosing to eat sourdough bread (Urien et al., 2019).

Partner roles

Consumers have been actively involved in the transition towards more sustainable breadmaking, in particular due to their willingness to link with bakers (and not only considering quality and health aspects). The farmers and bakers played a key role in this process, especially thanks to their knowledge of both traditional and modern varieties production and manufacturing. They also carried out experiments, participated in the data analysis and are actively communicating results. The roles of scientists have been to provide fundamental knowledge as well as practical support in the analysis of microbial diversity and bread quality. As a whole, this project shows that the whole food chain must be studied to establish the levers to improve the quality and sustainability of food. It shows the interest of participatory research projects including scientists, professionals and citizens to address questions and obtain relevant results on food systems.

What were the outcomes?

- **Social link:** A major outcome has been the importance of the social link between consumers, bakers and scientists in the process of developing new bread products in a sustainable manner, in particular taking into account socio-cultural diversity and traditional varieties.[74]
- **Environment:** The bakery local environment and, hence, house microbiota, have a deterministic impact on the quality of bread in particular its aromatic profiles. This provides opportunities for new 'territorial or local' products and their producers.
- **Science:** Not-yet-described microbial species may play a major role in new product and bread-making innovations.

Lessons learned

A participatory, public-private cooperation project has led to a success story in breadmaking in which tradition, modern production, product and process innovation and local environments have been combined.

74 A video of the project can be found at https://www6.inrae.fr/bakery

7.7. The Danish wholegrain partnership

Achieving dietary change through multisector collaboration

In Denmark, the population's wholegrain intake decreased during the 1990s and 2000s. To combat this, a partnership was formed which included public authorities, the food industry and health NGOs. The partnership established a solid evidence base, shared understandings and joint incremental goals. They defined a clear division of responsibilities, coordinated and evaluated activities, documented results and monitored wholegrain intake in the population. Since the partnership was formed, intake of wholegrain in the Danish population has increased substantially. This is widely ascribed to the activities of the partnership (European Commission, 2018) (see Figure 11 and Figure 12). The value of the Danish initiative was underlined by the European Healthgrain project.[75]

Who are the partners?

The partnership includes public authorities (The Danish Veterinary and Food Administration), the food industry (especially the bread industry) and health NGOs.

What is the aim?

The aim of the partnership is to increase wholegrain intake in the general population, including children. A special focus is on increasing intake among individuals with a low intake of wholegrain.

What was the process?

Providing evidence of rationale for the aim (review of research about health benefits from increased wholegrain consumption, study of people's relationship and understanding of wholegrain); then: agreeing on definitions of wholegrain, setting goals for work (in terms of increase in population intake of wholegrain), agreeing on activities, documenting, monitoring, and evaluating processes and results (Greve & Neess, 2014; Lourenço et al., 2019).

Activities

Issuing dietary guidelines for wholegrain intake; creating a logo for wholegrain products and setting up criteria for its use; increasing the supply of good-tasting wholegrain products meeting the logo criteria; reformulating existing products to meet the criteria; communication and educational activities.

75 https://healthgrain.org/healthgrain-project

Partner roles

Public authorities disseminate dietary guidelines, enforce the logo criteria, and communicate importance of wholegrains for health. The food industry ensures a broad supply of wholegrain products and uses the logo on packaging. Food retailers promote marketing through in-store activities and special deals. Health NGOs communicate the importance of wholegrains for health, and add to the evidence base by funding clinical and epidemiological research (Lourenço et al., 2019).

What were the outcomes?

- **Intake of wholegrain:** From 2000–2004 to 2011–2013, the general population's intake of wholegrain increased by 75% (from 36 to 61 g/MJ) and by 118% for children (from 28 to 58 g/MJ). The intake in the quarter of the population with the lowest intake doubled (from 12 to 23 g/MJ). The proportion of the population eating the recommended amount of wholegrain per day rose from 6% to 30%, and for children from 7% to 43% (Mejborn et al., 2014).
- **Use of logo:** The number of products with wholegrain logo rose from 150 in 2009 to 800 in 2018.
- **Interest in partnership:** The number of partners doubled from 14 in 2009 to 31 in 2018.

Lessons learned

A report from the partnership highlights that reaching consensus about evidence and definitions; understanding consumer behaviours and understanding; observing development of food trends; continually documenting results; and monitoring wholegrain intake are all essential pillars for the establishment of common goals which is key to success (Lourenço et al., 2019). All this takes time.

Figure 12. Partner contributions and relations in the Danish wholegrain partnership (The Danish Wholegrain partnership, 2020)

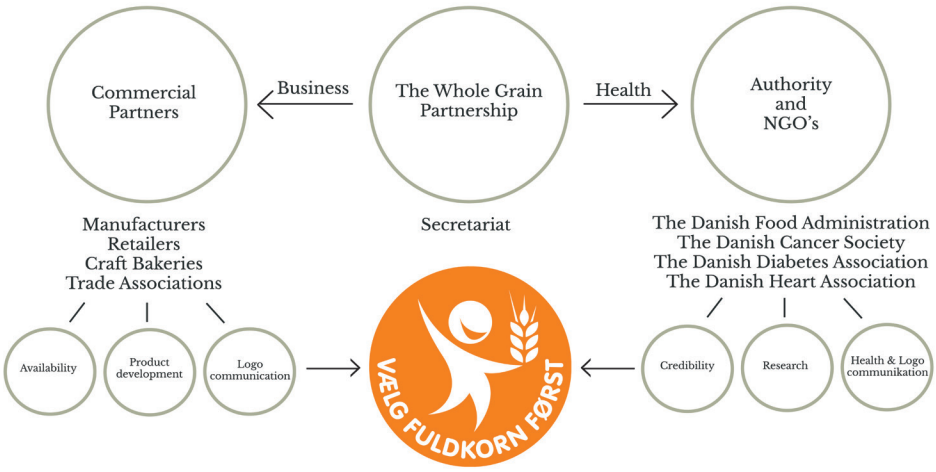
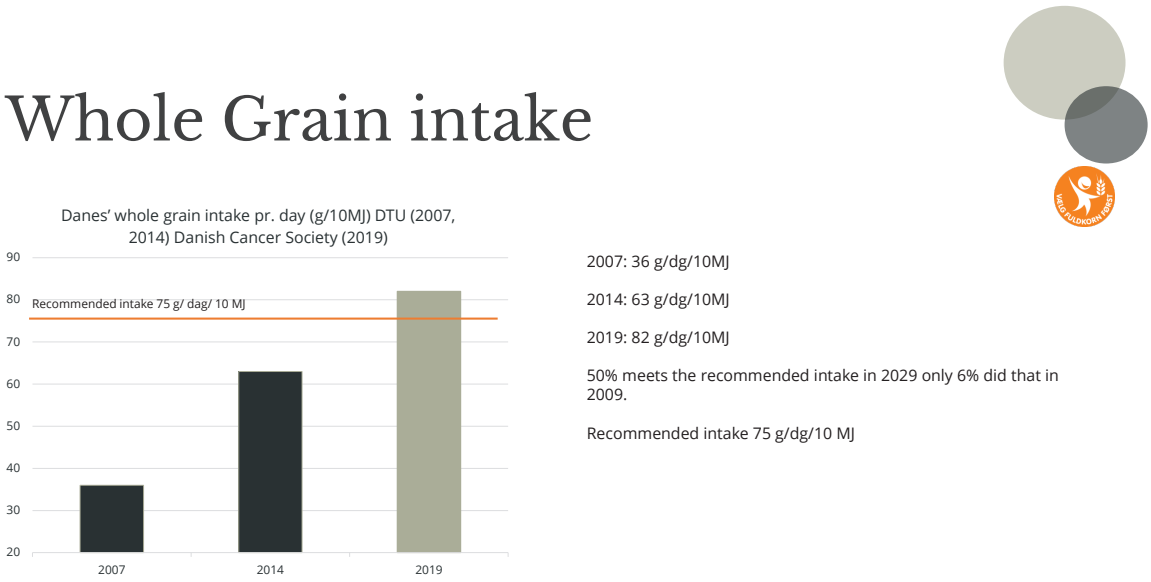


Figure 13. Wholegrain intake for the Danish population (Mejborn et al., 2008; Mejborn et al., 2014; Danish Cancer Society, 2019)



7.8. The Sustainable Food Cities Network, UK

To offer solutions to the many challenges posed by the current food system, local food groups have developed across Europe and especially in the UK. More particularly, UK cities have become leaders in the development of such groups and of specific food initiatives. In that context, the Sustainable Food Cities Network[76] (SFCN) was launched in 2011, a network of more than 50 cities in the UK that are developing food strategies and local food partnerships.

Aim

This initiative was created in 2011 to establish, consolidate, scale up and scale out synergies among pre-existing city-based sustainable food initiatives in the UK. It aims to create cross-sectoral partnerships and multi-level networks of local public-sector agencies, businesses, academics and NGOs. They are meta-governed by three national civil society organisations: the Soil Association (organic certification body); Sustain (an alliance for better food and farming); and Food Matters (building capacity and action for healthy, sustainable, fair food). They support and promote capacity-building, research and evaluation, raising awareness of healthy and sustainable food in cities across the UK.

76 http://sustainablefoodcities.org/about.html

Outcomes

The SFCN has grown significantly between 2011 and now, from five multi-stakeholder food partnerships in five UK cities to a network of 57 members, all local food groups based in small to large cities, boroughs and districts. This shows how local food initiatives have gained prominence, visibility and strength over the past decade, placing food in local politics' narratives.

The constitution of a very broad network enables a wide range of organisations to connect, even beyond member organisations, which facilitates impact beyond the very local level. Using their broad networks, the SFCN carries out national campaigns every year to raise awareness on specific food issues (Santo & Moragues-Faus, 2019).

Good practice

Two distinctive features of the network's activities are its membership application process and the distribution of Sustainable Food Cities Awards.

In order to be a member of the network and access all the opportunities it offers, members need to prove, among other things, that they have an action plan for achieving a sustainable food city and demonstrate capacity and willingness for cross-sector partnerships. A sort of contract with common goals is thus established for all members.

Meanwhile, the awards recognise the efforts made by cities who want to be acknowledged for their work to achieve a more sustainable food system. The SFCN develops requirements (which may be adjusted depending on the city's own profile) that need to be met in order to receive an award (Santo & Moragues-Faus, 2019). In 2015, five cities received an award for their work, and nine awards were distributed in 2019. This initiative brings local food organisations to work together towards common goals and provides an incentive to monitor progress (Santo & Moragues-Faus, 2019). Similar approaches are being applied at an international level, such as in the C40 Network,[77] where sustainability goals are set for cities and a monitoring of results is implemented.

Impact

Beyond the awards, the long-term effectiveness of the SFCN in the cities currently remains difficult to assess. The SFCN has compiled a toolbox of indicators that can help evaluate the impact of their activities.[78] This toolbox has been tested on the city of Cardiff (Moragues-Faus & Marceau, 2018), highlighting some progress made in terms of partnerships and number of activities, but also limitations as many phenomena could not

77 https://www.c40.org

78 https://www.ruaf.org/sites/default/files/RUAF_UAM34_p34-36.pdf

be captured and explained through this toolbox, e.g. causes for non-effectiveness. So far, its main strength has been to facilitate networking among a vast range of local and city-based organisations across the UK.

Success factors

The social, physical and digital infrastructure that is being used to connect places is essential for the success of the SFCN. Undoubted success factors include its online communication and networking, annual conferences, website and newsletter and functioning as a knowledge hub, and reliance on pre-existent local initiatives. The network also provides mentorship for cities when requested, which helps in moving some local initiatives forward (Moragues-Faus & Sonnino, 2019).

Limitations

While there is evidence that this network's structure has significant potential for out-scaling good practices to achieve a sustainable food system in cities, there is still too little evidence of its long-term impact. In fact, one of the most significant obstacles it faces seems to be the upscaling of its discourse and engaging with more contentious and transformative topics at a more political level. This is partly due to the fact that it is particularly difficult for such a broad network of local initiatives to find a common vision and speak with one voice (Santo & Moragues-Faus, 2019).

7.9. Key messages and policy implications

- The eight examples presented in this chapter illustrate how initiatives to promote sustainable food systems are taken both at national and local levels, by actors representing very different sectors in society and that specific goals and aims for initiatives may vary considerably. While some initiatives thrive by remaining in their local context, others expand successfully to national and international levels.
- The examples also point at different framings of the issues that initiatives address. Some focus on population health, some on environmental sustainability or on food waste, and others on inclusion of local social resources in the food system.
- Connecting actors from different sectors appears to be typical of several projects. By bringing consumers in direct contact with producers, or retailers in direct contact with charities, new forms of food provisioning emerge which appear not to involve mainstream markets.
- Often projects are based on active engagements of individuals who invest time and energy in setting up schemes and initiatives, and often projects are successful in mobilizing more people, organisations and institutions.
- The role of small and medium-sized farms in enhancing sustainable and resilient farming could be significant. Diversified production (if based on local knowledge and more general current knowledge) might be more profitable compared to monoculture production, and utilise natural resources in a better way. Local farmers' knowledge therefore needs to be recognised and applied in the whole farming system.
- Direct contact between people, acknowledging the resources of actors, building personal networks and pride in joint local actions, appear to be experienced as positive consequences of many local initiatives.
- Projects highlight the significance of aligning or accepting goals and definitions between participants and the importance of monitoring activities and their effects.
- Initiatives addressing both supply and demand for specific foods or types of food can be successful in promoting quite considerable changes in food markets and food consumption. This also appears to be true for initiatives mobilizing public authorities and commercial actors together.
- National political initiatives, e.g. taxation policy, appear to impact food markets, food products and market shares. Evidence of impact on population health or sustainability of the food sector is currently vague and scarce.

- Public funding and institutional arrangements have been crucial for initiating some projects and appear to be necessary for continuing or up-/out-scaling others.
- Some initiatives addressing food waste and reducing or utilizing abandoned spaces (e.g. community gardens) are examples of a circular economy approach.
- The highlighted examples all stem from Europe, but they are developed at specific places. The success of interventions and policies depend on the local socio-institutional context. Therefore, specific contexts such as political system, institutional trust, natural resources, historical traditions, civic engagement etc. must be taken into account when evaluating options for transfer to other places.
- Each example presents its own way of identifying success factors and analysing impact — be it as participation in initiatives, market development, changed prices, developments in the population's food consumption, new fashions or trends, or amount of redistributed food. Thus, comparing impact of different initiatives is not straightforward. Sustainability assessment is a field over which different interests, representations, and discourses confront each other (Brunori & Galli, 2016), and how to develop relevant indicators is an ongoing and important process.
- There is a need for more in-depth research and analysis of case studies around the EU, that would take in to account possible ways of upscaling or multiplying and long-term impact.

Chapter 8. Summary and conclusions

This chapter summarises the key messages from previous chapters and draws out the conclusions of our evidence review. It seeks to respond to the question: how can a socially just and sustainable food system for the EU best be defined and described, covering the societal, economic and environmental dimensions of sustainability? More ambitiously, through the identification of effective means, supported by evidence, it aims to answer the question outlined in the Scoping Review to which our Report responds:[79]

> What are workable paths to deliver an inclusive, 'just' and timely transition to an EU sustainable food system, considering 'co-benefits' for health, the environment, and socio-economic aspects, including the socio-economic situation of the farming sector, and addressing territorial imbalances, the rural-urban divide, food waste as well as responsible consumer behaviour?

8.1. (Re-)framing the issue

Our Report begins by clarifying that transitioning to a more just and sustainable food system will depend on how food is framed (as a right, as a commodity, as a source of anxiety or pleasure etc.). As people's closest link to the planet, food provides a great opportunity to address multiple social, ecological and economic goals and to coordinate diverse health, agricultural, environmental, development and social policies across multiple scales and sectors. How the food system is framed (Chapter 3) sets the terms of engagement with sustainability issues, establishes what will count as evidence of progress toward these sustainability goals, and defines whose interests will be served in any future transition.

Given the urgency of the global issues facing the food system (Chapter 2), including links to climate change and biodiversity loss, health (e.g. the double burden of malnutrition, overweight-related cardiovascular and kidney diseases, type II diabetes and various types of cancer) and socio-economic issues (e.g. affordable and healthy food, and the socio-economic situation of farm workers), 'business as usual' is no longer a viable option. Fundamental changes are required involving integrated, interdisciplinary and inter-sectoral approaches. Key to such an approach is to take an inclusive, system-wide

79 This question is set out in the Scoping Review which is available at https://ec.europa.eu/research/sam/index.cfm?pg=food

perspective rather than treating separate parts of the system in isolation (as discussed in Chapter 3).

Other reports from authoritative sources reach similar conclusions. For example, the recent iPES report calls for a common food policy for the EU, based on the collective intelligence of more than 40 food experts and practitioners (iPES, 2019),[80] while the FAO's report *Transforming food and agriculture to achieve the SDGs* lists 20 practical measures and interconnected actions, addressed to public and private decision-makers (FAO, 2018c). The recent OECD report on climate change, which includes a chapter on creating a sustainable food system, proposes a comprehensive, multi-criteria approach, designed to achieve a range of priorities including access to a healthy diet, ensuring a healthy and safe environment, mitigating the risks of climate change, and sustainably managing natural resources (OECD, 2019, p.166). The challenge for policymakers, the report suggests, is to identify measures that enhance synergies, anticipate trade-offs and facilitate alignment between objectives. Finally, we highlight the recent IPPC report on climate change and land (Mbow et al., 2019) which adopts a food systems approach and aims to identify synergies and trade-offs.

A recent UN report prepared by an independent group of scientists reaches similar conclusions (UN, 2019b). Recognising food systems and nutrition patterns as one of several 'entry points' to the achievement of sustainable development, the report notes that upscaling current food production to meet the projected increase in global food demand is completely inconsistent with meeting the Paris Agreement targets as well as many of the SDGs. Instead, it recommends enabling more equitable global access to nutritional foods, reducing food loss and food waste, increasing the resilience of food systems and exploring the scope for technological innovations together with associated changes in governance, behaviour and economic incentives.

Our Report, which focuses specifically on the EU and takes a social science perspective, drawing on available evidence from the peer-reviewed literature, emphasises that food is part of a complex system with mutually interacting social, economic and ecological components (Chapter 4). Chapter 4 also reflects on the transition from linear supply chains to more complex circular economy models of adaptive food systems, able to evolve within local, national, European and global contexts.

There is no single, universally agreed definition of what constitutes a sustainable food system. Its definition is complex and contested, reflecting the interests of the various actors involved in the system. Nonetheless, a degree of consensus has been reached over the value of certain definitions, such as the FAO's approach to food security which exists when all people, at all times, have physical, social and economic access to sufficient, safe and nutritious food to meet their dietary needs and food preferences for

80 Full text available at http://www.ipes-food.org/_img/upload/files/CFP_FullReport.pdf

an active and healthy life (FAO, 1996). There is also near-universal support for the SDGs, many of which (including SDG2 on ending hunger, achieving food security and improved nutrition, and promoting sustainable agriculture) recognise the centrality of food to the elimination of world poverty and the achievement of environmental sustainability. As the prime connection between people and planet, food has the potential to address multiple goals: climate change and biodiversity; affordable, nutritious food; strengthening livelihoods; revitalising rural and urban landscapes; and driving positive change across the 2030 Agenda for Sutainable Development.

Despite its central importance to everyday life, food remains a contentious issue, highlighting the many trade-offs and tensions between competing priorities. While imported wholegrains may be good for health, they may be bad for climate change. Reducing meat may be good for health and the environment but bad for primary producers and difficult to address in terms of deeply entrenched notions of what constitutes a 'proper meal'.[81]

There is serious concern about the contribution of intensive agriculture to greenhouse gas emissions and the need for food systems to change in order to mitigate climate change, biodiversity loss, and the degradation of soil and water resources. There is also strong agreement that current levels of food waste are unacceptable, with around one-third of food produced for human consumption currently being wasted. Reducing food waste and food loss throughout the entire supply chain, not just at the household level, is therefore a key priority. The social sciences have an important contribution to make here, demonstrating that the reduction of food waste is a collective responsibility rather than a matter of individual choice.

8.2. Food system transitions

The evidence we have reviewed, both in the systematic literature reviews and in the expert commentaries from our Working Group members, suggests that any transition to a more just and sustainable food system will require the coordination of actions at multiple levels of governance involving a range of actors, operating at a variety of scales in both terrestrial and marine environments. Coordination is key, together with an emphasis on adaptability and inclusiveness. The uneven distribution of power across the food system must also be addressed, including the existence of vested interests and the prevalence (for many actors) of short-term objectives over longer-term horizons. In this regard, it should be borne in mind that transitions involve power dynamics, implying a reorganisation of power relations associated with the access, use and distribution of

81 We are grateful to one of our anonymous reviewers for providing this phrasing.

resources among producers, consumers and social groups engaged in the transition process (El Bilali, 2018). Therefore, the trajectory of a transition and its impact on different layers of society will depend on the deployment of power and resistance to change. Radical changes leading to a transition out of an incumbent regime towards a more sustainable one is the outcome of "conflicts, power struggles, contestations, lobbying, coalition building, and bargaining" (Geels & Schot, 2007, p.145). Hence, transitions entail conflicts and might generate unequal outcomes — thus, power relations and vested interests are inevitably part of such transition processes (Avelino, 2011; Meadowcroft, 2009; Shove & Walker, 2007; van der Ploeg, 2009). These aspects are particularly salient in food system transitions, given divergence in expected sustainability outcomes (Smith & Stirling, 2010). In fact, food systems are characterised by multiple actors bearing different and often conflicting interests (Peters & Pierre, 2014; Tyfield, 2011) and this leads to different views on the desired direction of change as well as on the impact of such change in terms of the distribution of benefits (Leach et al., 2012). Such characteristics make power relations, vested interests and politics higly relevant in the food system context. Although "power and politics are still marginal topics in scientific literature dealing with agri-food sustainability transitions" (El Bilali, 2018, p.6), they should not be underestimated when investigating the trajectory and impact of such transitions.

Lessons about sustainability transitions might also be learned from other sectors, such as energy policy and water management, where these are ahead of similar initiatives in the food sector. In particular, we note that addressing the nexus of food, energy and water policy is an approach that is gaining traction among academics and policymakers.[82] Nexus thinking attempts to replace a sectoral approach to food, energy and water policy where each sector is thought of in isolation. People's domestic practices such as shopping and cooking clearly demonstrate the links between food provisioning, energy and water consumption (Godin & Sahakian, 2018). Even here, the tendency is to focus on resources rather than what people do with those resources, where an emphasis on practices and systems of provision might provide a good way forward.

Food systems will play a central role in achieving other transitions such as the changes required by the current climate emergency. In turn, climate change poses a significant threat to food production, processing, distribution, storage and consumption. While agricultural innovation has helped feed the world's growing population and contributed positively to economic development, the intensification of agricultural production has contributed significantly to greenhouse gas emissions, biodiversity loss, declining air quality and increased water pollution (IPCC, 2019a).

Animal farming, in particular, is a major contributor to greenhouse gas emissions and, in its current intensive and industrialised form, requires unsustainable levels of inputs

82 Some would add 'health' to this list of interacting nexus domains.

in terms of water, fertilisers and pesticides. Most research-based assessments now conclude that a reduction in the consumption of animal products (particularly red meat) would produce significant co-benefits for dietary health and reduced greenhouse gas emissions (EAT-Lancet Commission, 2018; Poux & Aubert, 2018). Similarly, researchers note that seafood generally has a smaller environmental footprint than many other foods (Hilborn et al., 2018).

The challenges of promoting increased food production while maintaining sustainability goals are often expressed in terms of 'sustainable intensification'. As defined by Pretty and Bharucha (Pretty & Bharucha, 2014) and by Pretty et al. (2018), sustainable intensification includes a set of principles and practices for moving towards a more sustainable food system. More specifically, Pretty (2018) refers to three non-linear stages in transitions towards sustainability: efficiency, substitution, and redesign. While both efficiency and substitution are important stages in transitioning towards sustainability, Pretty argues that they are not sufficient for ensuring the most favourable agricultural and environmental outcome at regional and continental scales. The third element, system redesign, as described by Pretty, is a social and institutional as well as an agricultural challenge, requiring the productive use of human capital in the form of knowledge and capacity to adapt and innovate, and social capital to promote common landscape-scale change (promoting biodiversity, water quality, pest management, soil health and other desirable outcomes).[83] Redesign is critical as ecological, economic, social and political conditions change across whole landscapes.[84]

Given its emphasis on maintaining high agricultural productivity while improving sustainability, the concept of sustainable intensification is a contested one, susceptible to appropriation by those who advocate narrow agri-tech solutions to the wider challenges of food security and sustainability.[85] For example, Loos et al. (2014) criticise the emphasis in much of the sustainability literature on food production at the expense of wider concerns about food accessibility, equitable distribution and empowerment. Critics also suggest that technical improvements in the intensification of agriculture do not always result in increased efficiency, particularly when subject to 'rebound effects' whereby part or all of the potential resource saving are offset as producers and consumers adapt their behaviour to changing circumstances (Paul et al., 2019).

As well as promoting more sustainable forms of production, our Report also addresses the related question of how to promote more just and sustainable modes of consumption. Without adopting new consumption practices, we conclude, humanity is rapidly

83 In this context, 'social capital' refers to the value of informal resources mobilised by social groups as the basis for system redesign and transformation, leading to new agricultural knowledge economies and innovative bottom-up platforms for technological change (Pretty 2018).

84 We acknowledge an anonymous referee for some of the phrasing used in this paragraph.

85 See, for example: Godfray (2015) and Godfray & Garnett (2014).

approaching the planetary limits of freshwater use, ocean acidification and other food-related social and environmental systems (cf. Steffen et al., 2015), We therefore accept the view that, unless dietary patterns change and food waste is reduced, foreseeable population growth will drive a 50–70% increase in the demand for food by 2050. These rapidly escalating levels of demand seem unlikely to be met via increased yields or other technological innovations such as aquaculture without wider system changes. At present, it is hard to estimate what potential sustainable solutions could be brought by biotechnology, synthetic biology, as well as by artificial intelligence and nanotechnology.

There are already signs of intolerable strains on the current food system, including unsustainable levels of under- and over-nutrition, focused respectively (but not exclusively) in the Global South and the Global North. Malnutrition (in all its forms) is estimated to cost the EU €120 billion annually, and these costs are likely to increase further without significant system-wide change. Calls are therefore increasing to develop an integrated, overarching food and nutrition policy for the EU.

Our review of the range of theoretical perspectives that are available for researching the transition to more just and sustainable food systems highlights the importance of understanding these issues and making visible the way the issues are framed (Chapter 3). Exposing the underlying premises of different ways of framing the issue is an important contribution of social scientific thinking, with different theories being more appropriate to some issues than to others. We note, however, that many of the social scientific theories that we reviewed offer a powerful way of (re)framing issues and revealing their often-implicit framing by policymakers, rather than ideas that can be immediately and directly translated into policy options or specific practical recommendations.

8.3. Food system governance

Our Report highlights the significance of food system governance which extends beyond the formal instruments of government and transcends the boundaries of traditional jurisdictions. Food system governance involves multiple actors (individuals and institutions), operating at multiple scales and levels, across multiple policy domains, involving both public and private spheres. Strong leadership will therefore be required to achieve an appropriate level of coordination and integration across these boundaries while respecting regional differences and local variations. We also acknowledge the importance of polycentric and multilevel forms of governance, bridging different interest groups and sectors, allowing a diversity of approaches including self-organisation and experimentation, and the range of activity being undertaken by citizen-consumers, pushing for active participation in decision-making about food sustainability. We would

also encourage the periodic monitoring of different approaches in order to improve decision-making and guidance in an open and transparent manner.

While some areas of governance, such as agricultural policy and fisheries policy, fall almost exclusively within the EU's competence, other areas such as public health remain largely within national governments' sphere of influence. However, even within agriculture and associated areas such as food manufacturing, many food system challenges occur at a global scale, so global governance arrangements will need to be strengthened in order to make an impact at the EU or member state level. Transitioning towards a more just and sustainable food system at the EU level is therefore contingent on changes to the rules of international trade and governance at the global level. Appreciating the European dimension of these issues will require that attention is paid to regional differences (as discussed in Chapter 6), with support for bottom-up, diverse, regional actions as well as the coordination of top-down guidance. It is also easy to focus too much on agriculture without acknowledging that food system transitions must involve a wide range of organisations across the value chain. This would also acknowledge the need for food policies to be better integrated across domains (environment, health, trade etc.) if they are to be effective in delivering greater justice and sustainability.

Apart from international levels, local food policy has emerged as a promising catalyst for food system change. An increasing number of municipalities and other local governments have developed integrated food system approaches, often comprising very concrete interventions that can have a direct impact on the daily lives of citizens and food chain actors, including farmers. There is significant potential for exchanging and diffusing these local governance approaches (several of which are included in our review of good practice examples in Chapter 7). More attention could also be paid to the various promising seeds of transformative change, including examples of effective leadership at all levels of governance and at all geographical scales. At the same time, there is a need for better coordination of local efforts within more integrated national and EU food system approaches.

Our review of specific policy instruments (Chapter 5) concludes that coercive instruments such as taxation and legislation are generally more effective than information campaigns or other interventions that increase awareness or educate the public but may not lead to desirable behavioural change. The Report highlights the many agents of change whose concerted action is required to effect a transition towards a more just and sustainable food system, also acknowledging their differential power to effect such system-wide change (Chapter 6).

Similarly, certification schemes and labelling policies now encompass a wide range of public and private actors, raising issues of consumer trust and protecting producers from freeriders who trade on misleading product information. The EU has a particularly strong

system of geographical indications (beyond those acknowleged by the WTO). These help address the homogenising tendencies associated with globalisation, supporting the rich mosaic of European food products and cultures while also having a significant role in the negotiation of international trade agreements. The proliferation of public and private labelling schemes increases the need for improved transparency and accountability (including the role of third-party certification and codifed standards). The development of new schemes might also be encouraged that combine information on environmental and health benefits.

Evidence suggests that combining different policy initiatives into synergetic policy mixes generally has greater impact than single measures on their own. The Danish wholegrain initiative (discussed on p.143) provides a good example, combining dietary guidance with product reformulation, communication and educational activities, effective marketing, monitoring and evaluation. Multi-level and multi-stakeholder initiatives around food have the potential to address multiple social, ecological and economic problems and coordinate multiple policies and interest groups. Despite the emphasis on policy mixes, the precise interactions between interventions, as well as with contextual conditions, remain largely unexplored and, as such, are an important avenue of future research.

Our review of the available evidence suggests that fact-based initiatives, designed to enhance consumer knowledge and raise awareness of sustainability issues, is a necessary but insufficient prerequisite to generating public understanding and engagement. Inducing positive behaviour change also requires changes to the 'choice architecture' and other elements of the food system, including work with food producers and manufacturers to address the wider food environment. More generally, a focus on 'consumer choice' and individual responsibility (at the household level) is likely to be insufficient in achieving wider system-level changes, given the fundamental information and power asymmetries that exist with the contemporary food system. Understanding what has been called the 'locus of responsibility' (Jackson, 2015) for environmental and food-related challenges is therefore a key issue (see also section 6.5, p.116 on responsible consumer behaviour).

8.4. Ways forward

The complexity of current food systems means that it is highly unlikely that any single actor (individual or institution) will be able to achieve even quite modest steps towards greater justice and sustainability (see Chapter 6). Concerted action is therefore required at multiple levels, involving coordination among a wide range of actors. The EU has the ability and responsibility to provide leadership in this area, acknowledging the role of

individual member-states and the range of initiatives being undertaken at more local (city and regional) levels.

Urgent action is required to meet the current challenges of food security and to advance towards a more just and sustainable food system addressing the challenges of the SDGs, including the changes to consumption and production patterns that are envisaged in SDG12. Our Report has reviewed the available evidence including a social scientific perspective on 'what works' in terms of specific policy instruments and interventions. Several examples of good practice have been identified at a range of scales, focusing on those that can be multiplied in other places or that are scalable to other levels (Chapter 7). But it is also important to acknowledge the social scientific literature on polycentric and multi-level forms of governance, which support a variety of approaches and are hesitant about the efficacy of overly centralised policies.

Evidence of the need for concerted action is overwhelming, but evidence of what works in practical policy terms is scarce and often limited to specific contexts. Critics might suggest that our report fails to provide a complete and clear answer to the question we were asked to address regarding "workable paths to deliver an inclusive, just and timely transition" to an EU sustainable food system. It is hard to make specific recommendations in the absence of more systematic evidence of what works, but we have been as explicit as the evidence allows in terms of how to improve policy integration, what stands in the way of adopting more joined-up thinking and a more consistent application of a systems approach — including the fragmented nature of the governance landscape and the power asymmetries that characterise the contemporary food system.

Based on existing social science research, we conclude that steps towards a more just and sustainable food system should be iterative and subject to careful evaluation of the steps taken. A social science perspective can help in understanding the compromises and trade-offs that the development of a more just and sustainable food system will require. We conclude that such a transition is achievable, but it will require coordination and political will.

Our Report also draws attention to the importance of polycentric and adaptive governance approaches (Chapters 3, 4 and 5). We acknowledge the uncertainty of knowledge, the contested nature of food sustainability goals, and the diversity of geographical contexts, interest groups and culinary heritage across Europe. Besides the emphasis on coordination and leadership, therefore, we have also provided evidence of the effectiveness of a range of more diffuse initiatives such as food sovereignty and slow food movements, urban food policy councils and other examples of more-or-less spontaneous good practice (Chapter 7). Leadership is needed, where existing policies, legislation and trade agreements have to be coordinated, harmful subsidies terminated and EU-wide taxation changes introduced — but local initiatives and national action also have their place, with an emphasis on experimentation, adaptive learning and a diversity of sustainability solutions.

References

Abrahamse, W., & Steg, L. (2013). Social influence approaches to encourage resource conservation: A meta-analysis. *Global Environmental Change, 23*(6), 1773-1785. doi:10.1016/j.gloenvcha.2013.07.029

Aceves Lara, C. A., Athès, V., Buche, P., Della Valle, G., Farines, V., Fonseca, F., . . . Trelea, I. C. (2018). The virtual food system: Innovative models and experiential feedback in technologies for winemaking, the cereals chain, food packaging and eco-designed starter production. *Innovative Food Science & Emerging Technologies, 46*, 54-64. doi:10.1016/j.ifset.2017.10.006

Agyeman, J., Bullard, R. D., & Evans, B. (Eds.). (2003). *Just sustainabilities: Development in an unequal world*: New York: MIT Press.

Ahlgren, S., & Di Lucia, L. (2014). Indirect land use changes of biofuel production – a review of modelling efforts and policy developments in the European Union. *Biotechnology for Biofuels, 7*(1), 35. doi:10.1186/1754-6834-7-35

Ajzen, I. (1991). The theory of planned behavior. *Organizational Behavior and Decision Processes, 50*, 179-211. doi:10.1016/0749-5978(91)90020-T

Alexander, P., & Houghton, K. (2012). The EU common fisheries policy in light of the precautionary principle. *Ocean & Coastal Management, 70*, 22–30. doi:10.1016/j.ocecoaman.2012.05.015

Alkon, A. H., & Agyeman, J. (2011). Introduction: The food movement as polyculture. In A. H. Alkon & J. Agyeman (Eds.), *Cultivating food justice: Race, class, and sustainability* (pp. 1-20). Cambridge, MA: MIT Press.

Allen, P. (2013). Facing food security. *Journal of Rural Studies, 29*, 135-138. doi:10.1016/j.jrurstud.2012.12.002

Allen, P. (2014). Divergence and convergence in alternative agrifood movements: Seeking a path forward. In D. H. Constance, M.-C. Renard, & M. G. Rivera-Ferre (Eds.), *Alternative agrifood movements: Patterns of convergence and divergence* (Vol. 21, pp. 49-68): Emerald Group Publishing Limited.

Alons, G. (2017). Environmental policy integration in the EU's Common Agricultural Policy: Greening or greenwashing? *Journal of European Public Policy, 24*(11), 1604-1622. doi:10.1080/13501763.2017.1334085

Amedzro St-Hilaire, W. (2018). *The multi-level perspectives of agribusiness*: World Scientific.

Amiot, C. E., El Hajj Boutros, G., Sukhanova, K., & Karelis, A. D. (2018). Testing a novel multicomponent intervention to reduce meat consumption in young men. *PLOS ONE, 13*(10), e0204590. doi:10.1371/journal.pone.0204590

Anderson, M. D. (2008). Rights-based food systems and the goals of food systems reform. *Agriculture and Human Values, 25*(4), 593. doi:10.1007/s10460-008-9151-z

Andreyeva, T., Kelly, I. R., & Harris, J. L. (2011). Exposure to food advertising on television: Associations with children's fast food and soft drink consumption and obesity. *Economics & Human Biology, 9*(3), 221-233. doi:10.1016/j.ehb.2011.02.004

ANR. (2018). ANR bakery. Retrieved from https://www6.inra.fr/bakery_eng/Home/Bakery

Ansell, C., & Vogel, D. (2006). *What's the beef? The contested governance of European food safety*. Cambridge, MA/London: MIT Press.

Armeni, C. (2015). Global experimentalist governance, international law and climate change technologies. *International and Comparative Law Quarterly, 64*(4), 875-904. doi:10.1017/S0020589315000408

Arnalte-Alegre, E., & Miranda, D. (2013). The 'southern model' of European agriculture revisited: Continuities and dynamics. In D. Ortiz-Miranda, A. Moragues-Faus, & E. Arnalte-Alegre (Eds.), *Agriculture in mediterranean Europe: Between old and new paradigms* (Vol. 19, pp. 37-74): Emerald Publishing.

Arno, A., & Thomas, S. (2016). The efficacy of nudge theory strategies in influencing adult dietary behaviour: A systematic review and meta-analysis. *BMC Public Health, 16*(1), 676. doi:10.1186/s12889-016-3272-x

Aschemann-Witzel, J., de Hooge, I. E., Rohm, H., Normann, A., Bossle, M. B., Grønhøj, A.,

& Oostindjer, M. (2017). Key characteristics and success factors of supply chain initiatives tackling consumer-related food waste – a multiple case study. *Journal of Cleaner Production*, *155*, 33-45. doi:10.1016/j.jclepro.2016.11.173

Aschemann, J., Hamm, U., Naspetti, S., & Zanoli, R. (2007). The organic market. In W. Lockeretz (Ed.), *Organic farming: An international history* (pp. 123-151). Wallingford: CABI.

Avelino, F. (2011). *Power in transition: Empowering discourses on sustainability transitions.* Erasmus University Rotterdam, Retrieved from http://hdl.handle.net/1765/30663

Bak, P., Tang, C., & Wiesenfeld, K. (1988). Self-organized criticality. *Physical Review A*, *38*(1), 364-374. doi:10.1103/PhysRevA.38.364

Balázs, B., Pataki, G., & Lazányi, O. (2016). Prospects for the future: Community supported agriculture in Hungary. *Futures*, *83*, 100-111. doi:10.1016/j.futures.2016.03.005

Bandura, A. (1977). *Social learning theory*. Englewood Cliffs: Prentice-Hall.

Bar, T., & Zheng, Y. (2019). 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

Barange, M., Bahri, T., Beveridge, M. C. M., Cochrane, K. L., Funge-Smith, S., & Poulain, F. (2018). *Impacts of climate change on fisheries and aquaculture: Synthesis of current knowledge, adaptation and mitigation options*. Retrieved from http://www.fao.org/3/i9705en/I9705EN.pdf

Barber, D. (2014). *The third plate: Field notes on the future of food*. New York: Penguin.

Barling, D. (2018). *Food agencies as an institutional response to policy failure by the UK and the EU. Qualities of food*. Manchester: Manchester University Press.

Barnes, S. J., & Mattsson, J. (2016). Understanding current and future issues in collaborative consumption: A four-stage Delphi study. *Technological Forecasting and Social Change*, *104*(C), 200-211. doi:10.1016/j.techfore.2016.01.006

Bauer, J. M., & Reisch, L. A. (2019). Behavioural insights and (un)healthy dietary choices: A review of current evidence. *Journal of Consumer Policy*, *42*, 3-45. doi:10.1007/s10603-018-9387-y

Baulcombe, D., Dunwell, J., Jones, J., Pickett, J., & Puigdomenech, P. (2014). *GM science update. A report to the council for science and technology*. Retrieved from https://www.gov.uk/government/publications/genetic-modification-gm-technologies

BDJ. (2018). Soft drinks levy: Sugar tax now in place. *British Dental Journal*, *224*(8), 565-566. doi:10.1038/sj.bdj.2018.323

Begotti, R., & Peres, C. (2019). Brazil's indigenous lands under threat. *Science*, *363*, 592.591-592. doi:10.1126/science.aaw3864

Béné, C., Oosterveer, P., Lamotte, L., Brouwer, I. D., de Haan, S., Prager, S. D., . . . Khoury, C. K. (2019). When food systems meet sustainability – current narratives and implications for actions. *World Development*, *113*, 116-130. doi:10.1016/j.worlddev.2018.08.011

Bennett, A. J., & O'Reilly, A. (2010). *Consumed: Rethinking business in the era of mindful spending*. New York: Palgrave Macmillan.

Benton, T. G. (2019). Using scenario analyses to address the future of food. *EFSA Journal*, *17*(S1), e170703. doi:10.2903/j.efsa.2019.e170703

Benton, T. G., & Bailey, R. (2019). The paradox of productivity: Agricultural productivity promotes food system inefficiency. *Global Sustainability*, *2*, e6. doi:10.1017/sus.2019.3

Bessière, J. (1998). Local development and heritage: Traditional food and cuisine as tourist attractions in rural areas. *Sociologia Ruralis*, *38*(1), 21-34. doi:10.1111/1467-9523.00061

Betzold, A., Carew, A. L., Lewis, G. K., & Lovell, H. (2018). The emergence, articulation and negotiation of a new food industry initiative in rural australia: Boundary object, organisation or triple helix model? Sociologia Ruralis, *58*(4), 867-885. doi:10.1111/soru.12211

Bexell, M., Tallberg, J., & Uhlin, A. (2010). Democracy in global governance: The promises and pitfalls of transnational actors. *Global Governance*, *16*(1), 81-101. Retrieved from https://www.jstor.org/stable/27800790

Biermann, F., Kanie, N., & Kim, R. E. (2017). Global governance by goal-setting: The novel approach of the UN sustainable

development goals. *Current Opinion in Environmental Sustainability, 26-27*, 26-31. doi:10.1016/j.cosust.2017.01.010

Biermann, F., Pattberg, P., van Asselt, H., & Zelli, F. (2009). The fragmentation of global governance architectures: A framework for analysis. *Global Environmental Politics, 9*(4), 14-40. doi:10.1162/glep.2009.9.4.14

Bilewicz, A., & Śpiewak, R. (2015). Enclaves of activism and taste: Consumer cooperatives in Poland as alternative food networks. *Socio.hu*, 145-166. doi:10.18030/socio.hu.2015en.145

Bilewicz, A., & Śpiewak, R. (2018). Beyond the "northern" and "southern" divide: Food and space in Polish consumer cooperatives. *East European Politics and Societies, 33*(3), 579-602. doi:10.1177/0888325418806046

Bíró, A. (2015). Did the junk food tax make the Hungarians eat healthier? *Food Policy, 54*, 107-115. doi:10.1016/j.foodpol.2015.05.003

Blay-Palmer, A. (2009). The Canadian pioneer: The genesis of urban food policy in Toronto. *International Planning Studies, 14*(4), 401-416. doi:10.1080/13563471003642837

Bock, B. B., Osti, G., & Ventura, F. (2016). Rural migration and new patterns of exclusion and integration in Europe. In M. Shucksmith & D. L. Brown (Eds.), *Routledge International Handbook of Rural Studies* (pp. 71-84). London/New York: Routledge.

Bødker, M., Pisinger, C., Toft, U., & Jorgensen, T. (2015). The Danish fat tax-effects on consumption patterns and risk of ischaemic heart disease. *Preventive Medicine, 77*, 200-203. doi:10.1016/j.ypmed.2015.03.031

Boltanski, L., & Thévenot, L. (2006). *On justification. Economies of worth*. Princeton: Princeton University Press.

Bosch, R., van de Pol, M., & Philp, J. (2015). Policy: Define biomass sustainability. *Nature, 523*(7562), 526-527. doi:10.1038/523526a

Bottura, M. (2017). *Bread is gold: Extraordinary meals with ordinary ingredients*. London: Phaidon Press.

Boysen, O., Jensen, H. G., & Matthews, A. (2016). Impact of EU agricultural policy on developing countries: A Uganda case study. *The Journal of International Trade & Economic Development, 25*(3), 377-402. doi:10.1080/09638199.2015.1069884

Brach, S., Walsh, G., & Shaw, D. (2018). Sustainable consumption and third-party certification labels: Consumers' perceptions and reactions. *European Management Journal, 36*(2), 254-265. doi:10.1016/j.emj.2017.03.005

Brand, U. (2016). Transformation as a new critical orthodoxy: The strategic use of the term transformation does not prevent multiple crises. *GAIA - Ecological Perspectives for Science and Society, 25*(1), 23-27. doi:10.14512/gaia.25.1.7

Bristow, G., & Healy, A. (2014). Building resilient regions: Complex adaptive systems and the role of policy intervention. *Raumforschung und Raumordnung, 72*, 93-102. doi:10.1007/s13147-014-0280-0

Broers, V. J. V., de Breucker, C., van den Broucke, S., & Luminet, O. (2017). A systematic review and meta-analysis of the effectiveness of nudging to increase fruit and vegetable choice. *European Journal of Public Health, 27*(5), 912-920. doi:10.1093/eurpub/ckx085

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

Brunori, G., & Galli, F. (2016). Sustainability of local and global food chains: Introduction to the special issue. *Sustainability, 8*(8), 765. doi:10.3390/su8080765

Brunori, G., Rossi, A., & Malandrin, V. (2011). Co-producing transition: Innovation processes in farms adhering to solidarity-based purchase groups (GAS) in Tuscany, Italy. *International Journal of Sociology of Agriculture and Food, 18*(1), 28-53.

Brzezina, N., Biely, K., Helfgott, A., Kopainsky, B., Vervoort, J., & Mathijs, E. (2017). Development of organic farming in Europe at the crossroads: Looking for the way forward through system archetypes lenses. *Sustainability, 9*(5), 821.

Brzezina, N., Kopainsky, B., & Mathijs, E. (2016). Can organic farming reduce vulnerabilities and enhance the resilience of the European food system? A critical assessment using system dynamics structural thinking tools. *Sustainability, 8*(10), 971.

Bui, S., Cardona, A., Lamine, C., & Cerf, M. (2016). Sustainability transitions: Insights on processes of niche-regime interaction and regime reconfiguration in agri-food systems. *Journal of Rural Studies, 48*, 92-103. doi:10.1016/j.jrurstud.2016.10.003

Buijzen, M., Schuurman, J., & Bomhof, E. (2007). The relation between television advertising and children's food consumption. *Psychologie & Gezondheid, 35*, 66-75.

Buijzen, M., Schuurman, J., & Bomhof, E. (2008). Associations between children's television advertising exposure and their food consumption patterns: A household diary-survey study. *Appetite, 50*, 231-239. doi:10.1016/j.appet.2007.07.006

Bulkeley, H., & Castán Broto, V. (2013). Government by experiment? Global cities and the governing of climate change. *Transactions of the Institute of British Geographers 38*(3), 361-375. doi:10.1111/j.1475-5661.2012.00535.x

Burch, D., & Lawrence, G. (2013). Financialization in agri-food supply chains: Private equity and the transformation of the retail sector. *Agriculture and Human Values, 30*(2), 247-258. doi:10.1007/s10460-012-9413-7

Busch, L. (2000). The moral economy of grades and standards. *Journal of Rural Studies, 16*, 273-283. doi:10.1016/S0743-0167(99)00061-3

Byerly, H., Balmford, A., Ferraro, P. J., Hammond Wagner, C., Palchak, E., Polasky, S., . . . Fisher, B. (2018). Nudging pro-environmental behavior: Evidence and opportunities. *Frontiers in Ecology and the Environment, 16*(3), 159-168. doi:10.1002/fee.1777

Camilleri, A. R., Larrick, R. P., Hossain, S., & Patino-Echeverri, D. (2019). Consumers underestimate the emissions associated with food but are aided by labels. *Nature Climate Change, 9*(1), 53-58. doi:10.1038/s41558-018-0354-z

Campos, S., Doxey, J., & Hammond, D. (2011). Nutrition labels on pre-packaged foods: A systematic review. *Public Health Nutrition, 14*(8), 1496-1506. doi:10.1017/S1368980010003290

Canali, M., Östergren, K., Amani, P., Aramyan, L., Sijtsema, S., Moates, G., . . . O'Connor, C. (2014). *Drivers of current food waste generation, threats of future increase and opportunities for reduction*. Retrieved from https://edepot.wur.nl/502827

Candel, J. J. L. (2014). Food security governance: A systematic literature review. *Food Security, 6*(4), 585-601. doi:10.1007/s12571-014-0364-2

Candel, J. J. L. (2016). *Putting food on the table: The European Union governance of the wicked problem of food security.* Wageningen University, Wageningen.

Candel, J. J. L., & Biesbroek, R. (2018). Policy integration in the EU governance of global food security. *Food Security: The Science, Sociology and Economics of Food Production and Access to Food, 10*(1), 195-209.

Candel, J. J. L., Breeman, G. E., Stiller, S. J., & Termeer, C. J. A. M. (2014). Disentangling the consensus frame of food security: The case of the EU Common Agricultural Policy reform debate. *Food Policy, 44*, 47-58. doi:10.1016/j.foodpol.2013.10.005

Candel, J. J. L., & Daugbjerg, C. (2019). Overcoming the dependent variable problem in studying food policy. *Food Security*. 12: 169–178. doi:10.1007/s12571-019-00991-2

Candel, J. J. L., & Pereira, L. (2017). Towards integrated food policy: Main challenges and steps ahead. *Environmental Science & Policy, 73*, 89-92. doi:10.1016/j.envsci.2017.04.010

Caraher, M., & Furey, S. (2017). *Is it appropriate to use surplus food to feed people in hunger? Short-term band-aid to more deep rooted problems of poverty*. Retrieved from https://foodresearch.org.uk/publications/is-it-appropriate-to-use-surplus-food-to-feed-people-in-hunger/

Carbonara, N., Giannoccaro, I., & McKelvey, B. (2010). Making geographical clusters more successful: Complexity-based policies. *Emergence: Complexity and Organization, 12*, 21-45.

Carlsson, B., & Stankiewicz, R. (1991). On the nature, function and composition of technological systems. *Journal of Evolutionary Economics, 1*(2), 93-118. doi:10.1007/BF01224915

Carolan, M. S. (2018). The promise of access. In M. S. Carolan (Ed.), *The food sharing revolution: How start-ups, pop-ups, and*

co-ops are changing the way we eat (pp. 55-69). Washington, DC: Island Press.

Cash, D. W., Adger, W. N., Berkes, F., Garden, P., Lebel, L., Olsson, P., . . . Young, O. (2006). Scale and cross-scale dynamics: Governance and information in a multilevel world. *Ecology and Society*, *11*(2). doi:10.5751/ES-01759-110208

Castán Broto, V., & Westman, L. (2017). Just sustainabilities and local action: Evidence from 400 flagship initiatives. *Local Environment*, *22*(5), 635-650. doi:10.1080/13549839.2016.1248379

Caswell, J. A., & Anders, S., M. (2011). Private versus third party versus government labeling. In J. L. Lusk, J. Roosen, & J. F. Shogren (Eds.), *The Oxford handbook of the economics of food consumption and policy*. Oxford: Oxford University Press.

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.12364

CFS. (2017). *Global strategic framework for food security and nutrition*. Retrieved from http://www.fao.org/3/a-mt648e.pdf

Chaiken, S. (1980). Heuristic versus systematic information processing and the use of source versus message cues in persuasion. *Journal of Personality and Social Psychology*, *39*, 752-766. doi:10.1037/0022-3514.39.5.752

Chandon, P., & Wansink, B. (2012). Does food marketing need to make us fat? A review and solutions. *Nutrition Reviews*, *70*(10), 571-593. doi:10.1111/j.1753-4887.2012.00518.x

Chaudhury, S. R., & Albinsson, P. A. (2015). Citizen-consumer oriented practices in naturalistic foodways: The case of the slow food movement. *Journal of Macromarketing*, *35*(1), 36-52. doi:10.1177/0276146714534264

Chen, X., & Yang, X. (2014). Does food environment influence food choices? A geographical analysis through "tweets". *Applied Geography*, *51*, 82-89. doi:10.1016/j.apgeog.2014.04.003

Cheung, W. W. L., Lam, V. W. Y., Sarmiento, J. L., Kearney, K., Watson, R., Zeller, D., & Pauly, D. (2010). Large-scale redistribution of maximum fisheries catch potential in the global ocean under climate change. *Global Change Biology*, *16*(1), 24-35. doi:10.1111/j.1365-2486.2009.01995.x

Chirita, A. D. (2010). Undistorted, un(fair) competition, consumer welfare and the interpretation of article 102 TFEU. *World Competition Law and Economics Review*, *33*(3), 417-436.

Ciaghi, A., & Villafiorta, A. (2016). *Beyond food sharing: Supporting food waste reduction with ICTs*. Paper presented at the IEEE International Smart Cities Conference, Trento, Italy.

Ciaian, P., Kancs, d. A., & Espinosa, M. (2018). The impact of the 2013 CAP reform on the decoupled payments' capitalisation into land values. *Journal of Agricultural Economics*, *69*(2), 306-337. doi:10.1111/1477-9552.12253

Cialdini, R. B., Reno, R. R., & Kallgren, C. A. (1990). A focus theory of normative conduct: Recycling the concept of norms to reduce littering in public places. *Journal of Personality and Social Psychology*, *58*, 1015-1026. doi:10.1037/0022-3514.58.6.1015

Ciulli, F., Kolk, A., & Boe-Lillegraven, S. (2019). Circularity brokers: Digital platform organizations and waste recovery in food supply chains. *Journal of Business Ethics*, 1-33. doi:10.1007/s10551-019-04160-5

Claeys, P. (2015). Food sovereignty and the recognition of new rights for peasants at the UN: A critical overview of la via campesina's rights claims over the last 20 years. *Globalizations*, *12*(4), 452-465. doi:10.1080/14747731.2014.957929

Clapp, J. (2014). Financialization, distance and global food politics. *The Journal of Peasant Studies*, *41*(5), 797-814. doi:10.1080/03066150.2013.875536

Clapp, J., & Murphy, S. (2013). The G20 and food security: A mismatch in global governance? *Global Policy*, *4*(2), 129-138. doi:10.1111/1758-5899.12039

Cohen, L. (2003). *A consumers' republic: The politics of mass consumption in postwar America*. New York: Vintage.

Cohen, M. J. (2013). Collective dissonance and the transition to post-consumerism. *Futures*, *52*, 42-51. doi:10.1016/j.futures.2013.07.001

Colchero, M. A., Popkin, B. M., Rivera, J. A., & Ng, S. W. (2016). Beverage purchases from stores in Mexico under the excise tax on sugar sweetened beverages: Observational

study. *The BMJ*, *352*, h6704. doi:10.1136/bmj.h6704

Cole, D. H. (2015). Advantages of a polycentric approach to climate change policy. *Nature Climate Change*, *5*(2), 114-118. doi:10.1038/nclimate2490

Coley, D., Howard, M., & Winter, M. (2009). Local food, food miles and carbon emissions: A comparison of farm shop and mass distribution approaches. *Food Policy*, *34*(2), 150-155. doi:10.1016/j.foodpol.2008.11.001

Community of Ede. (2015). *Visie food! De food visie van ede, in utivoering 2015-2020*. Retrieved from http://www.voedselbijgeldersegemeenten.nl/file.php/397/VisieFood%21%20Ede.pdf

Comune Milano. (2015). *Linee di indirizzo della food policy di milano 2015-2020*. Retrieved from https://web.comune.milano.it/wps/portal/ist/st/food_policy_milano/la_food_policy_di_milano

Corbo, C., & Fraticelli, F. (2015). The use of web-based technology as an emerging option for food waste reduction. In L. Escajedo San-Epifanio & M. De Renobales Scheifler (Eds.), *Envisioning a future without food waste and food poverty* (pp. 133-142). Wageningen, NL: Wageningen Academic Publishers.

Costello, C., Cao, L., Gelcich, S., & High Level Panel for A Sustainable Ocean Economy. (2019). *The future of food from the sea*. Retrieved from www.oceanpanel.org/future-food-sea

Craddock, S., & Hinchliffe, S. (2015). One world, one health? Social science engagements with the one health agenda. *Social Science & Medicine*, *129*, 1-4. doi:10.1016/j.socscimed.2014.11.016

Csurgó, B., Kovách, I., & Kučerová, E. (2008). Knowledge, power and sustainability in contemporary rural Europe. *Sociologia Ruralis*, *48*(3), 292-312. doi:10.1111/j.1467-9523.2008.00461.x

Cuéllar-Padilla, M., & Ganuza-Fernandez, E. (2018). We don't want to be officially certified! Reasons and implications of the participatory guarantee systems. *Sustainability*, *10*(4), 1142. doi:10.3390/su10041142

Dabbert, S., Haring, A. M., & Zanoli, R. (2004). *Organic farming: Policies and prospects*. London: Zed Books.

Danish Cancer Society. (2019). Danish population likes whole-grain – and this is good for health [danskerne er galde for fuldkorn – g det er godt for sundheden]. *Newsletter*. Retrieved from https://www.cancer.dk/nyheder/danskerne-er-glade-for-fuldkorn-og-det-er-godt-for-sundheden/

Darnall, N., Ji, H., & Vázquez-Brust, D. A. (2018). Third-party certification, sponsorship, and consumers' ecolabel use. *Journal of Business Ethics*, *150*, 953-969. doi:10.1007/s10551-016-3138-2

Darnhofer, I., D'Amico, S., & Fouilleux, E. (2019). A relational perspective on the dynamics of the organic sector in Austria, Italy, and France. *Journal of Rural Studies*, *68*, 200-212. doi:10.1016/j.jrurstud.2018.12.002

Daugbjerg, C. (1999). Reforming the CAP: Policy networks and broader institutional structures. *Journal of Common Market Studies*, *37*(3), 407-428. doi:10.1111/1468-5965.00171

Daugbjerg, C., & Feindt, P. H. (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

Daugbjerg, C., & Sønderskov, K. M. (2012). Environmental policy performance revisited: Designing effective policies for green markets. *Political Studies*, *60*, 399-418. doi:10.1111/j.1467-9248.2011.00910.x

Daugbjerg, C., & Swinbank, A. (2008). Curbing agricultural exceptionalism: The EU's response to external challenge. *World Economy*, *31*(5), 631-652. doi:10.1111/j.1467-9701.2008.01097.x

Daugbjerg, C., & Swinbank, A. (2016). Three decades of policy layering and politically sustainable reform in the European Union's agricultural policy. *Governance*, *29*(2), 265-280. doi:10.1111/gove.12171

Davies, A. (2019a). Redistributing surplus food: Interrogating the collision of waste and justice. In N. Cook & N. Butz (Eds.), *Mobilities, mobility justice and social justice* (pp. 250-262). London: Routledge.

Davies, A. (2019b). *Urban food sharing : Rules, tools and networks*. Bristol: Policy Press.

Davies, A., & Evans, D. (2019). Urban food sharing: Emerging geographies of production, consumption and exchange. *Geoforum, 99*, 154-159. doi:10.1016/j.geoforum.2018.11.015

Davies, A. R. (2012). *Enterprising communities: Grassroots sustainability innovations*. London: Emerald Publishing.

Davies, A. R. (2013). Cleantech clusters: Transformational assemblages for a just, green economy or just business as usual? *Global Environmental Change, 23*(5), 1285-1295. doi:10.1016/j.gloenvcha.2013.07.010

Davies, A. R. (2014). Co-creating sustainable eating futures: Technology, ICT and citizen–consumer ambivalence. *Futures, 62*, 181-193. doi:10.1016/j.futures.2014.04.006

Davies, A. R., & Doyle, R. (2015). Transforming household consumption: From backcasting to homelabs experiments. *Annals of the Association of American Geographers, 105*(2), 425-436. doi:10.1080/00045608.2014.1000948

Davies, A. R., Edwards, F., Marovelli, B., Morrow, O., Rut, M., & Weymes, M. (2017). Making visible: Interrogating the performance of food sharing across 100 urban areas. *Geoforum, 86*, 136-149. doi:10.1016/j.geoforum.2017.09.007

Davies, A. R., Fahy, F., & Rau, H. (Eds.). (2015). *Challenging consumption: Pathways to a more sustainable future* (1 ed.): Routledge.

Davies, A. R., Franck, V., & Cretella, A. (2019). Regulating urban food sharing: Policy, practice and food democracy goals. *Politics and Governance, 7*(4), 8-20. doi:10.17645/pag.v7i4.2090

Davies, A. R., & Legg, R. (2018). Fare sharing: Interrogating the nexus of ICT, urban food sharing, and sustainability. *Food, Culture & Society, 21*(2), 233-254. doi:10.1080/15528014.2018.1427924

Davis, J. N., Spaniol, M. R., & Somerset, S. (2015). Sustenance and sustainability: Maximizing the impact of school gardens on health outcomes. *Public Health Nutrition, 18*(13), 2358-2367. doi:10.1017/s1368980015000221

de Besi, M., & McCormick, K. (2015). Towards a bioeconomy in Europe: National, regional and industrial strategies. *Sustainability, 7*(8), 10461-10478. doi:10.3390/su70810461

de Boer, I. J. M., & van Ittersum, M. K. (2018). *Circularity in agricultural production*. Retrieved from https://www.wur.nl/upload_mm/7/5/5/14119893-7258-45e6-b4d0-e514a8b6316a_Circularity-in-agricultural-production-20122018.pdf

de Búrca, G., Keohane, R. O., & Sabel, C. (2014). Global experimentalist governance. *British Journal of Political Science, 44*(3), 477-486. doi:10.1017/S0007123414000076

de Cara, S., & Vermont, B. (2011). Policy considerations for mandating agriculture in a greenhouse gas emissions trading scheme: A comment. *Applied Economic Perspectives and Policy, 33*(4), 661-667. doi:10.1093/aepp/ppr027

de Moor, T. (2008). The silent revolution: A new perspective on the emergence of commons, guilds, and other forms of corporate collective action in Western Europe. *International Review of Social History, 53*(S16), 179-212. doi:10.1017/S0020859008003660

de Oliveira, U. R., Espindola, L. S., da Silva, I. R., da Silva, I. N., & Rocha, H. M. (2018). A systematic literature review on green supply chain management: Research implications and future perspectives. *Journal of Cleaner Production, 187*, 537-561. doi:10.1016/j.jclepro.2018.03.083

de Roest, K., Ferrari, P., & Knickel, K. (2018). Specialisation and economies of scale or diversification and economies of scope? Assessing different agricultural development pathways. *Journal of Rural Studies, 59*, 222-231. doi:10.1016/j.jrurstud.2017.04.013

de Schutter, O. (2014). The reform of the Committee on World Food Security: The quest for coherence in global governance. In N. C. S. Lambek, P. Claeys, A. Wong, & L. Brilmayer (Eds.), *Rethinking food systems: Structural challenges, new strategies and the law* (pp. 219-238). Dordrecht: Springer Netherlands.

de Ville, F., & Siles-Brügge, G. (2017). Why TTIP is a game-changer and its critics have a point. *Journal of European Public Policy, 24*(10), 1491-1505. doi:10.1080/13501763.2016.1254273

de Vries, H. (2017). Some thoughts about the bio-economy as intelligently navigated

complex adaptive systems. In Dabbert, S., Lewandowski, I., Weiss, J., & Pyka, A. (Eds.), *Knowledge-driven developments in bioeconomy: Technological and economic perspectives* (pp. 33-55). Switzerland: Springer International Publishing.

de Vries, H., Axelos, M. A. V., Sarni-Manchado, P., & O'Donohue, M. (2018). Meeting new challenges in food science technology: The development of complex systems approach for food and biobased research. *Innovative Food Science & Emerging Technologies*, *46*, 1-6. doi:10.1016/j.ifset.2018.04.004

Delaney, A., Evans, T., McGreevy, J., Blekking, J., Schlachter, T., Korhonen-Kurki, K., . . . Rist, S. (2018). Governance of food systems across scales in times of social-ecological change: A review of indicators. *Food Security*, *10*(2), 287-310. doi:10.1007/s12571-018-0770-y

Delormier, T., Frohlich, K. L., & Potvin, L. (2009). Food and eating as social practice - understanding eating patterns as social phenomena and implications for public health. *Sociology of Health and Illness*, *31*(2), 215-228. doi:10.1111/j.1467-9566.2008.01128.x

Devaney, L., & Davies, A. R. (2017). Disrupting household food consumption through experimental homelabs: Outcomes, connections, contexts. *Journal of Consumer Culture*, *17*(3), 823-844. doi:10.1177/1469540516631153

Di Cesare, M., Bentham, J., Stevens, G., Ruhli, F., Staub, K., Faeh, D., . . . NCD Risk Factor Collaboration. (2016). Trends in adult body-mass index in 200 countries from 1975 to 2014: A pooled analysis of 1698 population-based measurement studies with 19·2 million participants. *The Lancet*, *387*(10026), 1377-1396.

di Corato, L., & Brady, M. V. (2019). Passive farming and land development: A real options approach. *Land Use Policy*, *80*, 32-46. doi:10.1016/j.landusepol.2018.09.029

Dickson-Spillmann, M., & Siegrist, M. (2011). Consumers' knowledge of healthy diets and its correlation with dietary behaviour. *Journal of Human Nutrition and Dietetics*, *24*(1), 54-60. doi:10.1111/j.1365-277X.2010.01124.x

Doherty, R., Ensor, J. E., Heron, T., & Prado Rios, P. A. D. (2019). Food systems resilience. *Emerald Open Research*, *1*(4). doi:10.12688/emeraldopenres.12850.1

Dowd, K., & Burke, K. J. (2013). The influence of ethical values and food choice motivations on intentions to purchase sustainably sourced foods. *Appetite*, *69*, 137-144. doi:10.1016/j.appet.2013.05.024

Dowler, E. A., & O'Connor, D. (2012). Rights-based approaches to addressing food poverty and food insecurity in Ireland and uk. *Social Science & Medicine*, *74*(1), 44-51. doi:10.1016/j.socscimed.2011.08.036

Drimie, S., Arntzen, J., Dube, O. P., Ingram, J., Mano, R., Mataya, C., . . . Ziervogel, G. (2011). Global environmental change and food systems in southern Africa: The dynamic challenges facing regional policy. *Journal of Geography and Regional Planning*, *4*, 169-182.

Dubuisson-Quellier, S., Lamine, C., & Le Velly, R. (2011). Citizenship and consumption: Mobilisation in alternative food systems in France. *Sociologia Ruralis*, *51*(3), 304-323. doi:10.1111/j.1467-9523.2011.00540.x

Dudefoi, W., Villares, A., Peyron, S., Moreau, C., Ropers, M.-H., Gontard, N., & Cathala, B. (2018). Nanoscience and nanotechnologies for biobased materials, packaging and food applications: New opportunities and concerns. *Innovative Food Science & Emerging Technologies*, *46*, 107-121. doi:10.1016/j.ifset.2017.09.007

Duncan, J. (2015). "Greening" global food governance. *Canadian Food Studies / La Revue Canadienne Des études Sur L'alimentation*, *2*(2), 335-344. doi:.org/10.15353/cfs-rcea.v2i2.104

Duncan, J., & Barling, D. (2012). Renewal through participation in global food security governance: Implementing the international food security and nutrition civil society mechanism to the Committee on World Food Security. *International Journal of Sociology of Agriculture and Food*, *19*(2), 143-161.

Dupuis, J., & Knoepfel, P. (2013). The adaptation policy paradox: The implementation deficit of policies framed as climate change adaptation. *Ecology and Society*, *18*, 31. doi:10.5751/es-05965-180431

Duru, M., Therond, O., & Fares, M. h. (2015). Designing agroecological transitions. A review. *Agronomy for Sustainable*

Development, *35*(4), 1237-1257. doi:10.1007/s13593-015-0318-x

Dyck, B. (1994). Build in sustainable development and they will come: A vegetable field of dreams. *Journal of Organizational Change Management*, *7*(4), 47-63. doi:10.1108/09534819410061379

Eakin, H., Connors, J. P., Wharton, C., Bertmann, F., Xiong, A., & Stoltzfus, J. (2017). Identifying attributes of food system sustainability: Emerging themes and consensus. *Agriculture and Human Values*, *34*(3), 757-773. doi:10.1007/s10460-016-9754-8

EASAC. (2018). *Opportunities for soil sustainability in Europe*. Retrieved from https://easac.eu/fileadmin/PDF_s/reports_statements/EASAC_Soils_complete_Web-ready_210918.pdf

EAT-Lancet Commission. (2018). *Summary report of the EAT-Lancet Commission: Healthy diets from sustainable food systems*. Retrieved from https://eatforum.org/content/uploads/2019/07/EAT-Lancet_Commission_Summary_Report.pdf

EC FOOD 2030 Expert Group. (2018). *Recipe for change: An agenda for a climate-smart and sustainable food system for a healthy Europe*. Retrieved from https://op.europa.eu/en/publication-detail/-/publication/d0c725de-6f7c-11e8-9483-01aa75ed71a1/language-en

EcoBioCAP. (2015). *Final report summary*. Retrieved from https://cordis.europa.eu/project/id/265669/reporting/fr

ECORYS. (2014). *Food taxes and their impact on competitiveness in the agri-food sector*. Retrieved from https://ec.europa.eu/growth/content/food-taxes-and-their-impact-competitiveness-agri-food-sector-study-0_en

Edwards-Jones, G., Milà i Canals, L., Hounsome, N., Truninger, M., Koerber, G., Hounsome, B., . . . Jones, D. L. (2008). Testing the assertion that 'local food is best': The challenges of an evidence-based approach. *Trends in Food Science & Technology*, *19*(5), 265-274. doi:10.1016/j.tifs.2008.01.008

Edwards, F., & Davies, A. R. (2018). Connective consumptions: Mapping Melbourne's food sharing ecosystem. *Urban Policy and Research*, *36*(4), 476-495. doi:10.1080/08111146.2018.1476231

EEA. (2017). *Food in a green light: A systems approach to sustainable food*. Retrieved from https://www.eea.europa.eu/publications/food-in-a-green-light

El Bilali, H. (2018). Transition heuristic frameworks in research on agro-food sustainability transitions. *Environment, Development and Sustainability*, 1-36. doi:10.1007/s10668-018-0290-0

El Bilali, H. (2019). Research on agro-food sustainability transitions: A systematic review of research themes and an analysis of research gaps. *Journal of Cleaner Production*, *221*, 353-364. doi:10.1016/j.jclepro.2019.02.232

Ellen MacArthur Foundation. (2015). *Growth within: A circular economy vision for a competitive Europe*. Retrieved from https://www.ellenmacarthurfoundation.org/publications/growth-within-a-circular-economy-vision-for-a-competitive-Europe

Ericksen, P. J. (2008). Conceptualizing food systems for global environmental change research. *Global Environmental Change*, *18*(1), 234-245. doi:10.1016/j.gloenvcha.2007.09.002

Ericksen, P. J., Ingram, J. S. I., & Liverman, D. M. (2009). Food security and global environmental change: Emerging challenges. *Environmental Science & Policy*, *12*(4), 373-377. doi:10.1016/j.envsci.2009.04.007

Estrela, T., & Vargas, E. (2012). Drought management plans in the European Union. The case of Spain. *Water Resources Management*, *26*(6), 1537-1553. doi:10.1007/s11269-011-9971-2

European Commission. (1997). *Rural developments*. Retrieved from https://ec.europa.eu/agriculture/publi/pac2000/rd/rd_en.pdf

European Commission. (2014a). *The economic impact of modern retail on choice and innovation in the EU food sector*. Retrieved from https://ec.europa.eu/competition/publications/KD0214955ENN.pdf

European Commission. (2014b). *A policy framework for climate and energy in the period from 2020 to 2030*. Retrieved from https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX:52014DC0015

European Commission. (2016). *Food loss and waste platform: Terms of reference*.

Retrieved from https://ec.europa.eu/food/sites/food/files/safety/docs/fw_eu-actions_flw-platform_tor.pdf

European Commission. (2017). *Modernising and simplifying the CAP: Economic challenges facing EU agriculture*. Retrieved from https://ec.europa.eu/info/sites/info/files/food-farming-fisheries/key_policies/documents/eco_background_final_en.pdf

European Commission. (2018). *Policies and interventions to improve the nutritional intake and physical activity levels of Europeans. Review of scientific evidence and policies on nutrition and physical activity-objective a2: Effectiveness and efficiency of policies and interventions on diet and physical activity. Summary report*. Retrieved from https://ec.europa.eu/health/sites/health/files/nutrition_physical_activity/docs/2019_sciview_a2_sr_en.pdf

European Commission. (2019a). *Reflection paper – towards a sustainable Europe by 2030*. Retrieved from https://ec.europa.eu/commission/sites/beta-political/files/rp_sustainable_Europe_30-01_en_web.pdf

European Commission. (2019b). *Synthesis of existing food systems studies and research projects in Europe*. Retrieved from https://op.europa.eu/en/publication-detail/-/publication/84096f43-9d3c-11e9-9d01-01aa75ed71a1/language-en

European Environment Agency. (2019). *Climate change adaptation in the agricultural sector in Europe*. Retrieved from https://www.eea.europa.eu/publications/cc-adaptation-agriculture

Eurostat. (2018). Statistics on rural areas in the EU. Retrieved from http: // ec. europa. eu/ eurostat/ statistics-explained/ index. php/ Statistics_ on_ rural_ areas_ in_ the_ EU.

Evans, D. (2011). Blaming the consumer – once again: The social and material contexts of everyday food waste practices in some English households. *Critical Public Health, 21*(4), 429-440. doi:10.1080/09581596.2011.608797

Evans, D. (2014). *Food waste. Home comsumption, material culture and everyday life*: London: Bloomsbury Academic.

Evans, G. W., Jones-Rounds, M. L., Belojevic, G., & Vermeylen, F. (2012). Family income and childhood obesity in eight European cities: The mediating roles of neighborhood characteristics and physical activity. *Social Science & Medicine, 75*(3), 477-481. doi:10.1016/j.socscimed.2012.03.037

Fair trade International. (2018). *Monitoring the scope and benefits of Fair trade - ninth edition*. Retrieved from https://www.fairtrade.net/fileadmin/user_upload/content/Fair tradeMonitoringReport_9thEdition_lores.pdf

Falcone, P. M., & Imbert, E. (2017). Bringing a sharing economy approach into the food sector: The potential of food sharing for reducing food waste. In P. Morone, F. Papendiek, & V. E. Tartiu (Eds.), *Food waste reduction and valorisation*. Cham: Springer International Publishing.

Fanin, N., Gundale, M. J., Farrell, M., Ciobanu, M., Baldock, J. A., Nilsson, M.-C., . . . Wardle, D. A. (2018). Consistent effects of biodiversity loss on multifunctionality across contrasting ecosystems. *Nature Ecology & Evolution, 2*(2), 269-278. doi:10.1038/s41559-017-0415-0

FAO. (1996). Rome declaration of world food security. Retrieved from http://www.fao.org/3/w3613e/w3613e00.htm

FAO. (2005). *Voluntary guidelines to support the progressive realization of the right to adequate food in the context of national food security*. Retrieved from http://www.fao.org/3/a-y7937e.pdf

FAO. (2006a). *Livestock's long shadow: Environmental issues and options*. Retrieved from http://www.fao.org/3/a-a0701e.pdf

FAO. (2006b). *The right to food guidelines: Information papers and case studies*. Retrieved from http://www.fao.org/right-to-food/resources/resources-detail/en/c/46220/

FAO. (2009). How to feed the world in 2050. Retrieved from http://www.fao.org/fileadmin/templates/wsfs/docs/expert_paper/How_to_Feed_the_World_in_2050.pdf

FAO. (2014). *The water-energy-food nexus: A new approach in support of food security and sustainable agriculture*. Retrieved from http://www.fao.org/3/a-bl496e.pdf

FAO. (2017). *The future of food and agriculture – trends and challenges.* Retrieved from http://www.fao.org/3/a-i6583e.pdf

FAO. (2018a). *The future of food and agriculture – alternative pathways to 2050*. Retrieved

from http://www.fao.org/3/CA1553EN/ca1553en.pdf

FAO. (2018b). *Strengthening sector policies for better food security and nutrition results: Public food procurement*. Retrieved from http://www.fao.org/policy-support/resources/resources-details/en/c/1175509/

FAO. (2018c). *Transforming food and agriculture to achieve the SDGs*. Retrieved from http://www.fao.org/publications/transforming-food-agriculture-to-achieve-sdg/en/

FAO. (2019). *The state of food and agriculture 2019. Moving forward on food loss and waste reduction*. Retrieved from http://www.fao.org/3/ca6030en/ca6030en.pdf

FAO, IFAD, UNICEF, WFP, & WHO. (2017). *The state of food security and nutrition in the world 2017. Building resilience for peace and food security*. Retrieved from https://www.wfp.org/publications/2017-state-food-security-and-nutrition-world-sofi-report

FAO, IFAD, UNICEF, WFP, & WHO. (2018). *The state of food security and nutrition in the world 2018: Building climate resilience for food security and nutrition*. Retrieved from http://www.fao.org/state-of-food-security-nutrition/2018/en/

FAO, IFAD, UNICEF, WFP, & WHO. (2019). *The state of food security and nutrition in the world 2019. Safeguarding against economic slowdowns and downturns*. Retrieved from https://www.wfp.org/publications/2019-state-food-security-and-nutrition-world-sofi-safeguarding-against-economic

FAO, IFAD, & WFP. (2015). *The state of food insecurity in the world 2015. Meeting the 2015 international hunger targets: Taking stock of uneven progress*. Retrieved from ttp://www.fao.org/3/a-i4646e.pdf

Farr-Wharton, G., Choi, J. H. J., & Foth, M. (2014). *Food talks back: Exploring the role of mobile applications in reducing domestic food wastage.* Paper presented at the 26th Australian Computer-human Interaction Conference on Designing Futures: the Future of Design., Sydney, Australia.

Farsund, A. A., Daugbjerg, C., & Langhelle, O. (2015). Food security and trade: Reconciling discourses in the food and agriculture organization and the world trade organization. *Food Security, 7*(2), 383-391. doi:10.1007/s12571-015-0428-y

Fassio, F., & Tecco, N. (2019). Circular economy for food: A systemic interpretation of 40 case histories in the food system in their relationships with SDGs. *Systems, 7*(3), 43. doi:10.3390/systems7030043

Fazio, R. H. (1990). Multiple processes by which attitudes guide behavior: The MODE model as an integrative framework. *Advances in Experimental Social Psychology, 23*, 75-109. doi:10.1016/S0065-2601(08)60318-4

Feenstra, G. (2002). Creating space for sustainable food systems: Lessons from the field. *Agriculture and Human Values, 19*(2), 99-106. doi:10.1023/A:1016095421310

Feichtinger, P., & Salhofer, K. (2016). The Fischler reform of the Common Agricultural Policy and agricultural land prices. *Land Economics, 92*(3), 411-432. doi:10.3368/le.92.3.411

Feindt, P. H. (2010). Policy-learning and environmental policy integration in the Common Agricultural Policy, 1973-2003. *Public Administration, 88*(2), 296-314. doi:10.1111/j.1467-9299.2010.01833.x

Fendrychová, L., & Jehlička, P. (2018). Revealing the hidden geography of alternative food networks: The travelling concept of farmers' markets. *Geoforum, 85*, 1-10. doi:10.1016/j.geoforum.2018.06.012

Ferrando, T., & Lombardi, C. (2019). *EU competition law and sustainability in food systems: Addressing the broken links*. Retrieved from http://www.responsibleglobalvaluechains.org/images/PDF/FTAO_-_EU_Competition_Law_and_Sustainability_in_Food_Systems_Addressing_the_Broken_Links_2019.pdf

Ferrari, L., Cavaliere, A., de Marchi, E., & Banterle, A. (2019). Can nudging improve the environmental impact of food supply chain? A systematic review. *Trends in Food Science & Technology, 91*, 184-192. doi:10.1016/j.tifs.2019.07.004

Festinger, L. (1954). A theory of social comparison processes. *Human Relations, 7*(2), 117-140. doi:10.1177/001872675400700202

Field, C. B., Barros, V., Stocker, T. F., & Dahe, Q. (2012). *Managing the risks of extreme events and disasters to advance climate*

change adaptation: Special report of the Intergovernmental Panel on Climate Change. Retrieved from https://www.ipcc.ch/report/managing-the-risks-of-extreme-events-and-disasters-to-advance-climate-change-adaptation/

Filimonau, V., Lemmer, C., Marshall, D., & Bejjani, G. (2017). 'Nudging' as an architect of more responsible consumer choice in food service provision: The role of restaurant menu design. *Journal of Cleaner Production*, *144*, 161-170. doi:10.1016/j.jclepro.2017.01.010

Fitzmaurice, C., & Schor, J. B. (2018). Homemade matters: Logics of opposition in a failed food swap. *Social Problems*, *66*(1), 144-161. doi:10.1093/socpro/spx046

Flyvbjerg, B. (2006). Five misunderstandings about case-study research. *Qualitative Inquiry*, *12*(2), 219-245. doi:10.1177/1077800405284363

Foden, M., Browne, A. L., Evans, D. M., Sharp, L., & Watson, M. (2018). The water–energy–food nexus at home: New opportunities for policy interventions in household sustainability. *Geographical Journal*, *185*(4), 406-418. doi:10.1111/geoj.12257

Folke, C., Carpenter, S., Walker, B., Scheffer, M., & Rockström, J. (2010). Resilience thinking: Integrating resilience, adaptability and transformability. *Ecology and Society*, *15*, 20.

Folke, C., Hahn, T., Olsson, P., & Norberg, J. (2005). Adaptive governance of social-ecological systems. *Annual Review of Environment and Resources*, *30*(1), 441-473. doi:10.1146/annurev.energy.30.050504.144511

Fonte, M. (2013). Food consumption as social practice: Solidarity purchasing groups in rome, Italy. *Journal of Rural Studies*, *32*, 230–239. doi:10.1016/j.jrurstud.2013.07.003

Foran, T., Butler, J. R. A., Williams, L. J., Wanjura, W. J., Hall, A., Carter, L., & Carberry, P. S. (2014). Taking complexity in food systems seriously: An interdisciplinary analysis. *World Development*, *61*, 85-101. doi:10.1016/j.worlddev.2014.03.023

Ford, C. (2011). Policymaking at the edge of chaos. *E-International Relations, Feb 7*. Retrieved from https://www.e-ir.info/2011/02/07/policymaking-at-the-edge-of-chaos/

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

Fox, K. (2016). Foodcloud: New app proves a nourishing idea for wasted food. *The Guardian*. Retrieved from https://www.theguardian.com/environment/2016/dec/04/new-app-proves-a-nourishing-idea-for-wasted-food-foodcloud

Freijer, K., Tan, S. S., Koopmanschap, M. A., Meijers, J. M., Halfens, R. J., & Nuijten, M. J. (2013). The economic costs of disease related malnutrition. *Clinical Nutrition*, *32*(1), 136-141. doi:10.1016/j.clnu.2012.06.009

Fresco, L. O. (2009). Challenges for food system adaptation today and tomorrow. *Environmental Science & Policy*, *12*(4), 378-385. doi:10.1016/j.envsci.2008.11.001

Fresco, L. O., & Poppe., K. J. (2016). *Towards a common agricultural and food policy*. Wageningen: Wageningen University.

Frewer, L. J., Bergmann, K., Brennan, M., Lion, R., Meertens, R., Rowe, G., . . . Vereijken, C. (2011). Consumer response to novel agri-food technologies: Implications for predicting consumer acceptance of emerging food technologies. *Trends in Food Science & Technology*, *22*(8), 442-456. doi:10.1016/j.tifs.2011.05.005

Frewer, L. J., van der Lans, I. A., Fischer, A. R. H., Reinders, M. J., Menozzi, D., Zhang, X., . . . Zimmermann, K. L. (2013). Public perceptions of agri-food applications of genetic modification – a systematic review and meta-analysis. *Trends in Food Science & Technology*, *30*(2), 142-152. doi:10.1016/j.tifs.2013.01.003

Friedmann, H. (2007). Scaling up: Bringing public institutions and food service corporations into the project for a local, sustainable food system in ontario. *Agriculture and Human Values*, *24*(3), 389-398. doi:10.1007/s10460-006-9040-2

Friedmann, H., & McMichael, P. (1989). Agriculture and the state system: The rise and decline of national agricultures, 1870 to the present. *Sociologia Ruralis*, *29*(2), 93-117. doi:10.1111/j.1467-9523.1989.tb00360.x

Friel, S., Hattersley, L., Snowdon, W., Thow, A. M., Lobstein, T., Sanders, D., . . . Walker,

C. (2013). Monitoring the impacts of trade agreements on food environments. *Obesity Reviews*, *14*, 120-134. doi:10.1111/obr.12081

Froese, R., Winker, H., Coro, G., Demirel, N., Tsikliras, A. C., Dimarchopoulou, D., . . . Matz-Lück, N. (2018). Status and rebuilding of European fisheries. *Marine Policy*, *93*, 159-170. doi:10.1016/j.marpol.2018.04.018

Frykfors, C.-O., & Jönsson, H. (2010). Reframing the multilevel triple helix in a regional innovation system: A case of systemic foresight and regimes in renewal of Skåne's food industry. *Technology Analysis & Strategic Management*, *22*(7), 819-829. doi:10.1080/09537325.2010.511145

Fuchs, D., Kalfagianni, A., & Havinga, T. (2011). Actors in private food governance: The legitimacy of retail standards and multistakeholder initiatives with civil society participation. *Agriculture and Human Values*, *28*(3), 353-367. doi:10.1007/s10460-009-9236-3

Fuchsberger, C., Flannick, J., Teslovich, T. M., Mahajan, A., Agarwala, V., Gaulton, K. J., . . . McCarthy, M. I. (2016). The genetic architecture of type 2 diabetes. *Nature*, *536*(7614), 41-47. doi:10.1038/nature18642

Fullman, N., Barber, R. M., Abajobir, A. A., Abate, K. H., Abbafati, C., Abbas, K. M., . . . Murray, C. J. L. (2017). Measuring progress and projecting attainment on the basis of past trends of the health-related sustainable development goals in 188 countries: An analysis from the global burden of disease study 2016. *The Lancet*, *390*(10100), 1423-1459. doi:10.1016/S0140-6736(17)32336-X

Funtowicz, S. O., & Ravetz, J. R. (1993). Science for the post-normal age. *Futures*, *25*(7), 739-755. doi:10.1016/0016-3287(93)90022-L

Furey, S., Strugnell, C., & McIlveen, M. H. (2001). An investigation of the potential existence of ``food deserts'' in rural and urban areas of northern Ireland. *Agriculture and Human Values*, *18*(4), 447-457. doi:10.1023/A:1015218502547

FUSIONS. (2016). *Recommendations and guidelines for a common European food waste policy framework*. Retrieved from https://www.eu-fusions.org/

Gallar, D., Saracho-Domínguez, H., Rivera-Ferre, M., & Vara-Sánchez, I. (2019). Eating well with organic food: Everyday (non-monetary) strategies for a change in food paradigms: Findings from Andalusia, Spain. *Sustainability*, *11*, 1003. doi:10.3390/su11041003

Galt, R. E., Parr, D., Van Soelen Kim, J., Beckett, J., Lickter, M., & Ballard, H. (2013). Transformative food systems education in a land-grant college of agriculture: The importance of learner-centered inquiries. *Agriculture and Human Values*, *30*(1), 129-142. doi:10.1007/s10460-012-9384-8

Game, E. T., Tallis, H., Olander, L., Alexander, S. M., Busch, J., Cartwright, N., . . . Sutherland, W. J. (2018). Cross-discipline evidence principles for sustainability policy. *Nature Sustainability*, *1*(9), 452-454. doi:10.1038/s41893-018-0141-x

Ganglbauer, E., Fitzpatrick, G., Subasi, Ö., & Güldenpfennig, F. (2014). *Think globally, act locally: A case study of a free food sharing community and social networking.* Paper presented at the 17th ACM conference on Computer supported cooperative work and social computing, Baltimore, Maryland, USA.

García Villar, J., & Quintana-Domenque, C. (2009). Income and body mass index in Europe. *Economics & Human Biology*, *7*(1), 73-83.

Geels, F. (2006). Multi-level perspective on system innovation: Relevance for industrial transformation. In X. Olsthoorn & A. Wieczorek (Eds.), *Understanding industrial transformation: Views from different disciplines* (pp. 163-186). Dordrecht, NL: Springer.

Geels, F. W. (2002). Technological transitions as evolutionary reconfiguration processes: A multi-level perspective and a case-study. *Research Policy*, *31*(8), 1257-1274. doi:10.1016/S0048-7333(02)00062-8

Geels, F. W. (2005). The dynamics of transitions in socio-technical systems: A multi-level analysis of the transition pathway from horse-drawn carriages to automobiles (1860–1930). *Technology Analysis & Strategic Management*, *17*(4), 445-476. doi:10.1080/09537320500357319

Geels, F. W. (2011). The multi-level perspective on sustainability transitions: Responses to seven criticisms. *Environmental Innovation and Societal Transitions*, *1*(1), 24-40. doi:10.1016/j.eist.2011.02.002

Geels, F. W., & Schot, J. (2007). Typology of sociotechnical transition pathways.

Research Policy, 36(3), 399-417. doi:10.1016/j.respol.2007.01.003

Gerber, P. J., Steinfeld, H., Henderson, B., Mottet, A., Opio, C., Dijkman, J., . . . Tempio, G. (2013). *Tackling climate change through livestock – a global assessment of emissions and mitigation opportunities*. Retrieved from http://www.fao.org/3/i3437e/i3437e00.htm

Gerbrandy, A. (2019). Rethinking competition law within the European Economic Constitution. *Journal of Common Market Studies, 57*(1), 127-142. doi:10.1111/jcms.12814

Gerbrandy, A., & de Vries, S. A. (2011). *Agricultural policy and EU competition law : Possibilities and limits for self-regulation in the dairy sector*. Den Haag, NL: Eleven International Publishing.

Gereffi, G. (1996). Global commodity chains: New forms of coordination and control among nations and firms in international industries. *Competition & Change, 1*(4), 427-439. doi:10.1177/102452949600100406

Germond, C. S. (2015). An emerging anti-reform green front? Farm interest groups fighting the 'agriculture 1980' project, 1968–72. *European Review of History: Revue Européenne d'Histoire, 22*(3), 433-450. doi:10.1080/13507486.2014.1000268

Getz, W. M., & Gutierrez, A. P. (1982). A perspective on system analysis in crop production and insect pest management. *Annual Review of Entomology, 27*(1), 447-466. doi:10.1146/annurev.en.27.010182.002311

Ghent Food Policy Council. (2016). *Ghent en garde food policy. Recommendations of the food policy council*. Retrieved from https://www.ruaf.org/sites/default/files/Gent%20en%20Garde.pdf

Giannakis, E., & Bruggeman, A. (2015). The highly variable economic performance of European agriculture. *Land Use Policy, 45*, 26-35. doi:10.1016/j.landusepol.2014.12.009

Gibbons, M., Limoges, C., Nowotny, H., Schwarztman, S., Scott, P., Trow, M. (1994). *The new production of knowledge: The dynamics of science and research in contemporary societies*. London: Sage.

Gibson, C. C., Ostrom, E., & Ahn, T. K. (2000). The concept of scale and the human dimensions of global change: A survey. *Ecological Economics, 32*(2), 217-239. doi:10.1016/S0921-8009(99)00092-0

Gibson, M. (2015, 4 June). The food-sharing app that helps hundreds of irish charities just went international. *Time Magazine*.

Gillard, R., Gouldson, A., Paavola, J., & Van Alstine, J. (2016). Transformational responses to climate change: Beyond a systems perspective of social change in mitigation and adaptation. *WIREs Climate Change, 7*(2), 251-265. doi:10.1002/wcc.384

Giovannucci, D. (2008). *How new agrifood standards are affecting trade.* Paper presented at Trade-What If? New Challenges in Export Development, Geneva, Switzerland.

Godin, L., & Sahakian, M. (2018). Cutting through conflicting prescriptions: How guidelines inform "healthy and sustainable" diets in Switzerland. *Appetite, 130*, 123-133. doi:10.1016/j.appet.2018.08.004

Goldet, G., & Howick, J. (2013). Understanding grade: An introduction. *Journal of Evidence-Based Medicine, 6*(1), 50-54. doi:10.1111/jebm.12018

Gomiero, T., Pimentel, D., & Paoletti, M. G. (2011). Environmental impact of different agricultural management practices: Conventional vs. organic agriculture. *Critical Reviews in Plant Sciences, 30*(1-2), 95-124. doi:10.1080/07352689.2011.554355

Goodman, D., Dupuis, E., & Goodman, M. (2012). *Alternative food networks: Knowledge, practice and politics*. London: Routledge.

Goodman, D., DuPuis, E. M., & Goodman, M. (2013). Engaging alternative food networks: Commentaries and research agendas. *International Journal of the Sociology of Agriculture and Food, 20*, 425-431.

Goodman, D., & Watts, M. J. (1997). *Globalizing food*. London: Routledge.

Goodman, M. K. (2016). Food geographies i: Relational foodscapes and the busyness of being more-than-food. *Progress in Human Geography, 40*(2), 257-266. doi:10.1177/0309132515570192

Greater London Authority. (2018). *The London food strategy: Healthy and sustainable food for London*. Retrieved from https://www.london.gov.uk/what-we-do/business-and-economy/food/london-food-strategy-0

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

Gregory, T., & Patuelli, R. (2015). Demographic ageing and the polarization of regions—an exploratory space–time analysis. *Environment and Planning A: Economy and Space, 47*(5), 1192-1210. doi:10.1177/0308518X15592329

Greve, C., & Neess, R. I. (2014). *The evolution of the whole grain partnership in Denmark*. Retrieved from https://research.cbs.dk/en/publications/the-evolution-of-the-whole-grain-partnership-in-Denmark

Grin, J., Rotmans, J., & Schot, J. (2010). *Transitions to sustainable development: New directions in the study of long term transformative change*. New York: Routledge.

Grønhøj, A., & Thøgersen, J. (2009). Like father, like son? Intergenerational transmission of values, attitudes, and behaviours in the environmental domain. *Journal of Environmental Psychology, 29*(4), 414-421. doi:10.1016/j.jenvp.2009.05.002

Grønhøj, A., & Thøgersen, J. (2012). Action speaks louder than words: The effect of personal attitudes and family norms on adolescents' pro-environmental behaviour. *Journal of Economic Psychology, 33*(1), 292-302. doi:10.1016/j.joep.2011.10.001

Grønhøj, A., & Thøgersen, J. (2017). Why young people do things for the environment: The role of parenting for adolescents' motivation to engage in pro-environmental behaviour. *Journal of Environmental Psychology, 54*(Supplement C), 11-19. doi:10.1016/j.jenvp.2017.09.005

Gruère, G. P. (2015). An analysis of the growth in environmental labelling and information schemes. *Journal of Consumer Policy, 38*, 1-18. doi:10.1007/s10603-014-9275-z

Grunert, K. G., Hieke, S., & Wills, J. (2014). Sustainability labels on food products: Consumer motivation, understanding and use. *Food Policy, 44*, 177-189. doi:10.1016/j.foodpol.2013.12.001

Guerrero, L., Guardia, M. D., Xicola, J., Verbeke, W., Vanhonacker, F., Zakowska-Biemans, S., . . . Hersleth, M. (2009). Consumer-driven definition of traditional food products and innovation in traditional foods. A qualitative cross-cultural study. *Appetite, 52*(2), 345-354. doi:10.1016/j.appet.2008.11.008

Guillard, V., Gaucel, S., Fornaciari, C., Angellier-Coussy, H., Buche, P., & Gontard, N. (2018). The next generation of sustainable food packaging to preserve our environment in a circular economy context. *Frontiers in Nutrition, 5*, 121. doi:10.3389/fnut.2018.00121

Gutierrez, N. L., Hilborn, R., & Defeo, O. (2011). Leadership, social capital and incentives promote successful fisheries. *Nature, 470*(7334), 386-389. doi:10.1038/nature09689

Haas, P. M. (2004). Addressing the global governance deficit. *Global Environmental Politics, 4*(4), 1-15. doi:10.1162/glep.2004.4.4.1

Hadjimichael, M. (2018). A call for a blue degrowth: Unravelling the European Union's fisheries and maritime policies. *Marine Policy, 94*, 158-164. doi:10.1016/j.marpol.2018.05.007

Hagedorn, G., Kalmus, P., Mann, M., Vicca, S., Van den Berge, J., van Ypersele, J.-P., . . . Hayhoe, K. (2019). Concerns of young protesters are justified. *Science, 364*(6436), 139-140. doi:10.1126/science.aax3807

Hainmueller, J., Hiscox, M. J., & Sequeira, S. (2015). Consumer demand for fair trade: Evidence from a multistore field experiment. *The Review of Economics and Statistics, 97*(2), 242-256. doi:10.1162/REST_a_00467

Hajer, M., Nilsson, M., Raworth, K., Bakker, P., Berkhout, F., De Boer, Y., . . . Kok, M. (2015). Beyond cockpit-ism: Four insights to enhance the transformative potential of the sustainable development goals. *Sustainability, 7*(2), 1651-1660. doi:10.1162/REST_a_00467

Halkier, B. (2001). Consuming ambivalences: Consumer handling of environmentally related risks in food. *Journal of Consumer Culture, 1*, 205-224. doi:10.1177/146954050100100201

Halkier, B., & Jensen, I. (2011). Doing 'healthier' food in everyday life? A qualitative study of how Pakistani Danes handle nutritional communication. *Critical Public Health, 21*(4), 471-483. doi:10.1080/09581596.2011.594873

Halloran, A., Clement, J., Kornum, N., Bucatariu, C., & Magid, J. (2014). Addressing food waste reduction in Denmark.

Food Policy, *49*, 294-301. doi:10.1016/j.foodpol.2014.09.005

Hamerman, E. J., Rudell, F., & Martins, C. M. (2018). Factors that predict taking restaurant leftovers: Strategies for reducing food waste. *Journal of Consumer Behaviour*, *17*(1), 94-104. doi:10.1002/cb.1700

Harbaugh, R., Maxwell, J. W., & Roussillon, B. (2011). Label confusion: The groucho effect of uncertain standards. *Management Science*, *57*(9), 1512-1527. doi:10.1287/mnsc.1110.1412

Hargreaves, T. (2011). Practice-ing behaviour change: Applying social practice theory to pro-environmental behaviour change. *Journal of Consumer Culture*, *11*(1), 79-99. doi:10.1177/1469540510390500

Hargreaves, T., Longhurst, N., & Seyfang, G. (2013). Up, down, round and round: Connecting regimes and practices in innovation for sustainability. *Environment and Planning A: Economy and Space*, *45*(2), 402-420. doi:10.1068/a45124

Hartmann, M. (2011). Corporate social responsibility in the food sector. *European Review of Agricultural Economics*, *38*(3), 297–324. doi:10.1093/erae/jbr031

Hassanein, N. (2003). Practicing food democracy: A pragmatic politics of transformation. *Journal of Rural Studies*, *19*(1), 77-86. doi:10.1016/S0743-0167(02)00041-4

Hassanein, N. (2008). Locating food democracy: Theoretical and practical ingredients. *Journal of Hunger & Environmental Nutrition*, *3*(2-3), 286-308. doi:10.1080/19320240802244215

Hatanaka, M., & Busch, L. (2008). Third-party certification in the global agrifood system: An objective or socially mediated governance mechanism? *Sociologia Ruralis*, *48*(1), 73-91. doi:10.1111/j.1467-9523.2008.00453.x

Hauck, J., Schmidt, J., & Werner, A. (2016). Using social network analysis to identify key stakeholders in agricultural biodiversity governance and related land-use decisions at regional and local level. *Ecology and Society*, *21*(2), 49. doi:10.5751/ES-08596-210249

Hawkes, C. (2006). Uneven dietary development: Linking the policies and processes of globalization with the nutrition transition, obesity and diet-related chronic diseases. *Globalization and Health*, *2*(1), 4. doi:10.1186/1744-8603-2-4

Hawkes, C. (2013). *Promoting healthy diets through nutrition education and changes in the food enviromnent: An international review of actions and their effectiveness*. Retrieved from http://www.fao.org/3/i3235e/i3235e.pdf

Hayes-Conroy, J., & Hayes-Conroy, A. (2013). Veggies and visceralities: A political ecology of food and feeling. *Emotion, Space and Society*, *6*, 81–90. doi:10.1016/j.emospa.2011.11.003

Hayes, R. (2016). Textbox: Internalizing externalities: Techniques to reduce ecological impacts of food production. In G. Steier & K. Patel (Eds.), *International food law and policy*. Cham: Springer.

Hebrok, M., & Boks, C. (2017). Household food waste: Drivers and potential intervention points for design – an extensive review. *Journal of Cleaner Production*, *151*, 380-392. doi:10.1016/j.jclepro.2017.03.069

Hekkert, M. P., Suurs, R. A. A., Negro, S. O., Kuhlmann, S., & Smits, R. E. H. M. (2007). Functions of innovation systems: A new approach for analysing technological change. *Technological Forecasting and Social Change*, *74*(4), 413-432. doi:10.1016/j.techfore.2006.03.002

Hellmann, F., & Verburg, P. (2010). Impact assessment of the European biofuel directive on land use and biodiversity. *Journal of Environmental Management*, *91*, 1389-1396. doi:10.1016/j.jenvman.2010.02.022

Hemmerling, S., Hamm, U., & Spiller, A. (2015). Consumption behaviour regarding organic food from a marketing perspective—a literature review. *Organic Agriculture*, *5*(4), 277-313. doi:10.1007/s13165-015-0109-3

Hendriks, C. M., & Grin, J. (2007). Contextualizing reflexive governance: The politics of Dutch transitions to sustainability. *Journal of Environmental Policy & Planning*, *9*(3-4), 333-350. doi:10.1080/15239080701622790

Héritier, A., & Eckert, S. (2008). New modes of governance in the shadow of hierarchy: Self-regulation by industry in Europe. *Journal of Public Policy*, *28*(1), 113-138. doi:10.1017/S0143814X08000809

Hermsdorf, D. (2017). Food waste reduction practices in German food retail. *British Food Journal*, *119*(12), 2532-2546. doi:10.1108/BFJ-06-2017-0338

HighTech Europe. (2013). *Final summary report HighTech Europe*. Retrieved from https://cordis.europa.eu/project/rcn/90532/reporting/en

Hilborn, R., Banobi, J., Hall, S. J., Pucylowski, T., & Walsworth, T. E. (2018). The environmental cost of animal source foods. *Frontiers in Ecology and the Environment*, *16*(6), 329-335. doi:10.1002/fee.1822

Hilimire, K., Gillon, S., McLaughlin, B. C., Dowd-Uribe, B., & Monsen, K. L. (2014). Food for thought: Developing curricula for sustainable food systems education programs. *Agroecology and Sustainable Food Systems*, *38*(6), 722-743. doi:10.1080/21683565.2014.881456

Hinrichs, C. (2014). Transitions to sustainability: A change in thinking about food systems change? *Agriculture and Human Values*, *31*(1), 143-155. doi:10.1007/s10460-014-9479-5

HLPE. (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*. Retrieved from http://www.fao.org/3/a-i3901e.pdf

HLPE. (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*. Retrieved from http://www.fao.org/policy-support/resources/resources-details/en/c/1155796/

HLPE. (2019). *Agroecological and other innovative approaches for sustainable agriculture and food systems that enhance food security and nutrition. A report by the High Level Panel of Experts on food security and nutrition of the Committee on World Food Security*. Retrieved from http://www.fao.org/3/ca5602en/ca5602en.pdf

Holland, J. H. (1998). *Emergence: From chaos to order*. Boston, MA: Addison-Wesley Longman Publishing Co.

Hollingsworth, A. (2004). Increasing retail concentration: Evidence from the UK food retail sector. *British Food Journal*, *106*, 629-638. doi:10.1108/00070700410553611

Holm, L. (2013). Sociology of food consumption. In A. Murcott, W. Belasco, & P. Jackson (Eds.), *The handbook of food research* (pp. 324-337). London: Bloomsbury.

Hölscher, K., Wittmayer, J. M., & Loorbach, D. (2018). Transition versus transformation: What's the difference? *Environmental Innovation and Societal Transitions*, *27*, 1-3. doi:10.1016/j.eist.2017.10.007

Horton, P., Banwart, S. A., Brockington, D., Brown, G. W., Bruce, R., Cameron, D., . . . Jackson, P. (2017). An agenda for integrated system-wide interdisciplinary agri-food research. *Food Security*, *9*(2), 195-210. doi:10.1007/s12571-017-0648-4

Hospes, O., & Brons, A. (2016). Food system governance: A systematic literature review. In A. Kennedy & J. Lilieblad (Eds.), *Food systems governance: Challenges for justice* (pp. 13-42). London, New York: Routledge.

Hospes, O., & van der Meulen, B. (2009). *Fed up with the right to food? The Netherlands' policies and practices regarding the human right to adequate food*. Wageningen, NL: Wageningen Academic Publishers.

House, J. (2016). Consumer acceptance of insect-based foods in the Netherlands: Academic and commercial implications. *Appetite*, *107*, 47-58. doi:10.1016/j.appet.2016.07.023

House of Commons. (2012). *Greening the Common Agricultural Policy*. Retrieved from http://www.publications.parliament.uk/pa/cm201213/cmselect/cmenvfru/170/170.pdf

Hubert, B., Rosegrant, M., van Boekel, A. J. S., & Ortiz, R. (2010). The future of food: Scenarios for 2050. *Crop Science*, *50*, 33-50. doi:10.2135/cropsci2009.09.0530

Huffaker, C. B., & Croft, B. A. (1978). Integrated pest management in the United States. *California Agriculture*, 6–7.

Hynes, N., & Wilson, J. (2016). I do it, but don't tell anyone! Personal values, personal and social norms: Can social media play a role in changing pro-environmental behaviours? *Technological Forecasting and Social Change*, *111*, 349-359. doi:10.1016/j.techfore.2016.06.034

IFOAM. (2008). *Sistemas de garantía participativos: Visión compartida, ideales compartidos*. Retrieved from https://www.

ifoam.bio/sites/default/files/page/files/ifoam_pgs_spanish_web.pdf

Iles, A. (2007). Making the seafood industry more sustainable: Creating production chain transparency and accountability. *Journal of Cleaner Production, 15*, 577-589. doi:10.1016/j.jclepro.2006.06.001

Ilieva, R. T. (2017). Urban food systems strategies: A promising tool for implementing the SDGs in practice. *Sustainability, 9*(10), 1-35. doi:10.3390/su9101707

Inglis, D., & Gimlin, D. (Eds.). (2009). *The globalization of food*. London: Bloomsbury.

Ingram, J. (2011). A food systems approach to researching food security and its interactions with global environmental change. *Food Security, 3*. doi:10.1007/s12571-011-0149-9

IPBES. (2019). *The global assessment report biodiversity and ecosystem services*. Retrieved from https://ipbes.net/global-assessment

IPCC. (2014). *Ar5 synthesis report: Climate change 2014*. Retrieved from https://www.ipcc.ch/report/ar5/syr/

IPCC. (2018). *The 1.5 degree report*. Retrieved from https://www.ipcc.ch/sr15/chapter/spm/

IPCC. (2019a). *Special report on climate change, desertification, land degradation, sustainable land management, food security, and greenhouse gas fluxes in terrestrial ecosystems. Summary for policy-makers*. Retrieved from https://www.ipcc.ch/site/assets/uploads/2019/08/4.-SPM_Approved_Microsite_FINAL.pdf

IPCC. (2019b). *Special report on the ocean and cryosphere in a changing climate*. Retrieved from https://www.ipcc.ch/srocc/

iPES Food. (2016). *From uniformity to diversity: A paradigm shift from industrial agriculture to diversified agroecological systems*. Retrieved from http://www.ipes-food.org/_img/upload/files/UniformityToDiversity_FULL.pdf

iPES Food. (2017). *What makes urban food policy happen? Insights from five case studies*. Retrieved from http://www.ipes-food.org/_img/upload/files/Cities_full.pdf

iPES Food. (2019). *Towards a common food policy for the EU. The policy reform and realignment that is required to build sustainable food systems in Europe*. Retrieved from http://www.ipes-food.org/_img/upload/files/CFP_FullReport.pdf

Isakson, S. R. (2014). Food and finance: The financial transformation of agro-food supply chains. *The Journal of Peasant Studies, 41*(5), 749-775. doi:10.1080/03066150.2013.874340

Jackson, P. (2015). *Anxious appetites: Food and consumer culture*. London: Bloomsbury Academic.

Jackson, P., Brembeck, H., Everts, J., Fuentes, M., Halkier, B., Herty, F. D., . . . Wenzl, C. (2018). *Reframing convenience food*. Basingstoke: Palgrave Macmillan.

Jackson, P., & the CONANX Group. (2013). *Food words: Essays in culinary culture*. London: Bloomsbury Academic.

Jackson, P., Ward, N., & Russell, P. (2006). Mobilising the commodity chain concept in the politics of food and farming. *Journal of Rural Studies, 22*(2), 129-141. doi:10.1016/j.jrurstud.2005.08.008

Jaffry, S., Pickering, H., Ghulam, Y., Whitmarsh, D., & Wattage, P. (2004). Consumer choices for quality and sustainability labelled seafood products in the UK. *Food Policy, 29*(3), 215-228. doi:10.1016/j.foodpol.2004.04.001

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

Jaklin, U., Kummer, S., & Milestad, R. (2015). Why do farmers collaborate with a food cooperative? Reasons for participating in a civic food network in Vienna, Austria. *International Journal of Sociology of Agriculture and Food, 22*(1), 41-61.

Janssen, M., & Hamm, U. (2012). The mandatory EU logo for organic food: Consumer perceptions. *British Food Journal, 114*, 335-352. doi:10.1108/00070701211213456

Jeffries, N. (2019). Regenerative agriculture: How it works on the ground. *Circulate News*, 04.03.2019. Retrieved from https://www.ellenmacarthurfoundation.org/our-work/activities/food/stories/regenerative-agriculture-how-it-works-on-the-ground

Jehlička, P., & Smith, J. (2011). An unsustainable state: Contrasting food practices and state policies in the Czech republic. *Geoforum*, *42*(3), 362-372. doi:10.1016/j.geoforum.2011.01.005

Johnston, J. (2008). The citizen-consumer hybrid: Ideological tensions and the case of whole foods market. *Theory and Society*, *37*(3), 229-270. doi:10.1007/s11186-007-9058-5

Johnston, J., Biro, A., & MacKendrick, N. (2009). Lost in the supermarket: The corporate-organic foodscape and the struggle for food democracy. *Antipode*, *41*(3), 509-532. doi:10.1111/j.1467-8330.2009.00685.x

Jones, M., Dailami, N., Weitkamp, E., Salmon, D., Kimberlee, R., Morley, A., & Orme, J. (2012). Food sustainability education as a route to healthier eating: Evaluation of a multi-component school programme in english primary schools. *Health Education Research*, *27*(3), 448-458. doi:10.1093/her/cys016

Jonsson, H. (2013). The road to the new nordic cuisine. In P. Lysaght (Ed.), *The return of traditional food*. Lund: Lund University Studies.

Josling, T. (2006). The war on terroir: Geographical indications as a transatlantic trade conflict. *Journal of Agricultural Economics*, *57*(3), 337-363. doi:10.1111/j.1477-9552.2006.00075.x

Juhl, H. J., Fenger, M. H. J., & Thøgersen, J. (2017). Will the consistent organic food consumer step forward? An empirical analysis. *Journal of Consumer Research*, *44*(3), 519-535. doi:10.1093/jcr/ucx052

Jurgilevich, A., Birge, T., Kentala-Lehtonen, J., Korhonen, K., Pietikäinen, J., Saikku, L., & Schösler, H. (2016). Transition towards circular economy in the food system. *Sustainability*, *8*, 69. doi:10.3390/su8010069

Kahneman, D. (2011). *Thinking, fast and slow*. New York: Macmillan.

Karabell, Z. (2019). The population bust. Demographic decline and the end of capitalism as we know it. *Foreign Affairs, Sept/Oct*. Retrieved from https://www.foreignaffairs.com/reviews/review-essay/2019-08-12/population-bust

Karpouzoglou, T., Dewulf, A., & Clark, J. (2016). Advancing adaptive governance of social-ecological systems through theoretical multiplicity. *Environmental Science & Policy*, *57*, 1-9. doi:10.1016/j.envsci.2015.11.011

Kate, C. (2014). Digging deeper: Bringing a systems approach to food systems: Food system governance. *Journal of Agriculture, Food Systems, and Community Development*, *4*(2). doi:10.5304/jafscd.2014.042.012

Kauffman, S. (1995). *At home in the UNiverse: The search for the laws of self-organization and complexity*. New York: Oxford University Press.

Kearney, J. (2010). Food consumption trends and drivers. *Philosophical Transactions of the Royal Society B: Biological Sciences*, *365*(1554), 2793-2807. doi:doi:10.1098/rstb.2010.0149

Kemp, R., Rotmans, J., & Loorbach, D. (2007). Assessing the Dutch energy transition policy: How does it deal with dilemmas of managing transitions? *Journal of Environmental Policy & Planning*, *9*(3-4), 315-331. doi:10.1080/15239080701622816

Kennedy, A., & Liljeblad, J. (Eds.). (2016). *Food systems governance*. London, New York: Routledge.

Kirchner, C. (2015). *Overview of participatory guarantee systems in 2014*. Retrieved from https://www.organic-world.net/yearbook/yearbook2015.html

Kirwan, J., Ilbery, B., Maye, D., & Carey, J. (2013). Grassroots social innovations and food localisation: An investigation of the local food programme in england. *Global Environmental Change*, *23*, 830–837. doi:10.1016/j.gloenvcha.2012.12.004

Kjaer, A. M. (2004). *Governance*. Cambridge: Wiley.

Klinger, D., & Naylor, R. (2012). Searching for solutions in aquaculture: Charting a sustainable course. *Annual Review of Environment and Resources*, *37*(1), 247-276. doi:10.1146/annurev-environ-021111-161531

Kneafsey, M., Venn, L., Schmutz, U., Balázs, B., Trenchard, L., Eyden-Wood, T., . . . Blackett, M. (2013). *Short food supply chains and local food systems in the EU. A state of play of their socio-economic characteristics*.

Kneen, B. (1989). *From land to mouth: Understanding the food system*. Toronto, Canada: NC Press.

Knill, C., & Tosun, J. (2012). *Public policy: A new introduction*. Basingstoke: Palgrave Macmillan.

Kooiman, J. (2003). *Governing as governance*. Chennai, India: SAGE Publications.

Koski, C., Siddiki, S., Sadiq, A.-A., & Carboni, J. (2016). Representation in collaborative governance: A case study of a food policy council. *The American Review of Public Administration*, *48*(4), 359-373. doi:10.1177/0275074016678683

Köster, E. P., & Mojet, J. (2015). From mood to food and from food to mood: A psychological perspective on the measurement of food-related emotions in consumer research. *Food Research International*, *76*, 180-191. doi:10.1016/j.foodres.2015.04.006

Krüger, T., & Strüver, A. (2017). Narratives of "good food": Consumer identities and the appropriation of sustainability discourses. *Zeitschrift für Wirtschaftsgeographie*, *62*, 217-232. doi:10.1515/zfw-2017-0006

Kumar, K. (2005). *From post-industrial to post-modern society: New theories of the contemporary world, 2nd ed*. Malden, Massachusetts: Blackwell.

Kwok, L., Huang, Y.-K., & Hu, L. (2016). Green attributes of restaurants: What really matters to consumers? *International Journal of Hospitality Management*, *55*, 107-117. doi:10.1016/j.ijhm.2016.03.002

Lambek, N. (2018). The UN committee on world food security's break from the agricultural productivity trap. *Transnational Legal Theory*, *9*(3-4), 415-429. doi:10.1080/20414005.2018.1573406

Lambin, E., Meyfroidt, P., Rueda, X., Blackman, A., Börner, J., Cerutti, P., . . . Wunder, S. (2014). Effectiveness and synergies of policy instruments for land use governance in tropical regions. *Global Environmental Change*, 28, 129–140. doi:10.1016/j.gloenvcha.2014.06.007

Lamine, C., Darolt, M., & Brandenburg, A. (2012). The civic and social dimensions of food production and distribution in alternative food networks in France and southern Brazil. International Journal of Sociology of Agriculture & Food, 19(3), 383-401.

Lang, T. (1999). Food policy for the 21st century: Can it be both radical and reasonable? In M. Koc, R. MacRae, L. J. A. Mougeot, & J. Welsh (Eds.), *For hunger-proof cities: Sustainable urban food systems* (pp. 216-224). Ottawa, Canada: International Development Research Centre.

Lang, T., & Barling, D. (2012). Food security and food sustainability: Reformulating the debate. *The Geographical Journal*, *178*(4), 313-326.

Lang, T., & Heasman, M. (2004). *Food wars: The global battle for mouths, minds, and markets*. London: Earthscan.

Lang, T., Millstone, E., & Marsden, T. (2017). *A food Brexit: Time to get real — a Brexit briefing*. Retrieved from http://openaccess.city.ac.uk/id/eprint/18655/

Larceneux, F., Benoit-Moreau, F., & Renaudin, V. (2012). Why might organic labels fail to influence consumer choices? Marginal labelling and brand equity effects. *Journal of Consumer Policy*, *35*(1), 85-104. doi:10.1007/s10603-011-9186-1

Le Manach, F., Chaboud, C., Copeland, D., Cury, P., Gascuel, D., Kleisner, K. M., . . . Pauly, D. (2013). European Union's public fishing access agreements in developing countries. *PLoS ONE*, *8*(11), e79899. doi:10.1371/journal.pone.0079899

Le Mouël, C., de Lattre-Gasquet, M., & Mora, O. (Eds.). (2018). *Land use and food security in 2050: A narrow road : Agrimonde-Terra.*

Lee, C.-W., Kim, T.-Y., & Lee, J.-H. (2009). Exploring the triple helix innovation system in the Dutch food cluster (food valley). *Journal of the Korean Association of Regional Geographers*, *15*(5), 554-571.

Lee, M. M., Falbe, J., Schillinger, D., Basu, S., McCulloch, C. E., & Madsen, K. A. (2019). Sugar-sweetened beverage consumption 3 years after the Berkeley, California, sugar-sweetened beverage tax. *American Journal of Public Health*, *109*(4), 637-639. doi:10.2105/ajph.2019.304971

Lee, R. (2013). The politics of international agri-food policy: Discourses of trade-oriented food security and food sovereignty. *Environmental Politics*, *22*. doi:10.1080/09644016.2012.730266

Leer, J. (2016). The rise and fall of the New Nordic Cuisine. *Journal of Aesthetics & Culture*, *8*(1), 33494. doi:10.3402/jac.v8.33494

Lehner, M., Mont, O., & Heiskanen, E. (2016). Nudging – a promising tool for sustainable consumption behaviour? *Journal of Cleaner Production*, *134*, 166-177. doi:10.1016/j.jclepro.2015.11.086

Lelieveldt, H. (2018). Out of tune or well tempered? How competition agencies

direct the orchestrating state. *Regulation & Governance*. doi:10.1111/rego.12223

Lenschow, A. (2015). Environmental policy: Contending dynamics of policy change. In H. Wallace, M. A. Pollack, & A. R. Young (Eds.), *Policy-making in the European Union* (pp. 319-343). Oxford: Oxford University Press.

Lernoud, J., Potts, J., Sampson, G., Schlatter, B., Huppe, G., Voora, V., . . . Dang, D. (2018). *The state of sustainable markets – statistics and emerging trends 2018*. Geneva: ITC.

Levidow, L. (2015). European transitions towards a corporate-environmental food regime: Agroecological incorporation or contestation? *Journal of Rural Studies*, *40*, 76-89. doi:10.1016/j.jrurstud.2015.06.001

Levkoe, C., & Blay-Palmer, A. (2018). Food counts: Food systems report cards, food sovereignty and the politics of indicators. *Canadian Food Studies / La Revue canadienne des études sur l'alimentation*, *5*, 49-75. doi:10.15353/cfs-rcea.v5i3.277

Levkoe, C. Z. (2006). Learning democracy through food justice movements. *Agriculture and Human Values*, *23*(1), 89-98. doi:10.1007/s10460-005-5871-5

Lim, K. H., Hu, W., & Nayga, R. M. (2018). Is marine stewardship council's ecolabel a rising tide for all? Consumers' willingness to pay for origin-differentiated ecolabeled canned tuna. *Marine Policy*, *96*, 18-26. doi:10.1016/j.marpol.2018.07.015

Lindh, H., Olsson, A., & Williams, H. (2016). Consumer perceptions of food packaging: Contributing to or counteracting environmentally sustainable development? *Packaging Technology and Science*, *29*(1), 3-23. doi:10.1002/pts.2184

Lipinski, B., Hanson, C., Waite, R., Searchinger, T., Lomax, J., & Kitinoja, L. (2013). *Reducing food loss and waste: Creating a sustainable food future, installment two*. Retrieved from https://www.wri.org/publication/reducing-food-loss-and-waste

Little, A. (2019). *The fate of food*. New York: Harmony Books.

Liu, T., Wang, Q., & Su, B. (2016). 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

Liverman, D., & Kapadia, K. (2010). Food systems and the global environment: An overview. In J. Ingram, P. Ericksen, & D. Liverman (Eds.), *Food security and global environmental change* (pp. 3-24). London: Earthscan.

Livermore, M. (2006). Authority and legitimacy in global governance: Deliberation, institutional differentiation, and the codex alimentarius. *New York University Law Review*, *81*, 766.

Livingstone, S., Lunt, P., & Miller, L. (2007). Citizens, consumers and the citizen-consumer: Articulating the citizen interest in media and communications regulation. *Discourse & Communication*, *1*(1), 63-89. doi:10.1177/1750481307071985

Lloyd-Williams, F., Bromley, H., Orton, L., Hawkes, C., Taylor-Robinson, D., O'Flaherty, M., . . . Capewell, S. (2014). Smorgasbord or symphony? Assessing public health nutrition policies across 30 European countries using a novel framework. *BMC Public Health*, *14*(1), 1195. doi:10.1186/1471-2458-14-1195

London Development Agency. (2006). *Healthy and sustainable food for London. The mayor's food strategy.* Retrieved from https://www.london.gov.uk/sites/default/files/the_mayors_food_strategy_2006.pdf

Loo, C. (2014). Towards a more participative definition of food justice. *Journal of Agricultural and Environmental Ethics*, *27*(5), 787-809. doi:10.1007/s10806-014-9490-2

Loorbach, D. (2007). *Transition management: New mode of governance for sustainable development*. Utrecht: International Books.

Loorbach, D. (2010). Transition management for sustainable development: A prescriptive, complexity-based governance framework. *Governance*, *23*(1), 161-183. doi:10.1111/j.1468-0491.2009.01471.x

Loorbach, D., Brugge, R., & Taanman, M. (2008). Governance in the energy transition: Practice of transition management in the Netherlands. *International Journal of Environmental Technology and Management*, *9*(2), 294-315. doi:10.1504/IJETM.2008.019039

Loorbach, D., Frantzeskaki, N., & Avelino, F. (2017). Sustainability transitions research: Transforming science and practice for societal change. *Annual Review of Environment and*

Resources, *42*(1), 599-626. doi:10.1146/annurev-environ-102014-021340

Loos, J., Abson, D., Chappell, M. J., Hanspach, J., Mikulcak, F., Tichit, M., & Fischer, J. (2014). Putting meaning back into "sustainable intensification". *Frontiers in Ecology and the Environment*, *12*(6), 356-361. doi:10.1890/130157

Lourenço, S., Hansen, G., Frank, P., Stærk, B., & Petersen, C. (2019). The whole grain partnership—how a public–private partnership helped increase whole grain intake in Denmark. *Cereal Foods World*, *64*(3). doi:10.1094/CFW-64-3-0027

Lowder, S. K., Skoet, J., & Raney, T. (2016). The number, size, and distribution of farms, smallholder farms, and family farms worldwide. *World Development*, *87*(C), 16-29. doi:10.1016/j.worlddev.2015.10.041

Lycett, K., Miller, A., Knox, A., Dunn, S., Kerr, J. A., Sung, V., & Wake, M. (2017). 'Nudge' interventions for improving children's dietary behaviors in the home: A systematic review. *Obesity Medicine*, *7*, 21-33. doi:10.1016/j.obmed.2017.06.001

Lyndhurst, B. (2009). *An evidence review of public attitudes to emerging food technologies*. Retrieved from http://citeseerx.ist.psu.edu/viewdoc/download?doi=10.1.1.170.2733&rep=rep1&type=pdf

Lynggaard, K., & Nedergaard, P. (2009). The logic of policy development: Lessons learned from reform and routine within the CAP 1980–2003. *Journal of European Integration*, *31*(3), 291-309. doi:10.1080/07036330902782147

Lyon, S. (2006). Evaluating fair trade consumption: Politics, defetishization and producer participation. *International Journal of Consumer Studies*, *30*, 452-464. doi:10.1111/j.1470-6431.2006.00530.x

Mackenzie, S. G., & Davies, A. R. (2019). Share it: Co-designing a sustainability impact assessment framework for urban food sharing initiatives. *Environmental Impact Assessment Review*, *79*, 106300. doi:10.1016/j.eiar.2019.106300

MacRae, R., Szabo, M., Anderson, K., Louden, F., & Trillo, S. (2012). Empowering the citizen-consumer: Re-regulating consumer information to support the transition to sustainable and health promoting food systems in canada. *Sustainability*, *4*, 2146-2175. doi:10.3390/su4092146

Malhi, L., Karanfil, Ö., Merth, T., Acheson, M., Palmer, A., & Finegood, D. T. (2009). Places to intervene to make complex food systems more healthy, green, fair, and affordable. *Journal of Hunger & Environmental Nutrition*, *4*(3-4), 466-476. doi:10.1080/19320240903346448

Mallinson, L., Russell, J., Cameron, D. D., Ton, J., Horton, P., & Barker, M. E. (2018). Why rational argument fails the genetic modification (GM) debate. *Food Security*, *10*(5), 1145-1161. doi:10.1007/s12571-018-0832-1

Mancini, M. C. (2013). Geographical indications in Latin America value chains: A "branding from below" strategy or a mechanism excluding the poorest? *Journal of Rural Studies*, *32*, 295-306. doi:10.1016/j.jrurstud.2013.07.008

Manomaivibool, P., Chart-asa, C., & Unroj, P. (2016). Measuring the impacts of a save food campaign to reduce food waste on campus in Thailand. *Applied Environmental Research*, *38*, 13-22. doi:10.35762/AER.2016.38.2.2

Marcondes, G., & de Bruyn, T. (2015). Brazil's south-south cooperation in food security. *Food Security*, *7*(6), 1153-1164. doi:10.1007/s12571-015-0503-4

Margulis, M. (2013). The regime complex for food security: Implications for the global hunger challenge. *Global Governance*, *19*, 53-67. doi:10.1163/19426720-01901005

Mariola, M. (2008). The local industrial complex? Questioning the link between local foods and energy use. *Agriculture and Human Values*, *25*, 193-196. doi:10.1007/s10460-008-9115-3

Markard, J., Raven, R., & Truffer, B. (2012). Sustainability transitions: An emerging field of research and its prospects. *Research Policy*, *41*(6), 955-967. doi:10.1016/j.respol.2012.02.013

Markard, J., & Truffer, B. (2008). Technological innovation systems and the multi-level perspective: Towards an integrated framework. *Research Policy*, *37*, 596-615. doi:10.1016/j.respol.2008.01.004

Marovelli, B. (2019). Cooking and eating together in London: Food sharing initiatives as collective spaces of encounter. *Geoforum*, *99*, 190-201. doi:10.1016/j.geoforum.2018.09.006

Marsden, T. (2010). Food 2030: Towards a redefinition of food? A commentary on the new United Kingdom government food

strategy. *The Political Quarterly*, *81*, 443-446. doi:10.1111/j.1467-923X.2010.02096.x

Marsden, T. (2013). From post-productionism to reflexive governance: Contested transitions in securing more sustainable food futures. *Journal of Rural Studies*, *29*, 123-134. doi:10.1016/j.jrurstud.2011.10.001

Marsden, T. (2016). Exploring the rural eco-economy: Beyond neoliberalism. *Sociologia Ruralis*, *56*(4), 597-615. doi:10.1111/soru.12139

Martin, W. (2017). *Agricultural trade and food security. ADBI working paper no. 664*. Retrieved from https://www.adb.org/sites/default/files/publication/228906/adbi-wp664.pdf

Martínez-Torres, M. E., & Rosset, P. M. (2010). La Vía Campesina: The birth and evolution of a transnational social movement. *The Journal of Peasant Studies*, *37*(1), 149-175. doi:10.1080/03066150903498804

Masip, G., Sabalza, M., Perez-Massot, E., Banakar, R., Cebrian, D., Twyman, R. M., . . . Christou, P. (2013). Paradoxical EU agricultural policies on genetically engineered crops. *Trends Plant Sci*, *18*(6), 312-324. doi:10.1016/j.tplants.2013.03.004

Matser, A., Mastwijk, H., Bánáti, D., Vervoort, L., & Hendrickx, M. (2010). How to compare novel and conventional processing methods in new product development: A case-study on orange juice. *New Food*, *5*, 35-38.

Matthews, A. (2008). The European Union's Common Agricultural Policy and developing countries: The struggle for coherence. *Journal of European Integration*, *30*(3), 381-399. doi:10.1080/07036330802141998

Matthews, A. (2013). *Greening agricultural payments in the EU's Common Agricultural Policy*. Paper presented at the 87th Annual Conference of the Agricultural Economics Society, University of Warwick, United Kingdom. Retrieved from https://EconPapers.repec.org/RePEc:ags:aesc13:158681

Matthews, A. (2019). Introducing a development policy perspective into CAP strategic plans. *Trinity Economics Papers*, *tep0391*.

Matz-Lück, N., & Fuchs, J. (2015). Marine living resources. In D. R. E. Rothwell, A.G, K. Scott, & T. Stephens (Eds.), *The Oxford Handbook of the Law of the Sea*. Oxford: Oxford University Press.

Mauerhofer, V., Ichinose, T., Blackwell, B. D., Willig, M. R., Flint, C. G., Krause, M. S., & Penker, M. (2018). Underuse of social-ecological systems: A research agenda for addressing challenges to biocultural diversity. *Land Use Policy*, *72*, 57-64. doi:10.1016/j.landusepol.2017.12.003

Maughan, C., Chambers, E. t., & Godwin, S. (2017). Food safety behaviors observed in celebrity chefs across a variety of programs. *Journal of Public Health*, *39*(1), 105-112. doi:10.1093/pubmed/fdw026

Maxwell, S. (1996). Food security: A post-modern perspective. *Food Policy*, *21*(2), 155-170. doi:10.1016/0306-9192(95)00074-7

Maye, D. (2019). 'Smart food city': Conceptual relations between smart city planning, urban food systems and innovation theory. *City, Culture and Society*, *16*, 18-24. doi:10.1016/j.ccs.2017.12.001

Maye, D., & Kirwan, J. (2013). Food security: A fractured consensus. *Journal of Rural Studies*, *29*, 1-6. doi:10.1016/j.jrurstud.2012.12.001

Mayer, H., Habersetzer, A., & Meili, R. (2016). Rural–urban linkages and sustainable regional development: The role of entrepreneurs in linking peripheries and centers. *Sustainability*, *8*(8), 745. doi:10.3390/su8080745

Mbow, C., Rosenzweig, C., Tubiello, F., Benton, T., Herrero, M., Pradhan, P., … Xu, Y. (2019). *IPCC Special Report on Land and Climate Change. Chapter 5: Food Security*. Retrieved from https://www.ipcc.ch/srccl/chapter/chapter-5/

McCoid, C. H. (2004). Globalization and the consumer society. In T. Hamada (Ed.), *Social and cultural development of human resources* (Vol. 1, pp. 316-333). Oxford: Eolss Publishers.

McInnes, A. (2019). Integrating sustainability transitions and food systems research to examine consultation failures in Canadian food policymaking. *Journal of Environmental Policy & Planning*, *21*(4), 407-426. doi:10.1080/1523908X.2019.1623656

McKenzie, F. C., & Williams, J. (2015). Sustainable food production: Constraints, challenges and choices by 2050. *Food Security*, *7*(2), 221-233. doi:10.1007/s12571-015-0441-1

McMichael, P. (2005). Global development and the corporate food regime. *Research*

in Rural Sociology and Development, *11*, 265-299. doi:10.1016/S1057-1922(05)11010-5

McMichael, P. (2009). A food regime genealogy. *The Journal of Peasant Studies*, *36*(1), 139-169. doi:10.1080/03066150902820354

McMichael, P. (2011). Food system sustainability: Questions of environmental governance in the new world (dis)order. *Global Environmental Change*, *21*(3), 804-812. doi:10.1016/j.gloenvcha.2011.03.016

Meadowcroft, J. (2009). What about the politics? Sustainable development, transition management, and long term energy transitions. *Policy Sciences*, *42*(4), 323. doi:10.1007/s11077-009-9097-z

Meadu, V., Coche, I., Vermeulen, S., & Friis, A. (2015). Paris climate agreement unlocks opportunities for food and farming. Retrieved from https://ccafs.cgiar.org/research-highlight/paris-climate-agreement-unlocks-opportunities-food-and-farming#.XiqfQsRCcuU

Mechlem, K. (2004). Food security and the right to food in the discourse of the United Nations. *European Law Journal*, *10*(5), 631-648. doi:10.1111/j.1468-0386.2004.00235.x

Meek, D., & Tarlau, R. (2016). Critical food systems education (CFSE): Educating for food sovereignty. *Agroecology and Sustainable Food Systems*, *40*(3), 237-260. doi:10.1080/21683565.2015.1130764

Mejborn, H., Biltoft-Jensen, A., Trolle, E., & Tetens, I. (2008). *Fuldkorn - definition og vidensgrundlag for anbefaling af fuldkornsindtag i danmark [definition and scientific background for recommendations of wholegrain intake in Denmark]*. Retrieved from http://www.fuldkorn.dk/media/69047/Fuldkorn-definition-og-vidensgrundlag-2008.pdf.

Mejborn, H., Ygil, K. H., Fagt, S., Trolle, E., Kørup, K., & Christensen, T. (2014). Danskernes fuldkornsindtag 2011-2013. 1-7. Retrieved from https://backend.orbit.dtu.dk/ws/portalfiles/portal/96645809/Danskernes_fuldkornsindtag2011_2013.pdf

Mercure, J. F., Paim, M. A., Bocquillon, P., Lindner, S., Salas, P., Martinelli, P., . . . Vinuales, J. E. (2019). System complexity and policy integration challenges: The brazilian energy- water-food nexus. *Renewable and Sustainable Energy Reviews*, 105, 230-243. doi:10.1016/j.rser.2019.01.045

Meuleman, L. (2018). *Metagovernance for sustainability: A framework for implementing the sustainable development goals*. London: Routledge.

Meyerding, S. G., Schaffmann, A.-L., & Lehberger, M. (2019). Consumer preferences for different designs of carbon footprint labelling on tomatoes in Germany—does design matter? *Sustainability*, *11*(6), 1587. doi:10.3390/su11061587

Meynard, J.-M., Jeuffroy, M.-H., Le Bail, M., Lefèvre, A., Magrini, M.-B., & Michon, C. (2017). Designing coupled innovations for the sustainability transition of agrifood systems. *Agricultural Systems*, *157*, 330-339. doi:10.1016/j.agsy.2016.08.002

Mezzenga, R., Schurtenberger, P., Burbidge, A., & Michel, M. (2005). Understanding foods as soft materials. *Nature Materials*, *4*(10), 729-740. doi:10.1038/nmat1496

Micheelsen, A., Holm, L., & O'Doherty Jensen, K. (2013). Consumer acceptance of the New Nordic Diet. An exploratory study. *Appetite*, *70*, 14-21. doi:10.1016/j.appet.2013.06.081

Michel-Villarreal, R., Vilalta-Perdomo, E., Hingley, M., & Canavari, M. (2019). Evaluating economic resilience for sustainable agri-food systems: The case of Mexico. *Strategic Change*, *28*(4), 279-288. doi:10.1002/jsc.2270

Michelini, L., Principato, L., & Iasevoli, G. (2018). Understanding food sharing models to tackle sustainability challenges. *Ecological Economics*, *145*(C), 205-217. doi:10.1016/j.ecolecon.2017.09.009

Michelsen, J. (2001). Recent development and political acceptance of organic farming in Europe. *Sociologia Ruralis*, *41*(1), 3-20. doi:10.1111/1467-9523.00167

Midgley, J. L. (2013). Food (in)security in the Global 'North' and 'South'. In A. Murcott, W. Belasco, & P. Jackson (Eds.), *The handbook of food research* (pp. 425-438). London: Bloomsbury.

Midgley, J. L. (2014). The logics of surplus food redistribution. *Journal of Environmental Planning and Management*, *57*(12), 1872-1892. doi:10.1080/09640568.2013.848192

Miranda-Ackerman, M. A., Azzaro-Pantel, C., & Aguilar-Lasserre, A. A. (2017). A green supply chain network design framework for the processed food industry:

Application to the orange juice agrofood cluster. *Computers & Industrial Engineering, 109*, 369-389. doi:10.1016/j.cie.2017.04.031

Möllers, J., & Bîrhală, B. (2014). Community supported agriculture: A promising pathway for small family farms in Eastern Europe? A case study from Romania. *Landbauforschung, 64*(3-4), 139-150. doi:10.3220/LBF_2014_139-150

Monkelbaan, J. (2019). *Governance for the sustainable development goals: Exploring an integrative framework of theories, tools, and competencies*. Singapore: Springer.

Montefrio, M. J. F., & Johnson, A. T. (2019). Politics in participatory guarantee systems for organic food production. *Journal of Rural Studies, 65*, 1-11. doi:10.1016/j.jrurstud.2018.12.014

Monti, G., & Mulder, J. (2017). Escaping the clutches of EU competition law : Pathways to assess private sustainability initiatives. *European Law Review, 42*(5), 635-656.

Mooney, P. H., & Hunt, S. A. (2009). Food security: The elaboration of contested claims to a consensus frame. *Rural Sociology, 74*(4), 469-497. doi:10.1111/j.1549-0831.2009.tb00701.x

Moore, S. A., Wilson, J., Kelly-Richards, S., & Marston, S. A. (2015). School gardens as sites for forging progressive socioecological futures. *Annals of the Association of American Geographers, 105*(2), 407-415. doi:10.1080/00045608.2014.985627

Moragues-Faus, A., & Marceau, A. (2018). Measuring progress in sustainable food cities: An indicators toolbox for action. *Sustainability, 11*(1), 45. doi:10.3390/su11010045

Moragues-Faus, A., & Morgan, K. (2015). Reframing the foodscape: The emergent world of urban food policy. *Environment and Planning A, 47*(7), 1558-1573. doi:10.1177%2F0308518X15595754

Moragues-Faus, A., & Sonnino, R. (2019). Re-assembling sustainable food cities: An exploration of translocal governance and its multiple agencies. *Urban Studies, 56*(4), 778-794. doi:10.1177/0042098018763038

Moragues-Faus, A., Sonnino, R., & Marsden, T. (2017). Exploring European food system vulnerabilities: Towards integrated food security governance. *Environmental Science & Policy, 75*, 184-215. doi:10.1016/j.envsci.2017.05.015

Morgan, K. J., Marsden, T., & Murcoch, J. (2006). *Worlds of food: Place, power and provenance in the food chain*. Oxford: Oxford University Press.

Morone, P. (2019). Food waste: Challenges and opportunities for enhancing the emerging bio-economy. *Journal of cleaner production, 221*, 10-16. doi:10.1016/j.jclepro.2019.02.258

Morone, P., Falcone, P. M., Imbert, E., & Morone, A. (2018). Does food sharing leads to food waste reduction? An experimental analysis to assess challenges and opportunities of a new consumption model. *Journal of Cleaner Production, 185*, 749-760. doi:10.1016/j.jclepro.2018.01.208

Morrow, O. (2019). Sharing food and risk in Berlin's urban food commons. *Geoforum, 99*, 202-212. doi:10.1016/j.geoforum.2018.09.003

Moscatelli, S., El Bilali, H., Gamboni, M., & Capone, R. (2016). Towards sustainable food systems: A holistic, interdisciplinary and systemic approach. *International journal AgroFor, 1*, 103-112. doi:10.7251/AGRENG1601103M

Moubarac, J. C., Claro, R. M., Baraldi, L. G., Levy, R. B., Martins, A. P., Cannon, G., & Monteiro, C. A. (2013). International differences in cost and consumption of ready-to-consume food and drink products: United Kingdom and Brazil, 2008-2009. *Global Public Health, 8*(7), 845-856. doi:10.1080/17441692.2013.796401

Munn, Z., Porritt, K., Lockwood, C., Aromataris, E., & Pearson, A. (2014). Establishing confidence in the output of qualitative research synthesis: The conqual approach. *BMC Medical Research Methodology, 14*(1), 108. doi:10.1186/1471-2288-14-108

Murdoch, J., Marsden, T., & Banks, J. (2000). Quality, nature, and embeddedness: Some theoretical considerations in the context of the food sector. *Economic Geography, 76*(2), 107-125. doi:10.2307/144549

Murphy, F. (2019). Seeking solidarity through food: The growth of asylum seeker and refugee food initiatives in Ireland. *Studies in Arts and Humanities, 4*(2), 97. doi:10.18193/sah.v4i2.142

Myers, J. P., vom Saal, F. S., Akingbemi, B. T., Arizono, K., Belcher, S., Colborn, T., . . . Zoeller, R. T. (2009). Why public health agencies cannot depend on good laboratory practices as a criterion for

selecting data: The case of bisphenol a. *Environmental health perspectives*, *117*(3), 309-315. doi:10.1289/ehp.0800173

Myers, J. S., & Sbicca, J. (2015). Bridging good food and good jobs: From secession to confrontation within alternative food movement politics. *Geoforum*, *61*, 17-26. doi:10.1016/j.geoforum.2015.02.003

Mylona, K., Maragkoudakis, P., Bock, A.-K., Wollgast, J., Caldeira, S., & Ulberth, F. (2016). Delivering on EU food safety and nutrition in 2050–future challenges and policy preparedness. *Publications Office of the European Union* doi:10.2787/625130 (online).

National Academies of Sciences Engineering and Medicine. (2016). *Genetically engineered crops: Experiences and prospects*. Washington, DC: The National Academies Press.

National Research Council. (2010). *Toward sustainable agricultural systems in the 21st century*. Washington, DC: The National Academies Press.

Nature Editorial. (2019). Counting the hidden $12-trillion cost of a broken food system. *Nature*, *574*(296). doi:10.1038/d41586-019-03117-y

Neto, B., & Gama Caldas, M. (2018). The use of green criteria in the public procurement of food products and catering services: A review of EU schemes. *Environment, Development and Sustainability*, *20*(5), 1905-1933. doi:10.1007/s10668-017-9992-y

Nielsen, H. B., Sonne, A.-M., Grunert, K. G., Banati, D., Pollák-Tóth, A., Lakner, Z., . . . Peterman, M. (2009). Consumer perception of the use of high-pressure processing and pulsed electric field technologies in food production. *Appetite*, *52*(1), 115-126. doi:10.1016/j.appet.2008.09.010

Niva, M., & Jallinoja, P. (2018). Taking a stand through food choices? Characteristics of political food consumption and consumers in Finland. *Ecological Economics*, *154*, 349-360. doi:10.1016/j.ecolecon.2018.08.013

Niva, M., Mäkelä, J., Kahma, N., & Kjærnes, U. (2014). Eating sustainably? Practices and background factors of ecological food consumption in four Nordic countries. *Journal of Consumer Policy*, *37*(4), 465-484. doi:10.1007/s10603-014-9270-4

Notarnicola, B., Tassielli, G., Renzulli, P. A., 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

NovelQ. (2011). *Novelq: Novel processing methods for the production and distribution of high-quality and safe foods. Final publishable report*. Retrieved from edepot.wur.nl/202496

Nowotny, H., Scott, P., & Gibbons, M. (2001). *Re-thinking science. Knowledge and the public in an age of uncertainty.* Cambridge: Polity Press.

Nuetzenadel, A., & Trentmann, F. (Eds.). (2008). *Food and globalization*. London: Bloomsbury.

Nussbaum, M. C. (2000). *Women and human development: The capabilities approach*. Cambridge: Cambridge University Press.

Nuttavuthisit, K., & Thøgersen, J. (2017). The importance of consumer trust for the emergence of a market for green products: The case of organic food. *Journal of Business Ethics*, *140*, 323-337. doi:10.1007/s10551-015-2690-5

O'Brien, A. (2012). *Surplus food redistribution – a potential solution to reducing food waste in Ireland?* Trinity College, Dublin, Ireland.

OECD. (2019). *Accelerating climate action: Refocusing policies through a well-being lens*. Retrieved from http://www.oecd-ilibrary.org/environment/accelerating-climate-action_2f4c8c9a-en

Ölander, F., & Thøgersen, J. (2014). Informing versus nudging in environmental policy. *Journal of Consumer Policy*, *37*, 341-356. doi:10.1007/s10603-014-9256-2

Olsen, N. V., Grunert, K. G., & Sonne, A.-M. (2010). Consumer acceptance of high-pressure processing and pulsed-electric field: A review. *Trends in food science & technology*, *21*(9), 464-472. doi:10.1016/j.tifs.2010.07.002

Olsen, N. V., Menichelli, E., Grunert, K. G., Sonne, A. M., Szabó, E., Bánáti, D., & Næs, T. (2011). Choice probability for apple juice based on novel processing techniques: Investigating the choice relevance of mean-end-chains. *Food Quality and Preference*, *22*(1), 48-59. doi:10.1016/j.foodqual.2010.07.010

Oosterveer, P. (2007). *Global governance of food production and consumption : Issues and challenges*. Cheltenham, UK: Edward Elgar.

Oosterveer, P., & Sonnenfeld, D. (2012). *Food, globalization and sustainability*. London: Earthscan/Routledge.

Oshaug, A., Eide, W. B., & Eide, A. (1994). Human rights: A normative basis for food and nutrition-relevant policies. *Food Policy*, *19*(6), 491-516. doi:10.1016/0306-9192(94)90042-6

Osman, M., & Thornton, K. (2019). Traffic light labelling of meals to promote sustainable consumption and healthy eating. *Appetite*, *138*, 60-71. doi:10.1016/j.appet.2019.03.015

Ostrom, E. (2009). A general framework for analyzing sustainability of social-ecological systems. *Science*, *325*(5939), 419-422. doi:10.1126/science.1172133

Ostrom, E. (2010). Beyond markets and states: Polycentric governance of complex economic systems. *American Economic Review*, *100*(3), 641-672. doi:10.1257/aer.100.3.641

Ostrom, E. (2012). Why do we need to protect institutional diversity? *European Political Science*, *11*(1), 128-147. doi:10.1057/eps.2011.37

Oteros-Rozas, E., Ruiz-Almeida, A., Aguado, M., González, J. A., & Rivera-Ferre, M. G. (2019). A social–ecological analysis of the global agrifood system. *Proceedings of the National Academy of Sciences*, 201912710. doi:10.1073/pnas.1912710116

Paddock, J. (2017a). Household consumption and environmental change: Rethinking the policy problem through narratives of food practice. *Journal of Consumer Culture*, *17*(1), 122-139. doi:10.1177/1469540515586869

Paddock, J. R. (2017b). Changing consumption, changing tastes? Exploring consumer narratives for food secure, sustainable and healthy diets. *Journal of Rural Studies*, *53*, 102-110. doi:10.1016/j.jrurstud.2017.04.001

Padel, S., Lampkin, N., & Foster, C. (1999). Influence of policy support on the development of organic farming in the European Union. *International Planning Studies*, *4*, 303-315. doi:10.1080/13563479908721744

Parsons, K., Hawkes, C., & Wells, R. (2019). *Understanding the food system: Why it matters for food policy*. Retrieved from https://www.city.ac.uk/__data/assets/pdf_file/0008/471599/7643_Brief-2_What-is-the-food-system-A-food-policy-perspective_WEB_SP.pdf

Paul, C., Techen, A.-K., Robinson, J. S., & 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

Paulino, E. T. (2014). The agricultural, environmental and socio-political repercussions of Brazil's land governance system. *Land Use Policy*, *36*, 134-144. doi:10.1016/j.landusepol.2013.07.009

Pedersen, S., Grønhøj, A., & Bech-Larsen, T. (2012). Family members' roles in healthy-eating socialization based on a healthy-eating intervention. *Young Consumers: Insight and Ideas for Responsible Marketers*, *13*, 208-223. doi:10.1108/17473611211261610

Pedersen, S., Grønhøj, A., & Thøgersen, J. (2015). Following family or friends. Social norms in adolescent healthy eating. *Appetite*, *86*, 54-60. doi:10.1016/j.appet.2014.07.030

Pedersen, S., Grønhøj, A., & Thøgersen, J. (2016). Texting your way to healthier eating? Effects of participating in a feedback intervention using text messaging on adolescents' fruit and vegetable intake. *Health Education Research*, *31*(2), 171-184. doi:10.1093/her/cyv104

Penker, M. (2006). Mapping and measuring the ecological embeddedness of food supply chains. *Geoforum*, *37*(3), 368-379. doi:10.1016/j.geoforum.2005.09.001

Penker, M. (2017). Organising adaptive and collaborative landscape stewardship on farmland. In C. Bieling & T. Plieninger (Eds.), *The science and practice of landscape stewardship* (pp. 103-120). Cambridge: Cambridge University Press.

Pereira, L. M., & Ruysenaar, S. (2012). Moving from traditional government to new adaptive governance: The changing face of food security responses in South Africa. *Food Security*, *4*(1), 41-58. doi:10.1007/s12571-012-0164-5

Pérez Domínguez, I., Britz, W., & Holm-Müller, K. (2009). Trading schemes for greenhouse gas emissions from European agriculture: A comparative analysis based on different implementation options. *Review of Agricultural and Environmental Studies - Revue d'Etudes en Agriculture et Environnement (RAEStud)*, *90*(3), 287-308. doi:10.22004/ag.econ.207765

Perez, I., & Stecker, T. (2013, 4 March). Climate change and rising food prices heightened Arab spring. *Scientific American*.

Perramon, J., Alonso-Almeida, M. d. M., Llach, J., & Bagur-Femenías, L. (2014). Green practices in restaurants: Impact on firm performance. *Operations Management Research, 7*(1), 2-12. doi:10.1007/s12063-014-0084-y

Perrot, N., Trelea, I. C., Baudrit, C., Trystram, G., & Bourgine, P. (2011). Modelling and analysis of complex food systems: State of the art and new trends. *Trends in Food Science & Technology, 22*(6), 304-314. doi:10.1016/j.tifs.2011.03.008

Peters, B. G. (2017). What is so wicked about wicked problems? A conceptual analysis and a research program. *Policy and Society, 36*(3), 385-396. doi:10.1080/14494035.2017.1361633

Peters, B. G., & Pierre, J. (2014). Food policy as a wicked problem: Contending with multiple demands and actors. *World Food Policy, 1*, 4-11. doi:10.18278/wfp.1.1.1

Peters, B. G., & Pierre, J. (2016). *Comparative governance: Rediscovering the functional dimension of governing*. Cambridge: Cambridge University Press.

Petljak, K. (2018). Green supply chain management in food retailing: Survey-based evidence in Croatia. *Supply Chain Management: An International Journal, 23*(1), 1-15. doi:10.1108/SCM-04-2017-0133

Pettoello-Mantovani, M., Ehrich, J., Sacco, M., Ferrara, P., Giardino, I., & Pop, T. L. (2018). Food insecurity and children's rights to adequate nutrition in Europe. *The Journal of Pediatrics, 198*, 329-330.e321. doi:10.1016/j.jpeds.2018.04.042

Petty, R. E., & Cacioppo, J. T. (1986). *Communication and persuasion: Central and peripheral routes to attitude change*. New York: Springer.

Pfeiffer, D. A. (2006). *Eating fossil fuels: Oil, food and the coming crisis in agriculture*. Gabriola Island: New Society Publishers.

Phillips, L. (2006). Food and globalization. *Annual Review of Anthropology, 35*(1), 37-57. doi:10.1146/annurev.anthro.35.081705.123214

Pole, A., Gray, M. J. A., & Values, H. (2013). Farming alone? What's up with the "c" in community supported agriculture. *30*(1), 85-100. doi:10.1007/s10460-012-9391-9

Popkin, B. M. (2006). Global nutrition dynamics: The world is shifting rapidly toward a diet linked with noncommunicable diseases. *The American Journal of Clinical Nutrition, 84*(2), 289-298. doi:10.1093/ajcn/84.1.289

Poti, J. M., Braga, B., & Qin, B. (2017). Ultra-processed food intake and obesity: What really matters for health-processing or nutrient content? *Current obesity reports, 6*(4), 420-431. doi:10.1007/s13679-017-0285-4

Poux, X., & Aubert, P. M. (2018). *Une europe agroécologique en 2050 : Une agriculture multifonctionnelle pour une alimentation saine. Enseignements d'une modélisation du système alimentaire européen* (Study N°09/18). Retrieved from https://www.iddri.org/fr/publications-et-evenements/etude/une-europe-agroecologique-en-2050-une-agriculture

Prager, K. (2015). Agri-environmental collaboratives as bridging organisations in landscape management. *Journal of Environmental Management, 161*, 375-384. doi:10.1016/j.jenvman.2015.07.027

Prager, K., Reed, M., & Scott, A. (2012). Encouraging collaboration for the provision of ecosystem services at a landscape scale—rethinking agri-environmental payments. *Land Use Policy, 29*(1), 244-249. doi:10.1016/j.landusepol.2011.06.012

Pretty, J. (2018). Intensification for redesigned and sustainable agricultural systems. *Science, 362*(6417), eaav0294. doi:10.1126/science.aav0294

Pretty, J., Benton, T. G., Bharucha, Z. P., Dicks, L. V., Flora, C. B., Godfray, H. C. J., . . . Wratten, S. (2018). Global assessment of agricultural system redesign for sustainable intensification. *Nature Sustainability, 1*(8), 441-446. doi:10.1038/s41893-018-0114-0

Pretty, J., & Bharucha, Z. P. (2014). Sustainable intensification in agricultural systems. *Annals of Botany, 114*(8), 1571-1596. doi:10.1093/aob/mcu205

Pretty, J., Brett, C., Gee, D., Bragg, R., Mason, C., Morison, J., . . . Dobbs, T. (2001). Policy challenges and priorities for internalizing the externalities of modern agriculture. *Journal of Environmental Planning and Management, 44*, 263-283. doi:10.1080/09640560120033740

Prigogine, I., & Stengers, I. (1985). Order out of chaos. *British Journal for the Philosophy of Science, 36*(3), 352-354.

Purnhagen, K., van Herpen, E., & van Kleef, E. (2016). The potential use of visual packaging elements as nudges. In K. Mathis & A. Tor (Eds.), *Nudging - possibilities, limitations and applications in European law and economics* (pp. 197-216). Cham: Springer International Publishing.

Purnhagen, K. P., Kok, E., Kleter, G., Schebesta, H., Visser, R. G. F., & Wesseler, J. (2018). EU court casts new plant breeding techniques into regulatory limbo. *Nature Biotechnology, 36*, 799. doi:10.1038/nbt.4251

Purnhagen, K. P., & van Herpen, E. (2017). Can bonus packs mislead consumers? A demonstration of how behavioural consumer research can inform unfair commercial practices law on the example of the ECJ's Mars judgement. *Journal of Consumer Policy, 40*(2), 217-234. doi:10.1007/s10603-017-9345-0

Quiñones-Ruiz, X., Edelmann, H., Penker, M., Belletti, G., Marescotti, A., Scaramuzzi, S., . . . Altenbuchner, C. (2018). How are food geographical indications evolving? – an analysis of EU GI amendments. *British Food Journal, 120*(8), 1876-1887. doi:10.1108/BFJ-02-2018-0087

Quiñones-Ruiz, X., Penker, M., Belletti, G., Marescotti, A., Scaramuzzi, S., Barzini, E., . . . Samper, L. (2016). Insights into the black box of collective efforts for the registration of geographical indications. *Land Use Policy, 57*, 103-116. doi:10.1016/j.landusepol.2016.05.021

Raakjær, J. (2009). *A fisheries management system in crisis: The EU Common Fisheries Policy.* (PhD), Aalborg University, Denmark.

Ramírez, R., & Wilkinson, A. (2016). *Strategic reframing: The Oxford scenario planning approach*. Oxford: Oxford University Press.

Randall, E. (2000). European Union health policy with and without design: Serendipity, tragedy and the future of EU health policy. *Policy Studies, 21*(2), 133-164. doi:10.1080/713691365

Rashid, M. S., & Byun, S.-E. (2018). Are consumers willing to go the extra mile for fair trade products made in a developing country? A comparison with made in USA products at different prices. *Journal of Retailing and Consumer Services, 41*, 201-210. doi:10.1016/j.jretconser.2017.12.011

Raven, R. P. J. M., & Geels, F. W. (2010). Socio-cognitive evolution in niche development: Comparative analysis of biogas development in Denmark and the Netherlands (1973–2004). *Technovation, 30*(2), 87-99. doi:10.1016/j.technovation.2009.08.006

Raworth, K. (2017). A doughnut for the anthropocene: Humanity's compass in the 21st century. *The Lancet Planetary Health, 1*(2), e48-e49. doi:10.1016/S2542-5196(17)30028-1

Raymond, C. M., Reed, M., Bieling, C., Robinson, G. M., & Plieninger, T. (2016). Integrating different understandings of landscape stewardship into the design of agri-environmental schemes. *Environmental Conservation, 43*(4), 350-358. doi:10.1017/S037689291600031X

Rayner, G., Barling, D., & Lang, T. (2008). Sustainable food systems in Europe: Policies, realities and futures. *Journal of Hunger & Environmental Nutrition, 3*(2-3), 145-168. doi:10.1080/19320240802243209

Reckwitz, A. (2002). Toward a theory of social practices: A development in culturalist theorizing. *European Journal of Social Theory, 5*(2), 243-263. doi:10.1177/13684310222225432

Redman, E., & Redman, A. (2014). Transforming sustainable food and waste behaviors by realigning domains of knowledge in our education system. *Journal of Cleaner Production, 64*, 147-157. doi:10.1016/j.jclepro.2013.09.016

Renting, H., Marsden, T. K., & Banks, J. (2003). Understanding alternative food networks: Exploring the role of short food supply chains in rural development. *Environment and Planning A: Economy and Space, 35*(3), 393-411. doi:10.1068/a3510

Reynolds, C., Goucher, L., Quested, T., Bromley, S., Gillick, S., Wells, V. K., . . . 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

Rivera-Ferre, M. (2012). Framing of agri-food research affects the analysis of food security: The critical role of the social sciences. *International Journal of Sociology of Agriculture and Food, 19*(2), 162-175.

Rivera-Ferre, M., & Ortega, M. (2011). Recognising ignorance in decision-making strategies for a more sustainable

agriculture. *EMBO reports*, *12*, 393-397. doi:10.1038/embor.2011.55

Rivera-Ferre, M. G., Ortega-Cerda, M., & Baumgärtner, J. (2013). Rethinking study and management of agricultural systems for policy design. *Sustainability, v. 5*(no. 9), pp. 3858-3875-2013 v.3855 no.3859. doi:10.3390/su5093858

Rli. (2019). *European agricultural policy: Working towards circular agriculture*. Retrieved from https://en.rli.nl/publications/2019/advice/european-agricultural-policy

Robinson, E., Thomas, J., Aveyard, P., & Higgs, S. (2014). What everyone else is eating: A systematic review and meta-analysis of the effect of informational eating norms on eating behavior. *Journal of the Academy of Nutrition and Dietetics*, *114*(3), 414-429. doi:10.1016/j.jand.2013.11.009

Rocha, C., & Lessa, I. (2009). Urban governance for food security: The alternative food system in Belo Horizonte, Brazil. *International Planning Studies*, *14*(4), 389-400. doi:10.1080/13563471003642787

Rockström, J., Steffen, W., Noone, K., Persson, Å., Chapin, F. S., Lambin, E. F., . . . Foley, J. A. (2009). A safe operating space for humanity. *Nature*, *461*(7263), 472-475. doi:10.1038/461472a

Rockström, J., Stordalen, G. A., & Horton, R. (2016). Acting in the Anthropocene: The EAT-Lancet Commission. *The Lancet*, *387*(10036), 2364-2365. doi:10.1016/S0140-6736(16)30681-X

Rodriguez, J. M., Molnar, J. J., Fazio, R. A., Sydnor, E., & Lowe, M. J. (2009). Barriers to adoption of sustainable agriculture practices: Change agent perspectives. *Renewable Agriculture and Food Systems*, *24*(1), 60-71. doi:10.1017/S1742170508002421

Roederer-Rynning, C. (2015). The common agricultural policy: The fortress challenged. In M. A. P. H. Wallace, and A. Young (Ed.), *Policy-making in the European Union* (pp. 196–219). Oxford: Oxford University Press.

Roosen, J., Lusk, J. L., & Fox, J. A. (2003). Consumer demand for and attitudes toward alternative beef labeling strategies in France, Germany, and the UK. *Agribusiness*, *19*(1), 77-90. doi:10.1002/agr.10041

Rotmans, J., Kemp, M., & Van Asselt, M. (2001). More evolution than revolution: Transition management in public policy. *Foresight*, *3*(1), 15-31. doi:10.1108/14636680110803003

Rotmans, J., & Loorbach, D. (2009). Complexity and transition management. *13*(2), 184-196. doi:10.1111/j.1530-9290.2009.00116.x

Rousseau, S. (2012). *Food and social media: You are what you tweet*. Lanham, MD: AltaMira Press/Rowman & Littlefield.

Rousseau, S. (2015). The role of organic and fair trade labels when choosing chocolate. *Food Quality and Preference*, *44*, 92-100. doi:10.1016/j.foodqual.2015.04.002

Royal Society, & The Academy of Medical Sciences. (2018). *Evidence synthesis for policy: A statement of principles*. Retrieved from royalsociety.org/evidence-synthesis

Ruben, R., Verhagen, J., & Plaisier, C. (2018). The challenge of food systems research: What difference does it make? *Sustainability*, *11*(1), 171. doi:10.3390/su11010171

Ruiz-Almeida, A., & Rivera-Ferre, M. G. (2019). Internationally-based indicators to measure agri-food systems sustainability using food sovereignty as a conceptual framework. *Food Security*, *11*(6), 1321-1337. doi:10.1007/s12571-019-00964-5

Rundgren, G. (2016). Food: From commodity to commons. *Journal of Agricultural and Environmental Ethics*, *29*(1), 103-121. doi:10.1007/s10806-015-9590-7

Rut, M., & Davies, A. R. (2018). Transitioning without confrontation? Shared food growing niches and sustainable food transitions in Singapore. *Geoforum*, *96*, 278-288. doi:10.1016/j.geoforum.2018.07.016

Rutsaert, P., Regan, A., Pieniak, Z., McConnon, A., Moss, A., Wall, P., & Verbeke, W. (2013). The use of social media in food risk and benefit communication. *Trends in Food Science & Technology*, *30*, 84-91. doi:10.1016/j.tifs.2012.10.006

Sahakian, M., & Wilhite, H. (2014). Making practice theory practicable: Towards more sustainable forms of consumption. *Journal of Consumer Culture*, *14*, 25-44. doi:10.1177/1469540513505607

SAM. (2019a). *Scoping paper: Towards an EU sustainable food system*. Retrieved from https://ec.europa.eu/research/sam/pdf/meetings/hlg_sam_032019_scoping_paper_sustainable-food.pdf#view=fit&pagemode=none

SAM. (2019b). *A scoping review of major works relevant to scientific advice towards an EU sustainable food system*. Retrieved from https://ec.europa.eu/research/sam/pdf/meetings/hlg_sam_032019_scoping_report_sustainable-food.pdf#view=fit&pagemode=none

Sandhu, H., Wratten, S., Porter, J., Costanza, R., Pretty, J., & Reganold, J. (2016). Mainstreaming ecosystem services into future farming. *Solutions*, *7*, 40-47.

Santeramo, F. G., Carlucci, D., De Devitiis, B., Seccia, A., Stasi, A., Viscecchia, R., & Nardone, G. (2018). Emerging trends in European food, diets and food industry. *Food Research International*, *104*, 39-47. doi:10.1016/j.foodres.2017.10.039

Santo, R., & Moragues-Faus, A. (2019). Towards a trans-local food governance: Exploring the transformative capacity of food policy assemblages in the US and UK. *Geoforum*, *98*, 75-87. doi:10.1016/j.geoforum.2018.10.002

SAPEA. (2017). *Food from the oceans*. Retrieved from https://www.sapea.info/topics/foodfromtheoceans/

SAPEA. (2019a). *Making sense of science*. Retrieved from https://www.sapea.info/topics/making-sense-of-science/

SAPEA. (2019b). *Transforming the future of ageing*. Retrieved from https://www.sapea.info/topics/ageing/

SAPEA. (2020). *A Sustainable Food System for the EU – A systematic review of the European policy ecosystem*. Retrieved from https://www.sapea.info/topics/sustainablefood/

Sbicca, J. (2015). Food labor, economic inequality, and the imperfect politics of process in the alternative food movement. *Agriculture and Human Values*, *32*(4), 675-687. doi:10.1007/s10460-015-9582-2

Scalco, A., Noventa, S., Sartori, R., & Ceschi, A. (2017). Predicting organic food consumption: A meta-analytic structural equation model based on the theory of planned behavior. *Appetite*, *112*, 235-248. doi:10.1016/j.appet.2017.02.007

SCAR Food Systems Working Group. (2019). Standing committee on agricultural research (SCAR) food systems. Retrieved from https://scar-europe.org/index.php/food

Schaefer, F., & Blanke, M. (2014). Opportunities and challenges of carbon footprint, climate or CO_2 labelling for horticultural products. *Erwerbs-Obstbau*, *56*, 73-80. doi:10.1007/s10341-014-0206-6

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

Schiff, R. (2008). The role of food policy councils in developing sustainable food systems. *Journal of Hunger & Environmental Nutrition*, *3*(2-3), 206-228. doi:10.1080/19320240802244017

Scholte, J. A. (2002). Civil society and democracy in global governance. *Global Governance*, *8*(3), 281-304. doi:10.2307/27800346

Schot, J., & Geels, F. W. (2008). Strategic niche management and sustainable innovation journeys: Theory, findings, research agenda, and policy. *Technology Analysis & Strategic Management*, *20*(5), 537-554. doi:10.1080/09537320802292651

Schouten, G., & Hospes, O. (2018). Public and private governance in interaction: Changing interpretations of sovereignty in the field of sustainable palm oil. *Sustainability*, *10*, 4811. doi:10.3390/su10124811

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

Schwartz, S. H. (1977). Normative influences on altruism. In L. Berkowitz (Ed.), *Advances in experimental social psychology* (Vol. 10, pp. 221-279). New York: Academic Press.

Schwartz, S. H., & Howard, J. A. (1981). A normative decision-making model of altruism. In P. J. R. a. R. M. Sorrentino (Ed.), *Altruism and helping behavior: Social, personality, and developmental perspectives* (pp. 189-211). Hillsdale: Lawrence Erlbaum.

Secondi, L., Principato, L., & Laureti, T. (2015). Household food waste behaviour in eu-27 countries: A multilevel analysis. *Food Policy*, *56*, 25-40. doi:10.1016/j.foodpol.2015.07.007

Sen, A. (2009). *The idea of justice*. London: Allen Lane.

Service, O., Hallsworth, M., Halpern, D., Algate, F., Gallagher, R., Nguyen, S., . . . Kirkman., E. (2014). *East - four simple ways to apply behavioural insights*. Retrieved from https://www.bi.team/publications/east-four-simple-ways-to-apply-behavioural-insights/

Sexton, A. E. (2018). Eating for the post-anthropocene: Alternative proteins and the biopolitics of edibility. *Transactions of the Institute of British Geographers*, *43*(4), 586-600. doi:10.1111/tran.12253

Seyfang, G., & Smith, A. (2007). Grassroots innovations for sustainable development: Towards a new research and policy agenda. *Environmental Politics*, *16*(4), 584-603. doi:10.1080/09644010701419121

Shapiro, J. (2010). The eco-gastronomic mirror: Narcissism and death at the dinner table. *Ecopsychology*, *2*, 247-252. doi:10.1089/eco.2009.0033

Shareable. (2017). *Sharing cities: Activating the urban commons*. San Francisco: Shareable.

Shove, E., & Pantzar, M. (2005). Consumers, producers and practices: Understanding the invention and reinvention of Nordic walking. *Journal of Consumer Culture*, *5*(1), 43-64. doi:10.1177/1469540505049846

Shove, E., & Walker, G. (2007). Caution! Transitions ahead: Politics, practice, and sustainable transition management. *Environment and Planning A: Economy and Space*, *39*(4), 763-770. doi:10.1068/a39310

Shove, E., & Walker, G. (2010). Governing transitions in the sustainability of everyday life. *Research Policy*, *39*(4), 471-476. doi:10.1016/j.respol.2010.01.019

Siddiki, S. N., Carboni, J. L., Koski, C., & Sadiq, A.-A. (2015). How policy rules shape the structure and performance of collaborative governance arrangements. *75*(4), 536-547. doi:10.1111/puar.12352

Sigsgaard, T., Forsberg, B., Annesi-Maesano, I., Blomberg, A., Bolling, A., Boman, C., . . . Brunekreef, B. (2015). Health impacts of anthropogenic biomass burning in the developed world. *The European Respiratory Journal*, *46*(6), 1577-1588. doi:10.1183/13993003.01865-2014

Sijtsema, S. J., Onwezen, M. C., Reinders, M. J., Dagevos, H., Partanen, A., & Meeusen, M. (2016). Consumer perception of bio-based products—an exploratory study in 5 European countries. *NJAS - Wageningen Journal of Life Sciences*, *77*, 61-69. doi:10.1016/j.njas.2016.03.007

Sirieix, L., Delanchy, M., Remaud, H., Zepeda, L., & Gurviez, P. (2013). Consumers' perceptions of individual and combined sustainable food labels: A UK pilot investigation. *37*(2), 143-151. doi:10.1111/j.1470-6431.2012.01109.x

Sivramkrishna, S., & Jyotishi, A. (2008). Monopsonistic exploitation in contract farming: Articulating a strategy for grower cooperation. *20*(3), 280-296. doi:10.1002/jid.1411

Skogstad, G. (1998). Ideas, paradigms and institutions: Agricultural exceptionalism in the European Union and the United States. *Governance*, *11*(4), 463-490. doi:10.1111/0952-1895.00082

Slocum, R., Shannon, J., Cadieux, K., & Beckman, M. (2011). "Properly, with love, from scratch": Jamie Oliver's food revolution. *Radical History Review*, *2011*, 178-191. doi:10.1215/01636545-2010-033

Smith, A., & Raven, R. (2012). What is protective space? Reconsidering niches in transitions to sustainability. *Research Policy*, *41*(6), 1025-1036. doi:10.1016/j.respol.2011.12.012

Smith, A., & Stirling, A. (2010). The politics of social-ecological resilience and sustainable socio-technical transitions. *Ecology and Society*, *15*(1).

Smith, P., & Gregory, P. J. (2013). Climate change and sustainable food production. *Proceedings of the Nutrition Society*, *72*(1), 21-28. doi:10.1017/S0029665112002832

Sobal, J. (1978). Food system globalization, eating trans-formations and nutrition transitions. In R. Grew (Ed.), *Food in global history* (pp. 171-193). Boulder, USA: Westview Press.

Soldi, R. (2018). *Sustainable public procurement of food*. Retrieved from https://cor.europa.eu/en/engage/studies/Documents/sustainable-public-procurement-food.pdf

Sommerville, M., Essex, J., & Le Billon, P. (2014). The 'global food crisis' and the geopolitics of food security. *Geopolitics*, *19*(2), 239-265. doi:10.1080/14650045.2013.811641

Song, H.-J., Grutzmacher, S., & Munger, A. L. (2016). Project ReFresh: Testing the efficacy of a school-based classroom

and cafeteria intervention in elementary school children. *86*(7), 543-551. doi:10.1111/josh.12404

Sonnino, R., Lozano Torres, C., & Schneider, S. (2014). Reflexive governance for food security: The example of school feeding in Brazil. *Journal of Rural Studies*, *36*, 1-12. doi:10.1016/j.jrurstud.2014.06.003

Sonnino, R., & Marsden, T. (2006). Beyond the divide: Rethinking relationships between alternative and conventional food networks in Europe. *Journal of Economic Geography*, *6*, 181-199. doi:10.1093/jeg/lbi006

Sonnino, R., Tegoni, C. L. S., & De Cunto, A. (2019). The challenge of systemic food change: Insights from cities. *Cities*, *85*, 110-116. doi:10.1016/j.cities.2018.08.008

Sorensen, H. (2016). *Inside the mind of the shopper: The science of retailing* (2 Ed.). Hoboken, NJ: Pearson FT Press.

Southerton, D., Chappells, H., & van Vliet, B. (2004). *Sustainable consumption: The implications of changing infrastructures of provision*. Cheltenham: Edward Elgar Publishing.

Spaargaren, G., & Van Vliet, B. (2000). Lifestyles, consumption and the environment: The ecological modernization of domestic consumption. *Environmental Politics*, *9*(1), 50-76. doi:10.1080/09644010008414512

Spangenberg, J. (2017). Hot air or comprehensive progress? A critical assessment of the SDGs. *Sustainable Development*, *25*, 311-321. doi:10.1002/sd.1657

Sparkman, G., & Walton, G. M. (2017). Dynamic norms promote sustainable behavior, even if it is counternormative. *Psychological Science*, *28*(11), 1663-1674. doi:10.1177/0956797617719950

Śpiewak, R. (2016). The social process of defining quality food, based on the opinions of polish consumer cooperative members. *Village and Agriculture (Wieś i Rolnictwo)*, *4*(173), 123-139. doi:10.22004/ag.econ.268632

Śpiewak, R., & Jasiński, J. (2019). Knowledge transfer in the organic farming system: The role of agricultural advisory service. *Journal of Agribusiness and Rural Development*, *51*(1). doi:10.17306/J.JARD.2019.01111

Springmann, M., Clark, M., Mason-D'Croz, D., Wiebe, K., Bodirsky, B., Lassaletta, L., . . . Willett, W. (2018). Options for keeping the food system within environmental limits. *Nature*, *562*(7728), 519-525. doi:10.1038/s41586-018-0594-0

Spurling, N., McMeekin, A., Shove, E., Southerton, D., & Welch, D. (2013). *Interventions in practice: Re-framing policy approaches to consumer behaviour*. Retrieved from http://www.sprg.ac.uk/uploads/sprg-report-sept-2013.pdf

Stafford-Smith, M., Griggs, D., Gaffney, O., Ullah, F., Reyers, B., Kanie, N., . . . O'Connell, D. (2017). Integration: The key to implementing the sustainable development goals. *Sustainability Science*, *12*(6), 911-919. doi:10.1007/s11625-016-0383-3

Stam, C. (2018, 26.09.2018). European leaders urged to act on soil sustainability. *Euractiv*.

Statista. (2019). *Market share of grocery stores in Great Britain from January 2015 to September 2019*. Retrieved from https://www.statista.com/statistics/280208/grocery-market-share-in-the-united-kingdom-uk/

Stattman, S. L., Gupta, A., Partzsch, L., & Oosterveer, P. (2018). Toward sustainable biofuels in the European Union? Lessons from a decade of hybrid biofuel governance. *Sustainability*, *10*(11), 4111. doi:10.3390/su10114111

Steel, C. (2013). *Hungry city: How food shapes our lives* (2013 reprint ed.): Vintage.

Steffen, W., Richardson, K., Rockström, J., Cornell, S. E., Fetzer, I., Bennett, E. M., . . . Sörlin, S. (2015). Planetary boundaries: Guiding human development on a changing planet. *Science*, *347*(6223), 1259855. doi:10.1126/science.1259855

Steg, L., Bolderdijk, J. W., Keizer, K., & Perlaviciute, G. (2014). An integrated framework for encouraging pro-environmental behaviour: The role of values, situational factors and goals. *Journal of Environmental Psychology*, *38*, 104-115. doi:10.1016/j.jenvp.2014.01.002

Steier, G. (2011). Externalities in industrial food production: The costs of profit. *Dartmouth Law Journal*, *9*(3), 163-197.

Stenmarck, Å., Jensen, C., Quested, T., & Moates, G. (2016). *Estimates of European food waste levels*. Retrieved from https://www.eu-fusions.org/phocadownload/Publications/Estimates%20of%20European%20food%20waste%20levels.pdf

Steurer, R. (2013). Disentangling governance: A synoptic view of regulation by government, business and civil society. *Policy Sciences*, *46*(4), 387-410. doi:10.1007/s11077-013-9177-y

Stöckli, S., Dorn, M., & Liechti, S. (2018). Normative prompts reduce consumer food waste in restaurants. *Waste Management*, *77*, 532-536. doi:10.1016/j.wasman.2018.04.047

Straith, D., Adamowski, J., & Reilly, K. (2014). Exploring the behavioural attributes, strategies and contextual knowledge of champions of change in the Canadian water sector. *Canadian Water Resources Journal / Revue canadienne des ressources hydriques*, *39*(3), 255-269. doi:10.1080/07011784.2014.942576

Stranieri, S., Ricci, E. C., & Banterle, A. (2017). Convenience food with environmentally-sustainable attributes: A consumer perspective. *Appetite*, *116*, 11-20. doi:10.1016/j.appet.2017.04.015

Stuckler, D., McKee, M., Ebrahim, S., & Basu, S. (2012). Manufacturing epidemics: The role of global producers in increased consumption of unhealthy commodities including processed foods, alcohol, and tobacco. *PLOS Medicine*, *9*(6), e1001235. doi:10.1371/journal.pmed.1001235

Šūmane, S., Kunda, I., Knickel, K., Strauss, A., Tisenkopfs, T., Rios, I. d. I., . . . Ashkenazy, A. (2018). Local and farmers' knowledge matters! How integrating informal and formal knowledge enhances sustainable and resilient agriculture. *Journal of Rural Studies*, *59*, 232-241. doi:10.1016/j.jrurstud.2017.01.020

Šūmane, S., Kunda, I., Tisenkopfs, T., Pilvere, I., Stokmane, I., & Zēverte-Rivža, S. (2015). *Case study. Small farms' development strategies Latvia. Rethink project report*. Retrieved from http://www.bscresearch.lv/content/projects_files/pdf1_rethink_lv_final-27032015.pdf

Sunstein, C. R. (2013). *Simpler. The future of government*. New York: Simon & Schuster Paperbacks.

Swinbank, A. (2006). Like products, animal welfare and the world trade organization. *Journal of World Trade*, 687-711.

Swinburn, B., Vandevijvere, S., Kraak, V., Sacks, G., Snowdon, W., Hawkes, C., . . . Informas. (2013). Monitoring and benchmarking government policies and actions to improve the healthiness of food environments: A proposed government healthy food environment policy index. *Obesity Reviews*, *14*(S1), 24-37. doi:10.1111/obr.12073

Swinnen, J. (2015). *The political economy of the 2014-2020 common agricultural policy: An imperfect storm*. London: Rowman and Littlefield International.

Tanner, B. (2000). Independent assessment by third-party certification bodies. *Food Control*, *11*(5), 415-417. doi:10.1016/S0956-7135(99)00055-9

Tanumihardjo, S. A., Anderson, C., Kaufer-Horwitz, M., Bode, L., Emenaker, N. J., Haqq, A. M., . . . Stadler, D. D. (2007). Poverty, obesity, and malnutrition: An international perspective recognizing the paradox. *Journal of the American Dietetic Association*, *107*(11), 1966-1972. doi:10.1016/j.jada.2007.08.007

Termeer, C., Dewulf, A., & Biesbroek, G. R. (2016). Transformational change: Governance interventions for climate change adaptation from a continuous change perspective. *Journal of Environmental Planning and Management*, *60*(4), 558-576.

Termeer, C. J. A. M., Drimie, S., Ingram, J., Pereira, L., & Whittingham, M. J. (2018). A diagnostic framework for food system governance arrangements: The case of South Africa. *NJAS - Wageningen Journal of Life Sciences*, *84*, 85-93. doi:10.1016/j.njas.2017.08.001

Thaler, R. H., & Sunstein, C. R. (2008). *Nudge. Improving decisions about health, wealth and happiness*. London, UK: Penguin Books.

The Lancet. (2017). What has Europe ever done for health? *The Lancet*, *389*(10075), 1165. doi:10.1016/S0140-6736(17)30812-7

Thøgersen, J. (2000). Psychological determinants of paying attention to eco-labels in purchase decisions: Model development and multinational validation. *Journal of Consumer Policy*, *23*, 285-313. doi:10.1023/A:1007122319675

Thøgersen, J. (2010). Country differences in sustainable consumption: The case of organic food. *Journal of Macromarketing*, *30*(2), 171-185. doi:10.1177/0276146710361926

Thøgersen, J. (2011). Green shopping: For selfish reasons or the common good? *American Behavioral Scientist*, *55*(8), 1052-1076. doi:10.1177/0002764211407903

Thøgersen, J. (2014). Unsustainable consumption basic causes and implications for policy. *European Psychologist*, *19*, 84. doi:10.1027/1016-9040/a000176

Thøgersen, J., Jørgensen, A.-K., & Sandager, S. (2012). Consumer decision making regarding a "green" everyday product. *29*(4), 187-197. doi:10.1002/mar.20514

Thøgersen, J., & Nielsen, K. S. (2016). A better carbon footprint label. *Journal of Cleaner Production*, *125*, 86-94. doi:10.1016/j.jclepro.2016.03.098

Thøgersen, J., Pedersen, S., & Aschemann-Witzel, J. (2019). The impact of organic certification and country of origin on consumer food choice in developed and emerging economies. *Food Quality and Preference*, *72*, 10-30. doi:10.1016/j.foodqual.2018.09.003

Thomas, J. M., Ursell, A., Robinson, E. L., Aveyard, P., Jebb, S. A., Herman, C. P., & Higgs, S. (2017). Using a descriptive social norm to increase vegetable selection in workplace restaurant settings. *Health Psychology*, *36*(11), 1026-1033. doi:10.1037/hea0000478

Thompson, J., & Scoones, I. (2009). Addressing the dynamics of agri-food systems: An emerging agenda for social science research. *Environmental Science & Policy*, *12*(4), 386-397. doi:10.1016/j.envsci.2009.03.001

Tilman, D., Balzer, C., Hill, J., & Befort, B. L. (2011). Global food demand and the sustainable intensification of agriculture. *108*(50), 20260-20264. doi:10.1073/pnas.1116437108

Tilman, D., & Clark, M. (2014). Global diets link environmental sustainability and human health. *Nature*, *515*(7528), 518-522. doi:10.1038/nature13959

Timmer, C. P., Falon, W. P., & Pearson, S. R. (1983). *Food policy analysis- World Bank publication*. Baltimore and London: The John Hopkins University Press.

Tobey, L. N., & Manore, M. M. (2014). Social media and nutrition education: The food hero experience. *Journal of Nutrition Education and Behavior*, *46*(2), 128-133. doi:10.1016/j.jneb.2013.09.013

Tsakiris, G. (2015). The status of the European waters in 2015: A review. *Environmental Processes*, *2*(3), 543-557. doi:10.1007/s40710-015-0079-1

Tukker, A., Cohen, M. J., Hubacek, K., & Mont, O. (2010). The impacts of household consumption and options for change. *14*(1), 13-30. doi:10.1111/j.1530-9290.2009.00208.x

Tyfield, D. (2011). Food systems transition and disruptive low carbon innovation: Implications for a food security research agenda. *Journal of Experimental Botany*, *62*(11), 3701-3706. doi:10.1093/jxb/err123

UN. (2019a). Population. Retrieved from https://www.un.org/en/sections/issues-depth/population/index.html

UN. (2019b). *World population prospects 2019*. Retrieved from https://www.un.org/development/desa/publications/world-population-prospects-2019-highlights.html

UN DESA. (2019). *World urbanization prospects: The 2018 revision*. Retrieved from https://population.un.org/wup/Publications/

UNCTAD. (2013). *Trade and environment review 2013. Wake up before it is too late: Make agriculture truly sustainable now for food security in a changing climate*. Retrieved from https://unctad.org/en/PublicationsLibrary/ditcted2012d3_en.pdf

UNEP. (2011). *Towards a green economy: Pathways to sustainable development and poverty eradication*. Retrieved from https://sustainabledevelopment.un.org/index.php?page=view&type=400&nr=126&menu=35

Urien, C., Legrand, J., Montalent, P., Casaregola, S., & Sicard, D. (2019). Fungal species diversity in French bread sourdoughs made of organic wheat flour. *Frontiers in Microbiology*, *10*, 201. doi:10.3389/fmicb.2019.00201

van't Veer, P., Poppe, K. J., & Fresco, L. O. (2017). *Towards a European food and nutrition policy*. Retrieved from https://edepot.wur.nl/423602

van Amstel, M., Driessen, P., & Glasbergen, P. (2008). Eco-labeling and information asymmetry: A comparison of five eco-labels in the Netherlands. *Journal of Cleaner Production*, *16*(3), 263-276. doi:10.1016/j.jclepro.2006.07.039

van Bers, C., C, P.-W., Eakin, H., Ericksen, P., Lenaerts, L., Förch, W., . . . Eriksen, S. (2016). *Transformations in governance towards resilient food systems. CCAFS working paper no. 190*. Retrieved from https://ccafs.cgiar.org/publications/transformation-governance-towards-resilient-food-systems#.XiV8zMRCe70

van der Meulen, B., & van der Velde, M. (2010). The general food law and EU food legislation. In A. Oskam, G. Meester, & H. Silvis (Eds.), *EU policy for agriculture, food and rural areas* (pp. 267-283). Wageningen: Wageningen Academic Publishers.

van der Ploeg, J. D. (2009). Transition: Contradictory but interacting processes of change in Dutch agriculture. In K. J. Poppe, C. Termeer, & M. Slingerland (Eds.), *Transitions towards sustainable agriculture and food chains in peri-urban areas* (pp. 293-307). Wageningen: Wageningen Academic Publishers.

van Mil, H. G. J., Foegeding, E. A., Windhab, E. J., Perrot, N., & van der Linden, E. (2014). A complex system approach to address world challenges in food and agriculture. *Trends in Food Science & Technology*, *40*(1), 20-32. doi:10.1016/j.tifs.2014.07.005

Van Zanten, H. H. E., Herrero, M., Van Hal, O., Roos, E., Muller, A., Garnett, T., . . . De Boer, I. J. M. (2018). Defining a land boundary for sustainable livestock consumption. *Global Change Biology*, *24*(9), 4185-4194. doi:10.1111/gcb.14321

Vanclay, J., Shortiss, J., Aulsebrook, S., Gillespie, A., Howell, B., Johanni, R., . . . Yates, J. (2011). Customer response to carbon labelling of groceries. *Journal of Consumer Policy*, *34*, 153–160. doi:10.1007/s10603-010-9140-7

Vandenbergh, M. P., & Nielsen, K. S. (2019). From myths to action. *Nature Climate Change*, *9*(1), 8-9. doi:10.1038/s41558-018-0357-9

Vander Stichele, M. (2015). How financialization influences the dynamics of the food supply chain. *Canadian Food Studies / La Revue canadienne des études sur l'alimentation*, *2*(2), 258-266. doi:10.15353/cfs-rcea.v2i2.135

Vandevijvere, S., Dominick, C., Devi, A., & Swinburn, B. (2015). The healthy food environment policy index: Findings of an expert panel in New Zealand. *Bulletin of the World Health Organization*, *93*(5), 294-302. doi:10.2471/BLT.14.145540

VanEpps, E. M., Downs, J. S., & Loewenstein, G. (2016). Calorie label formats: Using numeric and traffic light calorie labels to reduce lunch calories. *Journal of Public Policy & Marketing*, *35*(1), 26-36. doi:10.1509/jppm.14.112

Velten, S., Schaal, T., Leventon, J., Hanspach, J., Fischer, J., & Newig, J. (2018). Rethinking biodiversity governance in European agricultural landscapes: Acceptability of alternative governance scenarios. *Land Use Policy*, *77*, 84-93. doi:10.1016/j.landusepol.2018.05.032

Verain, M., Bartels, J., Dagevos, H., Sijtsema, S., Onwezen, M., & Antonides, G. (2012). Segments of sustainable food consumers: A literature review. *International Journal of Consumer Studies*, *36*, 123-132. doi:10.1111/j.1470-6431.2011.01082.x

Verbruggen, P., & Havinga, T. (2017). *Hybridization of food governance: Trends, types and results*. Cheltenham: Edward Elgar.

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

Vermeir, I., & Verbeke, W. (2008). Sustainable food consumption among young adults in Belgium: Theory of planned behaviour and the role of confidence and values. *Ecological Economics*, *64*, 542-553.

Vermeulen, S. J., Campbell, B. M., & Ingram, J. S. I. (2012). Climate change and food systems. *Annual Review of Environment and Resources*, *37*(1), 195-222. doi:10.1146/annurev-environ-020411-130608

Vittersø, G., & Tangeland, T. (2015). The role of consumers in transitions towards sustainable food consumption. The case of organic food in Norway. *Journal of Cleaner Production*, *92*, 91-99. doi:10.1016/j.jclepro.2014.12.055

Vivero-Pol, J. L. (2017). Food as commons or commodity? Exploring the links between normative valuations and agency in food transition. *Sustainability*, *9*(3), 442. doi:10.3390/su9030442

Vivero-Pol, J. L., Ferrando, T., De Schutter, O., & Mattei, U. (Eds.). (2018). *Routledge handbook of food as a commons*. London: Routledge.

Volz, P., Weckenbrock, P., Cressot, N., Parot, J., & Dezsény, Z. (2016). *Overview of community supported agriculture in Europe*: European CSA Research Group.

von Hagen, O., Manning, S., & Reinecke, J. (2010). Sustainable sourcing in the food industry: Global challenges and practices. *Moderne Ernaehrung Heute, Official Journal of the Food Chemistry Institute of the Association of the German Confectionery Industry*, *4*, 1-9.

Voytenko, Y., McCormick, K., Evans, J., & Schliwa, G. (2016). Urban living labs for sustainability and low carbon cities in Europe: Towards a research agenda. *Journal of Cleaner Production*, *123*, 45-54. doi:10.1016/j.jclepro.2015.08.053

Vranes, E. (2011). Climate labelling and the WTO: The 2010 EU ecolabelling programme as a test case under WTO law. In C. Herrmann & J. P. Terhechte (Eds.), *European yearbook of international economic law 2011* (pp. 205-237). Berlin, Heidelberg: Springer.

Vringer, K., Heijden, E., Soest, D., Vollebergh, H., & Dietz, F. (2017). Sustainable consumption dilemmas. *Sustainability*, *9*, 942.

Wang, Z., Mathiyazhagan, K., Xu, L., & Diabat, A. (2016). A decision making trial and evaluation laboratory approach to analyze the barriers to green supply chain management adoption in a food packaging company. *Journal of cleaner production*, *117*, 10-28. doi:10.1016/j.jclepro.2015.09.142

Warde, A. (2005). Consumption and theories of practice. *Journal of Consumer Culture*, *5*(2), 131-153. doi:10.1177/1469540505053090

Warde, A. (2016). *The practice of eating*. Cambridge: Polity Press.

WBGU. (2011). *World in transition: A social contract for sustainability*. Retrieved from https://www.wbgu.de/en/publications/publication/world-in-transition-a-social-contract-for-sustainability

Welsh, J., & MacRae, R. (1998). Food citizenship and community food security: Lessons from Toronto, Canada. *Canadian Journal of Development Studies / Revue canadienne d'études du développement*, *19*(4), 237-255. doi:10.1080/02255189.1998.9669786

Westengen, O. T., & Banik, D. (2016). The state of food security: From availability, access and rights to food systems approaches. *Forum for Development Studies*, *43*(1), 113-134. doi:10.1080/08039410.2015.1134644

Westhoek, H., Ingram, J., van Berkum, S., & Hajer, M. (2016). *Food systems and natural resources* (9280735608). Retrieved from https://www.resourcepanel.org/file/133/download?token=6dSyNtuV

Weymes, M., & Davies, A. R. (2019). [Re]valuing surplus: Transitions, technologies and tensions in redistributing prepared food in san francisco. *Geoforum*, *99*, 160-169. doi:10.1016/j.geoforum.2018.11.005

Whitty, C. J. M. (2015). What makes an academic paper useful for health policy? *BMC Medicine*, *13*(1), 301. doi:10.1186/s12916-015-0544-8

WHO. (2016). *Fiscal policies for diet and the prevention of noncommunicable diseases*. Retrieved from https://www.who.int/dietphysicalactivity/publications/fiscal-policies-diet-prevention/en/

WHO. (2018). Obesity and overweight. Retrieved from https://www.who.int/news-room/fact-sheets/detail/obesity-and-overweight

Willer, H., & Lernoud, J. (2016). *The world of organic agriculture. Statistics and emerging trends 2016*. Retrieved from https://shop.fibl.org/chde/1698-organic-world-2016.html

Willer, H., & Lernoud, J. (2019). *The world of organic agriculture. Statistics and emerging trends 2019.* Retrieved from https://shop.fibl.org/chde/2020-organic-world-2019.html

Willett, W., Rockström, J., Loken, B., Springmann, M., Lang, T., Vermeulen, S., . . . Murray, C. J. L. (2019). Food in the Anthropocene: The EAT - Lancet commission on healthy diets from sustainable food systems. *Lancet*, *393*(10170), 447-492. doi:10.1016/S0140-6736(18)31788-4

Wills, W. J., Meah, A., Dickinson, A. M., & Short, F. (2015). 'I don't think I ever had food poisoning'. A practice-based approach to understanding foodborne disease that originates in the home. *Appetite*, *85*, 118-125. doi:10.1016/j.appet.2014.11.022

Wiskerke, J. S. C., Bock, B. B., Stuiver, M., & Renting, H. (2003). Environmental co-operatives as a new mode of rural governance. *NJAS - Wageningen Journal of Life Sciences*, *51*(1), 9-25. doi:10.1016/S1573-5214(03)80024-6

Wittman, H. (2011). Food sovereignty: A new rights framework for food and nature? *Environment and Society: Advances in Research*, *2*(1), 87-105. doi:10.3167/ares.2011.020106

Woods, J., Williams, A., Hughes, J. K., Black, M., & Murphy, R. (2010). Energy and the food system. *365*(1554), 2991-3006. doi:10.1098/rstb.2010.0172

World Economic Forum. (2017). *Shaping the future of global food systems: A scenarios analysis*. Retrieved from https://www.weforum.org/whitepapers/shaping-the-future-of-global-food-systems-a-scenarios-analysis

Wright, A., Smith, K. E., & Hellowell, M. (2017). Policy lessons from health taxes: A systematic review of empirical studies. *BMC Public Health*, *17*(1), 583. doi:10.1186/s12889-017-4497-z

Wright, L., Nancarrow, C., & Kwok, P. (2001). Food taste preferences and cultural influences on consumption. *British Food Journal*, *103*, 348-357. doi:10.1108/00070700110396321

Yin, R. K. (2014). *Case study research: Design and methods*. London: SAGE Publications.

Young, D., Borland, R., & Coghill, K. (2010). An actor-network theory analysis of policy innovation for smoke-free places: Understanding change in complex systems. *American journal of public health*, *100*(7), 1208-1217. doi:10.2105/AJPH.2009.184705

Young, W., Russell, S. V., Robinson, C. A., & Barkemeyer, R. (2017). Can social media be a tool for reducing consumers' food waste? A behaviour change experiment by a UK retailer. *Resources, Conservation and Recycling*, *117*, 195-203. doi:10.1016/j.resconrec.2016.10.016

Zander, K., Schleenbecker, R., & Hamm, U. (2017). Consumer behaviour in the organic and fair trade food market in Europe. In P. Parvathi, U. Grote, & H. Waibel (Eds.), *Fair trade and organic agriculture: A winning combination?* (pp. 51-60). Boston, MA: CABI.

Zurek, M., Hebinck, A., Leip, A., Vervoort, J., Kuiper, M., Garrone, M., . . . Achterbosch, T. (2018). Assessing sustainable food and nutrition security of the EU food system – an integrated approach. *Sustainability*, *10*, 4271. doi:10.3390/su10114271

Annex 1. Working Group members

- **Chair:** Professor Peter Jackson, University of Sheffield (UK)
- Dr Jeroen Candel, Wageningen University and Research (The Netherlands)
- Professor Anna Davies, Trinity College Dublin (Ireland)
- Dr Hugo de Vries, French National Research Institute for Agriculture, Food and the Environment (INRAE) (France)
- Professor Cristiane Derani, University of Santa Catarina (Brazil) and University of Cambridge (UK)
- Professor Verica Dragović-Uzelac, University of Zagreb (Croatia)
- Professor Alf Håkon Hoel, University of Tromsø (Norway)
- Professor Lotte Holm, University of Copenhagen (Denmark)
- Professor Piergiuseppe Morone, Unitelma Sapienza – University of Rome (Italy)
- Professor Marianne Penker, University of Natural Resources and Life Sciences, Vienna (Austria)
- Dr Marta Guadalupe Rivera-Ferre, Chair Agroecology and Food Systems, University of Vic-Central University of Catalonia (Spain)
- Dr Ruta Śpiewak, Polish Academy of Sciences, Institute of Rural and Agricultural Development (Poland)
- Professor Katrien Termeer, Wageningen University and Research (The Netherlands)
- Professor John Thøgersen, Aarhus University (Denmark)
- **Invited contributor:** Professor Erik Mathijs, University of Leveun (KU Leuven) (Belgium)

The above experts were identified with the support of:

- The British Academy
- The Royal Netherlands Academy of Arts and Sciences
- The Royal Irish Academy
- The National Academy of Technology of France
- The Croatian Academy of Engineering
- The Norwegian Academy of the Technological Sciences
- The Austrian Academy of Sciences
- The Institute of Catalan Studies
- The Polish Academy of Sciences
- The European Academy Networks forming the SAPEA consortium

Annex 2. Systematic literature review

Three literature reviews were run in parallel to support the evidence review:

1. The policy landscape and 'what works' in policy terms
2. Definitions and theoretical perspectives on sustainable food systems
3. Examples of good practice in sustainable food systems

Review 1 was conducted as a systematic review, whereas Reviews 2 and 3 were non-systematic.

Several additional literature searches on specific topics were also carried out for Working Group members who requested them; the results fed into the Evidence Review Report.

Review 1: Policy landscape

The aims of the systematic review on the policy landscape were set out in the Specification of Work. The review sought to achieve a broad understanding of the policy ecosystem and how it has developed to the present day, as well as providing an understanding of changes already happening. Its purpose was also to study policy transformation, exploring factors that might facilitate or speed up a 'just' transition towards an EU sustainable food policy. The review summarises the available evidence for the following questions:

- What are the main institutions/organisations supporting/carrying the main relevant policy instruments?
- What are the main interests and lobbies involved, and what is their respective power/influence?
- What are the incentives built into these instruments?
- How are shifts/transitions potentially achieved? What/who initiates these shifts/transitions, and what determines successful delivery? How is resistance overcome?
- What is required to achieve a 'just' (fair) shift/transition?
- What evidence exists with respect to the potential pace of change that might be achieved for a transition to an EU sustainable food system and what factors determine this?

Systematic literature review

A Review Team was formed of professional staff members of Cardiff University's Library Services/Specialist Unit for Evidence Review (SURE) and a topic specialist, Dr Kate Knowles. It was guided by an Advisory Panel, comprising the Working Group Chair and experts from Cardiff University, Harper Adams University and City University. Professor Carina Keskitalo (GCSA) and representatives of the SAM Unit and SAPEA were also consulted fully. Two physical meetings of the Advisory Panel took place in Cardiff to support the literature review work, in May and July 2019. They were chaired by Professor Ole Petersen on behalf of Academia Europaea (which oversaw the systematic review) and attended (either in person or remotely) by members of the Review Team, Advisory Panel, the GCSA, SAM Unit and SAPEA.

As a first step, the Review Team defined the protocol (a clear, transparent and replicable method statement), including the appropriate search strategy for the topic. The protocol was approved by the Advisory Panel and Working Group. The Team then oversaw the comprehensive and systematic search of multiple sources in the social sciences, with continuous feedback from the Advisory Panel and Working Group. The search strategy also incorporated an innovative approach, with the use of text mining to identify further key terms.

- **Languages:** English and all other European languages
- **Dates:** Initially 5 years (2014-2019), but seminal works will also be sought from earlier dates, based on input from the Working Group and Advisory Panel
- **Databases** with good coverage of the social sciences:
  - Applied Social Sciences Index and Abstracts (ASSIA)
  - European Sources Online
  - International Bibliography of the Social Sciences (IBSS)
  - OECD iLibrary
  - Scopus (limit to social sciences)
  - Social Science Research Network (SSRN)
  - Sociological Abstracts
  - Web of Science [Social Science Citation Index]

Search strategy

(TITLE ("blue growth strategy" OR "common agricultural policy" OR "common fisheries policy" OR "common fishery policy" OR "common fisheries policy" OR "biodiversity strategy" OR "environmental action programme to 2020" OR "european development policy" OR "European consensus on development" OR "marine strategy framework directive" OR "water framework directive" OR "circular economy action plan" OR "European fund for strategic investments" OR "european structural and investment funds" OR "food safety policy" OR "rural development policy" OR

"framework convention on climate change" OR "COP21" or "paris agreement" OR "kyoto protocol")) AND (TITLE (effect* OR evaluat* OR impact* OR outcome* OR implement* OR integrat* OR transform* OR incenti* OR assess* OR reform* OR improve* OR adapt*))

Limit to 2014-2019. Limit to Article or Review. Limit to Social Sciences.

(TITLE-ABS-KEY ("blue growth strategy" OR "common agricultural policy" OR "common fisheries policy" OR "common fishery policy" OR "common fisheries policy" OR "biodiversity strategy" OR "environmental action programme to 2020" OR "european development policy" OR "European consensus on development" OR "marine strategy framework directive" OR "water framework directive" OR "circular economy action plan" OR "European fund for strategic investments" OR "european structural and investment funds" OR "food safety policy" OR "rural development policy" OR "sustainable development goal*" OR "framework convention on climate change" OR "COP21" or "paris agreement" OR "kyoto protocol")) AND (TITLE-ABS-KEY (effect* OR evaluat* OR impact* OR outcome* OR implement* OR integrat* OR transform* OR incenti* OR assess* OR reform* OR improve* OR adapt*)) AND (TITLE-ABS-KEY (agricultur* OR "animal welfare" OR farm* OR food* OR fish* OR ecosystem* OR aquaculture* OR bioeconom* OR "bio-based" OR biobased OR agri-food* OR agro-food OR agroecology OR beverage* OR eat*)) AND (TITLE-ABS-KEY ("European union*" OR "member state*" OR "European commission" OR "mediterranean sea" OR "baltic sea" OR "black sea" OR "Adriatic sea" OR "Ionian sea" OR "north sea" OR "irish sea" OR EU))

Limit to 2014-2019. Limit to Article or Review. Limit to Social Sciences.

(TITLE-ABS-KEY (agricultur* OR "animal welfare" OR farm* OR food* OR fish* OR ecosystem* OR aquaculture* OR bioeconom* OR "bio-based" OR biobased OR agri-food* OR agro-food OR agroecology OR beverage* OR eat*)) AND (TITLE-ABS-KEY (policy OR policies OR strateg* OR framework* OR directive* or instrument* OR program* OR law* OR lobby* OR initiative*)) AND (TITLE-ABS-KEY (Europe* OR "member state*" OR mediterranean OR baltic OR "black sea" OR Adriatic OR Ionian OR "north sea" OR Austria* OR Belgi* OR Bulgaria* OR Croatia* OR Cyprus OR Cypriot* OR Czech* OR Denmark OR Danish OR Estonia* OR Finland OR Finnish OR France OR French OR German* OR Greece OR Greek* OR Hungar* OR Ireland OR Irish OR Ital* OR Latvia* OR Lithuania* OR Luxembourg OR Malta OR Maltese OR Netherlands OR Dutch OR Poland OR Polish OR Portugal OR Portuguese OR Romania* OR Slovakia* OR Slovenia* OR Spain OR Spanish OR Sweden OR Swedish OR UK OR United

Kingdom OR Britain OR British OR England OR English OR Scotland OR Scottish OR Wales OR Welsh OR EU)) AND (TITLE-ABS-KEY (effect* OR evaluat* OR impact* OR outcome* OR implement* OR integrat* OR transform* OR incentiv* OR assess* OR reform* OR improve* OR adapt*))

Limit to 2014-2019. Limit to Article or Review. Limit to Social Sciences.

Inclusion criteria

- **Population:** EU countries
- **Coverage:** The main relevant policy instruments, including:
  - EU Blue Growth Strategy
  - EU Common Agricultural Policy
  - EU Common Fisheries Policy
  - EU Conservation policies including the EU Biodiversity Strategy; the EU Environmental Action Programme to 2020
  - The European Development Policy
  - The European Consensus on Development
  - The Marine Strategy Framework Directive
  - The Water Framework Directive (WFD, *Directive 2000/60/EC of the European Parliament and of the Council establishing a framework for the Community action in the field of water policy*)
  - The Circular Economy Action Plan
  - EU-European Fund for Strategic Investments (European EFSI)
  - EU-European Structural and Investment Funds (European ESIF, European Regional Development Fund, European Social Fund, European Cohesion Fund, European Agricultural Fund for Rural Development, European Maritime and Fisheries Fund)
  - EU-Food Safety Policy
  - EU-Health Policy
  - EU-Rural Development Policy
  - UN Sustainable Development Goals (United Nations SDGs, specifically 1, 2, 3, 6, 7, 8, 9, 11, 12, 13 & 14)
  - The UN COP21 Climate Change (United Nations Framework Convention on Climate Change, Paris Agreement, Kyoto Protocol)
  - Relevant WHO Health policies including WHO strategic plan for food safety
- **Types of study:** All relevant published evidence from the peer-reviewed journal literature in the social sciences[1]

1 Example works to assist with protocol development: Bureau J-C, Swinnen J. EU policies and global food security. Global Food Security 2018; 16: 106–115

Following the execution of the searches and sifting of results, a coding framework was designed, approved and implemented, using NVivo software. The results were then analysed and written up as a detailed narrative.

The systematic review is published as a standalone report by SAPEA and is available at www.sapea.info/food. The report is divided into two parts. Part 1 describes the systematic review carried out on named policy instruments, which analysed the full text of 205 peer-reviewed empirical studies. Part 2 provides an overview of a further 430 publications that discuss broader EU policy and were analysed at keyword/abstract level only.

Review 2: Definitions and theoretical perspectives

After a number of attempts to focus the literature search in a manageable way, Review 2 was narrowed down iteratively over several months, in consultation with the Working Group and Advisory Panel. The final search was to retrieve already-published systematic reviews on sustainable transitions. The results were shared with the Working Group.

Review 3: Examples of good practice

Review 3 aimed at bringing together examples of good practice at member state and local community level. A non-systematic review methodology was adopted, with an emphasis on the social sciences literature.

The first phase of the search centred on obtaining a draft list of initiatives from across Europe, requesting examples from the Working Group and the Advisory Group and reaching out to external stakeholders.

The second phase of the search focused on detecting published critical reviews or assessments that could further support and provide substance to the future narrative of the report. It was decided with the Working Group that attention should remain on those initiatives for which a sufficient level of analysis and independent evaluation had been found.

The third phase of the search focused on producing a smaller consolidated table of examples, while also developing an indicative (less detailed) list of other initiatives detected by the team throughout the search. This indicative list aimed at acknowledging the existence of other initiatives, despite the lack of review literature on them. A list of references was also provided, aimed at informing the report on the definition of good

practice, success factors and measuring success. The categorisation of examples was based on Aschemann-Witzel et al. (2017):

- Information and capacity building
- Retail and supply chain alteration
- Redistribution of resources
- Government policy
- Network

The final table of examples in Annex 3a, p.206, includes details on the country (or countries) of the initiatives, whether the examples are based on an urban or rural environment, whether their scope is national or local, the means of financing and the time span of the initiatives.

Annex 3a. Long list of good practice examples

Country	Initiative / Stakeholder	Focus	Urban / Rural	Local / National	Means of financing	Time span	Reference(s)
AT	Gutes vom Bauernhof (Good things from the farm)	Retail and supply chain alteration	Urban, rural	National	Austrian government; European Commission	1998–	Kneafsey et al 2013; Schermer 2015
DK	Danish Whole Grain Partnership	Information and capacity-building	Urban, rural	National	Public-private partnership	2009–	Nordic Council of Ministers 2018; Greve & Neess 2014
DK	Stop Spild af Mad (Stop Wasting Food movement)	Information and capacity-building	Urban, rural	National	Sponsorship	2008–	Aschemann-Witzel et al 2017; Halloran et al 2014
DK	Tax on saturated fat in food products	Government policy	Urban, rural	National	n/a	2001–2012	Jensen et al 2016; Bødker et al 2015; Smed 2012; Cornelsen et al 2015
ES	Camposeven organic agriculture cooperative	Retail and supply chain alteration	Rural	Local	Cooperative	2007–	Herrera-Reyes et al 2015; de los Ríos et al 2016; Šūmane et al 2018; de Roest et al 2018
ES	Espigoladors – Tackling food waste and social exclusion	Redistribution of resources	Urban, rural	Local	Sponsorship	2014–	Alegre & Berbegal-Mirabent 2018; Barba & Dias-Ruiz 2015
FR	Drôme Valley agri-food system ('Biovallée')	Retail and supply chain alteration	Rural	Local	Local authorities	1987–	Rossi et al 2019; Bui et al 2016; Šūmane et al 2018; de Roest et al 2018
FI	North Karelia Project – Community intervention programme	Government policy, network	Urban, rural	Local	N/A	1972–	Berra et al 2017; Puska 2016; Puska et al 2016
HU	Consumer Supported Agriculture (CSA) initiatives	Retail and supply chain alteration	Rural	Local	Cooperative	1998–	Balázs et al 2016; Kneafsey et al 2013; Kis 2014
HU	Public Health Product Tax	Government policy	Urban, rural	National	N/A	2011–	Bíró 2015; Cornelsen et al 2015

Country	Initiative / Stakeholder	Focus	Urban / Rural	Local / National	Means of financing	Time span	Reference(s)
SE	Policy for Sustainable Development and Food (Malmö)	Government policy	Urban	Local	N/A	2010–	Moragues-Faus & Morgan 2015; Mendoza Villaneda 2013
UK	Brighton and Hove Food Partnership	Information and capacity-building, redistribution of resources	Urban	Local	Funders (Big Lottery Fund; Esmee Fairbairn Foundation; People's Postcode Lottery; Sussex Community Foundation; Brighton & Hove CCG; Brighton & Hove City Council)	2003–	Curry & Kirwan 2014; Sonnino 2016
UK	Sustainable Food Cities Network	Network	Urban	Local	Partnership (Soil Association; Sustain; Food Matters)	2011–	Santo & Moragues-Faus 2019; Moragues-Faus & Sonnino 2019
various	Edible Cities [Andernach, Berlin, Heidelberg, Oslo, Rotterdam]	Information and capacity-building	Urban	Local	Private funders and volunteers	Andernach 2010–	Kosack 2016; Säumel et al 2019; Hajzeri & Kwadwo 2019; Scharf et al 2019
various	TRAFOON - Traditional Food Network	Network, information and capacity-building, retail and supply chain alteration	Urban, rural	National	FP7 (EU R&I programme)	2013–	Smulders et al 2018; TRAFOON 2017
various	Consumer cooperatives or Civic Food Networks	Network	Urban, rural	Local	Members	n/a	Bilewicz & Śpiewak 2018, Jaklin et al 2015
various	Nordic Keyhole Initiative	Information and capacity-building, government policy	Urban, rural	National	N/A	1990–	Nordic Council of Ministers 2018; IPSOS 2015; Wang et al 2016

References for the long list of good practice examples

Alegre, I., & Berbegal-Mirabent, J. (2018). Gourmet products from food waste. In J. Marques (Ed.), Handbook of engaged sustainability. Pp. 683-702. Cham: Springer International Publishing.

Aschemann-Witzel, J., de Hooge, I. E., Rohm, H., Normann, A., Bossle, M. B., Grønhøj, A., & Oostindjer, M. (2017). Key characteristics and success factors of supply chain initiatives tackling consumer-related food waste – a multiple case study. Journal of Cleaner Production, 155, 33-45. doi: https://doi.org/10.1016/j.jclepro.2016.11.173

Balázs, B., Pataki, G., & Lazányi, O. (2016). Prospects for the future: Community supported agriculture in Hungary. Futures, 83, 100-111. doi: https://doi.org/10.1016/j.futures.2016.03.005

Barba, M., & Días-Ruíz, R. (2015). Switching imperfect and ugly products to beautiful opportunities. In L. E. San-Epifanio & M. D. R. Scheifler (Eds.), Envisioning a future without food waste and food poverty: Societal challenges (pp. 279-284). Wageningen, NL: Wageningen Academic Publishers.

Berra, K., Franklin, B., & Jennings, C. (2017). Community-based healthy living interventions. Progress in Cardiovascular Diseases, 59(5), 430-439. doi: https://doi.org/10.1016/j.pcad.2017.01.002

Bilewicz, A., & Śpiewak, R. (2019). Beyond the "northern" and "southern" divide: Food and space in Polish consumer cooperatives. East European Politics and Societies, 33(3), 579-602. doi: 10.1177/0888325418806046

Bíró, A. (2015). Did the junk food tax make the Hungarians eat healthier? Food Policy, 54, 107-115. doi: 10.1016/j.foodpol.2015.05.003

Bødker, M., Pisinger, C., Toft, U., & Jørgensen, T. (2015). The rise and fall of the world's first fat tax. Health Policy, 119(6), 737-742. doi: 10.1016/j.healthpol.2015.03.003

Bui, S., Cardona, A., Lamine, C., & Cerf, M. (2016). Sustainability transitions: Insights on processes of niche-regime interaction and regime reconfiguration in agri-food systems. Journal of Rural Studies, 48, 92-103. doi: https://doi.org/10.1016/j.jrurstud.2016.10.003

Cornelsen, L., Green, R., Dangour, A., & Smith, R. (2015). Why fat taxes won't make us thin. Journal of Public Health, 37(1), 18-23. doi: 10.1093/pubmed/fdu032

Curry, N., & Kirwan, J. (2014). The role of tacit knowledge in developing networks for sustainable agriculture. Sociologia Ruralis, 54(3), 341-361. doi: 10.1111/soru.12048

de los Ríos, I., Rivera, M., & García, C. (2016). Redefining rural prosperity through social learning in the cooperative sector: 25 years of experience from organic agriculture in Spain. Land Use Policy, 54, 85-94. doi: https://doi.org/10.1016/j.landusepol.2016.02.009

de Roest, K., Ferrari, P., & Knickel, K. (2018). Specialisation and economies of scale or diversification and economies of scope? Assessing different agricultural development pathways. Journal of Rural Studies, 59, 222-231. doi: https://doi.org/10.1016/j.jrurstud.2017.04.013

Greve, C., & Neess, R. I. (2014). The evolution of the whole grain partnership in Denmark. Retrieved from http://www.cbs.dk/files/cbs.dk/the_evolution_of_the_whole_grain_partnership_in_denmark.pdf

Hajzeri, A., & Kwadwo, V. O. (2019). Investigating integration of edible plants in urban open spaces: Evaluation of policy challenges and successes of implementation. Land Use Policy, 84, 43-48. doi: 10.1016/j.landusepol.2019.02.029

Halloran, A., Clement, J., Kornum, N., Bucatariu, C., & Magid, J. (2014). Addressing food waste reduction in Denmark. Food Policy, 49, 294-301. doi: https://doi.org/10.1016/j.foodpol.2014.09.005

Herrera-Reyes, A.-T., Méndez, M. R., & Carmenado, I. d. l. R. (2015). Social learning in innovation for resilience of a territory through university-company links. Procedia - Social and Behavioral Sciences, 191, 2117-2121. doi: https://doi.org/10.1016/j.sbspro.2015.04.502

IPSOS. (2015). A qualitative study concerning the keyhole's influence over 25 years on product development. IPSOS Consultancy. Retrieved from https://www.livsmedelsverket.se/globalassets/publikationsdatabas/rapporter/2015/keyholes-influence-on-product-development-2015.pdf

Jaklin, U., Kummer, S., & Milestad, R. (2015). Why do farmers collaborate with a food cooperative? Reasons for participating in a civic food network in Vienna, Austria. International Journal of Sociology of Agriculture and Food, 22(1), 41-61.

Jensen, J. D., Smed, S., Aarup, L., & Nielsen, E. (2016). Effects of the Danish saturated fat tax on the demand for meat and dairy products. Public Health Nutrition, 19(17), 3085-3094. doi: 10.1017/S1368980015002360

Kis, B. (2014). Community-supported agriculture from the perspective of health and leisure. Annals of Leisure Research, 17(3), 281-295. doi: 10.1080/11745398.2014.941885

Kneafsey, M., Venn, L., Schmutz, U., Balázs, B., Trenchard, L., Eyden-Wood, T., ... Blackett, M. (2013). Short food supply chains and local food systems in the EU. A state of play of their socio-economic characteristics. JRC Scientific and Policy Reports, 123.

Kosack, L. (2016). The edible city of Andernach: Urban agriculture in public space. Standort, 40(2), 138-144. doi: 10.1007/s00548-016-0430-4

Mendoza Villaneda, C. I. (2013). Sustainable development & food. Reinventing the school meal through public procurement practices: The case of Malmö. Lund University, Retrieved from http://lup.lub.lu.se/student-papers/record/3910836

Moragues-Faus, A., & Morgan, K. (2015). Reframing the foodscape: The emergent world of urban food policy. Environment and Planning A: Economy and Space, 47(7), 1558-1573. doi: 10.1177/0308518x15595754

Moragues-Faus, A., & Sonnino, R. (2019). Re-assembling sustainable food cities: An exploration of translocal governance and its multiple agencies. Urban Studies, 56(4), 778-794. doi: 10.1177/0042098018763038

Nordic Council of Ministers. (2018). Solutions menu – a Nordic guide to sustainable food policy. Retrieved from http://norden.diva-portal.org/smash/get/diva2:1214792/FULLTEXT01.pdf

Puska, P. (2016). Why did North Karelia—Finland work? Is it transferrable? Global Heart, 11(4), 387-391. doi: https://doi.org/10.1016/j.gheart.2016.10.015

Puska, P., Vartiainen, E., Nissinen, A., Laatikainen, T., & Jousilahti, P. (2016). Background, principles, implementation, and general experiences of the North Karelia project. Global Heart, 11(2), 173-178. doi: https://doi.org/10.1016/j.gheart.2016.04.010

Rossi, A., Bui, S., & Marsden, T. (2019). Redefining power relations in agrifood systems. Journal of Rural Studies, 68, 147-158. doi: https://doi.org/10.1016/j.jrurstud.2019.01.002

Santo, R., & Moragues-Faus, A. (2019). Towards a trans-local food governance: Exploring the transformative capacity of food policy assemblages in the US and UK. Geoforum, 98, 75-87. doi: https://doi.org/10.1016/j.geoforum.2018.10.002

Säumel, I., Reddy, S. E., & Wachtel, T. (2019). Edible city solutions - one step further to foster social resilience through enhanced socio-cultural ecosystem services in cities. Sustainability, 11(4). doi: 10.3390/su11040972

Scharf, N., Wachtel, T., Reddy, S. E., & Säumel, I. (2019). Urban commons for the edible city-first insights for future sustainable urban food systems from Berlin, Germany. Sustainability, 11(4). doi: 10.3390/su11040966

Schermer, M. (2015). From "food from nowhere" to "food from here:" changing producer–consumer relations in Austria. Agriculture and Human Values, 32(1), 121-132. doi: 10.1007/s10460-014-9529-z

Smed, S. (2012). Financial penalties on foods: The fat tax in Denmark. Nutrition Bulletin, 37(2), 142-147. doi: 10.1111/j.1467-3010.2012.01962.x

Smulders, M. J. M., van de Wiel, C. C. M., van den Broeck, H. C., van der Meer, I. M., Israel-Hoevelaken, T. P. M., Timmer, R. D., ... Gilissen, L. J. W. J. (2018). Oats in healthy gluten-free and regular diets: A perspective. Food Research International, 110, 3-10. doi: https://doi.org/10.1016/j.foodres.2017.11.031

Sonnino, R. (2016). The new geography of food security: Exploring the potential of urban food strategies. The Geographical Journal, 182(2), 190-200. doi: 10.1111/geoj.12129

Šūmane, S., Kunda, I., Knickel, K., Strauss, A., Tisenkopfs, T., Rios, I. d. I., ... Ashkenazy,

A. (2018). Local and farmers' knowledge matters! How integrating informal and formal knowledge enhances sustainable and resilient agriculture. Journal of Rural Studies, 59, 232-241. doi: https://doi.org/10.1016/j.jrurstud.2017.01.020

TRAFOON. (2017). TRAFOON final report. TRAFOON – Traditional Food Network. Retrieved from https://web.archive.org/web/20181125142344/https://www.trafoon.eu/trafoon-final-report/

Wang, Q., Oostindjer, M., Amdam, G. V., & Egelandsdal, B. (2016). Snacks with nutrition labels: Tastiness perception, healthiness perception, and willingness to pay by Norwegian adolescents. Journal of Nutrition Education and Behavior, 48(2), 104-111.e101. doi: https://doi.org/10.1016/j.jneb.2015.09.003

Annex 3b. Indicative list of other European initiatives

Milan Urban Food Policy Pact

International protocol aimed at tackling food-related issues at the urban level, to be adopted by as many world cities as possible.

German Nutrition Councils

Network of city-based councils focusing on developing resilient and just food systems, oriented towards common welfare that promotes seasonal and regional food from fair and organic/ sustainable production respective animal welfare principles.

Finnish Nutrition Commitment

Finnish operating model, which helps and encourages food business operators and stakeholders to improve the nutritional quality of the Finnish diet and to encourage nutritionally responsible practices.

European FOOD Programme

The programme 'Fighting Obesity through Offer and Demand' (FOOD) aims to promote healthy eating during the working day towards two complementary target groups: workers and commercial restaurants, making the healthy choice more obvious and more accessible.

Kids to kids – Let's prepare a healthy traditional meal

Project aims to encourage children to consume more seasonal vegetables and fruit from the surrounding area, to make healthy eating self-evident.

SFeSP - School Feeding Sustainability Program

Municipal programme in school feeding, affecting different stages of the food process – production, acquisition, confection and consumption – through articulation of different services of the Municipality

Annex 3b. Indicative list of other European initiatives

BigPicnic

A project with EU and Africa partners that brings together the public, scientists, policy-makers and industry to help tackle the global challenge of food security. Botanic gardens, with help from other Partners, will co-create a range of exhibitions and participatory events with people from all walks of life, to generate dialogue and build greater understanding of food security.

ForMat

Collaborative project led by and covering large parts of the value chain for the food and beverage sector in Norway, aimed at reducing edible food waste by 25% by the end of 2015.

Organic conversion of the public food system in Copenhagen Municipality

Municipal strategy which aims to train kitchen staff in cooking techniques, so that they are able to plan their menus sustainably and cook food from scratch.

Danish Salt Partnership

Objective is to reduce the intake of salt among consumers in Denmark, through awareness of the link between salt and health to consumers and food professionals, as well as collaboration with the food industry on reducing salt content in processed food.

Resource Management Agency (RMA)

The thematic focus of the RMA is on sustainable resource management for products, companies and regions.

Milchwerk

Retailer which focuses solely on aesthetically suboptimal foods.

Dörrwerk

Food processing company which recovers suboptimal fruits and vegetables.

Danish Meal Think Tank

Think-tank put together by the Government with the mission to focus on food waste and to support the development of the country's strategy to reduce food waste.

Danish Meal Partnership

Partnership with the purpose of making it convenient and desirable for all citizens in Denmark to eat healthier meals. The partnership has a special focus on improving social equality in food consumption patterns.

Fødevarebanken

The Danish Food Bank is a non-profit organisation fighting food waste and food poverty in Denmark.

The Netherlands Nutrition Centre Foundation

Provision of information to consumers and professionals (like in healthcare and welfare), aimed at supporting stakeholders making healthy, safe and more sustainable food choices.

Norwegian Partnership for a Healthier Diet

Memorandum of Understanding for facilitating a healthier diet in the population, signed between the Norwegian health authorities and food industry (food and trade organisations, food and beverage manufacturers, food retailers and food service industry).

Matsentralen

Food Banks Norway is non-profit organisation that fights food waste and helps the disadvantaged by rescuing and redistributing surplus food in risk of going to waste.

PROVE – Promoting and Selling

This is a LEADER co-operation project that aims to promote new forms of short marketing chains between small producers and consumers.

SkolmatSverige

The main aim of the system is to support Swedish primary schools in their work to provide good school meals. The secondary aims are to follow school meal quality over time, and to conduct research on the importance of school meals.

Eldrimmer

Provision of knowledge, support and inspiration to food craftsmen throughout Sweden and the Nordic region, at the beginning as well as in the development of the profession.

Annex 4. Expert workshop

A key milestone on the way to preparing this Report and associated evidence-based key messages was a one-day expert workshop which took place on 8 November 2019 in Brussels. This workshop brought together Working Group members with other experts who have applied or complementary knowledge and experience, as well as Carina Keskitalo, member of the Group of Chief Scientific Advisors. Experts attended in a personal capacity and not as the representative of any institution, company or organisation.

The aim of this workshop was to discuss and review the key findings of the draft Report, to ensure that the scientific report 'meets reality' outside of the scientific world, and to identify points to strengthen or prioritise in the content, with a view to informing the Advisors' Scientific Opinion. Workshop participants discussed the draft report's evidence in terms of strength, feasibility, practical applicability and policy implications regarding EU food systems becoming more sustainable.

The experts were provided with some guiding questions (see below) and the draft Report in advance of the workshop to familiarise themselves with the content.

Fourteen invited experts participated in the workshop, with another two experts submitting written comments. In addition, seven members of the SAPEA Working Group, one representative from the Group of Chief Scientific Advisors, one member of the SAPEA Board, four members of the SAM Unit and five SAPEA staff attended. Seven representatives from six different Directorates-General from the European Commission were also present as observers.

The workshop format consisted of six sessions, each corresponding to one or more chapters of the draft Report, and a final session for feedback and questions from Carina Keskitalo. For each chapter-based session, one or two SAPEA Working Group members presented the key conclusions of the respective draft chapters. This was followed by invited responses by discussants, and an open discussion with all invited experts. The SAPEA Working Group took into account the comments made and revised the report accordingly.

A report of the workshop, containing the Agenda and full participant list, is available at www.sapea.info/food.

Guiding questions for invited experts

General questions:

- Does the report answer all aspects of the question asked in the scoping paper? Are there any crucial gaps?
- Does the report use the appropriate and up-to-date evidence?
- Is the content of the draft report presented in an objective, evidence-based way?
- Is the report clearly structured?

Questions linked to the report's conclusions and policy implications:

- Are the conclusions and policy implications presented in the report sufficiently backed up by scientific evidence and follow logically the evidence presented in the text?
- Can the conclusions and policy implications presented in the report relevantly inform policy making? At what level are they relevant - at EU level? National level? And within what timeframe?
- Are there important trade-offs to consider that may not have been covered?
- Are some options more realistic than others, or should be considered more urgently, by policy-makers?

Expert workshop participants

- Professor Frode Alfnes, Norwegian University of Life Sciences (Norway)
- Professor Tim Benton, Chatham House (UK)
- Dr Nicolas Bricas, French Agricultural Research Centre for International Development (CIRAD, France)
- Mrs Carolin Callenius, University of Hohenheim (Germany)
- Professor Carsten Daugbjerg, University of Copenhagen (Denmark)
- Professor Jessica Duncan, Wageningen University and Research (the Netherlands)
- Dr Hamid El Bilali, Mediterranean Agronomic Institute of Bari (Italy)
- Professor Wojciech Goszczyński, Nicolaus Copernicus University (Poland)
- Professor Ingrid Hoffmann, Justus-Liebig University Giessen (Germany)
- Professor Erik Mathijs, University of Leveun (KU Leuven, Belgium)
- Dr Ana Moragues-Faus, Polytechnic University of Valencia (Spain)
- Professor Peter Oosterveer, Wageningen University and Research (the Netherlands)
- Professor Tanja Schneider, St Gallen University (Switzerland)
- Dr Rosalind Sharpe, City, University of London (UK)

The following experts did not attend the workshop but provided helpful written feedback on the draft report:

- Professor Alessio Cavicchi, University of Macerata (Italy)
- Professor Alberto Garrido, Universidad Politécnica de Madrid (Spain)

Annex 5. Peer review

A rigorous peer review process is part of the SAPEA Quality Assurance procedures before publication.

SAPEA follows a double-blind peer review process. The review is conducted by experts not involved in drafting the Report. Reviewers are nominated by the Academy Networks or individual Academies. Peer reviewers have to declare any risk of Conflict of Interest that would affect their impartial assessment of the quality of the report, before starting their work. In addition, reviewers agree that their name, affiliation and role as peer reviewer will appear in the report.

The Working Group responds to the reviewers' comments, detailing how those comments were addressed. The revised report is submitted, together with the reviewers' comments, the Working Group's response and the changes made highlighted in the report, for final approval by the SAPEA Board.

Questions for peer reviewers

Peer reviewers receive a checklist with the following questions to guide the peer review. In addition to responding with 'yes'/'no'/'partially', reviewers are requested to provide arguments in support of their comments.

- Does the report address satisfactorily the study's requirements as contained in the scoping paper?
- Does the report cite and rely on up-to-date literature?
- Does the executive summary concisely and accurately describe the key findings and conclusions? Is it consistent with other sections of the report? Is it sufficiently effective as a standalone summation of the report?
- Do the arguments advanced in the report show the requisite degree of analytical rigour? Are the conclusions well-supported by the scientific evidence and argument?
- Are any gaps, uncertainties or omissions in the evidence base acknowledged and addressed explicitly?
- Do the authors identify conclusions and recommendations based on opinion as such, and give satisfactory responses for this?
- Does the report deal competently with data (as applicable) and analyses?
- Have the working groups produced an objective report?
- Are the bibliography and any appendices relevant, given the purpose of the report?

- If you believe the report can be improved significantly, what improvements do you suggest?
- Are there signs of biases or undue influence from interest groups?

Reviewers

- Professor Gianluca Brunori, University of Pisa (Italy)
- Dr Patrick Caron, French Agricultural Research Centre for International Development (CIRAD, France)
- Dr Pierre Feillet, French National Research Institute for Agriculture, Food and the Environment (INRAE, France)
- Professor Jules Pretty, University of Essex (UK)
- Professor Marlyne Sahakian, University of Geneva (Switzerland)
- Professor Maria Weimer, University of Amsterdam (Netherlands)

Annex 6. Acronyms

AFNs	Alternative Food Networks
ALLEA	All European Academies
ANR	Agence Nationale de la Recherche
ASSIA	Applied Social Sciences Index and Abstracts
BDJ	British Dental Journal
BSE	Bovine Spongiform Encephalopathy
CAP	Common Agricultural Policy
CEE	Central and Eastern Europe
CFS	Committee on World Food Security of the UN
CIRAD	Centre de coopération internationale en recherche agronomique pour le développement
CRISPR	Clustered Regularly Interspaced Short Palindromic Repeats
CSA	Community Supported Agriculture
DG	Directorate General
DG AGRI	Directorate General for Agriculture and Rural Development
DG MARE	Directorate General for Maritime Affairs and Fishery
DG SANTE	Directorate General for Health and Food Safety
EASAC	European Academies' Science Advisory Council
EC	European Commission
EEA	European Environment Agency
EEC	European Economic Community
EESC	European Economic and Social Committee
EFF	European Food Forum
EFSA	European Food Safety Authority
EFSI	European Fund for Strategic Investments
ETS	Emissions Trading Scheme
EU	European Union
FAO	Food and Agriculture Organisation
FBA	Fellow of the British Academy
FOOD	Fighting Obesity through Offer and Demand
FUSIONS	Food Use for Social Innovation by Optimising Waste Prevention Strategies

GAP	Good Agricultural Practice
GATT	General Agreement on Tariffs and Trade
GCSA	Group of Chief Scientific Advisors
GDP	Gross Domestic Product
GECAFS	Global Environmental Change and Food Systems
GHG	Greenhouse Gas
GM	Genetically Modified
GMOs	Genetically Modified Organisms
GMST	Global Mean Surface Temperature
HACCP	Hazard Analysis and Critical Control Points
HLPE	High Level Panel of Experts
IBSS	International Bibliography of the Social Sciences
ICESCR	International Covenant on Economic, Social and Cultural Rights
ICT	Information and Communication Technologies
IDDRI	Institute for Sustainable Development of International Relations
IFOAM	International Federation of Organic Agriculture Movements
IIASA	International Institute for Applied Systems Analysis
ILUC	Indirect Land Use Change
INCAS	Intelligently Navigated Complex Adaptive Systems
INFORMAS	International Network for Food and Obesity/Non-communicable Diseases Research, Monitoring and Action Support
INRA	Institut National de la Recherche Agronomique
INRAE	Institut National de Recherche pour l'Agriculture, l'alimentation et l'Environnement
IPCC	Intergovernmental Panel on Climate Change
IPPC	International Plant Protection Convention
IPBES	Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services

iPES	International Panel of Experts on Sustainable Food Systems
ISO	International Standards Organisation
JRC	Joint Research Centre of the European Commission
LEADER	Liaison Entre Actions de Développement de l'Economie Rurale (Links between actions for the development of the rural economy)
MJ	Megajoule
MLP	Multi-Level Perspective
MODE	Motivation and Opportunity as Determinants
MSC	Marine Stewardship Council
NGOs	Non-Governmental Organisations
OECD	Organisation for Economic Co-operation and Development
OEF	Organisation Environmental Footprint
PDO	Protection of Designation of Origin
PEF	Product Environmental Footprint
PGI	Protection of Geographical Indications
PGS	Participatory Guarantee System
PHPT	Public Health Product Tax
PROVE	Promover e Vender (Promoting and Selling)
REDD+	Reducing Emissions from Deforestation and forest Degradation
RETHINK	Rethinking the links between farm modernization, rural development and resilience in a world of increasing demands and finite resources
RMA	Resource Management Agency
RSPO	Roundtable on Sustainable Palm Oil
SAM	Scientific Advice Mechanism of the European Commission
SAPEA	Science Advice for Policy by European Academies
SCAR	Standing Committee on Agricultural Research
SDGs	Sustainable Development Goals
SFeSP	School Feeding Sustainability Program
SFCN	Sustainable Food Cities Network
SFS	Sustainable Food System
SME	Small and Medium Enterprise
SNM	Strategic Niche Management
SPA	Social Practice Approaches
SSRN	Social Science Research Network
STOA	Science and Technology Options Assessment
SURE	Specialist Unit for Review Evidence
SURE Farm	Sustainable Resilient EU Farming Systems
TBT	Technical Barriers to Trade
TIS	Technological Innovation Systems
TM	Transition Management
TPB	Theory of Planned Behaviour
TRAFOON	Traditional Food Network
TSG	Traditional Speciality Guaranteed
TTIP	Transatlantic Trade and Investment Partnership
TUNA	Turbulent, Uncertain, Novel and Ambiguous
UK	United Kingdom
UN	United Nations
UN DESA	United Nations Department of Economic and Social Affairs
UNEP	United Nations Environment Programme
UNFCCC	United Nations Framework Convention on Climate Change
UNICEF	United Nations Children's Fund
UNCTAD	United Nations Conference on Trade and Development
US	United States (of America)
WBGU	Wissenschaftlicher Beirat der Bundesregierung Globale Umweltveränderungen (German Advisory Council on Global Change)
WFD	Water Framework Directive
WFP	World Food Programme
WHO	World Health Organisation
WRI	World Resources Institute
WRR	Netherlands Scientific Council for Government Policy
WTO	World Trade Organisation
3D	Three-dimensional

Annex 7. Acknowledgements

SAPEA wishes to thank the following people for their valued contribution and support to the production of this report.

Coordination Group members

- Professor Carina Keskitalo, Group of Chief Scientific Advisors
- Professor Rolf-Dieter Heuer, Group of Chief Scientific Advisors
- Professor Janusz Bujnicki, Group of Chief Scientific Advisors
- Professor Peter Jackson, Chair Working Group
- Professor Antonio Loprieno, President All European Academies, representing SAPEA
- Professor Ole Petersen, Vice-President Academia Europaea

Systematic literature review

- Professor Terry Marsden, Cardiff University
- Professor Roberta Sonnino, Cardiff University
- Dr Kate Knowles, Cardiff University
- Dr Eleanor MacKillop, Wales Centre for Public Policy
- Dr Kelly Parsons, City University
- Dr Ana Moragues Faus, Cardiff University
- Dr Hannah Pitt, Cardiff University
- Dr Poppy Nicol, Cardiff University
- Dr Kirstie O'Neill, Cardiff University
- Dr Alison Weightman, Specialist Unit for Review of Evidence, Cardiff University
- Frederico Rocha, Cardiff University Library Services
- Nigel Morgan, Cardiff University Library Services
- Delyth Morris, Cardiff University Library Services

Meeting hosts

- The British Academy
- The German National Academy of Sciences Leopoldina
- The Royal Netherlands Academy of Arts and Sciences
- The Royal Flemish Academy of Belgium for Science and the Arts

SAPEA staff

- Dr Céline Tschirhart (Lead Scientific Policy Officer)
- Dr Nina Hobbhahn
- Louise Edwards
- Hannah Whittle
- Antoine Blonce
- Toby Wardman
- Agnieszka Pietruczuk
- Robert Vogt
- Umida Masharipova
- Matthias Johannsen
- Dr Jacqueline Whyte
- Rudi Hielscher

SAM Unit staff

- Dr Gerjon Ikink
- Dr Ingrid Zegers
- Dr Piotr Kwiecinski
- Annabelle Ascher
- Dr Johannes Klumpers

Scientific writer

- Gavin Wren

SAPEA is part of the European Commission's Scientific Advice Mechanism, which provides independent, interdisciplinary, and evidence-based scientific advice on policy issues to the European Commission.

This Evidence Review Report informs the GCSA's Scientific Opinion on the topic.

www.sapea.info
@SAPEAnews