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Shaping healthy and sustainable food systems with behavioural food policy

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Abstract

This paper focuses on policies that are enlightened by behavioural insights (BIs), taking decision-makers' biases and use of heuristics into account and utilising a people-centric perspective and full acknowledgement of context dependency. Considering both the environmental and pandemic crises, it sketches the goal of resilient food systems and describes the contours of behavioural food policy. Conceptually built on BIs derived from behavioural economics, consumer research and decision science, such an approach systematically uses behavioural policies where appropriate and most cost-effective. BI informed tools (nudges) can be employed as stand-alone instruments (such as defaults) or used to improve the effectiveness of traditional policy tools.

Keywords: resilient food systems, behavioural insights, consumer behaviour, behaviour change, demand side policy

1. Introduction

Humanity historically has never fared better—but nature has rarely if ever experienced such rapid decline (UNDP, 2020). The food systems that have developed worldwide in the past 100 years have brought previously unknown prosperity, less hunger and greater access to healthier diets in no small part of humankind. However, at the same time and mainly due to the growing population that the Earth must sustain, this positive development led to new scarcities, overuse of nature's capital and novel challenges of over- and undernutrition. Today, it seems that a tipping point has been reached and that the food and

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farming systems need a profound change towards being less environmentally devastating in relation to natural sinks and sources (Otto *et al.*, 2020).

Personal and institutional food choices carry many consequences—for our health, the environment, the economy and the social fabric of societies. The United Nations (UN), in partnership with science, activists and business leaders, is currently preparing for the UN Food Systems Summit 2021 to take place in October 2021.[1] This summit's overall goal—and more so that of the movement it is expected to create—is to shift towards healthier and more sustainable food systems worldwide. This goal presents major and urgent challenges for policymakers, producers and consumers: How to design and adapt the existing policy frameworks shaping food systems? How to promote new foods and better farming and production processes? How to establish incentives and supportive contexts that move the demand side towards more sustainable and healthy consumption patterns? Above all, how to enlist the food system to help rather than endanger the prosperity and fate of the planet and people?

This summit builds on decades of global, national and sectoral initiatives, high-level scientific advice and grassroots engagement to change the food system for the better. Yet, the pressures of the 2020 double crisis—the climate crisis and the coronavirus disease 2019 (COVID-19) pandemic—have opened a window of opportunity to propel this agenda forward now. In 2020, scientists' wake-up calls became more urgent and more frequent. In September 2020, a consortium led by the World Meteorological Organization sent the message that, despite the pandemic, climate heating is on the rise and that 'new technological solutions and gradual change in consumption patterns are needed at all levels. Transformational action can no longer be postponed' (WMO, 2020). On the same day, the UN's 2020 Global Biodiversity Outlook emphasised how vital biodiversity is in addressing climate change and long-term food security, concluding that protecting biodiversity is essential to prevent future pandemics. These contemporary voices remind us that business as usual is not a viable option any longer. Major changes are needed to transform as rapidly as possible into a more resilient, sustainable, socially just, healthy and less wasteful economy and society.

Food systems are widely considered to be a significant entry point for change (Garnett, 2016). A sustainable food system has been defined as one 'that delivers food security and nutrition for all in such a way that the economic, social and environmental bases to generate food security and nutrition for future generations are not compromised' (FAO, 2018). A consortium of the FAO, WHO, UNICEF and others (FAO, IFAD, UNICEF, WFP, & WHO, 2020) concluded in its recent global assessment report that to achieve sustainable and healthy dietary patterns, large transformative changes in food systems, on all levels, will be needed. Indeed, the double crisis has made the food system's challenges more visible and salient and also has highlighted respective solutions and policies and made them more acceptable, moving the

1 Disclosure: the author is a member of the leadership team of Action Track 2 of the UN Summit.

'Overton window' (Lehman, 2010) towards more radical changes. As regards the discourse on food-system transitions, the double crisis has taught three main lessons.

The first is about the importance of *systems thinking and systems science* and their role in ensuring *resilience*: natural and social systems that are solely focused on efficiency and have no 'buffers' are widely acknowledged to be highly vulnerable to external and internal shocks and disruption. Diversity, substantial local resources, circular thinking and adequate access to public goods (including health) and services create needed buffers and increase system *resilience*. This critical concept was introduced in the 1970s by environmental ecosystem research (Holling, 1973). Ecological economics considers resilience as a condition for sustainability (Common and Perrings, 1992); in agroecosystems research, resilience is often linked to the level of biodiversity of a system (Di Falco and Chavas, 2008). Since the 1990s, its meaning has been expanded to include socio-economic-ecological systems (Berkes, Colding and Folke, 2002). In this broader meaning and application, resilience has been discovered by businesses and policymakers alike as the new sibling of sustainability.

The second lesson pertains to *preparedness and timing*: it pays to invest in preparedness and to act while active design is still possible, to develop alternative pathways, mitigation and adaptation options systematically and, more generally, to make use of the precautionary principle, before the full force of a crisis strikes. While the timing of the two current crises looks different (slow and incremental versus sudden and surprising), both climate change and COVID-19 have tipping points and profound long-term economic and social consequences that have not yet shown their full force. Sustainable development and climate policies have taken on a long-term perspective, making the Paris Accord (United Nations, 2015) concrete and supporting Europe's plans to become the first climate-neutral continent by 2050. Major cities (C40 Cities, Arup & University of Leeds, 2019) and many countries worldwide are setting ambitious climate targets for becoming 'carbon neutral' within decades. Despite people's initial reactions and impulses to draw back, the COVID-19 pandemic and its economic fallout have thus far not weakened these ambitions of major private and public actors. A parallel development is the quest to design self-sufficient 'COVID cities' (Bai *et al.*, 2020), i.e. built environments and urban infrastructures that cater to the need for a new 'distanced togetherness', including innovative urban farming concepts that help secure food provision independently from global supply chains. Progressive city leaders have started investing in self-sufficient, healthy and sustainable urban food systems, paired with micro-mobility and infrastructure for pedestrians, while testing new urban design models, such as retrofitting buildings and public spaces with healthier renewable alternatives that bring food production closer to city people.

Which brings us to the third lesson, which is about the importance of the *human factor* in policymaking aimed at shaping behaviour: without the acceptance, participation and engagement of consumers and citizens, even the most promising technological advances and product and process innovations

will not be successful. Without empirical knowledge about how, when and why farmers, innovators, prosumers and consumers actually make decisions, well-intended policies might not have the desired effects. System changes in democratic societies (which are the focus of the present paper) need a *human-centred approach* that engages people in the changes—that makes use of their knowledge of the issues and expertise in solving problems, that utilises the ability to design policies that work given deep-rooted biases and often-unconscious dependence on heuristics and that acknowledges the power of social, environmental and situational contexts. To achieve such goals, the traditional economic model of *Homo oeconomicus* is not very helpful; instead, a more realistic, empirically valid model of how humans think, decide, act and react within powerfully influential contexts is better suited. However, this approach is largely lacking today. As a recent IPCC report (2019, p. 114) observes, 'incorporating human and institutional behaviour in models' is a significant interdisciplinary science challenge.

This is what the present paper is about: it argues that good food policy, both in concept and practice, will benefit from a systematic inclusion of human and institutional behaviour in its models, processes, politics and policies. Extending the recent contribution of Dessart, Barreiro-Hurlé and Van Bavel (2019) on the supply side, it focuses on the demand side of food systems.

In the past decade, spurred by the path-breaking work of psychologists Kahneman and Tversky (1979, 1984), and then by economist Richard Thaler and legal scholar Cass Sunstein, behavioural economics (BE) has had a massive impact on academia as well as private and public institutions and governments. Building on the wealth of theoretical and empirical knowledge accrued in economics and policy research, psychology and sociology, marketing and consumer behaviour, BE has been a game changer (Hallsworth and Kirkman, 2020) and is slowly becoming the 'new normal' economic approach (Thaler, 2016). With its strong empirical focus, integrating the knowledge of how people decide and behave in reality (and not in abstract models), as well as its robust connectivity to other social sciences, BE promises to be instrumental in solving concrete problems. The key argument for BE is rooted in the two-systems theory of decision-making (Kahneman, 2011) used by behavioural science: the human mind operates on two 'systems'—fast and intuitive, and slow and deliberative (called System 1 and System 2)—that are both useful for decision-making in different situations. However, they also give rise to decision errors such as myopic and impulsive choices, mispredictions and wrong evaluations of current or future states or flawed evaluations of past experiences, to name just a few.

Behavioural factors are commonly understood in the BE literature as psychological and sociological factors, i.e. the cognitive, emotional, personal and social processes, mechanisms or stimuli underlying human behaviour. Research is based on behavioural theories such as prospect theory (Kahneman and Tversky, 1979). However, neither there is unified or dominant theory to date (see Schlüter *et al.*, 2017) nor is there widely accepted agreement on conceptual issues such as definitions and taxonomies (Beshears and Kosowsky,

2020). Many proposals have been made on how to categorise these behavioural factors. For instance, a recent literature review on farmer behaviour suggests grouping behavioural factors into three categories: dispositional factors (such as personality, resistance to change, risk tolerance and environmental concern), social factors (relevant when interacting with others, e.g. social norms and signalling motives) and cognitive factors (such as knowledge, perceived control and risk, perceived costs and benefits) (ibid.). Such conceptual groundwork is relevant since tackling the different behavioural factors needs distinct policy approaches.

More than a decade after the policy term *behavioural insights* (BIs)[2] was coined, interest and efforts have expanded rapidly to harness the insights of behavioural science (usually understood as the three overlapping fields of cognitive psychology, social psychology and BE) to induce change and make policy measures more effective. This has spurred the development of *Behavioural Public Policy* (Shafir, 2013), applied by hundreds of governments and public institutions worldwide, as well as what has been called 'Nudge Theory' for private organisations and corporations. Today, major supranational organisations such as the FAO, the WHO, the Organisation for Economic Development (OECD) and the United Nations Environment Programme (UNEP) have explicitly adopted such an empirical view of economic actors as 'humans not econs' (Thaler and Sunstein, 2008) to create more effective programmes and policies (Manning *et al.*, 2020). A carefully designed choice architecture (i.e. the context and background that inevitably must be established) and well-chosen and well-designed nudges, i.e. seemingly small, inexpensive, low threshold, unobtrusive stimuli and features of the decision context that steer people's behaviour in desirable directions (as judged by themselves), hold the promise of effective, low-cost and low-intrusion behaviour-change tools (ibid.). It is important to note that nudges are just one tool in the behavioural toolbox, and they are often used to supplement or improve rather than substitute for other policy instruments such as laws, taxes or information efforts (Sunstein, 2020a).

These lessons and insights inspire the present paper. Its focus will be on the last point: the role of human decision-making and behaviours for food-system change. It makes a case for a food system policy that incorporates BIs, an approach that we call *behavioural food policy*. In the following, we first review the current challenges and problem areas for food systems today. Second, we investigate the necessary steps and promising policy approaches to trigger or support needed changes. Third, we sketch the contours of a behaviourally informed food policy and close with suggested research directions for transformative food system and policy research.

2 We use the OECD (https://www.oecd.org/regreform/behavioural-insights.htm) definition that is mostly inspired by the work of the British Behavioural Insights Team: 'An inductive approach to policymaking that combines insights from psychology, cognitive science, and social science with empirically-tested results to discover how humans actually make choices'.

2. Challenges and problems

2.1. Food-system policy: an overview

Food-system policy impacts how (and what type of) food is produced, processed and distributed as well as purchased, consumed and disposed of. At its core, food policy governs food security and food safety, healthy and environmentally friendly diets, and access and equitability; indirectly, it also influences animal welfare and workers' rights (Smith, 2016). In high-income countries, major policy issues stem from a food system catering to 'Western diets' that are connected to various public health issues (specifically, the prevalence of obesity and non-communicable diseases such as Diabetes 2 and the increased vulnerability of overweight patients), climate issues (e.g. the high environmental impact of mass production of cattle), and other environmental detriments such as biodiversity loss, soil degradation, nitrogen and pesticide input and water shortages. The food system also impinges on and creates social costs, from conflicts over land use, working conditions and animal welfare to equal access to healthy diets for poorer consumer segments in general and children in particular. In the Global South and urban food deserts worldwide, food security is another paramount issue. Also, foodborne diseases (zoonoses) and food safety issues are an increasing concern worldwide and the source of potential future pandemics.

Global food security is threatened by rising temperatures and increases in the frequency of extreme weather and wildfires. For instance, the recent Lancet Countdown Report (Watts *et al.*, 2020) indicates that global yield potential for major crops declined by 1.8–5.6 per cent between 1981 and 2019. Also, climate change has apparent downstream effects, impacting broader environmental systems, thereby harming human health and livelihoods. A warming world makes formerly safe regions suitable for all kinds of deadly diseases, risking an explosion of new zoonotic pathogens and vector-borne diseases (ibid.). It also makes regions unlivable and unbearable, a major reason for poverty migration. The scientific evidence on the close connectedness of climate change, land use, food production, shrinking wildlife habitats, health and poverty has reached a level that is hard to ignore for both the corporate and political world. In this spirit, the Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services, representing the global biodiversity-research community, has recently called for an 'enlightened EU Common Food Policy' (De Schutter, Jaocbs and Clément, 2020), i.e. a policy that is well adapted to the systemic nature of the challenges that food systems cope with: obesity and the rise of non-communicable diseases, climate change, biodiversity loss and food poverty, to name a few. The authors sketch an integrated food policy framework and suggest four steps of a governance shift: coherence of policies across policy areas; coherence across governance levels; governance for transition; and 'food democracy' (ibid.). This is a critical and laudable vision of comprehensive governance, and the new European Green Deal reflects some of these suggestions.

2.2. Malnutrition and overweight: the double burden

What people eat has become the leading cause of disease and death worldwide, surpassing deaths caused by smoking or alcohol (GBD 2017 Diet Collaborators, 2019). Malnutrition, in the form of undernutrition as well as overweight, poses increasingly pressing problems—often at the same time within the same countries. For instance, on the African continent, practically every nation-state sees a growing obesity problem, particularly in the urban centres (Battersby and Crush, 2014; Demmler and Qaim, 2020), with foreseeable consequences for public health threats such as diabetes and cardiovascular diseases, indicating a 'double burden' (Clark *et al.*, 2020; Swinburn *et al.*, 2019). Unhealthy diets are the greatest health risk worldwide, and costs are externalised to the public health system and the environment (Bodirsky *et al.*, 2020). There is an ongoing 'nutrition transition' that transforms food systems globally, from now-scarce plant-based diets with fresh foods towards rich diets high in sugar, fat and ultra-processed and animal-sourced foods (Baker *et al.*, 2020; Masters *et al.*, 2016), bearing significant environmental and health consequences. A recent model (Bodirsky *et al.*, 2020) estimated that by 2050, 45 per cent of the world population will be overweight and 16 per cent obese. Moreover, the current global food system is failing large swaths of humanity who are deficient in nutrients needed for good health. Malnutrition and hunger are not a topic from the past but remain urgent issues in the Global South and for the poor in the developed countries, a problem magnified by the COVID-19 pandemic. Besides much-needed technological changes in farming and production—such as more diverse, nutritious, and resilient crops as well as innovative, digitally enhanced forms of sustainable farming—hope is pinned on behavioural approaches that help strengthen food security (Timmers, 2012; World Bank, 2015).

2.3. Climate and environmental impacts: preserving natural capital and ecosystem services

There is strong scientific evidence that food production and consumption are among the largest global environmental change drivers due to their contributions to greenhouse gas (GHG) emissions, biodiversity loss, freshwater use, eutrophication and land-system change (Creutzig *et al.*, 2021). The food system alone is responsible for 21–37 per cent of anthropogenic GHG emissions (Rosenzweig *et al.*, 2020). It is hence a critical focus for strategies of mitigation (i.e. reduction or elimination of current and expected future emissions) and adaptation (i.e. building resilience for emerging and long-term climate impacts) (Niles *et al.*, 2018). However, these efforts will not suffice. What is needed to secure long-term prosperity for people and the planet is a profound food-system change that internalises external costs and protects natural capital and the ecosystem services it provides. This is not a new insight. The need for and mechanisms of internalisation of externalised environmental costs have been discussed since the 1920s, and the unique character of natural capital has been debated for decades under the title of 'weak vs. strong sustainability',

with proponents advocating for the protection of natural capital (including biodiversity) that cannot be replaced or built up like man-made and human capital (Costanza *et al.*, 2014).

Due to growing global affluence, global demand for emissions-intensive foods (mainly meat and dairy) is rising, and demand for these foods is expected to double globally by 2050 (Garnett, 2009, p. 491). Food policies with a systems view can have impact deep into the value chain and hold the potential to change pre-production, production, processing, transport and consumption of such problematic food groups, as well as to help minimise food loss and waste (in general and of high-climate-impact foods in particular). Beyond taxes, subsidies, regulations and technological and structural improvements, the global climate-research community has identified behavioural changes that would substantially mitigate food-related GHG emissions (IPCC, 2019). Unsurprisingly, avoiding food waste and shifting diets towards more plant-based nutrition are repeatedly named as most impactful measures. Much of the food waste that occurs along the supply and consumption chain could be avoided by monetary incentives (e.g. tax reductions for retailers sharing food with food banks), supportive regulation (e.g. the French ban on throwing away surplus food by retail), as well as simple behavioural measures. For instance, paying attention to 'avoidable household food waste', meal planning and creative use of leftovers, along with shifting attitudes towards edibility can immediately help reduce the level of waste. Also, retail can focus its marketing on more sustainable options (Bauer *et al.*, 2021), regulators can improve the handling of expiration labels and best-before dates, and institutional food services and corporate canteens could be operated under the concept that it is not only money that gets wasted with poor food planning. As for reducing meat consumption (particularly mass-produced beef) and substituting animal protein with field-grown protein, the importance of demand-side change for mitigation is widely acknowledged (Garvey *et al.*, 2020) and viewed as being able to deliver environmental benefits 'on a scale not achievable by producers' (Poore and Nemecek, 2018, p. 5). Regarding the impact and effectiveness of regulating meat consumption, challenges have been identified, and different approaches are discussed (Bonnet *et al.*, 2020), including behavioural regulatory instruments (Reisch *et al.*, 2021).

Acknowledging both the advancement and impact of demand-side policies, the upcoming 6th Assessment Report of the Intergovernmental Panel on Climate Change (IPCC, n.d.) features a chapter dedicated solely to demand-side climate-mitigation instruments, including BIs to promote more sustainable diets. One of the chapter's lead authors summarises the collected evidence concluding that demand-side solutions' high potential is still not utilised as it should be (Creutzig *et al.*, 2021).

2.4. Resilience and access: social sustainability and just transition

It seems safe to assume that balanced systems that stay within the planetary boundaries and provide a minimum level of safety, access and equality (Raworth, 2017) are more resilient than systems that aim to maximise one

outcome or that focus exclusively on profit-based efficiency. The FAO (n.d.) defines resilience as 'the ability to prevent disasters and crises as well as to anticipate, absorb, accommodate or recover from them in a prompt, efficient and sustainable manner. This includes protecting, restoring and improving livelihood systems in the face of threats that impact agriculture, nutrition, food security and food safety'. As noted earlier, preparedness can increase resilience, as do supportive contexts, trust in government policies, systems thinking and design of robust structures.

The importance of resilient food systems became overwhelmingly clear with the COVID-19-induced lockdowns and closing of national borders (Acatech, 2020). While access to food was mostly not a problem in high-income countries, where the combination of regional value chains and the food industry's access to global markets provided a resilient structure, the disruption did reveal some weak spots and risky dependencies. Internationally, whereas agricultural markets have stabilised following some initial volatility, millions of people in emerging and developing countries had and still have only limited access to (healthy) food, due to both income loss and shortages induced by governmental restrictions (ibid.). Today, more than one year into the pandemic crisis, hunger and 'hidden hunger' are a serious topic.

In the near term, significant thought will be given to the lessons learned from the coronavirus pandemic that can be applied to future—not unlikely—similar events. A key aspect is consideration of how to increase food systems' resilience to be better prepared to endure another crisis (Acatech, 2020). Food chains have become long and globalised, and retail systems are streamlined for efficiency, both adding to systems' vulnerability. On the other hand, there are limited resources for double structures and safety buffers. While the essential food provision in Europe did work during the crisis (not least due to local food chains), cracks became evident at the retail level with shortages of staples. While many of these shortages were due to stockpiling by people—a behavioural factor—rather than genuine supply shortages, those media-driven incidents spotlighted the vulnerability of a system built on long, lean supply chains and just-in-time inventories.

3. Steps towards healthy, sustainable and resilient food systems

3.1. From chain to system: nexus thinking

It is now common knowledge that the entire food system is crucial for building resilience and delivering on the Sustainable Development Goals (SDGs) (Lawrence and Friel, 2020). This somewhat obvious insight has finally entered the European (EU, 2020; SAPEA, 2020) and global (FAO, 2018; GLOPAN, 2020; HLPE, 2017; OECD, 2021; United Nations, 2020) food policy agenda, where elaborate food-system frameworks have been developed. While definitions slightly differ, in principle a sustainable food system is one where food that is produced, manufactured, distributed and consumed is health supporting, safe, and environmentally and climate friendly; farmers and workers receive

fair wages and work under decent conditions; consumers have equal, easy and affordable access to a diversity of healthy foods; and nutrition security is provided for today's and future generations (HLPE, 2014; Lawrence and Friel, 2020; SAPEA, 2020).

Researchers, international organisations and forward-thinking policymakers worldwide increasingly base their efforts on the nexus of climate, water, land use, poverty and health (Aleksandrowicz *et al.*, 2016) instead of focusing on disciplinary silos and sector politics. With the advent of systems thinking, more academics, businesses and governments are approaching food policy issues from a complex food-system view rather than from the traditional food-chain approach or by focusing on single actors. By definition, a sustainable food system gathers all the elements (environment, people, inputs, processes, infrastructure, institutions, etc.) and activities that relate to the production, processing, distribution, preparation and consumption of food and the outputs of these activities, including socio-economic, health and environmental outcomes (HLPE, 2014; OECD, 2021). From a sociological perspective, these systems are often viewed as complex 'systems of provision' (Bayliss and Fine, 2020)—with agents, structures, processes, relations and material cultures—capturing the power-dependent interconnections among individuals' choices, their immediate food environment, and the larger social, economic, political, technological, cultural and environmental contexts. Zooming in further on the 'agents'—i.e. the individual decision-makers such as farmers and consumers—frameworks based on psychology and BE have recently gained attention (Dessart, Barreiro-Hurlé and Van Bavel, 2019).

There is no doubt that all the above elements are potential levers for change and that these changes will affect other system elements for better or worse, with spillover or spillunder effects and reinforcement or undermining of impact. A recent study (Rosenzweig *et al.*, 2020) structures dozens of promising food-system response actions to climate change that actors within the food system can apply: from improved crop and livestock management in farming and improved supply-chain efforts in food processing, retail, and agri-food industries to demand-side responses. The latter focus more broadly on consumer and producer behaviour and include actions such as dietary change, reduction of edible food loss (during production, postharvest and processing), and the minimizing of food waste (food discarded by consumers and retailers) that affect the transparency of food chains and externalised costs. The overview by Rosenzweig *et al*. shows that synergies and trade-offs between such responses will be crucial for success: 'Options to reduce food loss and waste can be more easily identified, designed and assessed through a system approach—including technical measures … and behavioural changes (for example, acceptance of less-than-perfect fruit and vegetable appearance, redistribution of food surplus …)' (ibid., p. 96). Widespread acknowledgement of co-benefits and the promotion of motive alliances within a nexus approach would be a breakthrough in food, farm, environmental, consumer and health policy—fields that closely interact to weave our methods of sustenance.

3.2. From animal-sourced foods to plant-based planetary diets

For the individual consumer, food is the single most potent lever to optimise one's health and environmental sustainability at the same time: a diet light in animal protein (ruminant meat, in particular) is better for human health,[3] reduces stress on animal welfare, helps reduce foodborne diseases and food safety issues and has—on average—a smaller ecological footprint on climate, soils, water and resources. Notably, a global diet primarily based on plants is more socially equitable and fair and more easily scalable to feed a growing worldwide population—an argument that has gained even more weight since the COVID-19 pandemic also increased global social and health inequality. In this spirit, the EAT-Lancet Commission on Healthy Diets for Sustainable Food Systems has suggested promoting 'healthy planetary diets' (Willett *et al.*, 2019), i.e. diets that are both nutritious and within the sustainable food-production boundaries. The Lancet Commission has defined a scalable 'universal healthy reference diet' that, if applied, can feed an anticipated global population of nearly ten billion people a healthy diet within the food-production boundaries by 2050 (Willett *et al.*, 2019, p. 447), thereby defining what would be a safe operating space for 'planet-proof' food systems (Rockström *et al.*, 2020).

Promoting such a scalable planetary diet means actively opposing and altering the worldwide nutrition transition ongoing in an asynchronous way over the past decades. Features of the 'triple challenge' (OECD, 2021) or 'global syndemic' (Swinburn *et al.*, 2019), i.e. undernutrition, overnutrition, and food-related environmental pollution and climate change, have common drivers and call for shared solutions (Bodirsky *et al.*, 2020). Sustained behaviour changes are central to all three challenges; therefore, the present paper calls for better evidence-based policies that help promote behavioural change.

3.3. From traditional to behaviourally informed demand-side food policies

While agricultural policies primarily apply to the farming system and the supply side of markets, food policies focus on people's diets in all their complexity. Historically, the two policy arenas tended to be influenced by different disciplinary perspectives: agricultural economics and plant/animal breeding on the supply side, and consumer science, agro-marketing, and health sciences on the demand side. Also, there always have been issues connecting both sides of the market, such as subsistence farming in the Global South and a new wave of own production and urban farming in the Global North.

Food policies target institutional and individual actors' decision-making, from breeders, farmers and growers to industry, retailers and prosumers to end consumers (Reisch, Eberle and Lorek, 2013). For decades, the policy focus was on the agricultural supply side and the distributional subsystem. Nevertheless, since the UN-driven SDG movement gained traction and the IPCC

3 We realise that this holds for the well-nourished consumers of high-income countries; in more impoverished regions, an increase (in any meat) would add to the nutritional value.

picked up on the demand-side mitigation potential, policies have also focused on environmentally sustainable food consumption and the needed changes in preferences, choices and notoriously persistent habits (Vermeir *et al.*, 2020). How to initiate and sustain behavioural change in individuals is the focus of a large interdisciplinary research field. Depending on the disciplinary roots and existing theories, we find competing theories of behavioural change (see, e.g. Duckworth and Gross, 2020)[4] as well as different guides to behaviour-change tactics and instruments (Beshears and Kosowsky, 2020). An influential recent approach, the 'behaviour-change wheel' (Michie *et al.*, 2013), identified 93 different behaviour-change tactics. Kok *et al.* (2016) list 99 different community-based techniques, and Knittle *et al.* (2020) describe 123 distinct self-initiated techniques. A practitioner-based approach has been developed over the past decades by Rare.org, the 'Rare approach' (Rare, & Behavioural Insights Team, 2019; Rare, & California Environmental Associates, 2019), that uses participative, engaging behavioural approaches to change behaviour mainly in the Global South.[5] Last but not least, Behavioural Public Policy (BPP) research has suggested several taxonomies and guides for employing 'nudges' (OECD, 2019; Sunstein, 2014) that mostly rely on Kahneman's 'System 1 vs. System 2' approach, as sketched above.

Behaviourally informed policy also means being aware that agents' actions are highly context dependent. Only a few particularly dedicated individuals will show the right behaviour in the wrong structures, i.e. sustainable choices within a context of affordances, social norms and incentives that support non-sustainable options. In sustainable-consumption research, one of the most common findings is a marked attitude–behaviour gap[6] on the part of consumers (Aschemann-Witzel and Zielke, 2017). More rule than exception, the gap is explainable by biases, heuristics and context dependency. Hence, promoting behaviour change on the individual level—condensed in the trilogy 'improve, shift and avoid'—without respective institutional, contextual and system changes that frame, support and sometimes initiate or re-initiate changes will not be useful in the long run.

For sure, information policies targeting consumers such as front-of-pack labelling can help interested and aware consumers to make a better choice. For instance, the new 'Nutriscore' label that uses intuitive colour codes for easy reference seems to work for some (Andreeva *et al.*, 2021). However, while information offers might spark short-lived changes, sustained long-term effects such as habit creation, taste discovery and deep learning are unlikely to happen for most consumers (Volpp and Loewenstein, 2020). Some information might even have off-target, unintended side effects such as rebound and moral licensing effects, and boomerang and reactance effects, as well as possibly creating behavioural fatigue or reinforcing lock-ins. However, the risk

4 The authors suggest a 'process theory of behavioural change' that differentiates between changes initiated by the individual and those where an external actor (such as a benevolent employer, the regulatory state and a civil society actor) nudges this individual.

5 Disclosure: the author is a (non-paid) member of the Scientific Board of Rare.org.

6 Behavioural economics has developed the concept of 'x-inefficiencies' (Altman, 2020) for behaviours that empirically diverge from what the models suggest.

of unintended side effects of food policies applies to traditional instruments alike (e.g. regressive effects of fat taxes, see Muller *et al.*, 2017); this calls for empirical ex ante and ex post evaluations of intended and unintended effects as a basic feature of good governance.

Behaviourally informed food policy harnesses what has been called a 'behavioural wedge' in climate politics (Dietz *et al.*, 2009), i.e. employing the (potentials and limits of) 'behavioural plasticity' of human decisions and behaviours on the part of the farmers, consumer-citizens, policymakers and policy shapers. The design of impactful policies starts with understanding this 'wedge', the roles, goals, incentives, perceptions, needs and interests of both the targeted actors and the decision-makers, and identifying the barriers, drivers and capacity for change. The latter requires the knowledge of options and the resources to consider, initiate and maintain change. Importantly, people drive change, adopt technical innovation (or not) and catalyse social innovation (or not). In short, successful policies put people—their wishes, goals, fears, biases and the inevitable behaviours that follow—in the centre of the problem and assume a people-centric view; they identify individual and contextual drivers and barriers in the specific case and test how different policy solutions resonate in different situations and thereby drive behavioural change.

The OECD (2019) has condensed the knowledge about this stepwise procedural approach of BPP design into a guide for practitioners. As regards food-system change, it recently suggests public–private collaboration through behavioural nudges (OECD, 2021), particularly those enhanced by digital technologies (Baragwanath, 2021). In more detail, the Global Panel on Agriculture and Food Systems for Nutrition (GLOPAN, Global Panel on Agriculture and Food Systems for Nutrition, 2020) has proposed a behaviourally enlightened policy framework on Agriculture and Food Systems for Nutrition. Here, priority policy actions to transition food systems are based on the four behavioural pillars of availability, accessibility, affordability and desirability (see Figure 1).

This simple framework, informed by the knowledge provided by consumer behaviour models, is a good starting point for behavioural policy action and research. A growing set of studies and reviews has shown the effectiveness of small nudge and choice-architecture interventions, curating the availability, accessibility, affordability and desirability of several behavioural change goals. For instance, increasing the visibility of meat substitutes (Vandenbroele *et al.*, 2021), offering smaller meat portion sizes (Vandenbroele *et al.*, 2018) and making more sustainable meat more salient (Coucke *et al.*, 2019) have helped reduce meat demand in these cases. Simultaneously, well-targeted, well-designed and combined behavioural nudges appear to have a moderately significant effect on fruit and vegetable choices (Broers *et al.*, 2017). Beyond effectiveness, there also seems to be a generally high level of public acceptance of behavioural instruments in general and 'green' and 'health' nudges specifically (Sunstein and Reisch, 2019) in many countries worldwide. Acceptance (and presumably, also the effectiveness) can be increased when the nudges are actively included in the policymaking process and there is an option to

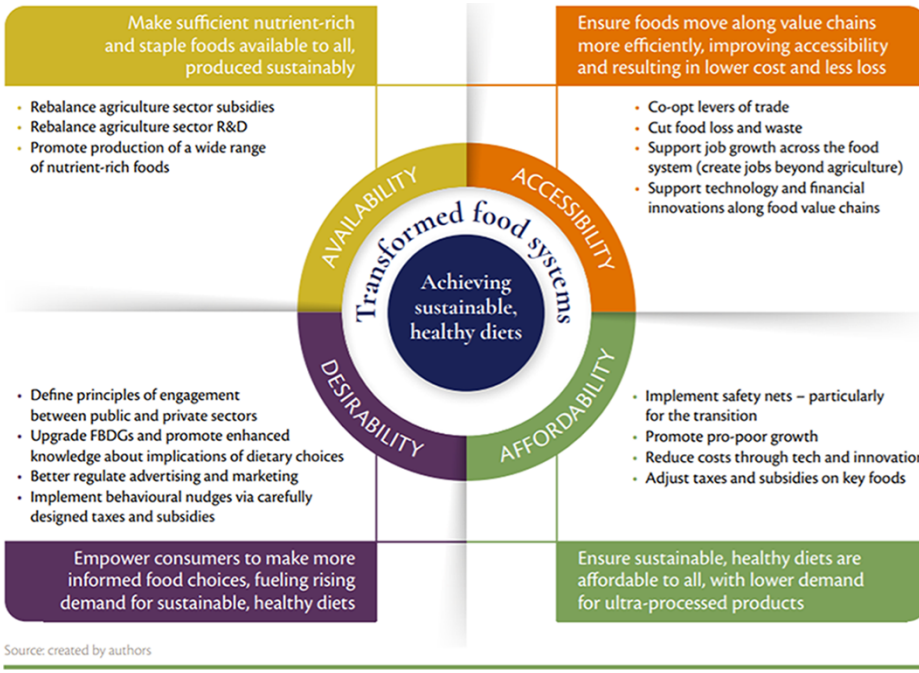

Fig. 1. Priority policy actions to transition food systems towards sustainable, healthy diets.
Source: GLOPAN (2020: 20).

participate in the creation process (John, 2018). To the contrary, acceptance is reduced when people assume that the nudges are not transparent and that they are being tricked into a decision—for instance, by a System 1 nudge such as a default they do not even realise exists (Wachner, Adriaanse and De Ridder, 2020). People seem to prefer System 2 nudges (Sunstein, 2016a), and it has repeatedly been argued that full transparency is a defining element of good governance of nudging (Sunstein and Reisch, 2019).

This paper is not the first to suggest such a behavioural perspective for food policy, not even in this journal (Dessart, Barreiro-Hurlé and Van Bavel, 2019). In the search for effective policy instruments to curb the worldwide obesity crisis, Just (2006) and a decade later Just and Gabrielyan (2016) called for the BI to be systematically included in global food policy. While they see the potential, they claim that there is still not enough evidence to roll out a full policy approach (ibid.). Similarly, Liu *et al*. (2014) review behavioural biases that are critical drivers for overeating and obesity and call for a food policy that builds on BIs. Reflecting food-security policy, Timmers (2012) recommends a new theoretical underpinning to political economic analysis that incorporates the behavioural perspective. With many others, Guthrie, Mancino and Lin (2015) and Vandenbroele *et al*. (2021) suggest nudging approaches to change food consumption behaviour towards greater sustainability. The EAT-Lancet Commission's project of a 'Great Food Transformation' targets different actors

in the food system and explicitly relies on demand-side approaches, employing the 'Triple-A' of behavioural public policy: improve access, attractiveness (desirability) and affordability (Willett *et al.*, 2019).

Creutzig *et al.* (2021) propose a transdisciplinary approach to identify demand-side solutions with high climate-mitigation potential, and they explicitly suggest behaviourally informed policy tools, nudges and choice architecture as promising methods. A 2020 SAPEA review report lists 'food choice architecture' and 'social norms' as particularly recommended approaches to shape a European sustainable food policy. Indeed, recent literature reviews suggest a high impact of both, choice architecture (Ensaff, 2021) and social norms (Enriquez and Archila-Godinez, 2021). Consequently, there is a call to focus on the 'diversity of cultural norms' as one of five priority areas of research and action for the great food-system transformation (Béné *et al.*, 2020). Targeting a practitioner audience, the British Behaviour Insights Team (BIT) (2020) recently reviewed strategies, tools and insights for behavioural food policy and mapped opportunities and limits, highlighting 12 behavioural strategies.

A similar trend can be seen in agricultural policy that also starts to embrace behavioural factors for more effective policymaking. Recent reviews of the literature suggest that the field of behavioural agricultural economics is gaining relevance in academia and policy (Dessart, Barreiro-Hurlé and Van Bavel, 2019; Palm-Forster *et al.*, 2019; Thomas, 2019). For instance, behavioural factors are used to better understand farmers' motivations for sustainable farming (Dessart, Barreiro-Hurlé and Van Bavel, 2019; Thomas, 2019) and to 'green' the European Common Agricultural Policy (Thomas, 2019). It is argued that voluntary schemes to incentivise sustainable farming practices warrant a behavioural perspective to be effective (Dessart, Barreiro-Hurlé and Van Bavel, 2019).

Altogether, the time seems ripe for both conceptual and empirical work on the polity, policies and politics of a behavioural food policy. As suggested earlier (Reisch, Sunstein and Gwozdz, 2017), BIs can inform food policy in multiple ways: first, by using a specific behavioural lens to examine existing food policies (and thereby make them more effective); second, by adding new tools (such as defaults) to the toolbox and third, by employing policy design and policy processes based on empirical testing, learning, adapting and sharing the results with others (Dessart, Barreiro-Hurlé and Van Bavel, 2019). Elsewhere, a scheme for 'good governance of nudging' has been put forth (Sunstein and Reisch, 2019), including transparent goals and processes, a strict welfare-orientation, public deliberation and informed participation by policy targets to increase effectiveness but also to forge understanding, create ownership and strengthen public approval.

While the potential seems great, recent literature reviews on behavioural change towards more sustainable lifestyles demand a sense of caution: in general, the larger the mitigation potential of action, the less willing households seem to be to implement it (Dubois *et al.*, 2019). Moreover, most policies effectively mitigating climate change show low behavioural plasticity—including reducing meat consumption and avoiding food waste (Nisa *et al.*,

2019). A recent systematic review (SAPEA, 2020) concludes that based on the available evidence, the most considerable potentials for behavioural change in the direction of more sustainable lifestyles lie in taxes and consumer information such as labels. More evidence is needed for promising choice-architecture and social norm-based approaches. Without doubting this conclusion, this paper argues for expanding the evidence base in regard to the effectiveness of behavioural instruments for behaviour changes in the food system and makes some concrete suggestions on priority research areas below.

4. Research directions for behavioural food policy

4.1. Transdisciplinary and transformative research

In the current crisis, decision-makers in the food system are grappling with the many 'unknowns' they encounter while being asked to manage today and plan the future. We need better insight into what people want, which needs and fears they have, how they make decisions and what hinders and supports them in changing unwanted or undesirable habits. At the same time, we also need knowledge about people's acceptance of improved products and processes, as well as innovative policy tools. Last but not least, there is a need to co-create visions of the future: how do we envision the future's food system? How can we co-create transformative pathways and negotiate divergent views and interests within different regions and societies to reach those goals? These are normative questions, and researchers must be transparent about their normative stand when delivering to society.

On a conceptual level, we mainly see gains from *transformative* research, i.e. research that aims to deliver on a normative mission promoting change processes. This is linked but not identical to *transformation* research, i.e. the study of societal transformations, their processes, barriers and promotors.[7] Finally, to deliver on the many 'unknowns' of the complex food system, we suggest a *transdisciplinary* research perspective, i.e. research that explicitly reaches beyond single disciplines as well as beyond academia and includes actors from politics, civil society and the private sector across the entire research process, starting with the development of a joint research question (Lawrence and Friel, 2020). As depicted in Figure 2, such an approach can provide the following:

- *orientation knowledge* that constructs and shapes the goals of processes of societal transformation: e.g. what do we know about the state of the food system and its impacts on the SDGs, and which goals should be set?
- *systems knowledge,* the empirical study of present challenges: e.g. how are the variables of a food system interlinked? Which are amplifiers and barriers?
- *transformation knowledge* that develops practical (political, technical, legal, social and cultural) means and tools to advance transformations and achieve

7 'Transition research' is usually understood as an overarching concept for both.

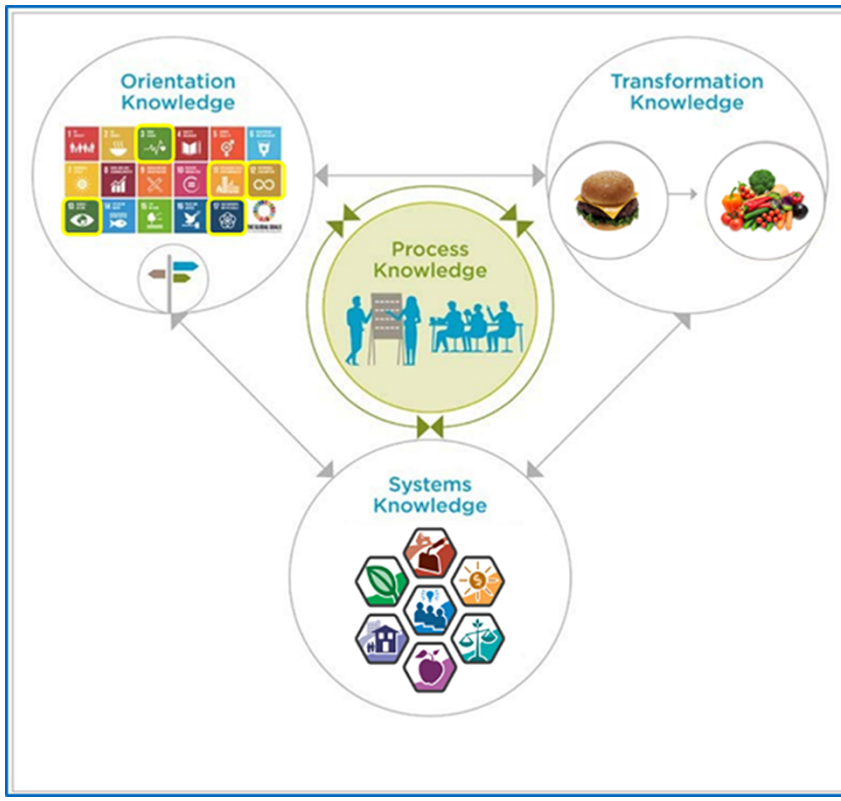

Fig. 2. Four types of knowledge systems.
Source: based on Lawrence, Nanz and Renn (2021).

defined goals: e.g. what can specific interventions and pilot projects contribute, and how can this be scaled up? How do we evaluate the cost-effectiveness of interventions?

- *process knowledge*, which is about processes of knowledge generation and collaborative goal finding as well as ways to channel socially robust knowledge to decision-makers; it is about the 'how' of change processes and of transformative research: who are the key actors to include, and how can effective change processes be designed and executed?

The targets of this knowledge are both academia and practice actors, the latter including (but not limited to) public administrators and food agencies, policymakers and policy shapers (such as foundations, NGOs), entrepreneurs and managers, retail and restaurants, schools and higher education, as well as the individual citizen consumer. Much (but not all) of this research will be applied, and often, co-creation with selected targets will be the most impactful way to create and test hands-on prototype solutions. While being explicit about their normative goals, researchers' role will be to apply the methods in a scientifically rigorous way, to create empirical evidence and to consult decision-makers as an 'honest broker'.

4.2. Research priorities

While BIs are being embraced in politics and management, the scientific empirical evidence and the theoretical foundations of this nascent field are growing but remain patchy, also as regards their application in food-system policy. Increasingly, systematic and scoping literature reviews and systematic maps on selected behavioural food policy instruments are being published, indicating that the research field has reached a level where it is worth compiling and reviewing the existing evidence. Some of these reviews systematically depict research gaps and suggest promising areas to further develop nudging and nudges influencing food demand (see, e.g. Bauer and Reisch, 2019; Reisch *et al.*, 2021; Vermeir *et al.*, 2020). The three topics of prominence due to their significant impact potential are first, instruments to shape individual food behaviour; second, shaping the food environment and in addition to that the consumption settings and third, food circularity, with a focus on curbing food waste by households, food services and retail.

This is not the place to discuss individual research gaps. Given the aim of shaping healthy planetary food systems with behaviourally informed policies, it is perhaps more important to ask which type of transformative research and knowledge creation is needed most to reach that goal and deliver scientific evidence for policymakers. Transformations towards sustainability can be understood as open-ended search processes. Sustainability research supports these processes by generating factual knowledge ('knowing *that*') and practical knowledge ('knowing *how*'), but also by reconstructing and ethically substantiating the values and norms that guide action.

'Knowing *that*' is primarily based on *orientation knowledge* that provides the goal, rationale and direction of system change, as well as *systems knowledge* that reflects the relations within the food system, the goal synergies and antinomies, the power relations among the actors and insights into the roots of 'wicked problems'. The behavioural element, the focus of the present paper, is most pronounced in 'Knowing *how*', i.e. *transformation knowledge* and *process knowledge* as covered below in more depth.

4.3. Transformation knowledge

As noted above, *transformation knowledge* helps to make intended changes happen—here: towards planetary and healthy food systems. It provides the needed empirical evidence for the effectiveness and acceptability of behavioural instruments that work. It also includes knowledge of methods studying and evaluating the effects of interventions, as well as the theoretical and conceptual foundations of the field to model pathways and explain results. The literature in which transformation knowledge is developed is genuinely multidisciplinary.

The behavioural sciences have provided theories and produced extensive empirical evidence about large individual and group differences in behavioural plasticity (Nielsen *et al.*, 2020), i.e. adaptation and behavioural change on an individual level, through experience, exposure and learning. As captured in

Box 1. Research questions: individual level

- Which nudges work best for which target group? Can we find systematic differences between genders,[a] age groups, personality traits (the 'big five'), socio-economic groups, ethnic cultures and nations[b] in terms of effectiveness and acceptance? How are effectiveness and acceptance interlinked?
- How do social and cultural norms regarding food choice evolve and change and can this be influenced and steered (Enriquez and Archila-Godinez, 2021)? By whom and based on which legitimate role (Béné et al., 2020)?
- (How) Can we safely and ethically harness information and availability cascades (Sunstein, 2019) as well as behavioural and social contagion (Frank, 2020; Sunstein, 2020b) to spread new norms and ideas?
- Which nudges are particularly impactful and/or cost-effective? Which are culturally and socially robust over different target groups?
- What are the long-run effects of behavioural interventions on actual consumption? When and how do effects fade out?
- How to monitor and avoid unintended side effects and non-target outcomes (spillovers, rebounds, boomerang and moral licencing)?
- How can BIs improve the effectiveness of existing tools, such as product information or taxes?
- How can behavioural tools best be combined with traditional demand-side tools such as boosting food skills, goal setting and offering more relevant and intuitively understandable information and updated dietary guidelines? Are there ideal suites or temporal patterns for successful interventions?
- When do nudges fail (Sunstein, 2017), when do consumers dodge nudges (Colby, Li and Chapman, 2020) and what can be done to prevent failure?

[a]For instance, behavioural research knows the 'white male effect' regarding risk assessment and openness to change; as regards meat consumption, men seem to be harder to reach and convince.
[b]One of the few exceptions: Kasdan and Lee (2020).

socio-cognitive models for sustainable consumption behaviour (e.g. Phipps *et al.*, 2013), the key variables influencing people's motivation, ability and potential to change towards more sustainable behaviours include cultural and social norms, socio-economic status, education, gender and age, individual character traits, family and peers, as well as political orientation. The key question is how people's biases and heuristics, 'desire lanes' (i.e. informal paths), and habits can be harnessed or overcome by behavioural stimuli to adapt, shift and improve diets towards greater sustainability. Exemplary research questions for the individual level are presented in Box 1.

Besides individual factors, the wider and immediate *food environment* mediates people's food acquisition and consumption within the larger food system. It encompasses such diverse variables as availability, accessibility, affordability, the desirability of sustainably produced, nutrient-rich food, as well as vendor and product characteristics, promotion information, the choice architecture of stores and more (GLOPAN, 2020). Multilevel and ecological models of sustainable consumption (e.g. Milfont and Markowitz, 2016)

Box 2. Research questions: environmental level.

- Can food product innovations such as meat (and milk) substitutes and alternatives, and hybrid and extended shelf-life products, be a solution, and how can demand be stimulated?
- Can we successfully utilise information nudges (such as digitally enhanced best-before data labels on packaged food), reminders (such as in-app messages; Valle, Nezami and Tate, 2020), and digitally enhanced food-sharing platforms (such as 'Too Good To Go'), and how should they be designed to enhance adoption by consumers? How can in-store choice-architecture promotions and analytics-based tools predict purchases and optimise food planning?
- Beyond the food system, dietary choices are closely interlinked with other lifestyle aspects (transport, mobility, housing, work, informal work, and healthy lifestyles) and the respective availability, affordability, and accessibility of options. Can we better understand non-area influences and non-area effects?
- Can technological solutions such as social data science and digital nudging help design targeted, effective change strategies? How can this be done in an ethically acceptable way? Can algorithmic systems be used to de-bias (i.e. objectivise) decision-making and attitude development, e.g. towards novel foods?

focus on the influence that the different environments have on (food) choice, i.e. the national, regional and household framework of rules, norms, expectations and values, as well as infrastructure. Food marketing plays a vital role here since it curates the interface between supply and demand regarding products, prices and preferences. A key question is how these (real and virtual) interfaces can best be designed (choice architecture) to make the healthy and planetary sustainable choice the easy and most rewarding choice and to provide the most fun, attractive and timely (FEAST) affordances.[8] Exemplary research questions are mentioned in Box 2.

While we have a solid knowledge about some of the influential individual and environmental factors and pathways regarding policies for food-demand transformation (Creutzig *et al.*, 2021), critiques have noted the need to raise evidence levels of BE-informed policies to enable solid policy advice (e.g. Ijzerman *et al.*, 2020). Also, behavioural research should be extended beyond consumers and prosumers, to include decision-makers in large households, organisations, public procurement entities, retail and other actors who are in a position to transform the food system. Here, however, we are mostly at the beginning.

8 For instance, the EU Group of Chief Scientific Advisors (EU, European Union, 2020) recommends in its 'Scientific Opinion Towards a Sustainable Food System' (No. 8, March 2020) as one of three key actions: 'Address power and information asymmetries *and make the easiest choice for citizens sustainable*' (emphasis added). The Scientific Opinion informs the Farm to Fork Strategy of the European Green Deal Call that identified four target impacts, among them: 'reduction of food loss and waste' and 'shifting to sustainable and healthy diets'. See also SAPEA (SAPEA, Science Advice for Policy by European Academies, 2020).

Box 3. Research questions: process level

- Who are the main (powerful) actors within food policy, creating the institutional and regulatory framework of food governance in a society, in a region, in a city? Are these actors aware of BIs and the 'rational irrationality' of people?
- How can schemes of 'levels of evidence' help policymakers evaluate existing evidence (Ijzerman et al., 2020)?
- How can policymakers spark and maintain consumer-citizens' broader engagement as end-users of products, services and infrastructure in the design, testing and reinvention of innovations?[a] Can we develop and test best-practice approaches for human-centred design, recognising people's civic agency and expertise in their own lives?
- Which role can human-centred design, systems thinking and moderated dialogues and citizen juries play in the co-creation processes, e.g. for innovative prototype solutions?
- How can field experiments play a more significant role in public policy (see, e.g. Al-Ubaydli et al., 2021; McConnell, 2021)?
- How can we harness living labs for this transition, involving different stakeholders (citizens, administrators, policymakers, retail, restaurants, food industry, start-ups and civic actors)?
- Can nudges reduce disparities and social inequalities by participative design (Mrkva et al., 2021)?
- How can we harness the potential of sustainable food businesses, i.e. small-scale enterprises working to deliver environmental sustainability, health and local economic development? Which type of supporting policies do they need to thrive? How can we harness the potential of emerging industry initiatives?
- What are recent promising food policy innovations in different countries (Walton and Hawkes, 2020), and what can we learn from them? How far are they transferable?

[a]For instance, see the results from an Australian deliberative forum (a 'Citizens Jury') on obesity hosted by an Australian Behavioural Insights Team, which produced rather radical proposals, including nudging governments and legislators themselves (Halpern, 2015).

4.4. Process knowledge

Process knowledge is about organising behaviourally informed food policymaking on different political levels, organising successful co-creation processes and implementing widely accepted policy programmes. This also includes skills in a case-specific design of pilots, testing in labs and then real-world settings, participative feedback loops and policy cycles to adapt and improve. BI-based solutions are rarely 'one size fits all' and usually have to be tested and adapted on a case-specific basis. Policies and instruments tend to be more accepted and more effective if co-created or tested with the targets themselves, in participatory approaches with stakeholders and practice partners (John, 2018). Questions deserving research attention are mentioned in Box 3.

5. Conclusion

With only 10 years left to meet the SDGs, policymakers, practitioners and researchers are exploring how food systems can be made more resilient and more serviceable to people's long-term well-being and that of the planet. This paper has argued that a behavioural approach to policy can help support and sustain system changes, an approach that is called behavioural food policy. Today, many cities, regions and governments worldwide make systematic use of BIs to transform food systems (Sunstein, 2016b; BIT, 2020). The results of their work strongly indicate that coupling considerations for context opportunities and limitations with a scientific understanding of people's behaviour and choices tends to enable the development of strategies, policies and measures that are more effective, accepted, suitable and fitted to the purpose than traditional model–based policies.

From a system perspective, big transformations tend to be triggered by one or more of four factors: a profound change of values in society (e.g. wasting edible food is not acceptable), a disruptive crisis (such as the COVID-19 pandemic) with visible tipping points, disruptive new technologies and innovations (e.g. digitisation and biotechnology) and, sometimes, visions and big ideas promoted by charismatic and trustworthy leaders (with some examples from the climate movement). The current double crisis has a bit of all four factors. In fact, it might even have a positive element since it blows open windows for change to develop and test cooperatively new policy tools that could help feed the world while conserving the planet's resources and wildlife and securing fair access for all. The first concrete results of such transformative food systems changes might become visible at the UN Food Systems Summit mentioned in Section 1, where food activists, practitioners, policymakers and researchers from the global food system will debate and promote game-changing solutions for a more sustainable, just and health-supporting food system.

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