



The relevance of behavioural insights in a transition towards a healthy and sustainable food system

Closing the gap to create science-based insights with societal impact
Wageningen Living Lab on Behaviour Change

Marleen Onwezen, Katell Hamon, Carolien de Lauwere, Stijn Reinhard, Marlene Roefs, Gonne Beekman, Ruerd Ruben

The world is currently confronted with growing environmental problems, significant decreases in food security and spreading public health challenges. *Environmental problems* include climate change, loss of biodiversity and water pollution (Auestad & Fulgoni, 2015; Brinzan, Tigan, & Radu, 2012; Garnett, 2013; Reisch et al., 2013; Tukker & Jansen, 2006). *Global hunger* had increased in 2016 after a prolonged decline (FAO, 2018). Despite progress in global public health outcomes, the 'Triple Burden of Malnutrition' (i.e., under-nutrition (stunting & wasting), micronutrient deficiencies (iron, zinc, iodine and vitamin A) and over-nutrition (overweight & obesity) still poses mayor *public health problems*, such as obesity and diabetes (e.g., Ebbeling et al., 2002; Global nutrition report 2017). In this whitepaper we aim to explain the relevance of human decision making within the real-life complexity of the total food system. In addition, we will identify the most relevant research gaps which need to be addressed to develop science-based insights with societal impact.

*Food production
responsible for 20 to
30% of environmental
impact*

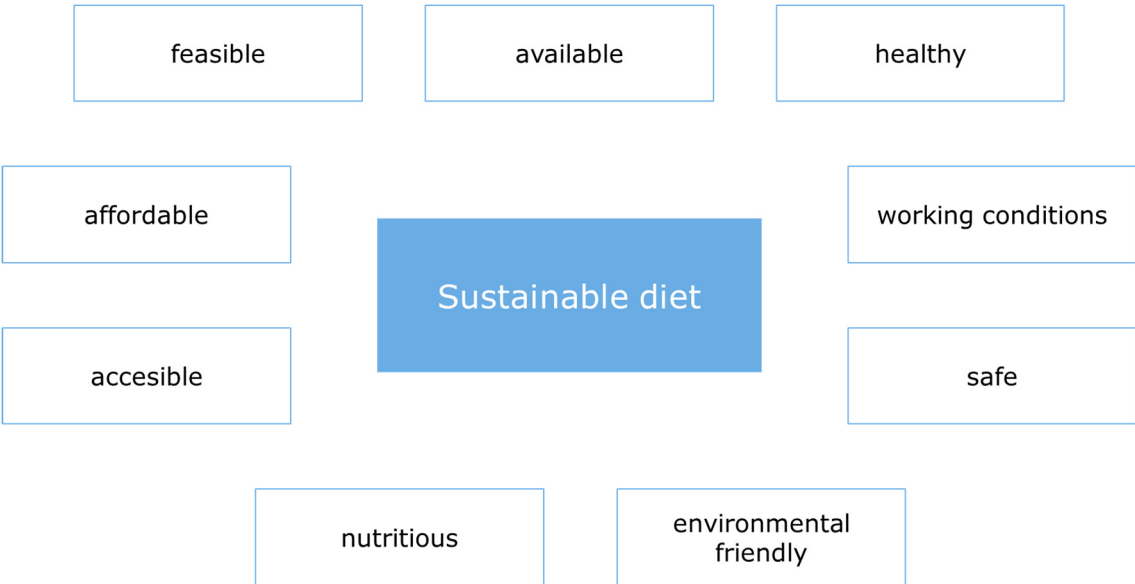
Behavioural change is needed

The problems are strongly related to stakeholders that affect the food system, like producers and consumers. *Producers* need to find answers to increasing pressure on land and sea use, to increasing emissions of greenhouse gasses, ammonia and minerals in relation to national and international climate goals and water quality, and to animal welfare and health issues. Although *consumers* may not be aware, their daily food choices have a huge impact on the environment and their health. It has for example been estimated that between 20% and 30% of the total environmental impact caused by humans is related to food production (Tukker & Jansen, 2006). Consumers' food preferences are important, and there are large differences in environmental (e.g. choosing proteins from meat versus vegetable sources (e.g., Visschers & Siegrist, 2015) and health impact across meals. Hence, by changing the diet consumers can improve their environmental impact and their health.

A recent report of the EAT Lancet commission for example states that drastic changes in diets are necessary to come towards a healthy and sustainable diet. Especially the interactions between health and sustainability are challenging at the moment (EAT-Lancet commission, 2018). Thus there is a responsibility for both producers and consumers. To achieve a healthy and sustainable food system, behavioural changes by producers and consumers are needed. Although there are many other stakeholders, like retailers or transport, we will focus on producers and consumers because behavioural choices are highly relevant for these actors.

Sustainable diets are healthy for people and planet

All of these environmental, food security and public health challenges are related to human decisions and behaviour patterns related to production and consumption of food (Egger, 2008; McCartney, Hanlon, & Romanes, 2008). Consumers’ health and environmental health would benefit from a sustainable diet. Although sustainable food is defined in various ways in the literature, the challenges related to environment, food security and health are part of broadly defined ‘sustainable diets’, involving many stakeholders in the food system, such as consumers, producers, chain actors and policy makers. Sustainable diets are safe, healthy, and nutritious for consumers at various purchase locations (supermarket, shops, restaurants). They are feasible, available, affordable, and accessible; and also respect conditions of employees and the environmental limits in production (Eberle et al. 2006; Reisch et al., 2013; UK Sustainable Development Commission, 2005; 2009).



A food system approach towards understanding human behaviour

Although the relevance of healthy and sustainable food production and consumption is widely acknowledged, not all actors of the food system engage in healthy and sustainable behaviour (e.g., Vermeir & Verbeke, 2005). Current research and policies often focus on technological solutions and on one actor in the chain. It is often reasoned that environmental problems and health-related problems can be solved by developing novel production processes or products that are more environmentally friendly or healthy. However, in the end these innovations should be accepted by producers, value chain actors and consumers. Although some innovations are very much needed and only provide benefits, they still require society-broad acceptance (or social licence to operate, van Putten et al. 2018). We therefore state that, in finding solutions with impact, it is highly relevant to focus on (1) understanding human behaviour and (2) multidisciplinary food system approaches, which incorporates food production, consumption and the chain actors in between in one framework.

Research and policy focus on technological solutions

1. Understanding human behaviour and drivers for behaviour change is of key importance

To understand the root causes of the challenges mentioned above and to address them, it is highly relevant to understand human behaviour. Sustainable transition processes in food systems go beyond regulation, innovative technologies and introducing novel products. Transitions only happen when for instance simultaneously farmers embrace good agricultural practices (GAPs), when retailers offer nutritious products that are produced sustainably, and when consumers choose healthy diets. Transition processes hence involve behavioural change of all actors involved. Understanding and finding ways to stimulate human behaviour in a way that supports a more healthy and sustainable food system is therefore highly relevant. This includes legislation and education, though it also involves nudging and psychological interventions.

Transitions only happen when actors want it

2. Including the whole food system is of key importance

Behavioural change and the maintenance of long-term changes (e.g., new habits) not only depends on individual factors such as knowledge, motivation and skills, but also on *system* factors, including the physical and social environments of the individual (National Center for Biotechnology Information, 1991, van Berkum et al., 2018; Ruben et al., 2019). Several actors form part of the whole food system. Producers, value chain actors, and consumers, as well as governmental actors all have to decide towards more healthy and sustainable choices to enact a more healthy and sustainable food system (see Figure 1). Therefore, these challenges should be addressed using a multidisciplinary food systems approach, taking into account the complex interrelations between the various human actors involved and the environments they are part of.

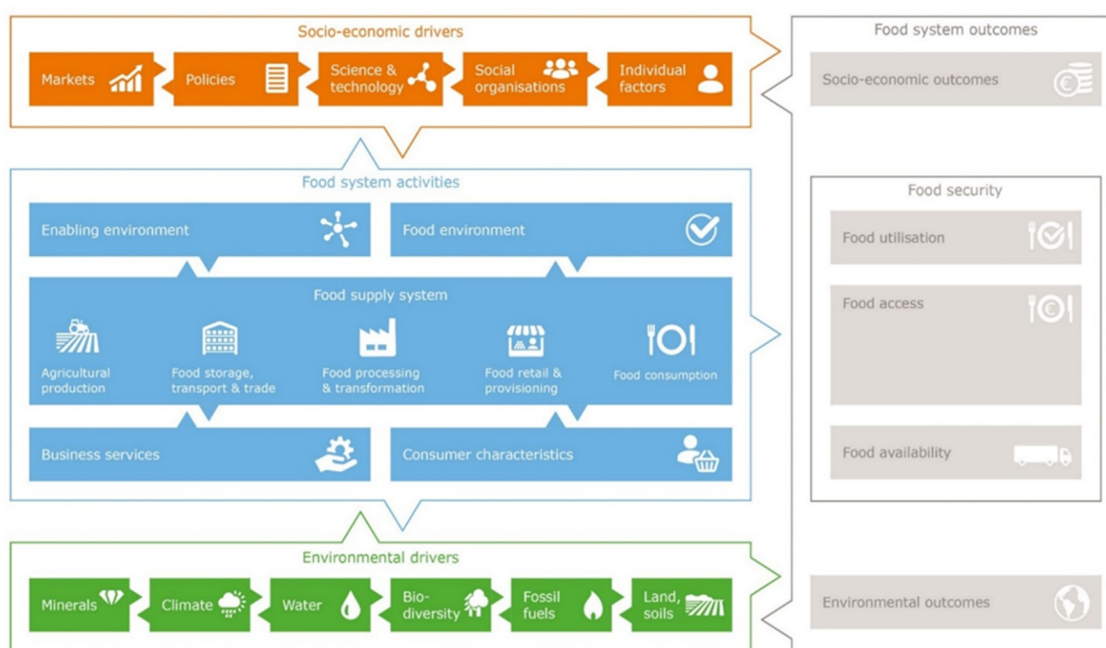


Figure 1 The Food System Approach: a way of mapping the relationships of the food system to its drivers
Source: Van Berkum et al. (2018).

Integrating understanding of human behaviour and multidisciplinary food system approaches

We thus argue for a combination of understanding human behaviour and the multidisciplinary food system approaches. Although consumers are currently included in food system approaches, the complexity of these methods and the variety of stakeholders involved mean that consumers are often included in basic manners. It is highly relevant to integrate human decision making in more sophisticated manners to further understand how the whole food system works.

Individual behaviour: relevant drivers for behaviour change

Individuals do not only base decision making on conscious deliberations. After all, if that were the case there would for example be no gap between healthy intentions and behaviour. In reality part of behaviour is irrational: we often base our decisions on affective and subconscious processes. Although individuals might believe they base their decisions on their own motivations, research shows behaviour is largely explained by social norms and habits. Thus individual behaviour is complex, and influenced by a large range of internal as well as external factors. Although behaviour might not always be that rational and consciously deliberated, the observed deviation from economically optimal behaviour shows a pattern and is predictable. Onwezen and colleagues (2016) developed a model to provide an overview of factors relevant in understanding consumer behaviour in the context of healthy and sustainable food choices (Figure 2). Although this model was developed in the context of consumer choices, the model might also be useful for understanding decision making of producers (e.g., Dessart et al., 2019). Although the context is highly different for consumers and producers, and other processes might play a role both consumers and farmers are individuals in which similar psychological mechanisms might operate. Subsequently the behavioural model might to some extent be applicable to individual decision making of producers. Similar factors (with different relevance and content) might play a role for other stakeholders. For example, cognitions may be more relevant for consumers' consumption whereas skills might be more relevant for producers' choices. Another example refers to long-term versus short-term considerations which might involve different themes but similar mechanisms. Consumers might consider long-term environmental and health benefits with short-term price and convenience motives, whereas producers might consider long-term environmental benefits with short-term income.



Figure 2 illustrates a conceptual model that categorises all factors that influence behaviour. The highest level involves policy and system. These factors involve governmental laws, societal and cultural values, and the industry which sets a norm. The second level involves the physical environment of the individual. These factors include availability, labelling and marketing, which are all factors that influence the physical presence of food. The third level involves the social environment, which involves norms and influences of for example family, friends and peers. The last level includes personal characteristics like lifestyle, physiology, habits, emotions, demographic factors, motives and norms and values.

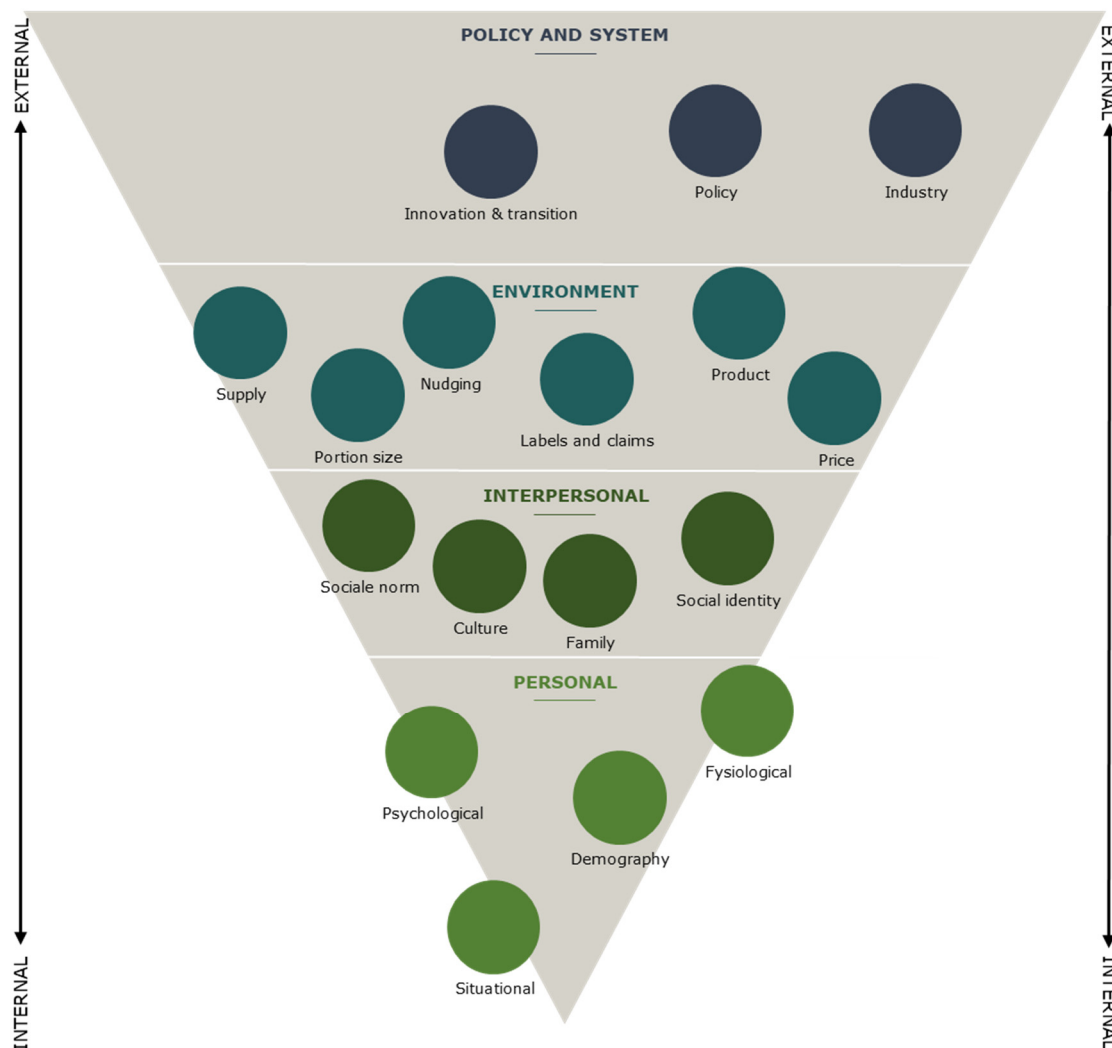


Figure 2 Behavioural model according to Onwezen et al. (2016)

Source: https://www.wur.nl/nl/Onderzoek-Resultaten/Onderzoeksinstituten/Economic-Research/Themas/Consument-Voeding/infographic_duurzaam_consumenten.htm#popup--innovatietransitie.

Understanding individual behaviour leads to better interventions

The model in Figure 2 provides an overview of relevant factors that can be used to steer behaviour in desired directions using for example nudges, interventions, information or policy. Figure 3 exemplifies how different factors can be bundled within interventions. In the text block we sum up some examples of interventions that steered behaviour into a desired direction. Thus

understanding individual behaviour can be used to develop interventions that result in a transition towards more healthy and sustainable choices.

Note that consumer behaviour has been studied much more than that of any other actor in the food chain.¹ The publication rate for consumer behaviour research is more than three times higher than that for research on farmers. The body of research on the midstream segment (food processors, traders, retailers, etc) is even lower. However, as behavioural change of farmers and other actors is also related to individual behaviour, we can use the results of the consumer behaviour research and apply it to the other actors in the food system.

¹ A search on Scopus with the topics "behaviour OR behavior" AND "consumer" results in more than 65,000 publications; the same search substituting "consumer" for "producer OR farmer OR fisher" displays only 19,00 publications. To ascertain that we use the correct terms we also did a search with choice OR adoption AND "producer OR farmer OR fisher" which also resulted in only 18,000 publications (14/06/2019).

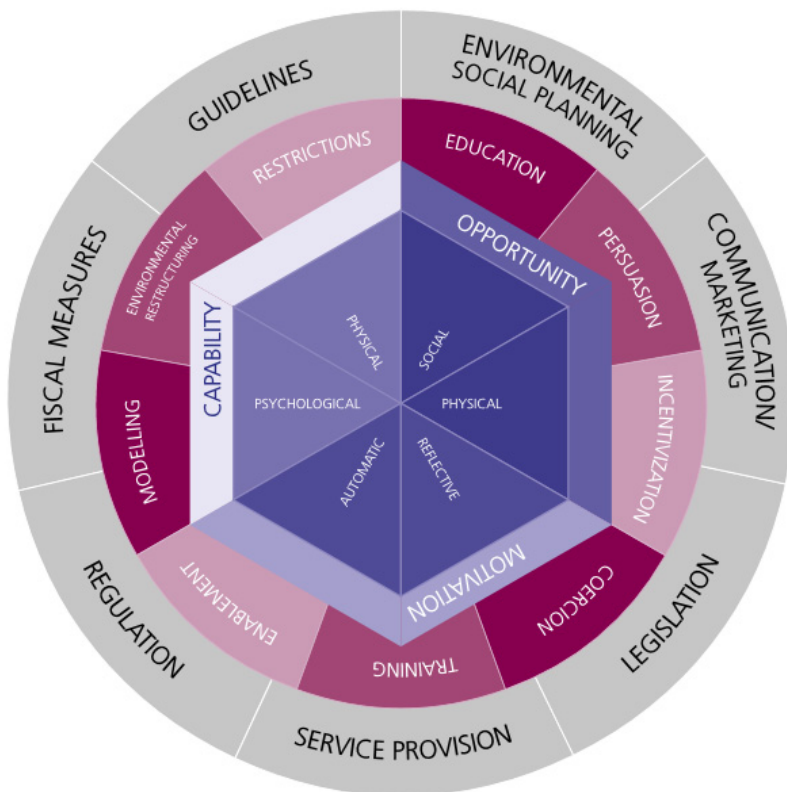


Figure 3 Behaviour change Wheel
Source: Michie et al. (2011).

Examples of interventions that increased healthy or sustainable consumption

- Increasing vegetable portions in combination with decreasing meat portions (unknowingly to the consumer) increased the amount of vegetables consumed and decreased the amount of meat consumed. Furthermore, despite the changes in portion sizes, participants remained satisfied with their restaurant visit and main dish. The findings of this study suggest that modifying portion size in restaurants is an effective tool for stimulating vegetable consumption and consequently healthy and sustainable diets (Reinders et al., 2017).
- Consumers may believe the environment or their own health is important, though when making food choices other factors like price and taste also become relevant (long-term versus short-term objectives). Although consumers might think the social environment is not that relevant, studies reveal that the social environment is highly relevant for decision making. Emotions can be used to help consumers to follow their own personal norms, and the norms of their environment (social norms) (Onwezen et al., 2013; 2014).
- In conditions that suggest that others have consumed certain types of food (healthy or unhealthy), people seem to follow those cues. There is evidence that choices are affected by such cues. People are more likely to choose a 'healthy' versus 'unhealthy' food item if they see evidence that previous participants have chosen 'healthy'. Similarly we see that peer social norms provide a potentially effective tool for the promotion of healthy eating. Interventions aimed at promoting healthier peer norms related to eating can, therefore, be part of a process in which changing norms slowly but steadily contribute to healthier eating among young people. (based on Prinsen, de Ridder, & de Vet, 2013 and Marijn Stok: Eating by the Norm: The Influence of Social Norms on Young People's Eating Behavior, PhD thesis 2014).
- Consumers think social norms do not influence their behaviour though analyses reveal that both injunctive (what we believe others think of our behaviour, what we ought to do) and descriptive norms (what we believe others do) highly influence behaviour regarding organic, fair trade, snacks and fruit (Voedselbalans 2011).

Examples of interventions influencing decision making of farmers

- In agriculture, nudging is a fairly new concept. An experiment aimed at nudging farmers to use fertiliser showed that farmers in Western Kenya failed to take advantage of apparently profitable fertiliser investments, but they did invest in response to small, time-limited discounts on the cost of acquiring fertiliser (free delivery) just after harvest. In addition, later discounts appeared to have a smaller impact, and when given a choice of price schedules, many farmers choose schedules that induce advance purchase (Duflo et al., 2009).
- A combination of financial incentives and nudging increased the conservation effort of farmers by more than 25%, as compared to financial incentives or nudging alone. In this study, emphasis was on empathy nudging: upstream farmers who had to choose a level of conservation on their 500 acres of land were asked to look at their conservation decisions from the point of view of the downstream water user (Czap et al., 2013).
- Farmers' risk aversion has been analysed extensively; the gain-loss disparity is a behavioural economic element of decision-making behaviour under risk. For instance, Huijps et al. (2010) provided empirical evidence that dairy farmers are more sensitive to penalties than to bonuses when urged to adopt new milking practices to improve cattle health. Hansson and Lagerkvist (2014) applied the Prospect Theory to understand the decision making of dairy farmers concerning mastitis control. Based on the behaviour of 163 and 175 Swedish dairy farmers, they distinguished a reactive and a pro-active option for mastitis control. Dairy farmers who adopted the reactive mastitis control option took measures to prevent a further spread of mastitis among their herd, and dairy farmers who adopted the pro-active mastitis control option took measures to prevent an outbreak of mastitis on their farms. Fitting the Prospect Theory, dairy farmers who chose the pro-active control option appeared to be more risk averse, and dairy farmers who chose the reactive option appeared to be more loss averse.

Food system approach

In the current environmental, economic and demographic situation, sustainable food production and consumption remains a global challenge. Innovations (e.g., novel production methods, novel products) and interventions or policy positively impacting the whole food system are not only highly relevant but also highly necessary to address these challenges.

Behaviour of all actors is interlinked

A wide range of individuals in different roles together form the whole food system (see Figure 1). Consumers, producers, and other actors in the value chain such as food processing industry and retailers, are all individuals that make decisions regarding food. The different roles and environmental incentives differ between individuals though individual psychological mechanisms are similar across all humans.

All actors influence each other

Moreover, all actors in the chain influence each other, since decisions are not made in isolation and the social and physical environment also play a role in human behaviour. Individuals are for example influenced by what others do and think of them

(descriptive and injunctive norms) and by the availability and signals of the environment. It is therefore highly relevant to find ways to include multiple actors from the whole food system.

Multistakeholder research methods in development stage

This need to include multiple stakeholders from the food system is identified by different disciplines. Historically technological solutions were developed and at a late stage tested in real life settings, if this step was at all included. However, at this moment a transition is taking place. Many novel research methods are developed that include multiple stakeholders to develop innovations for the food system, such as co-creation, reversed design and living labs. There is a

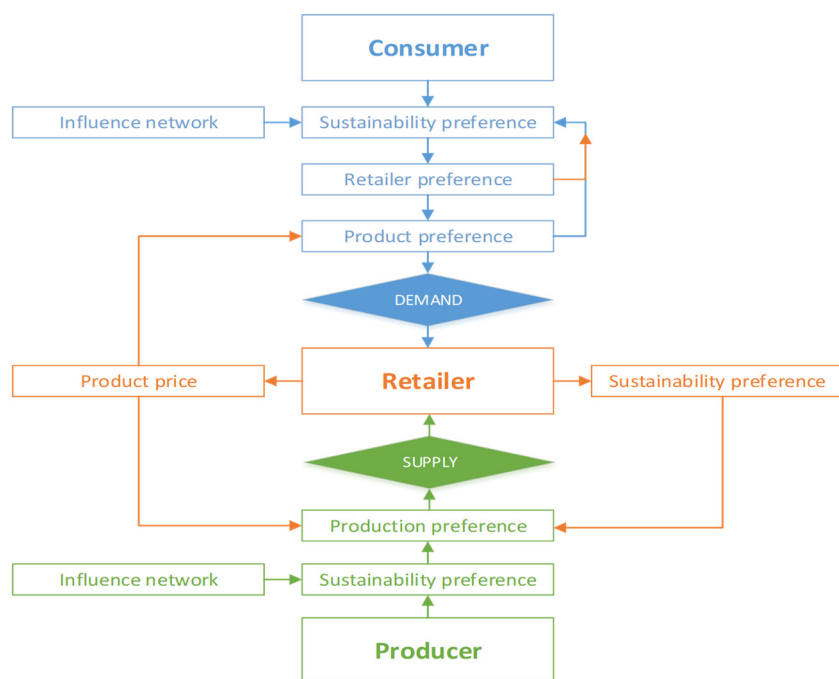
widely accepted need to include multiple stakeholders earlier in the development process, though the novel methods are not vested yet and they provide the opportunity to include multiple stakeholders earlier in the development process. An example is the Agent Based Model for the food chain of Wageningen Economic Research (Text box 3).

Thus, we state the relevance of finding ways to include multiple actors and behavioural insights into one approach. Transitions are largely based on human decision making and these decisions are not made in a vacuum but in a whole food system.

Agent Based Model for the food chain

The Agent Based Model (ABM) includes multiple actors from the food chain: consumers, retailers and producers. It illustrates how the whole food system and the different actors within the system are related and influenced by each other. The model represents a simplified version of reality illustrating an example of how different actors and behavioural insights can be included in one single approach.

The model allows the user to vary different aspects which in theory can be influenced by policy and interventions, like the social network, sustainability preferences, and prices. The ABM in turn shows how these interventions affect the whole system. For example adapting the influence of social networks on consumers might result in higher demand and higher prices for producers which increases production rates.



Knowledge gaps

Obviously many knowledge gaps remain. Below we describe the relevant science-based insights on behaviour in the food system with societal impact. This list is by no means exhaustive, though it provides a good overview of the relevant steps that should be undertaken to reach scientific insights with impact.

A need for an overarching conceptual model including the whole food system

Although many different studies indicate conceptual or theoretical models to explain behaviour, a comprehensive model in which all knowledge is bundled and researchers build upon each other, is lacking. At this moment science has developed a reasonably good overview of relevant factors when it comes to sustainable and healthy production and consumption, but we do not know what

the influence of all these factors is relative to each other and whether this influence differs per foodstuff, per context or per person. In addition, we do not know how different actors across the food system (e.g. farmers and food processors and retailers) interrelate to each other.

Behavioural interventions in the food system

A reason for disappointing results of implementation of new production practices, is that it is often assumed that supply chain actors are rational self-interested economic agents (Della Vigna, 2009; Chater et al., 2010). However, for the design of behavioural interventions, psychological and sociological elements should also be taken into account, for example considering intrinsic motivations, moral convictions, social preferences, reciprocity and impact of peer groups (Edward-Jones, 2006; Herzfeld & Jongeneel, 2012, Garforth et al., 2014). Understanding the intrinsic drivers of behaviour (attitudes, beliefs, motives), the role of the social environment (social norms, co-operative behaviour, the existence of social dilemmas) and the role of external circumstances (knowledge, education, farm characteristics, type of food system) is needed for the design of tailor-made interventions that can support or stimulate producers to make more sustainable choices which enable various actors in the food system to act in a sustainable but cost-effective way (Panter-Brick et al., 2006; Ellis-Iversen et al., 2010; Sok et al., 2016).



The decision-making environment varies globally

Most of the research on the food environment has been conducted in high-income countries. However, the specific position that consumers and producers have and the challenges they face, are strongly related to the food system they are part of. For example, in developing economies, the distinction between producers and consumers is often not clear-cut. And especially in the developed world, producers are under strict regulations, not allowing them much space to innovate. Implementation of innovations often results in disappointing uptake and disadoption, and limited upscaling. Therefore, tailor-made interventions are needed which fit within the decision-making environment of the actor.

Real-life integrated interventions

Based on knowledge on drivers of behaviour it is possible to develop interventions to stimulate behaviour in the desired direction towards more healthy and sustainable practices. In order to stimulate behaviour change, interventions need to be developed that motivate the desired

behaviour, educate, or teach skills, or make it easier to perform the specific behaviour. Historically interventions are often tested in controlled settings, which has the advantage that effects of the interventions are precisely explored. In real life the environment is not controlled, and to explore the effectiveness of interventions it is therefore needed to explore this in real life. Moreover, interventions should reach individuals tailored to their special needs and their environment (e.g., households and peers (network), schools, work sites or for point-of-purchase and the broader community; National Centre for Biotechnology Information, 1991), or to cite Wilson and Dowlatabadi (2007):

‘When applying behavioural theories to the design or evaluation of an intervention, an appropriate decision model must be selected to match the particular decision characteristics and context that the interventions seeks to influence.’

It is also highly relevant to include the context of individuals when broadening interventions towards behavioural change. Integrated interventions - interventions that include various aspects, including factors such as for instance the social desirability of various foods, influencers, and obviously the availability of food choices in a community, work place, school, camp, or household - are providing promising results.

The key to the transition to a more healthy and sustainable society lies in behaviour

Three main messages:

- Use a food system approach, by including all actors and their interaction to find sustainable and healthy solutions.
- As the food system is represented by humans it is highly relevant to include behavioural economics to understand human behaviour and find ways to influence it.
- Knowledge and interventions should be developed and tested in real-life to understand interaction between the person and the physical and social environment.

*Find easy to
implement, practical
and feasible solutions*

To conclude, in general current diets are unhealthy and the sustainability of production systems needs further improvement. This asks for a transition towards more sustainable production systems and consumption leading towards more healthy and sustainable food systems. As the whole food system is represented by humans who make decisions, it is

highly relevant to use behavioural insights to stimulate a transition towards a more sustainable and healthy society. Besides understanding human behaviour and finding ways to influence it, we also believe it is highly relevant to find practical and feasible solutions that can be easily implemented in practice. These solutions might for example involve behavioural interventions or novel products that are accepted by society. We state therefore when studying food systems as many actors and decision mechanisms as possible should be included. Decision making of all actors in the food system does not happen in a vacuum, but in an interaction between the person, and his or her physical and social environment. It is therefore highly relevant to include various aspects of the food system in finding solutions towards a transition to a more healthy and sustainable society.

More information

Marleen Onwezen, sr. researcher and strategic senior scientist consumer behaviour
T +31 (0)70 335 8175
E marleen.onwezen@wur.nl
www.wur.eu/economic-research

2019-087

References

- Auestad, N., & Fulgoni III, V. L. (2015). What current literature tells us about sustainable diets: emerging research linking dietary patterns, environmental sustainability, and economics. *Advances in Nutrition*, 6(1), 19-36.
- Brick, K., & Visser, M. (2015). Risk preferences, technology adoption and insurance uptake: A framed experiment. *Journal of Economic Behavior & Organization*, 118, 383-396.
- Brinzan, O., Tigan, E., & Radu, D. (2012). Food consumption and sustainability. *Journal of Environmental Protection and Ecology*, 13(1), 253-257.
- Chater, N., Huck, S., Inderst, R., 2010. Consumer decision-making in retail investment services: a behavioural economics perspective. Final Report for the EC, Brussels, 84 pp.
- Czap, N., H.J. Czap, G.D. Lynne, M.E. Burbach, 2013. Empathy nudging as a new component of conservation programs. *Cornhusker Economics*. Paper 654. Nebraska-Lincoln.
- Dessart, F. J., Barreiro-Hurlé, J., & van Bavel, R. (2019). Behavioural factors affecting the adoption of sustainable farming practices: a policy-oriented review. *European Review of Agricultural Economics*, 46(3), 417-471.
- Duflo, E., M. Kremer, J. Robinson, 2009. Nudging farmers to use fertilizer: theory and experimental evidence from Kenya. Working Paper 15131 of the National Bureau of Economic Research, Cambridge. ...
- EAT-Lancet commission (2018): <https://eatforum.org/eat-lancet-commission/eat-lancet-commission-summary-report/>
- Ebbeling, C.B., Pawlak, D. B., & Ludwig, D. S. (2002). Childhood obesity: public-health crisis, common sense cure. *The Lancet*, 360(9331), 473-482.
- Edwards-Jones, G., 2006. Modelling farmer decision making: concepts, progress and challenges. *Animal Science* 82, 783-790.
- Ellis-Iversen, J., Cook, A.J.C., Watson, E., Nielen, M., Larkin, L., Wooldridge, M., Hogeveen, H., 2010. Perceptions, circumstances and motivators that influence implementation of zoonotic control programs on cattle farms. *Preventive Veterinary Medicine* 93, 276-285.
- FAO (2018), the state of food security and nutrition in the world, <http://www.fao.org/3/I9553EN/I9553en.pdf>
- Garnett, T. (2013). Food sustainability: problems, perspectives and solutions. *Proceedings of the Nutrition Society*, 72(1), 29-39.
- Garforth, C., 2014. Livestock keepers' reasons for doing and not doing things which governments, vets and scientist would like them to do. *Zoonoses and public health* 62 (suppl. 1), 29-38.
- Hansson, H., C.J. Lagerkvist, 2014. Decision making for animal health and welfare: integrating risk-benefit analysis with prospect theory. *Risk Analysis* 34 (6), 1149-1159.
- Herzfeld, T., Jongeneel, R.A., 2012. Why do farmers behave as they do? Understanding compliance with rural, agricultural, and food attribute standards. *Land Use Policy* 29 (1). 250-260.
- Huijps, K., Hogeveen, H., Antonides, G., Valeeva, N. I., Lam, T. J., & Oude Lansink, A. G. (2010). Sub-optimal economic behaviour with respect to mastitis management. *European Review of Agricultural Economics*, 37(4), 553-568.
- Onwezen, M. C., Antonides, G., & Bartels, J. (2013). The Norm Activation Model: An exploration of the functions of anticipated pride and guilt in environmental behaviour. *Journal of Economic Psychology*, 39, 141-153.
- Onwezen, M.C., Bartels, J., & Antonides, G., (2014). The self-regulatory function of anticipated pride and guilt in sustainable and healthy consumption. *European Journal of Social Psychology*, 44, 53-68.
- Panther-Brick, C., Clarke, S.E., Lomas, H., Pinder, M., Lindsay, S.W., 2006. Culturally compelling strategies for behaviour change: a social ecology model and case study in malaria prevention. *Soc. Sci. Med.* 62, 2810-2825.
- Pollitt, M.G., Shaorshadze, I., 2013. The role of behavioural economics in energy and climate policy. In: R. Fouquet (Ed.), *Handbook on energy and climate change*. Edward Elgar, Cheltenham, UK, Northampton, MA, USA. pp. 523-546.
- Reisch, L., Eberle, U., & Lorek, S. (2013). Sustainable food consumption: an overview of contemporary issues and policies. *Sustainability: Science, Practice and Policy*, 9(2), 7-25.
- Reinders, M. J., Huitink, M., Dijkstra, S. C., Maaskant, A. J., & Heijnen, J. (2017). Menu-engineering in restaurants- adapting portion sizes on plates to enhance vegetable consumption: a real-life experiment. *International Journal of Behavioral Nutrition and Physical Activity*, 14(1), 41.
- Ruben, R., Verhagen, J., & Plaisier, C. (2019). The Challenge of Food Systems Research: What Difference Does It Make?. *Sustainability*, 11(1), 171.
- Sok, J., Hogeveen H., Elbers, A.R.W., Oude Lansink, A.G.J.M., 2016a. Using farmers' attitude and social pressures to design voluntary Bluetongue vaccination strategies. *Preventive Veterinary Medicine* 133, 114-119.
- Tukker, A., & Jansen, B. (2006). Environmental impacts of products: A detailed review of studies. *Journal of Industrial Ecology*, 10(3), 159-182.
- van Putten, Ingrid E., Christopher Cvitanovic, Elizabeth Fulton, Justine Lacey, and Rachel Kelly. 2018. 'The Emergence of Social Licence Necessitates Reforms in Environmental Regulation.' *Ecology and Society* 23(3).
- Wilson, C., H. Dowlatabadi, 2007. Models of Decision Making and Residential Energy Use. *Annual Review of Environment and Resources* 32, 169-203.
-