Wageningen Economic Research | White paper

Exploring the potential of (human) nature to improve the quality of life

A case for more attention to be paid to the role of behaviour change in food system transitions

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Wageningen Living Lab on Behaviour Change

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Preface

Our food system is a complex interplay between people and their environment. Understanding drivers of behaviour is key to being able to identify the best instruments to support behaviour change for system transformation. People's actions are driven by emotions, cognitions and, to a large extent, by their context too. In order to better respond to this complexity, in this booklet, the Wageningen Living Lab on behaviour change presents a practical approach for implementing a stronger focus on behaviour change in our University & Research (WUR) domains. It provides some illustrative examples for WUR research related to behaviour change, proposes research themes for future research and calls for more collaboration within and beyond WUR.

We call upon colleagues, partners, students, alumni and citizens to explore the potential of human nature with us. We hope this booklet helps to define and provide understanding of the behaviour challenges facing us, and that it helps us to discuss and navigate trade-offs and work toward evidence-based and socially inclusive answers that drive transitions.

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1 INTRODUCTION: Collaborate to understand behaviour change in food system transformations

Worldwide inequalities in access to safe, nutritious and sufficient food are substantial. In the summer of 2021, the sixth IPCC report reminded the world of the urgency of acting upon the global climate crisis. This came while we were still in the middle of the COVID-19 pandemic. In many countries, economic inequality is growing, which is increasing unequal access to healthy food, leading to inequity in health outcomes. Despite global efforts to reduce these inequalities, "the world has not been generally progressing either towards ensuring access to safe, nutritious and sufficient food for all people all year round or to eradicating all forms of malnutrition" (FAO 2021).[1]

To move to more sustainable and inclusive food systems, all food system actors need to collaborate in sustainable behaviours. The IPCC report stresses that "Humans are at the centre of global climate change: their actions cause anthropogenic climate change, and social change is key to effectively responding to climate change".[2] Hence, sustainable behaviour is necessary in efforts made throughout the food system. The transition to a more sustainable food system is a complex process that demands radical changes to social and technological systems (Termeer, 2019). Talking about behaviour in such a huge transformational change seems trivial. However, changing to more environmentally and socially sustainable food systems remains the work of people. It requires producers to shift to new modes of production, consumers to embrace shifts in lifestyle and diets, as well as behaviour shifts in food companies' board rooms and governmental offices: these 'food system agents' play a crucial role in shaping the food environments that producers and consumers are part of. Importantly: behaviour change is never an individual matter, but a collaborative effort made by all members of the food system, in continuous interaction with the enabling environment they are part of.

Understanding drivers of behaviour is key to being able to identify the right instruments to support changing behaviours. Experiences from the COVID-19 pandemic highlight how important it is to understand underlying drivers for behaviour that could explain gaps between actual and desired – or 'target' – behaviour.[3] Behavioural sciences are building on the understanding that behaviour is driven by a myriad of factors, which are usually much less rational than classical behavioural scientists – like economists – used to believe. For example, the pandemic illustrated how uncertainty can induce seemingly irrational behavioural responses, such as herd behaviour in supermarkets.[4] Only if we understand what drives behaviour can we work on instruments to motivate, capacitate and enable people to make different choices and to practice new behaviours. If we do not, interventions may fail to reach their intended effects and might even have unintended, adverse effects.

This booklet provides a snapshot of the research focussing on behaviour change to highlight the importance of behaviour change as a key element in food system transformations. We show some practical examples of WUR research related to behaviour change and provide suggestions for implementing this approach into our WUR domains. Chapter 2 examines ways to inquire about underlying motivations for behaviour (think of methods ranging from quantitative survey-methods to qualitative in-depth interviews). Chapter 3 explores methods that can be used to investigate behavioural outcomes and their trade-offs by modelling behavioural interactions and their implications on food systems level. Chapter 4 provides examples of how we can innovate food systems by encouraging people to embrace new modes of behaviour once the underlying drivers for their current behaviour are well understood. Finally, Chapter 5 proposes how to implement the understanding about the role of behaviour change in food system transitions by better implementing behavioural drivers in research that could support food systems transformation.

1 The State of Food Security and Nutrition in the World 2021 (fao.org)
2 Chapter 4 — Global Warming of 1.5 ºC (ipcc.ch)
3 Applying principles of behaviour change to reduce SARS-CoV-2 transmission | Nature Human Behaviour
4 Panic buying and herd behavior in the wake of the crisis: Understanding behavioral responses to COVID-19 | by Wageningen Living Lab | Medium

2 INQUIRE: Ask the right questions the right way

It is often hard to understand others' or even one's own behaviour. Until several decades ago, economists often assumed that actors were purely rational and acted on an economic basis. However, insights from psychology combined with research in more applied fields of social, economic and political sciences can provide new perspectives that can inform policy design on how individuals perceive, experience and evaluate their environment and what informs their decision-making process and changes in their behaviour.

Integrated behaviour change models in which intrinsic drivers of behaviour and external conditions are combined are needed to understand behaviour change. Three kinds of behaviour change models can be distinguished in the literature: 1) models that emphasise intrinsic drivers of behaviour, 2) models that emphasise the importance of the context in which individuals make choices, and 3) so-called 'integrated behaviour change models' or 'socio-ecological models'. In the latter, the starting point is that the intention to change behaviour not only depends on intrinsic drivers of behaviour – or underlying behaviour factors – but also on external conditions that influence the step from intention to action. Examples of intrinsic drivers include: attitudes toward a behaviour, sensitivity to social norms, perceived behavioural control, perceived capacity, self-efficacy, perceived risk and uncertainty, aversion to risk and ambiguity, and values, beliefs and norms (see for example Fishbein and Ajzen, 2010). Examples of contextual factors include: influences outside the sphere of influence of an individual, such as legislation, technological factors, cultural differences and available knowledge. However, individual factors, like education, age, income, religion and culture can also play a role (Wilson and Dowlatabadi, 2007). A frequently used integrated behaviour change model is the behaviour change wheel or COM-B model created by Michie et al. (2011). This model 'asks' whether people are willing to change (Motivation – intrinsic drivers), whether they are able to change (Capability – education and skills) and whether they have the opportunity to change (Opportunity

BOX 2.1: Understanding intrinsic drivers and external conditions affecting farmers' decision making for a successful transition to circular farming
In a study based on 13 in-depth interviews with farmers engaging in circular farming to various extents, Dagevos and De Lauwere (2021) looked for intrinsic drivers of behaviour and external conditions that influenced farmers' choices to contribute to circular farming. Farmers who really changed direction at their farms appeared to be more convinced that making profit whatever the (environmental) cost and axiomatic production growth whatever the inputs needed is no longer the right direction. They adopted practices like soil preservation, closing nutrient cycles, maintenance of biodiversity, renewable energy production or using residual flows from the food industry. Comparatively, other interviewed farmers went on with 'business as usual', albeit they invested in sometimes highly advanced technological solutions to contribute to circular farming, by decreasing greenhouse gasses for example. External conditions that were challenging, especially for the farmers who made changes were: non-fitting legislation, lack of knowledge and resistance from their environment (see also De Lauwere et al., 2022). This did not stop them. On the contrary, they felt challenged by these obstacles, and it made some of them even more eager to show others that their alternative could work. This showed their high intrinsic motivation. On the other hand, farmers applying technological solutions seemed to be more extrinsically motivated.

– external conditions). In Muranko et al.'s (2018) pro-circular change model, intrinsic drivers like attitude, social norms and perceived behavioural control are combined with social, economic and environmental values to understand the adoption of pro-circular behaviour by consumers.

We need to ask the right questions and apply the correct tools and theories to understand individual behaviour. In boxes 2.1 - 2.4, we present some examples of how behaviour can be understood by applying an integrated behaviour change model and asking the right questions in in-depth interviews to understand drivers for circular farming and sustainable fisheries (Box 2.1 and Box 2.2), using surveys to capture risk preferences in farm management (Box 2.3) or a combination thereof to capture horticulturists' motives, beliefs and perceptions(Box 2.4).

In-depth interviews give deeper insights into people's motivations. Dagevos and De Lauwere (2021, Box 2.1) performed in-depth interviews to find intrinsic drivers of behaviour and external conditions in a study with farmers who more or less contributed to circular farming. They found that external conditions were challenging, especially for farmers who wanted to change to more circular practises. However, this did not hold them back. On the contrary, they felt challenged by these obstacles, and this made some of them even more eager to show others that their alternatives could work. This showed their high intrinsic motivation, which moves people forward because they feel responsible, want to do something good or find something important. On the other hand, people who are extrinsically motivated move forward because they can earn more money, status or improve their image (Deci and Ryan, 2012) (Box 2.1).

BOX 2.2: Understanding behavioural drivers for better management of fisheries

Fisheries are notoriously difficult to manage. This is due to several factors, including the high uncertainty in the system, as we cannot observe the fish population directly, the current and future states of fish stocks are assessed using models. The fact that we do not fully understand what drives the behaviour of fishers while they are at sea is another issue. Asking the fishers helps us directly capture the non-economic drivers of behaviour and sheds light on how those influence the success of management measures.

In Dutch demersal fishery, three factors have been selected together with stakeholders as relevant for management. The working rhythm (weekdays on/ weekends off or alternating crews every week), the company structure (owner-operated or larger fishing company) and the polyvalence of the fisher (specialist or switcher) all lead to different behaviours under changing circumstances. Policy makers should understand and take advantage of these concepts while designing new management measures (Schadeberg et al., 2021).

Applying surveys are helpful, but context matters. A study by Naranjo et al. (2019, Box 2.3) explores the performance of survey-based methods for eliciting risk-taking in the field, approaching it as a relevant tool that practitioners and policymakers can easily implement in developing countries. Policymakers and researchers need to collect information about risk attitudes to draw correct conclusions, which raises the issue of how to best measure risk attitudes for practical purposes (Naranjo et al., 2019). By comparing context-free survey estimates and context-specific survey estimates, they test whether stated risk-taking is correlated with risk preferences obtained in an incentivised experiment. The results of

Box 2.3: Risk preferences vary across different contexts

Collaboration with Environmental Economics and Natural Resources Group (ENR) at Wageningen University

In an agricultural setting, there is no such thing as certainty. Every day, farmers have to make decisions involving risk, from the choice of crops, input use and harvest timing to the purchase of crop insurance and other strategies to cope with weather variation and price fluctuations. A good understanding of farmer's risk attitudes is needed in the context of development and agricultural programmes because the adoption or success of a given policy – which could include the uptake of new crops, change in technology or purchase of crop insurance – varies with the target population's risk preferences. Policymakers and researchers need to collect information about risk attitudes to draw correct conclusions, which raises the issue of how to best measure risk attitudes for practical purposes.

Although field experimental methods are the workhorse of researchers interested in risk preferences, practitioners find surveys easier to implement. We compare results from experimental methods and survey-based methods to elicit farmers' risk attitudes in context-free and context-specific decision settings. We then explore how the different survey estimates of risk preferences relate to real-life farming choices in a population of coffee farmers in Costa Rica. Our results indicate that one should be careful when extrapolating risk attitudes across contexts. Contextualised, survey-based estimates of risk preferences do not correlate with general context-free survey estimates, yet context-free survey estimates do predict risk-taking behaviour in a context-free risk experiment. Importantly, context-specific survey estimates are associated with risk-taking in the same agricultural real-life context, while context-free survey estimates are not. Practitioners interested primarily in using risk preferences as policy design inputs should ensure that preferences are elicited in the specific context targeted by the potential policy instrument.

various studies highlight the importance of context when asking questions about risk attitudes. As such, researchers and practitioners should be careful when extrapolating risk attitudes across contexts and estimate risk attitudes in the specific context in which they are interested (Naranjo et al., 2019) (Box 2.3).

A combination of qualitative and quantitative research methods can give better insights into people's motivations, beliefs and perceptions. In-depth interviews can be helpful to get a better understanding of survey results. De Lauwere et al. (2019) combined in-depth interviews among horticulturists with a survey and revealed that the horticulturists' low intention to change to and negative attitude toward fossil-free production methods were particularly caused by the perceived costs and benefits of investments, the desire to assure farm continuity and the belief that entirely fossil-free production is not possible (Box 2.4).

Box 2.4: Horticulturists motives, beliefs and perceptions with regard to the transition towards fossil free production methods

Dutch greenhouse horticulture is undergoing a transformation towards fossil-fuel free production that will be completed by 2050. To find out what the drivers for change are, as well as the obstacles, a mixed-method study was performed consisting of in-depth interviews with 49 horticulturists producing vegetables, pot plants and flowers. A survey was also sent to 208 horticulturists from the same sectors. Results of the survey showed that (amongst other points for attention) horticulturists had low intentions to change to fossil free production methods, had a negative attitude toward fossil free production and did not believe that fossil free production added value to their product, benefit plant health or benefit their horticultural farm results. The in-depth interviews help to explain the findings of the survey. They revealed that the low intention to change and the negative attitudes toward fossil-free production methods were caused by perceived costs and benefits of investments, the desire to assure farm continuity and the belief that entirely fossil-free production was not possible. The interviewed horticulturists considered gas a reliable energy source and questioned whether other innovative energy sources were sufficiently mature or reliable enough to replace gas. The lack of perceived realistic and affordable alternatives for fossil fuels was a frequently noted obstacle to change.

3 INVESTIGATE: Modelling behaviour

Models to improve our understanding of human behaviour. In addition to investigating behaviour through consulting stakeholders, models can be used to get a better understanding of human behaviour. Why are models being used more and more? Models are a simplification of reality that capture relevant behavioural processes; behavioural models improve our understanding of behaviour dynamics. Models can improve our understanding of current systems by testing specific assumptions and can also be used to project scenarios, testing potential futures.

Different types of actors can be included with their specific behaviours. The different actors in the food system can be incorporated in behavioural models where each actor or group has their own characteristics, preferences, perceptions and behaviours. The characteristics included in the model are factors identified as influencing actors' decisions (e.g. by asking as in Box 2.2 and/or statistically elicited).

WLL designed a dummy 'Agent-Based Model' (ABM), which illustrates how the behaviour of various actors in the food system affects (and is affected by) the transition to a more sustainable food system. This ABM includes three types of actors in the food system: producers, retailers and consumers. Here, sustainable preferences can change over time based on the availability (for consumers) and demand (for producers) of products they prefer and also based on their individual social network. It illustrates how the whole food system and the different actors within it are related to and influenced by each other. This model represents a simplified version of reality, illustrating how different actors and behavioural insights can be included in a single approach.

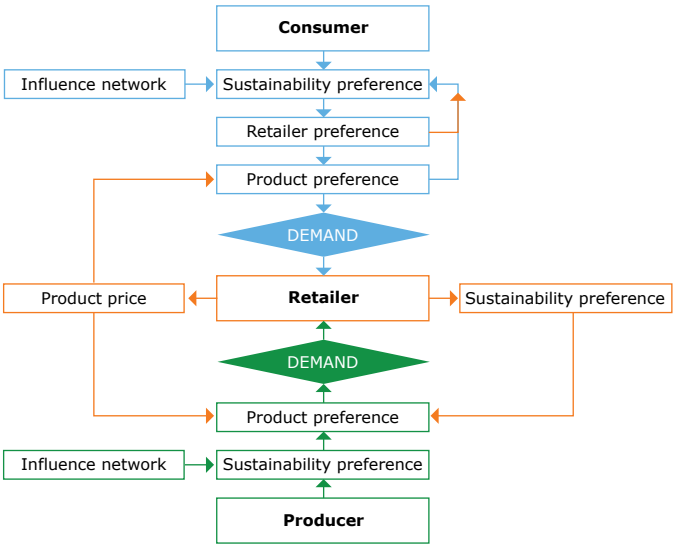

Figure 3.1: Simplified flow chart of an agent-based model of a value food chain from producer to consumer (source Wageningen Economic Research)

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

Box 3.1: ABMs can contribute to understanding the complexity of promoting collective investments with public good characteristics

Farmers in South-West Bangladesh face excess precipitation in the monsoon season, which cannot be discharged to the silted-up rivers, which leads to waterlogging. Water levels in the polder remain too high for rice production during the monsoon and the following season, so rice can only be grown in the dry season, leading to reduced annual yields and income. Using an agent-based model (ABM), we analyse the decision-making process of buying a pump collectively to discharge water to the river and extend rice production over the rainy seasons. We present an extension of the Consumat approach (Jager et al., 2001) to model cognitive behaviour and include farmers' prosocial behaviour characteristics in the choice of cooperation towards investing in a pump. We model different climate change scenarios and test if an increasing probability of waterlogging would encourage cooperation towards investment in a pump. Finally, we explore the role of social preferences in achieving cooperation towards investment in the pump. We find that farmers' incomes are significantly higher when the pump is present, and it reduces income variability considerably. Changes in the probability of waterlogging can significantly impact farmers' incomes. Farmers receive higher benefits from an investment in a pump in a rainy scenario. Income during the dry scenario is also higher with a pump. Farmers seek cooperation faster when the probability of waterlogging increases. Researchers find social preferences play a role in the time of investment in the pump, where a selfish scenario significantly would increase the time until investment in the pump. Our research contributes to understanding the complexity of promoting collective investments with public good characteristics and highlights the long-term benefits of collective investments on farmers' livelihoods, especially under climate variability.

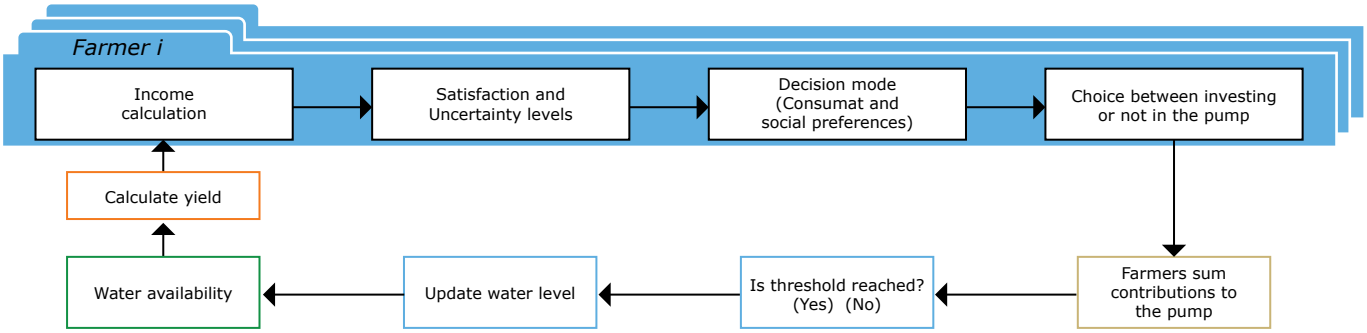

Figure 3.2. Model overview: the farmer decision-making model of investment in a pump (Reinhard et al. (2022).

Agent-based models can also capture social interactions. In addition to capturing individual characteristics and behaviours, ABMs are also used to capture the social components of decision-making processes. Actors in the system are dependent on one another, and they influence each other through their choices. Understanding the social dynamics of cooperative actions – such as collectively buying a pump on a polder in Bangladesh (Reinhard et al., 2021; Box 3.1) – or of individual actions that benefit the rest of the group – such as improving biodiversity on agricultural land (Naranjo et al., 2021; Box 3.2) – is important to facilitate these actions.

Models are particularly useful for decision makers. If decisions cannot be tested in-situ because of environmental, social and economic risks, or because there is not enough time (for long term processes), models can be used as 'flight simulators' to capture the potential futures of a system. Models act as a mechanism that simplifies the social system by capturing the dominant dynamics, allowing us to test specific assumptions and identify tipping points that allow shifts in the system. Decision makers can test various options and can, based on the knowledge of the system and the uncertainty built into the model, assess the theoretical performances of each option on a number of indicators.

BOX 3.2: A network of semi-natural landscape elements is needed to provide a sufficient level of biodiversity services

In agriculture, semi-natural/non-productive elements like hedgerows, flower strips, natural field edges and ditch banks provide essential services for farmers (e.g. water retention, natural pest regulation, pollination) as well as for society (e.g. aesthetic appreciation, biodiversity conservation). To provide a sufficient level of biodiversity services, a network of semi-natural landscape elements is needed, often on a spatial scale of several farms or even on a regional scale. Farmers in the landscape can benefit from the ecosystem services provided by these natural buffers.
We aim to provide knowledge for managing ecosystem services and promoting biodiversity conservation at regional levels by means of an Agent-Based Model (ABM). The model simulates the decision to contribute to ecosystem services beyond the farm level by converting part of the arable land to flower strips and hedgerows via the implementation of Agri-Environmental Schemes (AES). Our conceptual model further substantiates the insights needed to support nature transition initiatives in Europe using a multidisciplinary approach, in which social, economic and ecological knowledge and research methods are implemented, developing a method that can be applied in different case studies.

BOX 3.3: Socio-political scenarios to bound climate change driven futures

Climate change is an important driver of change of the global food system, on land as well as at sea. It is, however, a particularly uncertain driver, and the Intergovernmental Panel on Climate Change (IPCC) has long been using scenarios to forecast future trajectories following different assumptions on emissions. More recently, the IPCC has also included Shared Socio-economic Pathways (SSP). These pathways or scenarios include diverging options for mitigation and adaptation challenges and can be used to model socio-ecological systems. In our recent study, we operationalised and regionalised the SSP scenarios for EU fisheries, incorporating political, economic, social, technological, ecological and legal elements (PESTEL) into model simulations (Hamon et al., 2021). The results of these simulations were used to discuss future possibilities with stakeholders and their opportunities for behaviour adaptation in the different scenarios, allowing us to further specify the local applications of the scenarios.

These indicators can then be used to select the option with the most favourable and robust trade-offs (Hamon et al., 2021; Box 3.3). This increases the transparency of decision making processes.

Models must be validated to be trusted and therefore useful. To ensure that the models reflect reality and are trustworthy, all models must be tested and validated in the context in which they are applied. Validation is a particularly important step when modelling behaviour. For circumstances observed in the past, similar behaviours can be expected. These are usually well-described with existing models maximising the utility of actors (i.e. assuming that observed behaviour reflects personal preferences). However, if circumstances change dramatically due to climate change or the introduction of new regulations, for example, people adapt, and new behaviours are expected (Box 3.2). A study by Naranjo et al. (2022) shows that while it is impossible to predict these behaviours, scenarios about possible new behaviours can be co-developed with stakeholders by understanding the underlying drivers of the behaviour of actors in the system. This validation improves stakeholders' trust and acceptance of models, making them more useful for decision makers.

4 INNOVATE BEHAVIOUR: instruments, nudges and incentives

Innovators, investors and policy makers seem intrinsically optimistic about changing behaviour. Being able to predict the likelihood that a particular change will happen, why it will happen and what innovators, investors and policy makers could do about it is inherently valuable. Sustainable behaviour is key for a transition toward a more sustainable and healthy food system. However, change does not often occur by itself. For systemic behaviour change, interventions and nudges that incentivise behaviour supporting circular food systems are vital. These instruments need to align with the environment in which the behaviour takes place (see Box 4.1).

Changing behaviour as part of the experimental method to validate understanding. Once behaviour is sufficiently understood through inquiry methods and modelling, behaviour can be targeted and changed. While this is already part of the experimental method, it is also a goal of behavioural science in itself. Behavioural science uses a wide range of tools to achieve it.

Nudges are often used to change people's choice architecture. Nudges are small changes in the environment that are easy and inexpensive to avoid (Thaler & Sunstein, 2008). They often work via heuristics; these are almost automatic thought processes that we engage in without much second thought. Nudges aim to structure the decision environment in such a way that we choose the option most in line with our own values (Gestel, Adriaanse, De Ridder, 2020). More importantly, the prominence that nudges have received has sensitised policy-makers to incorporate psychological perspectives into their policies, although they are still currently underused (Box 4.2). We know, for example, that when motivation is effectively targeted, an intervention is more likely to be successful, as our next box shows.

BOX 4.1: A supportive enabling environment is indispensable to scale up initiatives

In this study, we scrutinise a case study with five initiatives on the reduction of food loss and waste (FLW) contributing to a circular food system, to understand how specific, well-targeted combinations of instruments as well as other contextual and personal factors can fuel the transition to a circular economy and the reduction of FLW. All the initiatives are taking place under the umbrella of the Dutch initiative 'Samen Tegen Voedselverspilling' (united against food waste). We use a behavioural change perspective to assess how initiatives that support circular food systems arise and how they can be further supported. Based on the case-study analysis, we arrive at five common success traits and barriers, and five key needs for upscaling. We conclude that motivated, inspiring frontrunners are of key importance in the initial phase of a transition process. However, once a niche initiative is ready to be scaled up, the enabling environment becomes increasingly important (Aramyan et al., 2021).

BOX 4.2: On the use of behavioural economics in fisheries

Fisheries management is a great example of a system that is hard to manage with traditional regulations. The system depends on a common resource with the possibility to be a free-rider, controls at sea are costly and can easily be anticipated, and social pressure can be low at sea, leading to suboptimal compliance with regulations. In this context, increasing attention has been drawn to behavioural economics to complement traditional measures and improve their success. To build on current knowledge, an international, multidisciplinary team of marine scientists led by early career scientists is conducting a review on the latest use of behavioural economics in fisheries. Wageningen University and Wageningen Economic Research is collaborating on this review, and its protocol has been published in PlosOne (Wieczorek et al., 2021).

Framing can be a powerful tool to change behaviour. The Prospect Theory of Kahneman and Tversky (1979) emphasises the importance of reference points or 'framing'. Some manifestations of these are: loss aversion, where people are willing to work harder to prevent a loss than to gain profit; reflection effect, when a person is risk averse in light of potential profit, but risk-seeking in the face of potential loss; endowment effect, which is the extra value that individuals attach to goods they already own or services they already receive, and status quo bias, which states that individuals tend to stick to the default option chosen for them. Like in the other areas of behavioural economics, the manifestations of the Prospect Theory aim to minimise the cognitive effort of decision making. The idea that it is possible to 'prime' a specific response to a given situation or choice by strategically framing the context is a powerful and well-established technique of persuasion (Jackson, 2005, p.67). Biel (2004 cf. Jackson, 2005) reports how unconscious 'priming' of respondents with images of nature had a significant impact on their value orientations and intentions to recycle.

Social norms and other external factors are needed for holistic behavioural models. Another important factor influencing behaviour is social norms. Social norms can influence decision-making as people often look to others for how to behave in novel situations. This also translates to environmental behaviour as social norms have shown to impact energy use (Schultz, et al., 2007) or littering

behaviours (Cialdini et al., 1990). Social norms considerably impact individuals' decision-making when faced with uncertainty regarding societally relevant issues, such as climate change. To address this issue, not only are descriptive and normative approaches to decision-making needed, but a thorough understanding of how the social environment impacts human decision-making is necessary too.

With the Living Lab, we have realised a range of behavioural economic interventions. In practice, we often use frameworks such as the Capability, Opportunity, Motivation lead to Behaviour model. The COM-B model or behaviour change wheel of Michie et al. (2011) (also see Chapter 2) provides a holistic approach to understand how potentially irrelevant factors in the decision-making process, such as social environment and individual motivation, lead to every-day behaviour. In the following sections, we elaborate on a few examples we encountered in our work.

Behavioural scientists use more diverse techniques than just nudges. While nudges have gained some popular recognition, they are not the only tool in the behavioural economist's toolbox. Other techniques, such as using taxes, regulations, providing information, or creating the right incentives, are also well-known techniques, albeit one would not see them as a behavioural economic tool. To reliably address behaviour in a public setting that is crucial to the successful adaptation of society, behavioural tools need to be combined with the traditional techniques. This combination can benefit from a combination of insights and informing each other about best practices and lessons learned.

Financial incentives can be effective when used with the right behavioural insights. There is a long tradition of incentivisation in behavioural and specifically, economic sciences. While mostly taking the form of monetary incentivisation to adopt targeted behaviour, the technique of providing a reward might seem easier than it actually is. Indeed, paying for pro-social behaviour, paying too little or too much can backfire and render a monetary incentive ineffective. The role of beliefs, social factors and preferences need to be accounted for. Therefore, investigating the effectiveness of incentives is necessary within a broader behavioural research context – to make sure that money is well spent (Box 4.1, Box 4.3 and Box 4.4).

Box 4.3: Price incentives for dairy farming are a potent tool for milk quality improvement

Stimulating change in farming practices and encouraging innovation in the agricultural sector is the bread and butter of WUR and its partners in the private, public and civil sectors. We know that technological innovation and knowledge alone are often not sufficient to change farmers' practices. However, we have little scientific proof of what it takes to changes dairy farmers' behaviours. In one of our public private partnership projects in the dairy sector, we supported the development of a Quality-Based Milk Payment System (QBMPS) together with a dairy processor and dairy cooperatives in Indonesia. The QBMPS introduced financial incentives for the production of better quality milk through the provision of bonuses for improved milk quality. It also encouraged farmers to change their practices by means of skill development and by providing them with improved milk collection centre infrastructure. An impact study conducted by Wageningen Development Economics with support from Wageningen Centre for Development Innovation showed that dairy farmers changed their behaviour due to the introduction of the QBMPS. Farmers delivering to milk collection centres with the QBMP produced higher quality milk than similar farmers delivering to centres without the QBMPS. This could be ascribed to the introduction of bonuses for higher quality milk and the accompanying training and improved infrastructure. Qualitative studies confirmed increased motivation for changing behaviour due to price incentives (see Roefs, 2020 and Treurniet, 2020).

BOX 4.4: Dairy farmers who make different choices with regard to joining dairy health programmes differ in their sensitivity to rewards or fines

Farmers play a decisive role in bettering animal welfare and health standards on their farms. It is often assumed that they act on a purely economic basis. However, novel insights have shown that psychological and sociological drivers should also be acknowledged. This was tested in a study focusing on dairy farmers' decision making processes concerning participation in a hypothetical dairy health programme. Bovine Virus Diarrhoea (BVD) was chosen as a case to create a realistic setting for the 130 dairy farmers participating in the study. Of the farmers, 82 already participated in the dairy health programme. The 48 farmers who did not participate were asked whether they would consider joining the programme if they were offered a reward of €3 per healthy (BVD-free) calf, or a fine of €30 per (BVD) infected calf. Of these farmers, 38 (79%) chose to join the programme, and ten (21%) did not. These ten farmers were the most distinct group in this study. They were less convinced than the other participants that joining the programme benefited the cows' health and welfare and would increase work pleasure, and they were less convinced than farmers who already participated in the programme that joining the programme would increase farm income. They also seemed to be less ambiguity averse than the others. This study indicates that dairy farmers who make different choices with regard to animal health – in this case – differ in their sensitivity to a reward or a fine. This should be taken into account when designing interventions. Apparently, a financial incentive will not convince every farmer to change their behaviour (De Lauwere et al., 2020).

5 INSPIRE: Research agenda

Approaching the transformation of the food system from the perspective of human behaviour has major implications for analysing food system dynamics. Putting people at the centre of the food system implies that future change in the system is induced by human action. This elicits the question of how we, as academics and research organisations, can support the behaviour change of food system actors to realise system transformation. As the examples presented in the previous sections show, WUR already engages in research and co-creation related to behaviour change. We strongly support and want to stimulate this trend through more systematic inquiry into human behaviour change, investigating behavioural drivers and innovating with behaviour change interventions in our daily work at WUR.

Integrate human behaviour in foresight and impact studies. Models developed to test and compare future scenarios should consider the characterisation of agents, and the validation of parameters and assumptions related to their behaviours more often. In the same vein, impact evaluations should more explicitly focus on the effectiveness and impact of mechanisms for behavioural change at individual (micro), group (meso) and societal (macro) levels.

Embed a focus on midstream actors throughout the food system. We have a strong focus on consumer and producer behaviour, but less on other midstream actors in the food value chain, such as input and service providers, processors and traders. This is an omission because midstream actors play a pivotal role in food system transformations. Research should focus on incentivising farmer investment in sustainable farm methods, for instance, while simultaneously paying attention to the role of in and outgroup favouritism in fostering cooperation between farmers and their neighbours. Lastly, of specific interest in changing behaviour for food system transformations are actors and behaviours related to governance of systems: who governs/influences/facilitates, how and why.

Pay more attention to people's context. The level of complexity of food systems is partly related to the variation of contexts in which people operate. Climatic zones and climate change, socio-economic trends, political stability, environmental conditions, and technological innovations determine to a large extend behavioural choices from micro to macro level. WUR international and multi-disciplinary research network provides many opportunities for addressing contextual variation and complex interactions in applied research on food system transformation.

A better understanding of the role of human behaviour in the resilience of our food systems. The world's food systems are not only changing constantly, but they are also changing faster and in less predictable ways. They are subject to global climate change, war, political and trade power changes, growing data networks, rapid technological innovations and population growth. Currently, our food system is confronted with disruption due to the COVID-19 pandemic, the war in Ukraine, and it is being strongly affected by climate change. At the same time, there is a pressing need for more sustainable diets. The role of human behaviour in the resilience of our food systems is a key topic for further research. What does this rapid change and elevated level of uncertainty or ambiguity do to us? How do feelings of fear, hope and uncertainty drive us, and how do they impact intergroup relations and cooperation or investments and innovation? How does this affect the resilience of food systems?

6 INVITE & IMPLEMENT: Four key recommendations

In this booklet, we presented some fundamental steps and practical examples of behavioural research in food system change. The examples in this booklet illustrate how we can address human behaviour and its complexity in advancing our understanding of food systems and food system transitions. Approaching the transformation of the food system from the perspective of human agency has major implications for how food system dynamics and trends can be analysed. We have also indicated some subjects to put on our research agenda. This elicits two main questions. The first: what role do we as academics and our research organisation play in shaping the system? The second: to what extent and how can or should we try to influence this transformation?

Improve inclusion of behaviour in theories, approaches and models. Internally, we suggest that we review Food-Ecosystems frameworks with an actor-oriented lens and develop theories of change for system transformation based on behaviour change approaches. In our modelling activities, the inclusion of agents and behavioural determinants is very concrete. Modellers with an interest in modelling behaviour should join the already existing SiLiCo group. The SiLiCo Centre Wageningen (Simulating Life Science's Complexity) is a virtual centre that acts as a portal to Wageningen University's expertise in modelling complex systems through agent-based simulations. Externally, we could seek international partnerships to complement and share our expertise in food and ecosystems, and to promote a behaviour change agenda, develop new approaches, methods and tools.

Continue and extend collaboration on behavioural research within WUR, through setting up a WUR-wide community of practice on behavioural research. The Wageningen Living Lab on Behaviour Change aims to bundle existing knowledge and generate new knowledge by building partnerships on behaviour change research between different research themes within Wageningen Economic Research and Wageningen Centre for Development Innovation, and by building concrete research collaborations between Wageningen Research and Wageningen University within the Social Sciences Group, as well as other science groups. We recommend continuing investing our efforts in studying drivers of behaviour and behaviour change and extending collaboration between Wageningen Economic Research, Wageningen Centre for Development Innovation and other research and university groups within WUR. We need joint spaces for an overview of tools and techniques that are applied in the field, to ensure that new and existing colleagues at WECR, WCDI and other research and University groups at WUR know who is working on behavioural research topics. This kind of collaboration can facilitate the application of field and lab in the field experiments for private sector clients as well as civil society organisation, in collaboration with local partners (also in the global south). To operationalise this kind of collaboration, we suggest setting up a WUR-wide 'community of practice' on behavioural research to facilitate learning and knowledge exchange on behavioural change research.

Work on bundling and communicating behaviour research to the outside world, especially for decision-makers or influencers. The importance of understanding drivers of behaviour change is receiving increasing attention from policy makers. Therefore, WUR could better position itself in the field of behaviour change research and food and ecosystem transformation. We advise WUR to create a webpage on the role of behaviour change in systems transformation, bringing together key publications and current research projects that address this topic. Furthermore, it would make sense to appoint a WUR ambassador for pushing the behaviour change agenda beyond WUR boundaries.

Embed behaviour change research in the Business Development and Scientific agenda. Finally, and in connection with the previous recommendations, behaviour change research should be firmly embedded within the Business Development and Research Agenda of applied research in WUR. The focus on people and their behaviour being central to the food system and eco-system is of clear added value to the work of other research groups within WUR. Behaviour change research is a clear cross-cutting theme that relates to every research discipline. This means the role of human behaviour should be embedded in KB research themes and WUR investment themes. In addition, we can further build knowledge on behaviour change research in European Horizon projects. Simultaneously, we can focus more on serving private sector and governmental clients with insights from behaviour change research.

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The mission of Wageningen University & Research is "To explore the potential of nature to improve the quality of life". Under the banner Wageningen University & Research, Wageningen University and the specialised research institutes of the Wageningen Research Foundation have joined forces in contributing to finding solutions to important questions in the domain of healthy food and living environment. With its roughly 30 branches, 7,200 employees (6,400 fte) and 13,200 students and over 150,000 participants to WUR's Life Long Learning, Wageningen University & Research is one of the leading organisations in its domain. The unique Wageningen approach lies in its integrated approach to issues and the collaboration between different disciplines.