Towards sustainable food systems

A Dutch approach

Anne-Charlotte Hoes, Roel Jongeneel, Siemen van Berkum and Krijn Poppe

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Preface

Wageningen University & Research (WUR) aims to play a catalytic role in the analysis of critical issues facing global society, such as the provision of adequate and safe food, climate change, the development of a circular economy, the protection and use of biodiversity, and poverty reduction.

We believe that it is crucial to develop new insights and solutions related to sustainable and healthy food systems in Europe and the world. This paper argues that there is a need for a food systems perspective to identify potential solutions for global challenges. The food system approach and food system innovations offer strong instruments to study and understand possible transition pathways to more sustainable and healthier food systems. We bring these points to life with some examples of Dutch initiatives.

At the same time, our goal is to strengthen international debates in these areas. New insights and solutions must be developed in dialogue with society by working in multidisciplinary teams and by encouraging synergies between fundamental & applied research. We look forward to further international cooperation with OECD member countries in facing the global challenges. We are locally rooted but our mandate is international.

This reflection paper aims to facilitate a dialogue about food policy with the members of the Food Chain Analysis Network of the OECD on the 4th of September 2019 in Wageningen, organized by the Ministry of Agriculture, Nature and Food Quality of the Netherlands in collaboration with WUR. The assignment and financial support for this paper was provided by the Ministry of Agriculture, Nature and Food Quality of the Netherlands.

In compiling this paper, the authors made use of work of many of their colleagues within Wageningen University & Research. They would like to extend their gratitude to all those who contributed.

Prof.dr *ir.* Louise O. Fresco
President Executive Board Wageningen University & Research


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Content


key
message

How a food system approach and food system innovation can enable sustainable and healthy food systems

Food systems perspective needed to overcome urgent food-related challenges

The key message of this paper is that there is a need for food systems perspectives and food system innovations to enable the transformation to a more sustainable and healthier food system on a global scale. The world faces a range of climate change, environmental pollution, biodiversity loss, social injustice, public health, food security and animal welfare challenges related to food production and consumption. This reflection paper argues that enabling society to work on solving these grand challenges requires a new food policy which integrates the food systems perspective.

While the current food systems have many benefits, including the wide availability of food, it also has negative aspects. The grand challenges mentioned above are caused by interactions between system drivers and the behaviour of actors across a range of different scales and levels. Solving the challenges will require integrated and coherent actions that transcend disciplinary, divisional and institutional boundaries. They will have to involve multiple stakeholders, both public and private, acting at local, national and global levels across multiple fronts (agriculture, health, environment, education, etc.).

Food system approach crucial to identifying drivers and barriers for change

A food system approach considers the drivers and actors in food systems, their relationships, and the effects of behaviour changes on system outcomes. Such an approach broadens the framing and analysis of a given issue, seeing it as the result of an intricate web of interlinked activities and feedback. Food system

analysis is a relatively new field of applied research which assists policy in shedding light on:

1 the root causes of identified problems, taking into account the interrelationships between actors and flows,
2 specific situations where interventions might have the most effect, while remembering that these might be found in a very different part of food systems than the place where the problem is initially identified, and
3 trade-offs between different intervention strategies. Food system approaches are considered to be of critical importance in overcoming trade-offs in agricultural and rural development, and for supporting a broad engagement of multiple stakeholders in food innovations and policies.

Transforming food systems is complex

Transforming current food systems to better support nutritious and sustainable food systems outcomes is a complex proposition. Challenges that hamper the transformation are:

1 an absence of sufficient viable and sustainable alternative business models,
2 status quo characteristics that hinder change, and
3 limited steering options.

Although there are numerous innovations and initiatives that experiment with sustainable alternatives for the status quo, such as plant-based meat substitutes or agro-ecological production systems, most are still under development and need to prove their viability to become mainstream. This scaling-up is an important component in any transition. A food system approach may assist in identifying scaling-up potentials and the effects of scaling-up.

There are several change-resistant dynamics hampering the process of going mainstream, including vested economic interests and established routines, dependencies and infrastructures. Transformative sustainable change is therefore unlikely to take place without pressure. It can be challenging to generate such pressure, given that food production and distribution systems involve a huge international web of actors, facilities, institutions and infrastructure without central management or control. Even so, there are historical examples, such as the Green Revolution (Third Agricultural Revolution) of the 1950s and 1960s, which illustrate that it is possible to change food systems and that policy can play a critical role in enabling this.

Changing food systems requires integrated and coherent policy approaches

In summary, this paper argues for food policy that includes complementary policy instruments in a range of international, national and regional policy domains. This in turn requires the alignment of various policy fields, including agriculture, environment, energy, health, education, infrastructure and planning. Policy can:

1 apply a food system approach to identify effective intervention points and design appropriate policy measures,

2 support innovation in food systems via actions such as funding specific R&D activities, targeted investment support and experimentation with promising alternatives, and

3 adapt institutions like regulations, laws, infrastructure, planning, healthcare and education to enable desirable change to food systems.

1

Some key features of the Dutch agri-business complex

Key part of an open economy

The agri-business complex in the Netherlands generates a net value add of about €50 billion, around eight per cent of the national economy. This includes food, ornamental plants such as flowers and biobased products such as wood, which are either domestically produced or imported and traded. The agri-business complex also covers a range of other activities linked to agriculture and food, like banking, insurance, seed breeding, production of machinery for food processing, and international consultancy.[1]

The Netherlands is located in a fertile region with a temperate climate that includes Europe's largest port, Rotterdam. These favourable geographical and natural conditions contributed to the development of a highly efficient and competitive agriculture and food sector that produces a wide range of affordable food products as well as ornamental plants and seeds.[2] The Dutch agri-food sector exports products worth €90 billion, while food imports amount to €60 billion. Exports include products that are imported first, then processed and exported, such as coffee, margarine, cocoa and oranges.[3]

Livestock farming is highly dependent on imported feed so Dutch agriculture is deeply embedded in the international trade systems. Much of the trade takes place with neighbouring countries like Germany and the UK, but Dutch products are shipped all over the world, and many companies, including large cooperative firms, have subsidiaries on other continents.[4]

There are 50,000 farms in the Netherlands. They are a varied mix, and the Dutch agricultural sector has a different structure from that of many other European countries. Dutch farms cultivate 1.8 million hectares: while this is not an exceptionally large surface per farm, it produces an extraordinary output and sales. Productivity per hectare and labour productivity need to be high in order to generate an income that justifies the high land and labour costs.[5]

Dairy farming is a significant subsector of Dutch agriculture thanks to fertile, wet

grasslands that are better suited to livestock than arable farming. There are other important sectors which do not require a lot of land, like horticulture[6], as well as pigs and poultry, for which large amounts of feed are imported from abroad. Also fisheries are present in the Netherlands which boarders the North Sea at the north and west of the country. Most farms are family farms, although horticultural holdings usually separate management from operational labour (partly with immigrant workers). Farmers are specialised and high educated: an emphasis on knowledge and innovation is an important aspect of Dutch agricultural policy.[2]

Role of policy in shaping Dutch agri-business complex

Knowledge and innovation policy has always played an important role in the development of the Dutch agriculture and food sector. From the 19th until the end of the 20th century, Dutch agricultural policy aimed to boost low price food availability by increasing food productivity per hectare, animal and/or labour unit.[7] After the famine during World War II, the government invested heavily in agricultural knowledge infrastructure to modernise the agricultural sector. The resulting knowledge system, referred to as the 'Research, Extension and Education triptych' (OVO drieluik), incorporated research and development organisations such as an agricultural university, applied and strategic research institutes, experimental stations, extension officers and demonstration farms.[8]

Over the years, researchers in these institutions monitored the agricultural sector and developed and tested new technologies, processes and products. The extension programmes included specialists and regional fieldworkers, who were responsible for the rapid diffusion and implementation of new knowledge, information, technologies, processes and products within the agricultural sector. In addition, there were several agricultural schools to educate future generations of farmers.[8,9] In addition to supporting the EER triptych, the government implemented policies on investment, agricultural taxes, land re-allotment schemes and land reclamation that were instrumental in facilitating measures to promote the modernisation of the Dutch agricultural sector in the 1960s and 1970s.[2]

Advent of sustainability issues

The downsides of increasingly efficient production have gradually become clearly visible since the 1970s, primarily in the form of their impact on nature, the environment, public health, climate change and biodiversity. In the Netherlands, the high level of input use and high livestock intensity (and associated manure

production) have caused environmental and health problems in the form of ground and surface water pollution, lower air quality, and soil and biodiversity degradation. The energy-intensive part of greenhouse horticultural activities (producing mainly vegetables and ornamental plants) and the livestock sector produce greenhouse gases, an important factor in climate change. The Dutch landscape is given over to monocultures, leading to pressure on nature and biodiversity. Last but not least, farming incomes are under constant pressure, despite structural changes causing farms to consolidate and become larger.[10]

In the 1980s, the European Union became self-sufficient in most core agricultural products and started to cap agricultural production with quotas and, from the 1990s, phase out price support. At the same time, EU support policies increasingly became linked to targets such as cross-compliance or agri-environmental schemes aimed at better matching agricultural production activities with issues affecting nature and the environment. Around the same time, the Dutch government introduced legislation on manure and fertilisers and stricter rules on pesticide use to prevent the decline of water and soil quality and biodiversity. These measures were not sufficient to restore the balance, however. Animal health crises (foot-and-mouth disease, swine fever, Q fever in goats) at the turn of the century put animal welfare and public health at the heart of agricultural policies. And the signing of the Paris Agreement made climate change a hot topic in a country that is mostly below sea level: agricultural practice is assumed to play a major part in strategies of adaptation to increased climate variability and in reducing greenhouse gas emissions.[11]


2

Dutch government vision:
circular agriculture as way to create sustainable food systems

Circularity as a response to improve sustainability

In September 2018, the Dutch Minister of Agriculture, Nature and Food Quality launched its 'Agriculture, Nature and Food: Valuable and Connected' vision document, making a strong case for circular approaches in agriculture. According to the Ministry's assessment, the sector's focus on increasing productivity and reducing the cost of production has been successful, but also made the sector vulnerable to market price volatility and power relations in the value chain, while leading to declining profit margins from farming. Moreover, current farming practices have a number of negative environmental impacts. All in all, the Ministry concluded that agriculture and food production in the Netherlands should be reoriented towards more sustainable practices, with circularity and resource use efficiency as the guiding principles. To ensure such a transition, the agricultural sector should be rewarded by consumers for investments into more sustainable production. In addition, the Ministry advocates strengthening the position of farmers in the supply chain to ensure they receive a fair price for the food they produce. See Box 1 for an elaboration of the Ministry vision.[12]

The transition to a circular agriculture has various implications. It requires that different sectors in primary agriculture make use of each other's products and by-products (see Figure 1). This includes using arable products as feed by the livestock sectors and the use of organic manure from these sectors by the arable sector. But there are also other possibilities, such as the use in the feed industry of residual streams from food production, the use of organic matter and certain by-products from the food processing industry for soil improvement, and the use of agricultural residual streams for biobased products (e.g. substitutes of plastics based on natural oil) and energy.[12,13]

The Minister acknowledged in the document that circularity faces scale issues in terms of both space (at the farm, regional, national, EU and world level) and connections to the wider economy and consumers. The ambition is to have nutrient cycles closed as much as possible by 2030, at the lowest possible level, either nationally or internationally.

Box 1 Vision Agriculture, Nature and Food: Valuable and Connected.[12]

The government's goal is for cycles of raw materials and resources to be closed at the lowest possible level, either nationally or internationally, by 2030, and for the Netherlands to be a leader in circular agriculture. In order to realise this perspective, the government has formulated three supplementary goals for a strong, sustainable food system:

1 *The economic position of farmers, growers and fishermen in the supply chain should be such that they are able to earn a good income in circular agriculture, can innovate and can maintain and pass on healthy businesses.*

2 *We need to appreciate food more. This goes for individual consumers, large-scale users and the catering industry. Wastage should be avoided. The distance between primary producers and citizens must become smaller.*

3 *The Netherlands has the ambition as an innovative global player to contribute to the sustainable production of food in circular processes with our knowledge and products, thus preventing and repairing damage to the ecosystem (water, soil, air).*

Key points and issues with respect to circular agriculture

The Ministry vision document underlines key points regarding the different themes and sectors. The proper use and maintenance of soils is emphasised as the basis of all agricultural production. This in turn has implications for fertilisation (which should be balanced, ensuring an appropriate organic matter content in the soil), integrated pest management (which should minimise the use of chemicals) and cultivation practices (tillage, impact of machinery on soil compaction, erosion and topsoil loss, crop rotations and cover crop use contributing to healthy soils).[12]

Another element is the stimulation of various forms of precision agriculture and related innovations to support the transition. Horticulture has already achieved a high degree of circularity, among others due to the public private initiative Greenhouse as a Source of Energy (Kas als Energiebron) but further improvements with respect to its use of water and energy are scheduled.[14] With regard to animal husbandry, the Ministry vision calls for feed nutrient cycles to be closed at the lowest possible level, while waste and emissions

(including greenhouse gas emissions) are reduced through measures such as building low-emission stables. Outdoor grazing by dairy cows and biodiversity are also part of the Ministry's circularity agenda.[12]

Additional objectives are expressed with respect to the transition to a circular agriculture. There is a call for agricultural entrepreneurship: farmers should be the key actors that drive and benefit from circular agriculture, which in turn should allow them to earn a decent living. To achieve this, consumers should revaluate food and recognise the importance of healthy food produced in a sustainable and environmentally friendly way.[12]

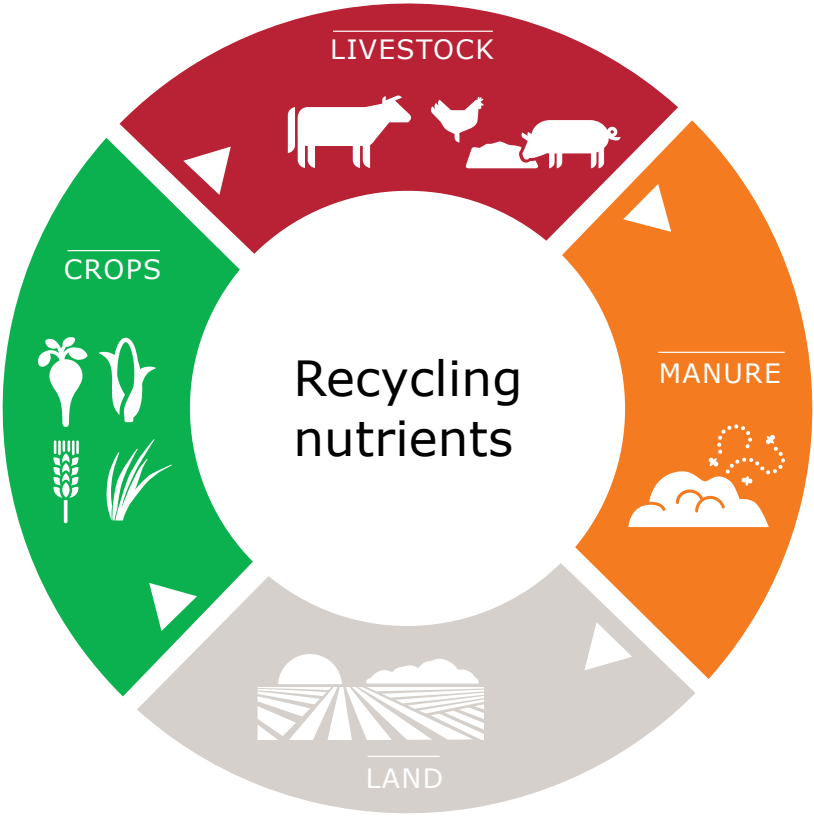

Figure 1 Circular agriculture
Source: ASG Livestock Manure brochure, WUR


3

Food system perspective on sustainable circular agriculture

The vision of the Ministry of Agriculture, Nature and Food Quality discussed above builds on the recognition that neither farmers nor any other actors in the food value chain exist independently from each other or the world. All are interdependent and cannot focus on their own narrow interest. To ensure that circular agriculture contributes to sustainable practices, activities at the primary sector level need to be connected to activities in both upstream and downstream supply chains, as well as with respect to different spatial levels. New partnerships, such as the Green Protein Alliance (see Chapter 5), will be necessary to facilitate collective solutions for the improvement of resource use efficiency and the recycling and reuse options for products, by-products and waste materials.

In other words, the circular agriculture vision requires a food system approach as well as policy approaches that go beyond the primary agriculture that is still the classical focus of a Ministry of Agriculture. The food system approach should also account for the way food systems are embedded in the wider economy, and cost-efficient circularity solutions should make use of the possibilities to achieve and enhance circularity which go beyond the food systems.

Food system approach shows many interdependencies among actors, drivers and outcomes in a system

A food system approach, which widens the scope from the activities in the food system to its socio-economic, environmental and health outcomes, is increasingly used to understand and shape transformative action to enhance food and nutrition security (FNS) and natural resource security (NRS).[15,16,17,18]

The food system approach takes into account the many interdependencies between food systems activities (supply and demand) and the ecological and socioeconomic context in which these activities take place. This approach also

makes it possible to include feedback loops: the results of a measure taken to solve a problem are routed back as inputs, reinforcing the chain of cause and effect that forms a circuit or loop. Systems thinking broadens the perspective when seeking solutions for the root causes of problems such as poverty, malnutrition, environmental pollution and climate change. Scientific insights on food systems are being translated into effective FNS and NRS interventions in a range of projects, although this remains a challenge, not least because of the multiple policy objectives at stake in creating a sustainable food future.[20]

The food system approach describes the different elements in the Dutch food system and the ways in which they are related. On the one hand, it looks at all the activities linked to the production, processing, distribution and consumption of food, and on the other it considers the outcomes of these activities in terms of food security (including nutrition), socio-economic issues (income, employment) and effects on the environment (biodiversity, minerals, water, climate, soils). Figure 2 presents the components of the socioeconomic and environmental drivers and uses arrows to show the direction of the feedback mechanisms between the system components.[a,20]

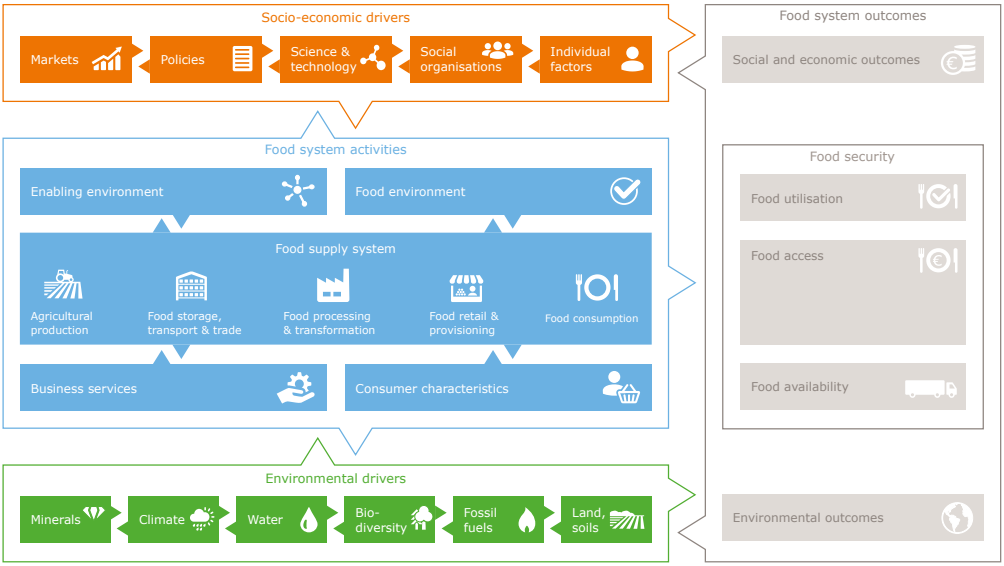

Figure 2 Relationships between food systems activities, drivers and outcomes.
Source: Van Berkum et al., 2018, slightly adjusted.

Food systems perspective reveals many pathways to sustainable food future

Food system analysis aims to identify how different types of policy incentives or business innovations influence the relationships between multiple stakeholders (input providers, farmers, traders, public officials, processors, retailers) and create changes in the way different components interact (consumption, distribution, processing, production). Improving the performance of the food system across the three dimensions of sustainability – economically, socially and environmentally – is the ultimate goal of the intervention types.[21]

A defining feature of systems thinking is that it sees the behaviour of a system as an interplay of interacting subsystems in which feedback plays a key role, rather than as a simple chain of cause-effect relationships. This also distinguishes food systems thinking from other approaches such as farming systems, sector or chain approaches, in which interventions are often (albeit not exclusively) designed to make optimal use of the factors of production (natural resources, labour, capital). This usually involves applying technological innovations at the level of family businesses, sectors and/or chains, with the focus on raising productivity and profitability.[20]

Although those approaches also consider the market and environmental effects of interventions, they tend to pay insufficient attention to feedback from the socio-economic system and/or ecosystem on the farm, sector or chain. Food systems thinking takes a step back from the place where the intervention occurs, as it were, providing an opportunity to include feedback from outcomes outside the activities directly related to food production and consumption. The added value of the food system approach is the wider perspective it offers, allowing more sustainable solutions to be found for a sufficient supply of healthy food.[20]

Applying a food system approach framework – one which shows where the main interactions and feedback between the subsystems occur – produces a number of useful insights:

- Mapping out opportunities for more efficient use of natural resources (beyond one product and/or value chain).
- Highlighting the importance of the food system's socio-economic context.

- Showing the implications of the food system for health, nutrition, livelihoods and the environment.
- Helping shed light on the trade-offs between different intervention strategies.
- Illustrating non-linear processes and feedback loops in the food system.[20]

These factors hint at the advantage of using a food systems lens in identifying pathways towards circular agriculture: indeed, narrowing or closing cycles of natural resources (the classical object of circular agriculture) requires insights into the potential contributions of all stages of agri-food supply chains. It also needs to consider the interactions of agriculture with other sectors in the economy. Above all, to ensure that behaviours change, the closing of cycles of natural resources has to be economically beneficial to the people involved. And before transition pathways towards greater circularity can be designed, we need to properly understand the policy, law and regulation contexts that will lead to value chain actors making more efficient use of resources.[20]


4

Food system innovation for a more sustainable systems

Food system analysis (FSA) can help determine where interventions can contribute the most to transforming the systems. FSA cannot achieve an actual food system transformation by itself. Researchers of sustainability transitions and system innovations study how change towards more sustainable modes of production and consumption generally proceeds in order to identify ways to support and enable sustainability transitions (see transitionsnetwork.org). System innovations are not about new products, processes or technologies: they transform the status quo of food systems, and that involves changing the established patterns of action and the structures in which they are embedded.[9] System innovation thereby links systems thinking and innovation theory.

Achieving food system innovation is challenging as most established actors and organisations in the current food systems are familiar with, and operate well under, the status quo. In addition to vested economic interests and dependencies between actors, the stability of the status quo is strengthened by rules – both formal laws and social norms – as well as existing hardware and infrastructure. Innovations aimed at changing the status quo require investment in areas like research, experimentation, construction, training and communication. Moreover, the end results of system innovation attempts are inherently uncertain and can lead to unforeseen negative side effects which harm the interests of stakeholder groups or individuals.[22]

It has been argued that, in addition to market failures, system and transformation failures are major obstacles to transitioning to a more sustainable world.[23] Market failures may arise for many reasons, including positive and negative externalities, vested interests and status quo bias. System failure is about outdated regulations, conservative social norms, weak or inexistent institutions, and inadequate networks, knowledge and competences. Transformation failure may occur due to a lack of urgency, reflexivity, learning ability, vision, clarity or policy coordination.[23]

Despite all these obstacles, food systems do change. An historic example is the Green Revolution (Third Agricultural Revolution) of the 1950s and 1960s, where the worldwide adoption of high-yielding varieties of crops, fertilisers, pesticides

and machines increased global food production. Studies of historical examples of system innovations[24] provided an analytical frame that distinguishes the three levels where effects on system innovations take place: niche (micro level), regime (meso level) and landscape (macro level). The levels higher up influence those lower down and vice versa (conditions and trends at the landscape level influence the regime and niche levels and vice versa). Landscape dynamics include demographic, political, economic and environmental developments such as population growth, climate change and wars.[24]

For the purposes of this paper, the regime level – with its established routines, institutions, actors, technologies and infrastructure – represents the dominant food systems. Sustainable new alternatives are usually not well aligned with the status quo, and can struggle to compete with the existing systems and become mainstream. Overcoming these obstacles to innovation and eventually crossing the 'valley of death' requires crucial actions at the niche level. The term 'valley of death' is used to highlight how complex innovations create negative cash flow in the early stages of commercialisation which usually last longer than initially anticipated.

Niches are 'pockets of change' that are sheltered from the regime dynamics by, for example, financial support (e.g. subsidies or fundraising). In initiatives at the niche level, actors can develop and experiment with fundamentally new products, processes and technologies that are considered more sustainable.[24]
In line with the infant industry argument, protection against regime dynamics should be temporary, as the alternatives developed in initiatives at the niche level eventually need to compete with the status quo to enable food systems change.

Initiatives required to develop sustainable alternatives

Initiatives operating at the niche level in food systems are found in a range of settings, from grassroots social/environmental start-ups and applied research & innovation projects to industry-led sustainability consortiums. Grassroots and social/environmental start-ups can be described as entrepreneurial initiatives. While they have a low market share, they are important incubators for sustainable alternatives and have the potential to significantly change food systems as a whole. Moreover, they inspire people by showing that change is in fact possible.[22]

An example of grassroots food initiatives are collective organic vegetable gardens maintained by professional growers, where members harvest fruit and vegetables for their own consumption (an example is De nieuwe ronde). There are many sustainable alternative start-ups in the biobased economy (e.g. YellowPallet, which converts banana stems into pallets) and the green protein movement (e.g. Algreen which markets locally produced fresh Spirulina algae) (see StartLife (start-life.nl) for more start-ups). Another example is care farming, which is explained in chapter 5.

Two examples of more sustainable alternatives that started with an applied research and innovation project are a Dutch seaweed farm Zeewaar and the new hen husbandry system Rondeel (see chapter 5 for more information). Although researchers have less potential than start-ups to actively and directly change current practices in the food system, they do have the ability to attract funds that help with the design of and experimentation with new sustainable solutions which are yet to become commercially viable. Funding for these types of research is important for overcoming innovation barriers.

Business or industry-led initiatives usually aim for less fundamental change but are able to upscale sustainable solutions and reach a large group of producers, processors and consumers. Their high market share means they play an important role in changing the food system. A few examples of business consortiums are the Sustainable Dairy Chain (SDC, duurzamezuivelketen.nl), the Sustainable Food Alliance (verduurzamingvoedsel.nl) and The Sustainability Consortium (TSC, sustainabilityconsortium.org).[10]

Interplay of promising initiatives and pressure on status quo for system innovations

System innovation and transition studies show that the interplay between viable new alternatives developed at the niche level and incumbents at the regime level

is a crucial component in achieving food system change.[25] Incentives for change at the regime level are important for overcoming regime dynamics which obstruct change. Incentives for change can be born out of necessity, such as societal, regulatory or economic pressure, or out of promising prospects. Examples of societal pressures in food systems are food safety crises (e.g. EHEC) and trends that lower the public appreciation of certain foods/production methods (e.g. animal welfare issues) and therefore threaten market share or the licence to produce/operate. Other types of pressure are regulations that ban, restrict or heavily regulate existing practices. Economic pressure occurs when cheaper alternatives or disruptive innovations enter and dislocate existing markets. Disruptive innovations and new consumer or societal demands can, however, also be seen as promising new business opportunities if viable sustainable alternatives are available.[10]

5


MICROBAR
LIMOENADE
VOOR BIJ JE
WIST JE DAT?
MICROBAR
SPRINKHAANTJE
1,50 3 VOOR 4,00
MEELWORMLOEMPIA
2,50 3 VOOR 6,00
WIST JE DAT?
MEELWORM
LOEMPIA
€2.50
€6,-

Six examples of food system sustainability initiatives

Policymakers, researchers, the agri-business complex, entrepreneurs, consumers, NGOs and civil society have been trying to cope with sustainability challenges for some time. There are examples of policies, inventions and new business models that aim to create not only economic but also environmental and social value. This chapter presents six examples of interventions in the Dutch food systems aimed at increasing its sustainability which are described in literature. These six examples were selected randomly to illustrate the diversity of interventions and presented in alphabetical order. They include two initiatives originating in government policies (National Prevention Agreement & eco-schemes), one from the agri-business complex (Green Protein Alliance), one from an NGO (Better Life label), one from farmers (care farming) and one based on scientific research (Rondeel).

The cases illustrate that, while an initiative may be started by a single actor or group, the people and stakeholders involved tend to increase over time. Table 1 provides an overview linking the six initiatives to the concepts that were introduced in chapters 3 and 4, that is, food system drivers and outcomes (chapter 3, figure 2) and the three innovation levels (niche, regime and landscape, chapter 4).

The examples are classified below by main motivator. The second column indicates the originator and the third the food system outcome of each example. The key motivators were consumer concerns with animal welfare (Better Life label and Rondeel), the connection between farmers and the population at large (care farming, Rondeel), environmental sustainability (eco-schemes in CAP, Green Protein Alliance, Rondeel) and health (National Prevention Agreement, Green Protein Alliance). The originators included the government as policymaker, as well as farmers, an NGO, a food chain and a research institute. As table 1 shows, each of the selected examples contributes to the three sustainability dimensions, albeit in different ways.

Regarding the innovations, table 1 indicates whether an initiative started at the niche or regime level, or both. As system innovations are influenced by dynamics at a niche, regime and landscape level, we assess these dynamics for each

initiative, giving the framework a practical aspect. For **Better Life** the ongoing trend of increased general concern about animal welfare (at the landscape level) and specific new animal welfare solutions, such as toys for pigs to overcome boredom (at the niche level) created a window of opportunity for the Dutch Society for the Protection of Animals to develop the Better Life label in cooperation with Dutch retail companies (at the regime level).

Care farming was initially developed at the niche level by pioneering farmers seeking an alternative business model for diversification and collaboration with other sectors instead of intensification and enlargement of their farm with regard to food products. Care farming was able to grow thanks in part to the trend of relative income decline among extensive farming operations (landscape level). Moreover, decades of women's emancipation have resulted in a situation in which more farmers' wives had degrees and jobs in care (landscape level). These trends contributed to a situation in which care farming provided a new business opportunity for a segment of Dutch farmers. But it was the national policy of introducing national care vouchers for the Dutch health system (regime level) in particular that created the momentum necessary for care farming.[26]

Eco-schemes in CAP initiated at the regime level created a policy provision for EU member states to extend and deepen the greening of the CAP and to improve

Table 1 Comparing initiatives in food system analysis and food system innovation

	Main motivation/challenge	Originator
Better Life label	Consumer concerns about animal welfare	NGO
Care farming	Connecting agriculture to society in new meaningful way	Individual farmers
Eco-schemes in CAP	Enhancing sustainability beyond minimum baseline level	Government
Green Protein Alliance	Sustainability (climate) and the need for a protein transition	Food chain
National Prevention Agreement	Health concerns	Government
Rondeel	Need for sustainability and transformative innovation	Research

on past initiatives that were considered to be underperforming. This also opened a route for EU Member States to experiment with performance-based payment schemes (niche level). Using the carrot rather than the stick can contribute to stimulating the entrepreneurial spirit of farmers in the service of improving the sustainability of agricultural practices.

The **Green Protein Alliance** aims to contribute to solving health and climate change issues (landscape level) by reducing meat consumption and stimulating green protein consumption. This consortium may grow as more new green protein products, initially developed at the niche level, enter the market. An increase in obesity and food-related diseases (landscape level) triggered the **National Prevention Agreement** and new developments such as personalised nutrition and health (niche level), which may in the long run contribute to reaching the ambitions of the National Prevention Agreement.

Rondeel started as a research design project at the niche level. The avian influenza disease outbreak, animal welfare concerns (landscape level), the coming ban on battery cages, and a retail system that was heavily criticised for a purchasing policy that disregarded animal welfare issues (regime level) created the momentum.[27]

Main food system outcome			Initiative started at		
Social and economic	Food security	Environmental	Niche level	Regime level	Landscape level
X				X	
X			X		
X		X		X	
X	X	X	X	X	
X	X			X	
X		X	X		

Better Life label

The Dutch Better Life (Beter Leven) label was designed for meat products coming from operations where welfare standards exceed the minimum regulatory requirement. This certification scheme was initiated by the Dutch Society for the Protection of Animals (Dierenbescherming) through a partnership with retailers and farmers in the Netherlands. It was designed to help consumers concerned with animal welfare find producers who were willing to market meat products from animals kept in better conditions than those stipulated by law. Between 2011 and 2016, the number of animals in Better Life operations quadrupled.[28] Many major manufacturers changed to Better Life meat for their processed products, while some supermarkets formulated the ambition to only sell Better Life meat in the future. There are ongoing evolutions of husbandry systems and labelling schemes, particularly in the broiler chicken and egg sector. This includes the Kipster system, which aims to use losses and waste from the food system as feed for laying hens, while minimising pollution (reducing small particle emissions) and raising animal welfare standards.

The Better Life label is a large-scale phenomenon, available for a range of fresh meat (poultry, pork and beef) as well as eggs. The label has three classes, one-star indicates animal welfare above legal standards, three stars indicates the highest sustainability standard and two stars in-between the one and three stars-classes. Its success can be measured by the fact that 28% of all sustainably certified food purchases in the Netherlands currently take place under this label, with a market value of over €1.6 billion.[29] In 2017, the share of products with a sustainability certificate in overall supermarket turnover was 43% for eggs (€103 of 237 billion), 42% for meat (€1281 of 3038 billion), and 7.4% for dairy (€228 of 3042 billion), most under the Better Life label.

Care farming

Care farming is an innovative practice in which agricultural production is combined with health and social services (Hassink, 2017). It is an innovation at the crossroads of agriculture and healthcare, with the agricultural sector actively involved in providing care to different client groups. Clients are involved in food production and, sometimes, in harvesting and preparation, which usually has a secondary benefit of healthier diets for these clients. In the Netherlands, the number of care farms increased from 75 in 1998 to more than 1100 in 2014. At first sight it is surprising that the care farming sector could develop this quickly

as Dutch farmers have long focused primarily on the intensification and enlargement of agricultural production. The first care farmers were newcomers to the care sector, pioneers and innovators who faced challenges like a lack of recognition and a mismatch with financing structures in the healthcare sector.[26]

Despite these challenges, the care farming sector was able to develop and grow, thanks in no small part to support for the care farming sector from the Dutch Ministries of Healthcare and Agriculture. Their financial support allowed the National Support Centre for Agriculture and Care to be set up. Increasing pressure from potential clients also resulted in the introduction and broadening of the care system, while the introduction of vouchers increased the independence of clients and enabled farmers to enter into direct contracts with clients without being dependent on accredited care organisations.[26]

The liberalisation of the care sector made it possible for regional organisations of care farmers to obtain an accreditation and enter into contracts with health insurance companies to fund the care services. The introduction of the quality system for care farmers and the professionalisation of regional organisations of care farmers increased the recognition and legitimacy of the care farming sector. So too did support from important players from the care and the agricultural sector, with care farming being seen as a good way to solve problems in both the care and agricultural sectors.[26]

Eco-schemes in CAP

As proposed for the new CAP 2020 (COM(2018) 392 final), EU Member States have to provide support for voluntary schemes (e.g. by offering payments to farmers that commit to pursuing certain environmental management practices on their farm) which are beneficial to the climate and the environment. Member States have to decide on the list of these agricultural practices, which must meet the objectives formulated under the CAP to 'contribute to climate change mitigation and adaptation, as well as sustainable energy', 'foster sustainable development and efficient management of natural resources such as water, soil and air' and 'contribute to the protection of biodiversity, enhance ecosystem services and preserve habitats and landscapes'.

Payments made for eco-scheme measures take the form of an annual payment per eligible hectare and are granted as either additional top-ups over the basic income support, or as payments that compensate beneficiaries for all or part of the

additional costs incurred and income foregone. Member States can create a profit margin for farmers participating in eco-schemes to potentially induce a more widespread adoption than that seen for agri-environmental and climate action schemes under the CAP's Rural Development Pillar. In other words, eco-schemes can be a vehicle to get a larger share of farmers involved in measures that are beneficial to the climate and environment. Moreover, eco-schemes create opportunities for performance-based payment systems, which are linked to farmers' entrepreneurial capabilities.

Some Member States have experience with such systems (e.g. Entry Level Scheme in the UK) or are considering their potential (see the Public Goods Bonus scheme developed and proposed by the Deutscher Verband für Landschaftspflege).[30] The Netherlands is considering a points system type of approach. Such schemes are a good fit for the philosophy of the new CAP (moving from compliance to performance or from action to results; the public funding for public goods principle) and have attractive elements that speak to the entrepreneurial rather than administrative skills of farmers. This includes rewarding farmers' current efforts as well as offering them incentives to extend their environmental services to new areas of their farms; allowing them to deploy an efficient mix of actions or to specialise in the provision of specific public goods; offering them the flexibility necessary to include a wide range of environmental services, including nutrient balancing and abstaining from artificial fertiliser use; and letting them tailor their operations to regional conditions in terms of agriculture, biodiversity and landscape.

Green Protein Alliance

The Green Protein Alliance (GPA) is supported by the Dutch government and has 25 members in the Netherlands, including the two largest retailers in the Netherlands, various leading food services providers, catering companies and food producers, and 10 knowledge partners. Their common goal is to help achieve a healthy and sustainable balance in people's protein consumption. The current ratio of plant-based to animal protein in the Dutch diet is 37:63. GPA's ambition is to realise a 50:50 balance by 2025.

The Green Protein Alliance is active in product innovation and media-informed social innovation; as such, it is an example of an organisation that aims to address multiple leverage points in a way which creates synergies. GPA members are involved in producing more and better meat replacements and plant-based alternatives for dairy, and boosting the production of pulses and nuts. The GPA

not only applies a full food chain approach by stimulating sustainable production and healthy products: its members are also helping their customers make this shift. The shift in consumption goes beyond the marketing of products by the retailers involved: the GPA envisages this as a social innovation that requires a strong communication strategy.

GPA has a social media channel that promotes general awareness of healthy and sustainable diets. It uses social media extensively to involve vloggers, chefs and other influencers and role models. Providing better information to consumers is a potentially effective way to change those habits and routines that form potent barriers against large-scale changes in diet. GPA's impact report for 2018 highlights that 70 new products based on plant-based protein were brought to supermarket shelves, with sales of such products growing by 3.2%. It also underlines that 300 messages by social media influencers reached 100,000 followers, although the impact of these messages and any change in consumer behaviour has not been assessed.

National Prevention Agreement

Our current lifestyles, including food consumption, have several undesirable effects such as reduced quality of life and worse health outcomes. Although governments have instruments that directly target consumers, like providing information and education and imposing taxes (such as on sugary drinks), a food system approach that also targets stakeholders such as retailers and the food industry could potentially be even more useful.

The Dutch National Prevention Agreement (2018) between the Dutch government and dozens of organisations on reducing obesity, smoking and alcohol consumption is an example. The signatories agreed to implement changes such as serving healthier meals in schools and sport canteens, reducing the sugar content of soft drinks, offering more water fountains, showing fewer commercials for unhealthy products and serving smaller portions of healthier products in catering. Supermarkets promised to nudge consumers into consuming healthier products.

This example is typically Dutch, with its overtones of consensus and public-private structure. The initiative is a reflection of the fact that it makes sense to reduce sugar and salt content of products step by step in a collective action instead of expecting competition in the market to provide healthier products.

Rondeel

Rondeel is a system for keeping laying hens that is more environmentally friendly and treats animals better than traditional practices. The initial design of Rondeel was developed in the research project Houden van Hennen, which means both 'keeping hens' and 'loving hens'. The project took place in a rather turbulent period for the Dutch egg-producing sector. In 2003, there was a massive outbreak of avian influenza throughout the areas of the Netherlands where chicken farms are concentrated. In addition, two European animal welfare regulations, scheduled to take effect in 2006 and 2012, outlawed the practice of trimming the beaks of chickens and forbade the use of battery cages, respectively. These two measures had a big impact but did not lead to many new initiatives in the sector itself. The Dutch Ministry of Agriculture asked the agricultural research institute Wageningen University & Research to look at new

ways of keeping laying hens for egg production in order to help boost the sustainability of this sector.[27]

Houden van Hennen adopted a design strategy in which a small team of young researchers from a variety of disciplinary backgrounds alternated between research & analysis on the one hand and close interactions with a diverse group of stakeholders from the sector on the other. This approach was implemented to maximise the influence of stakeholders on the goals of the project and the values embedded in its results, while also challenging them to look further than their immediate short-term interests so as to ensure that things would improve in the egg husbandry. The introduction of the system in commercial practice was taken up later on by an entrepreneur with a franchise formula and an exclusive contract for the largest retailer in the Netherlands.[27]


6

Food policy for a more sustainable and healthier food system

The key message of this paper is that there is a need for food systems perspectives and food system innovations to enable the transformation to a more sustainable and healthier food system on a global scale. This transformation is important as the planet and its inhabitants are facing urgent food-related problems such as climate change, environmental pollution, loss of biodiversity, and insufficient affordable food and unhealthy diets. Such a food transformation requires action from all stakeholders in food systems and this chapter focuses on policies that would encourage the transition to a more sustainable and healthier food systems.

As the root causes of urgent food-related challenges are an integral part of food system structures and dynamics, it is necessary to look for potential solutions in a food system perspective that go beyond the food chain perspective of production, processing, distribution and consumption. We recommend that policymakers adopt the food systems perspective, taking into account the social, political, economic and environmental factors in food chain activities, and allowing the inclusion of feedback loops. The food system approach helps clarify the trade-offs between intervention strategies and system outcomes in all three (social, economic and environmental) sustainability dimensions. More specifically, such an approach helps policymakers identify effective intervention points and design appropriate policy measures that contribute to at least one sustainability dimension without compromising others.

Need for well-targeted, coherent and integrated policy approaches

The food system approach also challenges the widespread policy approach of focussing mainly on 'getting prices right'.[b] While the incentive perspective is not obsolete, the food system approach emphasises the need for policy approaches which combines and integrates various measures at national and EU-level. Getting the information flows right and getting the institutions right matters as much in times of change.[31] This coherence issue has multiple aspects:

it combines first and second-pillar CAP measures, and includes regulatory measures and conditional payment schemes (e.g. cross compliance, agri-environmental and climate payments, environmental regulations and support for non-productive investments).

A second policy lesson is that policy approaches need to be carefully thought through as to where and in what manner the food system should be modified. Agricultural policy has a strong primary sector focus. But as the food system approach demonstrated, interventions in places other than primary agriculture could be as effective or even more so. In addition, when policy interventions in the primary sector are not combined with synergy-creating policy measures affecting the upstream and downstream stages of the supply chain, their intended impact could very well be quite limited. In other words, effective food policy should involve policy mixes that include several complementary policy instruments in a range of policy domains at international, national and regional governmental levels.

Achieving such a complementary policy mix is challenging due to existing policies: if policymakers are not careful, the addition of new policies may lead to

incoherent and inconsistent policy mixes.[32] For instance, innovation policies aimed at strengthening the economic position of domestic industries in exporting abroad may support unsustainable industries and consumer behaviour, and that can obstruct the transition to more sustainable and healthier food systems.[33] Health intervention can also stimulate healthy but unsustainable consumer behaviours. For example, stimulating fish consumption for the purpose of improving public health may have an unintended negative impact on marine life.[34] These tensions are inherent in decision making and it is important for policymakers to be conscious of potential trade-offs when designing policies.

Specific policy interventions needed for system innovation

As we have seen, the transition of agriculture to more sustainable pathways requires new approaches and innovations. Food system innovation focuses on promising upcoming alternatives that can change the status quo in a system, such as new or green proteins. System innovation reveals that policy plays an important role in safeguarding and supporting these promising alternatives. This protection is needed because it takes a lot of investment, time and

experimentation to develop an alternative that can compete with the established food system components. The institutional framework (including policies) is mostly geared to the incumbent industry, and not to the infant industry that still needs to prove its usefulness. Most initiatives working on promising alternatives do not reach their transformative potential due to issues like obstructive rules and regulations. Promising alternatives without policy support may very well lose their momentum and go bankrupt as funds dry up or volunteers lose interest. Or they may stay small and find it impossible to gain traction, increase market share and/or build an institutional context that facilitates upscaling.

Policy plays an important role in creating an environment in which system innovation initiatives by new entrants (grassroots and start-ups), researchers and industry partners can take root and bloom. Policies can be implemented to help kick-start and support desirable initiatives on the one hand and pressure incumbents to take responsibility while banning socially and environmentally unacceptable elements of the food system on the other. Policymakers can kick-start initiatives by organising brainstorming or networking events that bring together relevant actors from the private sector, civil society and research organisations. Funds can also be provided for social and research & innovation projects with valuable social and environmental concepts/ideas.

This alone is insufficient to generate system innovation, however. Pressure on the status quo can be exercised by banning or phasing out unsustainable or unhealthy practices that are deemed socially unacceptable. Policy depends on high-quality data on the environmental, social and health effects of food systems to identify undesirable effects and show established stakeholders that they are unacceptable. Moreover, NGOs and social movements play an important role in signalling concerns and organising social involvement and pressure on the status quo.

International environment as driver or barrier to reform

A country's food systems is not restricted to its national borders, operating in an international environment with respect to both market exchanges and the institutional-political framework (WTO, FAO, WHO, OIE, etc.). As food systems are a nexus of economic activities, fair economic rules that ensure a level playing field are a prerequisite for its good functioning. National policies, such as the stimulation of circular agriculture, cannot ignore this international dimension. Improving the sustainability of food systems ultimately needs collaborative

efforts, not only from different stakeholders (farmers, industry, retailers, consumers) but also at different governance levels (national, EU, WTO). Moreover, international agreements and standards (e.g. Codex Alimentarius, SPS, TRIPS) are important in co-determining the course food systems can take in its development. The international dimension can have an impact on food systems in a range of ways: as a constraint, as a barrier to change or as an impetus for urgent change (e.g. the Paris Climate Agreement). For this reason, the work of international institutions such as the OECD is crucial in helping create an enabling environment for food systems so that they can deliver sufficient, safe, healthy and tasty food in a sustainable manner. Innovations are also needed at the international level to address future challenges for food systems.

A benefit of the food systems framework is that it opens up the borders of the potential added value that the future food systems might bring. There are already multiple examples of farmers providing care, tourism, health products, raw materials for biobased products (e.g. furniture, textile, plastics), energy, nature conservation, water management, day care, landscape management and other economic activities. This challenges the division of policies into separate pillars, and underscores the need for cross-cutting and flexible policy approaches that transcend borders between agricultural, environmental, trade, health and food safety policy domains as and when necessary, and are able to adjust to changes in society.

About the authors

Anne-Charlotte Hoes (1982) is an action-researcher at Wageningen Economic Research. Her expertise in (system) innovation, stakeholder engagement, reflexive monitoring and communication enables Anne-Charlotte to assist multi-actor initiatives to improve their strategy and realise transformative change.

Roel Jongeneel (1962) is a Senior Scientist and policy analyst at Wageningen Economic Research and assistant professor at Wageningen University & Research. He is an expert with respect to EU and national agricultural and environmental policies, the dairy sector, and market outlook assessments.

Siemen van Berkum (1961) is a senior researcher at Wageningen Economic Research. He has a PhD in economics. His research concerns agricultural policy and trade analysis, food supply chain and food system analysis.

Krijn J. Poppe (1955) is a business economist working in research management at Wageningen Economic Research. As Chief Policy Analyst he helps decision makers in policy and business to understand and act upon trends in agri & food, based in science. Krijn is much in demand as a speaker on the future of farming and food.

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Colophon

Authors
Anne-Charlotte Hoes, Roel Jongeneel, Siemen van Berkum and Krijn Poppe

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Gertan / Shutterstock.com, Marte Hofsteenge, ingehogenbijl / Shutterstock.com, Shutterstock, Tada Images / Shutterstock.com, Wageningen University & Research, Hans Wolkers

Wageningen Economic Research
PO Box 29703
2502 LS Den Haag
Netherlands
www.wur.eu/economic-research

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