Towards sustainable and circular farming in the Netherlands

Lessons from the socio-economic perspective

Hans Vrolijk, Joan Reijs, Marijke Dijkshoorn-Dekker

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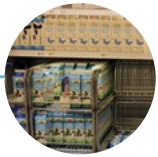
Content



Abstract

The dutch dairy sector has shown a strong development in the last decades, resulting in fewer but larger and more specialised farms. Larger farms and more intensive ways of production have raised concerns about environmental impacts. This paper shows that there is a clear economic incentive to increase the scale of production. Larger farms tend to show better economic results in terms of lower cost prices and higher incomes. The environmental results are more diverse and depend on the chosen indicators. Larger farms are able to include environmental objectives in their farm management when there are clear incentives to do so. These incentives can be provided by policies, but also by private sector initiatives. Several sustainability initiatives have been developed to monitor and improve the sustainability performance of farms.

Our current way of agricultural production is faced with several sustainability challenges. Circular food systems are expected to contribute to the solution of these challenges. In the Netherlands, policy measures and sector initiatives are developed to increase sustainability and to implement and experiment with the concept of Circular Agriculture. This concept is deliberately broadly defined. However, to guide development towards more sustainable production systems, it requires objective parameters and goals at different levels of scale. This would allow all stakeholders to develop solutions in their own circumstances and objectively evaluate progress.

One of the bottlenecks of the transition towards more circular food systems is the search for new business models for farmers. Some frontrunners are currently developing new circular farming businesses. These innovative (social) entrepreneurs are experimenting with new business models that contribute to the realisation of circular agriculture. This paper describes methods that have been developed to assist farmers but also regional governments in the transition to a more sustainable agriculture and the development of new business models.

Developing new business models together with frontrunners is just a first step. Questions like 'How to broaden these initiatives to sector level?', 'How to provide effective incentives?', 'How to incorporate external effects in prices?' and 'What are the costs of farm investments or practices to improve sustainability?' and 'Who should pay for a more circular agriculture?' are still very much unanswered.


1

Introduction

Global quest for sustainable agriculture and circular food systems

Sustainability has many definitions. The United Nations uses the concept of sustainable development, defined as development that meets the needs of the present without compromising the ability of future generations to meet their own needs. Food production plays a central, but also ambiguous role in the quest for sustainable development globally. On the one hand, food is a primary necessity and availability of food is essential to eradicate hunger, poverty and malnutrition. On the other hand, current agricultural production is an important contributor to various environmental problems. It contributes to climate change, deforestation, eutrophication, soil deterioration, water depletion and other adverse biodiversity impacts. A large share of the negative impacts of agriculture globally is attributed to livestock production. An important reason for this is that a large share of current agricultural land is used for the production of animal feed, instead of direct crop production for human consumption which is generally much more efficient in terms of land use. On top of that climate change increases the risk of incidents (such as floods and droughts) while the structural developments have made our current production systems economically more vulnerable to such incidents. The quest for sustainable development of agriculture can be viewed from many angles. In general it can be stated that it requires not only optimisation of current farming systems but also a smart re-allocation of land and a re-thinking of the current trends of structural development and specialisation and its impact on the sustainability performance of farms.

Dutch approach: Circular Agriculture

Recently, the Dutch Ministry of Agriculture, Nature and Food Quality introduced a future vision (LNV, 2018; LNV, 2019). This vision describes how Dutch agriculture can cope with its societal challenges through a transition towards 'Circular Agriculture'. Circular Agriculture is defined as agriculture with the lowest possible harmful emissions to the environment and the highest possible resource efficiency. The aim is to maintain a leading position in agriculture globally by taking the lead in a transition towards more circular farming systems.

In this vision, circular agriculture is deliberately broadly defined. It includes environmental goals like reduction of carbon and ammonia emissions, efficient use of inputs, reduction of food waste and biodiversity loss, a better integration of agriculture and nature conservation, and more efficient use of resources from other sectors. Also more socio-economic targets are included like improving the economic perspective and market power of farmers and improving social cohesion between farmers and society. Targets are not exactly defined. Circular Agriculture does not aim for a single production system but leaves room and takes time for experimentation on different solutions. The vision is valued for its richness, but also criticised for its vagueness. Regardless of your position on that axis, it is an important guiding document for sustainable agriculture in the Netherlands.

Although the scientific debate on the pros and cons of the giant leap transition versus small wins approach is still ongoing, the vision on circular agriculture takes a small wins approach as point of departure. Whereas the doyen of Dutch transition theory consistently argues that these sustainability and circularity challenges call for a giant leap of faith (e.g. Rotmans, 2017), recently the idea has gained momentum that an emphasis on small steps does not necessarily entail the incrementalism pitfall of piecemeal engineering but could also generate radical and durable innovations in the long run. Rather than relying on an apocalyptic time-is-running-out framing, a small wins transition approach emphasises careful observation of small steps and targeted incentives and policies. That requires time, since people need to have opportunities for experimenting, seeing how things evolve and for sharing their experiences. This approach may seem to conflict with a felt urgency to address major social issues rapidly, but it would be sage for policy-makers to show some patience (Termeer and Dewulf, 2019).

The vision on circular agriculture takes a small wins approach as point of departure

Article reading guide

The transition towards more sustainable and circular agricultural production is complex. Economic reality should not be ignored and the complexity of changing existing social relations and institutions should not be underestimated. This paper aims to describe the state-of-the-art and draw some lessons in achieving

a more circular and sustainable agricultural production from a socio-economic perspective. Here, the dairy sector in the Netherlands is used as show case. Dairy is a major sector in the Netherlands in terms of economic value, number of farms and the agricultural area utilised. This paper combines an analysis of the structural developments of the dairy sector, its implications for sustainability and sector initiatives to mitigate negative impacts.

Section 2 contains a retrospective analysis of the structural development of the dairy sector in the past decades and its implications for the sustainability performance of the dairy sector. Section 3 discusses several sectoral initiatives to improve sustainability of the Dutch dairy sector. The approach and value of these initiatives is briefly described. Section 4 discusses opportunities at farm level to create new business models that contribute to the circular economy and the way in which governments can facilitate the search for and implementation of new business models. Section 5 concludes with a discussion on the current situation and the research agenda for the comings years.


2

Structural development in the Netherlands and its implications for sustainability

Structural change has been a constant factor in Dutch agriculture. For decades the number of farms decreased and the size of farms increased. Since the 1970s the number of farms has decreased two to three per cent every year. The explanation is a combination of economic, technological and policy related factors (Zimmerman and Heckelei, 2012; Vrolijk and Poppe, 2016). Technological innovation reduces the per unit costs. When adoption spreads, competition increases and prices will go down. This forces the others to adopt this technology or leave the business which leads to structural change. This development is strengthened by developments in labour productivity. In the Netherlands still many farms are run as family farms. Investment in new labour-saving technologies allows the farmer or the farming family to run a larger farm with the available family labour or allows for off-farm employment. New juridical and financial structures further increased the scale of production.

Structural change in Dutch agriculture is clearly reflected in the developments of the dairy sector. In 1970 there were still more than 110 thousand dairy farms in the Netherlands (see Figure 1). The average number of dairy cows per farm was about 25. In 2019 the number of dairy farms decreased to about 16,300 and the average herd size increased to 96 cows. Although still limited compared to the development in some other countries, the Netherlands consequently also shows rapidly increasing herd sizes. The mid livestock point (Lund, 2004) in 2019 was above 140 dairy cows (50% of the cows are in herds of more than 140 cows and 50% of the cows in smaller herds) and the 75 percentile of this indicator increased to close to 170 cows (25% of the cows are in herds above 170). Despite this strong growth in size of dairy farms, the dairy sector still consists to a large extent of family farms. This increase in farm size has been accompanied by large changes in the organisational and financial structure of farms.

The average number of dairy cows increased from 25 in 1970 to 96 in 2019

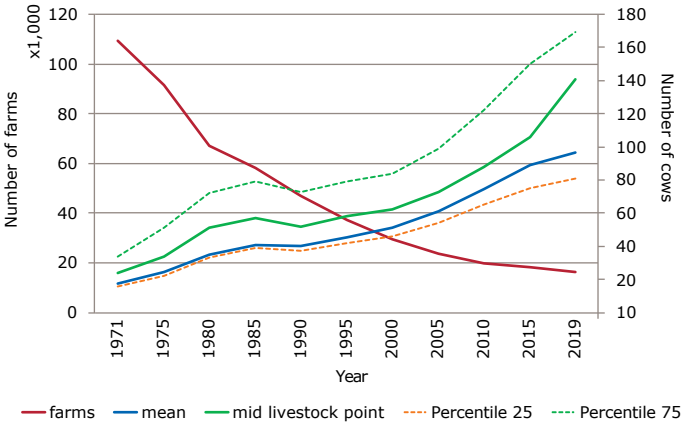


Figure 1 Structural change in the dairy sector (updated from Vrolijk and Poppe, 2016)

Structural change and its impact on farm incomes

Figure 2 shows how this structural change links to the development in farm incomes over a longer period. It shows that the increase in scale has been a necessity to keep incomes at the same level. The figure clearly shows that the fluctuations in income in dairy farming from 2006 are considerably larger than in previous years. High peaks (2007, 2017) alternate with deep lows (especially 2009, but also 2016). Fluctuations at farm level are known to be even larger than fluctuations at group level (Vrolijk and Poppe, 2020).

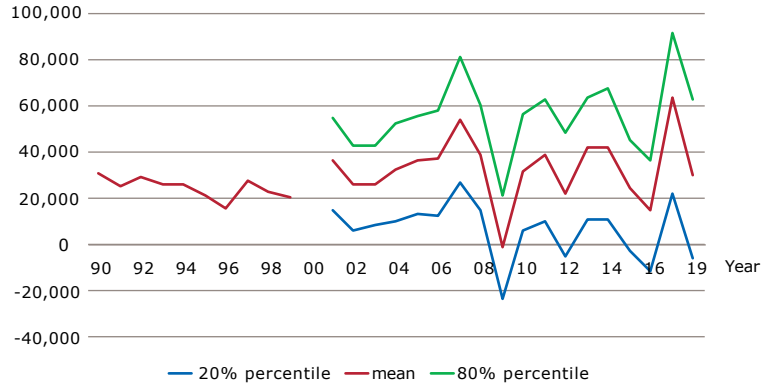


Figure 2 Development of income (€ per year per unpaid year unit) of dairy farms, including the spread (1990-2018, spread from 2001-2018). Source: Bedrijveninformatienet.

Figure 2 also shows that income differences between farms remain large. The farming sector is characterised by large differences in results. In the year 2017 the mean income per unpaid labour unit of dairy farmers was around 65,000 euros, but 20% of the farms achieved income levels of more than 90,000 euros and 20% of the farms achieved income levels lower than 23,000 euros. In 2016, with a mean income per unpaid labour unit of 18,000 euros, more than 20% of the farms achieved negative income levels. Large differences in income levels can be observed for all years.

Structural change and its impact on sustainability performance

Differences in economic performance are due to farm characteristics, such as size, intensity, location and the surroundings of the farm, but also due to the quality of farm management. A similar dispersion can be observed in the environmental performance (Doornewaard et al., 2019a).

Table 2 focuses on one aspect underlying differences in the sustainability performance of farms, the size of the farm. Structural change has resulted in an increase in large farms, at the same time a group of farms has chosen to combine farming activities with other on and off-farm income sources.

Table 2 Economic and environmental performance of different size classes (average 2016-2018)

Variable	Size class		
	0-300 kSO	300-600 kSO	> 600 kSO
Number of dairy cows	49.0	99.3	207.5
Economic size (1,000 SO)	211	420	874
Total utilised agricultural area (ha)	33.0	59.4	113.6
Hectare grassland (ha)	26.1	47.1	81.7
Total milk production (1,000 kg)	397	853	1890
Milk per cow	8,021	8,550	9,060
Milk per ha	12,452	15,347	18,052
Labour hours per 100 litres of milk	0.88	0.55	0.37
Cost price milk (euro per 100 kg)	44.83	39.97	34.29
Returns per 100 euro of costs	78	92	102
Income per unpaid labour unit (1,000 Euro)	20.2	37.1	60.8
Feed cost per cow	1030	1004	1077
Health cost per cow	102	99	97
Solvability	0.80	0.68	0.63
GHG emission per cow	9,921	10,368	10,786
Energy use per cow	4,900	5,097	5,236
Ammonia emission per ha	45.7	50.7	51.7
N surplus per Ha	157.6	147.2	132.0
Grazing hours	2,256	1,617	1,547
Antibiotics use per cow	1.90	1.97	2.28
Replacement rate	33.04	29.28	29.89
Somatic cell count	183.08	173.90	188.11
Percentage other economic activities	0.03	0.05	0.03
Types of nature management	1.99	1.68	1.98
Percentage revenues nature management	0.04	0.02	0.01
Herfindahl index	0.99	0.98	0.96

Source: Dutch Farm Accountancy Data Network (Bedrijveninformatienet); analysis by authors

Comparing the sustainability performance of farms in the lower, middle and highest size class shows some clear differences. In general, the economic performance of farms in the highest size class is better than those in the other classes. The labour productivity is much higher on farms in the highest size class. The cost price is substantially lower, resulting in higher returns, and higher incomes per unpaid labour unit. A lower number of grazing hours results in higher feed cost at farms in the highest size class. Despite a higher use of antibiotics, the health costs per cow are lower. Farms in the lowest size class are involved in a similar number of nature management activities, but the share of revenues from these activities is substantially higher at farms in the lowest size class.

The environmental performance shows a more mixed result, also depending strongly on the choice of the indicator. GHG emission and energy use per cow are for example higher on farms in the highest size class but this higher emission is offset by the higher milk production per cow, resulting in only small differences in the per kg GHG emission or energy use per litre of milk. Farms in the highest size class have a lower N surplus per hectare and higher antibiotics use. Also Wuepper et al. (2020) show mixed results with respect to the environmental performance. They conclude that the hypothesis that small family farming is unambiguously more sustainable cannot be supported.

The results confirm that there is an economic incentive to increase the scale of production. Larger farms have optimised their farms to increase labour productivity. The impact on the environmental performance is less straightforward. Although larger farms are more intensive, they are very well able to include environmental objectives in their farm management if there are clear incentives to do so. The vast amount of policy measures on manure and minerals is reflected in low N surpluses per hectare at larger farms. Sustainability objectives can contribute to the pressure to increase scale of production depending on the measures taken. More efficient feeding and better animal welfare can be achieved by all farms. Environmental measures requiring investments in for example new stables result in higher fixed costs. This increase in costs results in farms stopping when these investments are not economically viable. Given the better economic performance of larger farms, these farms are better able to bear the costs of additional investments. Besides policies, also sector and private company initiatives can provide clear incentives to increase the sustainability performance of farms. Some of these initiatives are described in the next section.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Current sustainability challenges and initiatives

Large companies in the agrifood domain play an important role in the realisation of sustainable and circular agriculture. Most companies are eager to take action to improve sustainability of their products and many present ambitious targets. Unilever, for instance, has developed its sustainable living plan[1], which includes among others the objective to reduce its environmental impact by half. Danone[2] has developed its One Planet One Health vision, of which one of the targets is to be carbon neutral by 2050. Drivers for such statements and targets to be achieved can be diverse: internal intrinsic motivation, market opportunities, security of resources, external pressure from NGOs or buyers and policy developments. Whatever the driver, taking action on sustainability of food production implies taking action at farm level, as the major part of the impact occurs at farm level. In many cases, taking action at farm level is easier said than done for such companies, because:

Taking action at farm level is easier said than done

1 many companies do not have a direct relation with farmers and are practically not able to directly influence production methods;
2 content and aims of sustainability goals often get lost in translation in the supply chain. Large companies sometimes lack a thorough understanding of farm management;
3 changes must be made in the context of existing international market conditions. Open markets imply that food can be sourced globally and that competition on price remains important.

In the Netherlands, agribusiness has developed several initiatives to improve sustainability and circularity of agricultural production. One of the most extensive initiatives in the dairy sector is the Dutch Sustainable Dairy Chain (SDC). This industry-wide initiative was initiated in 2008 by the Dutch Dairy Association NZO (representing dairy processing companies that process 98% of

1 https://www.unilever.com/sustainable-living/
2 https://www.danone.com/about-danone/sustainable-value-creation/our-company-goals.html

Dutch milk) and the Dutch Federation of Agriculture and Horticulture LTO (representing 70% of Dutch dairy farmers). SDC was initiated to collectively and proactively respond to sustainability issues and demands from society and policies. SDC has formulated sustainability targets for the associated partners.

Agribusiness has developed several initiatives to improve sustainability and circularity of agricultural production

All partners are free to develop their own sustainability programmes and activities to achieve these targets. SDC has developed several governance structures (see Duurzame Zuivelketen (2019) for details) to support its partners on improving sustainability performance. In 2019 SDC developed a new approach towards 2030. Central in this new approach are a broader cooperation within the supply chain and the inclusion of a broader set of sustainability issues. One of the aims is to contribute to the operationalisation of the 'Circular Agriculture' vision of the Ministry.

SDC is a collective, pre-competitive and nation- and industry-wide initiative to raise the sustainability performance of the Dutch dairy industry. Wageningen Economic Research contributes to these initiatives by developing and executing progress monitoring (including indicator development) on the sustainability targets defined by SDC (e.g. Doornewaard et al. (2019b)). Furthermore, Wageningen Economic Research contributed to the development of sustainability programmes of the associated dairy companies. These programmes aim to stimulate and facilitate farmers in improving their management.

This work focuses on identifying best practices to achieve targets and developing instruments that give farmers incentives to apply these practices. One of the central elements in this work is the RESET concept (Jansen et al., 2016, see Figure 3). The RESET concept departs from the perspective that farmers' behaviour (people's behaviour in general) is not only rationally determined but also by a more peripheral route (based on routines and executed more or less automatically and impulsive without thoughtful considerations). The model distinguishes five different types of incentives: Rules, Education, Social pressure, Economic Incentives and Tools. An example of an economic incentive used within Sustainable Dairy Chain is the grazing premium that has been introduced on a large scale in the Netherlands.

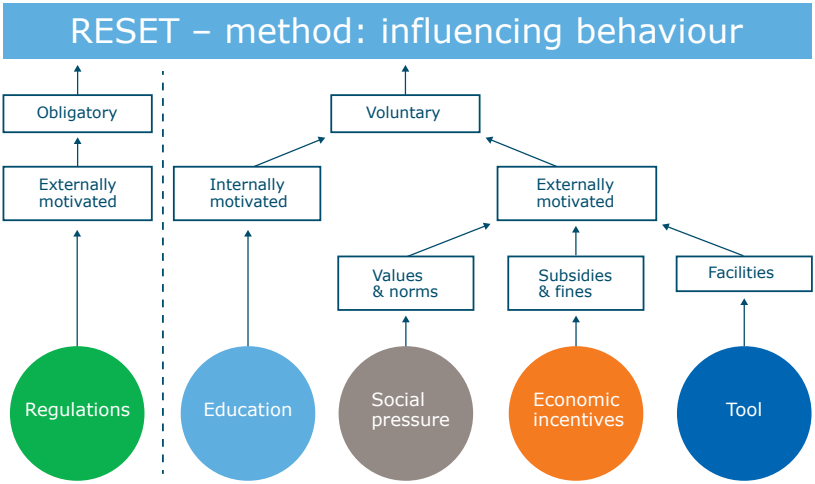

Figure 3 RESET model to influence farmers' behaviour (adapted from Jansen et al., 2016)

Development of new sustainable market concepts

Besides trying to collectively raise the bar for the sustainability performance in SDC, dairy companies in recent years have also developed new sustainable market concepts. One example of these concepts is 'On the Way to Planet Proof'. With these concepts, based on separated milk streams, higher milk prices are negotiated with clients. Supplying farms have to prove that they meet certain sustainability standards to participate in the concept. In return they get a higher milk price. These kind of concepts usually apply only to a limited portion of milk produced by the company, usually it starts with products for the national market with a high shelf-visibility.

Business initiatives to improve sustainability and circularity of dairy production are not restricted to dairy companies. Also other stakeholders are investing a lot of time and money in sustainability improvement. An important multi-stakeholder initiative with several partners (e.g. Rabobank, LTO Nederland, Agrifirm, For Farmers) as well as governmental and non-governmental organisations on board is Deltaplan Biodiversiteitsherstel. The aim of this initiative is to create a broad public movement to convert a trend of biodiversity loss in the Netherlands into a trend of biodiversity gain. It is anticipated that this

requires a system change in agriculture, nature and the public domain with a focus on shared values, improved business models, stimulating and coherent legislation, new knowledge and innovation and regional cooperation. One of the large challenges of this initiative is to find ways to fund the required transition. Wageningen Economic Research has, for instance, calculated the additional costs to make first steps in improving the biodiversity performance of dairy farms at 2-3 cents per kg milk (Beldman et al., 2020). An unanswered question is how these additional costs can be financed. Deltaplan Biodiversiteitsherstel is looking into fees or premiums for biodiverse milk and eco-system services provided.

Despite these promising initiatives, the implementation of circular agriculture still requires a clear and consistent definition of objectives and indicators to measure the achievement of these objectives. Given these objectives, more specific desired farm practises should be developed including incentives for farmers to adapt these farm practises. The development of business models in which farmers can fulfil the requirements of a circular agriculture requires a realistic estimation of costs and benefits of implementing sustainable farming practises. All these issues are work in progress. Different initiatives exist to experiment with farming practises and business models to search for viable building blocks for a circular food system.

Implementation of circular agriculture still requires a clear and consistent definition of objectives and indicators


4

Building blocks for circular food systems

Increasing societal demands, the policy vision on a circular agriculture and sector initiatives on sustainability performance all pose demands and restrictions on farmers and the way they run their farming business. Given the complexity of sustainability and the trade-off between different aspects of sustainability, it is not very straightforward what the future farming business should look like in a small wins transition approach (Termeer and Dewulf, 2019). In this approach different stakeholders play a role. Farmers are looking for new business models, research organisations try to support this search and regional cooperations, regional governments and national governments play a role in facilitating the transition process.

Need for new business models

To make a shift to a more circular food system there is a need for new business models. With the current dominant business models, in which the price of products plays a key role alongside statutory (minimum) quality requirements, a transition to a more value-oriented food system with circular and nature-inclusive[3] agriculture cannot be taken for granted. Ultimately, these new business models must be developed by the entrepreneurs themselves. All those who are unsuccessful will be forced by 'the discipline of the market' to end their activities. Farmers however, will not be able to develop the new business models resulting from new social demands on their own. The development of new innovative values and business models requires the cooperation of all partners in the chain, the government and consumers (Jongeneel and Baltussen, 2018).

A study by Dijkshoorn-Dekker and Kortstee (2020) into a broader range of knowledge and innovation shows that there is a need for knowledge on a number of points. An important challenge for any business model is how to create value from nature: How to demonstrate the value and even more important how to get somebody to pay for these values. It is difficult for many

3 Although there are subtle differences between definitions of circular and nature-inclusive agriculture, for the aim of this paper we use them interchangeably.

entrepreneurs and chain parties to translate the societal ambition for nature-inclusive agriculture into sustainable business models. There is also a lack of an unambiguous uniform vision on circular/nature-inclusive agriculture; for now it is still a vague dot on the horizon. There is a strong need for an integral approach. Many initiatives focus on one aspect (i.e. climate or bio-diversity) but farmers must deal with a system with trade-offs and synergies between different objectives.

Hekkert and Runhaar (2020) indicate that addressing structural barriers is needed to upscale nature-inclusive initiatives. One of the main problems, according to them, is the lack of appreciation for the (ecosystem) services that are provided by farmers. Furthermore, there is also:

- lack of knowledge among farmers and also lack of an independent advisory organisation. Most advice is coming from advisors with commercial interests or with lack of knowledge of different farming systems;
- lack of possibilities for farmers to make strategic changes, e.g. towards more extensive systems;

- lack of knowledge on the impact of circularity on business models. A better understanding of the contributions of circularity to the business model - both quantitatively and qualitatively - ensures more adoption.

Developing and experimenting with new initiatives in the area of circular agriculture are crucial in the development of business models. Various Dutch initiatives exist to experiment with circular food systems to stimulate innovations at farm level.

Polman and Dijkshoorn (2019) describe 31 possible business models for nature-inclusive entrepreneurship in arable farming and livestock farming that are suitable for conventional farmers. These examples cover both intensive and extensive farm businesses and farm businesses that focus more on other economic activities and collaboration with others, such as social organisations, fellow entrepreneurs and chain parties. In the examples, not only money is generated from agricultural production, but value is created for and with nature.

Hoes et al. (2020) give an overview of the diversity of innovative circular farms, providing insight into the various directions in which people can work on circular agriculture. The farms use innovative business models and differ from conventional farms. Existing farms that have integrated aspects of circular agriculture into their existing business model are not included in their overview. 250 farms were classified in seven categories: high-tech controllable systems, modern Mixed Farms, multifunctional agriculture with the community and natural environment as a starting point, new proteins, reduction of external inputs and creating value from residual flows.

Textbox 1 categorises examples of business models into 4 categories based on economic incentives: (1) intrinsic business model, (2) payments through government policy for nature or water management, (3) a price premium for the agricultural product that covers the additional costs of good nature management and (4) integration into a broader business concept.

The examples of business models and their economic rational (textbox 1) show a large variety. The optimal business model is unique for every company because the company structure, development possibilities and the setting of the company differ. Most of the successful farms apply a combination of business models. Polman and Dijkshoorn (2019) draw several lessons on the development of nature-inclusive business models:

Textbox 1: Examples of business models

1 Intrinsic business model – costs can be reduced in the long term by limiting inputs such as fertilizer, crop protection and by improving the soil organic matter, which reduces the risks of droughts. Nature and biodiversity, especially of the soil, are important production factors. Production of renewable energy and fodder at the farm increase the self-sufficiency. Herbal grassland can improve animal health, drought tolerance, image, biodiversity and mineral supply. A forest meadow gives shade to the cows, but also mitigates climate change and improves moisture retention.

A self-sustaining soil provides healthy food, a healthy cow and good manure. This manure in turn ensures an optimal soil. A self-sustaining, natural soil needs fewer extra nutrients and minerals. As a result, less concentrates and less fertilizer are needed. This not only improves the soil but saves money.

The 'Grazing farm' concept relies on as much grass (protein) as possible from own land and as little external input as possible in order to close the cycle at farm level as much as possible. The variable costs are therefore low. The housing is also very sober with low costs. Ultimately, this also leads to opportunities for added value (antibiotic-free).

2 Payment through government policy for nature or water management – National or regional governments or nature organisations can provide payments (or reduced land rentals) for farmers to adopt certain farming practises aimed at protecting or improving the flora, bio-diversity or meadow birds.

Examples of these programmes are 'Arable fields with valuable flora' that prevents the use of artificial fertilizer and herbicides; 'Botanical hay meadow' that forbids the use of fertilizer and plant protection products and 'Meadow bird' arrangements that regulate the mowing of grass and the management of water.

3 A price premium for the agricultural product that covers the additional costs of good nature management – A price premium for the higher production costs of nature-inclusive agriculture can be found in direct and local sales, where a

better price is achieved by means of story telling the product and production process. Another example is the cooperation of farmers with a wholesaler in organic products Udea (Natudis) and a bird protection organisation to develop a special cheese ('Save the rich meadow cheese') which generates money for bird protection.

4 Integration into a broader business concept – Activities that generate money (e.g. care farming, educational activities, cheese making, farm shop and recreation). Care farming is an innovative practice in which agricultural production is combined with health and social services (Hassink, 2017). Clients are involved in food production and, sometimes, in harvesting and preparation, which usually has a secondary benefit of healthier diets for these clients. Nature-inclusiveness adds value to these activities through strengthening the concept and can therefore be used for marketing or social legitimation.

Examples based on Hoes et al. (2019), Grin et al. (2015), Polman and Dijkshoorn (2019)

- There is a large variety of initiatives on nature-inclusive agriculture reflecting differences in entrepreneurs, farms and locations.
- Important drivers to adapt nature-inclusive agriculture are: engagement with nature, opportunity to provide an income, continuity of the farm and the appreciation and enjoyment of the work.
- The development of a nature-inclusive business model takes time.
- Incentives for the development towards a nature-inclusive business model can be found in the current farming practises, changes in societal expectations, new opportunities for cooperation and objectives with respect to the soil, water and bio-diversity.
- Creativity, courage, learning and experimenting are crucial for the success of a new business model.

Given the large variety of business models, an important question is whether the examples can be upscaled to a larger group of farmers, how this transition can be supported and how farmers can be supported to find solutions that fit their setting:

- create space for new business models by adapting agricultural and spatial planning policies,
- create space for experiments in which innovators do not have to comply with some regulations and carefully assess the impact and risk

in order to have a good foundation to adapt regulations,
- focus on targets in policy development and leave it up to the farmers how to achieve the targets,
- look at possibilities to make land available for new initiatives, since land is hard to get and difficult to finance,
- focus on knowledge development and continuous evaluation related to the upcoming systems,
- support innovative farmers is making investments possible,
- support (future-) farmers in strengthening their entrepreneurial skills (Hoes et al., 2020).

Methods to support entrepreneurs

An important approach to support entrepreneurs is the Canvas model. The Canvas business model (developed by Alexander Osterwalder and Yves Pigneur in 2010) is a practical tool to identify and test various business ideas to create value for products or services. This is done by displaying all business activities in a clear and visual way. The model provides insight into the most important challenges for the realisation of an idea and helps to think about testing the assumptions. Canvas can be used for individuals or in a group process to develop, test and ultimately realise opportunities for agriculture with nature (Polman and Dijkshoorn, 2019). An interactive approach to facilitate this process, offers entrepreneurs inspiration, but is also a tool to gain insight in opportunities and limitations. A wide range of nature-inclusive business models for arable farming and dairy farming have been considered taking into account differences in entrepreneurs, companies and locations. Solutions should be tailored to current business operations, a changing environment, 'renewed' cooperation, soil, water and biodiversity.

The Canvas business model is a practical tool to identify and test various business ideas to create value for products or services

In many real-life settings there is a need for a regional approach. To support such a regional approach, Wageningen Economic Research has developed a hands-on Transition Support System (TSS) approach. In the dichotomy of small steps versus big transitions, the TSS approach is more in line with a small steps approach.

TSS is mainly aimed at governments and the agri-food sector to give insight in future developments and possible actions in order to develop and implement strategies. The participation of all stakeholders is crucial for the success of the approach. The TSS approach has been gradually developed through sector initiatives like the Sustainable Dairy Chain and regional initiatives in for instance the province of Overijssel that aims for a transition towards a sustainable food system in 2050. The approach has been used to cultivate a widely supported vision of the future in the province of Overijssel and to develop policies based upon the knowledge of stakeholders, science, models and data. The kernel of the approach is to enable different stakeholders to jointly explore potential future pathways towards sustainable, circular and liveable environments. It provides insight into different prospective actions, and offers policy-makers, business communities and other actors tools to change their policies and strategies (Figure 4 shows the five steps of the TSS approach). The transition of the agri-food sector in Overijssel to a sustainable sector and self-sufficient food system is a complex issue that has been explored by conducting the five steps of the TSS approach:

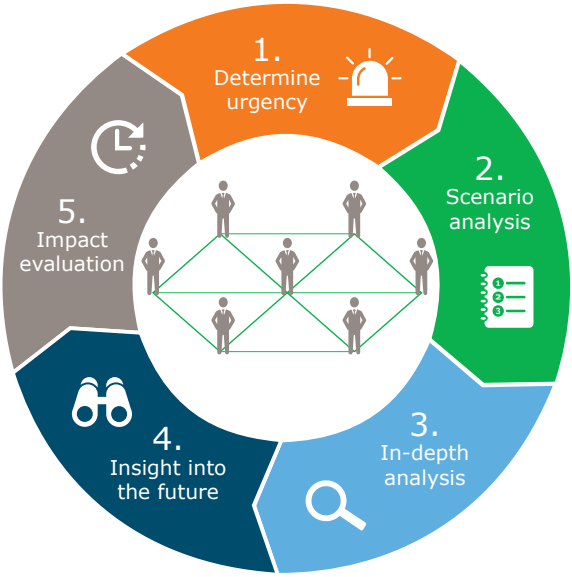

Figure 4 Five steps of Transition Support System approach
Source: Dijkshoorn-Dekker et al. (2019)

- **Step 1: Urgency** – The approach starts with raising awareness of urgent issues, i.e. climate change, population growth in cities and food security.
- **Step 2:** Scenario analysis –Through interviews with stakeholders, anticipated trends and climate scenarios are outlined. The five future scenarios from the IPCC and the Shared Socioeconomic Pathways (SSP), were used to describe impacts for the province of Overijssel.
- **Steps 3 and 4:** In-depth analysis of the prospective actions – In the third and fourth step, the consequences of prospective actions on the landscape, natural settings, citizen groups, geographical locations and economic sectors are evaluated with the aid of spatial and statistical insights. Interactive sessions with regional experts were organised in which potential and ideal future scenarios for the food system for 2050 were formulated, including essential prospective actions to achieve them (Figure 5 shows an artist's impression of the ideal future scenario and prospective actions).
- **Step 5: Retrospective** – Finally, each strategy or portfolio of policies is evaluated on realised versus desired impacts. This also entails raising additional and new policy questions during the interactive sessions.

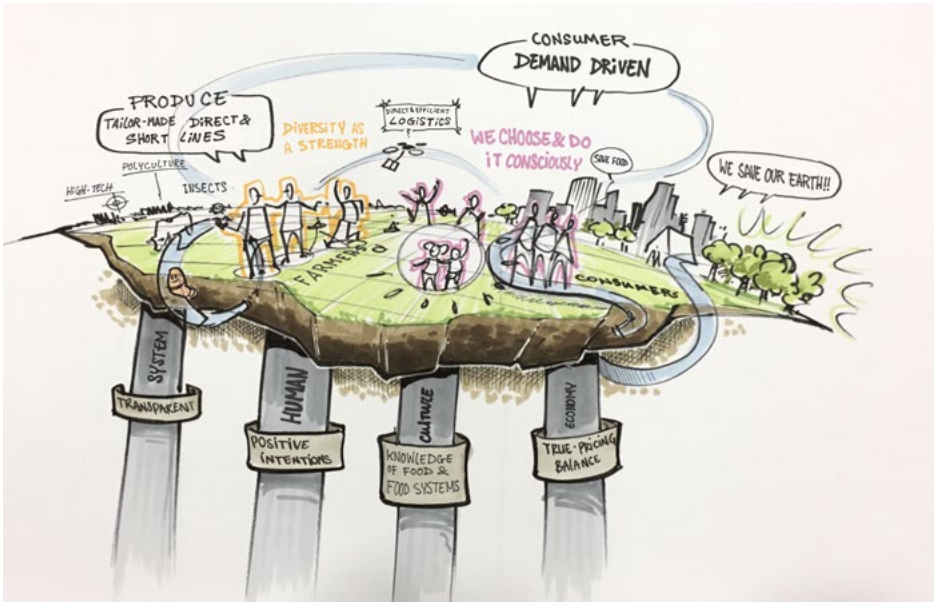

Figure 5 Artist's impression of the ideal future scenario for 2050 and prospective actions to achieve it
Source: Dijkshoorn-Dekker et al. (2019)

Reducing institutional risks is essential in the successful development and implementation of new business models. Clarity, consistency and stability of policies are essential for individual farmers to develop their farm business in directions accepted and appreciated by society. Stability is important for farmers, to adapt their farm businesses and to be able to invest in longer term developments (Poppe en Koutstaal, 2020).

Policy objectives, such a self-sufficiency in Overijssel should be translated in clear policies and policy measures, that give farmers the opportunity to adapt and contribute to these objectives. For example a provincial objective of nature-inclusive agriculture should be backed by supporting measures in the provision of land to those who adopt these practises. Farmers are looking for directions that create sustainable perspectives for the coming years. Farmers, but also the contribution of other stakeholders, are essential in creating these perspectives.


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5

Discussion and future work

Structural change in Dutch agriculture has resulted in fewer but larger farms. Specialisation and more intensive ways of production have resulted in pressures on the sustainability performance of farms. Larger farms show a better economic performance. Larger farms are able to show better results in environmental performance on indicators where they are incentivised by for example strong regulations. The shift to more circular food systems is expected to contribute to sustainability challenges. This paper has described building blocks for a more sustainable and circular agri-food sector in the Netherlands with a focus on the dairy sector. A wide range of initiatives exist to experiment with new approaches and new business models to contribute to a sustainable and circular system.

Further research is needed on how to upscale the successful examples of innovators and niche markets to main stream

The transition towards a more sustainable and circular food system still needs a clearer definition of the (policy) objectives and measures. Furthermore it requires a better definition of an integrated set of indicators to evaluate progress. Objective parameters are needed to evaluate progress at different scale levels (e.g. EU – NL- sector - region – farm). Research projects like FLINT (Poppe and Vrolijk, 2016) have contributed to the measurement of sustainability. The EU Farm to Fork strategy proposes to improve the monitoring system by extending the Farm Accountancy Data Network to a Farm sustainability network. Such a network could greatly help to monitor the sustainability performance within countries and to compare the sustainability of farms across Europe.

Further research is needed on how to upscale the successful examples of innovators and niche markets to main stream. Should it be facilitated by the major food companies, for example the acquisition of innovative concepts like Ben & Jerry's or the 'Vegetarische slager' by Unilever, or should it be made compulsory by law. This immediately leads to the question who should pay for the transition. Will it be paid by the market, the citizens or the consumers? And does the consumer pay for milk or also for landscapes related to dairy production? And should retailers advertise food products on price or on

sustainability? Currently, the willingness to pay for sustainable products is still limited. Even when the Dutch consumers would be willing to pay for more sustainable products, the problem is that a large share of the production is exported. This export market is even more driven by prices.

Or should a shift be made to true price? Given the limited willingness to pay, a relevant question is how the revenues are being distributed over the different stakeholders. Does the farmer get a fair compensation for the extra costs and efforts to produce in a more sustainable way? At national and international level there are several initiatives to monitor prices in the food chain and the distribution of profits in this chain.

The true price is the market price plus the price for all (hidden) costs of externalities that are not reflected in the market price. By offering insight into these hidden costs, which may have value for consumers, chain parties can create new markets/chains in which sustainable products are offered at a higher market price but at lower hidden costs (Jongeneel and Baltussen, 2019). Research into true pricing is still in its infancy (see De Groot Ruiz et al., 2018). There are still methodological challenges (choice of themes/factors, definition of indicators, quantification, comparisons between different dimensions, standardisation, robustness, support) and there is still a lack of sufficient empirical applications and their evaluation (the degree of acceptance is therefore still difficult to determine).

Finally, at the end of day, when asking the question which tangible incentives and policies could be used to support the desired transition, economists will always, at least also, have a look at the possibilities of financial policy measures from the whole plethora of other policy options (Lam et al., 2017). It might for instance be possible to achieve circularity objectives through dedicated payments (subsidies) to farmers adopting certain nature protection measures on their farms (for example a sectoral dairy initiatives in the province of Friesland) or through internalising societal costs in market prices by taxing environmental impacts. Such financial incentives could contribute to the transition towards circular agri-food systems with a more

Financial incentives could contribute to the transition towards circular agri-food systems with a more sustainable use of natural resources and ecosystem services

sustainable use of natural resources and ecosystem services, since consumers respond to the impact of such policy measures on product prices. It could also help to inform consumers about the societal costs of agri-food systems, even if these are not directly reflected in product prices. Information about "true prices" or "true costs" might for instance help consumers to avoid food products with negative environmental impacts and thus high societal costs (Jongeneel et al., 2019).

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