Deloitte.

Net-Positive Future of Food

Harvesting Food and Agriculture opportunities in the Netherlands

November 2022

MAKING AN IMPACT THAT MATTERS since 1845

Chapter 1: The need for food system change

The food system transition is one of the most pressing and complex challenges of our time. Against the backdrop of the current war, supply chain complexity and climate disruption, we need to produce sufficient nutritious food in a sustainable and fair manner to feed a growing population that is expected to reach 10bn by 2050[1]. As the spending power of emerging markets increases, the rising food consumption per capita[2] and a more meat-heavy human diet will put more and more pressure on our ability to feed everyone.

We must transform the way we produce food to become more sustainable. Agriculture accounts for a quarter to a third of total GHG emissions[3], and other planetary boundaries are already at or beyond their limit[4]. We need to produce more nutritious food to enable positive health outcomes, and we must support consumers in their decision to buy food based on nutrition content and sustainable production methods. We also need to improve fairness in the food system, ensuring a fair return for those who produce our food, and make sure that proper food is available at a fair price for the entire global population. While a third of the food produced is wasted[4], the prevalence of severe food security increased from 9.3% in 2019 to 11.7% in 2021, which is the equivalent of 207 million more people in need of food - in only two years' time[5]. Obviously, the status quo is not an option.

The Dutch food and agriculture sector is a powerhouse of vital importance to the Netherlands and to the world. The Netherlands is the globe's number two exporter of food as measured by value, second only to the United States. Agricultural goods account for more than 50% of the total trade surplus and the Dutch economy is estimated to have gained EUR 46.1bn from its export in 2021[6]. There is no doubt that Netherlands needs to take a leadership role in driving the necessary food system transformation.

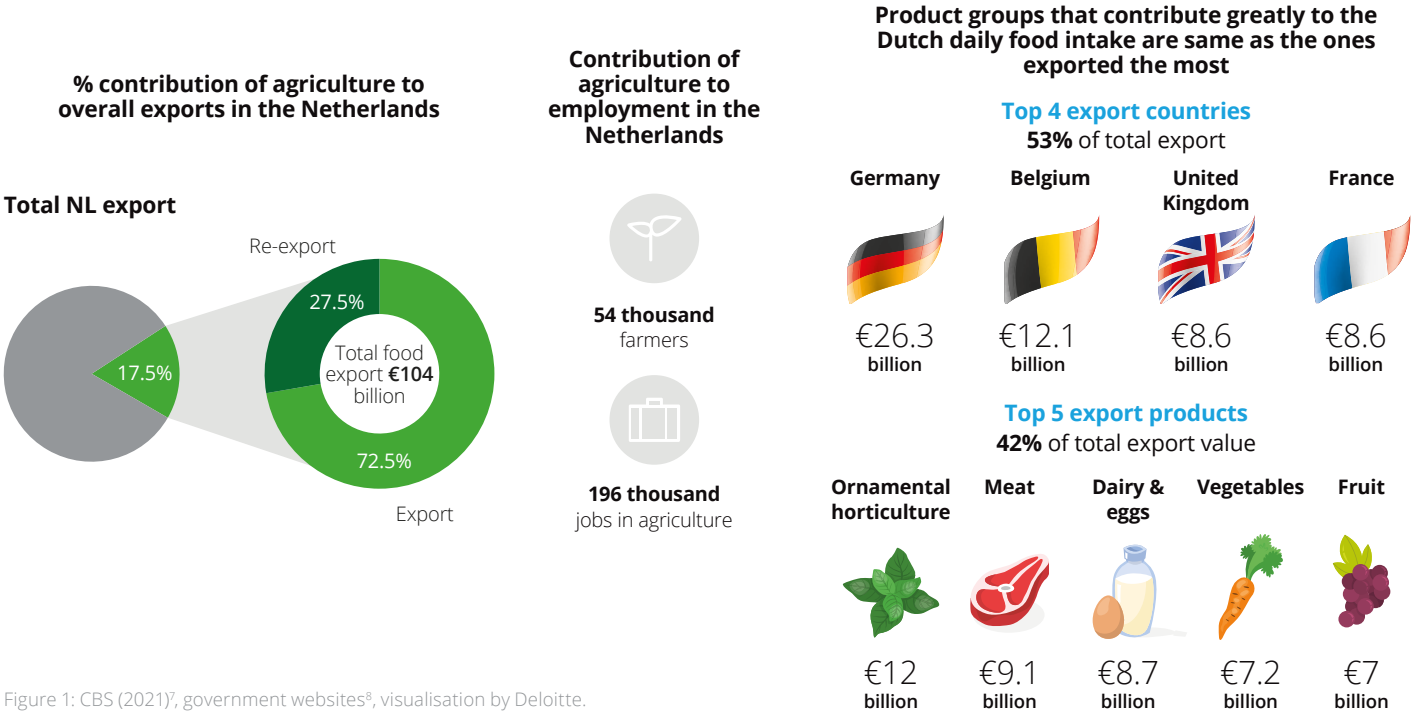
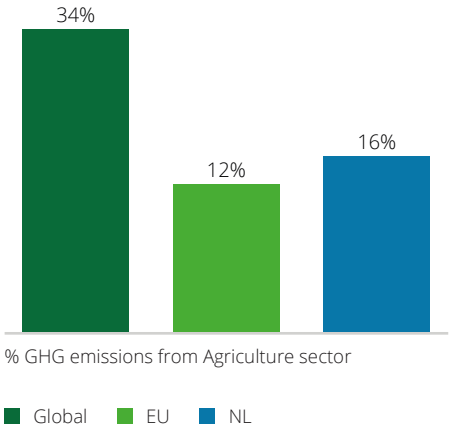


Figure 1: CBS (2021)[7], government websites[8], visualisation by Deloitte.

However, the environmental cost of the sector is equally high. The Netherlands, which has by far the highest livestock concentration in the EU[10], is one of the top greenhouse gas emitters in the region. Although nitrogen oxide levels have been more than halved since 1990[11], 75% of Dutch natural soil is still suffering from an excessive surplus of nitrogen[12]. This presents a natural tension for the sector, trying to balance the value of the sector for the Netherlands and the world in terms of food production on the one hand and reduction of its environmental impact on the other hand.

Given the importance of agriculture to the Netherlands and the world, how do we future-proof the Netherlands leadership position while reducing environmental impact. Sustainable agricultural production, healthy nutrition and waste reduction opportunities need to be grown and harvested in the Netherlands to translate the disruption into a leadership opportunity.



Source: CBS[13], European Environment Agency[14]

Chapter 2: The opportunity

There are significant opportunity areas for sustainability within the Dutch food and agriculture sector. These wil not only help retain the current value of the sector but actually enhance it. We define an opportunity area as something that has the potential to:

- reduce the environmental impact of the food system (consumption and/or production)
- provide economic benefit (protecting existing business or creating new business)
- be aligned to the competitive advantage of the Netherlands.

Taking each in turn, the first step is to zoom in on the emissions caused by the agriculture sector and find the areas where an intervention could be most impactful. These can be divided across four buckets mentioned in **figure 2** (below). As production follows demand, the next step is analysis of consumer diets to discern any opportunities for improvement.

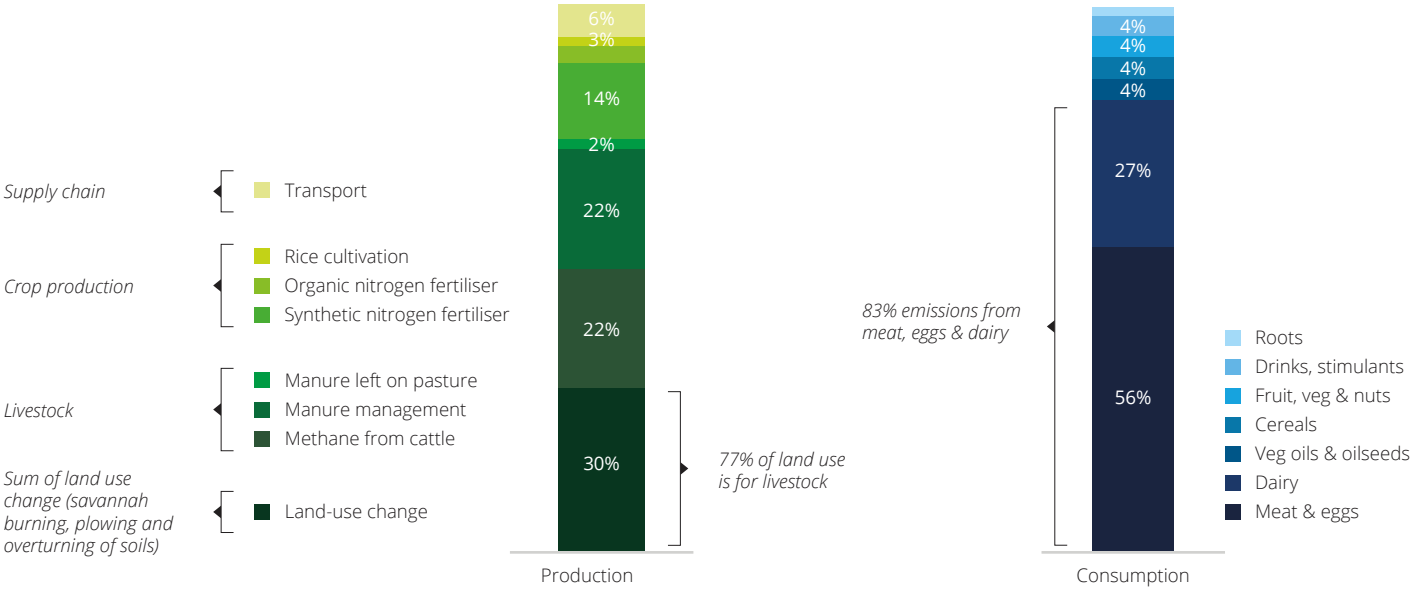


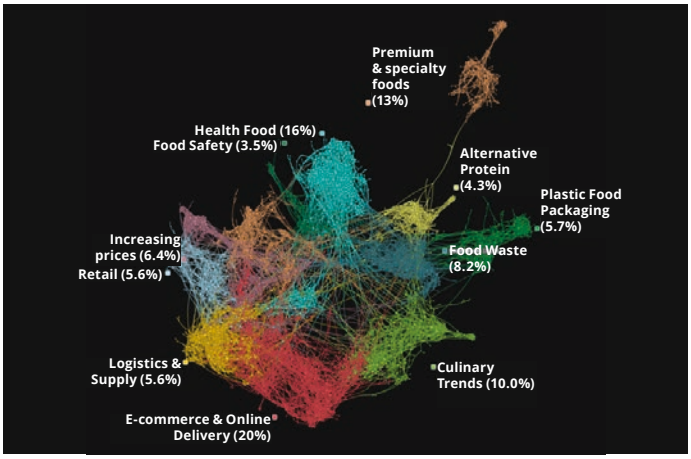
Figure 2: On the left global CO_2e emission from food systems[3], on the right the carbon footprint of average diets across the European Union[3].

Majority of global emissions are a product of land use change, or emissions at farm level – with most methane emissions come from cattle and manure management with fertilisers. Yet there are retail and post retail emissions as well. The majority of post retail is caused by food waste, which is responsible for 6% of global greenhouse gas emissions[3]. When broken down by consumption, it is clear that dairy, meat, and eggs are dominant, accounting for 83% of GHG emissions from the average EU diet[3]. In conclusion, the five top areas where an intervention could significantly reduce individual carbon footprint are:

- targeted use or sustainable replacement of traditional fertilisers
- reduction of livestock emissions
- improvements in on-farm agricultural sustainability and efficiency improvements
- consumption of sustainable (and nutritious) products
- waste reduction across the value chain.

The five areas of environmental intervention mentioned above have also the attention of consumers and investors. **For instance, these areas appear frequently in investors' and consumers' lists of 'most discussed matters' on sustainable agriculture and food systems, over the last seven years, both globally and in the Netherlands.**

Global (2016-2022)



The Netherlands (2016-2022)

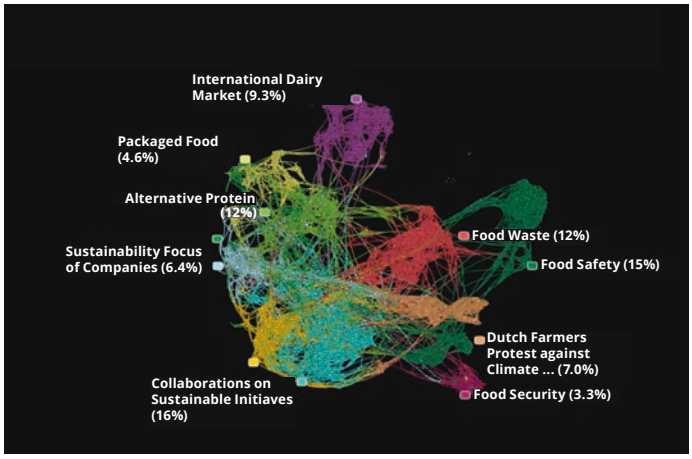


Figure 3: Deloitte Analysis based on 3646 news articles and blogs (Quid database (https://i.quid.com/), using a selection of keywords related to sustainable agriculture and food systems) shows top searches such as alternative protein, food waste, and food packaging.

AgTech	Precision agriculture e.g., soil health sensors	Autonomous farm equipment e.g., drones, planting robots	Sustainable farm management i.e., decision support tools	Energy generation e.g., from manure
Regenerative agriculture	Bio pesticides i.e., natural pesticides	Organic fertilizers e.g., animal waste, compost	Electricity from manure i.e., methane to electricity	No till farming e.g., via precision tools
Livestock management	Feed additives & alternatives e.g., for reducing emissions	Alternate sourcing of feeds e.g., local produce	Animal health & wellbeing e.g., housing & nutrition	Pasture management e.g., forages & legumes
Alternative protein	Cultivated meat i.e., lab grown meat	Plant-based protein i.e., protein from plants & nuts	Insect protein e.g., cricket flour	Consumer behavior change i.e., reduce meat diet
Short supply chain	Local farming e.g., green vertical farming			
Food waste solutions	Maximising food shelf life e.g., smart refrigerators	Transparent supply chains e.g., IoT enabled supply chains	Consumer behavior change i.e., conscious consumption	

Figure 4: Quid analysis, Deloitte analysis

Next, we will focus on the success factors that make the Netherlands stand out. We are fortunate to have a significant presence of institutions, think-tanks, several large Agri multinationals with an R&D focus, excellent universities (more particularly, one with a strong focus on Food & Agri), talented Agri professionals and farmers, large Agri tech players and a strong Agri finance sector. For the Netherlands, opportunities that require research-based expertise or use of technology are aligned with its competitive advantage.

All the opportunities listed will help reduce emissions, but differ in terms of degree of impact. Therefore, we have ranked the opportunities, based on the three parameters mentioned earlier: economic impact, environmental impact, and competitive advantage for the Netherlands. See also **figure 5** below.

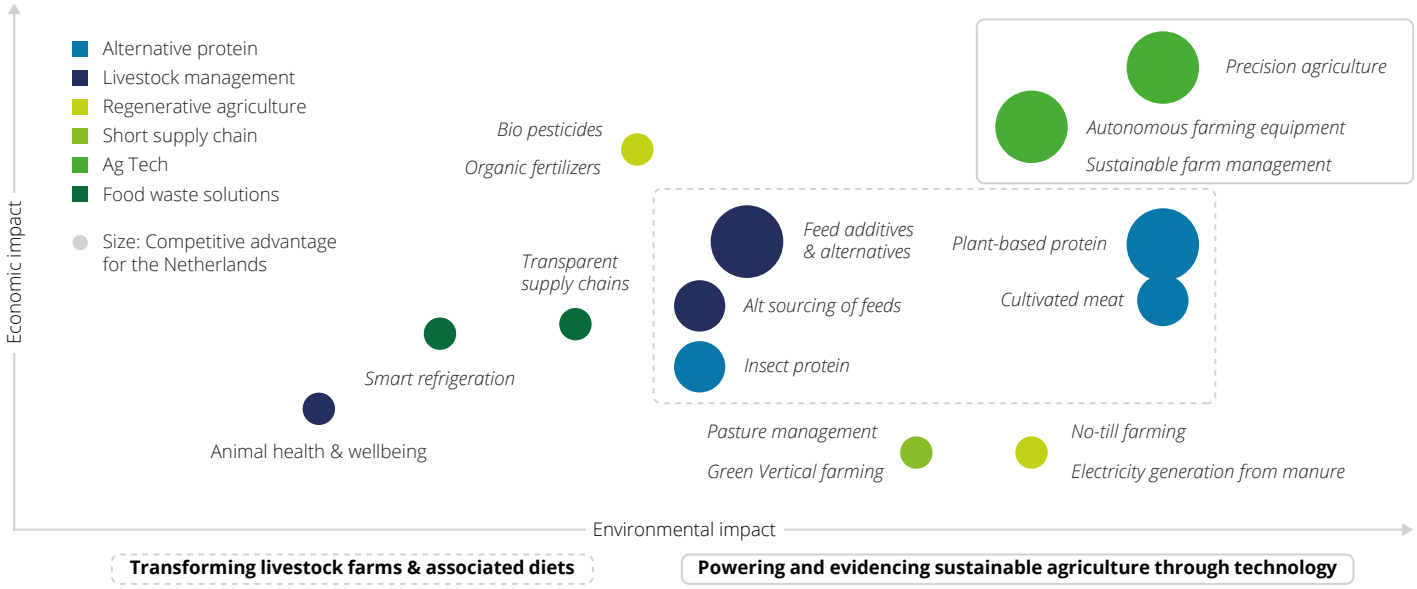


Figure 5: Ranking of opportunities with maximum impact, based on economic impact, environmental impact, and competitive advantage for the Netherlands. (Source: Deloitte Analysis based on desk research and substantiated by interviews with subject matter experts and industry experts.)

The opportunities that are expected to have maximum environmental impact and that offer the most interesting business opportunities for the Dutch agriculture and food sector, have two things in common:

- they use technology to make agriculture sustainable
- they render the existing livestock farms more sustainable and reduce dependence on livestock diets.

Chapter 3: The mega-opportunity spaces

Mega-opportunity 1: Using tech to improve and evidence sustainable agriculture

As consumers increasingly prefer brands that are committed to sustainability and the climate[16], companies require ways to prove that production has been done in a sustainable manner. The recent technological advancements in Artificial Intelligence, Internet of Things, and other digital areas could improve sustainability and efficiency in agricultural production and the value chain. As a consequence, "AgTech" (the convergence of tech and agriculture) that specifically enables more sustainable production, and can evidence any improvements towards regulators and consumers, will be increasingly in demand. The Netherlands is fortunate to have an advanced set of farmers, researchers, multinationals and technology players who can develop, test and then scale these technologies globally - becoming the global enablers of sustainable production. Some examples that showcase "AgTech" as an enabler of sustainable agriculture are:

Precision agriculture

Use of sensors, data analytics and smart farming practices to routinely gauge factors like moisture levels, sunlight, wind to determine the optimum amount of water, fertilisers and pesticides

Autonomous agriculture equipment

Use of drones/robots for tasks like spraying and weeding, fruit picking to enhance productivity and achieve no till farming

Decision support tools

Use of software tools to record farm data, analyse it, and generate evidence-based recommendations to undertake environmental interventions and facilitate effective farm management

These precision tools, drones and analytics platforms increase productivity, optimise the use of inputs, reduce waste, and ensure food traceability and quality – thus having a substantial environmental impact. According to a study conducted for Dutch agriculture, the emissions of agricultural soils can be decreased by 0.3 to 6.4 tonnes CO_2 equivalent per hectare, using solutions such as precision agriculture. This could cover most of the target for 2050 - reducing emissions by 10.3 tonnes CO_2 equivalent per hectare[17].

From an economic opportunity point of view, Pitchbook data shows that venture capital in global AgTech grew from $322mn in 2010 to $4.1bn in 2019, at a compound annual growth rate of 32.7%[18]. AgTech is expected to be a $22bn market by 2025[19]. There are already 350 AgTech start-ups in the Netherlands[18]. As developments across companies and organisations show, AgTech hugely appeals to new entrepreneurial initiatives and investments.

According to the Dutch government, Agri-food is one of the nine top Dutch sectors. Agtech can be pivotal in the sustainability of the sector. The Dutch government is funding research by TNO and other institutes on how digitalisation can be used to make agriculture more sustainable. With the AgTech industry ripe for disruption, now is the time for governments and investors to get on board.

Mega-opportunity 2: Transforming livestock farms

The pressure on Dutch livestock farms, specifically to cut emissions, keeps increasing, and so does the moral responsibility of Dutch institutions and multinationals to support this transition. The Netherlands has one of the largest livestock industries in Europe, with more than 115 mn cattle, chickens, and pigs[20]. The contribution of livestock to environmental impact ranges from 2% for consumptive water use in the Netherlands to 95% for phosphorus transfer to soils, 40% of nitrogen deposition, and 70% of methane pollution[21]. It is clear that the transformation of the current livestock farms into sustainable ones is an essential condition to meet the emission reduction targets for 2050. With its farming heritage, its huge R&D spending, mature multinationals, and its being home to a few of the world's biggest agriculture lenders, the Netherlands is well positioned to build the livestock farms of the future. Shortlisted opportunity areas which can help achieve this goal are:

Feed additives

Additives such as 3 Nitrooxypropanol (3-NOP)

Alternate Feeds/Alternate sourcing of feeds

Responsible sourcing of soy or alternate feeds such as microalgae, macroalgae, duckweed, yeast protein concentrate, bacterial protein meal, leaf protein concentrate and insects

From the perspective of environmental impact, the use of animal feed additives can reduce methane intensity in dairy cattle and beef cattle in the range of 12%-98%[22]. As for the economic opportunity, global sales of methane-reducing feed equalled $30 million in 2021. It is expected to grow to a multi-billion-dollar opportunity within the next five years.

Another way in which livestock farms impact global emissions is their demand for soy. 70% - 75% of all soy becomes livestock feed - for chickens, pigs, and farmed fish, as well as for cows[23]. European farmers rely on the import of soy-based animal feed, yet soybean production is the second biggest driver of tropical deforestation. In South America, the land used for soy production increased from 42 million acres to 114 million acres between 1990 and 2010[23]. Other high protein meals/additives such as sunflower seed, algae, and insects could replace 75–82% of current EU animal fat and protein production. This would free up 11–14 million hectares[24] outside the EU, making a considerable positive impact on the environment. In terms of economics, the global alternative protein market for animal feed application offers lucrative business opportunities. Its size surpassed $2.85 bn in 2020, growing at a CAGR of over 7.5%[25].

At Deloitte, we believe these types of products, coupled with business model innovations, can power a climate-neutral future. The Netherlands can become a leader in sustainable livestock farming & export these products and approaches to the world. Click to learn how Deloitte helped a market leader in health, nutrition, and biosciences with the introduction of a cow feed supplement that reduces methane emissions by approximately 30%.

Mega-opportunity 3: Exploring the potential of plant-based protein

The current Dutch diet consists mostly of animal protein. However, consumer behaviour is shifting rapidly. A third of the Dutch population reduced their meat consumption in 2020 and 0.5 percent stopped eating meat entirely[26]. In fact, 3.9% consider themselves vegetarian or vegan. Therefore, the opportunity for alternative protein is increasing annually. Research shows that the population of the Netherlands is the biggest consumer of meat substitutes in Europe[28]. Despite the fact that the Dutch also spend more on meat alternatives than other Europeans, domestically this only accounts for about 2.5 percent of the value of the meat market. In other words, there is a huge potential waiting to be consumed[28]. As the Netherlands is the "gateway to Europe" – as well as to Dutch consumers, obviously - the country provides a unique pivot market for firms to test their products before scaling them up. With groups like the Protein Cluster (a platform that connects alt-protein start-ups and corporates worldwide) the Netherlands has a thriving community that is excited about plant-based alternatives for meat and dairy. The Netherlands can explore specific opportunities in the areas of:

- using potatoes for alternative protein as the world's top exporter of potatoes
- converting food imported from other countries into alternative protein
- exporting alternative protein products and expertise

As **figure 6** shows, plant-based foods have lower emissions overall compared to animal foods. Also, these foods reduce land use and methane from ruminants, which means their environmental impact decreases as well. GHG emissions from animal-based food aggregate to 11 GtCO2e per year. The potential reduction is 3.1 GtCO2e per year, 28.2%, assuming that 50% to 75% of the world's population cuts down on their animal-based food intake and limits their diet to 2250 calories[29].

Protein quality and current cost of various alternative proteins			Quality		Current Cost	
			Protein content (g protein/100g)	Amino acids (PDCAAS)[1]	Production ($/100 g protein)[2]	Environmental (CO2/100 g protein)[3]
Animal	Mammal	Beef	25.2	0.92	5.3	114.9
		Milk	3.3	1.00	2.7	
	Bird	Chicken	25.8	0.95	3.1	23.8
		Eggs	12.6	1.00	2.6	
	Fish	Salmon	20.0		13.7	
	Insect	Silkworm	63.9	1.00	17.1	2.2
Plant	Legumes	Tofu	10.0	0.91	10.4	12.5
		Chickpeas	5.4	0.78	6.0	18.7
	Nuts & seeds	Hemp seed	19.5	0.66	12.4	6.2
	Vegetables	Broccoli	0.9	0.73	9.1	
Synthetic	Prec. fermentation	Milk powder	26.0	1.00	10.0	
	Cell-based	Cultured beef	25.2	0.92	32.1	91.0
Microalgae	Microalgae	Spirulina	57.4	0.85	9.1	11.1

Figure 6: Deloitte perspective on alternative proteins
Note: (1) Protein Digestibility Corrected Amino Acid Score (1=highest); (2) Variable cost and weighted fixed cost; (3) kg CO2 equivalent emissions (e.g. 1 kg methane is equivalent to 25 kg CO2 emissions)
Source: USDA; WEF (2019) 'White paper alternative proteins'; American Egg Board; Various research papers; RethinkX (2019) 'Rethinking food and agriculture 2020-2030'

Consumer preference and venture capital investment for plant-based food is also increasing. Compared to 2018, the plant-based protein market in the Netherlands grew with 50% in 2020, to a value of $291 mn[30]. This sector is led by plant-based meat ($174 million), followed by plant-based milk (€62 million), plant-based yoghurt ($43 mn) and plant-based cheese ($4.8 mn)[30]. Also, compared to 2018, European demand for plant-based alternatives is growing as well with 49% in 2020, to a value of $3.6 bn[30]. Globally this demand was valued at $29.4 bn in 2020, and predicted to rise with a 18.6% CAGR to $162 bn in 203031, offering solid economic opportunities both at national and international level.

This leaves us with the following question: now that we have shortlisted the opportunities, what will it take to realise their full potential? We will explore a number of tools and mechanisms in the next chapter.

Chapter 4: Tools and mechanisms for stakeholders

Given the urgency of the situation, the food transition will need several simultaneous transformations to succeed within the required timeframe. To convert disruption into opportunities, we will need to adopt new ways of working, both as individual companies and together in the industry.

Stakeholders along the value chain can exert direct influence on the transition pathway towards a more sustainable food system, and more and more companies and institutions are collaborating in multi-stakeholder partnerships to address pre-competitive constraints in order to change. In communities of practice the different stakeholders can interact and learn from and with each other, enabling development of sustainable solutions. The key will be doing so in a way that farmer and consumer behaviour are changed, and that connects to the competitive aspirations of individual companies. **Figure 7** outlines the value chain and the various mechanisms and tools that different stakeholder groups can use to realise the potential of the opportunity at hand.

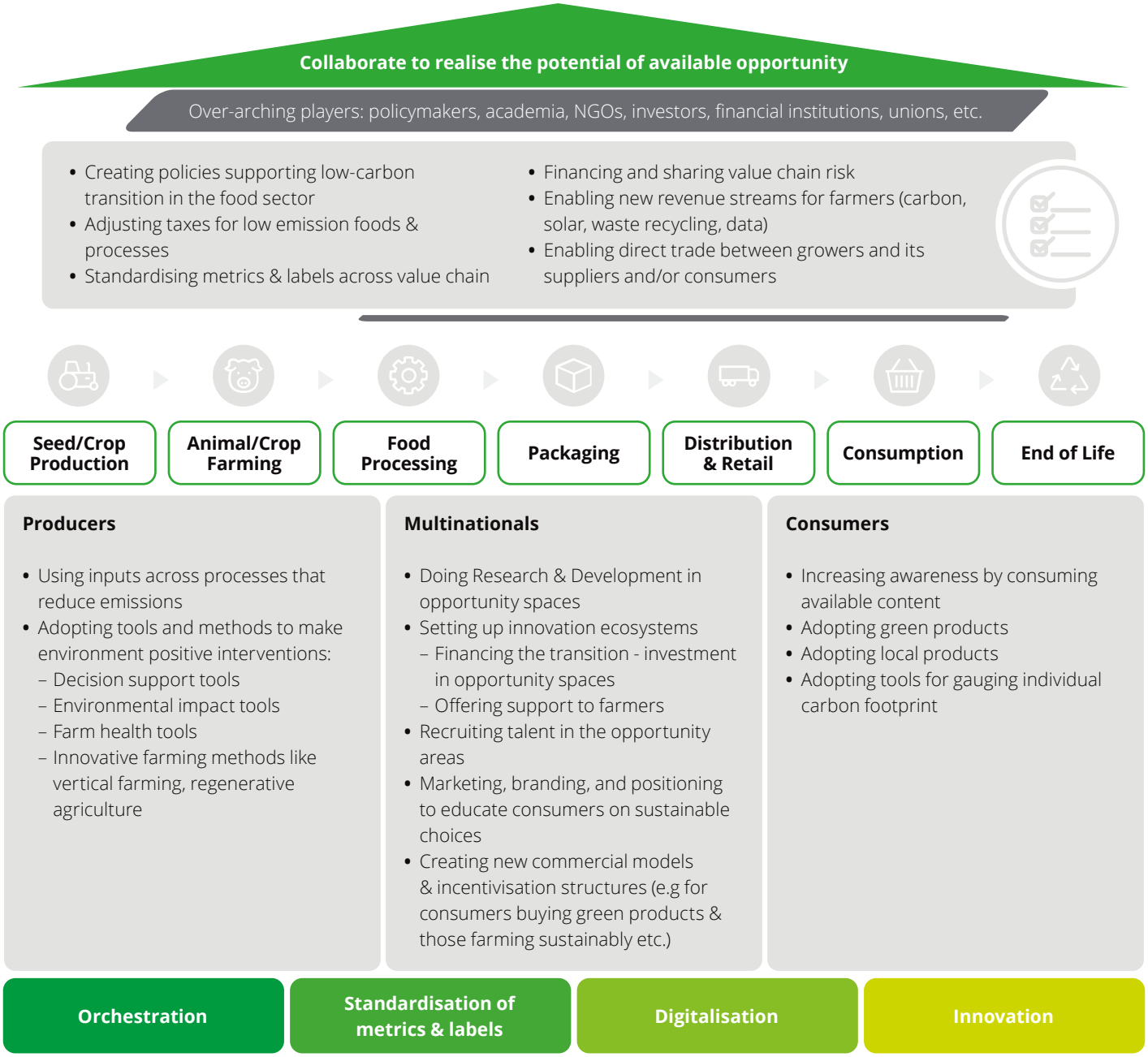


Figure 7: Various stakeholders and placement of orchestrator in the agriculture value chain

From creating the business case for farmer interventions to driving consumer behaviour change, the two ends of the value chain will have to be brought together. In addition to the players in the supply chain, there is a need for supporting over-arching players and independent orchestrators who facilitate collaboration. Joining the conversation about what can be done versus why it cannot be done, we are boldly affirming the end of an unjust food system. Big challenges need to be made actionable by using smart and small coalitions that iterate on the potential of collaboration. Our hope is that through orchestrating the community, new ideas and models are stimulated and the movement from disruption to opportunity has begun. Not only will we imagine the future of food, we will grow, harvest and consume it.

Case study - Net-Positive movement

In 2021 Deloitte has started our journey towards a net positive food system. We aim to drive collaboration across the food value chain and create scalable high impact interventions. We do that by orchestrating smart coalitions of partners, creating insights through sustainability analytics, and creating a platform for scaling solutions. Through a series of net-positive dinners with CEOs, experts, farmers, young talent, founders and creatives, we showcase the progress we made and align on where next. This is how we bring our big ambition to your plate. A few of the building blocks are:

Co-creation of net-positive solutions

Meat coalition
- Scale the 2-star pork farming through collaboration
- How to create more circular pig feed chain

Dairy coalition
- Bio-gas energy generation at dairy farms
- Defined business model hypothesis and roadmap for development

Waste coalition
- Set focused ambition to reduce food waste across the whole value chain in NL
- Create viable proof points on positive sum opportunities for collaboration

Common sustainability metrics labelling

Sustainability metrics
- Design, build, test, refine and roll-out a common sustainability metrics labelling system
- Reached consensus on major food metric and label design choices and indicated activities and roadmap to accelerate the industry developments

Partner activation

Net-positive academy
- Low Food academy with 20 young talent from the partners to create collaboration propositions bottom-up

Dining it forward
- Taking the Dinner to net-positive to next level
- Smaller local dinners or lunches to grow the movement and dialogue

Sustainability analytics

Net-positive analytics
- Data driven experiments to create more transparency around net-positive consumer choices and make them easy to understand
- Sustainability impact assessment of end-2-end foodservice operations (i.e. restaurants)

Bibliography

1. https://www.google.com/url?sa=t&rct=j&q=&esrc=s&source=web&cd=&cad=rja&uact=8&ved=2ahUKEwiT3eC7xPD5AhVK7jgGHaV1BDEQFnoECB4QAQ&url=https%3A%2F%2Fblogs.worldbank.org%2Fopendata%2Fworlds-population-will-continue-grow-and-will-reach-nearly-10-billion-2050&usg=AOvVaw3pg3-CBRDjYP8dW_U1OAvC
2. Joint WHO/FAO Expert Consultation on Diet, Nutrition and the Prevention of Chronic Diseases
3. https://ourworldindata.org/environmental-impacts-of-food#breakdown-of-where-food-system-emissions-come-from
4. EAT-Lancet
5. https://www.worldbank.org/en/topic/climate-smart-agriculture
6. https://www.fao.org/3/cc0639en/cc0639en.pdf
7. https://www.wur.nl/en/research-results/research-institutes/economic-research/show-wecr/agricultural-export-in-2021-in-excess-of-100-billion-euros-for-the-first-time.htm
8. CBS (2021)
9. NL Government website
10. https://edgar.jrc.ec.europa.eu/edgar_food, https://ourworldindata.org/greenhouse-gas-emissions-food
11. https://ec.europa.eu/eurostat/statistics-explained/index.php?title=Agri-environmental_indicator_-_livestock_patterns
12. https://www3.epa.gov/region1/airquality/nox.html
13. https://www.resource-online.nl/index.php/2019/10/03/the-nitrogen-problem-in-five-questions/?lang=en
14. https://www.eea.europa.eu/publications/data-and-maps/data/data-viewers/greenhouse-gases-viewer
15. https://www.cbs.nl/nl-nl/dossier/dossier-broeikasgassen/welke-sectoren-stoten-broeikasgassen-uit-
16. https://www.barrons.com/articles/most-sustainable-companies-51644564600
17. https://www.statista.com/statistics/934176/share-of-consumers-willing-to-pay-extra-for-sustainable-products-in-the-netherlands/
18. https://bscmsc.pps.wur.nl/thesis-calculations-literature
19. https://www.fdiintelligence.com/content/feature/the-dutch-model-of-the-future-of-farming-79387
20. https://www.statista.com/statistics/1222535/worldwide-agricultural-technology-market-value-by-region/#:~:text=In%202021%2C%20the%20agricultural%20technology,other%20regions%20throughout%20the%20world.
21. https://longreads.cbs.nl/the-netherlands-in-numbers-2021/how-many-farm-animals-are-there-in-the-netherlands/
22. https://www.sciencedirect.com/science/article/pii/S0048969720332228, https://www.wur.nl/en/dossiers/file/methane.htm
23. https://clear.ucdavis.edu/explainers/how-can-cattle-feed-additives-reduce-greenhouse-gas-emissions
24. https://www.worldwildlife.org/magazine/issues/summer-2018/articles/what-are-the-biggest-drivers-of-tropical-deforestation
25. https://www.tabledebates.org/research-library/scenarios-halting-european-union-soybean-feed-imports
26. https://www.gminsights.com/industry-analysis/alternative-protein-market-for-animal-feed
27. https://www.cbs.nl/nl-nl/nieuws/2021/23/vlees-geen-dagelijkse-kost-voor-8-op-de-10-nederlanders
28. https://www.vegetariers.nl/organisatie/pers/persberichten/forse-groei-vegetariers-en-veganisten-onderzoek-vegatrends-2020
29. https://nltimes.nl/2021/05/10/dutch-biggest-consumers-meat-substitutes-europe
30. The Drawdown Review, NSE WorldClimate Ecosystems Sustainable food systems | Food waste reduction, Deloitte Analysis
31. https://smartproteinproject.eu/wp-content/uploads/Smart-Protein-Plant-based-Food-Sector-Report.pdf
32. https://www.bloomberg.com/company/press/plant-based-foods-market-to-hit-162-billion-in-next-decade-projects-bloomberg-intelligence/

Contacts

Randy Jagt
Partner, Global Future of Food lead
Monitor Deloitte
E-mail: rajagt@deloitte.nl

Maarten Oonk
Director, Journey to Net-Positive
program director
New Business and Technology
E-mail: moonk@deloitte.nl

Dominique van Seggelen
Partner, Consumer Industry lead
Tax and Legal
E-mail: dvanseggelen@deloitte.nl

Fred Nijland
Director, Customer Strategy
and Future of Food Innovation Design
E-mail: fnijland@deloitte.nl

Harsheen Anand
Manager, Digital Customer
E-mail: haanand@deloitte.com

Karlijn Alderliesten
Analyst, Monitor Deloitte
E-mail: kalderliesten@deloitte.nl

Deloitte.

Designed by CoRe Creative Services. RITM1173406