pwc

How we feed ourselves

Providing adequate, affordable, and nutritional food in a resource-constrained and demanding world

Content

Main findings

Context: the concept of value in motion

The way we live and work is changing. New technologies, shifting climate patterns, and evolving geopolitical influences are creating new customer demands, opening new markets, and enabling innovative business models. However, they also bring new competitors and collaborators, blurring the boundaries between sectors and industries. We see that industries are reconfiguring into complex value chains and ecosystems – domains – centered on serving fundamental human needs. The domains represent how we move, feed and care for ourselves; build and make things; power and fuel our energy needs; fund and insure; connect and compute; and govern and serve.

What is the how we feed domain?

The **how we feed** domain serves a key human need: **adequate, affordable, and nutritional food**. Such a domain emerges because expertise from a broad range of stakeholders is needed to develop solutions for global food systems. At the same time, we see that consumer preferences also play an important role. Supply-side challenges and consumer demands shape and will continue to impact the how we feed domain.

What does the how we feed domain in the Netherlands look like?

The Dutch how we feed domain is export-focused, built on collaboration between companies, governments, and leading research institutions. Generating €71bn in annual added value in 2022, it plays crucial roles domestically and globally. The Netherlands, among the world's smallest countries, behind only the United States and Brazil, stands as the third-largest agricultural exporter – a true agricultural superpower. While the traditional agri-food sector, from farmers to food retailers, forms the domain's core, boundaries are expanding as health, technology, life sciences, and other sectors play increasingly important roles in food and nutrition.

What are the drivers of the domain?

The Netherlands is part of the global how we feed domain that helps to provide adequate, affordable, and nutritional food to a growing world population.

With the global population projected to reach 9.8 billion by 2050 – up from 8.2 billion in 2025 – the challenge is immense, particularly as 673 million people still face hunger today.

This population growth, combined with rising incomes and economic development, is reshaping the global distribution of food suppliers and consumers, creating unprecedented challenges for food production. It needs to increase by 40-56% by 2050 to adequately feed the growing population and eliminate hunger.

With that, this report examines the major drivers of food production and consumption within the Dutch how we feed domain and its contribution to addressing these global challenges.

Supply-side: providing adequate, affordable, and nutritional food in a resource-constrained world

On the supply side, several pathways exist to tackle food production needs in an increasingly resource-constrained and food-insecure world. Relying more on resource-intensive production is a challenging proposition. However, focusing on high productivity, high-value-added, and distinguishing activities that fit within the environmental constraints, as well as exporting not just world-class agricultural products but also expertise, offers more 'future-proof' options for the Dutch how we feed domain.

Here's why:

- **More land use is not a viable pathway**
  First, while expanding agricultural land is theoretically possible, it presents significant practical challenges. Agriculture already occupies approximately half of the world's habitable land, and contributes to biodiversity loss, deforestation, soil degradation, greenhouse gas emissions, and freshwater depletion and pollution.
- **Input- and technology-driven productivity is key**
  Second, boosting crop yields offers another path. Most agricultural productivity has relied on increased inputs like chemical fertilisers, pesticides, and antibiotics. However, this approach is increasingly challenging in countries like the Netherlands, as overuse leads to environmental and health concerns. Therefore, focusing on improved inputs (biological fertilisers for instance) and technology-driven productivity should be prioritised.
- **More efficient calorie intake and tackling food waste are also important**
  Third, there is an oversupply of calories in developed countries and undersupply in developing nations. With an estimated 40% of food lost or wasted throughout the value chain, reducing food waste represents a 'low-hanging fruit' to meet nutrition needs using existing production capacity.

Demand-side: consumer preferences as a driver of the how we feed domain

Demand-side pressures are also significant, as consumers increasingly expect food that meets multiple criteria: affordability, convenience (always available, novel, and tasty), sustainability, ethical consumption (socially responsible and animal-friendly), and quality (healthy, safe, and nutritious).

Points to consider for stakeholders in the how we feed domain

While the how we feed domain is becoming increasingly complex, it also creates significant opportunities for those who can strike the intricate **balance** between **people**, **planet**, and **profit**: new value pools are emerging while others decline. Against this backdrop, here are key considerations for different stakeholders in the how we feed domain:

- **Producers**: embrace technology-driven, high-value production to simultaneously boost yields, food security, and sustainability
- **Agricultural commodity traders**: digital platforms, strategic sourcing, and facilitating regenerative and tech-enabled farming
- **Feed suppliers**: focus on circularity and sustainability
- **Food processing and retail companies**: focus on demand-driven production, while nudging consumers to make better choices
- **Consumers**: understand and accept the sustainability premium
- **Policymakers, financiers, and regulators**: orchestrate the domain stakeholders to achieve better food systems

The Dutch how we feed domain

The concept of value in motion

The way we live and work is changing. New technologies, shifting climate patterns, and evolving geopolitical influences are creating new customer demands, opening new markets, and enabling innovative business models. However, they also bring new competitors and collaborators, blurring the boundaries between sectors and industries. We see that industries are reconfiguring into complex value chains and ecosystems – domains – centered on serving fundamental human needs. The domains represent how we move, feed and care for ourselves; build and make things; power and fuel our energy needs; fund and insure; connect and compute; and govern and serve.

The **how we feed** domain serves a key human need: **adequate, affordable, and nutritional food**. Such a domain emerges because expertise from a broad range of stakeholders is needed to develop solutions for global food systems.

The agri-food sector: backbone of the how we feed domain

While agri-food remains central to the how we feed domain, we're seeing expanded convergence with health, technology, life sciences, and other sectors that are increasingly playing vital roles in food systems. We can map the how we feed domain activities accordingly:

Primary activities:

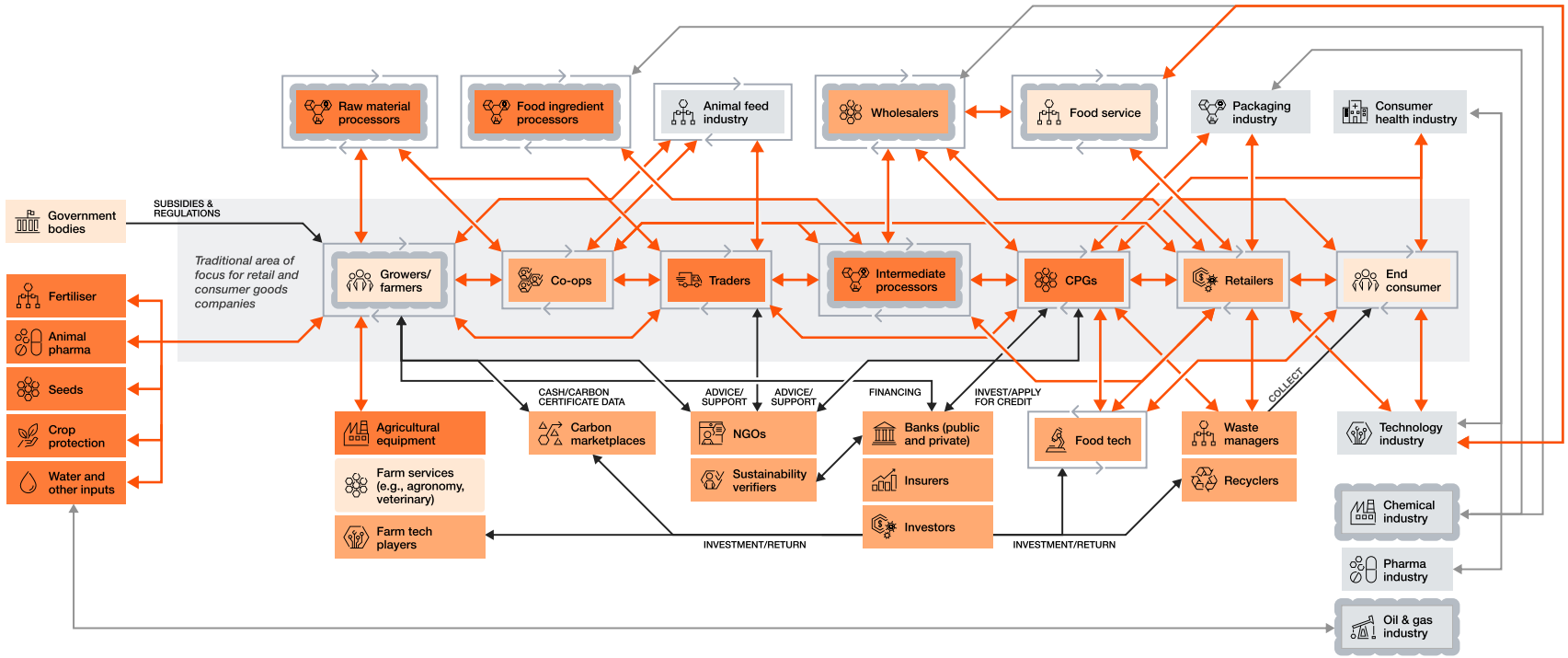
- Producers - agriculture, horticulture, aquaculture and fisheries,
- Food processing,
- Wholesale,
- Retail,
- Food service.

And, in addition to the primary activities, the entire ecosystem of supporting services:

- Animal and seed breeding,
- Supply of inputs (raw materials, energy, pesticides, fertilisers, chemicals, etc.),
- Technology, innovation (patents, machinery, packaging, etc.), scientific research and development,
- Processing,
- Trading and logistics,
- Financing, legal advice and professional services,
- Responsible government and regulatory agencies,
- Living environment and nature that encompass and bound the domain.

Finally, consumers, including every human on the planet, are the driving force of the domain, and farmers are the lifeblood of the system. See Figure 1 for an illustrative example of the different activities in the how we feed domain.[1]

Figure 1: A snapshot of the how we feed domain



Note: For simplicity, some connections between market players have been omitted. 'Density of market players' indicates the number of entities relative to the size of the market.
'CPG' refers to consumer packaged goods companies. Some retailers also act as CPGs through the sale of their own private label products.
Source: PwC

The country exports

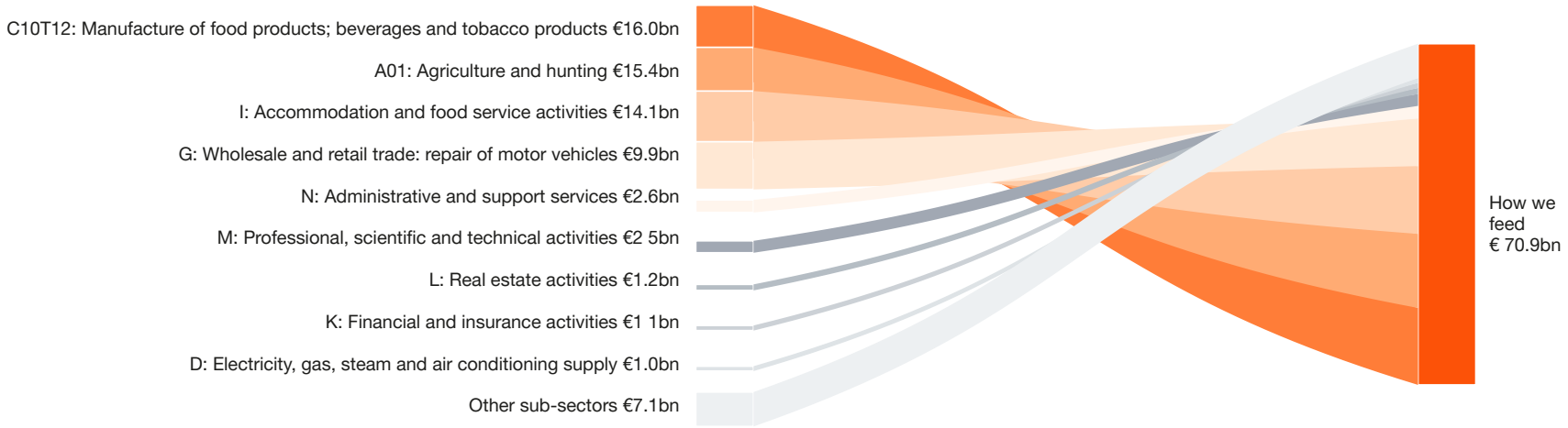
75%

of its agricultural goods and services.

The Netherlands is heavily integrated into the global how we feed domain. The country exports 75% of its agricultural goods and services,[2] ranking as the third-largest exporter globally,[3] while being only the 18th largest economy[4] and the 134th largest country by area.[5] Conversely, the Netherlands is the largest agri-food importer into the EU, with 75% of food consumed in the Netherlands being imported.[6]

Furthermore, 30 out of the top 40 agri-food companies worldwide are either Dutch or have a presence in the Netherlands.[7] With that, we estimate the gross value added (GVA) of the Dutch how we feed domain to be around €71bn or 8.1% of the total GVA of the Dutch economy in 2022 (Figure 2, see Appendix for more detail).

Figure 2: The yearly value added of the Dutch how we feed domain is €71bn



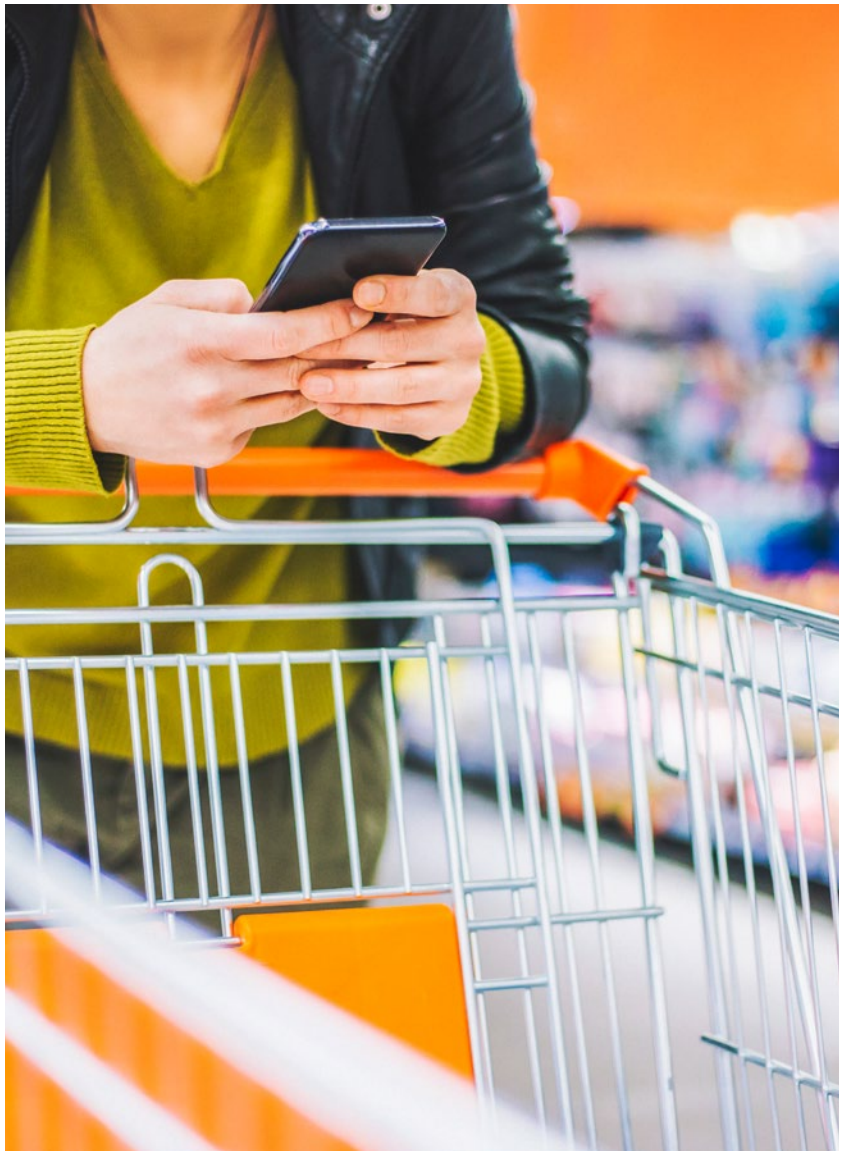
Sources: OECD, PwC analysis.

This successful integration in global markets is not only enabled by the strategic location, excellent infrastructure, logistics and port infrastructure, but also by the triple helix: collaboration between companies, the government, and renowned educational and research institutions within the Dutch how we feed domain.

Food Valley exemplifies this approach. In this region, food companies, research institutes, and Wageningen University and Research Centre actively collaborate on food-related sciences, research, and technological development.[8] Other multidisciplinary universities in Amsterdam, Delft, Den Bosch, Eindhoven, Groningen, Maastricht, and Utrecht are also heavily involved in the domain.

This emphasis on research and innovation is driving new growth areas that are converging in the Dutch how we feed domain: companies – from startups to established players – are leading the way in biotechnology, digitisation, robotisation, precision agriculture, smart greenhouses, and new processing technologies.

These innovations position the Dutch how we feed domain as a key player in the global food system, whose main purpose is to provide the global population with adequate, affordable, and nutritious food in an increasingly resource-constrained world. Next, we look at two areas that are driving the how we feed domain: supply-side issues related to food production and consumer preferences from the demand side.



Supply-side: providing adequate, affordable, and nutritious food in a resource-constrained world

The Netherlands is part of the global how we feed domain that helps to provide adequate, affordable, and nutritious food to a growing world population. This chapter explores several pathways to tackle food production needs in an increasingly resource-constrained and food-insecure world.

Expanding agricultural land is not a viable solution due to mounting environmental pressures. While boosting crop yields with the use of more inputs presents an alternative, it risks the overuse of chemical fertilisers, pesticides, and antibiotics, creating sustainability and health challenges. Instead, priority must be placed on developing superior and ecologically friendly inputs and leveraging technology-driven productivity. Finally, tackling food waste is also important.

The global population is expected to reach

9.8bn

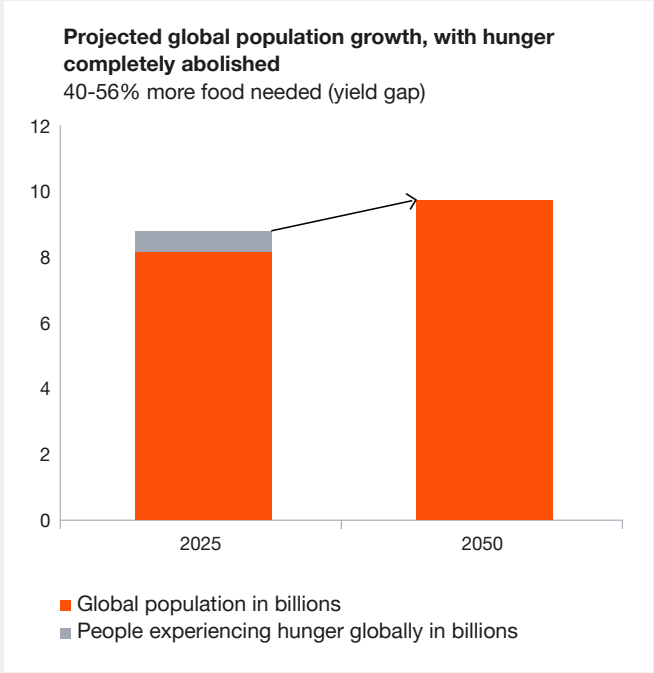
people by 2050.

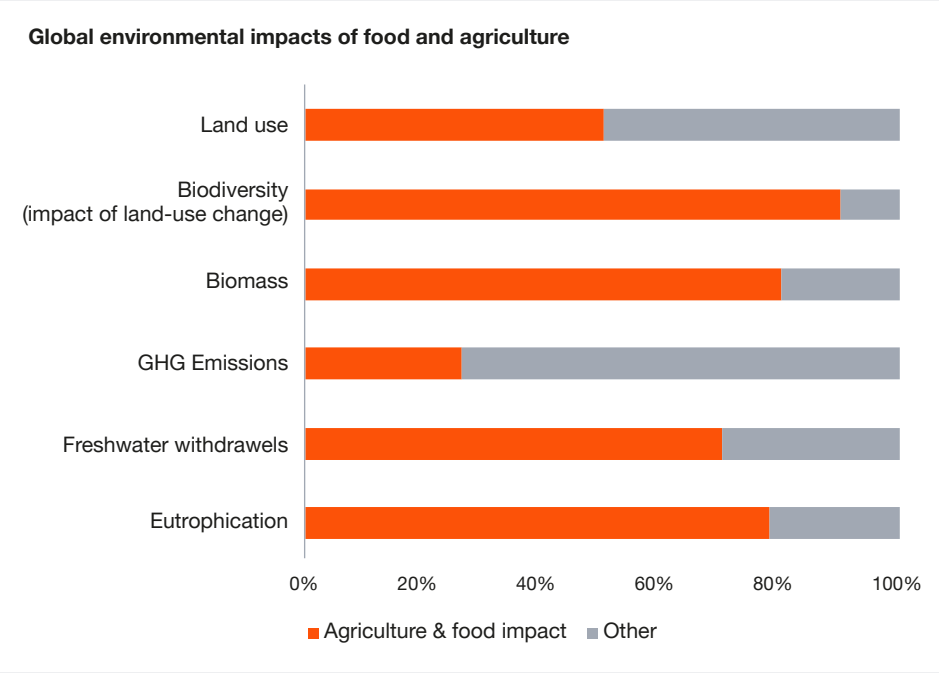
Demographic pressures on the how we feed domain

The global population is expected to reach 9.8 billion people by 2050, up from 8.2 billion in 2025,[9] while 673 million people globally still experience hunger.[10] Population growth, rising incomes, and economic development are shifting the geographic distribution of food suppliers and consumers and creating challenges to global food production. The largest increases in population, total food consumption, and hunger prevalence are expected in Africa and Asia. The FAO estimates that agriculture would need to produce 40-54% more food, feed and biofuel feedstock than in 2012,[11] while the World Resources Institute estimates a 56% yield gap between 2010 and 2050 to feed the growing world population and tackle global hunger.[12] These pressing demands for increased food production strain already resource-constrained food systems that have contributed to crossing five of nine planetary boundaries – quantitative thresholds representing safe limits for human pressure on critical life-sustaining processes.[13]

As part of the global food system, the Dutch how we feed domain is contributing to the goal of adequate, affordable, and nutritious food for the growing population. There are three key pathways, both globally and in the Netherlands, to achieve this: expanding agricultural land use; boosting crop yields through technology-driven productivity, innovation, and the use of better inputs; and minimising food waste. Each pathway brings unique challenges for the how we feed domain in an increasingly resource-constrained and food-insecure world (Figure 3).

Figure 3: Challenges to feed the global population in an increasingly resource-constrained world





Sources: Our World in Data, World Resources Institute, FAO.

Declining food security puts increasing pressure on the how we feed domain

Agriculture is constrained by natural environmental factors such as terrain, soil fertility, and available land, making some countries better able to produce certain crops than others. The distribution of 'natural endowments' for specific crop production is highly uneven. Large countries with abundant and fertile soil, such as the United States and Ukraine, are much better positioned to become major agricultural exporters than Norway and Singapore, which rely heavily on food imports. Furthermore, some crops like cocoa (with Ivory Coast and Ghana accounting for 50% of global supply) and coffee (Brazil and Vietnam accounting for 65%) can only be grown in specific regions.[14]

However, countries such as Denmark and the Netherlands have overcome the natural limitations (small land area) through exceptional productivity and technological development in the agri-food sector. For example, the Netherlands, ranked 134th globally by land area, has become the second-largest exporter of live pigs, accounting for (18% of global market) and among the top five global dairy exporters.[15]

With increasing internationalisation of food trade and demanding consumer preferences, global food supply chains have become more complex. Consequently, disturbances in crop production in one country can create food security disruptions felt globally. For example, Russia's invasion of Ukraine in 2022 heavily impacted the production and export of several key agricultural commodities such as wheat and corn, leading to significant price hikes that impacted many countries in Africa, the Middle East and Asia.[16]

Beyond geopolitical disruptions, climate-related disasters – droughts, floods, wildfires, and other natural hazards – are intensifying and occurring more frequently, often striking core global food production regions while already imposing a large economic toll. Furthermore, the outlook is concerning: by 2050, climate could significantly impact 50% of wheat, 60% of maize, and 42% of rice supply in the EU.[17] This translates to squeezed producer margins and rising consumer prices and food insecurity. Beyond economic effects, food insecurity often triggers social unrest and migration from affected regions.

These trends are making many countries reconsider their food security strategies. As a major importer for Europe and exporter of products to other European countries, food security is a key prerequisite not only for a resilient Netherlands but also for Europe within a changing geopolitical context. The Dutch economy is highly dependent on international consumption and production trends. Even an affluent country, like the Netherlands, which ranks fifth globally in food security,[18] relies heavily on chemical fertiliser and 75% of domestically consumed food imports, including importing the entirety of as olive oil, coffee, and rice consumption.[19] Moreover, 75% of the agricultural land used for Dutch food consumption is located abroad.[20]

However, the Dutch how we feed domain also strengthens global food security. As a major exporter and re-exporter, it supplies essential agricultural products worldwide. Additionally, Dutch expertise extends beyond trade by helping low- and middle-income nations improve food production through innovations like drought-resistant seeds that perform well in hot climates with limited water, as well as exporting dairy and greenhouse technology, research, and knowledge in collaboration with knowledge institutions.[21]

More land use is not a viable pathway

Land use

Expanding agricultural land represents the first pathway to increasing food production. Agricultural land use has grown dramatically over the last century – around half of the world's habitable land is now devoted to agriculture. The breakdown reveals stark priorities: 80% supports animal feed and livestock, 16% are crops for human consumption, and 4% are non-food crops like biofuels and textiles.[22] Agricultural land use ranges from below 10% in Egypt, Sweden, and Canada to 70-80% in the United Kingdom, Uruguay, South Africa, Nigeria, and Saudi Arabia.[23]

In 2022, the Netherlands used more than 53% of its land area for agriculture (down from 68% in 1961).[24] However, the total land footprint of the Dutch agricultural sector spans 13 million hectares, with 86% located abroad – more than three times the area of the Netherlands itself (4.2 million hectares).[25]

Dutch agri-food production focuses on homogeneous and land-intensive bulk commodities like dairy, onions, potatoes, and pork. These products trade in large volumes, are difficult to differentiate, compete primarily on price with low margins.[26] The international competitiveness of these products stems from multiple factors: the exceptional productivity, efficiency, and innovation of Dutch farmers and how we feed domain stakeholders, successful international branding, and key structural advantages including port access, energy imports from Russia, and reliance on relatively low-paid labour for labour-intensive production. However, the last two factors, namely Russian energy imports, as energy imports are coming much more from the United States, and labour migration focused on low-paid, low value-added production, are no longer viable options.

In 2022, the Netherlands used more than

53%

of its land area for agriculture.

Beyond these factors, expanding agricultural land, both in the Netherlands and globally, not only pressures other economically and socially important activities[27] but also generates significant environmental costs: biodiversity losses, deforestation, soil degradation, net greenhouse gas (GHG) emissions, and freshwater depletion and pollution.[28]

Biodiversity losses, deforestation and soil degradation

Of the approximately 6,000 plant species that can be grown for food, just nine crops determine 66% of our diet and occupy more than 90% of global agricultural area.[29] Moreover, while livestock make up 62% of the world's mammal biomass, humans account for only 34% and wild mammals represent just 4%.[30]

Globally, more than 90% of biodiversity impacts from land-use change stem from reduced natural habitats and deforestation because of agriculture, with crop cultivation (72%) and pastures (21%) being the main contributors.[31] Furthermore, intensive agriculture, when not managed sustainably, is one of the main causes of soil degradation. Yet agriculture is also one of the most affected sectors: degraded soil yields less, is more vulnerable to droughts, and leads to higher costs for farmers.[32]

The Netherlands has also been significantly impacted by biodiversity losses, with agricultural land use and livestock cultivation being primary drivers.[33]

Agriculture consumes

70%

of global freshwater resources.

GHG emissions

Beyond biodiversity, deforestation and soil degradation, agriculture also contributes significantly to climate change. The entire food system – including agricultural production, land use, storage, transport, packaging, processing, retail, and consumption – accounts for 25-30% of total annual human-induced GHG emissions. This share is projected to reach 30-40% by 2050 as population and income levels continue to grow.[34] Livestock and fisheries account for 31%, crop production for 27%, land use for 24%, and supply chains for 18% of food emissions.[35]

Recognising these challenges, many stakeholders in the how we feed domain are already innovating to reduce their environmental footprint. These efforts include lower carbon on-farm energy use, the adoption of nitrogen fertiliser management technologies, alternative cultivation methods, such as regenerative agriculture, as well as feeding and breeding technologies for reducing enteric methane. If used on a sufficient scale, these technologies could reduce agricultural GHG emissions by 45%.[36]

Nevertheless, more than 50% of agricultural emissions remain challenging to decarbonise because they originate from biological processes, such as soil emissions and livestock digestion, and will require carbon dioxide removal technologies, as well as a change in diets, to achieve net-zero.[37] Available techniques like bioenergy with carbon capture and storage and enhanced rock weathering already show promise, though at a price premium.[38] Therefore, the path forward requires not only continued innovation but also scaled adoption of sustainable and circular technologies.

Freshwater depletion and pollution

Finally, agriculture consumes 70% of global freshwater resources, which not only puts pressure on freshwater availability but makes food systems themselves increasingly exposed to risks from droughts.[39] The Netherlands has expertise in water management and agriculture, including in greenhouse cultivation. Since 2000, water management has reduced water dependence for some crops by up to 90%.[40] However, water management remains a major challenge as climate change and warmer weather lead to summer rainfall deficits, while agricultural water use competes with other freshwater demands.[41]

Given that agricultural land use has reached saturation in many regions – to preserve other valuable economic and social activities while minimising environmental impact – further expansion is not a viable path for increasing food production.

In the Netherlands, meeting climate, nature, and environmental targets requires agriculture to become more sustainable and less resource intensive. The Dutch Environmental Assessment Agency states that 150,000-200,000 hectares of farmland must become nature areas with no agricultural use – three to four times more than current policy targets. Much of the remaining land must shift to less intensive farming, especially within one to two kilometers of nature reserves.[42]

Input- and technology-driven productivity is key

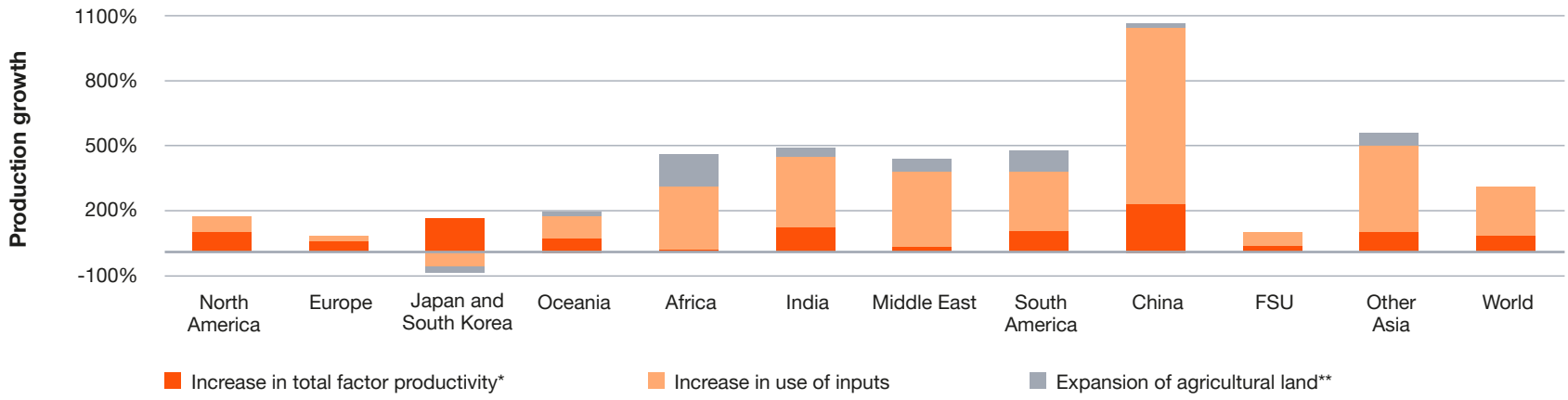
Next pathway considers boosting crop yields and increasing productivity through greater use of inputs and technology.

More use of inputs, such as chemical fertilisers, pesticides and antibiotics

Chemical fertilisers, improved seeds have, together with expanded international trade and advanced machinery, powered global agricultural productivity growth over recent decades.[43] Yet food production increasingly faces diminishing returns from additional inputs or expansion of agricultural land – a trend especially pronounced in Europe (Figure 4).[44]

Chemical fertilisers, as one of the main inputs, have been used at an unprecedented scale, boosting agricultural yields worldwide. Nitrogen and phosphorus are the two main fertilisers that farmers add to their fields. Fertilisers have dual benefits: supporting crops and thus farmer incomes and food security while reducing farmland demand through higher productivity. However, many countries overapply fertilisers, both natural (manure) and chemical, leading to eutrophication, a process where water becomes overly enriched with nutrients, causing excessive plant and algae growth.[45] Seventy-eight percent of the global ocean and freshwater eutrophication is caused by agriculture.[46] Beyond environmental damage, fertilisers also threaten human health: ammonia from fertilisers has been linked to preterm birth, certain congenital anomalies, and diseases such as colorectal cancer.[47]

Figure 4: In Europe, productivity growth in agriculture has increasingly come from technology



Note: *More strategic use of inputs. **Weighted by productivity.
Source: USDA/ERS, RaboResearch 2025

The Netherlands has the second-highest nitrogen balance (or surplus) in Europe,[48] and as agriculture accounts for 50% of all acid equivalent (nitrogen) emissions, it has been one of the main drivers of the nitrogen crisis in the Netherlands.[49] Transitioning to the production and use of environmentally friendly fertilisers is essential to keep high levels of food production within planetary boundaries.

Pesticides – substances used to control crop pests – have been employed in agriculture for millennia. Modern synthetic pesticides target specific organisms and can significantly protect crops and boost yields. However, they also pose risks: negative impacts on local biodiversity and potential toxicity to farmers and workers when safety protocols are not followed.

Antibiotics present a similar challenge in livestock agriculture. While essential for treating diseases and preventing infections, their overuse creates antibiotic-resistant bacteria that can transfer to humans. The Dutch agricultural sector has managed to eliminate the use of chemical pesticides on plants in greenhouses entirely and cut the use of antibiotics for poultry and livestock production by up to 60%.[50]

Technology, innovation and the use of better inputs

Globally, tech-enabled, data-driven agriculture holds enormous potential to simultaneously increase yields, reduce costs, and enhance sustainability.

The Essential Eight technologies – AI, together with advanced data analytics and predictive modelling, internet of things (IoT), blockchain, virtual and augmented reality, advanced robotics, quantum and neuromorphic computing, combined with the increasing use of sensors, drones, regenerative farming, and improved seeds – are already transforming production systems.[51] While increasing the usage of each of these technologies in the production processes offers significant value on its own, it is their convergence that truly unlocks transformative potential.

We are seeing companies combine these technologies in practical ways: for example, integrating IoT sensors with AI and blockchain to enhance supply chain transparency, or using VR together with AI analytics for immersive employee training. These kinds of cross-technology applications are accelerating progress and enabling solutions that would not be possible with a single technology alone.

This technological shift is further accelerated by persistent labour shortages affecting agricultural sectors worldwide, making productivity-enhancing investments essential. Consequently, technology-driven productivity growth represents the most promising pathway to boost crop yields while managing increasing resource constraints.

The Dutch how we feed domain is highly productive and technologically advanced. It should put more emphasis not only on exporting world-class agricultural products, but also on exporting agricultural and food know-how, for example, knowledge about greenhouse construction, climate control technologies for greenhouses, crop science, seed technology, and related innovations.

Tackling food waste is also important

The global supply of calories per person has grown throughout the world over the last fifty years, helping to reduce hunger from around 30% in developing countries to 12% in 2015.[52] Existing global food production is now so high that solving global hunger is no longer primarily about producing more food.[53] The issue centers on prevalent food waste.[54]

First, there remains a wide discrepancy in total calorie intake across different parts of the world. While countries in Sub-Saharan Africa face malnutrition concerns, much of the developed world grapples with obesity, overconsumption of resource-intensive and highly processed foods, and widespread food waste.

Second, it is estimated that up to 40% of food produced is lost or wasted somewhere along the value chain, with food waste causing 6% of total GHG emissions.[55] There is, however, significant regional variation. In developing countries, most food losses occur during production, while in developed regions, such as the EU, households are by far the largest source of waste, accounting for more than half of the total (54%), followed by processing and manufacturing (19%) and retail and food services (19% combined).[56] In terms of land use, an area equivalent to the size of China is used annually to produce food that no one will eat.[57] According to FAO estimates, cutting food waste could feed 1.26 billion people every year.[58]

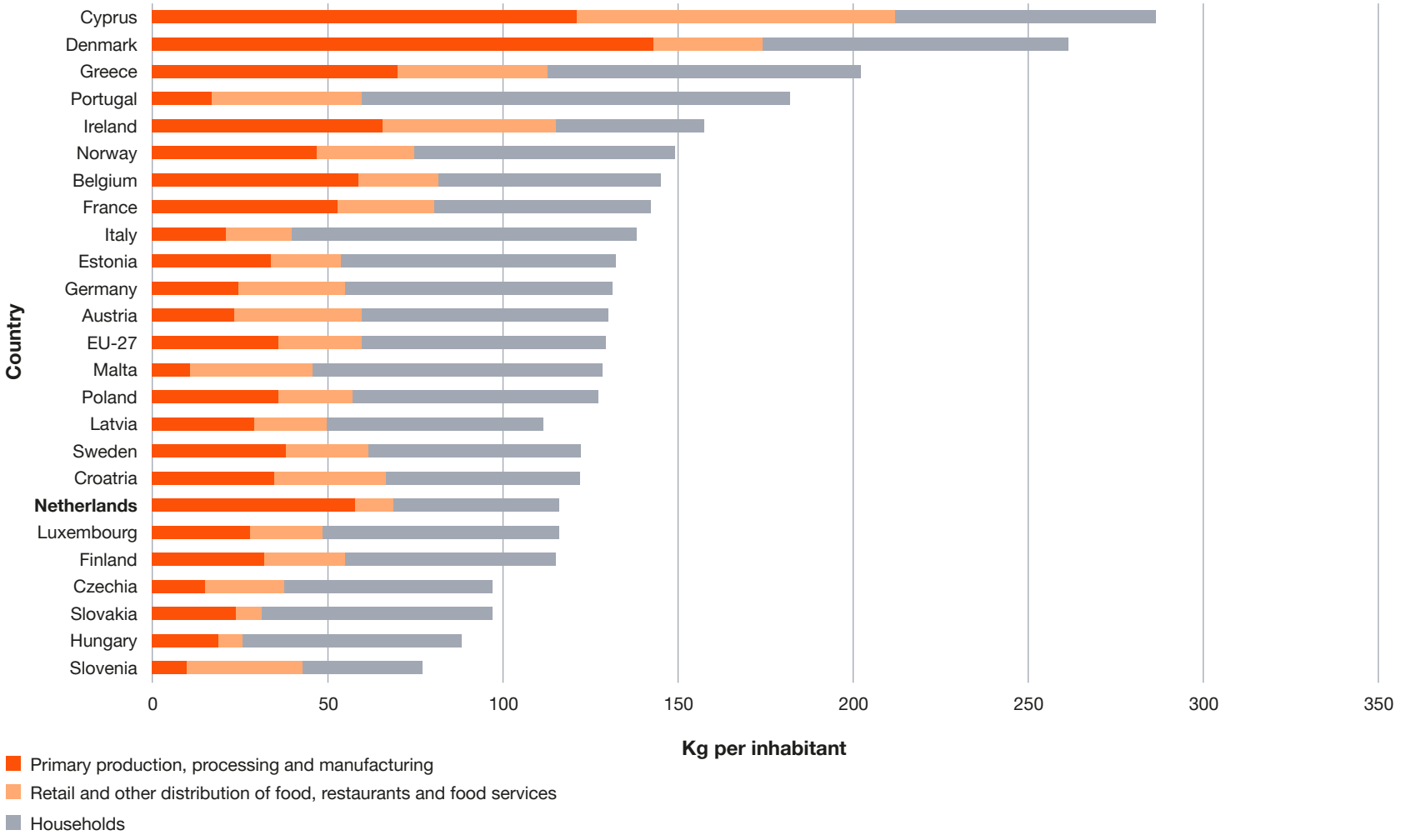
While the Netherlands ranks slightly below the EU average for food waste, the scale remains significant: over 100kg of food per person is wasted annually (Figure 5).[59]

Progress has been made in reducing Dutch food waste – total food waste has dropped by 17% since 2015 – but current trends will not achieve the government's 2030 target of 50% reduction. Instead, the likely outcome is a 30% reduction from 2015 levels.[60]

The greatest potential for waste reduction lies with food processing and manufacturing (46% of total waste) and household consumption (37% of total waste).[61] The household impact alone is striking: eliminating household food waste entirely would save land equivalent to the province of Utrecht; reduce CO_2 emissions by the equivalent of 25 million car trips from Groningen to Maastricht; and conserve enough drinking water to meet total Dutch consumer demand for 4.5 years.[62] This underscores the critical role of consumer behaviour in minimising food waste.

On the food manufacturing and processing side, greater emphasis on circularity in production and expanding non-food applications for agricultural products – such as biofuels and materials for the bio-based economy – could further reduce waste. Applications, such as Too Good To Go, and more emphasis on reducing food waste in the retail segment with more efficient supply-chains and technological tools, are also important.

Figure 5: The Dutch food waste is below the EU average



Source: Eurostat.

Demand side: consumer preferences as a driver of the how we feed domain

This chapter examines demand-side consumption pressures. Modern consumers present complex challenges by demanding food that simultaneously satisfies multiple criteria: affordability, convenience (always available, novel, and tasty), sustainability, ethical consumption (socially responsible and animal-friendly), and quality (healthy, safe, and nutritious).

Affordability

The stakes are rising: food price pressures, expected to worsen with climate impacts and biodiversity losses, have already sparked social unrest and political instability globally.[63] As **PwC's Voice of the Consumer 2025 survey** shows, price is king for consumers both in the Netherlands and globally, with affordability being the number one factor in food purchasing choices.

In the Netherlands, overall food affordability is good, as despite recent bursts of inflation, incomes have outpaced food inflation.[64] Nevertheless, price remains the single most important factor driving Dutch consumer behaviour.[65] There are generational differences, however: younger consumers are willing to pay more for items with desired properties, value or quality.[66]

Convenience, novelty and taste

Next, consumers increasingly seek convenience, novelty, and taste satisfaction. Consumer preferences vary significantly not only across cultures but also generations: younger people seek greater personalisation, respond to social media trends and novel concepts, and view food as an experiential purchase rather than mere sustenance.[67]

Furthermore, Dutch consumers increasingly live alone or in smaller households with busier lifestyles, driving demand for convenience. This is reflected in the well-developed and growing ready-to-eat meal market, high consumption of imported foods, and prevalent restaurant dining, especially in urban areas.[68]

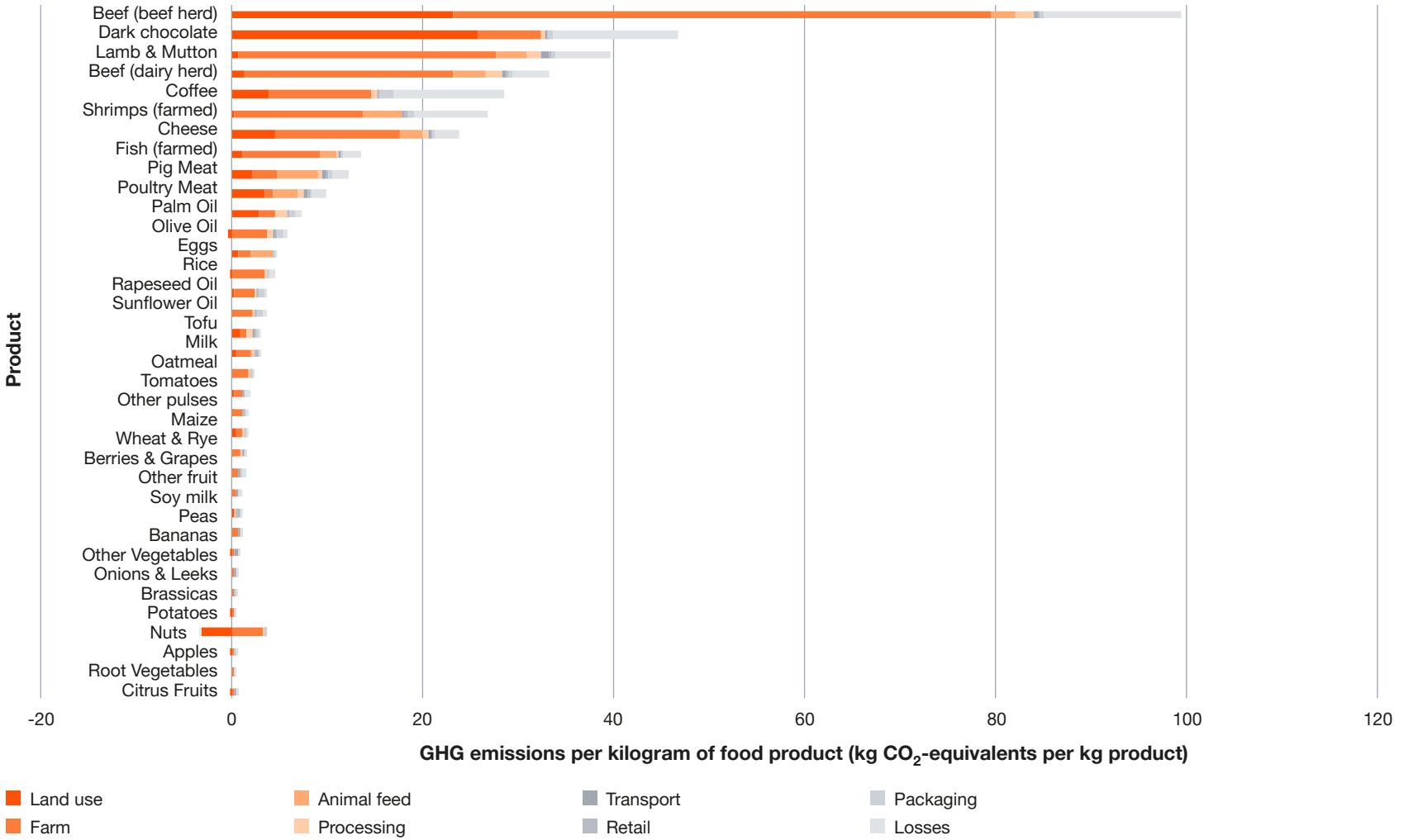
Dutch consumers are also highly digitally literate, increasingly shopping online, including for food. Supermarkets have responded with self-scanning technology, digital apps, and AI systems. However, the proliferation of individual discounts, deals, and omnichannel shopping has made customers less loyal and more willing to shop around for specific purchases.[69] These trends are expected to further accelerate with wider AI adoption.

Sustainability

One of the major drivers of food systems globally is the transition from animal-based to plant-based sources of protein, with plant-based proteins offering a more efficient way to deliver calories and nutrients.

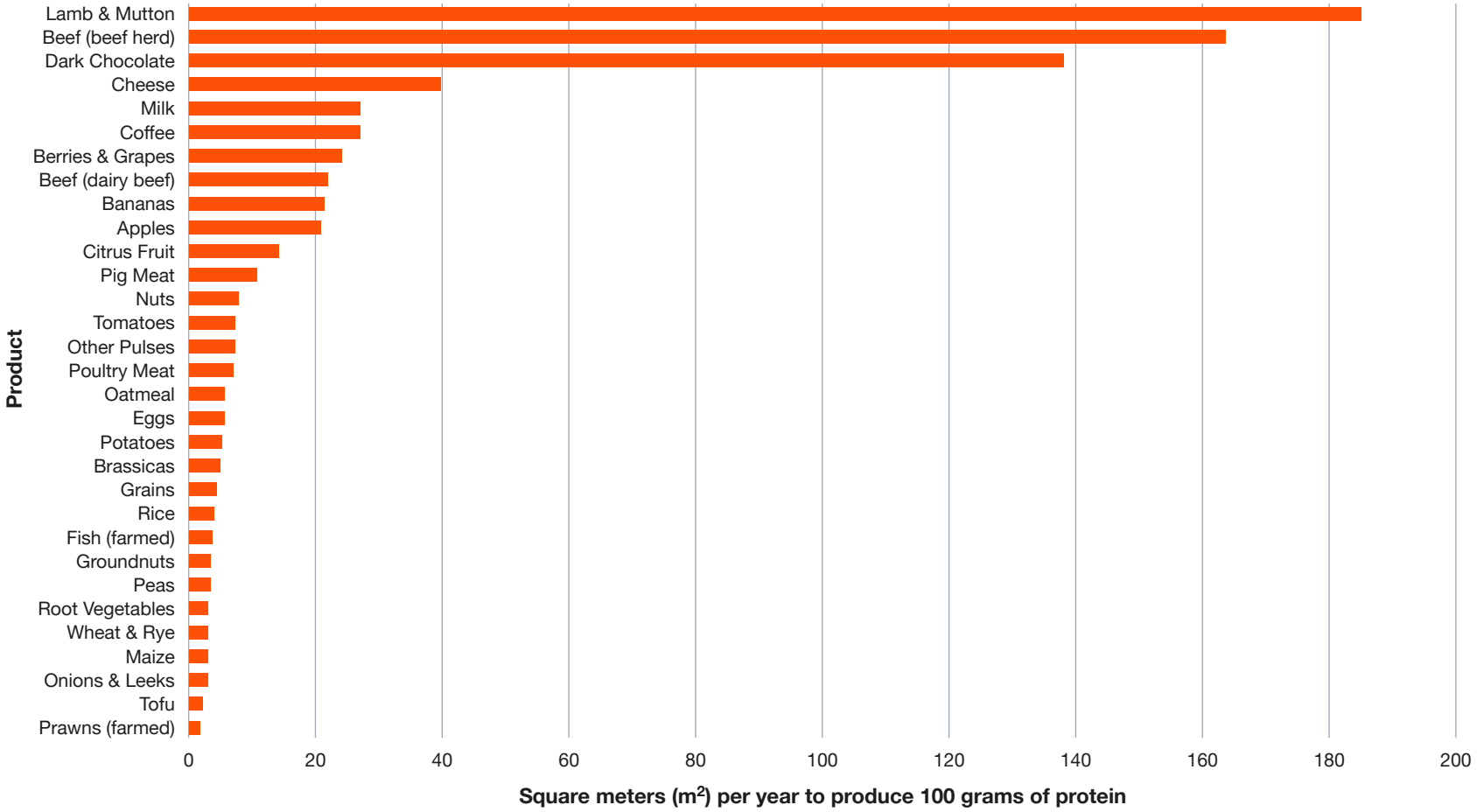
To start with, there are massive differences in the GHG emissions and land use of different food products (Figures 6 and 7).

Figure 6: Environmental impact of different food products



Source: Our World in Data, based on Joseph Poore and Thomas Nemecek (2018).

Figure 7: Land use impact of different food products



Source: Our World in Data, based on Joseph Poore and Thomas Nemecek (2018).

Animal-based foods have far greater environmental impacts than plant-based alternatives. Producing meat and dairy generates significantly higher greenhouse gas emissions and requires much more land compared with crops such as peas or beans. Even the less resource-intensive animal products, like poultry and pork, still have a much larger ecological footprint than most plant-based sources of protein.

For most foods – and particularly for the largest emitters – most GHG emissions result from land use change and farm-stage processes, which combined account for more than 80% of the GHG emissions.[70] Transport is a relatively small contributor, accounting for less than 10% of emissions for most food products and much less for the largest GHG emitters (for example, only 0.5% of emissions for beef production). Indeed, all post-farm processes – including transport, processing, retail, and packaging – typically account for only a small share of total emissions.[71]

A critical market failure emerges when environmental externalities remain unpriced, cheap resource-intensive foods encourage overconsumption and undermine sustainable transitions. It would be more efficient if humans consumed more plant-based proteins. This is because growing crops for direct human consumption uses fewer resources – such as land, water, and energy – than growing crops to feed animals, which are then used for meat or dairy production. Research by Van Zanten et al. (2023) demonstrates that circular economic principles and plant-based diets, such as the planetary health diet,[72] could reduce agricultural land use by 71% and per capita GHG emissions by 29%, while maintaining European food self-sufficiency and expanding production capacity by 149%.[73]

However, this requires smarter, more sustainable food production and consumption. With technological solutions already available to meet consumer needs within planetary boundaries, food system transformation has become primarily a change management challenge. Market forces may accelerate change, but success requires coordinated action: consumers, companies, and regulatory stakeholders in the how we feed domain must work together to enable the transition toward more plant-based consumption.

Demographics add another layer to rising protein demand. Meat and dairy consumption are strongly correlated with rising incomes. So, as large and fast-growing countries develop economically, particularly in Asia, they typically aspire to match the animal protein consumption levels of wealthier regions.[74]

Furthermore, while developing countries will see the largest population and income growth, high-income nations face ageing populations with significantly more elderly residents. Growing scientific consensus indicates that older adults require higher protein intake. Combined with overall population growth, global protein needs will increase from both expanding and ageing populations.[75] This creates a sustainability paradox: developed countries maintain high animal protein consumption while developing nations increase theirs, challenging agriculture's environmental transition.

Indeed, consumers in wealthy countries with diverse food options – like the Netherlands – despite increasingly recognising the environmental impact of animal-heavy diets, maintain high levels of animal protein consumption.[76] Dutch diets currently comprise 39% plant-based and 61% animal proteins.[77] While the government has set a target to equalise consumption of both protein types, progress toward plant-based alternatives remains slow.[78]

The FAO estimates that unhealthy dietary patterns impose

$8bn

in annual hidden costs on global agri-food systems.

Resource-intensive proteins – beef, pork, and dairy – while declining, continue to dominate Dutch diets. The consumption of chicken and cheese has been increasing, with Dutch consumers spending $300 per person annually on cheese, trailing only France in European spending.[79]

Many major supermarkets in the Netherlands – and increasingly across Europe – have set the goal that by 2030, 60% of their protein sales will be plant-based and 40% animal-based.[80] This commitment is part of a broader effort to align with the planetary health diet and reduce the environmental impact of food systems. Dutch retailers such as Albert Heijn and Lidl are leading this transition, and over 90% of Dutch food retailers are already tracking their protein split using dedicated methodologies.

Ethical consumption (animal welfare and social responsibility)

Growing consumer consciousness around animal welfare and social responsibility represents another significant trend. A generational divide is emerging in developed countries: traditional consumers maintain protein-heavy diets, while younger demographics increasingly expect producers to prioritise ethical considerations – animal welfare, social responsibility, and fairness.[81, 82]

Nevertheless, the sustainability premium creates a significant challenge: ethical food products consistently cost more due to higher production and compliance standards. Layered onto existing inflation and input cost increases, this generates a critical dilemma – how to advance environmental and social goals without pricing out lower-income consumers.

Health, safety, and nutritional value

Finally, consumer demand is also shaped by health and wellness trends and growing expectations for safe and nutritious food. The stakes are significant: the FAO estimates that unhealthy dietary patterns impose $8bn in annual hidden costs on global agri-food systems,[83] while 2.6 billion people lack access to affordable healthy diets.[84]

Health considerations matter to Dutch consumers, particularly concerns about pesticide use and ultra-processed foods, though they express lower worry levels than their international counterparts.[85] Although declining, Dutch consumption of sugar and alcohol remains high. Simultaneously, demand continues for lower-calorie, gluten-free, and organic products, with growing interest in high-protein foods for health benefits.

Besides promoting environmentally friendly diets, governments and policymakers are increasingly advocating for a reduction in salt, saturated fat, sugar and alcohol intake to combat obesity, while simultaneously recommending consumption of essential vitamins and minerals.[86] The EU's Farm to Fork Strategy aims to advance organic farming, climate-smart agriculture, traceability, local sourcing, and healthier diets.[87] Consumers, including those in the Netherlands, are increasingly responsive to food safety issues and scandals.

Food consumption patterns now intersect with wellness technology and lifestyle trends, particularly around obesity – affecting 18% of OECD adults and 14% of Dutch adults.[88] GLP-1 drugs, which mimic natural hormone production to manage blood sugar and suppress appetite, could prove transformative by reducing daily caloric intake by 720-990 calories per person.[89] If widely adopted, these medications could significantly lower food demand in affluent countries, enabling both healthier eating patterns and redirection of agricultural production toward regions with insufficient caloric access.

Points to consider for stakeholders in the how we feed domain

Agricultural and food production involves intricate coordination of planting, processing, and distribution processes – all constrained by natural cycles and requiring careful balance of environmental, land use, and social costs. Yet food represents far more than a standard consumer product: it embodies deep emotional significance and necessity, woven into the historical and cultural fabric of every human society.

This complexity demands comprehensive understanding – not just of how modern food systems function and their societal implications, but of how diverse stakeholders, both established and emerging, shape this critical domain.

We have described major trends in driving food production and consumption. These trends are transforming the traditional agri-food sector into a broader how we feed domain – serving the underlying human need for adequate, affordable, and nutritious food – where industries, companies and other stakeholders increasingly collaborate and compete, forming new ecosystems that replace traditional linear value chains.[90]

While the how we feed domain is becoming increasingly complex, it also creates significant opportunities for those who can strike the intricate balance between people, planet, and profit: new value pools are emerging while others decline. Against this backdrop, here are key considerations for different stakeholders in the how we feed domain.

Producers: embrace technology-driven, high-value production to simultaneously boost yields, food security, and sustainability

Producers must acknowledge that the sustainability transition is underway. The strategic response is to pivot toward high-productivity, high-value-added, and specialised activities that comply with environmental limits and suit local production conditions. Since producers often operate as price takers, rising health and sustainability standards will create viable markets only for those who can produce at scale with sufficient efficiency to generate adequate margins.

Adopting agricultural technology (AgTech) solutions that increase yields, enhance food security, and enable sustainable production is essential. Such production advances include gene discovery and editing, the development of sustainable alternatives to palm oil, chemicals, pesticides, and fertilisers, alternative protein R&D, vertical farming (growing crops indoors in stacked layers), regenerative agriculture, which is a great way to reduce inputs, increase yields and soil quality, smart water management, and precision technologies – including remote monitoring, robotic planting and harvesting, and predictive analytics.

However, such investments are costly despite providing significant societal benefits. Therefore, other stakeholders – including consumers – must support producers' productivity and sustainability transition by accepting price premiums. Financiers, such as banks, insurers and governments, should also incentivise and reward sustainable behaviour.

Agricultural commodity traders: digital platforms, strategic sourcing, and facilitating regenerative and tech-enabled farming

Challenging geopolitical conditions and intensifying climate change impacts are expected to keep global commodity markets highly volatile.

To navigate this uncertainty, agricultural commodity traders should invest in digital platforms for transparent sourcing and risk management, while adopting flexible supply strategies – securing long-term contracts during shortages and leveraging spot market advantages during abundance. Additionally, agricultural commodity traders play an important role in building business cases to monetise sustainability initiatives and premiums.

Feed suppliers: focus on circularity and sustainability

Feed suppliers should prioritise the development of sustainable feed formulations, circularity initiatives, and creating alternative feed solutions.

One example of improving the environmental footprint of cattle farming is reducing individual animals' emission intensity, for instance by replacing conventional soy- or corn-based concentrated feed with a more sustainable, forage-based diet (for example grasses and legumes). Feed additives, such as the red seaweed Asparagopsis (a product containing active compounds derived from red seaweed), which decrease methane production by cattle by 30-60%, deserve specific attention as they could help significantly reduce methane emissions.

Food processing and retail companies: focus on demand-driven production, while nudging consumers to make better choices

These companies are uniquely positioned to understand consumer preferences and actual market demand. By organising value chains to respond to these demand signals and incorporating appropriate sustainability credentials, they can align entire supply networks with evolving market expectations.

This positioning gives retailers a crucial role in driving shifts toward sustainable diets, even amid the current green backlash. Companies can effectively support consumers by informing, nudging, enabling, and rewarding healthy, sustainable choices through strategic interventions across the customer journey.

Relatively achievable 'quick wins' include minimising food waste and emphasising local supply chains where societally beneficial – simultaneously addressing sustainability, affordability, and resilience. Circular approaches can transform current waste streams into valuable assets, creating new revenue opportunities.

Looking ahead, evolving consumer preferences across different cultural and demographic groups will reshape food consumption patterns beyond simple pricing considerations. Companies should anticipate demand shifts emphasising affordability, sustainability, health, variety, safety, convenience, novelty, and digital channels, while understanding how different consumer segments prioritise these factors. They should make it easy to align sustainability and health requirements with the desires of consumers. Emerging trends like GLP-1 drugs and the convergence of technology, wellness, and food are already shifting consumer behavior.

Consumers: understand and accept the sustainability premium

Currently, food prices fail to reflect true costs when environmental and social externalities are included. Initiatives like True Price, which attempt to bridge this gap, should be more widely endorsed by both producers and consumers to create a more sustainable and equitable food system.

As consumers represent the largest group of agri-food stakeholders, they can drive transformative change through their purchasing decisions. While affordability will remain a key driver of consumer behavior, climate change and environmental pressures in a resource-constrained world are already pushing food prices upward. Therefore, consumers, especially older generations, who tend to prioritise affordability over sustainability relatively more than younger generations, must recognise the critical role their dietary choices, consumption patterns, and waste behaviors play in driving food system transformation.

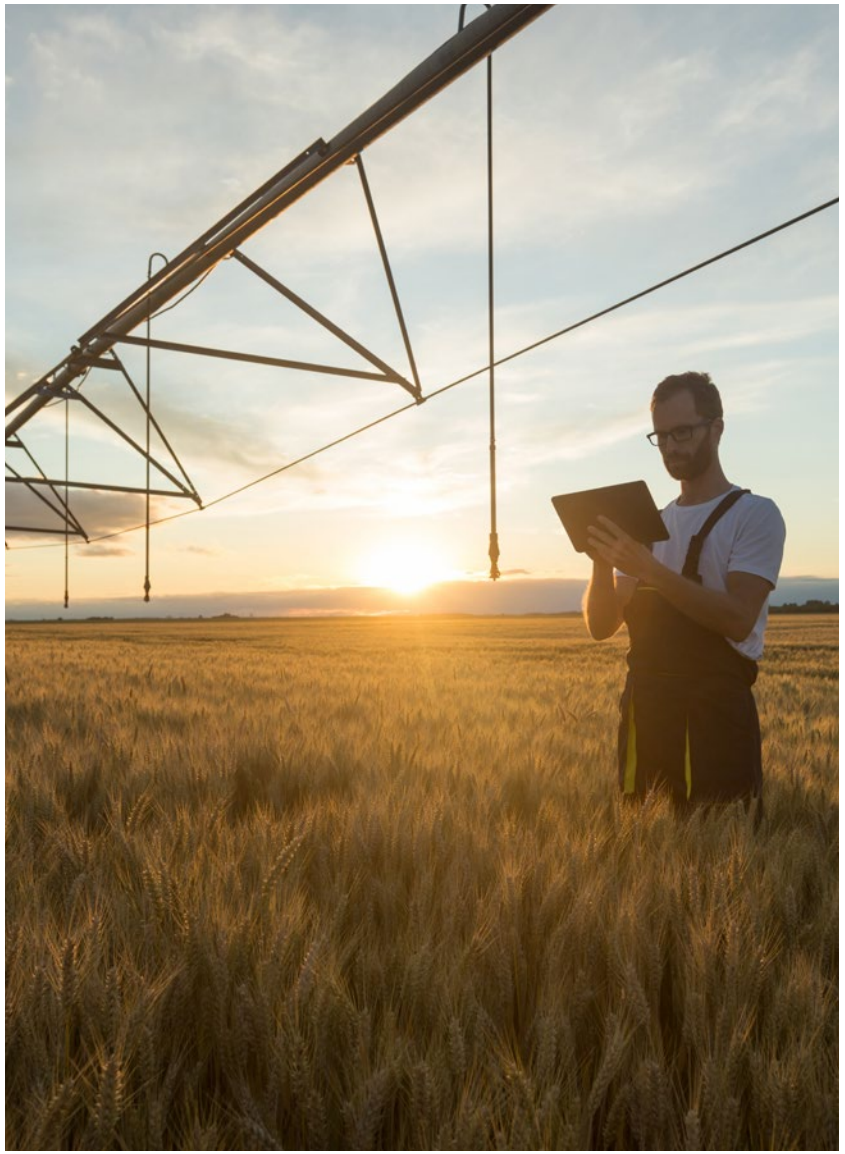
Financiers, such as banks and investors, have an important role to play in terms of providing capital for promising but under-invested AgTech solutions that require capital to scale.

Policymakers, financiers, and regulators: orchestrate the domain stakeholders to achieve better food systems

Finally, transforming modern food systems requires coordinated communication and collaboration to navigate complex trade-offs. Intensifying agricultural production to boost food availability can compromise sustainability through soil degradation, water depletion, pollution, and climate impacts. Similarly, importing agri-food products from cheaper markets to improve affordability may undermine local production and sustainability goals. Enforcing strict food safety standards, while essential for public health, can reduce affordability by increasing production costs and food waste.

Policymakers and regulators must carefully balance these competing priorities, supporting those disadvantaged by societal transitions while creating conditions for new winners to emerge. They should strategically deploy available policy tools – including production, health and environmental standards, competition policy, public procurement, education, and fiscal measures like taxes or subsidies – to shift consumption toward societally beneficial products while maintaining price accessibility.

Most critically, policymakers serve as orchestrators of the entire food ecosystem, fostering communication and collaboration within and across sectors toward a shared vision: ensuring adequate, affordable, and nutritious food for all.



Appendix

We estimate that the Dutch how we feed domain has a GVA of approximately €71bn. Here are the steps that we follow to compute it.

We use the OECD input-output (I-O) table for the year 2022 as a base to capture how different industries in the Netherlands are linked in buyer-supplier relationships. We use 2022 as a base year, given that it was the year for which the latest OECD I-O table was available. It could be that there were distortions because of rebound effects from Covid-19 or Russia's invasion of Ukraine. Nevertheless, we chose the latest available I-O table as a leading factor, as the 2021 and 2020 versions would also have the Covid-19 impact, while 2019 would already be at least five years old. As our aim was to only approximate the value of the how we feed domain, we did not test how this number would match using different I-O tables.

Then, following the sector-domain mapping (p.31-34) methodology in **PwC's Value in Motion: Methodology publication**, we use agriculture, hunting, forestry and fishing (A), and accommodation and food service activities (I) as anchor tenants for the how we feed domain (sectors that most strongly represent the how we feed domain). Deviating slightly from the original methodology, we allocate food processing (C10T12) also as an anchor tenant for the how we feed domain.

By assigning anchor tenants, we allocated some proportion of the total value of the sector output to that domain and let the logic of the I-O table quantitatively allocate the rest of the sector's value across the other domains, based on the relationship between the anchor tenant and each sector comprising the other domains.

The anchor tenant (AT) values are apportioned to their relevant domain in terms of their value by:

$$\text{AT} = \frac{\text{total sector output}}{(\text{total sector output to other sectors} + \text{total sector output})}$$

With the AT apportioned to its domain, we allow for the rest of the value (1–AT) to be apportioned across the other domains as per their relationship; that is, informed by the relevant I-O table, to the other sectors, which act as anchor tenants in their own right. The remaining allocation of the AT is scaled across the other domains, and scaled such that the row total of all sectors across all domains, including the 'Other' domain – a catchall domain for GVA not explicitly accounted for in the nine named domains – captures the full value of the sector output. Hence, the row total of the sector across all domains is equal to the full value (in GVA terms) accounted for.

We obtain a conversion matrix from all sectors to nine domains, one of which is how we feed, indicating the percentages each sector contributes to each domain. Subsequently, we multiply the sector to domain percentages row by each sector's total GVA to get the GVA flows each sector contributes to each domain. Finally, each domain-specific column sum indicates the total GVA associated with a domain.

Endnotes

1 PwC (January 2025): Reconfiguring the global food system.
2 Baarsma (August 2020): Nederland voedselparadijs.
3 World-Grain (February 2025): Country focus: The Netherlands.
4 IMF (October 2025): GDP, current prices.
5 Britannica: List of the world's largest countries and dependencies by area.
6 Baarsma (August 2020): Nederland voedselparadijs.
7 FoodDrinkEurope (2022): Data & trends EU food and drink Industry.
8 PwC (July 2025): Making sense of economic ecosystems.
9 World Bank (July 2025): World Population Day: trends and demographic changes.
10 World Health Organization (July 2025): Global hunger declines, but rises in Africa and western Asia: UN report.
11 FAO (October 2018): Food security and nutrition: challenges for agriculture and the hidden potential of soil.
12 World Resources Institute (December 2018): How to sustainably feed 10 billion people by 2050, in 21 Charts.
13 Wageningen University & Research (October 2025): Global food systems are exceeding planetary boundaries.
14 Earth.org (June 2025): Bananas, coffee, chocolate: how climate change is threatening the world's most beloved foods.
15 The Observatory of Economic Complexity.
16 Bondarenko (August 2025): From battlefield to market: How disruptions in Ukraine affected grain price trends.
17 PwC (December 2024): Protecting People & Prosperity. Climate risks to US and EU commodity supplies.
18 Economist (2022): Global Food Security Index.
19 Wageningen University & Research: How 'food secure' is the Netherlands?
20 Baarsma (August 2020): Nederland voedselparadijs.
21 Rijksoverheid: Food security.
22 Our World in Data: Land use.
23 Ibid.
24 Ibid.
25 Wageningen University & Research (2025): De Nederlandse agrarische sector in internationaal verband.
26 Baarsma (August 2020): Nederland voedselparadijs.
27 PwC (March 2025): Which industries are future-proof, and which need action?
28 Lucas & Horton (October 2025): A global and just future for food.
29 Wageningen University & Research: Biodiversity, agriculture and food.
30 Ritchie (December 2022): Wild mammals make up only a few percent of the world's mammal biomass.
31 Cabernard et al. (2024): Biodiversity impacts of recent land-use change driven by increases in agri-food imports.
32 Etifor: Soil degradation: why it matters and how we can measure its impact.
33 Utrecht University: Bending the curve of biodiversity loss starts with insight into the causes.
34 Rabobank (July 2021): How to unlock the green potential of the agricultural sector.
35 Our World in Data (2019): Food production is responsible for one-quarter of the world's greenhouse gas emissions.
36 Rosa & Gabrielli (May 2023): Achieving net-zero emissions in agriculture: a review.
37 Allianz (October 2025): Feeding a warming world: Securing food and economic stability in a changing climate.
38 Rosa & Gabrielli (May 2023): Achieving net-zero emissions in agriculture: a review.
39 RVO (October 2023): Circular agrifood & biomass. Food & materials for a sustainable future.
40 National Geographic (September 2017): This tiny country feeds the world.
41 Wageningen University & Research (April 2025): Imminent drought in The Netherlands: groundwater levels plummet due to dry spring.
42 Dutch News (October 2025): Dutch political parties "far too weak" on farming and climate.
43 Rabobank (March 2025): Five key transformations to watch to navigate the global food system amid increasing volatility.
44 Ibid.
45 Our World in Data: Fertilisers.
46 Our World in Data: Environmental impacts of food production.
47 Allianz (October 2025): Feeding a warming world: Securing food and economic stability in a changing climate.
48 Energy Monitor (August 2022): The Dutch nitrogen crisis shows what happens when policymakers fail to step up.
49 PwC (March 2025): Future-proofing the Dutch economy.
50 National Geographic (September 2017): This tiny country feeds the world.
51 PwC: How we feed ourselves.
52 Our World in Data: Hunger and undernourishment.
53 World Food Programme (June 2024): 5 facts about food waste and hunger.
54 According to Eurostat, 'food waste is any food and inedible parts of food, that has entered in the food supply chain, that then has been removed or discarded from the food supply chain or at the final consumption stage, that is finally destined to be processed as waste, either separately collected as food waste or collected in municipal waste; moreover, food waste is any food, and inedible parts of food, removed from the food supply chain to be recovered or disposed.'
55 World Resources Institute (November 2024): How much food does the world really waste? What we know — and what we don't.
56 Allianz (October 2025): Feeding a warming world: Securing food and economic stability in a changing climate.
57 World Resources Institute (November 2024): How much food does the world really waste? What we know — and what we don't.

58 RVO (October 2023): Circular agrifood & biomass. Food & materials for a sustainable future.
59 Eurostat (September 2025): Food waste and food waste and prevention – estimates.
60 Dutch News (September 2025): The Dutch are throwing away food for 4.5 billion meals each year.
61 Wageningen University & Research (September 2025): Monitor voedselverspilling update 2009 – 2023.
62 Voedingscentrum (2022): Household food waste by Dutch consumers in 2022.
63 ECB (June 2024): Economic and financial impacts of nature degradation and biodiversity loss.
64 ABN AMRO (October 2025): Transaction Trends - Cost of living improved despite more expensive groceries.
65 PwC (July 2025): Voice of the consumer 2025.
66 Ibid.
67 Ibid.
68 BMI (September 2025): Netherlands food and drink report.
69 Ibid.
70 Farm-stage emissions include processes such as the application of fertilisers — both organic ("manure management") and synthetic; and enteric fermentation (the production of methane in the stomachs of cattle). **71** Our World in Data (January 2020): You want to reduce the carbon footprint of your food? Focus on what you eat, not whether your food is local.
72 The planetary health diet (PHD), also known as the EAT-Lancet diet, is designed to be healthy, adaptable to diverse cultures, and environmentally sustainable for a world population of up to 10 billion people. The PHD is a flexitarian diet consisting largely of plant-based foods: vegetables, fruits, whole grains, legumes, nuts and unsaturated oils. It includes moderate amounts of fish and shellfish, poultry, dairy, and eggs. Red meat (beef, lamb, and pork) is included in small quantities. Processed meat, highly processed foods, added sugars, refined grains and starchy vegetables are minimised.
73 RVO (October 2023): Circular agrifood & biomass. Food & materials for a sustainable future.
74 Our World in Data: Daily per capita protein supply vs. GDP per capita, 2022.
75 Smith et al. (2024): Meeting the global protein supply requirements of a growing and ageing population.
76 Ibid.
77 Wageningen University & Research (March 2024): Persistent preference for meat and dairy, and a sluggish transition to a more plant-based diet.
78 Ibid.
79 BMI (September 2025): Netherlands food and drink report.
80 Proveg (October 2024): Retailers urged to shift to 60% plant 40% animal protein.
81 Rabobank (September 2024): The key trends shaping the future of European animal protein consumption.
82 PwC (July 2025): Voice of the consumer 2025.
83 FAO (November 2024): Unhealthy dietary patterns drive $8 trillion in annual hidden costs of global agrifood systems.
84 World Bank (2024): Can everyone afford to eat healthy? New data show progress, but not everywhere.
85 PwC (July 2025): Voice of the consumer.
86 BMI (September 2025): Netherlands food and drink report.
87 European Commission: Farm to fork strategy.
88 OECD (November 2023): Health at a glance 2023.
89 Dilley et al. (2025): Characteristics and food consumption for current, previous, and potential consumers of GLP-1 s.
90 PwC (April 2025): The leader's guide to value in motion.

Contacts

Acknowledgments

Authors:
Barbara Baarsma, Chief Economist, PwC Netherlands
Sebastiaan Nijhuis, AgriFood Leader, PwC Netherlands
Stuti Sethi, Global How We Feed Leader, Strategy& Netherlands
Guntars Upis, Chief Economist Office, PwC Netherlands

The author would like to thank Robin van den Akker, Remko Blom, Yentl Knossenburg, Saskia Leurdijk, Ricardo Ribas Santolim, Corrina Schoordijk, Richard Volbeda, and Astrid van der Werf for their valuable contributions in the making and dissemination of this report.

Barbara Baarsma
Chief Economist,
PwC Netherlands
T: +31 (0)6 24 20 47 07
E: barbara.baarsma@pwc.com

Sebastiaan Nijhuis
AgriFood Leader,
PwC Netherlands
T: +31(0)6 18 56 71 25,
E: sebastiaan.nijhuis@pwc.com

Veronique Roos-Emonds
Reinvention Leader,
PwC Netherlands
T: +31 (0)6 12 34 56 78
E: veronique.roos@pwc.com

Stuti Sethi
Global How We Feed Leader,
Strategy& Netherlands
T: +31 (0)6 23 80 22 71
E: stuti.sethi@pwc.com

Milo Hartendorf
Consumer Markets Industry Leader,
PwC Netherlands
T: +31 (0)6 22 99 15 98
E: milo.hartendorf@pwc.com