



MAPPING THE UK FOOD SYSTEM

A Report for the UKRI Transforming UK
Food Systems Programme

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ACKNOWLEDGEMENTS

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The authors would like to thank Guy Poppy, Programme Director, Strategic Priorities Fund (SPF) Food Systems Programme; Riaz Bhunnoo, Director of the Global Food Security Programme, and Flora Hetherington, Senior Manager, Global Food Security Programme for the helpful guidance and advice provided throughout the project.

This report is supported by an interactive on-line resource at
www.foodsecurity.ac.uk/uk-food-mapping

This report should be referenced as:

Hasnain, S., Ingram, J. and Zurek, M. 2020. Mapping the UK Food System – a report for the UKRI Transforming UK Food Systems Programme. Environmental Change Institute, University of Oxford, Oxford. ISBN 978-1-874370-81-9

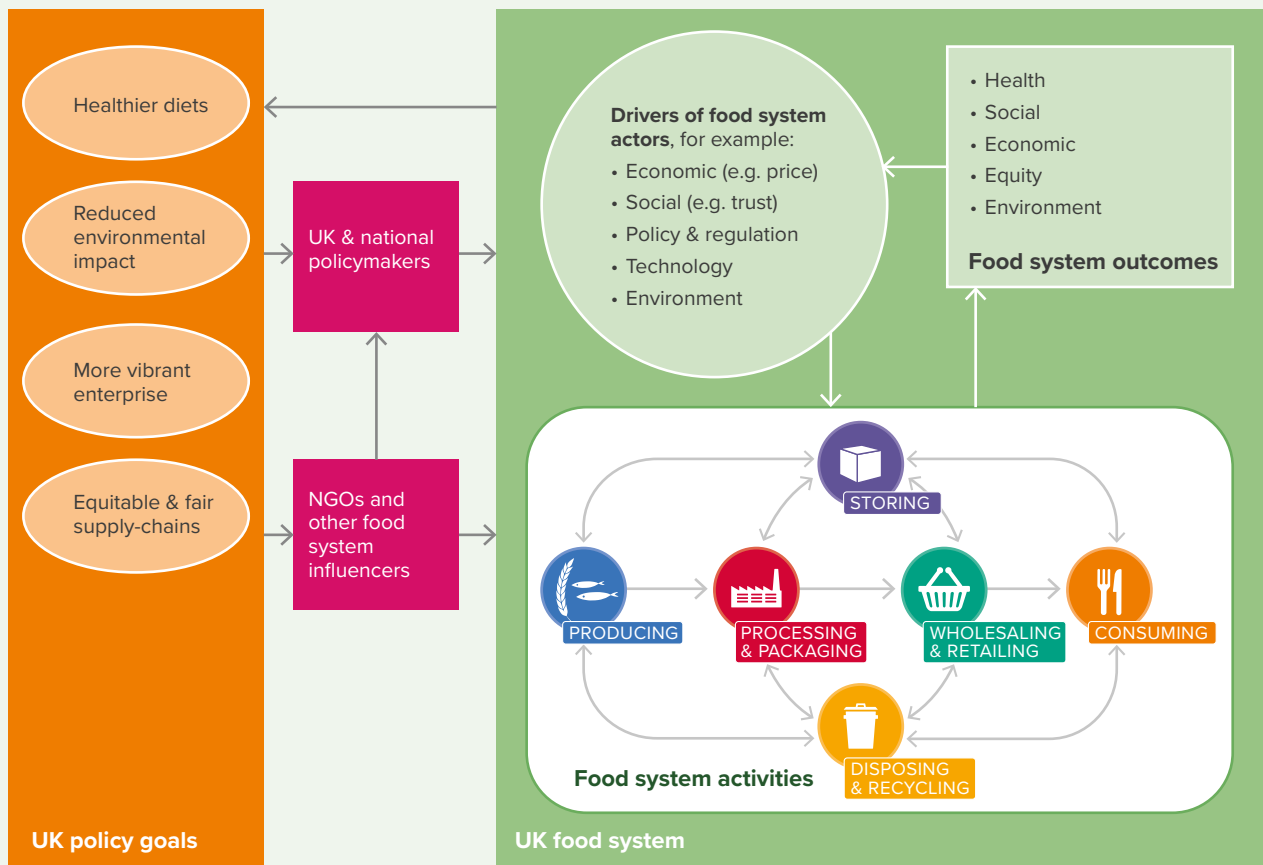
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EXECUTIVE SUMMARY

This report quantifies the distribution of economic value, the number of enterprises, and levels of employment across the UK food system. It has 'mapped' UK food system activities as described by their economic value, employee and enterprise numbers. This provides a first assessment of the overall shape of the UK food system and a foundation to build on for further analyses.

Figure 1: Conceptual framework for the UK food system. Adapted from the SUSFANS project. [22]



The UK food system is complex. It includes a wide range of food system ‘activities’ (e.g. producing, processing, retailing, consuming, and disposing) undertaken by a wide range of ‘actors’ operating across multiple levels on spatial, temporal, and jurisdictional scales. These actors are influenced by many different socioeconomic and biophysical ‘drivers’ which shape the behaviour and future direction of the food system. The food system activities and their actors are supported by a diverse range of facilities (e.g. transport and market infrastructure, financial services, trade, logistics and IT systems), and are governed by regulations, policies, laws, certifications, and norms across multiple sectors. The activities of these actors result in a wide range of ‘outcomes’ affecting food security and nutrition, other aspects of economic and social well-being, and environmental sustainability. [Figure 1](#) gives a conceptual framework for the UK food system.

The ‘food systems’ approach is frequently used in analyses and planning of agri-food development. Taking a food systems approach allows for exploring multiple perspectives, addressing differing objectives, analysing trade-offs of transformations, and for dealing with complexity. It helps to identify the motives of different food system actors and the range of policy, market, social, technological, and biophysical environmental drivers that influence their activities. It functions as a necessary foundation for this report as the approach also allows food-chain activities to be identified and linked to their social, economic, and environmental contexts.

Report highlights

The UK agri-food sector is a major driver of economic growth. Overall, in 2018 it contributed £121 billion or 9.4% to national Gross Value Added (GVA) and the wider system employed 4.3 million people. Food and drink accounts for 20% of the total manufacturing sector by turnover and employs over 430,000 people in the UK. Of these, 46,000 were employed and £4.04 billion of value added in Scotland; 23,750 were employed and exports worth £0.54 billion in Wales; and 20,776 were employed and £1.55 billion in value added in Northern Ireland.

Although there are enormous economic benefits from the UK food system, it faces multiple challenges. Diets too rich in fat, sugar, and meat and too low in fruit and vegetables are contributing to obesity and related health problems, especially in deprived households. Unsustainable production methods are driving biodiversity loss, soil degradation, pollution, water scarcity and climate change in both the UK and overseas. Poor working conditions persist, especially for low-skilled labour in the food sector. Meanwhile, stresses and shocks including climate change, COVID-19, and EU-exit highlight the need for greater resilience. It is clear that transformational change is needed, but this must balance with complex trade-offs and competing needs and interests across the food system.

Some of the major findings in this report include:

- Concentration in the UK economy has increased with time. There are ten large food retailers. Together, the top five food manufacturers have a £30 billion turnover. There are two main UK big players in contract catering while US multinationals dominate fast food alongside SMEs.

- While the food sector is the biggest employer in the UK, 30% of food manufacturing employees are from the EU (63% of which are in meat processing plants). Other sectors in food employment have low wages, and there is an increasing issue of a lack of appropriate workplace skills.
- The UK has the third highest volume sales of ultra-processed foods per capita out of 80 high- and middle-income countries, and the most processed diet of countries in Europe. This contributes to the 63% of UK adults being obese or overweight.
- Land use is dominated by animal and cereal production (e.g. 52% of croppable area in the UK is covered with cereals).
- The UK heavily relies on external food sources, particularly the EU. 53% of food consumed in the UK in 2018 was produced domestically, followed by 23% sourced from the EU. There are financial deficits in all food categories, except for drink (due to whisky exports). The UK is importing food that can be grown here, albeit often dictated by seasonality.

Despite extensive searching, it is clear that data gaps exist in a number of important areas:

- The proportion of food-related employment, enterprises, and turnover in supporting activities such as freight, logistics, storage, packaging, and trade.
- The proportion of food-related packaging.
- Enterprise breakdown in food retailing, catering, and wholesaling.

Report caveats

It is also important to note five major caveats of the report:

1. Much of the available data is aggregated so disaggregating it to display discrete food system activities is not always possible.
2. For the purposes of this report, differences between the UK (England, Scotland, Wales, and Northern Ireland) and Britain (England, Scotland, and Wales) matter because of the data sources. Not all data sets include all countries, and this has been made apparent where relevant.
3. Whenever possible, the data has been taken from the most recent available source. This has resulted in a data spread from 2012–2020. The source year has been made apparent.
4. The complexity of the food system can be observed in the data where disaggregating food-focused activities, employers, and enterprises is challenging, particularly for activities in import and export, logistics, and other key supporting services. This has been noted where relevant.
5. Data sets relate to different activities and actors within the food system including the 'food sector', 'agri-food sector', 'food and drink sector' and 'food and drink manufacturing sector' as well as the broader 'food system' itself.

Despite these caveats, the report does indicate important future research challenges:

1. An extended analysis of the structure of the UK food system by a deeper examination of the connections and interactions between the different food system activities. This would describe, for example, material and information flows, to identify potential vulnerabilities of the food system.
2. An analysis of how the identified driving forces are impacting on specific food system actor groups and what this means for the functioning and the outcomes of the food system.
3. An analysis of which actors are more influential than others to determine who is shaping actor behaviour across the system; the role of concentration in particular food system actor groups and whether and how this impacts power relationships in the UK food system.

This report should be studied hand-in-hand with the interactive web-based product at: www.foodsecurity.ac.uk/uk-food-mapping/

This visually demonstrates the main information and underlying data.



INTRODUCTION

The UK food system is complex and includes a wide range of food system activities (e.g. producing, processing, retailing, consuming, and disposing). These food system activities and their actors are supported by transport and market infrastructure, financial services, trade, and logistics (to name a few). They are governed by regulations, policies, laws, certifications, and norms across multiple sectors and multiple levels on spatial, temporal and jurisdictional scales. Together with biophysical factors, these drivers shape the behaviour and future direction of the food system. The food system results in outcomes in food and nutrition security, economic and social well-being, and environmental sustainability.

The Economist Intelligence Unit's 2019 Global Food Security Index places the UK at 17 out of 113 countries [1]. On the Food Sustainability Index, it is at 24 out of 67 countries (2018) when considering food loss and waste, agricultural sustainability, and nutritional challenges [2]. The UK faces a food and nutrition insecurity crisis, poor equity in relation with food access and affordability, and natural resource degradation as a result of food system activities. The complexity and vulnerability of the UK food system is partly associated with the just-in-time (JIT) food supply system with necessary items in supply chains arriving just when they are needed. Such systems are at the mercy of even minor disruptions where the impacts flow through and magnify on their journey [3].

The UK agri-food sector is a major driver of economic growth. Overall, in 2018 it contributed £121 billion or 9.4% to national Gross Value Added (GVA) and the wider system employed 4.3 million people [4], [5]. Food and drink accounts for 20% of the total manufacturing sector by turnover and employs over 430,000 people in the UK. Of these, 46,000 were employed and £4.04 billion of value added in Scotland; 23,750 were employed and exports worth £0.54 billion in Wales; and 20,776 were employed and £1.55 billion in value added in Northern Ireland [5], [6].

The information in this report is drawn from a range of publicly-available data sources, public documents, and research articles. It has been supplemented by a set of interviews with stakeholders in food governance in the United Kingdom. It identifies key food system activities, actors, and policies of the UK food system and explores the situation in the devolved administrations. This report intends to illustrate the complexity and interconnections within the UK's food system through food system activities.¹

It presents a review of existing food systems maps and then explores the UK food system through a description of the various aspects of food system activities, the actors involved at each stage, the drivers influencing their activities, and key outcomes of food system activities.

Food system maps

The food systems approach is frequently used in matters of agricultural development and food and nutrition security. Taking a food systems approach allows for the exploration of multiple perspectives, addressing multiple objectives, analysing [11] trade-offs of transformations, and for dealing with complexity. This means that the food system concept can be operationalised in several ways depending on the purpose of the analysis. Historically, most existing food systems models were limited by a narrow focus on aspects of the food system or by adopting a single disciplinary perspective [7]. Later models were developed to explore concerns of power and vulnerability within food systems [8], [9]. More recently, food systems have begun to include food system activities in the context of food system objectives such as achieving food security, and food system drivers such as demographic change. This combined approach therefore fully defines the activities and examines their interactions with natural and human systems while accounting for food and nutrition security, sustainability, and equity [10], [11].

The approach has been particularly useful in exploring food security as a goal. The FAO's definition of food security "when all people, at all times, have physical, economic and social access to sufficient, safe, and nutritious food to meet their dietary needs and food preferences for an active and healthy life" necessitates the structure and analysis provided by a food system approach [12]. Activities within the food system, such as farming, fishing, packing, consuming, disposing are part of the core value chain, and are carried out by the actors involved, such as farmers, factory-workers, and consumers. These actors are affected by social, economic, political, and environmental drivers [13]. Impacts of these activities result in a range of health, socio-economic, and environmental outcomes [14].

¹ Given the scope of the report, it excludes food policy in recognition of a forthcoming associated report, and sector specific regulations, codes, and standards.

See Appendix A for a sample of food systems models, for example, [Figure A-1](#), the model developed by the Global Environmental Change and Food Systems (GECAFS) programme [\[15\]](#). This model includes the main food system activities, drivers, and outcomes, but also emphasises the social and environmental processes that are a key part of this relationship. The feedback loops in this model are significant in highlighting the role of trade-offs in food systems transformations: interventions made within the system have environmental and socio-economic impacts. However, this model does not allow for the examination of interactions across spatio-temporal and institutional scales [\[16\]](#), [\[17\]](#).

The framework developed by the United Nations Environment Programme's (UNEP) International Resources Panel focuses on the impact of food system activities on natural resources such as land, water, and fossil fuels (see [Figure A-2](#)) [\[18\]](#). The model notes that besides food production activities such as farming and fishing, other activities also influence natural resources through their consumption of inputs (e.g. use of paper by packaging activities and fuel by logistics and consumption activities).

Similarly, the model for the TransMango project explores the use of natural and anthropogenic assets utilised by the food system ([Figure A-3](#)) [\[19\]](#). Additionally, the TransMango map expands on the supporting food system activities performed by regulatory institutions and bodies. The project aimed to examine the vulnerability of food systems to shocks and stresses, so the conceptual map examines the sources of the disruptions, drivers, and their pathways.

The model developed for the Center for Integrated Modeling of Sustainable Agriculture and Nutrition Security (CIMSANS) project ([Figure A-4](#)) was developed for exploring malnutrition [\[20\]](#). Here, there are explicit connections between the causes of malnutrition, food system activities, and drivers of production, with an emphasis of feedback loops influenced by socio-economic, technological, and environmental drivers. Unlike other models exploring food insecurity, the CIMSANS model takes the malnutrition causes as a starting point and follows the food system activities back to production and its determinants. Similarly, the Global Panel on Agriculture and Food Systems for Nutrition (GLOPAN) model is focused on evaluating diet quality ([Figure A-5](#)) through a nested approach [\[21\]](#). The model relates diet quality within the smaller sub-systems of the food environment and consumer characteristics but does not make the connection with the broader food system [\[17\]](#).

The EU project Metrics, Models and Foresight for European Sustainable Food And Nutrition, or SUSFANS, ([Figure A-6](#)) developed a conceptual framework through rigorous stakeholder engagement [\[22\]](#). This conceptual map was designed to connect EU food policies with their impact on diet, nutrition, the environment, and markets. The SUSFANS map therefore still contains the core food system activities but provides an explicit link with the EU food policy goals and emphasises the differences between direct and indirect drivers influencing food system actors. The nested feedback loops allow for an exploration of the necessary activities and relevant drivers for the different actors within the complex system.

In a different vein, the FAO food system wheel is organised around FAO's goals of poverty reduction and food and nutrition security. These are embedded in the system that consists of a layer of activities, supporting services and the societal and natural context. This framework is useful in situating FAO's development strategies and improving performance in its various activity areas ([Figure A-7](#)) [23]. The food system map developed by the City, University of London's Centre for Food Policy ([Figure A-8](#)) focuses on the interconnections between the core food chain activities with economic, political, environmental, health and social dimensions (including system drivers and outcomes) of the food system [24]. The model is intended to be a tool for policymakers to guide decision-making around food and examine implications of interventions across the food system.

The Foresight4Food conceptual model ([Figure A-9](#)) draws on insights from integrated food systems and market systems thinking and allows for an exploration of the critical trade-offs in exploring food system transformations [25]. The model has been operationalised to examine the future of small-scale agriculture in global food systems. RAND Europe and the UK Food Standards Agency (FSA) conducted a foresight exercise to explore the specific food system themes relevant to the FSA's activities ([Figure A-10](#)).

This exercise involved the development of a food system map alongside a logic model of the FSA, which were used to examine systemic interdependencies and pathways of supporting a safe food system [26].

UK food system

The food system review above demonstrates the diversity of conceptual maps. Conceptual maps for examining food system problems are developed to respond to specific purposes, for example, identifying areas of vulnerability or exploring the proximal causes of complex problems. For the purposes of this illustrative exercise, insights are drawn from the GECAFS food system model [11], the SUSFANS conceptual model for the EU food system [22], and the Foresight4Food food system diagram [25]. The policy goals for the UK have been taken from the Global Food Security Programme and are aligned with the ambitions of the National Food Strategy. This diagram will be used to organise the content of this report. Section 1 will map the UK food system's activities, Section 2 will examine key drivers, and Section 3 will discuss the key food system outcomes in relation to the UK policy goals.

SECTION 1: MAPPING FOOD SYSTEM ACTIVITIES

In this section, key aspects of food system activities are visualised.

Number of people employed in the UK food system

Figure 2: Number of people employed in the UK food system.



Key messages

- In the UK, farming accounts for only 11% of people employed in the food system.
- Farming and processing have about the same number of employees.
- By far the most people in the food system are employed in retailing and hospitality.



*This is a total figure for all freight and logistics in the UK because it was not possible to disaggregate food and food-related products.

Figure 2 does not include employees in supporting activities such as policymaking and research and development. We further recognise that each part of these food system activities has its own non-food supply chain. This is demonstrated with the addition of the agricultural inputs which includes agricultural machinery, agro-chemicals, and agricultural wholesalers, but non-food supply chains of other food system activities have not been investigated. Please note that this diagram has been compiled primarily through data from Defra (for which employee data is rounded) and other data points are from different years and organisations [33]. Employee numbers for freight and logistics include employees for the entire road haulage and logistics industry [46]. Employee numbers for packaging are sourced from the Packaging Federation [53]. Employee numbers for logistics and packaging have not been disaggregated by involvement in food and food-related products. Caterers refer to non-residential catering; input suppliers include the agricultural supply industry (with manufacturing of agricultural machinery, fertilisers and pesticides), and agricultural wholesalers. Primary processing refers to food and drink processing that feeds into food manufacturing (and includes food and drink processing machinery), and secondary processing refers to food and drink manufacturing activities from primary processing (e.g. slaughtering, malting, etc.) to complex food preparations. For the web-based version of this report, click on any circle to see a breakdown in terms of e.g. number of employees in manufacturing.

Number of enterprises in the UK food system

Figure 3: Number of enterprises in the UK food system.



Key messages

- In the UK, approximately the same number of enterprises are engaged in farming as in food trade.
- 96% of food system enterprises are SMEs.
- The food system relies on only a small number of input suppliers and packaging companies.



*This is a total figure for all freight and logistics in the UK because it was not possible to disaggregate food and food-related products.

Figure 3 does not include enterprises in supporting activities in the food system. See visualisation in Figure 1 above for descriptions of the other food system aspects. Enterprises here refer to the smallest combination of legal units with a degree of autonomy and functions as an organisational unit producing goods and or services. This data does not include the number of sites, but enterprises may carry out their activities across multiple sites. This diagram has been compiled primarily through Defra data [33], except for the number of packaging enterprises [105]. Number of enterprises in freight considers only road freight [106], and the number of enterprises in logistics (192,525) has been drawn from the Freight Transportation Authority’s Logistics Report [28]. Data on the number of veg box schemes has been drawn from the Food Foundation [32]. Of internationally trading companies, 43,800 considers the number of internationally trading businesses in Great Britain only in production and agriculture, and 172,400 include distributors. The data for distributors has not been disaggregated by food-related distribution, and the data does not include traders for other sections of the food system [107]. For the web-based version of this report, click on any circle to see the breakdown in terms of e.g. enterprises in food production.

This visualisation is supported by the following data on the grocery market share in the UK, and the number of SMEs in the UK food system.

Grocery market share

Tesco alone commands 21% of the UK market share, followed by Sainsbury’s at 11%, and Asda at 10%. It is noteworthy that food shopping on the internet that includes the major supermarkets has reached 7%, up from 6.1% in 2015 (see Figure 4 below). the Institute of Grocery Distribution (IGD) finds that 40% of all British shoppers have purchased some food and groceries online, and that 98% of British shoppers use a supermarket or hypermarket for their grocery shopping [27].



The role of SMEs

There are an estimated 7,030 micro, small- and medium-sized enterprises² in the UK food and drink manufacturing sector [3]. In 2018 they had a turnover of £25 billion and 110,000 employees (Figure 5 and 6). Excluding beverages, SMEs account for 96% of businesses, 25% of employment, and 25% of total turnover. A third of SME manufacturers are bakeries and producers of baked goods. Other food products³ comprised the largest GVA⁴ contribution with £6 billion in 2017. Baked and farinaceous products had a GVA of £3.9 billion, 12% of the total food and drink manufacturing GVA. SMEs also have a strong presence in the rest of the UK food system as well, for example, of the 192,525 logistic enterprises presented in Figure 3, nearly 192,000 are SMEs [28].

Figure 5: Number of SMEs in in UK food and drink manufacturing in 2018. [4]

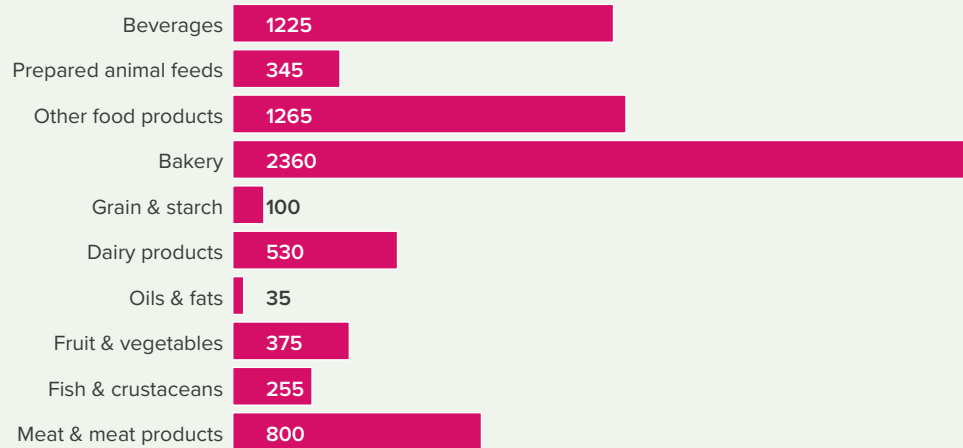
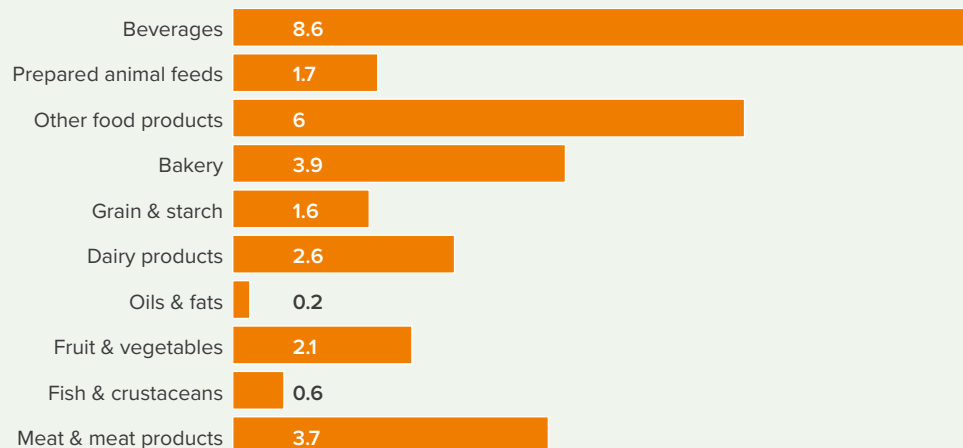


Figure 6: GVA of sector by product in 2017. [4]



² SMEs are classified as businesses with 0–249 employees.

³ Refer to prepared meals, confectionary, condiments, and seasonings.

⁴ Small contributions (less than 4% overall) to food and drink manufacturing have been treated as zeroes in the source data [4]

Of the 5.9 million UK businesses (as of 2019), 99.9% are SMEs [29]. Of these, more than 95% are micro-businesses with 0–9 employees, less than 4% are small businesses with 10–49 employees, and 0.6% are medium-sized with 50–259 employees. Therefore, more than 95% of businesses in the UK appear to employ fewer than 10 people. The construction industry dominates with 17.68% of all businesses, although the retail sector dominates by generating 33.7% of turnover generated by UK industries [30].

SMEs make up a significant proportion of the UK food system:

- In 2019, there were 157,595 SMEs in agriculture, forestry and fishing, accounting for 2.69% of total businesses in the UK [30].
- SMEs make up 99% of businesses in the UK hospitality sector and contribute at least 50% of the industry's total GVA [31].⁵
- There are 276,190 SMEs in the manufacturing sector (including food processing), which is 4.71% of total businesses. [30].⁶

Veg box schemes

Veg box schemes connect producers directly with consumers and decentralise food supply. Sales in 101 surveyed veg box schemes increased by 111% between end of February to mid-April 2020 as a result of COVID-19 [32]. Collectively, across the 500 estimated box schemes currently operating, at least 3.5 million boxes have been delivered during this crisis. 82% of box schemes now have waiting lists or have closed to new applicants. The Food Foundation estimated that if these lists are met and the customers who have been turned away are supplied, an additional 5.3 million veg boxes could be supplied from mid-April to mid-June 2020 [32]. Box schemes vary from small schemes that supply about 300 boxes per week, large schemes supplying 300–2000 boxes a week and large-scale schemes that supply 55,000 boxes per week. Although the size of boxes varies, medium boxes weigh about 5 kg, enough to supply the recommended fruit and vegetable intake for one person for a week. If medium sized boxes cost £12⁷ on average and that at least 3 million boxes have already been sold in the six weeks of crisis, this amounts to nearly £42 million that has bypassed the central machinery of the food system and supported primary producers directly. Veg box schemes therefore benefit primary producers directly.

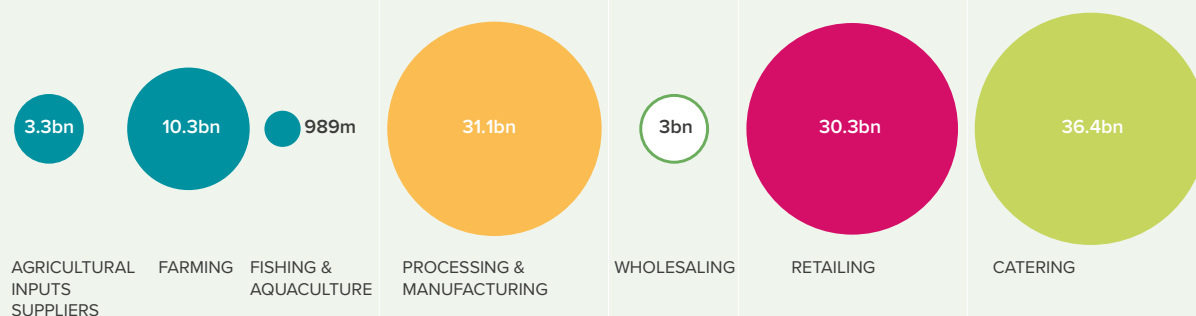
⁵ The hospitality industry data includes hotel, holiday, and other accommodation, restaurants (licensed and unlicensed), cafés, take away food shops and stands, clubs and bars, event catering, food service activities, convention and trade show organisers, cultural and recreational activities, and placement agency activities.

⁶ This data has not been disaggregated for food-related processing.

⁷ Small veg boxes for an individual average at £7.5 and large boxes for a family of 4 average at £16.

Economic summary of the UK food system

Figure: 7 Economic summary of the UK food system.



Key messages

- The gross value add (GVA) decreases along the food chain.
- Although largely unseen, processing and manufacturing is about the same value as retailing.
- Over 90% of retail food items do not go through wholesaling companies.
- The UK trade deficit in food and drink is £24.3 billion.



PACKAGING

FREIGHT & LOGISTICS*

FOOD TRADE GAP

*This is a total figure for all freight and logistics in the UK because it was not possible to disaggregate food and food-related products.

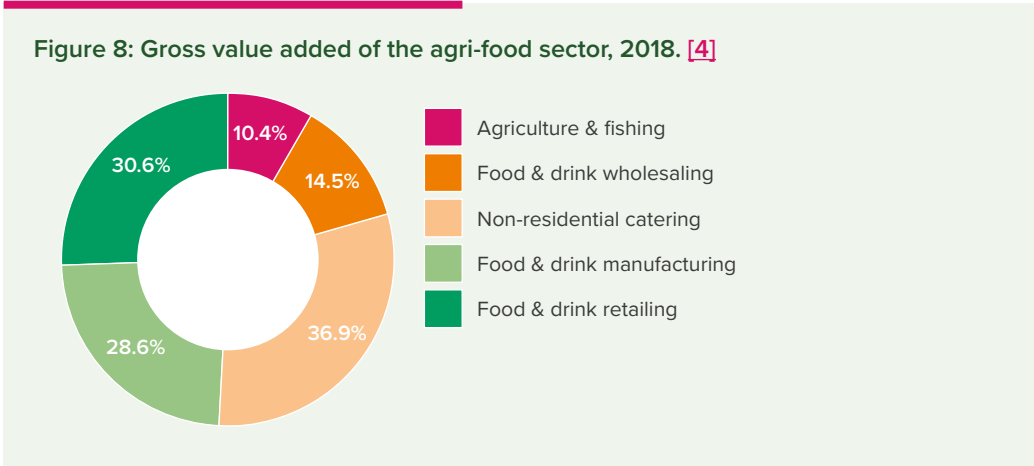
The data for Figure 7 has been primarily drawn from Defra [33], with GVA defined as the difference between the value of goods and services produced and the cost of input material used. These have been taken from the Annual Business Survey's provisional data for 2017 calculated at basic prices (market price minus taxes plus subsidies). All data shown are GVA except for freight, which refers to amount contributed to the UK economy in 2018 [47]. £124 billion refers to the GVA of road haulage and logistics (RHA 2019), and packaging refers to total sales in the industry in 2012 [53]. Expenditure for the UK population refers to household expenditure on food and drink (£128.7 bn) and expenditure on non-residential catering services (£97 bn). The food trade gap refers to earnings from imports (£46.8 bn) which feed into manufacturing, wholesaling, retailing, and consuming, or exports (£22.5 bn) coming out of production, manufacturing, and input supplies) [33]. For the web-based version of this report, click on any circle to see the breakdown in terms of e.g. GVA in retail.

Food system activities

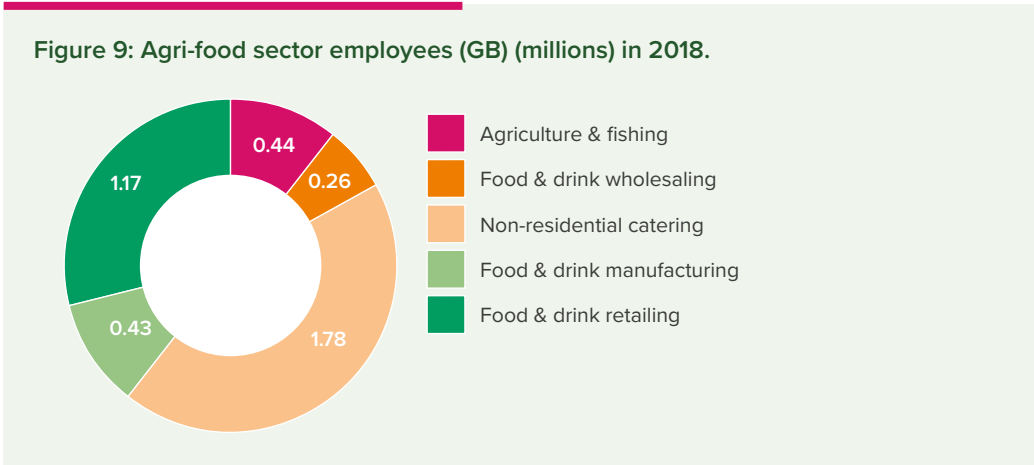
Employment in the UK food sector accounted for 14% of employment in Great Britain if agriculture, fishing, self-employed farmers, manufacturing, wholesaling, retailing, and catering are considered. Agriculture and fishing alone contributed £10.4 billion to the GVA in 2018, with 0.44 million employees [4]. Total factor productivity of the UK food chain post-farmgate has increased by 0.8% between 2017 and 2018 [4].

Food system activities such as production are further supported by input industries such as feed, pesticides, fertiliser, and technologies. The UK food sector has a critical role in employment, contribution to the economy, and food security. This section presents key data points on food system activities and their associated actors as illustrated in [Figure 1](#).

The GVA in 2018 (see Figure 8) of the food sector increased by 5.6% from 2017, by 10.4% for wholesaling, 2.3% for manufacturing, 6.7% for catering, and 5.1% for retailing [\[4\]](#).



In terms of employment in Great Britain (see Figure 9), non-residential catering accounts for 49% of post-farmgate employment, an increase of 2.2% from 2017.



Production

Agriculture and fishing contributed £10.4 billion to the national GVA in 2019, with 0.44 million employees [\[4\]](#).

Total factor productivity of UK’s agriculture decreased by 2.1% from 2017 to 2018 due to decreased production volumes and increased input volumes.

Key facts

- Utilised Agricultural Area covers 71% of the UK's land
- Total labour force on commercial holdings is 477 thousand
- Agriculture contributes less than 1% to the national economy
- 14% of UK farms failed to make a positive Farm Business Income (FBI) in 2017/18, while under a third had an FBI over £50,000
- Total income from farming: Fell by 17% to £4,697 million between 2017/18
- Cost of intermediate consumption: Rose by 7.6% with higher costs of fuel, feed, and fertilizer

Source (Defra 2020)

The Utilised Agricultural Area (UAA) covers 71% of UK's land. The UAA includes arable and horticultural crops, uncropped arable land, common rough grazing, temporary and permanent grassland and land for outdoor pigs. There were 217,000 agricultural holdings in 2017, with the average holding area amounting to 81.4 hectares [33].

Figure 10 below shows major crops in the UK by area of production. Area planted is dominated by cereals, followed by oilseeds. It is useful to note here that some of these crops are more intensively cropped than others. Figure 11 reveals the breakdown for total horticultural area in the UK. Amount devoted to crop area can be compared with the total output at market prices. For example, in 2014 alone, the UK crop and plant sector equated to £8,282 million, with major contributions from wheat, vegetables, and horticultural plants and flowers (Figure 12) [34].

Figure 10: Breakdown of croppable area at June 1 compared to 2018. [35]

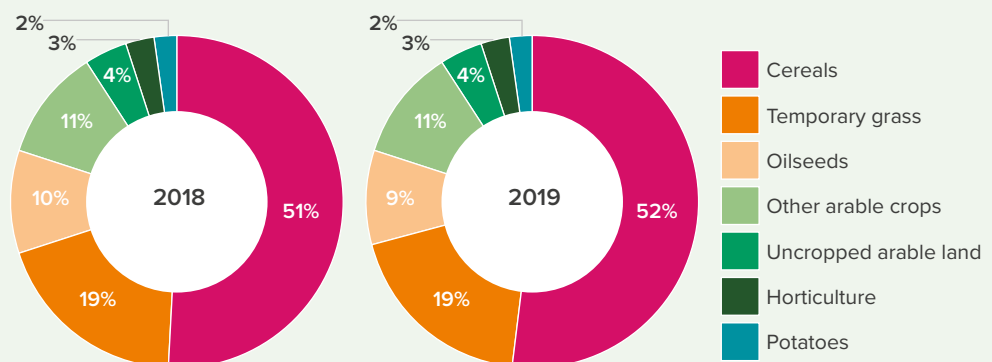


Figure 11: Breakdown of total horticultural area, June 2019. [35]

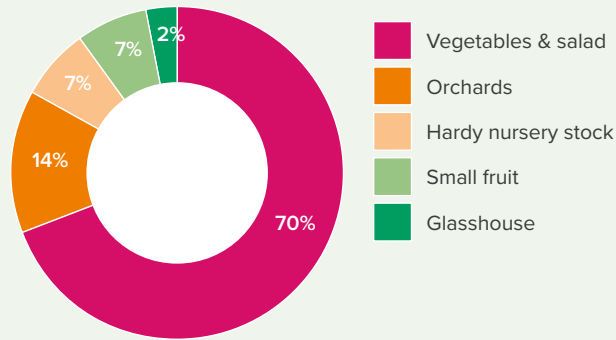
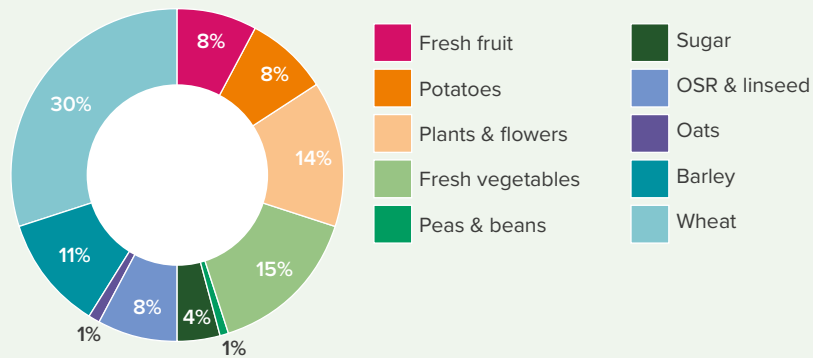


Figure 12: Total output at market prices for the plant growing sector in 2014. [34]



In terms of the livestock population, cattle and calves have decreased by 1.1% from 2017 and 2018 to 9.891 million, beef and dairy populations remained mostly unchanged at 1.6 and 1.9 million animals, sheep and lambs decreased by 3% to 34 million animals, pigs increased by 0.9% to 5.012 million, and poultry increased 3.6% to 188 million. Value of milk increased to nearly £4.5 billion, mainly because of price increases, as the number of cattle had decreased. Value of eggs increased to 641 million primarily through increased volume of production. Value of livestock meats increased across the sector except for pig meat (due to overproduction). Cattle meat increased by £43 million to £3,031 million, sheep meat by £57 million to £1,258 million (driven by price), poultry increased by £208 million to £2,626 million (driven by an expanding sector and higher prices) [33].

Horticulture is a valuable sector in the UK. Home produced fruit was valued at £769 million in 2018, with a 4.1% decrease in production between 2017 and 2018. Production of vegetables contributed nearly 53% of the UK's supply in 2018 (a reduction from 57% in 2017) [33].

Agricultural workforce

The agricultural workforce in 2018 was made up of 477,000 people. This is an ageing workforce, with nearly a third of all holders aged 65 or over, and the median age for workers at 60 years old. The agriculture industry depends on a high number of seasonal workers that often come from EU countries. While difficult to enumerate because of the nature of the jobs and methods of data collection, the British Growers Association estimated 75,000 non-UK seasonal workers in 2016 [36]. This number however, includes 'positions filled' only. The Survey of Agriculture and Horticulture estimated 64,200 seasonal, casual and gang workers in the UK. This number does not disaggregate by nationality.

Of the 466,000 agricultural workers in 2016, 64,000 are estimated to be seasonal, casual, and gang workers. The poultry industry also employs about 13,000 seasonal workers, mostly for the Christmas season. With the abolition of the Seasonal Agriculture Worker's Scheme, the National Farmers Union (NFU) gathered information on the demand and supply of seasonal workers since 2016. However, this survey does not collect information on seasonal workers in the pig industry, dairy cattle, poultry, or meat industry (although these are not as dependent on seasonal workers as much as horticulture) [36]. The agriculture labour force for the UK is a point of vulnerability. The soft fruit production and horticulture overall depends on seasonal labour, much of which is recruited out of the UK. The UK has an ageing farm population, a push to increase domestic consumption of fruits and vegetables, and a low up-take of seasonal jobs from within the UK. As labour requirements of within the UK, it is useful to explore the dependence of each country on seasonal workers across the UK countries.

Consolidation in fishing

- Over two thirds of the UK fishing quota is managed by 25 businesses
- Four fifths of the English fishing quota is controlled by foreign owners
- The five largest quota holders control more than a third of all UK fishing quotas
- Small fishing boats account for 77% of the fishing fleet, but have less than 4% of the quotas

Source: Dowler 2018

Seeds and plant breeding

The UK is a net importer of seeds. However, the annual turnover from UK plant breeding is estimated to be between £200–230 million, with seed sales accounting for £290 million in 2013. It directly employs 400 people through research and technical activities. Plant breeding is conducted by UK based businesses and subsidiaries of transnational corporations. Only MSMEs are involved in the commercial plant breeding sector. The top four players represent 58% of the cumulative market share for fodder and oilseeds, and 95% for barley [34]. UK plant breeding is an important component of UK's agricultural, horticultural and ornamental markets, and its impact can be seen in improvements in yield, quality, and resilience improvements.

Fertilizer and other agrochemicals

Fertilizer use in the UK has declined since the 1980s with improved farming practices and increasing efficiencies. Currently, the UK imports most of its fertilizer from the EU or countries such as Morocco, Algeria, or Russia. The fertilizer and nitrogen compound manufacturing industry occupies a market size of at least £1 billion, with nearly 2000 employees across 106 businesses [37]. Over the past three decades, fertilizer use has decreased 30% for nitrogen, 45% for potash, and 55% for phosphate [38]. Pesticide and other agrochemical manufacturing has a market size of £972 million, with nearly 3000 employees over 90 businesses [39].

Between 2017 and 2018, fertilizer costs increased by £116 million to £1,345 million because of increased global oil prices [33].

Animal feed and other inputs

Between 2017 and 2018, the cost of inputs also rose, with animal feed increasing by £509 million to £5,615 million because of greater demand driven by weather conditions, energy costs rose by £113 million to £1,346 million driven by global oil prices but managed by increased efficiencies [33]. The value of sales for farm equipment in 2019 was just under £2 billion, with exports of £1.8 million (a decrease of 6%). Farm equipment here refers to agriculture tractors, telehandlers, tractor loaders, ploughs, power harrows, sprayers, utility AVs, combines, balers (round and big square), and self-propelled foragers [40].

Key organisations in UK production

Production and producer focused: Defra, National Farmers Union, Tenant Farmers Association, Agricultural Industries Confederation, Scottish Government Agriculture and Rural Delivery Directorate, Science and Advice for Scottish Agriculture (SASA), Agriculture and Horticulture Development Board (AHDB), Advisory Committee on Releases to the Environment, British Food Standards Agency, Food Standards Scotland, Food Foundation, Agri-Food and Biosciences Institute (Northern Ireland), Centre for Environment, Fisheries and Aquaculture Science, Met Office, Compassion in World Farming, Landworkers Alliance, Low Carbon Farming, Fresh Direct, Foundation for Local Food Initiatives, The Soil Association, Environment Agency, Natural England, Nature Friendly Farming Network, National Bee Unit

By crop type: Fresh Produce Consortium, Scottish Fishermen's Association, Scottish Seafood Association, UK Seafood Industry Alliance, Sea Fish Industrial Authority, Home Grown Cereal Authority (AHDB), Crop Health and Protection (CHAP), Veterinary Medicines Directorate (VMD), Animal and Plant Health Agency (APHA), British Growers/Fruit and Vegetable Alliance, British Summer Fruits

Agri-supply: Agricultural Industries Confederation, European Feed Manufacturers' Federation, UK Intellectual Property Office, British Society of Plant Breeders (BSPB), Advisory Committee on Animal Feedingstuffs (British Food Standards Agency), Fertilizer Manufacturers Association, International Fertilizer Association, British Automation and Robot Association, Agricultural Engineering Association

Supporting services: Office for National Statistics, UK Research and Innovation, Food Ethics Council, Sustain, Rural Payments Agency, Marine Management Organization, Committee on Climate Change

Source: compiled by author

Primary processing and secondary processing (manufacturing)

The UK food and drink sector on the whole employs over 430,000 people across the UK and contributes more than £28 billion to the economy. [5]. Food and drink manufacturing contributed £28.6 billion to the national GVA in 2018 [4]. Overall, food processing and manufacturing includes sectors such as fresh foods, ambient foods, chilled foods, frozen foods, drinks, confectionary, bakery, dairy, and meat, poultry and seafood. The sector is changing constantly to meet changing and growing demand particularly through technological and process innovations such as automation. As food and drink processing and manufacturing is large and diverse with at least 30 distinct sectors, this section will present examples from a few areas within it.

Dairy processing

The UK's dairy sector employs at least 23,000 people at processing sites, 50,000 people at dairy farms, and 13,000 active dairy farmers. The sector produces almost £8.8 billion annually from 14 billion litres of milk [41]. These are turned into cheeses (there are over 700 named cheeses produced in the UK), yogurts, milk, and butter. In February 2020, the UK Dairy Roadmap signed on to a sustainability initiative for the UK to ensure that the sector's sustainability targets are met.

Flour milling

Flour milling alone has an annual turnover of £1.25 billion. 12 million bread loaves, 2 million pizzas, and 10 million cakes and biscuits are produced in the UK every day. The flour needed is produced by 32 companies, 51 milling sites and processes 6.2 million tonnes annually. Milled flour is sent to bakeries (66%), biscuit making (11%), others (10%), export (7%), household flour (4%), cake making (2%). 85% of the wheat used by UK millers in 2018/19 was grown in the UK. Infrastructure investments have resulted in a labour productivity of 2.5%/year [42].

Bread and baking

The UK's bread and bakery sector employs 75,000 people and is worth £3.9 million at retail sales value. The sector produces nearly 4 billion units which translated into 11 million loaves of bread sold daily. The sector is made up of large baking companies that produce 80% of the UK's bread by volume, in-store bakeries in supermarkets that produce 17%, and high street or craft bakeries that produce almost 3% [43].

Meat processing

The British meat processing industry is worth £8.2 billion annually and employs over 75,000 people. 40% of these are skilled butchers [44]. There are about 250 red meat abattoirs in the UK, as one in three small abattoirs have closed in the past decade. This is down from nearly 1,890 abattoirs in 1970. Local abattoirs are useful for local producers, saving them longer journeys and providing a market alternative to supermarkets. The closure of smaller units also has an impact on employment as skilled local butchers and processors lose their jobs. Large slaughterhouses currently depend more on unskilled labour and foreign-recruited staff, resulting in nearly 75% of the meat industry workers being from outside of the UK [45].

Key organisations in processing and manufacturing

Process focused: Chilled Foods Association, British Frozen Food Federation, National Association of British and Irish Flour Millers (NABIM), British Meat Processors Association, Dairy UK

Actor focused: Federation of Bakers, Food and Drink Federation, Processing Packaging and Machinery Association, British Automation and Robot Association, Northern Ireland Food and Drink Association, IGD, Department for Business, Energy and Industrial Strategy (BEIS), British Meat Processors Association, British Sandwich Association, Food and Drink Forum, Farm Animal Welfare Committee, Association of Independent Meat Suppliers, British Veterinary Association, Association of Independent Meat Supplies, AHDB, Food Standards Agency, Defra, British Veterinary Association, RSPCA, Compassion in World Farming, UK Export Certification Partnership, Red Tractor Beef and Lamb Board, Livestock, Campaign for Local Abattoirs, Inspiring Excellence and Trust in Food

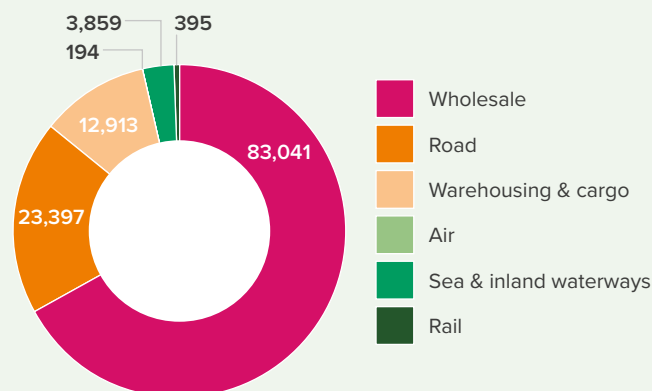
Supporting services: Food Ethics Council, Farm Animal Welfare Committee, Compassion in World Farming, RSPCA, Global Food Safety Initiative, Food and Drink Sector Council, Cold Chain Federation,

Source: compiled by author

Logistics, storage, and packaging

Food logistics now includes more than just freight and truck traffic. It includes the IT systems, complex communication systems, distribution hubs that supply to shops, fast-turnaround ferries, pallet systems, and container and freight management systems. The logistics sector on the whole employs nearly 2.7 million employees over 192,525 enterprises, with a turnover of £942.5 billion and GVA of £123,799 million (10% of the UK's non-financial business economy). The industry can be broken down as follows according to GVA (Figure 13) [28]:

Figure 13: GVA of the UK logistics sector.



Logistics

98% of all food and agricultural products in Great Britain are transported by road freight. Road haulage on the whole employs 2.54 million people and contributes £124 billion to the UK's GVA [46]. In 2017 alone, 287 million tonnes of food products were lifted by heavy goods vehicles (HGVs) registered in Great Britain. This is 21% of all goods lifted [47]. Food lorries themselves account for a fifth of all of UK truck traffic (Lang 2020). Air freight accounts for a smaller proportion of all freight moved, and air freighted food consists mostly of highly perishable food. It is estimated that by value, 6% of air freight imports are food, mostly from Brazil, Kenya, and South Africa [48]. In terms of exports, salmon is the most valuable export valued at £0.6 billion in 2017. The dependence on transportation can be observed in the impacts of the lorry-driver strikes of 2000, where 1000 drivers went on strike for a few days, jeopardising UK food supply [3].

Food products amount to 12.2 million tonnes or 22% of intermodal tonnage, where intermodal journeys involve movement of freight across modes of transportation [47], and 4.9 million tonnes of agricultural products or 9% of intermodal tonnage in 2018. Groupage⁸ amounts to 8 million tonnes, or 14% of intermodal transport.

UK ports alone handle 14 million tonnes of agricultural produce annually, which is 15% of the total dry bulk handled. This breaks down to 8.5 million tonnes of import and 5.5 million tonnes exported [47]. Of the hundreds of UK ports, 88% of food trade goes through 20 big ports. This is considering that nearly 120 are large cargo-handling ports, and 400 non-cargo-handling [49]. UK ports have increasingly become privatised and foreign owned. One estimate considers that UK ports are foreign owned [50]. This has implications for public oversight and money leaving the country instead of getting invested within.

Cold chain

The UK's cold chain is critical to the functioning of the agricultural, manufacturing, processing, and retailing sectors. The frozen food industry and chilled food industries are worth £8 billion and £12 billion alone. The chilled food sector employs over 70,000 people and is responsible for more than 12,000 products every year. Chilled foods consist of dressed and leafy salads, prepared vegetables and fruits, stir fry kits, sandwiches and fillings, cooked meat slices, quiches and flans, pizza, recipe kits, meal accompaniments, sushi, fresh pasta, soups, sauces and dips, desserts, and fresh juices.

Storage

In terms of storage, the members of the UK's Warehousing Association (UKWA) alone have 9.3 million sq. metres of space across the country [51]. The Food Storage and Distribution Federation (FSDF) represents 350 warehouse owners and 75% of all (commercially) available frozen and chilled food warehouse. Of the 424 m sq. ft of warehouse space (1500 units), 62m sq. ft is occupied by food retailers (35% of all users) [52]. In terms of warehousing uptake, 10.1% is taken up by food retail and 2% by the food industry [28].

⁸ Mixed consignments where no single commodity accounts for 75% or more of the weight.

Packaging

Packaging on the whole employs 85,000. The paper industry alone has 56,000 direct employees, 86,000 indirect employees and a yearly turnover of £11 billion [53], [54]. The glass industry has a turnover of £1.3 billion [55]. The industry is critical to the food system but may not always be very visible. However, the value of packaging can be seen in the value of certain goods: for example, the retail value of canned goods is estimated at £2.3 million and the fact that 99.4% of UK households purchase from the canned food category [56].

Packaging permeates the entire food system, with the greatest visible presence through supermarkets. As the retail sector accounts for over half of 1.5 million tonnes of consumer plastic packaging yearly. The top ten UK supermarkets in the UK use more than 810,000 tonnes of single use plastics every year, with a recycling rate of 30–34% for consumer plastic packaging. Supermarkets were also using more than 1.1 billion single use bags and 1.2 billion produce bags. The introduction of the 5p plastic charge reduced plastic use in supermarkets by 80% [57].

Supply chain stocks

At any one point, the UK's retail supply chains hold about 1–4 weeks of stocks, although suppliers hold stocks longer than retailers. However, this varies with commodities, as fresh produce stocks usually last less than 24 hours. If the countries that the UK imports food from are considered as virtual stocks, then it is estimated the UK is effectively only 30% self-sufficient in terms of land [58], [59].

Key organisations in logistics, storage, and packaging

Logistics: Department for Transport, Freight Transportation Association, Road Haulage Association, National Infrastructure Commission, HSE Logistics, Infrastructure and Projects Authority, Network Rail, British Ports Association, Institute of Grocery Distribution, Institute of Refrigeration, Cold Chain Association

Storage: Food Storage and Distribution Federation, Associated Cold Stores and Transport (ACST), UK Warehousing Association

Packaging: Industry Council for Research on Packaging and the Environment (INCPEN), Packaging Federation, Confederation of Paper Industries, British Printing Industries Federation, Tetra Pak, British Glass, Packaging and Films Association, Metal Packaging Manufacturers Association, The Packaging Society (10m3), Paper and Board Association, Paper Industry Technical Association, Paper Packaging Forum, European Federation of Corrugated Board Manufacturers, Foodservice Packaging Association, Pack2Go Europe, British Plastics Federation, British Takeaway Campaign

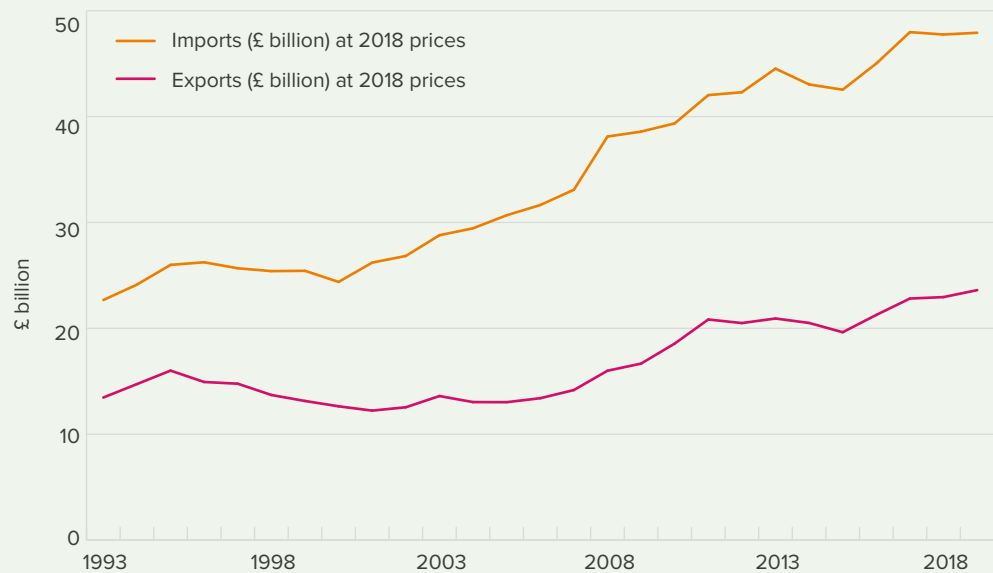
Source: compiled by author

Trade

The UK's food supply is dependent on trade, particularly from the EU. At least 10,000 food containers arrive daily from the EU and supply about 50,000 tonnes of food for the UK [60]. The UK deficit in food and drink reached £24.3 billion in 2018, an increase from £22.8 billion in 2016. Food exports were valued at £22.5 billion, but imports were at £46.8 billion [33]. 24 countries provide more than 90% of what the UK buys [61].

This is a sizeable food trade gap. Fruits and vegetables make up the largest proportion of this deficit at about £9 billion (see Figure 14). Consider that the UK consumers want more UK-grown foods and this gap is not currently being addressed with local production or imports. Figure 15 shows the proportion of UK's food consumption produced within the country, in terms of the farmgate values of raw food, and Figure 16 for trade by different food groups.

Figure 14: Value of trade in food, feed, and drink at 2018. [33]



In 2018, food and drink exports from the UK exceeded £23 billion and reached over 220 countries [5]. 53% of food consumed in the UK in 2018 was produced domestically, followed by 23% sourced from the EU, and the rest from Africa, North America, South America, Asia, non-EU Europe, and Australasia (based on farmgate values of unprocessed foods in 2018) [4]. The largest value imported commodity groups were fruit and vegetables, meat, and beverages. Value of imports has been greater than exports in 2018 in most food categories, except for beverages, where Scotch Whisky exports contributed to a trade surplus of £1.81 billion [4]. Consider UK's self-sufficiency in different food products as shown in Figure 17.

Figure 15: Origins of food consumed in the United Kingdom. [35]



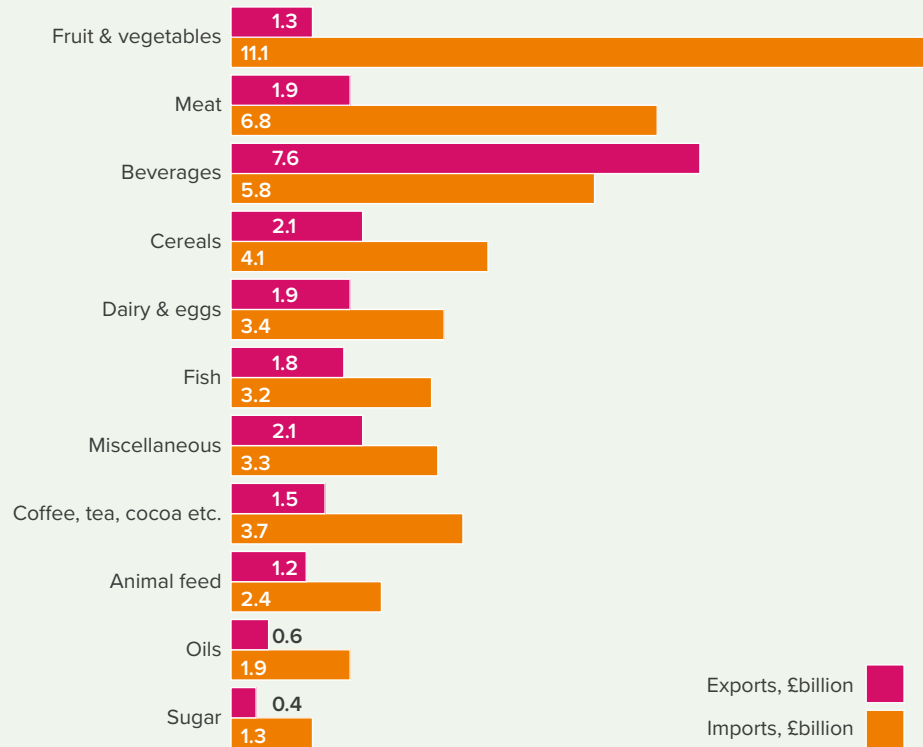
Based on the farmgate value of raw food.

(a) Consumption of UK origin consists of UK domestic production minus UK exports

(b) UK exports are given as a percentage of total UK consumption

(c) Membership of the EU increased between 2002 and 2013, from 15 to 28 countries

Figure 16: UK trade in different food groups, 2018. [4]

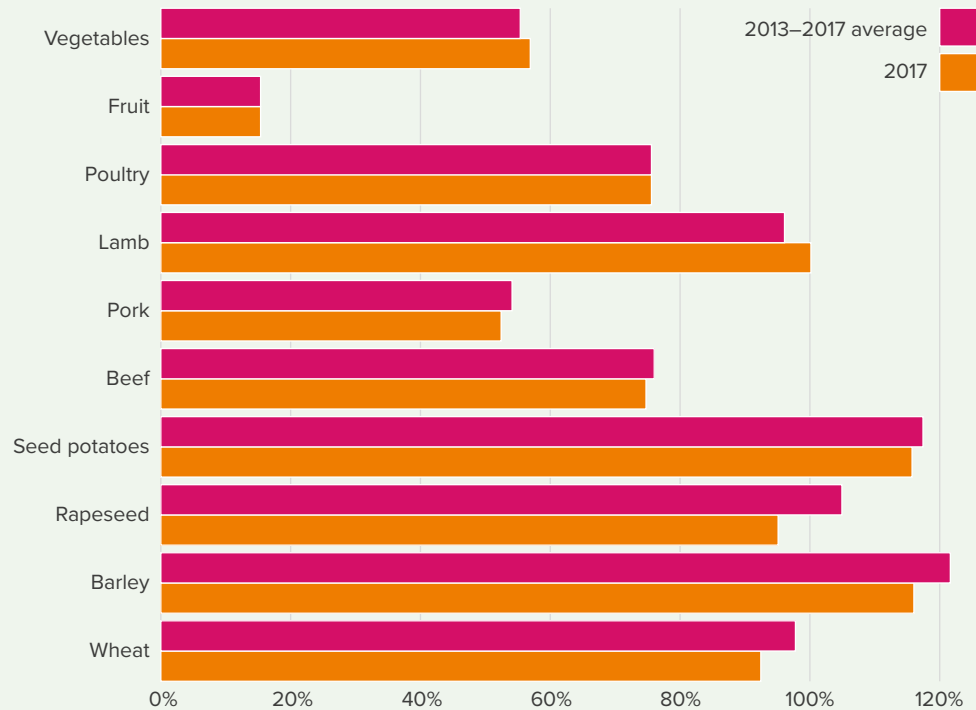


Key facts in trade

- Manufacture of food and beverages exports are worth £6.3 billion, which account for 19% of all international exports. Exports from this sector have grown by 74% since 2007. Whisky accounts for 74% or £4.7 billion of exports in 2018. Food and drink is followed by coke and petroleum, professional, scientific and technical activities, financial and insurance and mining and quarrying
- Export of accommodation and food service activities increased by £75 million to £385 million in 2018.
- Exports to EU: Of the £16.1 billion total in 2018, food and beverage exports made up £2.3 billion, 14% of the total
- Non-EU exports account for £17.7 billion in 2018, of which exports of manufactured food and beverage account for £4 billion, 23% of the total. Accommodation and food service make up 26.3% of the £7.1 billion export of services.

Source: Defra 2019

Figure 17: UK self-sufficiency in food products. [62]



Source: Defra, IHS Maritime & Trade – Global Trade Atlas® / HMRC, AHDB

In 2018, the UK exported 245,000 tonnes of flour. Flour exports have grown steadily in the last five years, and with flour mixes and doughs, flour exports are worth over £230 million. Exports of flour-based products amount to £900 million. These exports represent nearly 700,000 tonnes of wheat necessary for such value-addition [42].

Meat processing companies rely on imports for 26% of their supply. Beef accounts for almost half of all meat imports to the UK, pork accounts for nearly 30% and lamb nearly 20% [44]. The largest supplier is Republic of Ireland, followed by New Zealand, Germany, and the Netherlands. 17% of the UK's meat processing industry's revenue comes from exports. 40% of export revenue comes from beef, followed by sheep and lamb at 36%, pork by 20%, and the rest by other animal products. Export markets are in France, Republic of Ireland, Netherlands, and increasingly China and the US. [44]

Key organisations in trade

Department for International Trade, British Ports Association, Food and Drinks Exporters Association, Defra, Advisory Committee on Novel Foods and Processes, British Customs Authority, COCERAL, China Britain Business Council.

Retail and wholesale

Food and drink retailing contributed about £30.6 billion to UK's GVA in 2018 and employed 0.36 million people. Food and drink catering contributed £36.9 billion, and employed 1.78 million people. Total factor productivity of wholesaling increased by 2% in 2018, while food manufacturing decreased by 0.5%. Women accounted for 55% of food retail employees, and 53% of non-residential catering employees in 2018 [4].

Retailing takes place through a range of sites in the UK. See [Table 1](#) for a summary of food-related shops in the UK.

Of large grocery stores, Tesco had the greatest market share in 2017–18 with 21%, an increase from 19% in 2016–17. Aldi, Iceland, and Lidl combined accounted for 16% market share. Shopping via the internet (including shopping at the bid supermarkets) represented 7% of food sales and non-alcoholic drinks. This has not had a significant change in the past three years [4] ([Figure 4](#)). The breakdown of food sales by type of retail outlet is summarised in [Figure 18](#).

Figure 18: Food sales by retail outlet in the UK. [63]

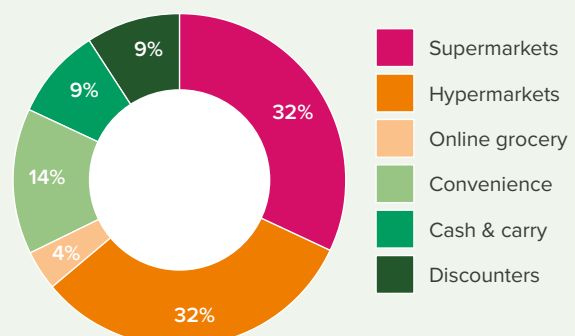


Table 1: Food-related UK shops as of 25 July 2019 [3]

Category	Total units	% of total GB units	Independents	Independents %	Multiples	Multiples %
Bakers	6,213	1.1	2,474	39.8	3,739	60.2
Bars, pubs, clubs	28,925	5.0	16,843	58.2	12,082	41.8
Butchers & fishmongers	3,602	0.6	3,467	96.3	135	3.7
Cafés, fast food	64,061	11.0	48,671	76.0	15,390	24.0
Confectionery, tobacco, and newsagents	11,897	2.1	8,523	71.6	3,374	28.4
Entertainment	14,670	2.5	4,784	32.6	9,886	67.4
Groceries, supermarkets & food shops	43,465	7.5	14,930	34.3	28,535	65.7
Off licences	2,736	0.5	1,915	70.0	821	30.0
Petrol stations	6571	1.1	93	1.4	6,478	98.6
Restaurants	27,983	4.8	22,118	79.0	5,865	21.0

Key organisations in retailing

British Hospitality Association, Institute of Hospitality, Association of Licensed Multiple Retailers (ALMR) (merged with BHA), Association of Convenience Stores, British Retail Consortium

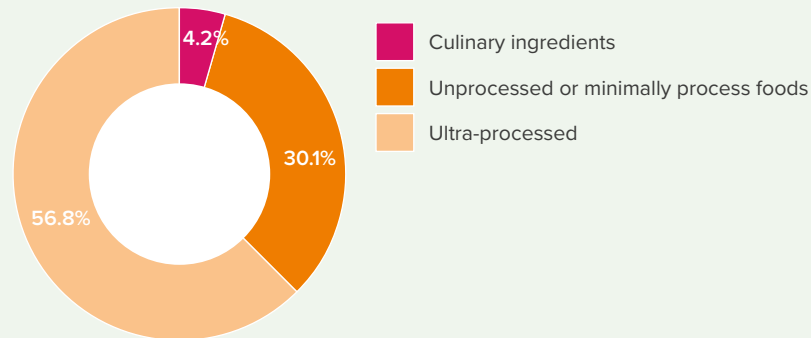
Source: compiled by author

Consuming

Consumer expenditure on food, drink, and catering increased by 2.5% to £225 billion in 2018. Food expenditure for the household increased by 3.5%, eating outside the house increased by 1.1%, and alcoholic drink expenditure by 2.8% [33]. Consumers spent 12% more on household food in 2018 as compared to 2008 (inflation excluded), but only 2% more on catering. The UK also has the third highest volume sales of ultra-processed foods per capita (140.7 kg/capita/year) out of 80 high- and middle-income countries [64], and the most processed diet of countries in Europe [64]. These foods make up more than half of the total dietary energy consumed in the UK (from 2008-2014 national dietary survey) (Figure 19) [65]. Higher consumption of ultra-processed food in the UK is associated with higher BMI and odds of being obese [66].

Surveys consistently observe that despite a stated desire to purchase more British food, consumers in the UK do not. Tim Lang suggests that this disconnect is partly because of insufficient information on what is produced in the UK and the higher consideration of purchasing cheap food [3].

Figure 19: Average energy intake by source. [65]



In 2018, 28% of adults consumed the recommended five portions of fruit and vegetables a day (see [Figure 20](#) for fruits consumed by the UK). Consumption varies with age and gender: those aged 16 to 24 consumed the lowest proportion daily; women were more likely to consume the recommended amounts while only 18% of those aged 5 to 15 ate the recommended portions [67].

Government recommendation for free sugars (all added sugars, naturally present sugars in fruit and vegetable juices, purees and pastes, and sugars in non-dairy drinks) is 5% or less of total caloric intake. Average intakes of free sugars exceeded government recommendations for all age groups and genders (NHS 2020).

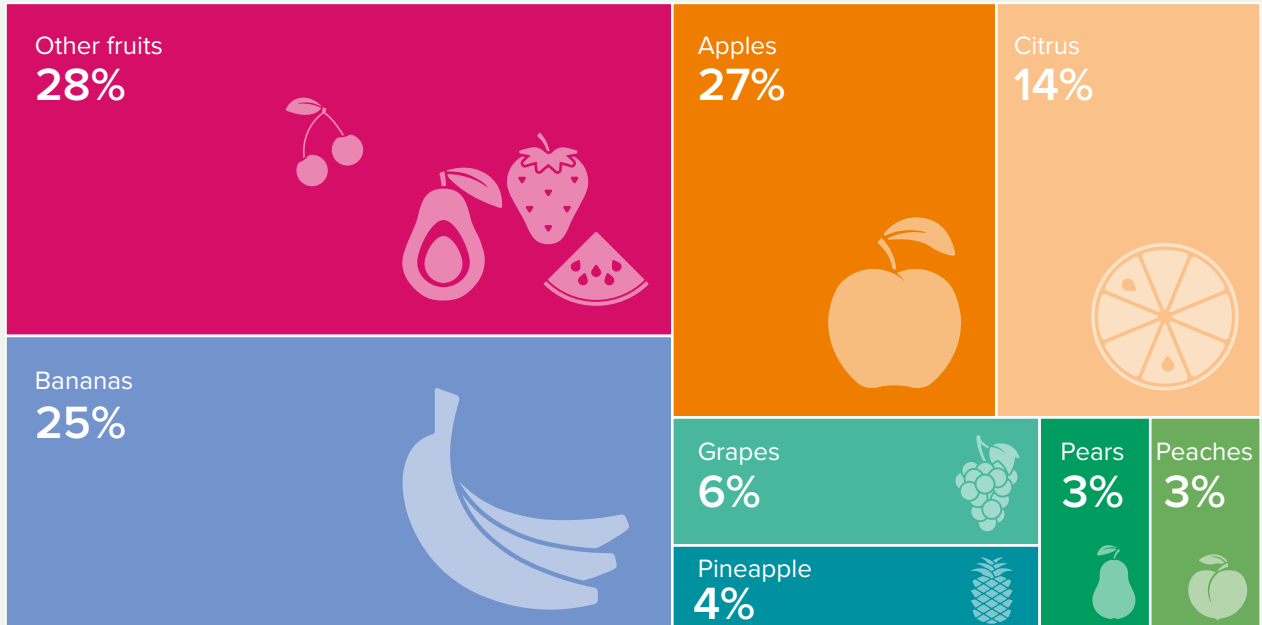
Average consumption of saturated fats exceeded government recommendation (less than 11% of total caloric intake) for all age groups. Average consumption of oily fish is below the recommended 20 grams per day for all age groups. Meat consumption has shown a downward trend over the past nine years: consumption for women meets the maximum recommendation, but average consumption for men exceeds this [67].

From the Food and You survey of England, Northern Ireland, and Wales [68]:

- 81% of respondents eat chicken and turkey at least once a week
- 55% ate beef, lamb, or pork once a week,
- 92% ate milk and dairy foods at least once a week
- 41% ate cooked or smoked fish once a week
- 91% ate raw fruit at least once a week, 56% ate it every day
- 95% ate cooked vegetables, and 87% ate raw vegetables once a week. Women more likely than men to eat fruit and vegetables
- 65% ate pre-cooked meats at least once a week
- 32% ate sausages at least once a week
- 31% ate cured and dried meats at least once a week
- 17% ate burgers at least once a week
- 21% ate pre-packaged sandwiches at least once a week
- 25% ate ready meals at least once a week

Consumption of red meat and processed meats has fallen from 2012. Notably in 2012, 75% of adults ate beef, lamb and pork once a week, 86% ate chicken and turkey once a week, and 65% ate pre-cooked meats once a week.

Figure 20: Fruits consumed in the UK by volume. [63]



Cooking

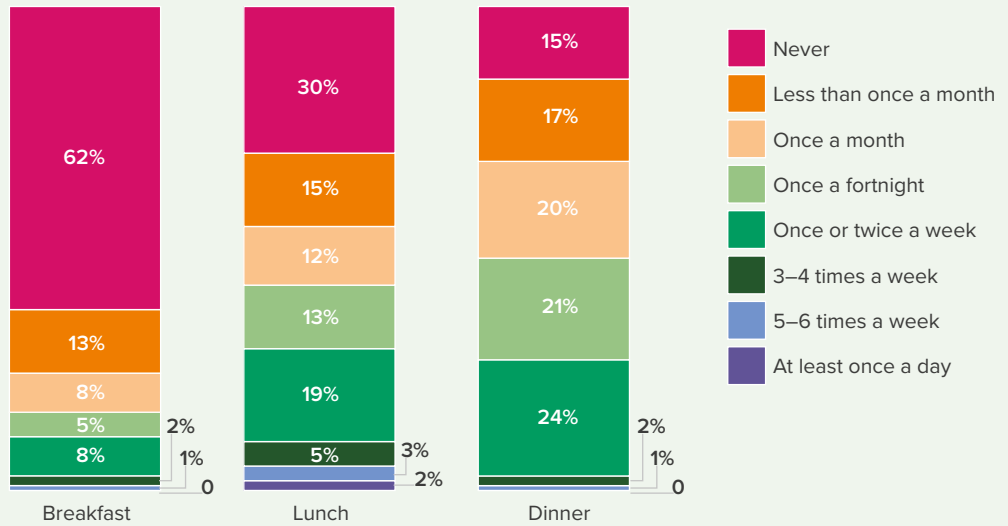
90% of respondents of the Food and You survey in 2018 reported having at least some responsibility of food preparation at home. 63% of women reported being all or mostly responsible for food preparation and cooking, as compared to 33% of men [68].

Shopping

96% of respondents of the Food and You survey shop for food in large supermarkets, 43% use mini supermarkets, 31% shop from independent butchers, and 30% from local and corner shops. Purchasing from mini supermarkets has increased from 35% to 43% since 2012, and home deliveries from supermarkets has increased from 10% to 17% (this data does not include changes due to COVID-19) [68].

Eating outside the home

Figure 21: Frequency of eating or purchasing breakfast, lunch, or dinner away from home. [68]



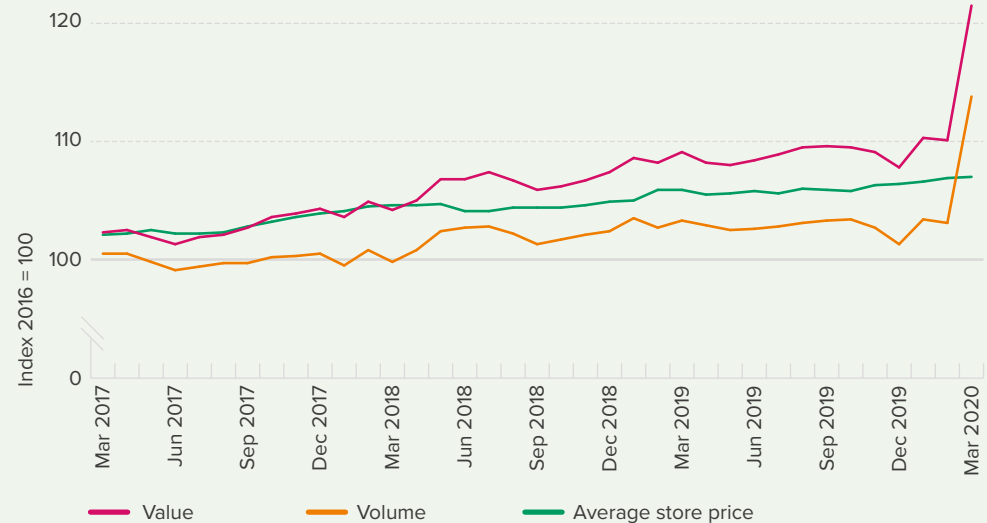
Spending

Over all households, 10.6% of spend went to food in 2017–18. By equivalised income, 15.2% of spend went to food for the lowest 20% of households [4].

On average, weekly household spending in the UK was £585.60 (fiscal year ending 2019, inflation adjusted). Household spend on food and non-alcoholic drinks makes up 10.6%, or £61.90 per week of total expenditure. 8.8% of total expenditure, or £51.30 per week are spent in restaurants and hotels [69].

Online spending on food reached 5.4% of food retailing in January 2020 in Great Britain with 0.8% year-on-year growth. This proportion does not include online purchases at restaurants or takeaway spots. Overall, food store retailers in Great Britain have experienced a 0.6% increase between February 2019 and February 2020. Retailing overall experienced a 0.3% decline as compared to the previous month because of the impact of extreme rainfall on affected markets and a reduction on sales from China because of COVID-19 (Office for National Statistics 2020). There has been a sharp rate of growth for March 2020 associated with COVID-19 shopping in terms of food sales (Figure 22) [69].

Figure 22: Increase in growth for value and volume of food sales in March 2020. [70]



Key organisations in food consumption

Feeding Britain, Committee on Toxicity of chemicals in food, consumer products and the environment, Health Research Authority, Department of Health and Social Care, Food Standards Agency, Food Ethics Council, Health Foundation, Consensus Action on Salt and Health, Compassion in World Farming, Fareshare, Friends of the Earth, Foundation for Local Food Initiatives, UK Food Group, The Soil Association, Advisory Committee on the Microbiological Safety of Food, Global Food Safety Initiative, Codex Alimentarius Commission, Defra, Consumer Council for Water, Food Standards Scotland, Royal Society for Public Health

Source: compiled by author

Disposing and recycling

Annual food waste from hospitality and food service in UK in 2018 amounted to 9.5 million tonnes, 70% of which was intended to be consumed by people (30% being the 'inedible parts'). This was valued at: over £19 billion a year with more than 25 million tonnes of GHG emissions. Over 85% of this waste results in the household and food manufacturing sector (Figure 23). In 2018, UK households threw away 6.6 million tonnes of food, as compared to 8.1 million in 2007. Of the 6.6 million discarded, 4.5 million tonnes could have been eaten.

700,000 tonnes of food surplus from manufacturing, retail and hospitality and food service is either being redistributed via charitable and commercial routes (56,000 tonnes in 2018) or being diverted to produce animal feed (around 660,000 tonnes in 2015).

2.2 million tonnes of food by-products from food manufacturing is used as animal feed, and up to another 2 million tonnes of animal by-products sent to rendering plants [71]. In terms of value of food waste, the average household's annual food waste accounts to nearly £210 in value if edible food parts are considered. With inedible food parts, food waste can be valued at £730 [71].

Figure 23: Food waste (excluding inedible food) by sector in the UK (total post-farmgate: 6.4 million tonnes). [71]

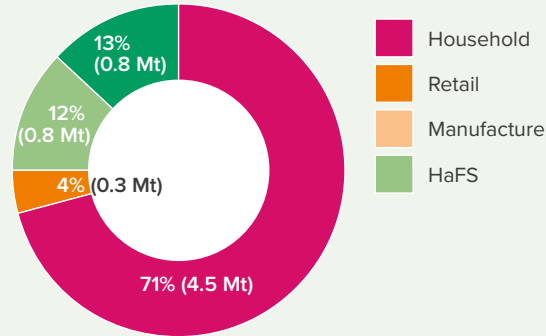
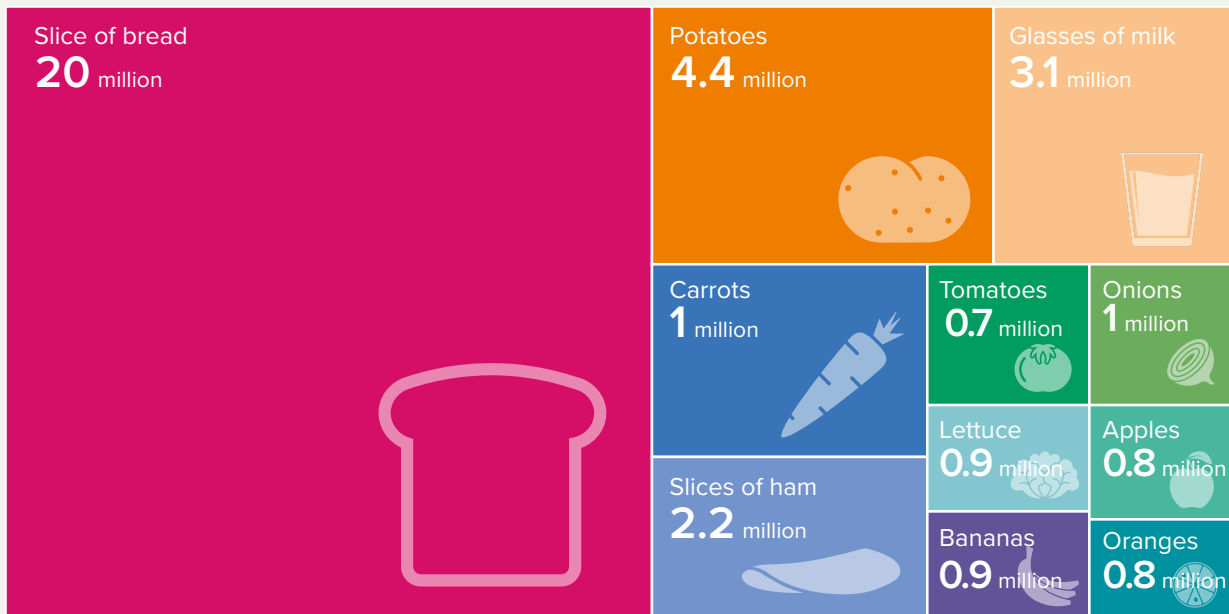


Figure 24: Food thrown away in the UK, every day. [71]



Every day in UK homes, the following food is thrown away [71]:

- 20 million whole slices of bread (equivalent to 1,000,000 loaves at 20 slices per loaf; but more than a third less than in 2007)
- 4.4 million whole potatoes
- 0.9 million whole bananas
- 1.2 million whole tomatoes
- 0.7 million whole oranges
- 0.8 million whole apples
- 2.7 million whole carrots
- 1 million whole onions
- 0.9 million whole lettuce
- 3.1 million glasses' worth of milk
- 2.2 million slices' worth of ham

The proportion of the wasted food and drink by food group (edible parts only) [71]:

- 15% of drinks
- 11% of bakery products
- 9% of dairy and eggs
- 6% of fresh fruits
- 6% of meat and fish
- 9% of meals
- 16% of sauces, pasta, rice, confectionery, cakes and desserts, oils and fats together.

Key organisations in food waste and recycling

WRAP, Local Authority Recycling Advisory Committee, Anaerobic Digestion and Bioresources Association, Environmental Services Association, ReFood, Packaging Recycling Group Scotland, FareShare, AD industry

Source: Compiled by author

SECTION 2: FOOD SYSTEM DRIVERS

Under each heading, the influence across the food system actors has been examined where data is available.

Economic

Production

Producers in the UK are affected by the regulatory environment, input and farmgate prices, contract opportunities, natural resource availability, available technology, producer and farm characteristics. Agricultural income is driven by the volume of production, commodity prices and the costs of input. These drivers are further driven by weather, exchange rates, oil prices and global supply and stocks of commodities. Agriculture income in the UK is, therefore, volatile and fluctuates. Generally, incomes followed an overall upward trend after 2000, in 2015, Total income from farming (TIFF) fell sharply despite high production because of low commodity prices and unfavourable exchange rate. TIFF increased in 2017 because of a favourable combination of a weaker pound, strong commodity prices and high levels of production (see [Figure 25](#)). Commodity pricing is also significant, with Annual Agricultural Price Index (API) for agricultural outputs increasing by 3.6% and inputs by 6.3% in 2018. With increasing crop prices, the average price of crop products increased by 6.9%. Meat and dairy are affected by feed costs, where feed crops such as forage are impacted by weather conditions. Overseas trade and fluctuations in the exchange rate further influence the farmgate prices.

The retail price is shared between the farmer and the actors in the middle of the food chain, particularly food processors. In 2017, the farmgate share of retail price of agricultural staples was 41%. This share depends on the choice of product, with some products having higher levels of value addition. The exchange rate between the pound and euro has a key impact on UK farming, particularly in terms of subsidies, and exports of commodities to the EU. A weak pound in relation to the euro between 2016 and 2018 improved the competitiveness of UK exports but increased the price of imports.

This impacted food producers because of higher costs of inputs such as fertilizers and pesticides (Figure 26). Direct payments for farmers are expected to increase 0.7% to £2.75 billion, those for agri-environment schemes are expected to rise by 9.1% with £436 million, but those for the Less Favoured Area Support Scheme are expected to decrease 9.8% to £74 million.

Figure 25: Total income from farming (1993–2019) in real terms. [72]

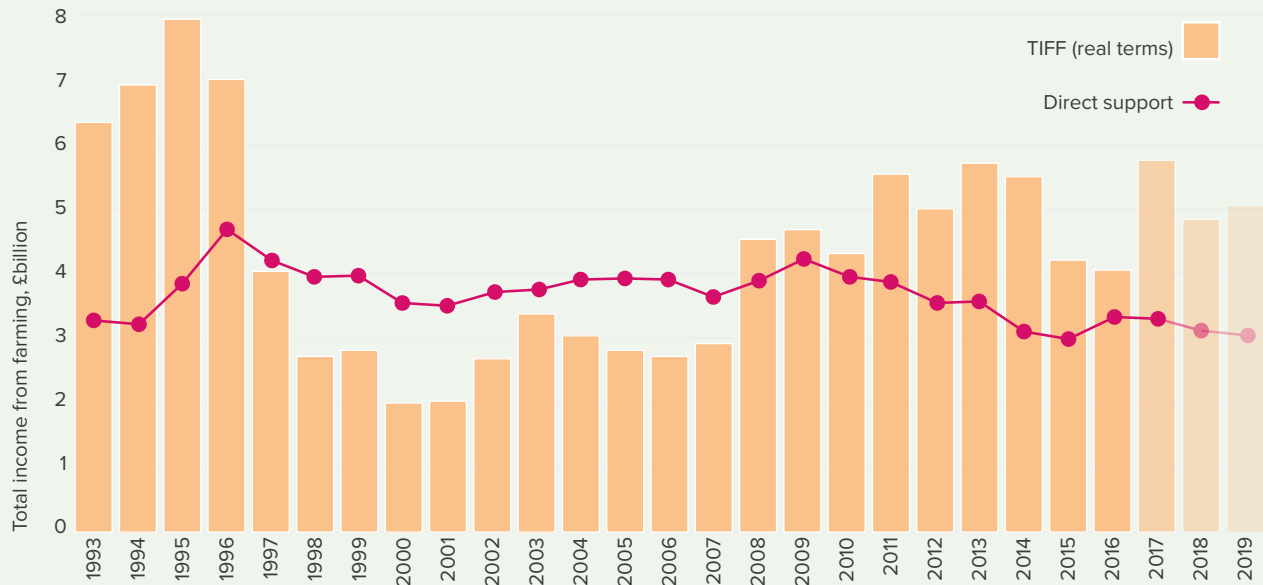
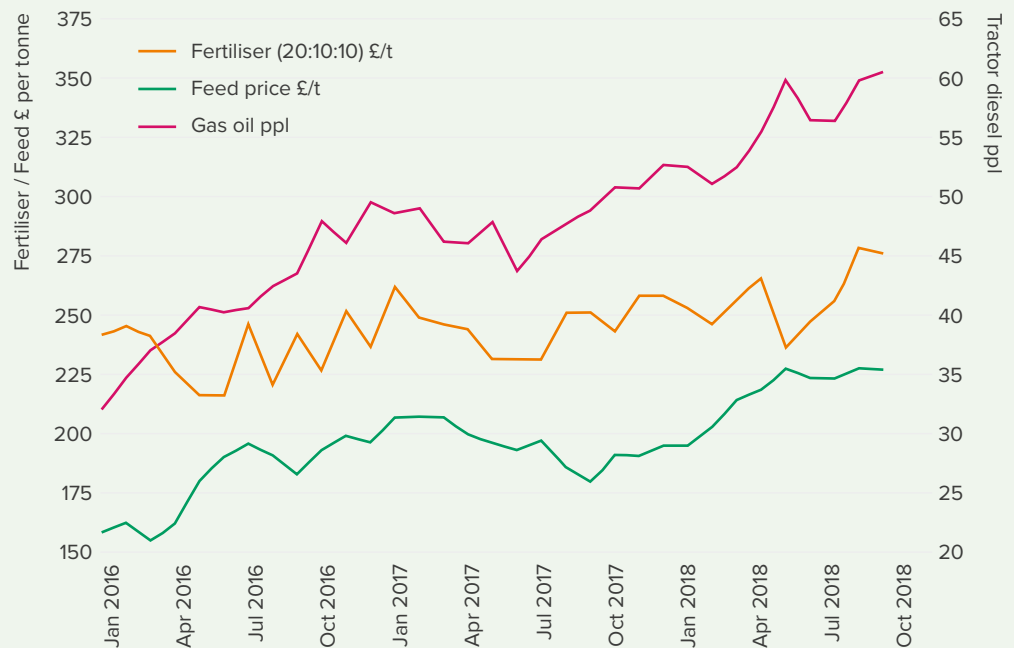


Figure 26: Input costs (2016–18). [72]



Social

The UK population is expected to grow from 65.6 million in 2016 to 72.9 million in 2041 [40]. The UK's growth rate of 12% is lower than the global average of 25%. Within the UK between 2016–26, England's population growth is projected at 5.9%, Scotland's by 3.2%, Wales by 3.1%, and Northern Ireland by 4.2% [40]. Migration has been the main driver of UK population growth in the past three decades. Foreign-born people in UK employment increased from 7.2% in 1993 to 18% in 2017 [73]. The UK has an ageing population which has an impact on UK labour. By 2068, it is estimated that an additional 8.2 million people will be aged over 65 years in the UK. This would mean that 26.4% of the UK's projected population will be aged 65 years and over, an increase from 18.3% in 2018 [74]. The life expectancy gap between 2011–2016 between most affluent and most deprived increased from 6.1 to 7.9 years for females and 9 to 9.7 years for males [75].

Consumption

In 2016, the UK food industry spent £0.927 billion for advertising (third after entertainment and finance) [76]. Forty food and drink companies in the fast-moving consumer goods sector spent £222 million on advertising. In 2017 as compared to 2016, Arla's adspend increased 2,0831.1%, Birds Eye Chicken by 274.1%, Carte D'Or by 444.3%, and Kellogg's Crunchy Nut Cereal by 253.8% [3].

Price

“ The less income people have, the higher the proportion of that income they have to spend on food, and the less the actual amount spent on food is. Poor people spend proportionately more but get a worse diet.” [3]

In the last few years, food prices have fluctuated for food and non-alcoholic beverages. Food and non-alcoholic beverage prices (excluding catering) increased 12% between 2008 and 2014 [4]. Increases in agricultural commodity pricing since 2007 have contributed to high retail costs. This is particularly problematic for low income households because they spend a greater share of their income on food, so a smaller share is left for spending in other places – since 2014, households in the lowest income group have bought less meat and fish, vegetables and fruit, but more fruit, milk, soft drinks, eggs, cheese, cakes, and biscuits [4]. In 2017–18, low income households purchased 49% less lamb than in 2014, and all households purchased 3% less [4].

Even if those lower incomes purchase different food items from those with high incomes, food prices have increased at nearly the same rate. All food and non-alcoholic beverage groups have increased in price since 2007.

Coffee, tea and cocoa, fruit, fish, oils, fats, jam and confectionery have increased in price by 35% or more since 2007 [4]. The highest socio-economic group consumed 128 g/day more fruit and vegetables, 26 g/day less red and processed meat, and 2.6% less non-milk extrinsic sugars [77].

Trust

61% of the population of England, Northern Ireland and Wales responded that they would be very sure that they knew where food they had purchased had come from. 58% of respondents said they were sure that food purchased from the UK and Ireland had been prepared to the highest quality of standards. 24% of respondents said that food prepared abroad had been prepared with the highest of standards. 80% were sure that food purchased was safe to eat. 84% of respondents were confident that food purchased was what it said on the menu or label. In relation with attitudes to the FSA, 73% of Food and You survey thought there was a high likelihood that the FSA would inform the public about new evidence on food safety. 66% of respondents thought there was a high likelihood that the FSA would tell the truth if there was new evidence about food safety [68].

Policy and regulation

The food system links multiple social, health, economic, environmental, and political dimensions. Challenges within the food system are therefore complex and require systemic and long-term solutions that span multiple sectors and disciplines. Different departments across scales will be responsible for policies that relate to food. Policies related to agriculture, health, or workplace skills therefore span multiple departments. Parsons (2020), summarises the multiple policies and relevant departments that come under 'food policy' for England and emphasises the necessity of policy coherence for constructive engagement for the future. This is discussed in a forthcoming report commissioned.

Regulations on environmental emissions, fuel technologies, e-commerce, local and regional manufacturing, autonomy and automation, infrastructure pricing, and land use planning have impact on logistical operations (understanding the UK freight transport).

Technology

Logistics

Technological innovations have had a significant impact on the development and growth of the logistics sector. Electric vehicles, Big Data, and Internet of Things have had an impact on how the fleet is managed, cyber-security is ensured, and digitalisation is promoted. Changes in the characteristics of the fleet (e.g. electric vehicles, increased capacity of containers and/or ships) has an influence on how the supply chains function and how volatility is managed.

Advances in cold-chain technology is further set to influence the transport of perishables such as fresh produce and highly sensitive items such as pharmaceuticals. Digitalisation has an impact on the management of e-commerce and the smooth functioning of cross-border supply chains and border checks [28].

Environment

Production

Extreme weather conditions contribute to a greater demand of animal feed as late spring means that livestock are kept indoors longer and hot and long summers affect the growth of grass and foliage. There was a £509 million increase in the cost of animal feed in 2018 to £5,615 million, as a result of increased prices of animal feed and increased volumes (Defra 2019).

Logistics

High tides, bad weather, and sea surge disrupted a few major ports when water levels rose above flood defences. Weather events like this significantly disrupt the critical infrastructure underlying the food system (Transport Resilience Review 2014). The rail network particularly is impacted by flooding caused by heavy rainfall, heatwaves, extreme cold, high winds and snow. Heavy rainfall and flooding can damage rail infrastructure, interrupt services, and result in costly repairs. Buckling of tracks due to heatwaves can cause derailments and damaged electrical lines [78]. In the summer of 2018, more than 1,000 trains were cancelled in Scotland alone because of record temperatures. A significant investment of £4 million reduced the impact in 2019 to about 200 cancellations despite even higher temperatures [79].

SECTION 3: FOOD SYSTEM OUTCOMES

Food system activities result in a set of different outcomes that then further influence the performance of the system. Here, health, social, economic, and environmental outcomes are explored in the UK context:

Health outcomes

Hunger

While there is no single measure for hunger in the UK, according to the Food Foundation,⁹ 4.9 million adults, or 9% of the population are affected by food insecurity [80]. In comparison, 5.6% of the UK population had experienced food insecurity between 2016–2018 based on FAO's threshold of food insecurity. The FAO further considers <2.5% of the UK population as undernourished (2016–18), 1.8% with severe food insecurity. prevalence of severe food insecurity at 1.8%, moderate insecurity at 5.6%, and obesity (in 2016) at 29.5%. Further, 19% of UK children under the age of fifteen live with an adult who is moderately or severely food insecure [81].

Nutrient deficiencies

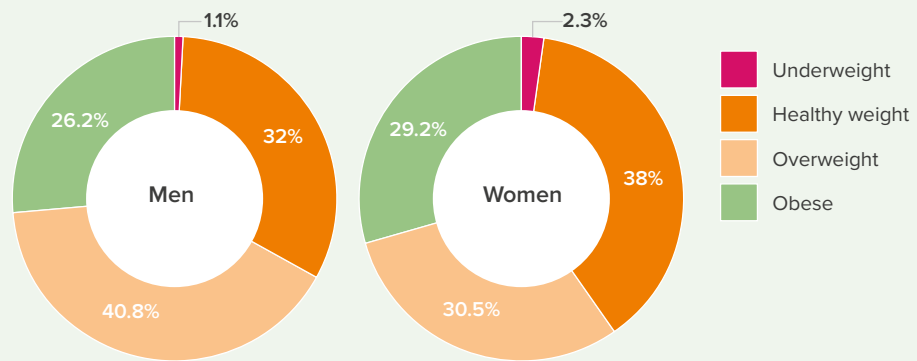
Research indicates that across age groups, the UK population is at a high risk of vitamin and mineral deficiencies, particularly in selenium (affecting 25.8% of men, 50.3% of women), potassium (10% of men, 24.3% of women), magnesium (14.2% of men, 11.5% of women), and iron (25.3% of women) [82].

⁹ Data gathered from the fourth YouGov survey on behalf of the Food Foundation that surveyed 4,352 adults.

Obesity

29.5% of the UK population is obese [81]. 63% of adults in England in 2018 were overweight or obese (see Figure 27). There was a 4% increase between 2017–18 and 2018–19 in hospital admissions with a primary diagnosis of obesity. There has been an increase of 22% since 2014–15 [67]. Hospital admissions directly attributable to obesity were approximately 4 times more likely in most deprived areas of the UK as compared to the least deprived areas (33 per 100,000 individuals as compared to 8 per 100,000 individuals) [67].

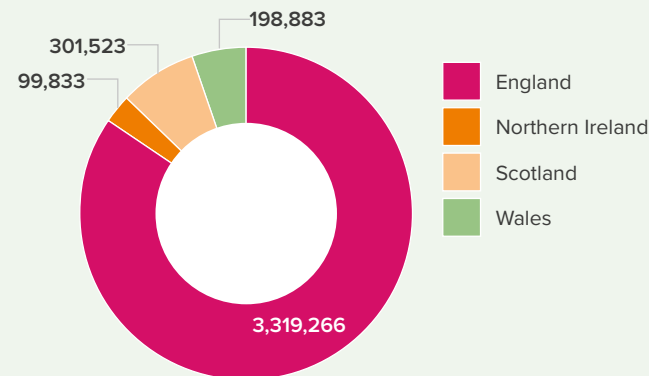
Figure 27: Weight distribution by gender in England (2019). [67]



Diabetes

Diabetes UK reports that 3.9 million people have been diagnosed with diabetes in the UK (Figure 28) [83]. It is estimated that there are at least 1 million more people living with diabetes who have not been diagnosed yet. This brings the total number of people with diabetes to 4.8 million [83].

Figure 28: People diagnosed with diabetes in the UK (2018–19). [83]

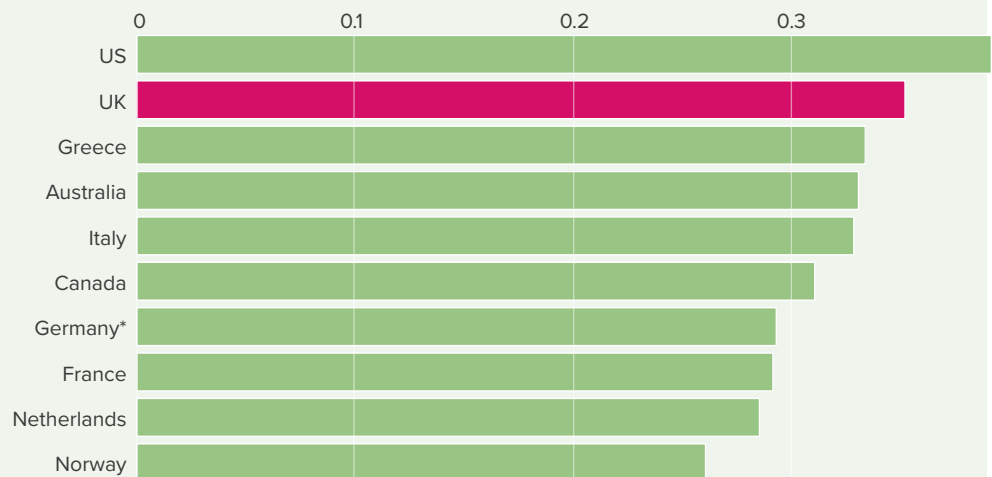


Social and economic outcomes

Livelihoods

The Social Metrics Commission report estimates that 22% of the UK population, about 14.3 million people, are classified as 'poor'. Within these, 4.5 million suffer from extreme poverty [84]. The UK also has one of the highest Gini coefficients for Europe and has high levels of inequality in comparison with other developed countries [85]. In 2014 to 2016, the level of inequality, or gap, in life expectancy between the most and least deprived areas of England was 9.3 years for males and 7.3 years for females [86]. The mortality rates in more deprived areas from heart disease, lung cancer, and chronic lower respiratory diseases account for around a third of the total gap in life expectancy for both sexes. Smoking and obesity are the main risk factors for these diseases [86]. In 2014 to 2016, children in the most deprived areas were twice as likely to be born with low birthweight than children in the least deprived areas, and this inequality has not changed since 2010 to 2012.

Figure 29: UK's Gini coefficient in comparison with Europe and the US (2015). [85]



Guardian graphic: Source: IFS. *2015.

Note: 0 = perfect income equality across all households.

1 = all income goes to a single household

Food poverty

Food poverty is increasing in the UK. Between 2018 and 2019, the Trussell Trust provided 1.6 million packages of emergency food supplies, compared to 41,000 in 2009 [87]. Approximately 8.4 million people struggle to get enough to eat and 4.7 million go a full day without eating [88].

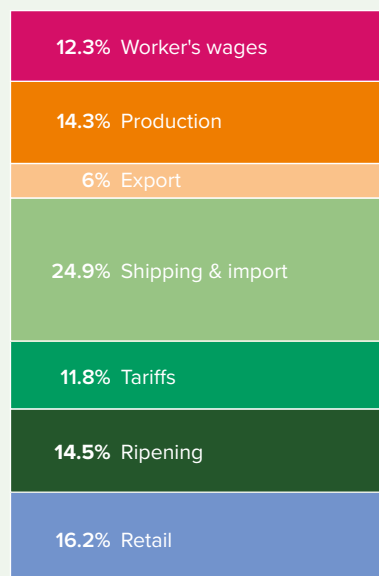
Dark kitchens

At least a hundred kitchens across England supply takeaway food for meals ordered through apps such as Deliveroo. These are specialised workspaces where restaurant quality meals can be provided to customers without straining existing expensive sites. These kitchens can provide meals for well-known brand names as well as food brands without traditional sites. While cheap to operate and a source of employment, they often provide low-paid and zero-hour contracts. The RSPH describes such sites as being dark, cramped, and with inhospitable environments for those who work here [89].

Economic outcomes

The agri-food sector contributed £121 billion to national GVA in 2018, with food-sector employment representing 14% of all employment in Great Britain [4]. There is a fundamental unfairness underlying the UK's food system that emerges in the distribution of finances and power structures. This can be observed in the fact that of the money paid by a British consumer for a Cavendish banana from Columbia, most of the value is absorbed by the middle of the food chain (Figure 30) [63].

Figure 30: Breakdown of UK banana value chain sourced from Colombia. [63]



Environmental outcomes

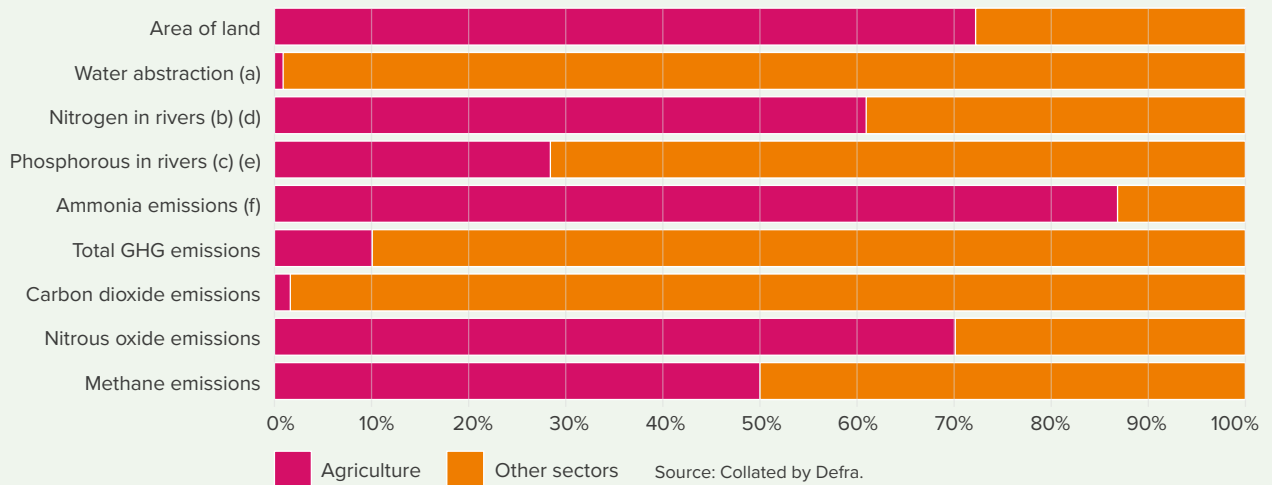
Food is affected by and drives climate change, biodiversity loss, water stress, and demographic change. Such pressures are not limited to the UK's own land and food production. Climate change, resource degradation and water use are impact countries on which the UK already depends for its food supply. People are being pushed from their countries as environmental drivers make livelihoods difficult to achieve.

Agriculture alone accounts for nearly 70% of the UK's land use. In combination with the consequences of land use, agriculture and food production have significant outcomes for environmental sustainability. Practices such as farming using agro-chemicals directly impact water, air, and soil quality and biodiversity. Application rates for nitrogen and phosphate have fallen in recent decades through a combination of improving efficiencies and changing farm practices. This has led to a decrease in air pollution emissions:

- nitrous oxide emissions by 11% between 2000 and 2017,
- methane by 10% between 2000 and 2017, and
- ammonia by 18% between 2000 and 2016 [33]

Some of these changes have been driven by reductions in the number of livestock, reduction in fertilizer application on grasslands and decoupling production from subsidy payments. Through the reforms in the Common Agriculture Policy, agriculture practices are more sensitive to market conditions that may have an impact on the environment. See Figure 31 for a summary of environmental outcomes linked with agriculture.

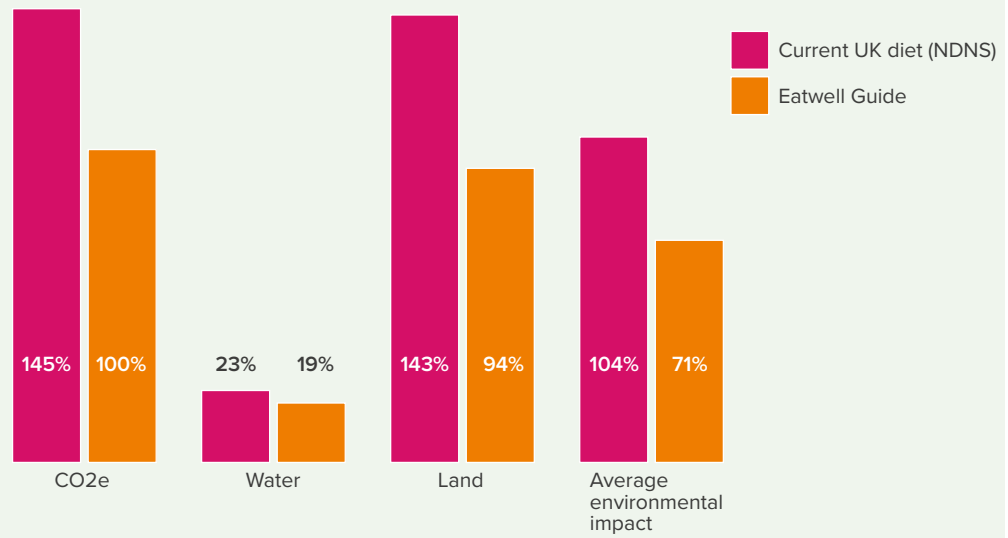
Figure 31: Summary of agriculture's environmental footprint. [33]



The UK diet overall also has impacts on the environment, as summarised in Figure 32, below. The figure displays the impact on carbon dioxide emissions, water and land use and the average environmental impact of the average UK diet and the recommended Eatwell diet.

Research further shows that our food production has a significant impact in terms of land usage. Gerbens-Leenes and colleagues found that in order to feed a person for a year, 8,178 m² of land is needed for beef production, 2,592 m² for pork, 1,369 m² for fruit, 1,314 m² for vegetables, and 274 m² for potatoes [91].

Figure 32: Impact of the current UK diet compared with the Eatwell guide.^[90]



Application of pesticides and agrochemicals is particularly harmful to the environment, although they are necessary to assist with pest and disease management. In the UK, while UK pesticide use has declined overall, it is crucial to recognise that pesticide toxicity has increased, area of land treated has increased, number of times crops are treated has increased, and variety of pesticides used has also increased (Table 2).

Table 2: Area treated by pesticides in the UK ^[3]

	Area treated ha 1990	Area treated ha 2016	% increase in area treated 1990–2016
All pesticides	44,981,520	59,063,553	+63%
Fungicides	21,471,678	27,298,559	+69%
Herbicides	14,438,110	20,287,443	+60%
Insecticides	5,926,245	5,084,694	-13%

Greenhouse gas emissions

Agriculture accounts for nearly 10% of all greenhouse gas emissions in the UK. 70% of total nitrous oxide emissions and 50% of all methane emissions are also a result of agriculture. This is in comparison to 1% of carbon dioxide emissions because of agriculture. Almost 90% of methane is a result of ruminant animals, with the rest because of manure management ^[35]. Ammonia emissions have fallen by 18% since 1990 because of efficient use of fertilizers and reductions in livestock numbers. However, agriculture still accounts for 87% of the UK's ammonia emissions.

Water use

Water use is another area of concern for agricultural practice because of the harm to aquatic ecosystems. In the UK, water abstraction varies by time and region particularly during growing seasons. Agriculture only accounts for 1% of the total water abstracted in England. However, the UK fruit and vegetable supply consumes about 560 million m³ of freshwater annually, of which 74% is from abroad. As proportions of imports have increased, this means that the water footprint of the UK's water use increasingly includes water stressed countries [92]. The 'Increasing resilience to water-related risks in the UK fresh fruit and vegetable system' project finds that as the per capita fruit supply has increased by 23% and vegetables by 7% over the past two decades, the water scarcity footprint has increased by 32%. This is of concern as a proportion of imports come from water-stressed countries such as Spain, Morocco, and Egypt. This can be seen in the reduction of imports of potatoes from Egypt, where water scarcity has led to a decline in production. The UK is now more dependent on domestic supplies of potatoes with a much lower water scarcity footprint. See Figure 33 below on the water stress of countries exporting food to the UK.

Figure 33: Water stress in countries exporting food to the UK. [93]



Agriculture has been estimated to contribute nearly 61% of total nitrogen in rivers in England and Wales and 28% total phosphorous [94]. The State of the Environment report finds that of the assessed river bodies in England, 55% had a "less than good" status for phosphorous in 2016 and that half of groundwater bodies will not reach a good status by 2021, and that nitrates have been responsible for 65% of all failures in groundwater sources protected for drinking water [95].

At least 57% of UK waters have had physical disturbance of seafloor habitats by bottom contact fishing gear between 2010–2015. The status of 18% of UK fish stocks is unknown. At present, half of UK fisheries are sustainably fished [96].

Soils

The UK has lost 84% of fertile topsoil since 1850 [97]. Soil degradation costs England and Wales nearly £0.9–1.4 billion annually, with almost 17% of land effected by soil erosion [98]. Soil nutrient balances show that the nitrogen balance for managed agricultural land was 90.2 kg/ha. The UK phosphorous balance for managed agricultural land was 6.2 kg/ha. The levels of both have fluctuated over time due to changing livestock numbers and reductions of applications of inorganic fertilizers. The long-term trend for both is downward suggesting a reduced environmental risk [35]. 300,000 ha of UK soil are contaminated with toxic metals such as cadmium and arsenic (Commons Environmental Audit Committee). It is estimated that soil degradation costs England and Wales between £0.9 and 1.4 billion annually, of which 80% is a result of compaction and loss of organic matter. However, most of these costs occur elsewhere, for example, the contribution of damaged soils to greenhouse gas emissions is estimated at £600 million, agriculture and productivity losses at £240 million, flooding events at £233 million, and £100 million for water quality [99].

Biodiversity

The State of Nature 2019 reveals that since 1970, there has been a 13% decline in the average abundance of wildlife studied. 41% of UK species have declined, 26% have increased, and 33% have shown marginal change. The number of butterflies has decreased by 17% and moths by 25%. Evidence reveals that land management for agriculture in combination with the continuing impacts of climate change are having the biggest impacts on biodiversity loss [96]. Based on the evidence collected by the State of Nature Partnership, it is apparent that despite progress, most 2020 Aichi targets will not be met. There has been a long-term decline of farmland birds in the UK, particularly because of the reduction of specialist species that are dependent on farmland habitats. 2017 recorded a slight increase, but overall, all farmland bird species are currently less than half than levels in 1970 [33].

The 250 species of bee in the UK have seen an overall decline across the country in the past five decades. It is estimated that through crop pollination, pollinators add at least £600 million to the value of UK crops. The National Pollinator Strategy recognises the value of pollinators to the UK economy and has applied a number of strategies to address pollinator decline [100]. Another study confirms the overline decline of pollinator populations in the UK, driven by factors such as loss of habitat, climate change, and pesticide use. However, agri-environmental schemes have been helpful improving populations on farmlands and the recovery of some crop pollinator species [101].

Beyond agriculture, the food system impacts the environment through the rest of the supply chain, particularly manufacturing. Food manufacturers in the UK represented by the Food and Drink Federation (FDF) have set targets through *Ambition 2025*: shaping sustainable value chains. Through this, member organisations have already achieved a 44% reduction in emissions, 3.2% reduction in supply chain waste, 3.8% reduction of carbon impact of packaging, 30.1% reduction in water use, and a 6.8% reduction in transport emissions [102]. This connects with FDF's members commitment to resource efficiency and WRAP's *Cortauld 2025* targets on food waste, emissions, and water.

BIG PICTURE AND CAVEATS

Big picture

The UK food system faces multiple challenges. Diets too rich in fat, sugar and meat and too low in fruit and vegetables are contributing to obesity and related health problems, especially in deprived households [103]. Unsustainable production methods are driving biodiversity loss, soil degradation, pollution, water scarcity and climate change in both the UK and overseas [18]. Poor worker conditions persist, especially for low-skilled labour in the food sector [104]. Meanwhile, stresses and shocks including climate change, COVID-19 and EU-exit highlight the need for greater resilience. It is clear that transformational change is needed, but this must balance with complex trade-offs and competing needs and interests across the food system, especially as food is the biggest manufacturing sector in the UK with an annual turnover of £105b [5]

- The UK heavily relies on external food sources, particularly the EU. There are financial deficits in all food categories, except for drink (due to whisky exports). The UK is importing food that can be grown here, albeit often dictated by seasonality.
- While food is the biggest employer in the UK, 30% of food manufacturing employees are from the EU (63% of which are in meat processing plants). Other sectors in food employment have low wages, and there is an increasing issue of a lack of appropriate workplace skills.
- UK has the highest consumption of ultra-processed foods in the EU countries. This contributes to obesity and poor health, with 63% of UK adults being obese or overweight.
- Concentration in the UK economy has increased with time. There are ten large food retailers. The top five food manufacturers have a cumulative £30 billion turnover. There are two main big players in contract catering, US multinationals dominate fast food alongside SMEs.

- While other parts of the food system are profitable, most of English primary producers are not because of the strong reliance on subsidies. Subsidies form a large part of farmer income and fluctuations in TIFF should be a matter of concern for financial dependency.
- Land use is dominated by animal and cereal production.

Caveats

- Much of the available data is aggregated so disaggregating it to display discrete food system activities is not always possible.
- For the purposes of this report, differences between the UK (England, Scotland, Wales, and Northern Ireland) and Britain (England, Scotland, and Wales) matter because of the data sources. Not all data sets include all countries, and this has been made apparent where relevant.
- Whenever possible, the data has been taken from the most recent available source. This has resulted in a data spread from 2012–2020. The source year has been made apparent.
- The complexity of the food system can be observed in the data where disaggregating food-focused activities, employers, and enterprises is challenging, particularly for activities in import and export, logistics, and other key supporting services. This has been noted where relevant.
- Data sets relate to different activities and actors within the food system including the ‘food sector’, ‘agri-food sector’, ‘food and drink sector’ and ‘food and drink manufacturing sector’ as well as the broader ‘food system’ itself.

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APPENDIX A: FOOD SYSTEM MAPS

This Appendix provides examples of some of the food systems maps that the authors noted during the course of this research.

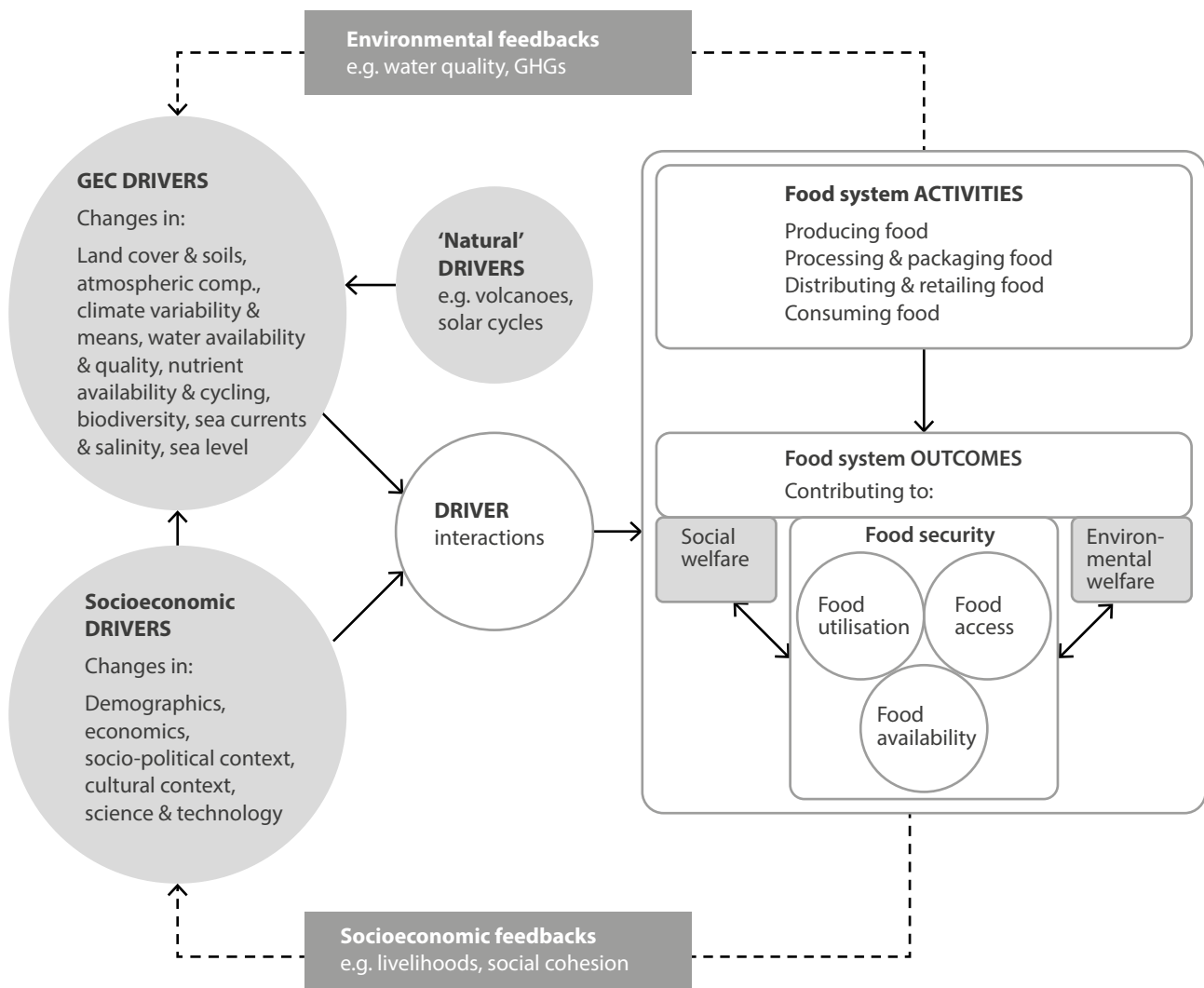


Figure A-1: GECAFS model describing environmental and socio-economic drivers and feedbacks. [11]

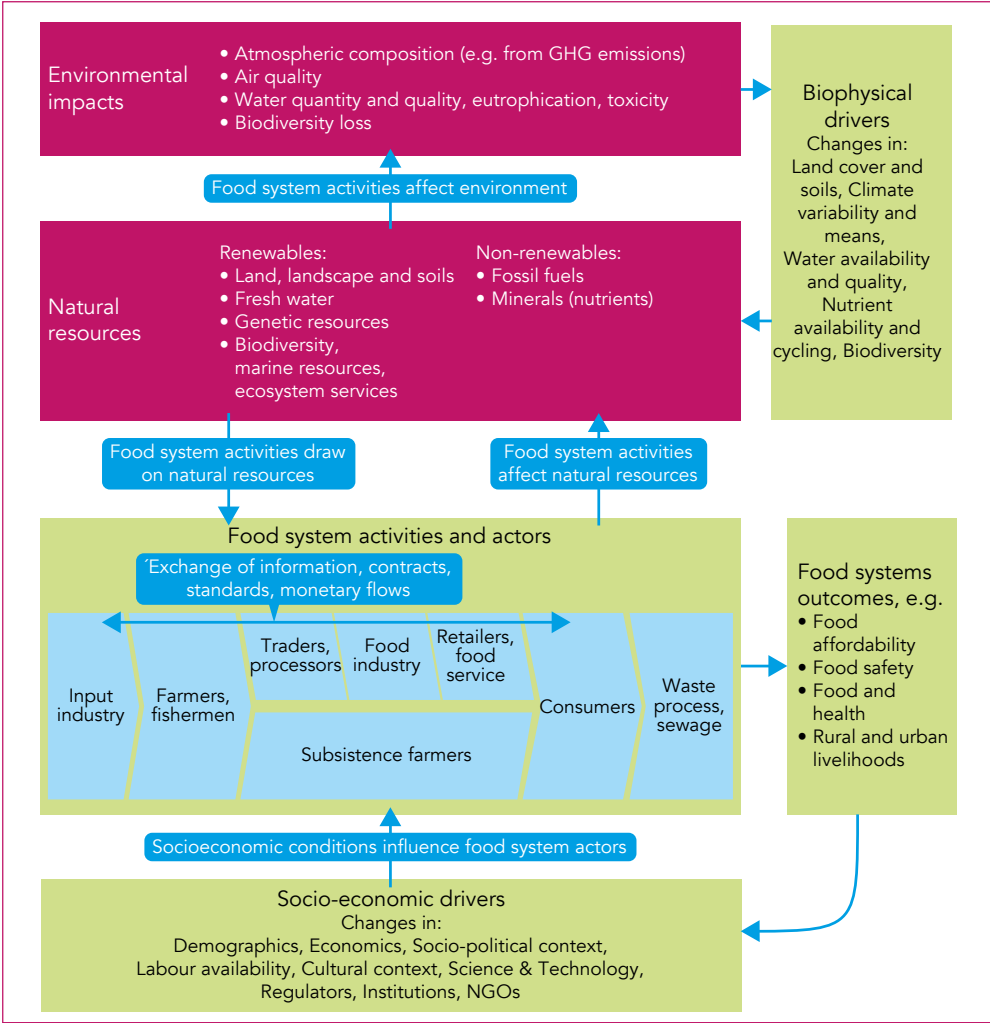


Figure A-2: UNEP's Food Systems Map for Analysing Natural Resources. [18]

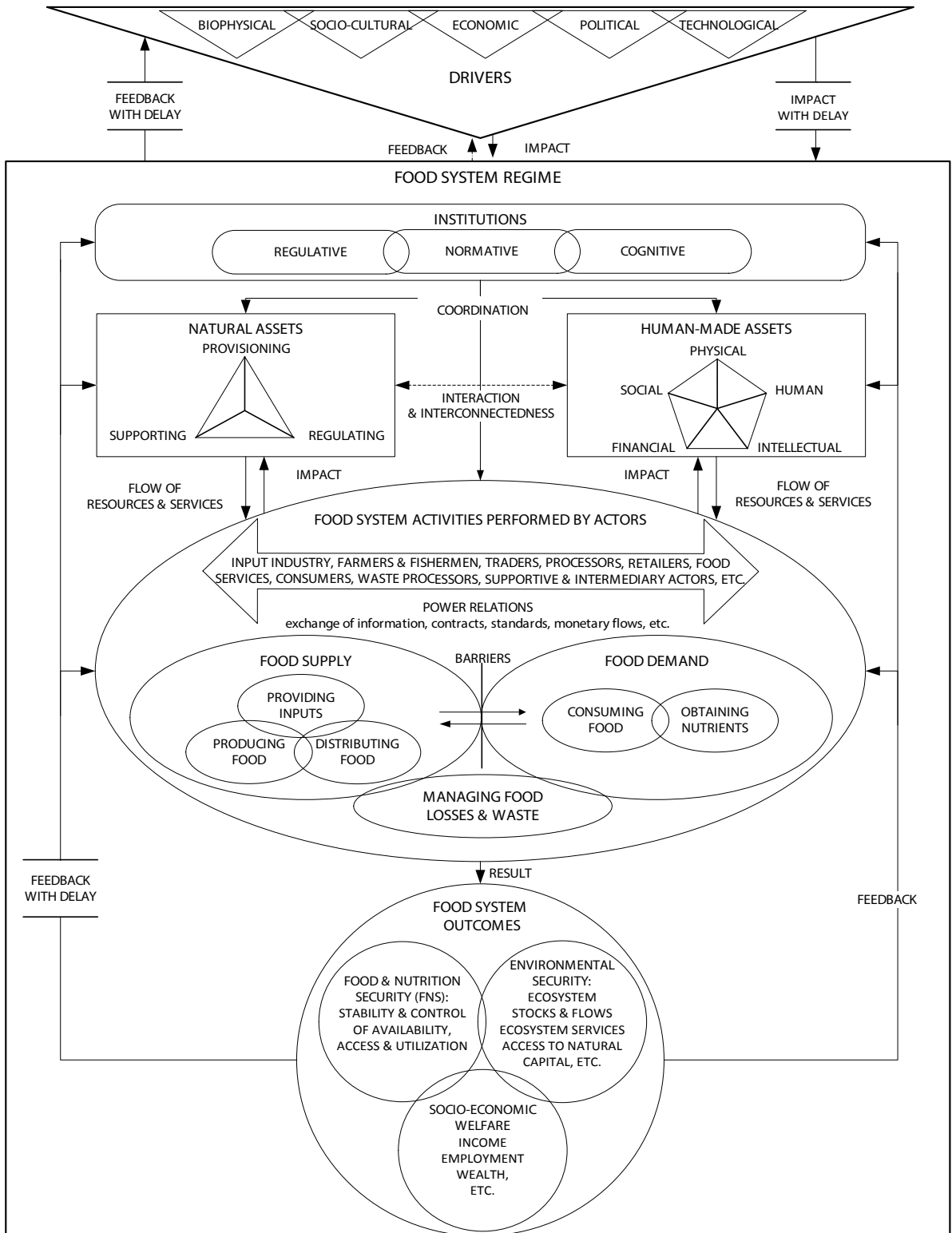


Figure A-3: TransMango conceptual framework of the food system for vulnerability assessment.

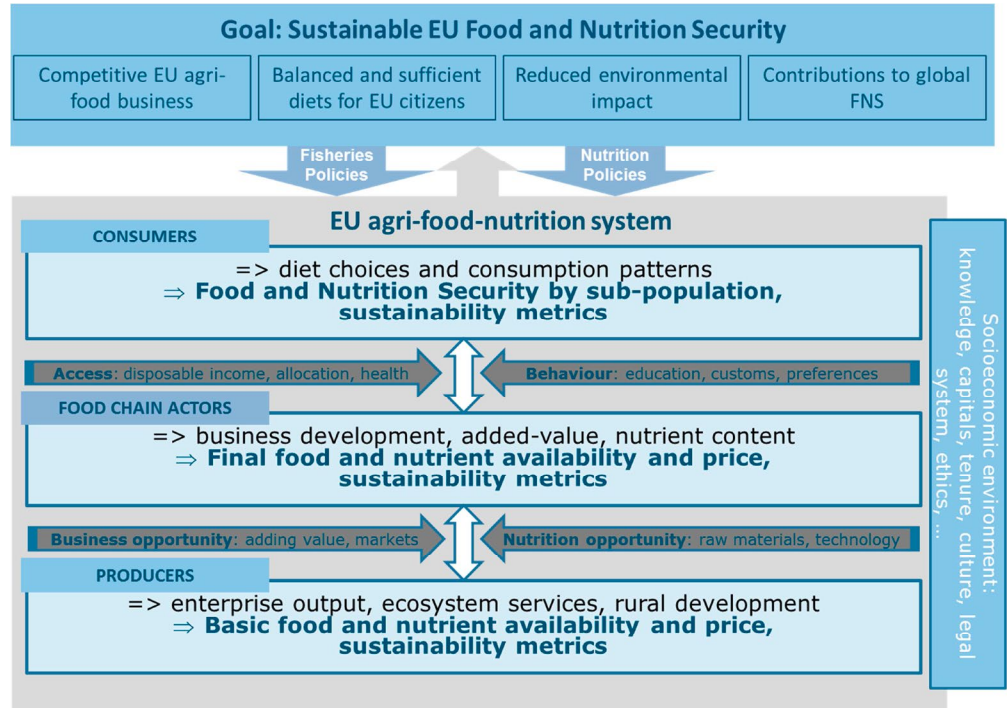


Figure A-4: SUSFANS framework for sustainable EU food and nutrition security. [20]

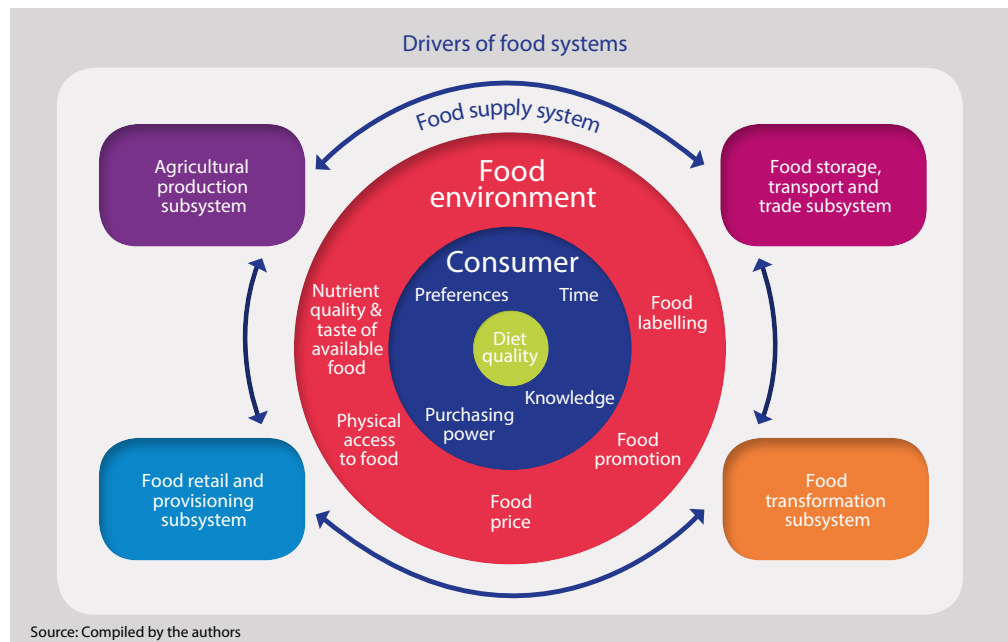


Figure A-5: GLOPAN's diet quality food systems model. [21]

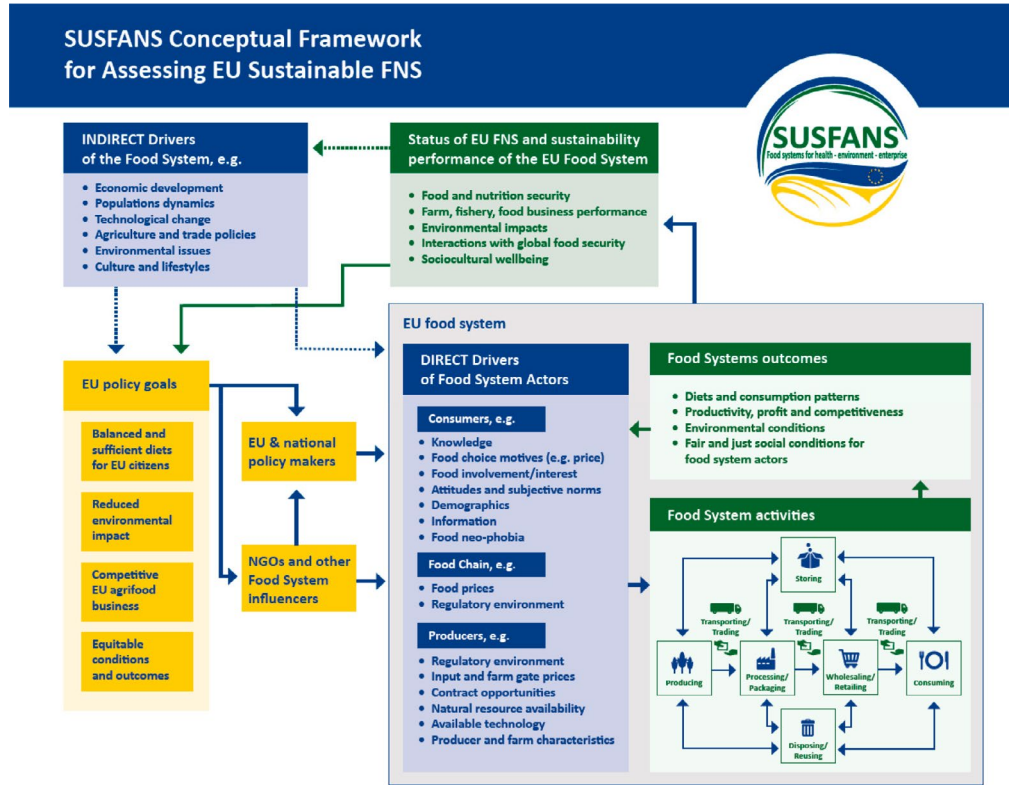


Figure A-6: SUSFANS conceptual framework for sustainable food and nutrition security in the EU. [22]

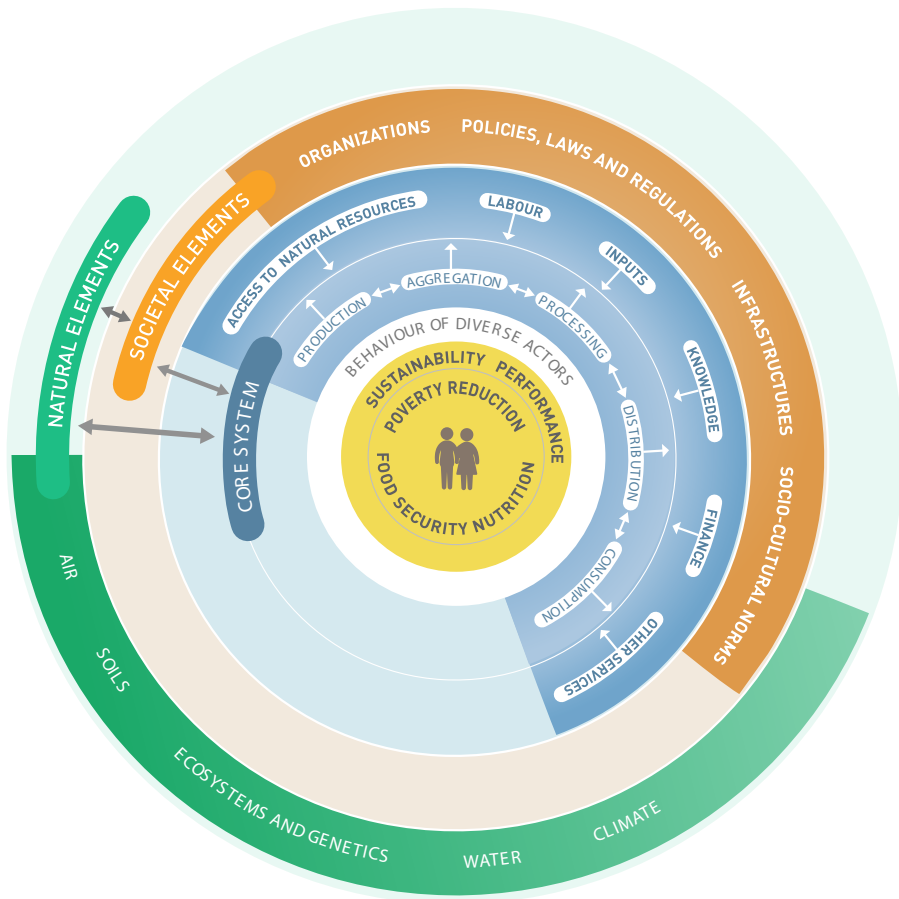


Figure A-7: The FAO food systems wheel. [23]

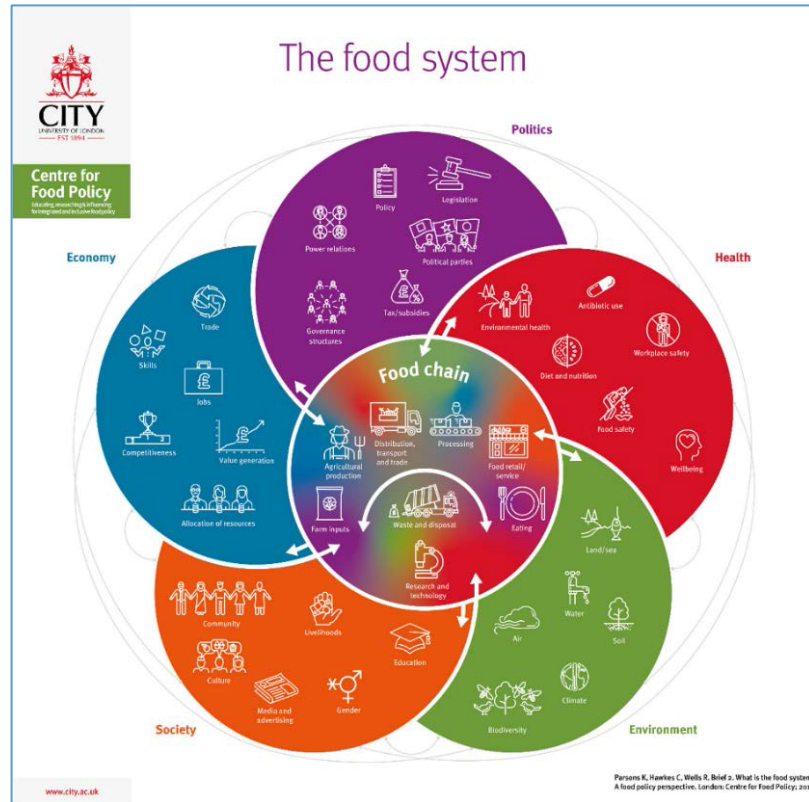


Figure A-8: The Centre for Food Policy's map for policymakers. [24]

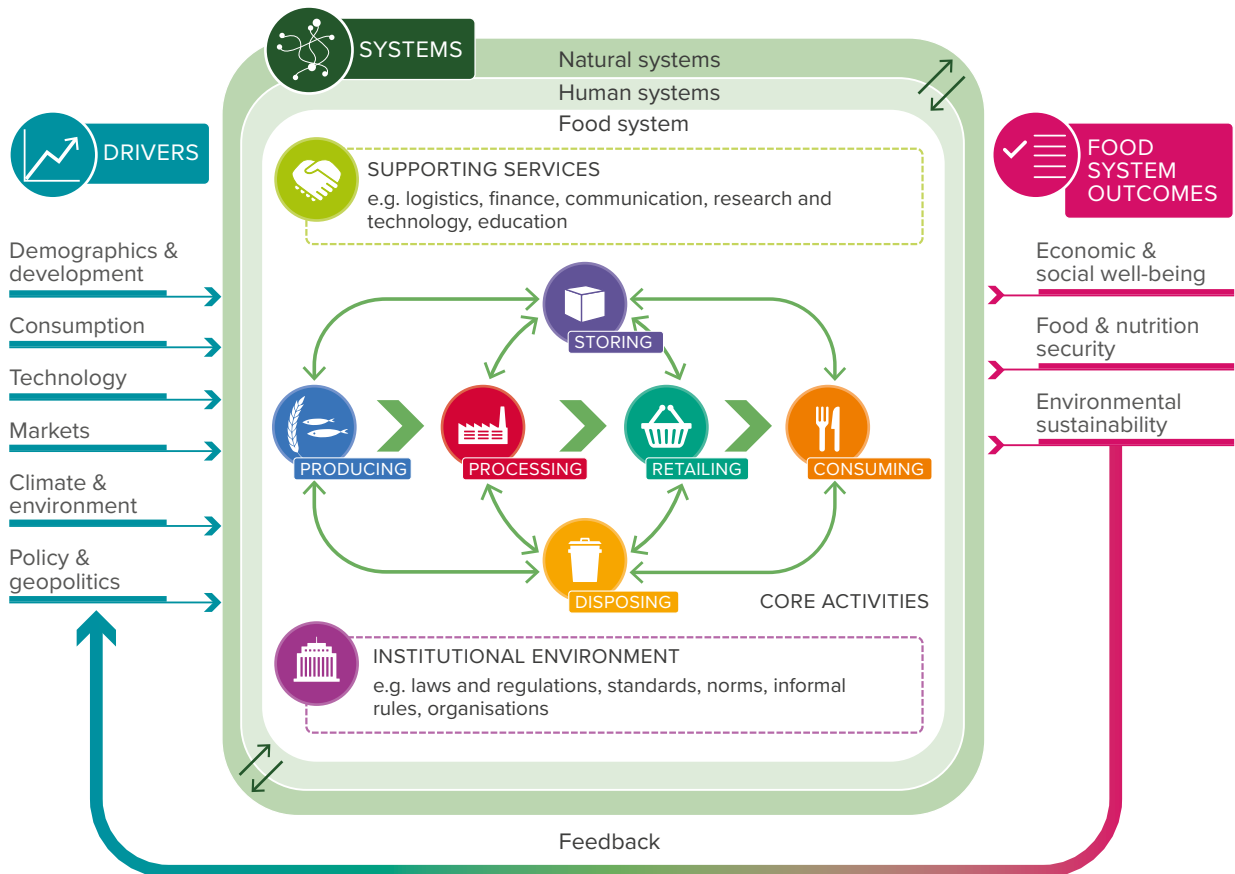


Figure A-9: Foresight4Food's integrated food systems map. [25]

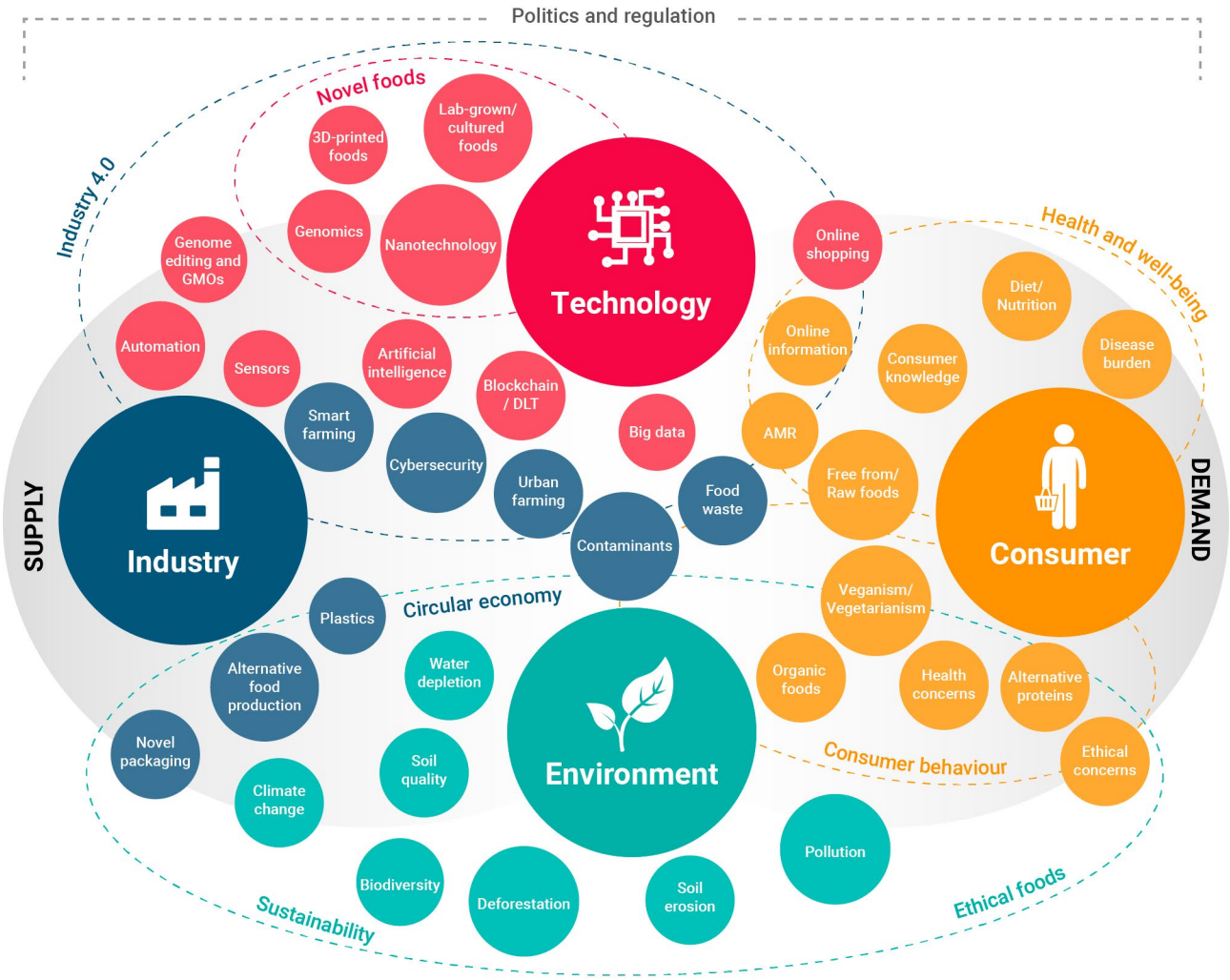


Figure A-10: RAND Europe’s food system map for the Food Standard’s Agency. [26]



About the 'Transforming the UK Food System for Healthy People and a Healthy Environment' programme

The £47.5M UKRI programme on 'Transforming the UK Food System for Healthy People and a Healthy Environment' is led by the Global Food Security Programme, in partnership with BBSRC, ESRC, MRC, NERC, Defra, DHSC, PHE, Innovate UK and FSA. It aims to fundamentally transform the UK food system by placing healthy people and a healthy natural environment at its centre, addressing questions around what we should eat, produce and manufacture and what we should import, taking into account the complex interactions between health, environment and socioeconomic factors.

By co-designing research and training across disciplines and stakeholders, and joining up healthy and accessible consumption with sustainable food production and supply, this programme will deliver coherent evidence to enable concerted action from policy, business and civil society.

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About the Food Systems Transformation Group

The Food Systems Transformation Group is based in the Environmental Change Institute, University of Oxford. Taking an integrated food systems approach and using innovative methods and tools, the Group helps a wide range of stakeholders develop and implement enhanced food system policy and practice. Research is aimed at delivering outcomes that are better balanced across food security, livelihoods and enterprise, and environmental goals.

The collaborative projects and initiatives that the Food Systems Transformation Group undertakes aim to:

- Shape the future of food
- Create food systems thinkers
- Build food systems resilience

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ISBN 978-1-874370-81-9



Environmental *Change* Institute

