



**Harper Adams
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The move to Net Zero and Sustainability
**A review of key issues impacting the UK's food supply
chain and recommendations.**

A report prepared for HSBC UK

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Summary

This paper considers the key factors for the food industry in the transition to a NetZero economy. It considers the landscape of Net Zero from the perspective of the UK Government, the sector and the consumer, highlighting key areas of focus and the need to understand the social drivers as much as the regulatory. The report focuses on the need to understand the supply chain, how it changes and its requirements, before considering ways in which it can be decarbonised. It then reviews the need for and approaches to data, auditing and reporting concluding with some key suggestions and case studies of emerging sustainable practice within the sector.

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Introduction

Since the Industrial Revolution, the level of carbon dioxide (CO₂) in the atmosphere has increased by some 46%, meaning it is now at its highest level for at least 800,000 years¹. The vast majority of the CO₂ is derived from human sources, whilst natural events such as volcanic activity and natural changes in CO₂ levels make a minimal contribution. The planet is now on track to experience global warming of between 1.0 °C to 2.5°C above pre-industrial levels with widespread change in weather patterns and extreme weather patterns predicted. The impact of climate change is so dramatic that the US Government now classifies it as a geostrategic risk, where climate hazards such as widespread drought and flooding have not only primary impacts such as reduced water supply or damage to infrastructure but longer-term secondary impacts such as rising food prices due to crop failure². Such issues are seen as drivers for greater disruption of economic systems, trade, supply chains and destabilisation of not just economies but societies, as the climate warms and populations compete for resources. Predictions of up to 2.0°C global warming are at the lower end of the scale of emerging predictions with worst-case scenarios predicting a rise of up to 4.0°C leading to widespread moisture deficit, wildfires and parts of the globe ceasing to be capable of supporting human life, leading to widespread mass migration³.

Climate change is reshaping the physical, social, political-economic and business environment exacerbating existing risks, impacting supply chains as ports and airports become subject to disruption and changing consumer behaviour. Businesses need to assess and manage risks to themselves derived from a changing climate, but they also need to adapt to a changing consumer landscape.

For the UK, the impact of climate change is one where the UK winters will become warmer and wetter, and summers hotter and drier with increased extreme rainfall events, to high heat events. For producers, processors, retailers, and consumers climate change will not only impact daily lives but their lived experience of the environment. It will shape their behaviours, aspirations, needs and wants, and to a degree, the certainty of the past will become a memory. The prospect of uncertainty should drive businesses to understand risks brought by climate change and seek, where possible to mitigate. In the case of the consumer, the greatest risk to businesses is how they see and feel about companies, brands, and products. The current patterns of consumption are no indicator of the future⁴ and consumers are increasingly looking beyond rhetoric to identify with brands and products that reflect their values concerning climate change and wider sustainability.

The UK's position on Climate Change

The UK has a longstanding policy for climate change laid out in the 2008 Climate Change Act. This established long term targets for the reduction of greenhouse gases⁵ and sets the target date for net-zero emissions as 2050. In November 2020, the UK Climate Assembly was commissioned by six

¹ Lüthi, D., et al., 2008 <https://www.ncdc.noaa.gov/paleo-search/study/6091>

² Department of Defense Climate Risk Analysis, (2021) <https://media.defense.gov/2021/Oct/21/2002877353/-1/-1/0/DOD-CLIMATE-RISK-ANALYSIS-FINAL.PDF>

³ World Economic Forum (2020) The worse-case climate change scenario could look like this. <https://www.weforum.org/agenda/2020/09/the-worst-case-climate-change-scenario-could-look-like-this-we-need-to-avert-it/>

⁴ <https://www.weforum.org/projects/consumers-and-climate-change-living-within-limits>

⁵ A Greenhouse gas is one that contributes to the greenhouse effect by absorbing infrared radiation. Carbon dioxide, methane, nitrous oxide and chlorofluorocarbons are examples of greenhouse gases.

Parliamentary Select Committees to develop a pathway to Net Zero 2050. Its September 2020 report 'The Path to Net Zero'⁶ lays the groundwork for ten areas of human activity including food as to how best to achieve Net Zero within an internationally consistent framework. Within the document, it clearly identifies the need for communication within the supply chain and to consumers, the provision of information to enable choices to be made in favour of low carbon production, labelling of carbon used in production and increased training and education in the sector. Subsequently in October 2021, the UK Government released the 'Net Zero Strategy: Build Back Greener'⁷ which set out policies and proposals for decarbonising all sectors of the UK economy to meet the Net Zero 2050 target. In the run-up to COP26, the UK set an ambitious target of a reduction in 68 per cent emissions reduction by 2030⁸. This would put the UK on track to be net-zero by 2050. This figure, however, is considered to be highly ambitious and is unlikely to be fully met in this timeframe. The International aim is to secure Net Zero and maintain global warming at a maximum of plus 1.5°C.⁹ . However, the world is currently not on track to limit global warming to this level.

For the food sector, the 'Net Zero Strategy' offers little in the way of firm commitment and guidance beyond that relating to lower carbon and more environmentally friendly agricultural production and reaffirming the need for the food sector was the need to minimise food waste and packaging. It therefore increasingly falls to the food sector to develop operational strategies and approaches which maintain an affordable food supply, a range of offerings while meeting the targets themselves. The starting point, therefore, has to be considering the consumer, who may passionately want change, but may not have the information to make choices at that moment they are located in the retail food environment. We need to question whether the retail environment is the best place to make those decisions and where the information needs to be imparted. Most importantly the industry needs to be clear as to the messaging on Net Zero and sustainability. What is clear is that the modern consumer cares about where food comes from, animal welfare, food safety and who produces the food with an increasing leaning towards UK producers. The contemporary shopper displays a high degree of awareness but not necessarily is empowered with all the information. However, the consumer cannot be left as the final arbiter of what is a 'good environmental product', it is incumbent on the industry to help enable those choices. More information and education do not necessarily result in behavioural change, however, working to drive the values of the sector in the environmental sphere will allow consumers to make better choices.

Greenwashing

Greenwashing or the application of Green Sheen to a product is increasingly being called out by environmental campaigners and consumers. The process of claiming false or misleading environmental attributes for a product to persuade consumers that a product or company is

⁶ The Path to Net Zero, Executive Summary <https://www.climateassembly.uk/report/read/final-report-exec-summary.pdf>

⁷ Net Zero: Build Back Greener Strategy https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/1028157/net-zero-strategy.pdf

⁸ <https://inews.co.uk/news/world/cop26-emission-reduction-targets-announced-glasgow-paris-agreement-climate-compared-1281917>

⁹ <https://ukcop26.org/cop26-goals/mitigation/>

environmentally friendly is increasingly under focus¹⁰. Increasingly consumers are sceptical of unsupported claims, and even when evidence is offered, they often scrutinise it. Greenwashing creates distrust of brands and products within consumers' minds. What consumers seek is not just evidence of the environmental status of a single product but the commitment of a producer across the range¹¹. Similarly, there is a danger that greenwashing may impact a range regardless of efforts made by individual producers¹², which means that communication is key alongside evidence of environmental engagement. In many respects, the evidence points to consumers preferring a brand moving in an environmentally conscious way, rather than simply producing one or two 'green' products. Consumers are increasingly looking for brands to sustain engagement with the environment rather than use it as a marketing tool. This means that communication of evidence of progressive improvement is key, and the employment of meaningful metrics is core. Today's consumer has access to facts and opinions at their fingertips, and their personal concerns about the environment are easily factored into choices and decision-making behaviour.

The Sustainable Consumer

The sustainable consumer is not just one type of person. Contrary to the often-stereotypical view of what a 'green' consumer looks like, they come from a wide demographic. What we do know is that the sustainable consumer researches and evaluates purchases, weighing up differentials between products and environmental attributes¹³. While the price may be a key factor in purchase decision making, behaviours and aspirations cannot be ignored as their core values may impact and direct future purchasing decisions.

The 2021 Consumer Survey by Deloitte¹⁴ indicates that despite the global pandemic and the economic downturn, the 'Sustainable Consumer' is very much alive and making choices about which products to purchase based on its environmental credentials, particularly in the area of single-use plastics. Whilst single-use plastics are a key element in sustainability, there is increasing evidence that the consumer is moving towards a stance where it is not just the environmental impact of an individual product they are concerned about but the environmental and ethical practices of brands that inform their choices. At the heart of this is the consumers growing awareness of sustainability and increasing cynicism over brands they consider are engaged in greenwashing. The threat of greenwashing impacting social, ethical, and environmental products – goods and services, has been raised repeatedly in the media, however, crucially for investment, it is being focused on by the financial industry.¹⁵ It is clear that consumers want honesty, demonstrable change and to see brands

¹⁰ Torelli, Riccardo; Balluchi, Federica; Lazzini, Arianna (2019-08-14). "Greenwashing and environmental communication: Effects on stakeholders' perceptions". *Business Strategy and the Environment*. 29 (2): 407–421. doi:10.1002/bse.2373. ISSN 0964-4733. S2CID 202310493

¹¹ Foreh, Mark R.; Grier, Sonya (2003). "When Is Honesty the Best Policy? The Effect of Stated Company Intent on Consumer Skepticism". *Journal of Consumer Psychology*. 13 (3): 349–356. doi:10.1207/S15327663JCP1303_15. ISSN 1532-7663.

¹² Szabo, Szerena; Webster, Jane (2020-02-28). "Perceived Greenwashing: The Effects of Green Marketing on Environmental and Product Perceptions". *Journal of Business Ethics*. 171 (4): 719–739. doi:10.1007/s10551-020-04461-0. ISSN 1573-0697. S2CID 213799479.

¹³ Feber, D., Granskog, A., Lingqvist, O., & Nordigården, D. (2020, October 21). Sustainability in PACKAGING: Inside the minds of US consumers. Retrieved from: <https://www.mckinsey.com/industries/paper-forest-products-and-packaging/our-insights/sustainability-in-packaging-inside-the-minds-of-us-consumers>

¹⁴ <https://www2.deloitte.com/uk/en/pages/consumer-business/articles/sustainable-consumer.html>

¹⁵

https://www.spglobal.com/ratings/en/esg/greenwashing?utm_source=google&utm_medium=cpc&utm_campaign=

moving positively forward with sustainable products. Deloitte's survey clearly shows 80% of consumers are interested in a more sustainable lifestyle, cost is a concern, but so is a lack of information. There is a clear need for producers to help consumers to make better-informed purchasing decisions. With over a third of consumers already doing this, there is clearly space in the market for this to be expanded. With the World Economic Forum calling for more consumer-centric businesses to tackle climate change,¹⁶ there is a broad consensus that positive environmental behaviour is core to achieving Net Zero and mitigating climate change impacts.

Sustainability

To better inform consumers about environmental actions, language is key. Many are confused by the multitude of definitions of sustainability from the widely referenced Brundtland definition¹⁷ to that of the UK Government¹⁸. These definitions are all an interpretation of the core components of sustainable development which encompass three areas – Social, Economic and Environmental factors which emphasises the need to maintain human development while at the same time not undermining the integrity and stability of the environmental system which sustains life. While sustainable development encompasses social issues, biodiversity, water, etc nothing perhaps speaks to the consumer more than climate change¹⁹ and this environmental issue encompasses the key issues of sustainable development and as such is increasingly influencing choices we make as a society and as individuals.

For the food sector sustainability as a concept offers many opportunities, with much that can be done in the traditional areas of energy, waste, and water. More challenging and aligned with the climate change issue is the role in which the sector can play in promoting biodiversity and wider environmental management. The UK Government's 25 Year Environmental Plan²⁰ is an ambitious strategy to protect and enhance the UK environment with targets in air, water, biodiversity, mitigation against natural hazards, climate change mitigation, biosecurity, and protection of heritage. It is aimed at not just the countryside but also provides opportunities for urban, commercial, and industrial locations to contribute. For example, the creation and management of pollinator sites in both rural and urban areas²¹, extending habitats, developing green space within industrial areas are all important steps in promoting biodiversity and climate change resilience

[aign=ESG_Phase_2_Greenwashing&utm_term=greenwashing&utm_content=545397306945&gclid=EA1aIQobChMI_ZTLwPi38wIVCr_tCh3UCgP-EAAYASAAEgKf6vD_BwE](https://www.weforum.org/projects/consumers-and-climate-change-living-within-limits)

¹⁶ <https://www.weforum.org/projects/consumers-and-climate-change-living-within-limits>

¹⁷ [https://www.un.org/en/academic-](https://www.un.org/en/academic-impact/sustainability#:~:text=In%201987%2C%20the%20United%20Nations,development%20needs%2C%20but%20with%20the)

[impact/sustainability#:~:text=In%201987%2C%20the%20United%20Nations,development%20needs%2C%20but%20with%20the](https://www.un.org/en/academic-impact/sustainability#:~:text=In%201987%2C%20the%20United%20Nations,development%20needs%2C%20but%20with%20the)

¹⁸ The UK Government defines sustainable development as making the necessary decisions now to realise our vision of stimulating economic growth and tackling the deficit, maximising wellbeing and protecting our environment, without negatively impacting on the ability of future generations to do the same. See https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/183409/mainstreaming-sustainable-development.pdf

¹⁹ <https://www.un.org/en/chronicle/article/business-and-climate-change-rising-public-awareness-creates-significant-opportunity>

²⁰ A Green Future: Our 25 Year Plan to Improve the Environment

<https://www.gov.uk/government/publications/25-year-environment-plan>

²¹ B-Lines are a series of 'insect pathways' running through the countryside and towns, along which restored and created wildflower-rich habitat stepping stones benefit bees and butterflies.

<https://www.buglife.org.uk/our-work/b-lines/>

through the provision of an extended range of habitats. In addition, many of these initiatives contribute to social sustainability - help with mental health, loneliness and developing communities.

Net Zero Language

Consistency is key within the NetZero lexicon. We often talk of carbon (Carbon Dioxide, CO₂) yet in reality, we should include other key Green House Gases (GHG) principally methane and nitrous oxide. We should often, therefore, be talking of Carbon Equivalent, abbreviated as CO₂-eq. Carbon Equivalent is a metric measure used to compare the emissions from various greenhouse gases based on their global-warming potential (GWP). This is achieved by converting amounts of other gases to the equivalent amount of carbon dioxide with the same global warming potential.²² However, in general communication, it may be easier and clearer to talk of simply CO₂. If that is the case, we need to communicate clearly how that phrase is being employed within strategies;²³

- Carbon neutral means that any CO₂ released into the atmosphere from a company's activities is balanced by an equivalent amount being removed.
- Climate positive means that activity goes beyond achieving net-zero carbon emissions to create an environmental benefit by removing additional carbon dioxide from the atmosphere.
- Carbon negative means the same thing as "climate positive."
- Carbon positive is how organisations describe climate positive and carbon negative. It's mainly a marketing term, and understandably confusing—we generally avoid it.
- Climate Neutral refers to reducing all Greenhouse Gas (GHG) to the point of zero while eliminating all other negative environmental impacts that an organisation may cause.
- Net Zero carbon emissions mean that an activity releases Net Zero carbon emissions into the atmosphere.
- Net Zero emissions balance the whole amount of GHG released and the amount removed from the atmosphere.

Key Challenges facing the food supply chain in the UK

The current food supply chain, global and local, is very complex and it is only recently that we are starting to realise its vulnerability and fragility. While we assume that the food supply chain is finely-tuned, and incorruptible – like any other process – it is constantly evolving to cope with many hurdles.

Brexit and Trade Disruption

Prior to Brexit, the UK used to rely on five to ten days' worth of groceries within the country and in the case of fresh produce, that time would be even less. Post-Brexit, the food industry is working on factoring longer times due to additional steps such as extended inspection checks for imported commodities²⁴. Also, many companies are relocating production facilities from the UK to the EU, to benefit from being closer to centres of demand and international markets.

²² https://ec.europa.eu/eurostat/statistics-explained/index.php?title=Glossary:Carbon_dioxide_equivalent#:~:text=A%20carbon%20dioxide%20equivalent%20or,with%20the%20same%20global%20warming

²³ <https://plana.earth/academy/what-is-difference-between-carbon-neutral-net-zero-climate-positive/>

²⁴ Benton, T., Froggatt, A., Wright, G., Thompson, C. E., & King, R. (2019). Food politics and policies in post-Brexit Britain. Chatham House: London, UK.

Energy Cost Flux

There is a strong link between energy cost and the price volatility of food. The major driver of this is rising oil price. It is therefore desirable to diversify the energy production in this sector, from relying predominantly on fossil fuels to an optimal combination of renewable and non-renewable energy. Whilst this is feasible, there remain challenges of adoption as renewables mature as a sector.²⁵

Labour and Wages

The effects of Brexit, and now Covid-19, has made skilled workers in the UK food industry a premium. This has raised issues for an industry that has traditionally relied heavily on migrant labour. The Government has indicated that the UK will turn to the domestic labour market for filling many gaps in the food supply chain after Brexit. While relying on national labour is advantageous and gives a sense of security, there has been scepticism as to whether it can be achieved, as the wages and the working conditions of many of the current vacancies are perceived as sub-optimal by some potential applicants.

Meeting Fluctuating Demand

Issues relating to spikes in product demand were evident during the recent Covid-19 pandemic as panic buying emerged across the world. This has put extensive pressure on the retail and food manufacturing sectors. Understanding, and being able to adapt to such social-economic issues whilst maintaining productivity and reducing waste is a key challenge.

Climate change and volatility of food production

The effects of climate change are increasingly impacting the availability of some products as well as the quality. The heatwave in Western Canada in 2021 extensively impacted Durum Wheat production leading to prices spikes in the pasta market. Whilst such issues may currently impact only certain sectors there will be increased competition for land in climatic zones that support crop resilience, leading to disparity in food production across the globe. This is seen as a driver of socio-political instability.

Robotics, automation, and advances in Technology

Over the past few years, there have been many interesting innovations in food industry automation. Automated solutions have become the key to keeping food companies profitable through increased efficiency and improved product consistency. Further innovations and adoption, especially in the light of ongoing labour issues will be key to remaining competitive.

²⁵ Taghizadeh-Hesary, F., Rasoulinezhad, E., & Yoshino, N. (2019). Energy and food security: Linkages through price volatility. *Energy Policy*, 128, 796-806.

Advancement in auditing and reporting

There is mounting recognition of global food supply chain vulnerability, this may be attributed to external factors such as Covid, economic instability, operational difficulties, or social and environmental practices²⁶. To mitigate some of these uncertainties in the supply chains, external auditors may be utilised to indicate to the company their competency in handling these risks²⁷, which could avert or lessen potential non-compliances²⁸, improve transparency²⁹, and maintain legality³⁰.

The success of any audit and the continued resilience of a supply chain are highly dependent on the quality and timeliness of the data used to inform the actions arising. Accuracy and speed are vital features of any data-based auditing function³¹. Emerging technologies, such as the incorporation of Blockchain, big data, sensors, satellite imaging, and even social networking, provide exciting opportunities to expand the reliability of auditing within the food supply chain^{32,33}. Involving technology opens the door to alternative and improved scopes that were previously hard or impossible to examine for practicality and cost. This was recently illustrated by Castka in 2020³⁴.

Blockchain

Blockchain works on the principle of facilitating and tracking cryptocurrency transactions through multiple linked databases, it is decentralised and is used fundamentally to sort information, this ensures transparency and simplicity to trace operation. So, what do we get out of Blockchain if adopted in the food industry?

- unchangeable nature of records
- removing intermediaries between producers and consumers
- consensus
- traceability guarantee

²⁶ Thorlakson, T., de Zegher, J. F., & Lambin, E. F. (2018). Companies' contribution to sustainability through global supply chains. *Proceedings of the National Academy of Sciences*, 115(9), 2072-2077

²⁷ Castka, P., & Prajogo, D. (2013). The effect of pressure from secondary stakeholders on the internalization of ISO 14001. *Journal of Cleaner Production*, 47, 245-252.

²⁸ Porteous, A. H., Rammohan, S. V., & Lee, H. L. (2015). Carrots or sticks? Improving social and environmental compliance at suppliers through incentives and penalties. *Production and Operations Management*, 24(9), 1402-1413.

²⁹ Dando, N., & Swift, T. (2003). Transparency and assurance minding the credibility gap. *Journal of Business Ethics*, 44(2), 195-200.

³⁰ Mueller, M., Dos Santos, V. G., & Seuring, S. (2009). The contribution of environmental and social standards towards ensuring legitimacy in supply chain governance. *Journal of Business ethics*, 89(4), 509-523.

³¹ Rubin, V., & Lukoianova, T. (2013). Veracity roadmap: Is big data objective, truthful and credible? *Advances in Classification Research Online*, 24(1), 4.

³² Appelbaum, D., & Nehmer, R. A. (2017). Using drones in internal and external audits: An exploratory framework. *Journal of Emerging Technologies in Accounting*, 14(1), 99-113.

³³ Herding, W., & Fischer, S. (2015). *Smart Data: An Exploration into Technology Innovations for Sustainability Standards*. London: ISEAL Alliance.

³⁴ Castka, P., Searcy, C., & Mohr, J. (2020). Technology-enhanced auditing: Improving veracity and timeliness in social and environmental audits of supply chains. *Journal of Cleaner Production*, 258, 120773.

A number of supermarkets and food suppliers have joined the Blockchain initiatives like Walmart, Carrefour and Nestle aiming to address some key challenges. More than 50% of the grocery sector economic profit disappeared between 2012 and 2017 due to rising operating costs and fierce competition making it impossible to raise prices³⁵. Around 63% of people surveyed said they would pay up to 36% more for products that are responsibly made and transparently sourced³⁶. More than 40% of food waste in developed countries occurs at the retail and consumer level³⁷. Up to £11 billion is lost to fraud by the global food industry every year, affecting 10% of all food products sold commercially. 19 billion kg of food or about 10% of all food stocked in grocery stores, never makes it off the shelf every year. 22-38 years old expect companies to be socially and environmentally responsible and to offer sustainable, traceable products.

According to the Walmart research team, with Blockchain, research that used to take 7 days can now take as little as 2.2 seconds. It also acts as an audit trail throughout the lifecycle of a product and establishes trust between the parties in the chain. Blockchain technology allows Walmart and its customers to track the exact geo-location of a food product by scanning the barcodes. If any problem occurs, the Blockchain can detect the precise location³⁸.

Big data

The use of large information sets and the digital tools for collecting, aggregating, and analysing them together, also known as Big Data, has the potential to address problems within the food supply chain that would not have been possible to tackle before.

As digitalised smart machinery and sensors emerge from farm to gate and data grows in quantity and scope, processes will become progressively data-driven and data-enabled. Rapid developments in Information Technology (IT) and Cloud and Quantum Computing are driving the phenomenon of what is called Smart Food System³⁹.

Sensors and Satellite imaging

Food production nowadays relies strongly on many different sensing methodologies to provide accurate information on a crop, soil, climate, environmental conditions, safety and quality of finished products. Almost every sensing technique may find an application in agriculture and the food industry. Some studies have taken advantage of numerous new remote sensing data sources, particularly from international satellites, for example, the CropWatch system has extended the scope of its analyses to international territories through the development of new indicators and an

³⁵ Kuijpers, D., Simmons, V., & van Wamelen, J. (2018). Reviving grocery retail: Six imperatives. December, available at: <https://www.mckinsey.com/industries/retail/our-insights/reviving-groceryretail-six-imperatives> (accessed 28 October 2019).

³⁶ Mann, S., Potdar, V., Gajavilli, R. S., & Chandan, A. (2018, December). Blockchain technology for supply chain traceability, transparency and data provenance. In Proceedings of the 2018 International Conference on Blockchain Technology and Application (pp. 22-26).

³⁷ FAO. 2011. Global food losses and food waste – Extent, causes and prevention. Rome. Global food losses and food waste (fao.org)

³⁸ Walmart, "Outside the Box: Breaking Down Blockchain with Brigid McDermott: VP of Blockchain Business Development & Ecosystem at IBM & Frank Yiannas: VP of Food Safety at Walmart," June 20, 2017, podcast, <https://corporate.walmart.com/outside-the-box-podcast>, accessed November 2017.

³⁹ Sundmaeker, H., Verdouw, C. N., Wolfert, J., & Freire, L. P. (2016). Internet of food and farm 2020. In Digitising the industry (Vol. 49, pp. 129-150). River Publishers.

upgraded operational methodology⁴⁰. These technologies will play a more crucial role in feeding the world as they can be used as early warning systems.

Furthermore, the use of satellite imaging, robotics and sensors with our crops and livestock and so on gives rise to the question can we attain better advancements using artificial intelligence (AI) by using all that data we are gathering⁴¹?

Social media

Customers have been voicing their opinion on social media for a while now. Using social media data, a business may gain insight into the perception of their existing or potential consumers about their product offerings. Social media data is cheap and fast to attain capturing the viewpoint of large audiences on a particular area of interest.

Some studies used Twitter data analysis approach to understand problems related to the beef/steak supply chain based on consumer feedback on Twitter. The analysis helped to understand the reasons behind positive and negative opinions, to identify communication patterns, prevalent topics and content, and characteristics of Twitter users discussing beef and steak. Social media analytics can be used to gather information and intelligence for companies aiming to have consumer-centric food supply chains⁴².

Understanding demand and minimising waste

For many years growing agricultural yields have kept pace with demand, however, there is an indication that yields may be levelling off⁴³. The progressive increase per capita food demand, alongside a global population that is forecast to hit more than 9 billion by mid-century, has led to fears to how future global food demand will be met and what impact the effort to supply sufficient future food will have on the environment. Many voices suggest that, before increasing production per capita, food waste must be addressed.

Food waste is particularly challenging due to the cumulative number of resources (labour, energy, water, etc.) required to produce the final products. The environmental and economic impacts are the highest the later the waste takes place in the supply chain, and it becomes more problematic. For instance, the cumulative energy use for 1 kilogramme of beef can increase from 28.16 MJ at the farm gate to 49.91 MJ at the consumption stage⁴⁴.

Examples of emerging tools helping minimise waste between farm and household

Farm

- [Hazel Technologies](#) invented small pouches which produce a compound known as 1-MCP, a potent plant hormone that sends a strong signal to fruit produce that it is not yet time to

⁴⁰ Wu, B., Gommers, R., Zhang, M., Zeng, H., Yan, N., Zou, W. & Van Heijden, A. (2015). Global crop monitoring: a satellite-based hierarchical approach. *Remote Sensing*, 7(4), 3907-3933.

⁴¹ Kakani, V., Nguyen, V. H., Kumar, B. P., Kim, H., & Pasupuleti, V. R. (2020). A critical review on computer vision and artificial intelligence in food industry. *Journal of Agriculture and Food Research*, 2, 100033.

⁴² Singh, A., Shukla, N., & Mishra, N. (2018). Social media data analytics to improve supply chain management in food industries. *Transportation Research Part E: Logistics and Transportation Review*, 114, 398-415.

⁴³ Grassini, P., Eskridge, K. M., & Cassman, K. G. (2013). Distinguishing between yield advances and yield plateaus in historical crop production trends. *Nature communications*, 4(1), 1-11.

⁴⁴ Foster, C., K. Green, M. Bleda, P. Dewick, B. Evans, A. Flynn, and J. Mylan. 2006. *Environmental Impacts of Food Production and Consumption: A Report to the Department for Environment, Food and Rural Affairs*. Manchester Business School. London: Defra.

ripen. Packers just need to incorporate a Hazel sachet into the packaging of the fruit. The chemical compound released from the sachets can last for 3 weeks, given that around 45% of all fruit produced is wasted, an innovation that gives more time for fruits to make it to the shop could have a positive impact on waste.

Shops

- [Neurolabs](#) builds object recognition algorithms based only on automated generated data. They focus on predicting sales for supermarkets by understanding the consumer attitude within a shopping environment. The Neurolabs team, based in Romania, worked on perfecting their algorithms and launched some of their products in 2019. Results indicated that they reduced supermarket waste by up to 40%.
- [Wasteless](#) an Israeli company bring a more data-driven (evidence-based) approach, using small screens to display actively adjusting prices for each item on the shelf. It uses machine learning to optimize these prices. They claim to cut waste by nearly 30% while increasing profits.

Restaurants

- [Tenzo](#) is a restaurant analytic software, it assists restaurants to predict accurately how much they would sell by creating a very precise AI sales prediction algorithm. The prediction uses weather conditions data, growth trends, and all of the restaurant's historical data to produce forecasts that are significantly more accurate. It also helps businesses forecast to menu item level, allowing a considerable cut in food waste.

Households

- [Olio](#) is a platform that links neighbours through an application to indicate and share spare or excess food. Members just upload a description and a photo, then people in the neighbourhood can collect the food before it is wasted.
- [FridgeCam](#) is an affordable way to help consumers always modify their lifestyles and think more about using up what is already in their fridge. The wireless low-cost camera can sit inside and takes a picture when you shut the fridge door. The items become visible from anywhere via an application. This can help with better planning of meals and what to shop for, avoiding excess buying.

Decarbonising supply chains

There are five areas in which the food sector can focus in order to decarbonise the supply chain. These have been suggested by a range of organisations including the World Economic Forum.

1. Data Collection
2. Optimising the supply chain for CO2
3. Engaging with Suppliers
4. Sector Initiatives
5. Developing Low Carbon Governance.

1. Data Collection

The first stage is to develop a carbon emissions baseline with suppliers. This is key to understanding where carbon is utilised and produced thus establishing a carbon footprint for a product. Initially, this will be a high-level process that will establish the main factors, after which granularity can be added by looking at individual elements, similar to life cycle analysis. Data exchange is essential to

eliminate double accounting of emissions as well as enabling full capture to be achieved. Communication with suppliers is paramount as they know their sources and processes better than an external auditor and inputs may vary over a season impacting carbon emissions. The benchmark for emission reduction should be aligned (at a minimum) to the UN COP26 declaration of 1.5°C and should be a public target. For most food processors the majority of carbon emissions are out of their direct control, so close cooperation across the supply chain is key.

2. Optimising the supply chain for CO2

The most publicly visible action of emission reduction is through the redesign of products for sustainability. This may mean changing ingredient sourcing, formulation, production, packaging, or transport. For new products, it is easier to design in sustainability from the outset. Options include using 'greener' materials for packaging, reducing waste, sourcing more locally to reduce transport emissions, increasing recyclability, reducing the weight of packaging etc. Again this has to be conducted across the supply chain to maximise benefit. It also allows trade-offs to be made for product costs to be managed. When designing new products there may be the option to consider developing a sustainable sourcing or value chain, focussing on not just the products but logistics. At the upper end of optimisation companies may consider 'nearshoring'⁴⁵ which can reduce the carbon footprint of a product substantially but may increase costs. However, where carbon taxes are considered, this may be an economically rational decision.

3. Engaging with Suppliers

The setting of procurement or processing standards for suppliers is a key tool in driving down emissions. Such standards could outline the level of renewable energy utilised or the amount of recycled material contained in a product's packaging. Standards may be imposed by the end-user or left to individual suppliers to set. The former gives greater control over the final product, whereas the latter allows partners to incrementally change a process thus spreading costs. Regardless of the approach, and the latter is increasingly favoured, standards must first and foremost be measurable, achievable, and appropriate. This approach allows standards to be raised over time with technological advancements and also where there are changes elsewhere in the supply chain. This allows incentivisation to be built into the system, whereby (for example) improvements in defined metrics are matched with improved payment terms. Overall the key is partnering along the supply chain whereby good practice, information and education is shared along with a degree of risk-sharing.

4. Sector Initiatives

It is key that sectors are seen by both governments and consumers to be driving meaningful change. Promoting best practices, standards and policy is key to the Net Zero commitment. Sector level commitments create a level playing field for competitiveness and allow supply chains to adapt and develop. Sector initiatives may also promote buying groups or invest in key technological developments and most importantly work with regulators and external bodies to establish good practice and wider standards.

5. Developing Low Carbon Governance

Decarbonisation needs a company and its suppliers to think differently. Decarbonisation is not only about meeting standards, but driving targets and adapting to changes in the political and environmental landscape. Communication is at the heart of this and as such both supplier and consumer engagement is key. In complex supply chains, with multiple ingredients and processes, it is

⁴⁵ Nearshoring is where a business moves its operations to a nearby country from one of greater distance in order to reduce the carbon footprint through shortening the supply chain.

important that the system is capable of being monitored and that changes in one process do not impact another sector. As such Key Performance Indicators should reflect emission as much as efficiency and productivity in order to obtain a balance.

Some suggestions to address the current challenges

Even though efforts have been invested in the food sector over the years to lower carbon footprints and emissions, there remain some clear gaps to be addressed. This report suggests the following points to help cut carbon footprints and emissions:

1. Understand the supply chain in particular how it changes with supplier disruption and market demand.
2. Collect data on emissions for the supply chain and involve suppliers in that collection.
3. Recognise the value of dynamic investment in skills and education of the workforce in this area.
4. Engage with suppliers to establish meaningful standards.
5. Set measurable, meaningful, and appropriate targets for reduction.
6. Invest in carbon governance within the industry.
7. Communicate intent, needs and aspirations up and down the supply chain in a timely fashion.
8. Encourage transparency in relation to the use and sharing of new technology.
9. Share good practice and knowledge with suppliers.
10. Work with partners – a critical friend may be appropriate.

Belton Farm Case Study – a dairy business transitioning to Net Zero



Background

Belton Farm is a family-owned and run business set in the glorious Shropshire countryside where the Becket family have been producing handcrafted British regional cheese since 1922. Milk for cheesemaking comes from 65 local family-run farms within a 25-mile radius of the dairy where cows are grass-fed and free to roam for a minimum of 180 days.



Cheese Making at Belton Farm

Belton Farm Case Study Information

Belton Farm is committed to reducing the impact that their activities have on the environment by optimising their use of resources, minimising emissions, and reducing wastage.

Central to this has been the rigorous focus on reducing carbon emissions and energy usage through the implementation of environmental efficiency schemes, which includes investing in renewable energy and introducing energy reporting.

A significant amount of electricity consumption is generated on-site. The electricity produced comes from a 135,397 kWh Solar PV array, which has been expanded over three phases. The introduction of the arrays has reduced the reliance on grid electricity and made a significant contribution to the companies' environmental performance.

The Solar PV Portfolio generated 135,397 kWh of electricity during 2020, offsetting 34 tonnes of greenhouse gas emissions. Put in other terms, this carbon saving is the equivalent of the electricity produced by 6.8 households per year.



Solar Panels at the Belton Farm Dairy

Heat recovery units have been implemented at Belton Farm with the aim of decreasing the reliance on oil (Kerosene and Gas Oil), this has led to a significant reduction in the amount of oil being used on site. Between 2009 and 2019 there has been a 30% reduction in the total amount of oil being used.

To maintain sustainability the company process by-products, selling WPC, whey cream and lactose permeate for further processing. The Lactose permeate they produce is sold for anaerobic digesters and animal feed. Also, following the elimination of cardboard, all the cheese produced is stored in reusable plastic crates.

Carbon Footprint on Farm

Belton was one of the first cheesemakers to run a carbon footprint programme both at the business level and with their local farmers. Throughout the last eleven years, they have seen a 46% reduction in their total emissions (2009-2020). This is despite the production of cheese increasing year on year.

What's next?

The aim for Belton Farm is to be at Net Zero within the next 10 years, a key aim will be to collaborate with their group of dairy farmers to reduce their carbon footprint at the same time.



Background

Bakkavor is the UK's leading provider of fresh prepared food, manufacturing everything from salads and soups to pizzas and cheesecakes for all the major supermarket retailers under their own brand labels. Whilst not being a household name, with over 1,700 products in their portfolio, the company's scale is significant and core to its operating model is being able to manage complexity and work collaboratively through long-standing relationships with the retailers.



Bakkavor's range has ingredients drawn from a wide geography

This relationship is no less significant when it comes to sustainability, as retailers rely on Bakkavor to support their own targets and ambitions as a critical link to the rest of the food and agricultural supply chain. The company sources around 13,000 specific products from more than 750 suppliers across 50 countries. This complexity means that Bakkavor's ESG strategy Trusted Partner includes responsible sourcing as a major focus area.

Risk Assessment

To manage this scale and complexity in a strategic way, Bakkavor has developed a web-based, data-driven risk assessment system that assesses sourcing risks in three areas: environmental sustainability, human rights, and raw material integrity. The system quantifies risk based on the suppliers' completion of self-assessment questionnaires as well as against location-based risk metrics. For environmental sustainability, this includes, for example, a number of climate-related aspects such as drought risk and flooding. By surfacing this insight, it allows Bakkavor to understand, anticipate and potentially mitigate supply issues and risks to build resilience.

Using this information alongside historical and current knowledge Bakkavor identifies suppliers who have a potential risk in specified areas and aims by engaging with the relevant suppliers to understand that risk further, and to support the supplier in identifying potential mitigations. When the size of raw material suppliers can range from multinational companies to small-scale producers, this tailored approach to engagement is crucial to making meaningful improvements, as it identifies priority hotspots and relevant, practical actions to take.

For Bakkavor, challenges still remain when it comes to influencing change at scale – not least that many of its direct suppliers are themselves procuring from additional links further on in the food supply chain.

Net Zero Commitment

On their own climate commitment, Bakkavor are committed to Net Zero by 2040 across their UK, China and US operations. As an own-brand manufacturer, their big carbon hotspots come in the form of refrigeration, cooking systems and powering machinery in factories. All are critical processes vital for food safety and quality, so continual innovation will be required to deliver the Net Zero roadmap. One workstream involves overhauling refrigeration systems across its 23 UK sites to lower carbon models, with the potential to unlock significant carbon savings. Food waste is another sector priority, and its link to climate change is undeniable.

Globally, food waste contributes 8-10% of total man-made GHG emissions and the manufacturing phase of food production and retail contributed to 1.5m tonnes of food waste in 2018 in the UK alone. Bakkavor is part of the industry commitment Champions 12.3 which aims to halve food waste by 2030. Tackling waste in manufacturing comes in broadly three plans: minimising waste created in the first place by optimising process efficiency in new product development, careful monitoring of product lines, and avoiding waste through redistribution – to people where possible through redistribution networks like food banks, or to animal feed for items like vegetable offcuts and pizza dough. Being part of a sector commitment has helped to elevate food waste as a priority at every level of the organisation and triggered innovative ideas from bread and butter puddings made using the end slices of loaves to partnership opportunities with start-ups making new products with fruit peelings.

With the global nature of food production unlikely to change any time soon, it's clear that industry momentum and collaboration is key within the food system. Overcoming transparency challenges, access to data and ensuring that the business case for sustainability is understood at all tiers is critical if the food and agricultural industry is to deliver on its current commitments to achieving the substantial change that has been identified.