

Future Factory

Supercharging digital innovation
in food and drink manufacturing

Featured in the UK
Government's Food
Strategy 2025



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Executive summary

BECOMING WORLD LEADERS WOULD UNLOCK £7–14 BILLION OF VALUE FOR THE UK ECONOMY

Compared to other G7 countries and Europe, the UK performs well in terms of the gross value added (GVA) per employee, with only USA, Canada, Netherlands and Belgium performing significantly better. If the UK is to transition from great to world-leading, this could unlock a further £7–14 billion of value for the economy, representing a 22–44% improvement (2–4% annual improvement above inflation over 10 years).

Food and drink manufacturing has huge investment potential

Compared to other UK advanced manufacturing, food and drink has only seen 27% of the investment that transport and engineering has over the last 20 years. However, food and drink manufacturing has returned **£9 for every £1** invested in that period, with transport and engineering returning £5 for every £1.

How well is the industry adopting automation, digital and AI?

Now, after a period of turbulence, the industry is innovating extensively including in the use of AI as it moves into a new era. From manufacturing, R&D, procurement, commercial and the supply chain, there are great success stories across the industry in companies of all size.

While these technologies hold enormous promise, their adoption is not without challenge. There are three key obstacles standing in the way of sweeping transformation:

1. Proving return on investment quickly enough
2. Attracting top talent to drive digital transformation
3. Integrating innovative solutions into legacy systems



Can the digital age propel UK food and drink manufacturing from great to ground-breaking?

The question is, how can the industry overcome these obstacles so it thrives in the digital age? The answer lies in investing strategically and collaborating closely. To unlock the sector's full potential, a united focus is required, with everyone also playing their own role in the transformation:

- businesses can overcome legacy infrastructure challenges by taking a long-term vision while implementing digital solutions iteratively and delivering tangible business outcomes;
- the sector can work together to activate talent, drawing the right people in by focusing on purpose, the opportunity to work on complex manufacturing problems, the real world impact the sector offers, and creating a culture where diverse talent can thrive;
- and if the system comes together as a whole – manufacturers, retailers, suppliers, technology and government – to rewrite the rules of engagement on how we collaborate, we can supercharge collective productivity and growth.

If the UK can direct investment and resources to the right places to overcome industry challenges, the food and drink manufacturing sector has a remarkable opportunity to set a global example of how digital transformation can drive true economic growth.

Introduction

THE CRITICAL ROLE OF FOOD AND DRINK MANUFACTURING

- £38 billion gross value added (GVA) to the UK economy
- 17% of UK manufacturing GVA – the biggest manufacturing sector
- 12,515 businesses
- 474,000 people employed
- Truly national, in all parts of the UK
- £24 billion of food and drink exports to over 200 countries
- 70% of UK land usage is in agriculture, with food and drink manufacturing the largest customers
- Around a quarter of UK's domestic CO₂ emissions are from the food sector, with the ability to have a huge impact on Net Zero

Sources: FDF, Food Foundation, gov.uk

Food and drink is the largest manufacturing sector in the UK, accounting for almost 20% of total manufacturing and generating more than £142 billion in turnover. Nearly half a million people in over 12,500 businesses – ranging from heritage brands to innovative startups – are employed in the sector. For every £1 the sector generates in gross value added (GVA), an additional £2.48 circulates back into the economy through supply chain activity and employee spending. Food and drink manufacturing is an undeniably powerful engine for economic growth, and its impact cannot be understated.

Drives regional economic growth and job creation

Each direct job in the sector supports more than three jobs elsewhere, making it a multiplier of local prosperity. It creates well-paid, reliable jobs and long-term careers in communities often underserved by other industries. Jobs range from entry level work on the factory floor right through to highly skilled roles in engineering, food science and digital technology.

By purchasing domestic agricultural output, the sector also supports the UK's farming community, creating a virtuous cycle of local sourcing and production.

At a time when the government's growth and opportunity missions seek to bridge regional inequalities, food and drink manufacturing offers a model of local economic growth.

Feeds the UK every day and in times of crisis

By sourcing locally and internationally, the food and drink sector provides variety but also stability, cushioning against potential shocks. During the COVID-19 pandemic, the war in Ukraine and post-Brexit trade shifts, for instance, manufacturers demonstrated their resilience, swiftly adapting to supply chain disruptions and market volatility, keeping shelves stocked and the public reassured.

Fuels export growth

The UK's food and drink products are prized worldwide with exports reaching a record £25 billion in 2022. Rising demand leads to increased production and more jobs, further solidifying the industry's role as a driver of economic growth.

Adapts fast to the future

With the UK committed to achieving net-zero emissions by 2050, food and drink manufacturers are stepping up sustainability efforts. Global manufacturers and small enterprises alike are adopting renewable energy, upgrading to energy-efficient machinery, and implementing advanced recycling and waste-reduction systems. By going green, the industry not only meets regulatory requirements but also gains a competitive edge.

Companies are also investing in technology to stay competitive. Robotic arms, precision packaging machines and automated sorting systems have become staples in modern production lines. The payoff is efficiency: faster throughput, reduced error rates and lower operational costs. Employees are freed up to focus on higher-value work.

Artificial intelligence is also finding its place in the sector. Machine learning algorithms forecast demand, optimise inventory and identify quality issues early. Predictive maintenance powered by AI keeps production lines running smoothly by diagnosing potential faults before they disrupt operations. These digital tools enable manufacturers to keep goods competitive in both domestic and international markets.

With the use of data analytics, businesses can make informed decisions at every level, from improving product quality to reducing waste. Digital twins – virtual replicas of production environments – are helping companies trial and improve production processes before implementing them in real life. The result is greater productivity and more efficient use of resources across the board.

The UK's food and drink manufacturing sector is more than a source of employment and exports. It is a foundation of economic stability, growth and innovation across the country.

As the government pursues its Industrial Strategy, supporting this sector could yield outsized returns in productivity, sustainability and community resilience. Through investment in automation, digitisation and sustainable practices, UK food and drink manufacturers are not only safeguarding the country's economic future but ensuring a more resilient, secure, greener one.

This is an industry that the UK can ill afford to overlook.

From great to groundbreaking

A COMPELLING CASE FOR TRANSFORMATION

By going from great to groundbreaking, the food and drink manufacturing sector has the potential to unlock £7–14bn¹ of extra value for the UK economy

Based on an extensive literature review and study of economic and industrial indicators, the research programme set out to quantify the potential of the UK’s food and drink manufacturing industry by comparing its performance internationally and domestically with other advanced manufacturing sectors. These are the findings.

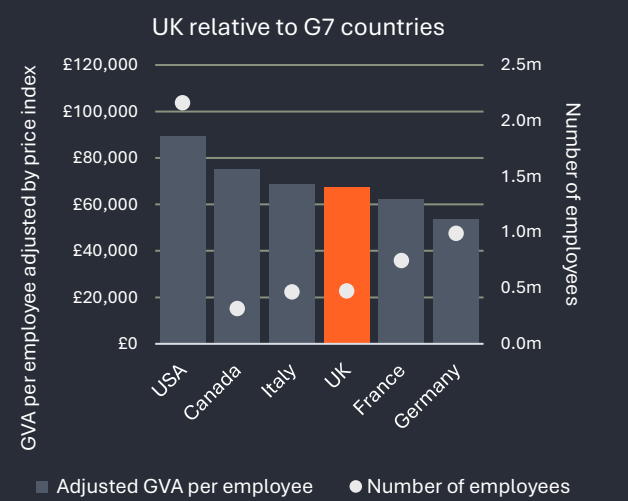
1. International comparisons: G7 economies and beyond

Our research found that the UK’s food and drink manufacturing industry performs relatively well amongst its G7 peers. Only North America and Italy have a more productive industry, while France and Germany have lower GVA per employee (Chart: Labour productivity in the food and drink manufacturing in the G7 economies). Our labour productivity measure is gross value added (GVA) per employee², adjusting GVA figures to remove consumer goods price level differences between countries.

It’s noteworthy that the UK is more productive than its G7 European counterparts while having fewer employees.

Expanding the same view to other European countries, the food and drink sectors in the Netherlands, Belgium and Norway are performing better than the UK. The UK sits above both Spain and Poland which have similarly sized workforces, but a smaller output per employee (Chart: Labour productivity in the food and drink manufacturing in European economies).

Labour productivity in the food and drink manufacturing in the G7 economies, 2022³



Labour productivity in the food and drink manufacturing in European economies, 2022⁴



1. Opportunity calculated by multiplying the number of UK employees in the food and drink manufacturing industry by the median GVA per employee of Northern American countries (US and Canada), and the median GVA per employee of smaller, more successful European economies (Netherlands, Belgium, Norway).

2. Gross Value Added (GVA) measures the value generated in the production of goods and services. It is one measure of overall economic performance. GVA is displayed per employee for comparison across countries.

3. Data sourced from: UK GDP (low-level aggregates), Office for National Statistics (2024), JOBS03: Employee jobs by industry, Office for National Statistics (2024), JOBS04: Self-employment jobs by industry, Office for National Statistics (2024), Enterprises by detailed NACE Rev.2 activity and special aggregates, Eurostat (2022), Value Added by Industry, U.S. Bureau of Economic Analysis (2024)

Labour Force Statistics from the Current Population Survey, U.S. Bureau of Labour Statistics (2024), Labour productivity and related measures by business sector industry and by non-commercial activity consistent with the industry accounts, Statistics Canada (2023), Canada GDP deflator, Trading Economics (2022), Price Level Indices, OECD (2022)

4. Data sourced from: UK GDP (low-level aggregates), Office for National Statistics (2024), JOBS03: Employee jobs by industry, Office for National Statistics (2024), JOBS04: Self-employment jobs by industry, Office for National Statistics (2024), Enterprises by detailed NACE Rev.2 activity and special aggregates, Eurostat (2022), Price Level Indices, OECD (2022)

No country provides a perfect benchmark, with differences in consumer preferences, size of economies and the scale of imports and exports. However, they do provide an indication of the value that can be generated by more productive food and drink manufacturing sectors.

Looking at macroeconomic differences, the Netherlands is the most productive, but highest salaries are in Switzerland. The US is the largest food importer and exporter by value. However, both the Netherlands and Belgium also have significant export levels relative to their economic size, which can be attributed to their strategic location, efficient logistics networks, and specialisation in the manufacturing of particular products.

Consumer behaviour also differs significantly. North American households appear to be more price sensitive, while the Swiss and the Dutch have a strong preference for own-label products.

If the UK was to move to achieve the average North America productivity, that would represent a 22% improvement or a 2% annual improvement above inflation over 10 years, generating a further £7 billion of value for the economy.

While if it was to reach the average productivity of the world leading Dutch and Belgian food and drink manufacturing sectors, that would bring a 44% improvement or 4% annual improvement above inflation over 10 years, representing £14 billion of extra value for the economy.

Such growth would strengthen the UK as a world leader in food and drink manufacturing, enhance food security, provide the potential to increase exports and support the UK economy.

2. Comparison with other advanced manufacturing in the UK

In interviews with manufacturers, innovation hubs and academics, transport and engineering manufacturing was often brought up as a key comparator.

Transport and engineering is a wide category, consisting of multiple manufacturing sectors from automotive, other transport, computer, machinery and electrical equipment. Although not exactly like-for-like, there are similarities in workforce demands, supply chain dependencies, regulatory pressures and technological advancement.

Comparison of food and drink manufacturing industry characteristics across different nations⁵

Country	Adjusted GVA per employee	Average annual salary per employee	Value of food imports (m)	Value of food exports (m)	Private label value share in consumer goods (%)	% of consumers who would switch to less expensive foods to save money
Netherlands	£102,720	£39,914	£80,943	£106,795	45.2%	43%
Belgium	£91,630	£35,916	£42,601	£47,487	39.8%	39%
US	£89,201	£40,430	£81,558	£172,147	18.9%	66%
Canada	£75,248	£50,057	£39,817	£60,541	18.5%	66%
Norway	£69,731	£43,679	£8,334	£12,297	23.0%	
Italy	£68,815	£22,261	£50,471	£51,933	30.2%	27%
UK	£67,308	£31,486	£60,578	£27,468	44.0%	43%
Switzerland	£66,674	£51,004	£12,189	£8,447	52.3%	34%
Denmark	£62,704	£44,678	£13,699	£17,993	34.0%	37%
France	£62,117	£28,490	£60,276	£69,256	34.4%	37%
Spain	£58,096	£21,742	£43,915	£53,944	45.6%	36%
Poland	£57,389	£12,376	£27,392	£41,392	27.2%	38%
Germany	£53,376	£26,614	£94,842	£77,208	41.4%	46%

5. Data sourced from: UK GDP (low-level aggregates), Office for National Statistics (2024), JOBS03: Employee jobs by industry, Office for National Statistics (2024), JOBS04: Self-employment jobs by industry, Office for National Statistics (2024), Enterprises by detailed NACE Rev.2 activity and special aggregates, Eurostat (2022), Value Added by Industry, U.S. Bureau of Economic Analysis (2024), Labour Force Statistics from the Current Population Survey, U.S. Bureau of Labour Statistics (2024), Labour productivity and related measures by business sector industry and by non-commercial activity consistent with the industry accounts, Statistics Canada (2023), Canada GDP deflator, Trading Economics (2022), Price Level Indices, OECD (2022), Annual Survey of Hours and Earnings, ONS (2022), Occupational Employment and Wage Statistics, Bureau of Labour Statistics (2022), World Development Indicators, World Bank (2022), Private Label Value Share of FMCG in Europe, Statista (2024), Private Label Share of Consumer Goods in the US, Statista (2024), Private Label Market in Canada, Statista (2022), The State of Grocery Retail, Europe, McKinsey and Company (2023), The State of Grocery Retail, North America, McKinsey and Company (2023)

Food and drink has only seen 27% of the investment that transport and engineering has over the last 20 years. Despite this, GVA in food and drink manufacturing has increased 149%, compared to 163% in transport and engineering in the same period (Chart: Investment and GVA by UK industry over time).

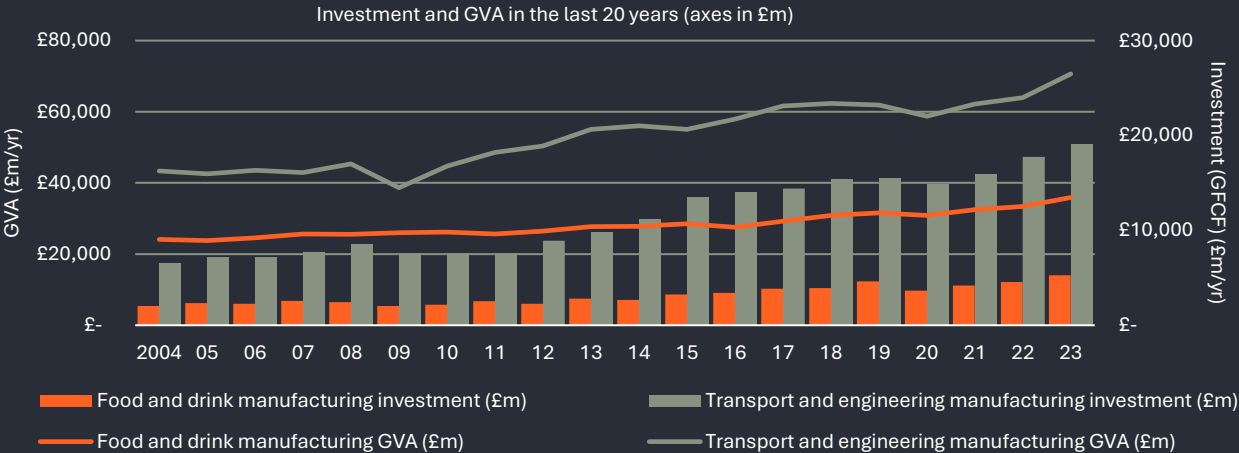
The respective Compound Annual Growth Rate (CAGR) of GVA in each sector has been 2.0% in food and drink manufacturing vs. 2.5% in transport and engineering manufacturing.

When compared with transport and engineering, food and drink manufacturing has generated more value added per unit of investment over the last 20 years⁶. **For every £1 invested, £9 has been returned in food and drink manufacturing, compared to £5 in transport and engineering** (Chart: GVA to investment ratio by UK industry over time).

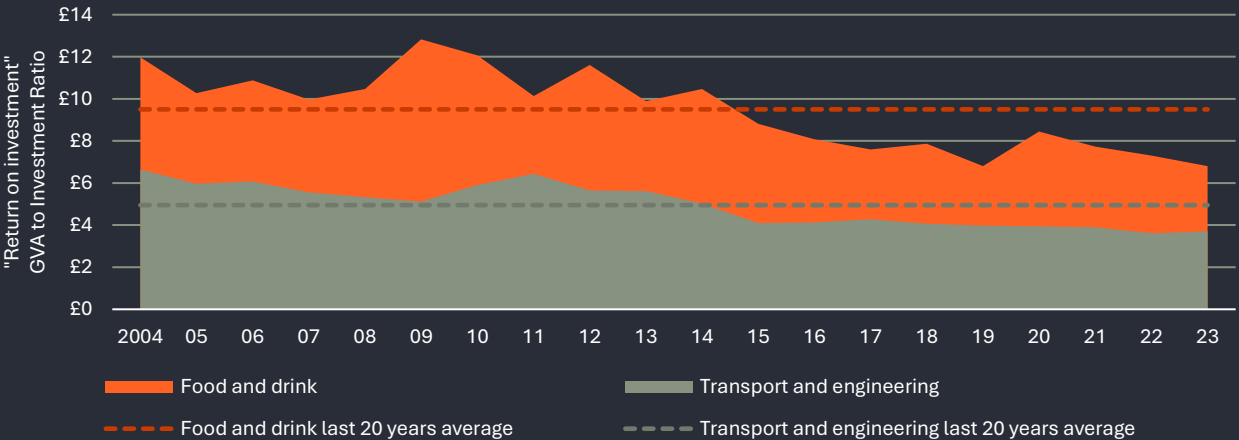
As more investment is made, we expect it to have a diminishing return which is reflected in (Chart: GVA to investment ratio by UK industry over time).

Looking at a shorter time horizon over the last five years, food and drink manufacturing returned £7.40 to every £1 invested, vs. £3.80 in transport and engineering, demonstrating **1.95x greater return potential in food and drink manufacturing**.

Investment and GVA by UK industry over time



GVA to investment ratio by UK industry over time⁸



6. Gross fixed capital formation (GFCF) has been used as the investment variable.
7. Data sourced from: Business Investment by Industry and Asset, Office for National Statistics (2024) UK GDP (low-level aggregates), Office for National Statistics (2024)
8. Ratio of investment per employee and GVA per employee for each industry over the past 20 years.
Data sourced from: Business Investment by Industry and Asset, Office for National Statistics (2024), UK GDP (low-level aggregates), Office for National Statistics (2024), JOBS03: Employee jobs by industry, Office for National Statistics (2024), JOBS04: Self-employment jobs by industry, Office for National Statistics (2024)

There is an opportunity to invest more in UK food and drink manufacturing before we achieve diminishing returns. The imperative is to create the right investment environment, direct investment in the right areas and enable innovation that drives productivity. This report further explores the obstacles being faced by manufacturers that need to be overcome.

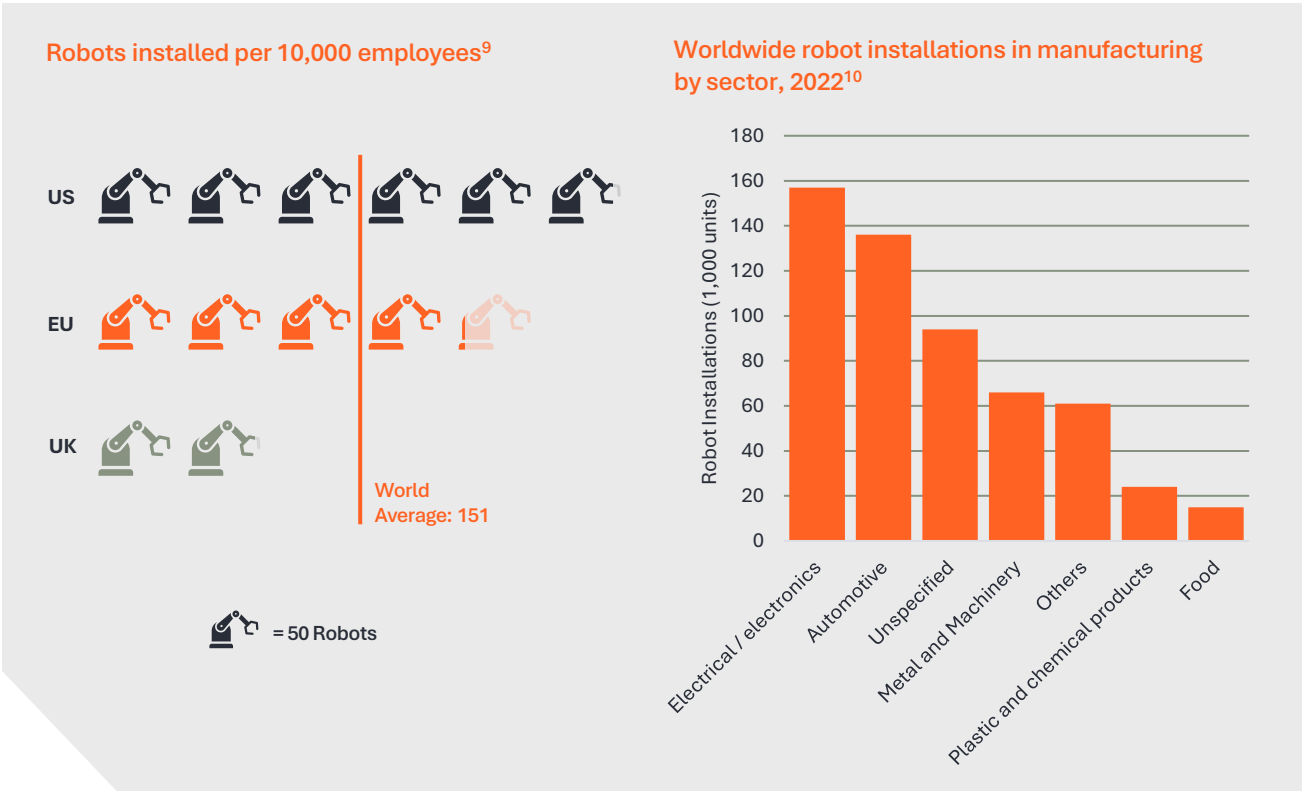
Spotlight: Can better automation unlock value?

Across manufacturing sectors, robot density in the US and EU is substantially higher than in the UK.

Food and drink generally across the world has lower robot density compared to other manufacturing sectors. This trend reflects the challenges with predictability and variation of demand in some areas of the sector, as well as the complex manufacturing environment given the high number of products and nature of handling food.

Using digital and AI technology to invest in the right areas to automate and optimise supply chain and commercial decisions can be a key enabler to help the UK food and drink sector unlock its economic growth and productivity potential.

Investing in automation and so prioritising productivity and growth will secure the food and drink manufacturing industry’s competitive edge, at home and internationally, cementing its role as a critical contributor to the UK economy.



9. World Robotics: Industrial Robots, International Federation of Robotics (2022)
10. World Robotics: Industrial Robots, International Federation of Robotics (2022)



Closing the action gap

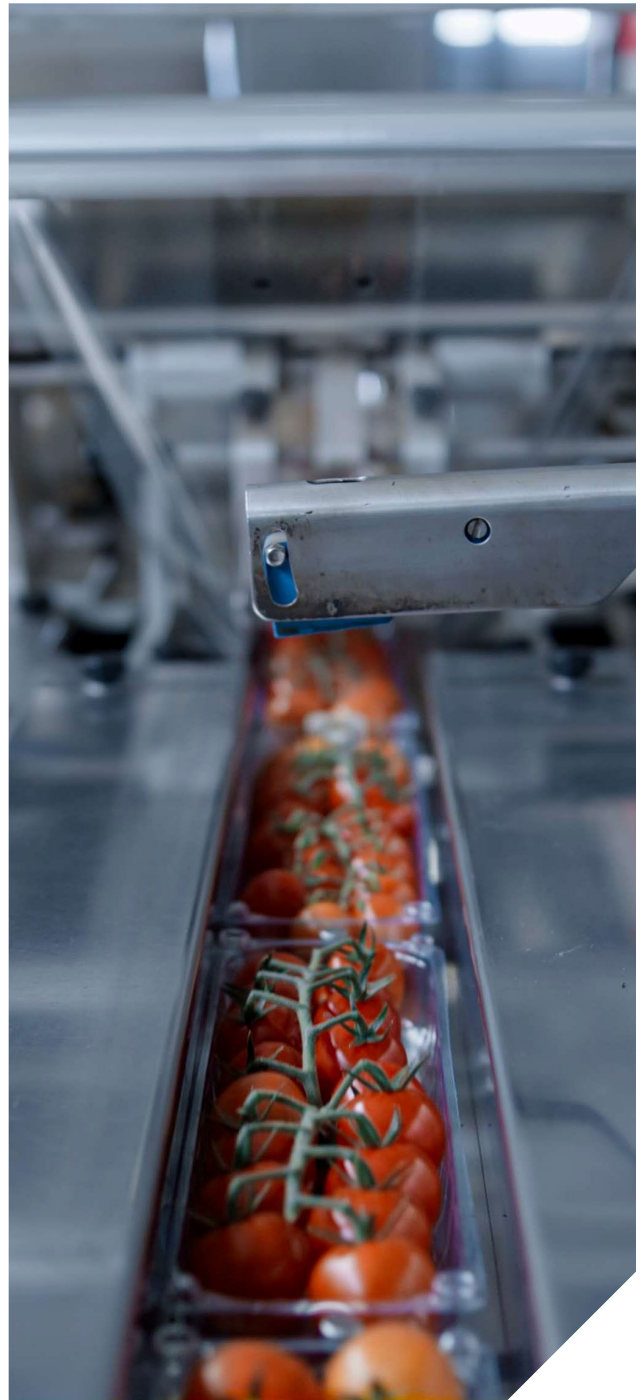
Closing the action gap

TO UNDERSTAND HOW ALL THIS POTENTIAL CAN BE FULLY UNLOCKED, THE RESEARCH PROGRAMME SPOKE TO INDUSTRY LEADERS ABOUT WHAT OBSTACLES THEY FACE.

When it comes to automation, the industry was one of the early adopters of the technology, and it knows how to automate effectively when conditions align. If there is an issue, it is that engineering solutions do not always perform well out of the gate, slowing integration processes. In some cases, the lower cost of some labour proves a tempting potential short-term solution.

For digital and AI, the landscape is more nuanced. **Three quarters of the leaders in the research revealed that they can see the benefits of digital and AI solutions and how they can support their company's strategic objectives.** Most have already identified exciting opportunities for their business. However, full maturity is a way away. Just half are confident that their business knows the right approach to implementing and effectively deploying newer technologies. **There is an action gap between digital enthusiasm and actual implementation.**

Three key interlinked reasons for this gap emerged during industry interviews, each of which can be overcome with a joined-up industry-wide approach.



Obstacle 1. Commercial environment

FIRST MOVE MOMENTUM VS. FIREFIGHTING

Proving a significant return on investment (ROI) in a sufficient time frame is one of the greatest challenges facing food and drink manufacturers when adopting technology. Implementation costs are seen to be high compared to perceived benefits¹¹, and without short-term gains, long-term investment becomes challenging.

This issue was raised repeatedly in industry interviews and is compounded by quarterly shareholders' review cycles, private equity ownership, and consumer and government expectations around ultra-low food prices.

Keith Thornhill, Siemens' Head of Food & Beverage, UK and Ireland, put it succinctly: "Companies can't see the wood for the trees because they are forever in firefighting mode. It's like trying to redesign a plane while it's flying."

The highly competitive, fast-moving nature of the food system disincentivises innovation particularly for mid-sized organisations predominantly selling private label products directly to retailers on short-term, open-book contracts. This unpredictable environment can limit innovation as suppliers lose interest. **It is difficult to commit to significant investments without the assurance of long-term business stability.**

"SMEs and midcaps are often firefighting focused on getting the orders out on time with little to no headspace to think about the longer term," believes Bhavnita Patel, Sector Development Manager for Agri-Tech at the Manufacturing Technology Centre. "A frequent blocker to process and technology projects is that everyone is looking for short-term returns on their investment of between 12 months and two years." However, if an organisation wants to invest in new technology, such as energy efficient ovens or an automated packaging line, it typically requires sizeable upfront capex for benefits which might not be realised fully for >10 years."



The picture is similar in SMEs and private label companies. **Businesses generally target two-year ROI for automation projects, making it challenging to justify investments in advanced technologies that require a longer horizon to demonstrate value.**

Andrew Martin, Head of Food and Drink at the Advanced Manufacturing Research Centre (AMRC) calls it the "valley of death" and sees it on a daily basis: "Businesses have a great idea but can't get it to the point where it's commercial," he says. "Suppliers are disincentivised from investing too much because of open book agreements. Retailers control the market and, yes, they want innovation but want to know they're going to get something back."

"In other sectors," Andrew continues, "everyone knows they have to make enough money to invest in new technology so there's enough space in the marketplace. In food and drink, the cash left can be miniscule so they might spend money on recipe development, rather than tech."

Making the business case

Business cases for investment look very different in other advanced manufacturing sectors such as aerospace and automotive because organisations are delivering a small number of very high value items making technical innovation easy to link back to value.

In food and drink, while marginal gains may be small individually, they accumulate across large volumes, resulting in significant overall savings that, although complex to model and track, contribute to substantial returns.

While a challenging situation, industry research clearly shows that investment in food and drink manufacturing offers strong returns. As explored in the 'Vanishing horizons' section of the report, making a successful business case in this sector is more than possible by focusing on real, tangible business outcomes.



Obstacle 2. Capabilities

INDUSTRY EVOLUTION VS. TALENT ATTRACTION

A third of senior leaders who took part in the research admit the biggest issue holding back digital and AI solutions is the lack of skilled labour to even identify the scope for such work.

Attracting highly skilled talent, especially outside London where most food and drink manufacturing takes place, is a struggle. At the moment, the proportion of employees in food and drink manufacturing lacking key skills is 11.8% – more than twice the national average of 5.7%¹², and higher than all but one other manufacturing subsector. **Labour and skills shortages continue to hold back growth and productivity with an estimated loss of £1 billion in output in 2023 due to these shortages**¹³.

There are many interconnected reasons behind the challenges facing talent attraction in food and drink manufacturing. Almost a third of the food and drink manufacturing workforce is estimated to reach retirement age by 2033-35¹⁴. Replacing more experienced parts of the workforce can be difficult as new talent isn't fully aware of the meaningful, long-term career opportunities available in the sector.

As a result, other advanced manufacturing sectors are gaining the upper hand in recruiting domestic talent in engineering and science.

This dichotomy is brought to life starkly in one particular business who contributed to the research. It's harder to recruit people into one of its factories so automation has been ramped up there to meet demand. This has also meant investment has had to be put on the backburner at its other site.

A post-Covid shift in work expectations also plays a role. Many professionals now expect remote work options, but most fast-moving consumer goods (FMCG) sites require on-site presence, often in remote locations. These settings can be less attractive to new graduates eager to start their careers in urban areas. The geographic spread of the industry also makes it difficult to upskill as it can be challenging to form sufficient apprentice cohorts to sustain consistent, high-quality training.

Additionally, there's a significant gap in salary expectations between the UK and other markets, particularly the US. Concerns are growing that recent budget changes may make it even harder for UK businesses to remain competitive in attracting and retaining skilled talent.

It becomes a Catch-22: **businesses must allocate extra resources to attracting and recruiting the right people, diverting budget from innovative tech and digital where these people would do their best work.** Some businesses end up focusing instead on low-cost, labour-intensive technologies¹⁵.

12. Department for Education, Employer Skills Survey (2022)

13. FDF State of Industry Survey, Q1 (2024)

14. Food and Drink Sector Council: Preparing for A Changing Workforce (2019)

15. Lloyd, Caroline, Payne Jonathan, Food for thought: Robots, jobs and skills in food and drink processing in Norway and the UK, New Technology, Work and Employment (2021)

Dario Riccomini, Managing Director of Scottish confectioners Aldomak, says it is difficult to attract the right talent: “We need generalist, multi-skilled engineering talent who do not need to be told what to do but are solution-focussed and self-starters. But many of those people want to work in automotive and aviation.”

This rings true based on insights from universities and students alike. University attempts to get food engineering courses off the ground have stumbled as there has not been enough interest from undergraduates, while engineering courses tend to focus on the knotty problems in automotive and aeronautical. Project engineers, scientists, lab technologists and plant engineering technicians often do not even consider entering the food manufacturing industry¹⁶.

16. Labour shortages are stifling economic growth for the UK's food and drink producers, FDE, (2023)

With students showing little interest in FMCG, university courses focus assignments elsewhere, and so students miss the chance to consider the fascinating, meaningful problems of food security, healthy eating and sustainability.

Raising awareness of the meaningful career opportunities within the sector is becoming increasingly urgent, as is expanding the use of AI, robotics, and automation to enable employees to focus on areas where they can make the greatest impact. Practical steps organisations, the industry and the government can take to overcome these capability hurdles are outlined in the activating talent section of this report.



Obstacle 3. Solutions

LEGACY SYSTEMS VS. MODERN SOLUTIONS

Nearly all (85%) of food and drink businesses who were part of the research programme are using automated business reporting, with 1 in 3 running initiatives to implement AI and data science solutions. But, while there is clearly growing demand, there is a wide variety of maturity in the industry.

Some companies use digital twins and simulation to model processes and create capacity to allow for growth, while, at the other end, some struggle to obtain accurate measurements.

Implementation of new technology can be challenging in any industry, but it is particularly so in food and drinks manufacturing. Food products are fragile, meaning any machinery needs to handle delicately¹⁷. The industry is highly regulated, with production processes being tightly controlled. Machinery must adhere to strict health and safety policy¹⁸. There is huge variability in food items compared to other manufacturing industries that are successfully using robotics and autonomous systems¹⁹. In some cases, automation has already been implemented in what is a mature manufacturing sector, so the challenge then becomes how to modernise factories with legacy assets.

Specialised food and drink manufacturing technology is also harder to come by than in other industries²⁰. The off-the shelf technology products that do exist require complex customisation which often don't easily integrate into existing, legacy machinery and data systems.

Many technology products are not in a "hand able" state, believes Dario Riccomini from Aldomak: "The software I have engaged with has unnecessary conversions to fit a standard which I then have to convert back to something that makes sense," he says, and he's frustrated. "We keep talking about Industry 4.0 and 5.0 but we've not even made it to 2.5 as a sector."

What these firms are experiencing is not unusual, according to Bhavnita Patel from the Manufacturing Technology Centre. "Off-the-shelf products to help across manufacturing do exist, but they're not always being used properly or to their potential," she says. "Many organisations have invested in Enterprise Resource Planning (ERP) systems, for instance, but few are using them effectively. Getting the basics right is essential but, quite often, I see businesses still running on basic spreadsheets."

Companies know they need to be outcomes-focussed with automation and AI initiatives, looking for value on the profit and loss sheet. But the technology often depends on the foundation of existing infrastructure. **Solutions can't be built on quicksand and accelerating AI opportunities relies on solid data and systems.**

17. Onyeaka, Helen, Phemelo Tamasiga, Uju Mary Nwauzoma, Taghi Miri, Uche Chioma Juliet, Ogueri Nwaiwu, and Adenike A. Akinsemolu. 2023. "Using Artificial Intelligence to Tackle Food Waste and Enhance the Circular Economy: Maximising Resource Efficiency and Minimising Environmental Impact: A Review" Sustainability 15, no. 13: 10482.

18. Dora, M., Kumar, A., Mangla, S. K., Pant, A., & Kamal, M. M. (2021). Critical success factors influencing artificial intelligence adoption in food supply chains. International Journal of Production Research, 60(14), 4621–4640. <https://doi.org/10.1080/00207543.2021.1959665>

19. Dora, M., Kumar, A., Mangla, S. K., Pant, A., & Kamal, M. M. (2021). Critical success factors influencing artificial intelligence adoption in food supply chains. International Journal of Production Research, 60(14), 4621–4640. <https://doi.org/10.1080/00207543.2021.1959665>

20. Lloyd, Caroline, Payne Jonathan, Food for thought: Robots, jobs and skills in food and drink processing in Norway and the UK, New Technology, Work and Employment (2021)

Leading the change

Even with the right technology, success depends on how well organisations manage and adapt to the changes, fostering a culture of collaboration and embracing new ways of working.

Vanshi Suvarna, Group Chief Information and Transformation Officer at Britvic emphasises that the biggest challenge lies in getting people to adopt and effectively use new technologies. It's key to work together to build strong data foundations: **"It's complex integrating various data sources, both internal and external, to generate meaningful insights, requiring significant time and resources to manage and potentially delaying the realisation of benefits from digital initiatives. Technology these days works. I have not found a single technology that doesn't work. The problem is the change management of people."**

Keith Thornhill from Siemens believes leadership, culture and people set the environment for business improvements, but tech will be a significant enabler in solving many sustainability and productivity challenges. "Tech is creating the demand but tech alone is not a golden bullet," he says. "What technology and consulting organisations can do is provide the headroom for leaders in this industry to get on the front foot."

Sue Whalley, Group People and Performance Officer at Associated British Foods believes leadership buy-in is crucial: "Post-Covid and Ukraine, we've got more headspace to invest in innovation. For example, we're now running AI pilots in a range of areas including for commodities purchasing, treasury management and how we might leverage more technology for product development and for smart factories. We're in an exciting moment."

To unlock the full potential of automation and AI, companies need to build strong data foundations, optimise existing investments and focus on outcome-driven initiatives. But success will also depend on leaders fostering a culture that embraces change and thrives on collaboration, so providing better demand signals to technology companies, academia and entrepreneurs. The next section outlines how technology and people-related challenges can be collectively overcome.



A kickstart to transformation

How can the industry overcome the interconnected commercial, capability and solution obstacles and close the action gap? The research programme highlighted three key focus areas for businesses, industry and the government.



Vanishing horizons

PROVING IMPACT TODAY

Start specific with a long-term vision. By tackling tangible business problems, manufacturers can generate value quickly, building momentum to replace legacy technology without the risk of a full-scale overhaul.

This prevents the need to ask for huge sums of money for a dream scenario, such as to transform whole systems, improve system resilience or become future fit: these are not business outcomes. With a vanishing horizon, over time technical debt is reduced with incremental implementation. It's a better frame, bringing technical teams together where everyone is speaking the same language.

The research programme highlighted a large bakery manufacturer as an example of this strategy. It was interested in implementing robotics, but it was still largely working on paper and, perhaps unsurprisingly, had issues with communication. The company decided to invest first in digital screens with Chromecast software. Overnight, this improved how everyone shared and recorded information. That momentum has since been used to install the right robotics as leaders realised they better understood what they needed to do with technology.

Building the business case with digital and data

Digital is an enabler, helping to build stronger business cases which bring together newer technologies and automation. It can reveal where to focus to achieve the next level of performance, although by itself, its impact is limited.

With all the focus on big data, it's important not to lose sight of the power of a well curated small data set and the value it can bring. Growing data availability and quality internally over time, supplemented by strategic data partners with relevant data can add value incrementally while modernising overall data infrastructure. For example, at one drinks manufacturer in the research programme, analytics allowed the commercial teams to see the operational impact of adding more lines, allowing a stock keeping unit (SKU) rationalisation programme.

To help a leading UK manufacturer of pastry and plant-based products understand store shoppers, Newton started by switching the company from Excel to machine learning to speed up calculation time by 1,000 times. We could then quickly cluster stores based on shopper missions, analyse product performance and spot and replace underperforming products. These changes led to a 3% net margin improvement.

How do you get a data driven digital transformation off the ground in an organisation as complex and global as BP? One of the largest companies in the world, it took this 'vanishing horizons' approach to improve reliability and safety in plants. It started with connecting existing data sets in one platform to provide visibility and focus, bringing experts together to spark new ideas and thinking based on the data, creating a multitude of use cases that improve business outcomes and then improving data with the aid of sensors for these use cases. It's enabled them to move from more reactive to preventative ways of operating to unlock value.

Businesses can overcome legacy infrastructure challenges by taking a long-term vision while implementing digital solutions iteratively and delivering tangible business outcomes.

Activating talent

SPOTLIGHTING PURPOSE AND PROGRESSION

How can businesses, industry and the government rewrite the narrative on food and drinks manufacturing so talent realises the incredible innovations and new thinking taking place?

“Food industry issues are just as interesting as those in automotive and aviation,” believes Dario Riccomini from Aldomak. But does talent know how interesting and multifaceted a career in the industry can be? Feedback from graduates suggests that food and drinks manufacturing rarely or never features in engineering courses. There is an opportunity for companies to feed their biggest issues into local universities and further education colleges to build food-specific content into science and engineering courses, to offer work experience and industry placements and to partner on hands-on research.

Amanda Johnston, Co-Director of the Advanced Food Innovation Centre at Sheffield Hallam University, believes food engineering isn't understood as an academic discipline in the UK nearly as well as it is in other parts of Europe, the Republic of Ireland, and the United States. Added to that, it fails to attract talent because the food manufacturing industry gets such negative press.

Promoting purpose

Organisations in the research programme who were confident in their recruitment and retention strategies believe their success is due to their clear, compelling direction and strong purpose. Jason Rommer, partner at recruitment consultants, Wilton & Bain, agrees: **“Attraction is helped by the scale and scope of work – is it truly transformative? Food and drink is hugely important and interesting to people outside their careers so why aren't we all tapping into that potential?”**

Food and drink manufacturing challenges and opportunities rival any industry, and with a purpose to feed the nation and help tackle strategic challenges such as climate change and health, it offers incredible careers for modern and diverse talent. **But the industry could highlight its value more, as well as ensure the sector's challenges are embedded into education and training, producing technical, motivated, empowered talent at all levels.**

There is still more work to be done by manufacturers to showcase the fantastic career opportunities for young people with a wide range of skills – working closely with government and education providers. A recent industry-led campaign to attract new talent into the food industry, Mmmake Your Mark, is a positive example of what the food and drink industry can do to showcase what it has to offer. It could be built on further to attract highly technical and advanced manufacturing skills.

Collaboration with technology companies can inspire talent into food and drink manufacturing. One of the food and drink manufacturers we spoke to, for instance, works closely with global technology product providers that will second their AI and data analysts to help grow their domain skills. Some of these people are fascinated by the purpose of the industry and stay on in the food and drink industry. Some of them return to the tech space, leaving with better expertise and helping create products that work better for the industry.

Revitalising skills

Food and drink manufacturers have long been calling for more cohesion across the UK skills system to meet employers' needs and the reform of the current Apprenticeship Levy. Sue Whalley, Group People and Performance Officer at Associated British Foods, thinks that it could be the key: **"The Apprenticeship Levy is often not fully utilised; it would be valuable to have a broader set of options to use this for in the innovation space including training and upskilling our people for digital."**

The newly created Skills England could provide an opportunity to build a better skills system that works for employers of all sizes with both a national and regional presence. In a recent report²¹, the body identified future mega-trends – demographics, technology and green – that reflect similar trends seen in food and drink manufacturing suggesting that its work will support transformation in the sector.

Through a unified approach, food and drink manufacturing can build a robust, forward-thinking workforce equipped and excited to tackle future opportunities and challenges. The sector can work together to activate talent, drawing the right people in by focusing on purpose, the opportunity to work on complex manufacturing problems, the real world impact the sector offers, and creating a culture where diverse talent can thrive.

21. Driving growth and widening opportunities, Skills England, September (2024)

The new rules of engagement

COLLABORATION FROM FARM TO FORK

In a fiercely competitive environment, organisations aren't collaborating extensively. But the cost of this is high – from deterring talent, to providing confusing demand signals to technology organisations, to scuppering long-term business planning. But, what if the rules of engagement were ripped up and rewritten?

There are an endless number of pre-competitive areas with broader industry benefits where expertise can be pooled such as decarbonation efforts, improving energy efficiency and reducing waste, creating more sustainable packaging, boosting health, improving infrastructure and attracting talent. **“We need to find where companies can relate to one another but aren't competing,”** says Simon Baty, Knowledge Transfer Manager (AgriFood), Innovate UK Business Connect.

85% of food and drink manufacturers develop innovation 'in-house' using their own company expertise while some collaborate with third parties: retailers (35%), research/innovation organisations (31%), universities (25%) and catapult centres (10%)²². Increasing collaboration within the industry by working with research partners from across the innovation ecosystem could deliver real benefits.

The Pudding Compartment in North Wales, with help from the Advanced Manufacturing Research Centre (AMRC), has been on an iterative journey of transformation from surviving to thriving, with growth of 20% year-on-year. The journey started small, with low-cost digital investments, such as monitoring fridge temperatures. This freed up people's time and led to the discovery that the temperature was too low and there were energy savings to be made. To become a data-driven business, AMRC provided digital skills, allowing the biscuit and cake supplier to make the right decisions on equipment, increase control, reduce waste and provide an early warning system. The next step is for a bigger automation journey, from bake to pack, a significant investment which aims to fuel ambitious 50% growth. The wheels are truly in motion.

In the short term, this will help build genuine trust by resetting and strengthening the relationship between retail and manufacturing, recognising interconnected pressures and exploring ways to shift entrenched ways of working. It means sharing innovation and implementation expertise to fuel greater adoption and highlight cutting-edge, meaningful careers.

In the longer term, imagine the impact of more joint business planning between manufacturers and retailers with the view of growing together.

Imagine the solutions the industry would have at its fingertips if it gave better demand signals to technology companies, academics and with UK-based start ups addressing specific pain points felt by the industry. It's about collaboration across the entire cycle, ensuring investment of time and energy is put in the right places.

The UK can cement its place as an advanced manufacturing, high productivity country if the entire food system works together – manufacturers, retailers, suppliers, technology and government – to supercharge collective productivity and growth.

The Advanced Propulsion Centre UK has been working with industry to rewrite the rules of engagement in automotive. One example of this is Project Trident which sought to decarbonise heavy-duty vehicles by increasing the efficiency of hydrogen fuel cells. It got off the ground at pace due to close collaboration between multinational technology leader Cummins, SMEs and academia, coupled with government investment. The work has achieved its aims to reduce CO₂, as well as driven job creation in the UK supply chain and led to new ways of innovating for everyone involved. Cummins can now get energy efficient products to market faster, while one of the SMEs involved, Holtex, has since spun out a new business thanks to opportunities spotted during the collaboration.

Inspiring innovation uncovered in the Future Factory research programme

Smart factory

A drinks manufacturer is achieving an Amazon-style, lights-out smart factory, powered by sensors, software and automation and scaling the approach across its portfolio.

AI-powered strategy

AI is being used to support commercial strategy – from determining pricing strategy to optimising product range and distribution.

Optical sorting

Enhanced with AI, optical sorting is being used for the delicate jobs of classifying and grading fruit.

Product development

AI is creating new food and drink variants – predicting flavour, texture and aroma preferences for consumers across the world.

Technical specifications

Small and medium-sized enterprises (SMEs) are using generative AI to supplement technical knowledge.

ESG reporting

Generative AI is interpreting raw product specifications to automate Environmental, Social and Governance (ESG) reporting.



Conclusion

To state the obvious, food and drink plays an essential role in all our lives – few of us would function well beyond midday without something to eat and drink. But much more than simply sustaining us, food and drink frames our lives. It's the foundation of our relationships, our communities and our society; of our heritage, our culture and our traditions.

It goes without saying that we couldn't support a nation of 68 million people, nor one that's projected to be 78 million by 2050, without the food industry we have. Our industry makes an enormous range of food and drink at scale right across the country, as part of a hugely efficient and sophisticated food system that delivers this fresh into shops, supermarkets and homes every day.

By any measure, today's food system is an astonishing success. But we're not complacent. Like other industries, there are pressures on us that we know we must address – from climate change to the resilience of our supply chains, from poor diets and ill-health to innovation and technology adoption in manufacturing. So we must continue to transform, and stay at the cutting edge of science, invention and advancement in manufacturing. If we don't, we risk not only creeping food insecurity but a failure to grasp the economic growth and productivity gains that an advanced economy such as ours can and should achieve.

This report highlights the opportunities open to us today to harness next generation technology, automation, digitisation and AI in the UK's food and drink manufacturing industry. This will in turn drive greater productivity and business growth, alongside new jobs and more opportunity right across the UK, securing the future of our planet for the long term.

To do this, we need to collaborate more – within and between businesses up and down the food supply chain, and with academia, government and others. As Newton sets out, there are firm foundations to build on. UK food and drink is groundbreaking in some areas and could be so in more, if between us we drive the right change. Working with FDF and our members, our new Food & Drink Technology Task Force will prioritise and progress the recommendations in this report, including:

- benchmarking UK against global best practice in technology investment, and testing and adjusting business services to better suit food and drink manufacturing;
- identifying areas of pre-competitive collaboration across our supply chain including retailers and farmers, to create the conditions in which investment can flourish, including creating a 'food & drink sandbox' to pilot new approaches; and
- working with Skills England, industry and education sector on food and drink engineering and science skills, learning from other sectors.

The work we're starting today will be judged by its effectiveness in creating a more productive, sustainable, resilient and healthier food system. But make no mistake, it's within our gift, acting together and as an industry, to renew the foundations on which we are built, and to ensure that, in ten years' time, they are rooted in the technologies of the future.



Karen Betts OBE
Chief Executive, FDF

About Newton

Newton partners with clients in strategic delivery across the public and private sectors, unlocking complexity to create meaningful and lasting impact.

Throughout its 20+ year history, Newton has shaped and delivered programmes across leading retail and manufacturing supply chains, public sector organisations and defence and infrastructure organisations. This work delivers real impact, including better value offerings for consumers, over £1.5 billion savings on a national defence programme, and more than £1.6 billion savings across the public sector, while also improving outcomes for thousands of people.

Newton believes so strongly in what can be achieved together with clients, that it stands by the founding idea of Newton – guaranteeing its fees against delivering real, measurable outcomes.

[NEWTONIMPACT.COM](https://newtonimpact.com)

About The FDF

The Food and Drink Federation (FDF) is the voice of the food and drink manufacturing industry – the UK's largest manufacturing sector. We contribute over £38 billion to the country's economy, supporting half a million jobs and driving growth at home and abroad.

For more information on the FDF and the industry we represent, visit:

[FDF.ORG.UK](https://fdf.org.uk)



About the Future Factory research programme



Research programme



Report



Roundtables



Food & Drink
Technology Task Force



Recommendations
to UK government

The Future Factory research programme underpins this report – as well as informing discussions at the follow-up roundtables with senior industry leaders and the final recommendations to the UK government. It is based on interviews with:

- Senior leaders including managing directors, supply chain and procurement leaders, data and analytics officers and site managers at 30+ UK food and drink companies, covering big players and growing businesses including Aldomak, Britvic and Associated British Foods
- Public bodies, including Innovate UK Business Connect, the Manufacturing Technology Centre and Advanced Manufacturing Research Centre (AMRC)
- Recruitment and innovation experts such as Wilton & Bain and Sheffield Hallam University Advanced Food Innovation Centre

FDF members also provided views on the food and drink manufacturing industry through detailed questionnaires.

These qualitative insights, and Newton's 20 years' navigating complicated systemic challenges, have been synthesised with a detailed literature review and analysis of key economic and industry indicators. This approach aims to provide a robust, data-driven, insight-led perspective on the productivity, performance and potential of the food and drink manufacturing industry as benchmarked against other countries and manufacturing areas.

Thank you to everyone who took part and the team at the FDF who supported the research.

Be part of it

The insights shared by senior leaders in this document and analysis of how the UK measures up to other economies will be used as conversation starters at upcoming events with businesses and government ministers. Collaboratively, we will develop a set of targeted, actionable steps for organisations and policy recommendations to help shape the new government's industrial strategy.

If you are involved in food and drink manufacturing, we are keen to include your views.

INNOVATION@FDF.ORG.UK

[NEWTONIMPACT.COM](https://newtonimpact.com)

These findings in this report are based on the methodology outlined on page 27, and a representative sample of respondents to a qualitative survey undertaken with the membership of the FDF. This sample is felt to be representative of the market as a whole

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