Digitalisation of the Food and Drink Industry in Ireland

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Foreword by Food Drink Ireland

The Irish Food and Drink industry is Ireland's most important indigenous industry, with a turnover of €39 billion and exports of €17 billion. It is a vibrant industry, with deep roots across Ireland, and one which has repeatedly shown resilience and agility in rising to a wide range of opportunities and challenges.

One such opportunity and challenge is the rate of technology change and the importance it places on all industries to embrace digital transformation. For the Irish Food and Drink industry, this is essential to maintain competitiveness and support long-term sustainability. This report outlines key insights into the ongoing digitalisation efforts within the sector. It highlights both the immense opportunities as well as the current barriers that need to be addressed.

The conclusions of this research demonstrate the wide scope that digital transformation will play in shaping the future of the industry. This includes aspects such as enhanced product quality and supply chain management to accelerated research and development and increased efficiency. However, despite a strong awareness of available technologies, the adoption rate remains low.

This report identifies the current barriers to increased adoption, as well as making a range of practical recommendations for change. It serves as a call to action for industry leaders, policymakers, and educators to work together in facilitating a smooth transition toward a more digitally driven food and drink sector. By leveraging the potential of emerging technologies and addressing the skills gaps, Ireland's food and drink sector can reinforce its position as a global leader in food innovation, sustainability and efficiency.

Paul Kelly
Head of Sectors and Director,
Food Drink Ireland

By addressing these challenges and leveraging the outlined opportunities, the Irish Food and Drink sector can position itself as a **global leader in innovation, efficiency, and sustainability.**

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This Report is co-authored by I-Form and CeADAR.

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I-Form, the Research Ireland Centre for Advanced Manufacturing, hosted at UCD, is a collaboration between nine institutes across Ireland. The Centre leverages a nationwide pool of expertise in materials science, engineering, data analytics, and cognitive computing to research the digitalisation of materials processing, aiming to enhance efficiency and sustainability. Working closely with industry, I-Form drives a step-change in the competitiveness of Irish manufacturing. The Centre focuses on advancing the low-cost, low-risk design of new products and the production of high-value components with enhanced material performance, while reducing processing times and improving process reliability.

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CeADAR, Ireland's Centre for AI, is a market-focused technology Centre based at University College Dublin (UCD). The Centre is also the European Digital Innovation Hub in AI for Ireland. Funded by Enterprise Ireland and IDA Ireland, CeADAR specialises in innovation and applied research in Artificial Intelligence across various industry sectors. The Centre collaborates with businesses and public organisations to accelerate the development and deployment of AI technologies, offering services such as prototyping, training and support to find investment. CeADAR regularly acts as AI advisor and collaborates in a large range of projects at both Irish and European level while fostering a robust national ecosystem through seminars, conferences, and networking events

We would also like to thank and acknowledge the large number of companies who took the time to contribute to this research by completing the survey, taking part in one-to-one interviews as well as providing use case examples.

Connect with Food Drink Ireland Skillnet

For any questions on this report, or to discover how Food Drink Ireland Skillnet can support your business deliver its digitalisation strategy, please contact Mark Skinner on mark.skinner@ibec.ie

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Executive Summary

01 | Executive Summary

Digital transformation is increasingly necessary for food and drink companies to remain competitive and responsive in a market driven by geopolitical and climate uncertainties, requiring greater agility, resilience, and sustainability in operations.

The recent Draghi report on the future of European Competitiveness (September 2024) indicated that digitalisation and the adoption of advanced technologies are key enablers for enhancing productivity and competitiveness across sectors, including traditional industries such as food and drink [1]. In Ireland, the innovation ecosystem within food and drink processing is at a relatively early stage, and the adoption of digital technologies has been slow. This has limited the impact of digitalisation on innovation, productivity, and sustainability in comparison to other sectors of the economy [2]. Many manufacturing companies have embarked on digital transformation journeys over the last decade but while some have realised significant value, more than 70% of the companies in the manufacturing ecosystem are stuck in what can be defined as “pilot purgatory”, a phenomenon well recognised within the food and drink industry. "Pilot purgatory" refers to the stagnation of digital transformation initiatives at the pilot stage, preventing full-scale implementation and realization of benefits. Factors contributing to this include technology-led rather than value-led pilots, complex legacy systems, and poor data access, which create implementation challenges across sites. [3]

This report examines the trends, opportunities, and challenges affecting the digital transformation of the Food and Drink industry both in Ireland and internationally. While the sector is beginning to deploy digital tools for automation, quality control, and predictive maintenance, adoption remains limited. Key obstacles are identified which include low analytics maturity, challenges in identifying return on investment (ROI), and the absence of comprehensive digital strategies within companies. In addition, talent shortage is also highlighted as one of the most pressing barriers, influenced by the sector’s perceived lack of appeal and the remote locations of many companies. In tandem with this, the report provides an insight into the need for targeted digital upskilling mechanisms, especially for senior and middle management, to ensure that businesses can effectively implement and scale digital technologies.

The report presents the results of a survey conducted with a variety of employees from Food and Drink manufacturing companies in Ireland and provides insights, conclusions and practical recommendations for both companies and policymakers to support the sector’s digitalisation efforts, with the aim of fostering a more competitive and sustainable Irish Food and Drink industry. Increased investment in research and development, enhanced government support, and greater industry collaboration will be important enablers.

Companies that approach digitalisation strategically, addressing operational challenges and regulatory requirements, can unlock new efficiencies and drive growth, while concerted efforts to enhance the industry's attractiveness and develop robust training programmes will help address the talent gap.

CASE STUDY

Lough Ree Distillery

Lough Ree Distillery, situated in Lanesborough, Co. Longford, holds the distinction of being Ireland's smallest verified whiskey distillery. Specialising in premium whiskey, gin, and vodka, the distillery is poised for growth, armed with a solid understanding of the benefits of digitalisation by the management team, all while maintaining their commitment to artisanal, high-quality production. The company is also the Island-of-Ireland operator for ecoSPIRITS, the smart and circular economy distribution system for spirits.

In their pursuit of operational streamlining, the distillery has incorporated several digital tools such as a web-based CRM (customer management) tool, digital scanning of deliveries and returns and are in the process of implementing a distillery ERP system. A challenge lies, however, in balancing further automation investment decisions that are required for scaling the business against the significant associated costs and predicted growth forecasts.

Marketing and customer engagement strategies at Lough Ree Distillery are marked by a deliberate approach focused on personalised interactions. The use of digital tools and data analytics has allowed the company to reach and grow a customer base at international level. While they have explored technologies like blockchain and virtual reality, the distillery carefully prioritises cost-effectiveness and value for customers. While these technologies are interesting, they remain cost-prohibitive to implement.

A significant hurdle for small alcohol producers is the burdensome regulatory landscape, marked by time-consuming and costly reporting and compliance. Collaborative efforts with government bodies to streamline regulatory processes using digital technologies, seeking solutions that alleviate the burden on small businesses are suggested. In addition, tailored schemes to mitigate financial risks associated with digital adoption would enhance operational efficiency and de-risk scaling plans, enabling small businesses like Lough Ree Distillery to flourish while staying true to their artisanal, high-quality value proposition associated with this type of Irish manufacturing.

> The use of digital tools has allowed Lough Ree Distillery reach and grow a customer base at **international level.**

02
Introduction

Food and Drink production is the oldest and largest indigenous industry in Ireland [4]. As outlined in the Irish Government's Food Wise 2025 [4] and Food Vision 2030 [2] strategies, significant opportunities exist for continued industry growth while achieving national sustainability targets. It is envisioned that future export growth will be primarily driven by expansion in dairy, beef, seafood and consumer food and drinks exports. Key areas of strategic focus to ensure this growth include: productivity improvements driven by technology and innovation; consumer insights that maximise market opportunities; and the attraction and development of talent with the required skills. The successful adoption of digital tools and processes in the industry is a key element of delivering on these growth plans [4].

The goal of this report is to research how digitalisation can support the Irish Food and Drink sector in maintaining and growing its international competitiveness. The current levels of digitalisation in the sector will be examined to identify barriers and risks related to its implementation. While a major focus of the analysis is on processing and manufacturing, insights into product development, company strategy and marketing, are also addressed.

The output of the report is a set of recommendations to Skillnet Ireland and wider stakeholders, which will support the development of a roadmap for the delivery of the necessary skills to overcome barriers and embrace the benefits of digitalisation in the Irish Food and Drink industry.

Terminology related to Digitalisation

The term 'digitisation' refers to the conversion of analog data (continuous signal) to digital data (1s and 0s), so it can be used by computers. Information gets digitised, not processes. Digitisation is a requirement and a subset of 'Digitalisation' which refers to the use of digital technologies and information to transform business operations in order to realise a benefit. In manufacturing, targeted benefits of digitalisation have typically been in the areas of productivity and efficiency, however delivering sustainable and resilient operations have recently also strongly come to the fore as key investment drivers for digital tools [3].

The effective implementation of digital-enabled systems – typically composed of machines with sensors that collect data, coupled with intelligent analysis and decision-making computing tools - can be a complex and long-drawn-out process, which may explain why many companies have struggled to get further than a pilot phase of introducing these technologies. Demonstration of benefit can be achieved at a single machine level through smart monitoring, control and equipment health management. However, to fully realise value and return on investment, the collection and joint analysis of data across several systems that supports improved decision making at factory or enterprise level needs to be demonstrated. Realising benefits from digitalisation investments requires an understanding of what is required at each of these levels, at least as a starting point, while considering the range of skill sets that staff need in order to develop and interact effectively with each system level and make informed decisions. The assignment of innovative people dedicated to this task and the adoption of an enterprise digital strategy are key enablers of success.

Industry 4.0 - The expression 'Industry 4.0' (4th industrial revolution) was coined in Germany in 2011, to account for the emerging digitalisation, or digital transformation, of both products and production systems in the industrial sector to drive efficiency and productivity. The term 'Smart Manufacturing' is often used outside of Europe.

Industry 5.0 - This term was introduced by the European Commission to provide a vision of industry that aims beyond efficiency and productivity as the sole goals and reinforces the role and the contribution of industry to society. Industry 5.0 incorporates sustainability and worker wellbeing as primary objectives.

Industrial Internet-of-Things (IIOT) - The networking together of a range of devices in an industrial setting to provide data collection, exchange and analysis. The goal is that these 'smart' systems can provide real-time recommendations to enable quick, informed decision making by the business.

Artificial Intelligence - In the context of manufacturing, AI refers to the use of software algorithms that can process large amounts of data and 'learn' patterns and adapt in order to perform tasks that typically require human intelligence, such as reasoning, problem-solving, perception, and language understanding.

This report is structured in five sections:

The Irish Food and Drink Digitalisation Landscape

An outline of the unique challenges related to the industry and the potential benefits digital tools can enable.

Food and Drink International Industry Mapping

Desk research summary of international adoption of digital tools in the industry.

Talent and Skills Development

Skills gaps and needs to deliver digital transformation, including examples of international initiatives.

Survey Results

Current levels of adoption of digital tools, barriers and opportunities.

Conclusions and Recommendations

Summary of insights from industry feedback and recommendations to Skillnet Ireland.

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The Irish Food and Drink Digitalisation Landscape

03 The Irish Food and Drink Digitalisation Landscape

3.1 The Food and Drink Challenge: Navigating a Complex and Challenging Industry

Irish food and drink exports maintained an upward growth trend in 2024, increasing by 5% over 2023, to €17 billion [5, 52]. Despite an overall positive outlook over recent years, operating conditions for Irish food and drinks businesses remain difficult due to issues such as rising energy costs, inflationary pressures both at farm and manufacturing level, climate change, recruitment difficulties, and the pressure on international supply chains (including issues, such as the war in Ukraine and COVID-19).

The food and drink sector is certainly not exempt from the impact of digitalisation trends and many companies are undergoing digital transformation to allow them to optimise their processes for maximum efficiency and to build resilience into their supply chains [6]. In fact, the COVID-19 pandemic further accelerated the need for digitalisation within the industry, allowing companies to respond to changing consumer needs and growth opportunities [7].

The food and drink manufacturing sector has some distinct challenges regarding digitalisation at both enterprise and operational levels [8]. Some of the key challenges facing the sector are:

Complex Supply Chains: The food and drink sector often has complex and lengthy supply chains. Implementing digital technologies can be challenging when dealing with various suppliers, farmers, and distributors. This complexity can make it harder to achieve end-to-end visibility and traceability.

Regulatory Compliance: The industry is highly regulated, with strict standards for food safety, traceability and quality. Any technology employed must not only enhance efficiency but also maintain/ensure compliance with these regulations [9].

High Customization: The food and drink sector often requires high levels of customization to cater to varying customer demands. Implementing digital technologies that can efficiently accommodate customization can be expensive and complex.

Skills Gap: Ireland, like many other countries, faces a skills gap in the workforce when it comes to successful implementation of digitalisation. Attracting and training the right talent to operate and maintain these systems can be a challenge.

Costs and ROI: The initial costs of implementing a digitalisation strategy can be significant. Many businesses in the food and drink sector are hesitant to invest heavily without a clear understanding of the return on investment (ROI).

Integration Challenges: Integrating new technologies with existing legacy systems can be complex, especially for older food production facilities. Ensuring that new and existing systems work seamlessly can be a significant challenge. Facilitating the breathing space to take down existing production systems, enable retrofits for increased sensorisation/process feedback and trial new digital tools, can be a major barrier for many in the sector.

In comparison with other industry sectors in Ireland, with some notable company exceptions, the adoption of digitalisation strategies by the Food and Drink sector has been slower. For example, the Pharmaceutical [10,11] and Medical Device industries have rapidly adopted digitalisation, due in part to traceability and quality control requirements. In this regard, these sectors are similar to the highly regulated food and drink sectors. However, the margins available on Pharma and MedTech products are significantly higher, and the ROI is easier to estimate. That being said, the food and drink sector can draw lessons from Pharma/MedTech in terms of technology adoption. Similarly, the Services and Finance sector (Fintech) have been at the forefront of digital transformation, however they do not have the same production challenges as Food and Drink. Learning from Fintech experience in terms of data security and customer engagement, could be valuable for the Food and Drink sector at enterprise level.

It is also important to note that digitalisation is a gradual process, and the challenges faced vary among companies. Government support, industry collaboration, and investment in research and development are essential to overcome these challenges and ensure a successful digital transformation in the food and drink sector in Ireland.

3.2 Economic Significance: Potential economic gains through higher levels of digitalisation

The digitalisation of the food and drink industry holds significant economic importance due to the potential for increased efficiency, cost savings, improved quality, and enhanced competitiveness.

Some key areas where digitalisation can increase competitiveness for the industry are:

- **Improved Operational Efficiency:** AI, automation, and data-driven technologies can optimise various aspects of production, from supply chain management to processing and packaging. Benefits include reduced waste, lower production costs, and improve resource utilisation.

- **Enhanced Quality and Safety:** Digitalisation allows for real-time monitoring and control of food/drink production processes. This can help in maintaining consistent product quality and safety standards (and reduce the risk of product recalls).

- **Supply Chain Optimisation/Inventory Management:** The ability to track and trace products throughout the supply chain can reduce the likelihood of spoilage, contamination, or fraud. Advanced data analytics can help with more accurate demand forecasting and inventory management. Reducing overstock and stockouts leads to cost savings and better customer satisfaction.

- **Sustainable Practices:** Digitalisation can aid in the adoption of sustainable practices, which can be both cost-effective and allow the sector to meet the growing demand for products made and distributed in an environmentally friendly manner. Digitalisation can also help businesses to reduce their environmental impact by enabling them to monitor and manage their energy consumption, waste production, and carbon emissions [12]. This can help businesses to comply with environmental regulations, reduce costs, and enhance their reputation as socially responsible organisations.

- **Innovation, Research and Development:** Digital tools such as simulation, modelling and Artificial Intelligence (AI) can reduce the time and cost of developing and testing new products and processes. Embracing digitalisation will allow companies to stay competitive and drive innovation in the industry, and hence reap significant economic gains.

- **Job Creation:** While automation may reduce some traditional roles, there will be significant opportunities for new jobs in areas such as product innovation, cybersecurity, and technology development. These roles may not exist in many Food and Drink companies currently [13]. In addition, adoption of digital tools and automated systems is expected to be a baseline expectation of future employees. Therefore, to attract a long-term talent pipeline, digitalisation will need to be a strong element of a company's strategy [14].

The economic gains from higher levels of digitalisation are evident in both short-term cost savings and long-term growth opportunities. In a highly competitive industry like food and drink, those who adapt to digitalisation can thrive by meeting customer demands more effectively, improving product quality and safety, and optimising their supply chain. Furthermore, the COVID-19 pandemic highlighted the need for digitalisation as it exposed vulnerabilities in traditional supply chains and highlighted the importance of e-commerce and remote operations. As a result, the economic importance of digitalisation in the food and drink sector has become even more pronounced. Companies that invest in digitalisation are better positioned to weather disruptions, seize new market opportunities, and contribute to the economic growth and resilience of the sector. [8]

3.3 Examples of Food & Drink Industry Digitalisation Leaders

Several companies have set examples in different areas of the food and drink industry, from manufacturing and supply chain management to retail and customer engagement. They illustrate how digitalisation can drive innovation and competitiveness in the sector, enabling organisations to adapt to changing consumer demands and market dynamics.

- **Kerry Group (Ireland):** The company has invested significantly in digitalisation, including data analytics and artificial intelligence (AI) to optimise their product development, supply chain, and customer engagement. Kerry Group has developed an AI tool called Kerry Trendspotter™ in partnership with IBM Watson [15]. This tool leverages social media conversations of tens of thousands of food and drink micro-influencers to identify emerging flavour, format, and product trends, long before they register in typical consumer research. This real-time access to consumer sentiment gives their researchers an unfiltered view of the spread of new food and drink trends. Kerry Trendspotter™ then assists R&D activities for new product development [16].

- **Nestlé (Switzerland):** Nestlé has been a leader in the adoption of digitalisation technologies. The company uses automation and IoT (Internet of Things) solutions, to improve production efficiency, traceability, and quality control. Nestlé's connected factories are a significant part of their digital transformation efforts. Nestlé's core digital technologies are now deployed in more than 275 factories in 60 countries [17]. This enables over 50,000 connected workers to be highly productive and autonomous with fast and easy decision making. The connected factories are a part of Nestlé's data-driven digital transformation. They use data to streamline business practices, becoming more strategic and predictive while making changes in real time. Nestlé has also been expanding the use of augmented reality technology to provide remote support to its production and R&D sites and to connect with suppliers [18,19].

- **Danone (France):** Danone, a leading French food company, has embraced and successfully implemented digitalisation to enhance its operations. The World Economic Forum has designated Danone's infant nutrition factory in Opole, Poland, as an Advanced Fourth Industrial Revolution Lighthouse for adopting cutting-edge technologies at scale [20]. 'Industry 4.0' and digital transformation in manufacturing have led to significant value from data and analytics, AI, and machine learning [20]. These advancements have allowed Danone to boost efficiencies and significantly reduce greenhouse gas emissions [21]. Danone has two factories in Ireland (Macroom and Wexford). The Wexford (Baby Formula Factory) was the first Danone plant certified carbon neutral by the Carbon Trust (in 2020).

- **Coca-Cola (United States & Ireland):** The Coca-Cola Company, headquartered in the U.S., has employed digitalisation to optimise their production processes and improve predictive maintenance, ensuring that their bottling plants run efficiently. Coca-Cola has established a digital academy to upskill managers and frontline team leaders across its business operations. In its first year, the academy trained more than 500 people in digital skills [22]. Coca-Cola is increasingly using data analytics and AI to drive its strategic business decisions, and this allows new insights to help further optimise production [23, 24]. The company's plant in Ballina was recently endorsed as a World Economic Forum 'Industry 4.0' lighthouse [25, 26, 27].

CASE STUDY

Mowi

Mowi is one of the largest seafood companies in the world and the world's largest producer of Atlantic Salmon. The company is headquartered in Norway and has developed its own Industry 4.0 strategy to digitalise and automate its value chain from roe to plate. By 2025, the company expects to have completed the roll-out of Smart Fish Farming technologies in its largest farming unit in Norway. By means of advanced imaging technology and intelligent sensors, Mowi intends to perform real-time monitoring of biomass, digital lice counting, autonomous feeding and tracking of fish welfare.

The Irish operation is the smallest entity in the group and is primarily a B2B export business. The division is the largest producer of organic salmon in the country with several operations and 250 employees along the West Coast. The Irish team has already embraced digital technology in fish farming, including remote feeding barges via satellite and advanced pen monitoring systems. Several opportunities for improving efficiency still exist, including warning systems for jellyfish and plankton impacts on fish pens. As the farm-to-fork lifecycle is long (2.5 to 3.5 years), using advanced digital tools to give early warnings and avoid issues would be very helpful. The company has collaborated with universities on the development of more efficient monitoring tools with some success, however the exposed nature of the west coast has unique challenges for new digital-based tools to operate effectively.

In terms of factory processing, the Irish operation is currently labour intensive. Advanced automation is readily available in the industry, but capital costs are high, and investment decisions depend on scale and growth projections. Acceleration of the licensing process would help greatly in growing the business more quickly which would then support increasing investment in digitalisation.

From a digital skills perspective, the Irish team is keen to upskill. Bespoke interactions on new technologies specific to the industry are more desirable than general courses. The company shared a success story about replacing human divers for net inspection with a ROV (remote operating vehicle). This was initially greeted with push-back and scepticism, but after initial testing and collaborative training, it was fully embraced.

> Advanced automation technologies are available, but capital **costs are very high**.

04

Food and Drink Industry International Mapping

04 | Food and Drink Industry International Mapping

In Section 3 we saw some examples of the adoption of digitalisation in the food and drink sector (Kerry Group, Nestle, Danone, Coca Cola) - all Global multinationals. Aside from these small number of industry sector leaders, it has been difficult to consistently find public examples of 'Industry 4.0'/digitalisation adoption within the Food and Drink industry, particularly at SME level.

Many companies have piloted AI and IoT for specific problems but in many cases, these are not part of an overarching digital strategy. Some examples of these specific use cases are highlighted below.

4.1 International Use Cases

A) SORTING AND QUALITY CONTROL

Kewpie Corporation – Automated potato sorting using Machine Learning (ML). Kewpie Corporation, a major Japanese food company, is using machine learning for automated potato sorting. These potatoes are used in baby food and are therefore subject to strict safety standards. In order to increase efficiency, the company acquired automated sorting capabilities to improve the sorting of diced potatoes for use in their products. The solution relies on supervised ML techniques that detect the visual patterns of potatoes and use them for sorting. The company used Google's Tensor Flow framework to implement the solution in 2017 [28,29,30].

B) FOOD SAFETY COMPLIANCE

Tetrapak – A spotlight on food safety and digitialisation. Food and drink manufacturers face demands for ever-higher standards of food safety and quality from consumers, retailers, regulators and shareholders. Several companies are using digital-led quality control systems that measure compliance to food safety regulations such as good manufacturing practices, as detailed in TetraPak's white paper on the topic [31]. Examples include the use of robots to automate tasks, virtual reality for machine maintenance, and track and trace technology for better traceability and transparency [31].

C) EQUIPMENT MAINTENANCE AND CLEANING

Several companies in the food and drink industry have successfully adopted digital technologies for maintenance and repair. Coca-Cola, Nestle and PepsiCo have all implemented 'Industry 4.0' technologies across their production lines for predictive maintenance, quality control, and energy efficiency [35, 36, 37], allowing reduction in downtimes and improved production efficiency.

For example, multinationals such as Nestlé and Arla reported a reduction of cleaning times by up to 50%, by using AI sensor technology developed by researchers at the University of Nottingham, in collaboration with Martec of Whitwell (a UK company) [32, 33, 34]. It is claimed that the wider adoption of this technology could in theory save food processing plants in the United Kingdom up to £100m a year.

D) PRODUCT DEVELOPMENT

AI technology uses machine learning and predictive algorithms to model consumer flavour preferences and predict how well they will respond to new tastes. The data can be segmented into demographic groups to help companies develop new products that match the preferences of their target audience. With these insights, manufacturers could know what products will thrive before they hit the shelves.

Coca Cola uses AI to predict which new products could be commercially successful. The company installed thousands of self-service soft drink fountains across numerous restaurants that allow individuals to customise their own drinks. The data analysis by artificial intelligence determined that people on their own created a significant amount of cherry-flavoured Sprite and that it would do well as its own standalone product. These insights led to 'Sprite Cherry', the first new product launch to the company's permanent drink line-up using this methodology [38].

E) PACKAGING DESIGN

Ferrero's Nutella used an AI algorithm to design 7 million unique jars in Italy. This represents an example of the scope of AI in packaging design and customisation. With data on consumer preferences, shopper behaviour and general psychology around colour and ease of handling of the pack, machine learning algorithms can easily predict optimal package designs.

(***Figure 1:*** *Packaging designs for Nutella jars using AI [39].)*

4.2: Systematic Adoption of Digital Technologies

At an international level, the World Economic Forum (WEF) has highlighted that there is an issue with systematic adoption of digital technologies in manufacturing (WEF use the term 'Industry 4.0'). To close this gap and accelerate a more comprehensive and inclusive adoption of advanced technologies in manufacturing, WEF's Centre for Advanced Manufacturing and Supply Chains has set up the Global Lighthouse Network [40] A global lighthouse being defined as

"a manufacturer showing leadership in applying Industry 4.0 technologies at scale to drive step-change financial, operational and sustainability improvements by transforming factories, value chains and business models".

The most successful Lighthouse's practice three crucial must-haves:

- **Building a clear strategy:** Digital transformation must be designed from customer value back down the value chain, in close alignment with the company's overall business strategy.
- **Investing in people:** providing the right resource and capability models.
- **Setting up the right governance:** For companies to capture the value and impact there must be strong governance and value assurance review.

In a recent survey by the WEF and McKinsey & Company, two-thirds of respondents cited the scaling of technologies across their production networks as a critical lever to achieve their strategic priorities. Yet scaling is proving challenging, and companies are progressing slowly. This is especially true for small sites with old equipment and old ways of working. According to the same survey, companies so far have scaled technologies on average to no more than 11% of their production network [40].

To date there are 132 Lighthouses from different industry sectors, however there are only 4 of these in the food and drink sector: Danone, Mondelez, Tsingtao Brewing and Coca-Cola. As previously mentioned, Coca-Cola's lighthouse manufacturing site is situated in Ballina, Co Mayo. This Irish facility was added to the WEF Global Lighthouse Network in 2023, in recognition of use of advanced technologies to boost sustainability and increase productivity.

4.3: Summary of Desk Research on adoption of digitalisation

The following insights were obtained through investigating the state of the art in digitalisation and AI adoption in the Food and Drink industry:

- Food and Drink Manufacturing is a highly challenging and complex industry, exposed to many external challenges, and one where the key to success lies in the ability to remain competitive.
- Digitalisation initiatives are somewhat evident across the industry and are delivering benefits in areas including operational efficiency, quality and safety, innovation and new product development as well as sustainability. However, digitalisation, AI and IoT applications in Food and Drink are still limited in breadth and depth. This is partly due to most companies (87%) having low Business Intelligence (BI) and analytics maturity, which hinders the use of advanced AI and IoT applications [41].
- In the companies that have started to adopt AI and IoT in their processes, there does not seem to be an overarching company strategy that governs the integration of these technologies, and there is little indication that they are being used across multiple processes and lines of business. Current applications of AI and IoT are in niche areas, and they focus on specific problems (most examples earlier in this section).
- Challenges companies face in adopting further digitalisation, centre on difficulties in identifying a robust return on investment (ROI), complex supply chains, integration with existing systems and production lines, higher levels of product customisation compared to other industries and potential regulatory challenges." to "Challenges companies face in adopting further digitalisation centre on (i) difficulties in identifying a robust return on investment (ROI), (ii) complex supply chains, (iii) integration with existing systems and production lines, (iv) higher levels of product customisation compared to other industries and (v) potential regulatory challenges.
- Compared to other fields, there is a scarcity of literature on the topic of digitalisation and AI in the Food and Drink industry (i.e., very few white papers and publications). This can create hype and unrealistic expectations of the benefits which can be derived from these technologies, there is also the potential for uninformed business decisions motivated by the race to adopt them [42].
- Companies in this sector do not seem to have yet engaged in serious open collaboration and knowledge sharing, which can be explained by the sensitivity of industry secrets (i.e., product formulas) and the infancy of digitalisation and AI in the field. There is an opportunity for Food and Drink companies to engage in open innovation with their peers, start-ups, and university partners. This would create opportunities to demonstrate the benefits of digitalisation and AI in Food and Drink and could accelerate their adoption in the field.
- There is a lack of digitalisation skills and attraction of digital talent into the industry. This is possibly driven by a lack of awareness and understanding of the digitalisation opportunities in the industry.
- Key enablers for adoption of digitalisation include increased investment in R&D as well as increased government support and increased collaboration across the industry.

Driven by their awareness of the high potential of digitalisation and AI, more Food and Drink companies are starting to adopt these technologies [43], however the level of digitalisation and AI adoption differs between companies and sectors. Most use cases currently seem to be centred around automation, such as sorting and quality control, food safety compliance, equipment cleaning and predictive maintenance, development of new products, and packaging design and marketing.

In all of these use cases, there are examples of companies leading the way with attractive business cases, giving them a notable competitive advantage. It is therefore fair to expect that other companies will follow once the business benefits of these use cases have been clearly demonstrated.

> Keen to accelerate the transition of workers from ‘check and validate’ to ‘ **innovate** and **problem-solve**.’

CASE STUDY

Dawn Farms

Dawn Farms is the leading multi species cooked and fermented protein ingredients company in Europe, providing customised solutions to the leading brands in the food manufacturing, foodservice and indirectly to the retail sectors. The company supplies the world’s leading food brands across 55+ international markets, including the UK, Europe, the Middle East, Asia, and Africa.

The organization is well advanced in the use of digital technologies in supply chain management, business operations, and the innovation process. While automation and vision systems are evident in food processing, food production remains labour-intensive. Challenges in recruiting and retaining staff in this environment are key drivers in the desire to invest in further automation opportunities, using digital tools that can make positions more appealing to highly qualified workers.

The company is keen to accelerate the transition for workers from 'check and validate' activities to 'innovate and problem-solve' roles. Dawn Farms states that access to demonstrations of industry case studies, which have successfully developed integrated smart factory models with usable data streams from all equipment, would be valuable. This would help them plan the next level of their digitalisation efforts.

The company sees the need for increased data science resources and would benefit most from insights into where these resources will be most effective within the organization. A roadmap for managing upskilling, reskilling, and the necessary cultural changes to support increased digitalisation, while maintaining human-centric decision-making, would also be very beneficial for integrating new technologies efficiently.

05

Talent and Skills Development

05 | Talent and Skills Development

Food and Drink Processing involves a large range of company types, with sub-sectors including dairy, meat, consumer foods and fish that all need to be catered for when considering talent and skills development.

A number of national and international reports have been published outlining skills needs and paths to delivery, including several with a particular emphasis on Food and Drink Processing. It is clear that the growing impact of digitalisation requires both sector specific technical skills and broader skill development at all levels of the organisation. Closing the skills gap is crucial to support industries in leveraging the potential of digitalisation effectively, with a focus on upskilling workers to handle new tools and systems [44].

In addition, recommendations include an emphasis on the 'softer skills', particularly communications, which are highlighted as being critically important for the successful introduction of digital technologies within companies. Examples of existing resources for skill development in the sector are also available and can be leveraged to improve the successful adoption of digitalisation in Food and Drink organisations in Ireland.

5.1 Examples of previous reports related to skills needs

GENERAL, CROSS-SECTORAL REPORTS

The European Centre for the Development of Vocational Training (Cedefop) report from 2022 titled "Setting Europe on course for a human digital transition", highlighted ..."that the digital transition is first and foremost a skills transition, not an uncontrollable job destructing megatrend. Some jobs will be lost, and some tasks will be taken over by robots or other technology but, simultaneously, new jobs and tasks will emerge" [45]. This report highlighted the relatively high level of skill development programmes delivered on-line in Ireland, compared with that in other European countries.

The increased demand for higher skills is highlighted in a 2018 discussion paper by McKinsey titled "Skill shift: Automation and the future of the workforce" [46]. Manufacturing employment demand is decreasing at more than twice the rate of other sectors largely due to automation. In line with this decline, the number of professionals such as sales representatives, engineers, managers, and executives are expected to grow. This will lead to growth in the need for social and emotional skills, especially advanced communication and negotiation, leadership, management, and adaptability.

Demand for cognitive skills will be mainly altered from basic level to higher competencies; the increasing automation of machines will decrease the number of tasks that demand basic cognitive skills (such as basic data processing). Higher cognitive skills, such as creativity, critical thinking, teamwork, problem-solving, decision-making and lifelong learning, will become crucial, especially in technical profiles, such as production operators and control technicians. Moreover, the demand for managerial, communication and organisational skills will increase significantly[47].

The wider adoption of Industry 4.0 will also increase the demand for digital technology skills, targeted at increasing production efficiency and flexibility, for example through the application of robotic and AI technologies [60]. Industry 4.0 will require a workforce which will be responsible for more complex tasks, which will require numeracy, solid literacy, problem-solving, and information and communication technologies (ICT) skills as well as soft skills of autonomy, collaboration and coordination [61].

EU policymakers are increasingly also focused on 'Industry 5.0', which places an emphasis on technology as a means to achieve societal goals beyond efficiency, such as sustainability and worker wellbeing. It is hoped that this new economic paradigm will reshape work in a human-centric way, where people collaborate with technology, rather than being replaced by it [56]. An example of an Irish initiative in this area is the Human-Centric manufacturing culture study carried out by Digital Manufacturing Ireland (February 2024) [62]. Based on a survey of 89 leaders in 11 high tech manufacturing companies, it was concluded that for the successful introduction of digital technologies, it is critical that the workforce is deeply engaged in the design and deployment of these new technologies.

Cedefop carried out surveys of skills highlighted in online job advertisements for 27 European countries [58]. Its 2022 analysis of online job advertisements collected from Ireland ranked 'liaising and networking' as being the most widely ranked skillset for all jobs, followed closely by using digital tools for collaboration, content creation, and problem solving [59]. In conclusion, the need for digital skills has become increasingly important at all levels within organisations.

A report by Google in partnership with Amárach (April 2022), highlighted the substantial economic opportunity for Ireland, if there is a meaningful investment in digital skills [53, 54]. The study, involving feedback from 1,000 SMEs throughout the country, concluded that most Irish SMEs are in the process of adopting, developing, and evolving their use of digital technologies. Recruiting people with the necessary digital skillset is also a challenge for Irish SMEs, with 41% of respondents agreeing that they do not have a person within the organisation who is tasked with developing digital skills.

The report finds that only 11% of Ireland's SMEs feel their employees have the skills needed to successfully adopt and use new technology, a statistic borne out in the data, where only 53% of SMEs have (or use) social media and video platforms and just 18% make use of customer insight tools. The number of Irish SMEs that have their own business website, at 55%, is lower than the EU average of 77% [53].

This e-commerce deficit was also highlighted in the 2019 .IE Digital Health Index report, which examined the digital behaviours of 1,000 Irish SMEs [55]. At the time, only 32% of Irish SMEs could take sales orders or process transactions through their website. The report highlighted that this trend is pushing Irish consumers to shop with online competitors and international online retailers.

The 2024 Skillnet Ireland report titled "Ireland's Talent Landscape 2024 - Future Skills Challenges of Irish Business", provided feedback from 500 businesses of different sizes [44]. The survey highlighted that 65% of businesses require some form of upskilling to facilitate their digital transition, with over 30% indicating that over half of employees would need digital upskilling.

A second 2024 report from Skillnet Ireland titled 'Study of data and digital skills for all non-IT roles across multiple industries', provided feedback from 104 respondents working in FDI (largely medtech and finance) [63]. 49% of the survey respondents for this study identified data analysis as a skill gap for all employees. The report highlights that leaders overseeing non-IT functions play a key role in data and digital skill development and it is therefore critical that they role-model proficiency and comfort with data and digital skills and tools.

Furthermore, leaders who actively create a culture that is data-driven, and values lifelong learning are best placed to successfully manage their teams through digital transformation. One of the key conclusions is that the workforce as a whole is going to need to be able to interpret, use and create meaning from data, and have the digital proficiency to work with technology and improve efficiency. In addition, the core data skills required include: data input, analysis, validation, manipulation and visualisation. Other key skills include virtual communication and collaboration, presentation and digital problem solving. The study went on to highlight key 'core skills', which are industry or function group specific.

FOOD SECTOR SPECIFIC REPORTS

Amongst the previous studies which identified skill and training needs within the Food Processing Sector are the 2003 Future Skills Needs report [48] and the 2009 and 2017 reports from the Expert Group on Future Skills Needs [50, 51]. The latter also addressed the wider impact of digitalisation in their 2018 report titled "Digital Transformation: Assessing the Impact of Digitalisation on Ireland's Workforce" [64]. This report highlighted that for enterprises to be successful in their adoption of digital technologies, they will need a diverse set of skills. In addition to technical skills and high levels of IT literacy, leadership, interpersonal skills and business skills were identified as of particular importance.

A similar trend was also highlighted by the Deloitte and The Food Industry Association (FMI) survey of more than 150 US-based executives at US consumer packaged goods, food manufacturing, and processing companies, as well as grocers and other food retailers (December 2021) [57]. Out of the 12 skill types assessed, "digital skills" were indicated to be the ones most likely to increase in value over others, even for the non-managerial frontline workforce. This was true for product suppliers (95%) and food retailers (92%) alike. The survey identified in particular the need for more advanced automation and digital delivery skills.

In its 2023 report titled "Skills in transition - The way to 2035", Cedefop highlighted that in low-skilled occupations, where no special training was needed in the past, there will be an increased shift towards digitalisation with, for example, the increased application of sensors-based technologies [56]. As such, food and drink sectors which were considered as 'low-tech' manufacturing, will no longer be designated as such in the future, because the share of high-tech jobs is set to increase.

5.2 Examples of digital / training supports for the Food Processing sector

Skill training supports to those working in the food and drink sectors are offered by Skillnet Ireland, as well as by a range of Irish academic institutions [65]. Another digital skill training support available specifically for those working in the food sector, is that provided by the European Institute of Innovation and Technology (EIT) - Food [67]. A range of training is offered including the Inspire Programme as detailed in Figure 2. Specialist training in digital skills for business is also available from technology companies such as Google [68,69].

Internationally, individual countries have developed training specifically targeting those working in their food sectors, examples include Australia [70] and Canada [71,72]. In the case of the latter, this is achieved through the web-based Canadian Food Skills Library training resource, which provides supports for those currently working in food and drink manufacturing, as well as new employees for evaluating their training needs (Figure 3).

A competency framework defines Essential Skills, which are regarded as the fundamental "building blocks" that enable people to learn all other skills [73]. They were developed based on a national study by Employment and Social Development Canada [ESDC], based on over 3,000 interviews, performed in 180 occupations across various kinds and sizes of organisations and sectors.

The study participants were workers identified as doing their jobs satisfactorily. Essential Skills Profiles describe how workers in an occupation use each of the nine essential skills, as well as the level of skill required for a given role, based on a rating of complexity.

The essential skills were defined as:
reading • document use • writing • numeracy • oral communication • thinking – problem solving • decision making • critical thinking • finding information • digital technology • working with others • continuous learning.

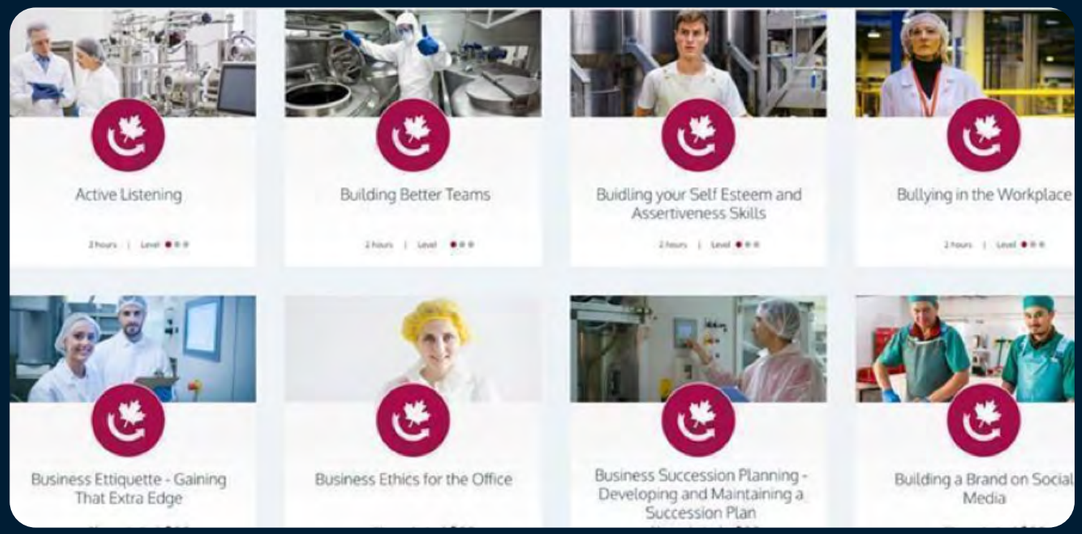
In the Canadian Foods Skills Library, digital technology was defined as the skills needed to understand and use digital systems, tools and applications, and to process digital information. The Digital Technology Skills (duration 3 hours) course includes applying security measures to protect hardware, software and personal data; and understanding using digital information [74]. Programmes are defined based on necessary skill levels.

For example, Food Production Managers recommended courses in the digital skills area include - Building a brand on social media, Traceability systems in the Food Manufacturing Industry and Managing Recall in a Wired World.

While there is no directly comparable offering to the web-based Canadian Food Skills Library training resource in Ireland, examples of digital skills initiatives targeting the Food and Drink sector include those provided by the Digital School of Food (www.digitalschooloffood.ie). This e-learning service is provided by the Local Enterprise Office, targeting food producers from idea through start-up and growth stages. It consists of an online platform that will help new and innovative food businesses to start-up and scale. The programme consists of practical workshops which assists those on the programme to develop their business. Digital training elements are included within each course. Follow on programmes include training in digital marketing, along with dedicated mentoring sessions with industry experts.

There are also several existing digital courses offered by Skillnet Ireland, which could be applicable to those working in the Food and Drink sectors. These included programmes covering Technological Innovation (5G, AI, Machine Learning, IoT), as well as Applications of Artificial Intelligence under the IRDG Skillnet [75].

*(**Figure 2:** Example of a digital training course provided under the EIT-Food Inspire program [67])*



*(**Figure 3:** Examples of some courses along with the duration and level recommended for Food Production Manager on the Canadian Food Skills Library site [71])*

With respect to upskilling in digital technologies for manufacturing, an excellent example of an existing partnership between Skillnet Ireland, industry and the tertiary education system is the collaboration between the Cobotics Skillnet, ThermoKing and ATU to codevelop and deliver upskilling in advanced robotics and automation [76, 77].

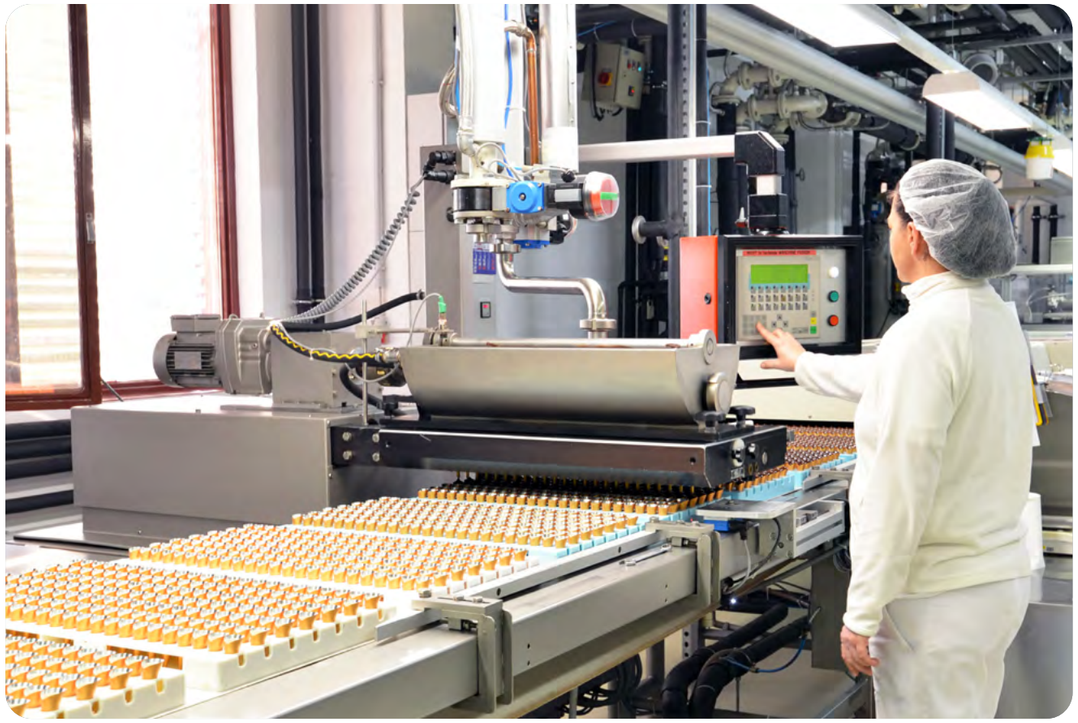
In addition, the First Polymer Training Skillnet Centre of Excellence in Athlone is an example of a best-in-class learning factory environment, with hands-on training and upskilling opportunities in partnership with TUS. While there is not yet corresponding programmes like these specifically targeting those working in the Food and Drink Industry, there may be potential to leverage some of the digital training aspects already developed.

Irish universities also deliver several digital skills related programmes that could be tailored to provide a Food and Drink focus. These courses are available from micro-credential to degree level and are delivered through a range of formats including fully online and hybrid learning.

5.3 Skills Development Summary

With the increased use of digitalisation and automation associated with the introduction of aspects of Industry 4.0, the food and drink workforce will be responsible for more complex tasks. The execution of those tasks will require numeracy, solid literacy, problem-solving, and ICT skills as well as soft skills of autonomy, collaboration and coordination. For more technical roles, as highlighted in the recent study involving representatives from FDI companies, data analysis is increasingly cited as a key skill. While the provision of digital skill training is expanding, there is a gap in the provision of education in digitalisation, that takes specific focus on the complex challenges in food and drink production.

Communication skills have also been highlighted by a number of the references cited, in order to facilitate the introduction of digitalisation along with sustainability programmes. This is due to the importance of communication skills in order to influence both a broad range of stakeholders, as well as the employees charged with introducing the change programmes.



06

Survey Results – Ireland's Food and Drink Industry Needs

06 | Survey Results – Ireland's Food and Drink Industry Needs

A core element of the research into the level of digitalisation of the food and drink industry in Ireland was industry consultation across a range of company sizes and sector focus areas. This primary research step consisted of a survey and a series of follow-up interviews. The survey aimed to achieve the following objectives:

- Determine levels of digitalisation in Irish Food and Drink companies
- Determine if the profile of these companies has an impact on levels of digitalisation
- Understand both the challenges and expectations from digital technology adoption

6.1 Survey methodology description

The survey consisted of a total of 23 questions. The final set of questions were narrowed down from an original group of 50 via a co-creation exercise with a number of companies.

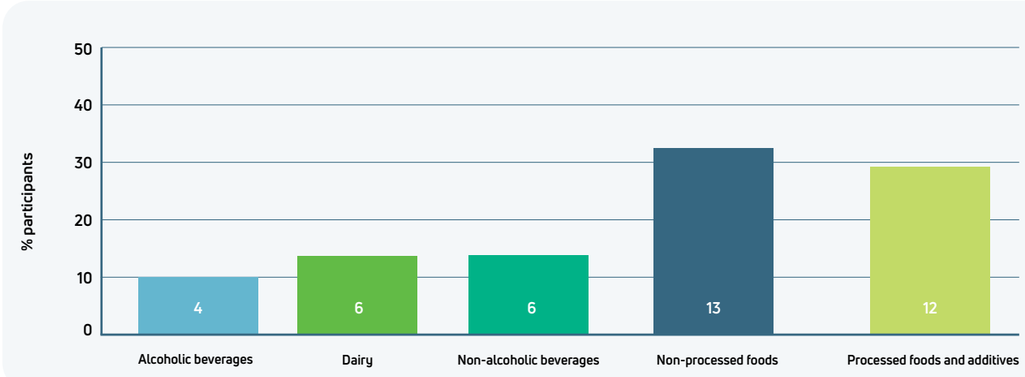
The survey was made available online using Google Forms, which is a convenient tool that supports the efficient creation of surveys and collection of responses. To reach out to participants, Ibec, CeADAR and I-Form used their networks and shared the survey with their Irish partner companies. Figure 4 presents the number of companies per F&D sectors participating in the survey. Responses from 30 companies (15 SMEs, and 15 MNCs) across 5 main sub sectors were received. The reduced sample is complemented by company interviews to produce the conclusions from the survey.

6.2 Industry feedback: Key learning and insights

The survey revealed insights on the digitalisation level of Food and Drink companies in Ireland and actionable knowledge that can help companies and organisations such as Ibec and Skillnet Ireland support the greater adoption of digitalisation within the sector. In this section, the survey findings are discussed in detail.

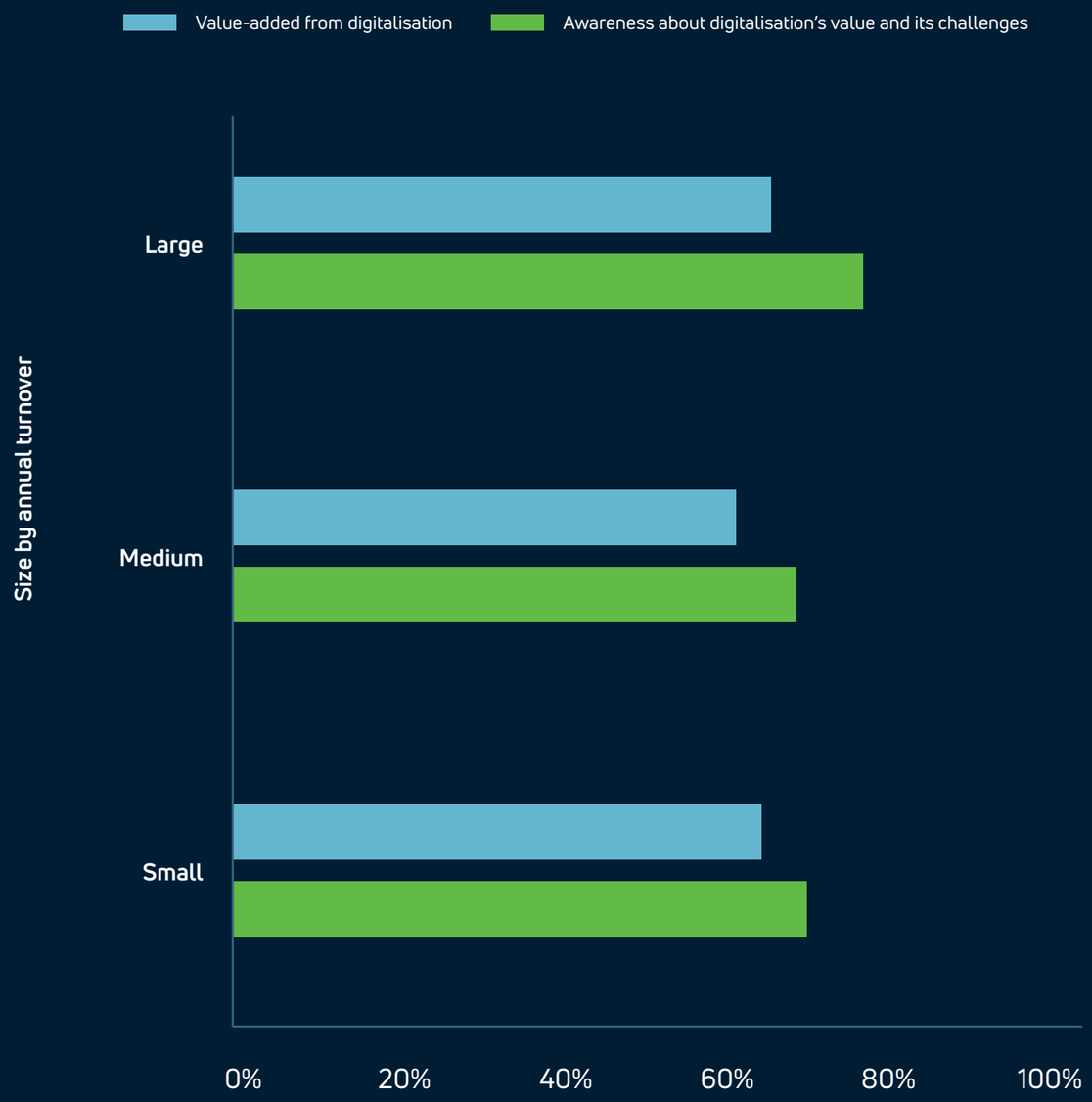
Finding: Over 60% of companies are aware of the value of digitalisation, with little difference between large and small organisations.

Large companies have potentially higher awareness and adoption of digitalisation, however this may not be borne out with a statistically significant sample size. Through interviews, it is clear that available budget and risks related to return on investment are barriers across all company sizes.



(***Figure 4:*** *Companies per F&D sub-sector participating in the survey (% on y-axis, no. of companies in column)*

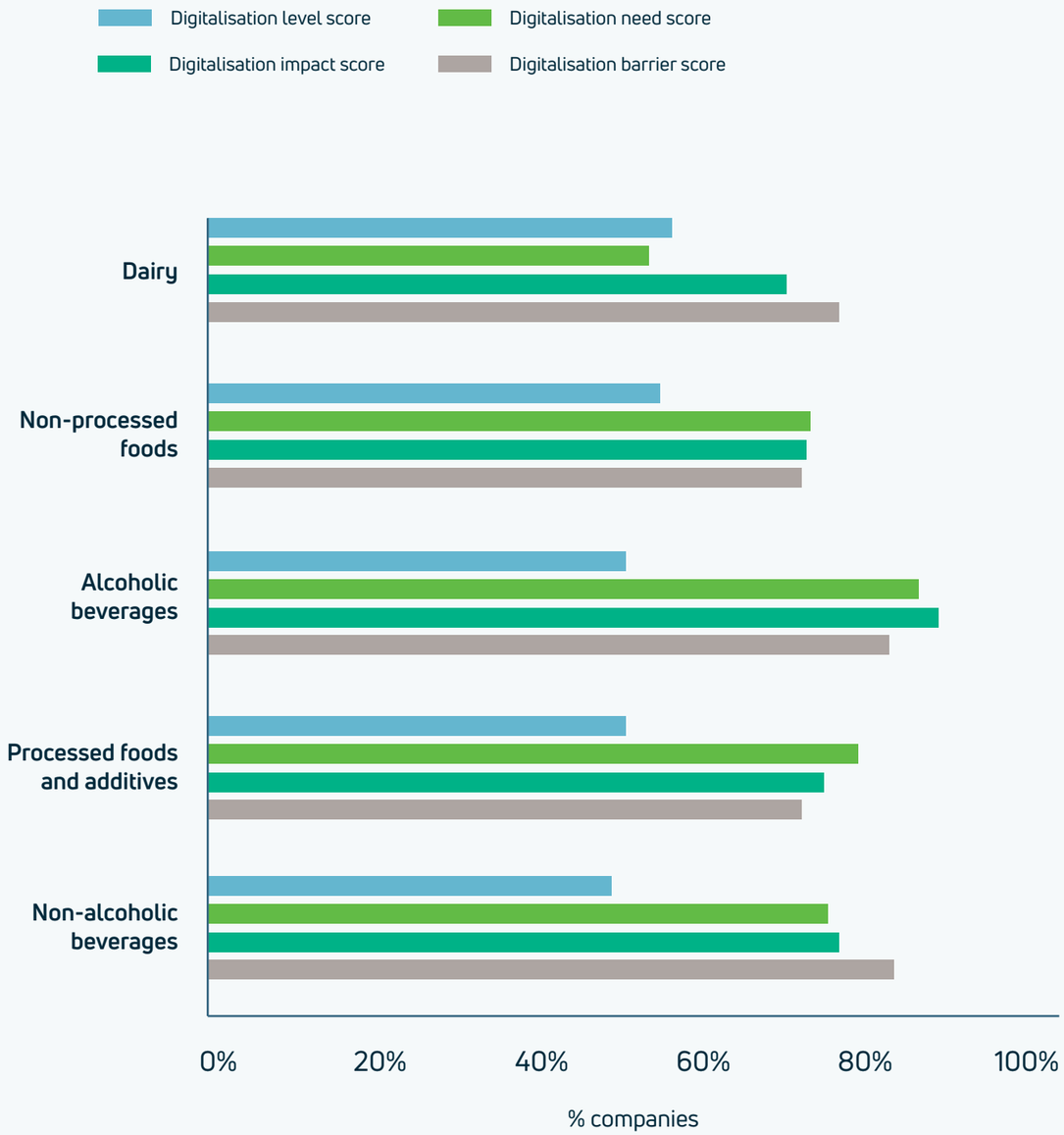
Digitalisation value **per company size**



*(**Figure 5:** Digitalisation value per company size)*

Finding: Levels of digitalisation achieved is similar across food and drink sub-sectors, with a general high level of acknowledgement of needs, impact and barriers. Aggregating industries into five broad categories reveals a similar level of implementation of digital tools and awareness of the need across groups. Across all groupings, there was a relatively high expression of digitalisation needs and awareness about its impact and barriers.

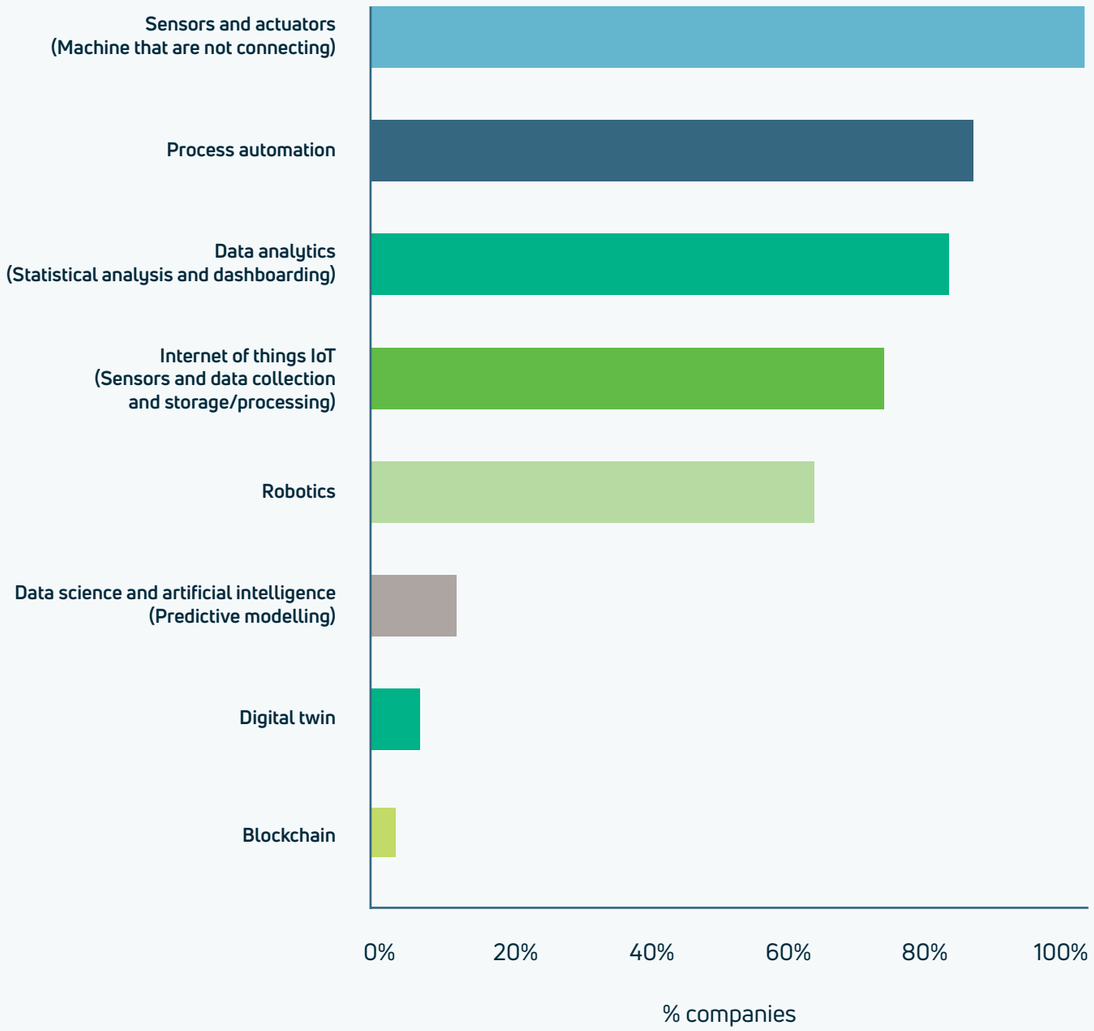
Digitalisation level and **impact per F&D sub-sectors**



*(**Figure 6:** Digitalisation level, impact, needs and barriers per F&D sub-sectors (digitalisation scores are calculated by averaging responses from multiple questions in each category)*

Note: In this analysis, 1) Non-processed Foods include Meat, Grain & Cereal, Fruit and Vegetables; 2) Processed Foods and Additives include Nutrition and Supplements, Snack Food, Bakery & Confectionery, Condiments & Sauces, Ready Meals, Flavours & Additives, and Organic & Natural Food.

Main digital solutions that companies **have already implemented**

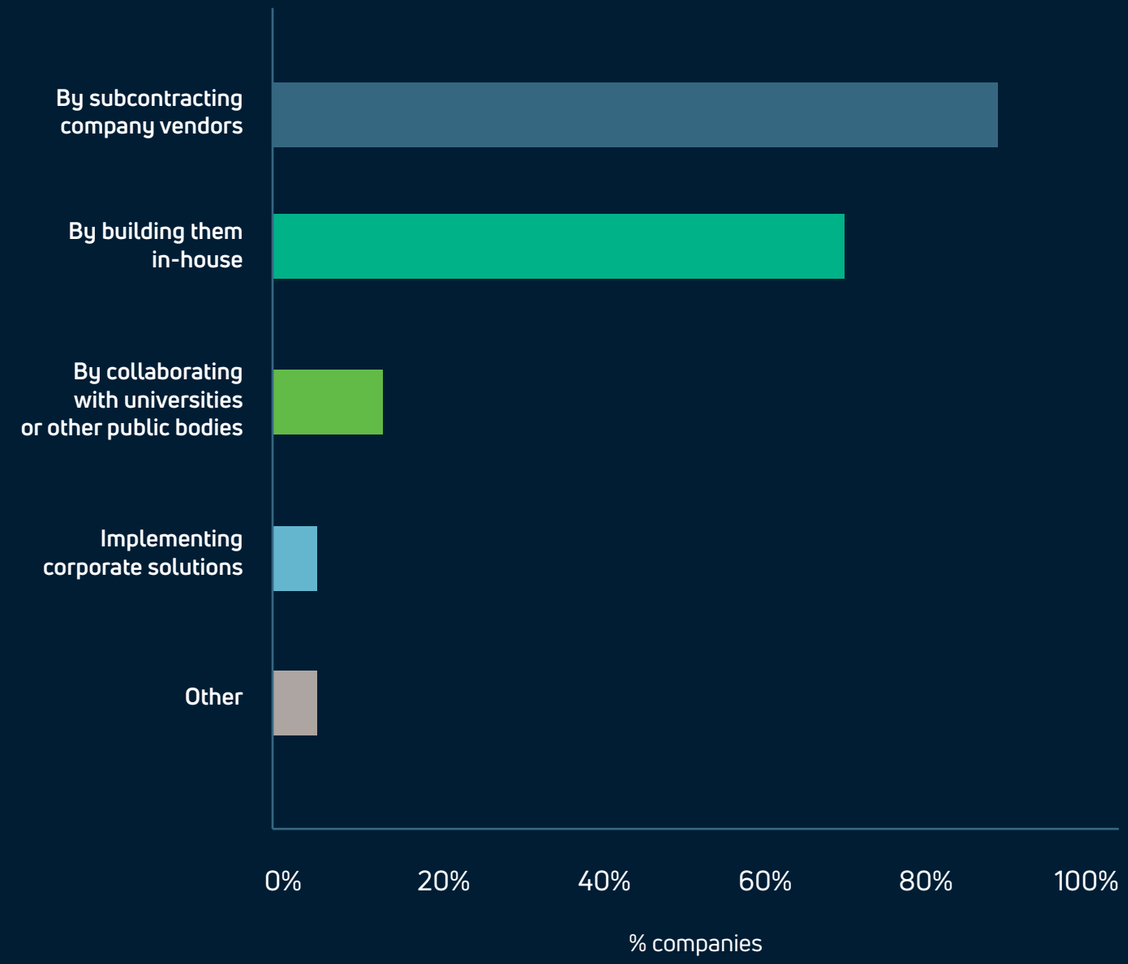


*(**Figure 7:** Main digital solutions that companies have already implemented)*

Finding: Digitalisation approaches taken by the majority of companies included the introduction of process monitoring sensors, process automation, data analytics, IoT and robotics. These have involved the use of both vendor and in-house solutions.

The main digital solutions that companies have implemented so far include automation solutions (Sensors and actuators – 97%, Process automation 83%), data analytics and dashboards (80%), IoT (70%) and Robotics (60%). Less companies are using data science and AI (13%), and even less use Digital Twins (7%) and Blockchain (3%).

Ways companies have followed **to acquire digital solutions**

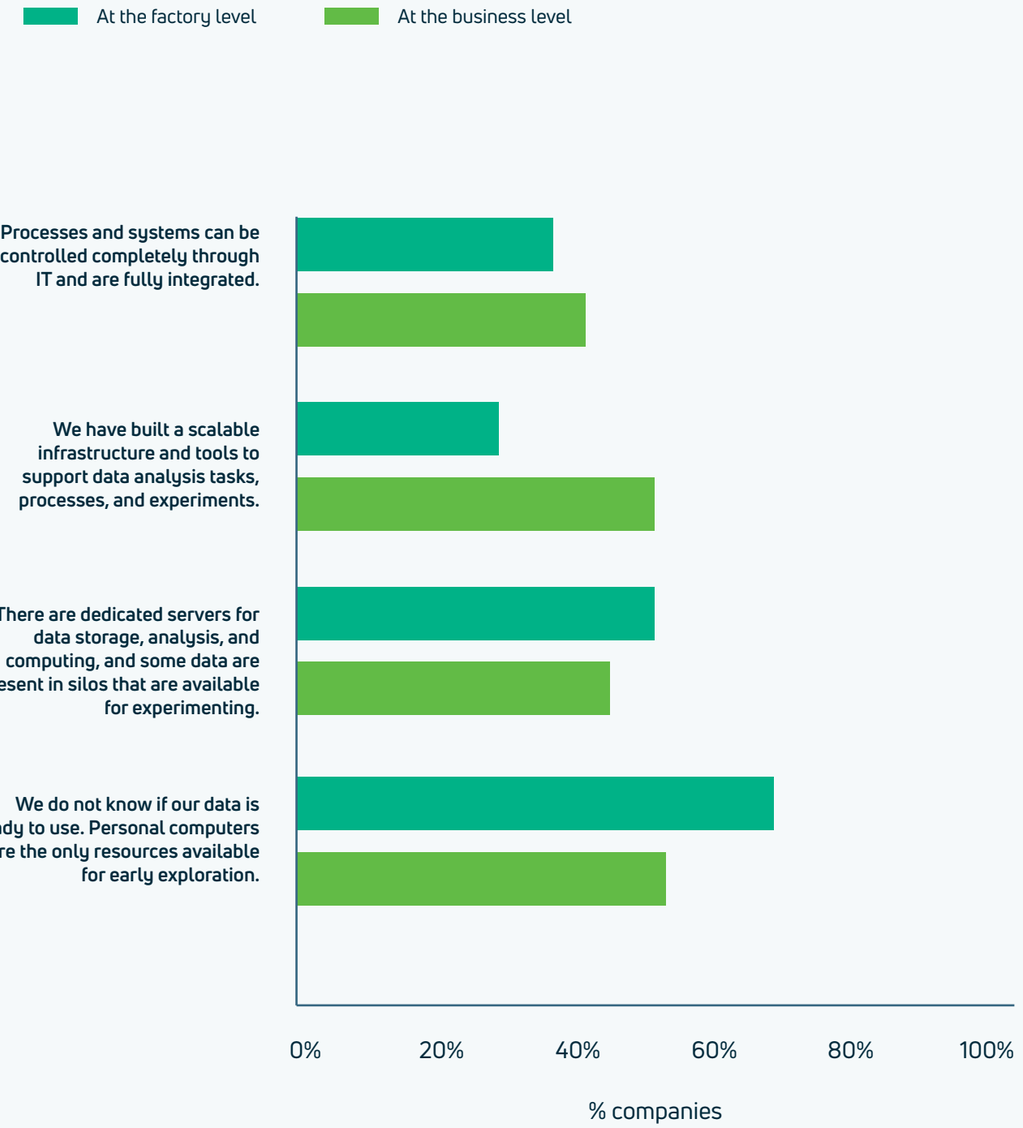


*(**Figure 8:** Ways companies have followed to acquire digital solutions)*

In most cases, companies acquired digital solutions from external vendors (90%), followed by building solutions in-house (70%). Only a small number of companies are engaging in co-creation with universities (13%) or other public bodies (3%).

> Over 60% of companies are aware of the value of digitalisation, with little difference between large and small organisations.

Level of digitalisation adoption at **Food and Drink companies in Ireland**

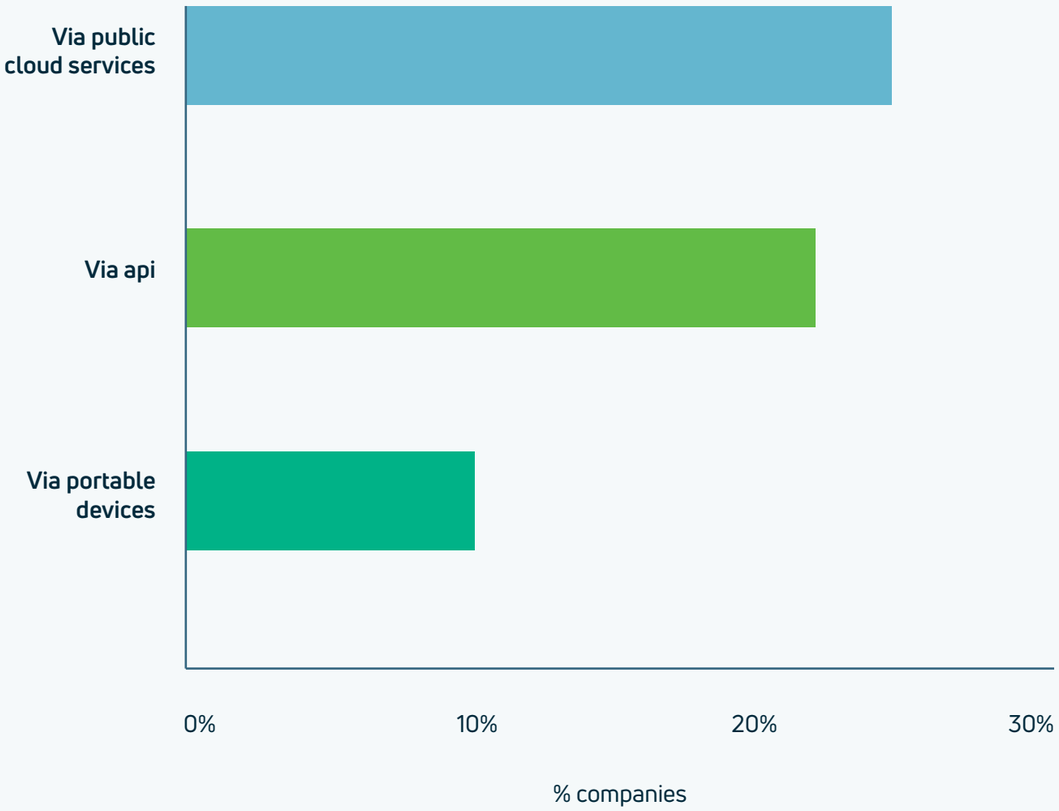


***(Figure 9:** Level of digitalisation integration at Food and Drink companies in Ireland)*

Finding: 60% of companies have data-related issues, and 53% of companies are reluctant to share data with third parties.

According to the survey responses, 60% of companies consider that they do not have the data they need. This creates an opportunity for projects that will determine the existing data, explore possible use cases driven by this data, and assess the need and requirements for an architecture that would enable data-driven decision making.

Ways companies share **data with third parties**



(Figure 10:** Ways companies share data with third parties**)

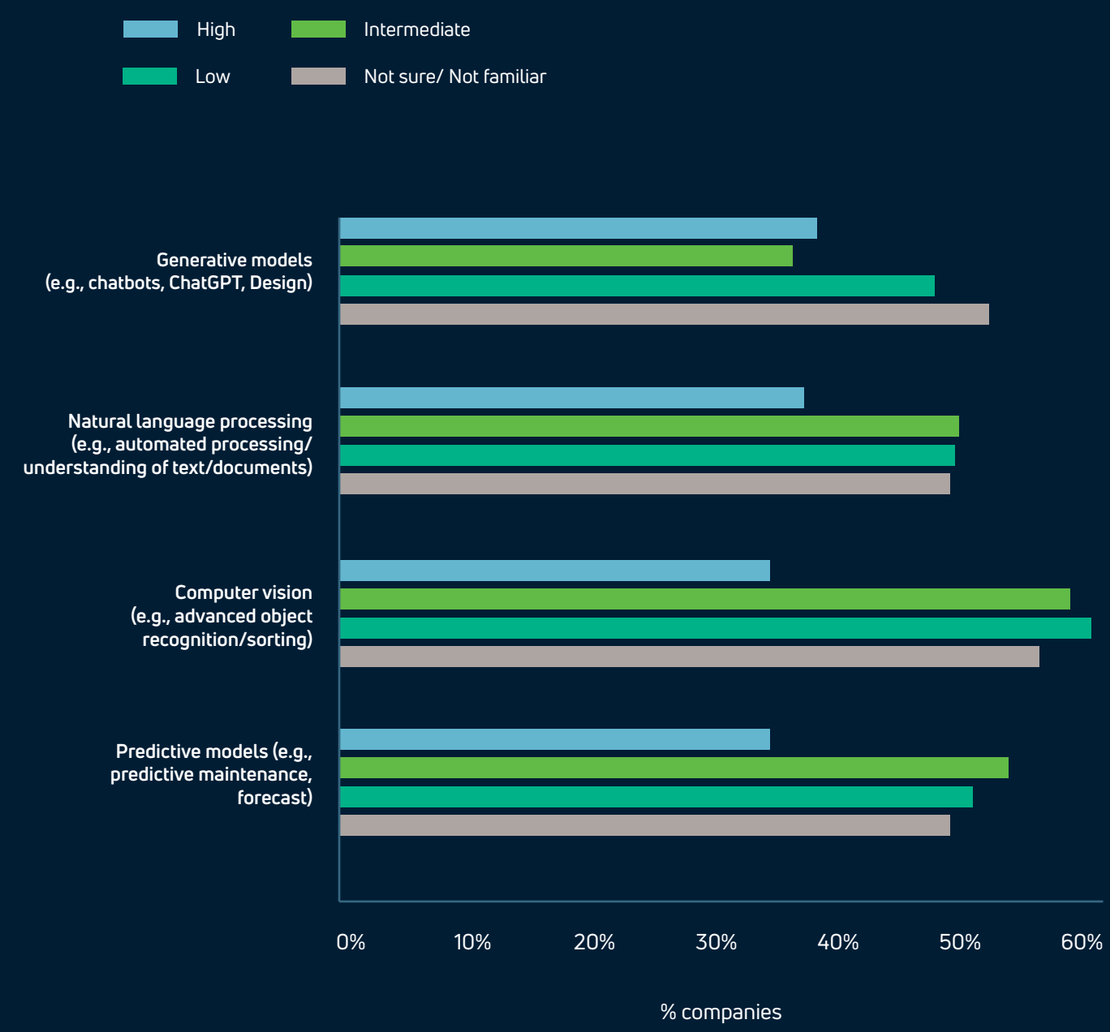
Among the companies that believe that they have the data they need, 47% of them share their data with suppliers, clients, distributors or collaborators using public cloud services, followed by APIs (Application Programmable Interfaces), and fewer use portable devices.

The remaining companies presented the following reasons for not having a data sharing mechanism:

- Preferring to keep all data in-house
- GDPR concerns
- Lack of clarity about the benefits of data sharing, apart from when necessary (e.g. regulatory compliance, providing statistics for trade associations)

Similar to other findings, these reasons highlight an opportunity to educate companies on the benefits of data sharing when conducted under a good governance structure and with best practices.

Impact expected from **different AI technologies.**



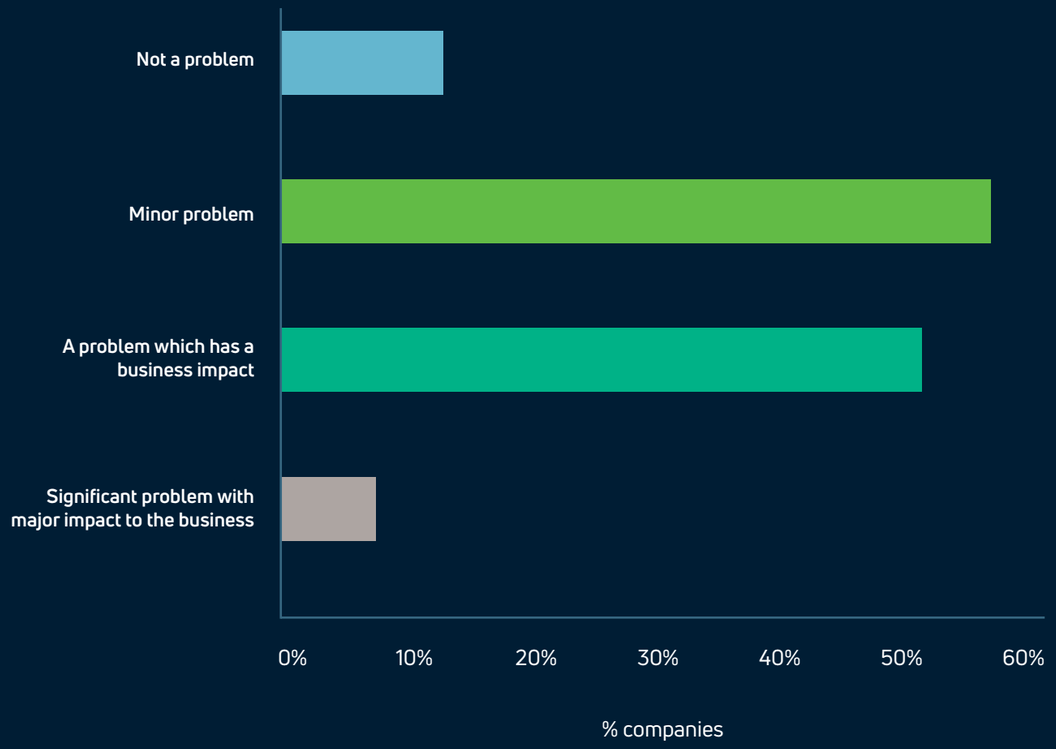
(Figure 11:** Impact expected from different AI technologies**)

Finding: With respect to Artificial Intelligence, Generative AI is expected to have a high impact, followed by Natural Language Processing

According to the survey responses, Generative AI is leading in terms of expected impact from AI technologies. This highlights the awareness that the companies have of this technology, but also the hype around this new capability (e.g. ChatGPT). Companies would benefit from education on Generative AI in order to have reasonable expectations.

Natural Language Processing and computer vision score reasonably in terms of expected impact, but surprisingly predictive modelling scores lower in terms of high expectations. This indicates a clear need to educate companies on the business value of this long-established AI capability.

Companies' view of **digitalisation skill shortage**



*(**Figure 12:** Companies view of digitalisation skill shortage)*

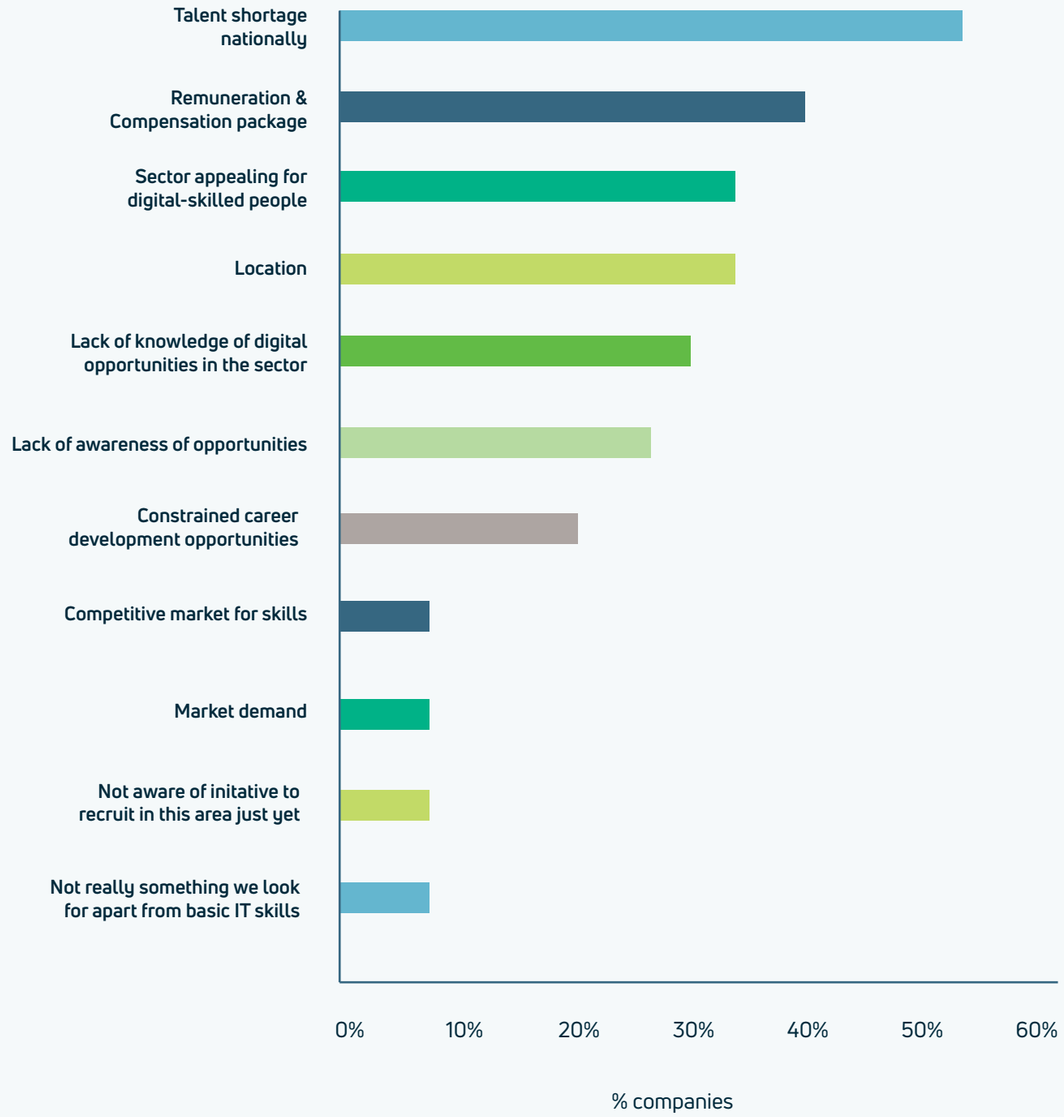
Finding: Talent shortage is a problem, and the companies identified the lack of the sector's appeal, career prospects, and remote locations as the causes.

According to the survey responses, 93% of companies consider that talent shortage is a problem.
The main blockers for talent attraction and retention are the following:

- **Talent shortage** – A fundamental scarcity of talent on a national level is the main challenge for talent attraction and retention. This finding will support Ireland's ongoing efforts in international talent attraction, in designing university programmes and industry upskilling and reskilling training supports.
- **Sector's appeal and the lack of knowledge around the digital opportunity in the sector** - This finding could provide inspiration for solutions that consist of spreading awareness of the opportunities in the sector for digital talent, the societal and sustainability benefits of digitalising the Food and Drink industry, career opportunities, and other similar approaches to create appeal for the sector.
- **Location** – This may be related to the challenges in attracting talent in remote areas in Ireland outside large cities, where several Food and Drink companies are located.
- Other factors, e.g. potential challenges in matching the remuneration and compensation packages compared to other industries.

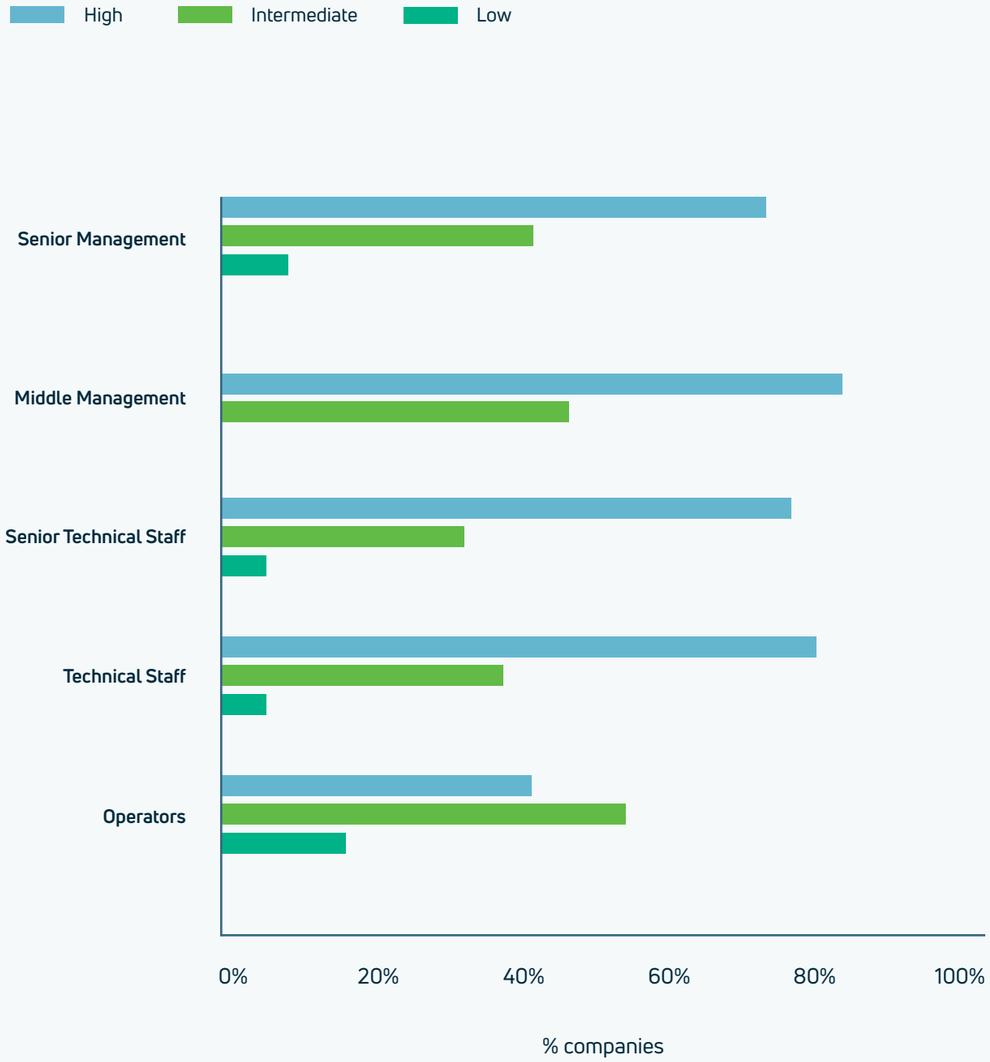
Barriers to talent **attraction and retention**

Barriers to attract and retain talent with digital skills



*(**Figure 13:** Barriers to talent attraction and retention)*

Companies' view on staff that **would need upskilling in digitalisation**

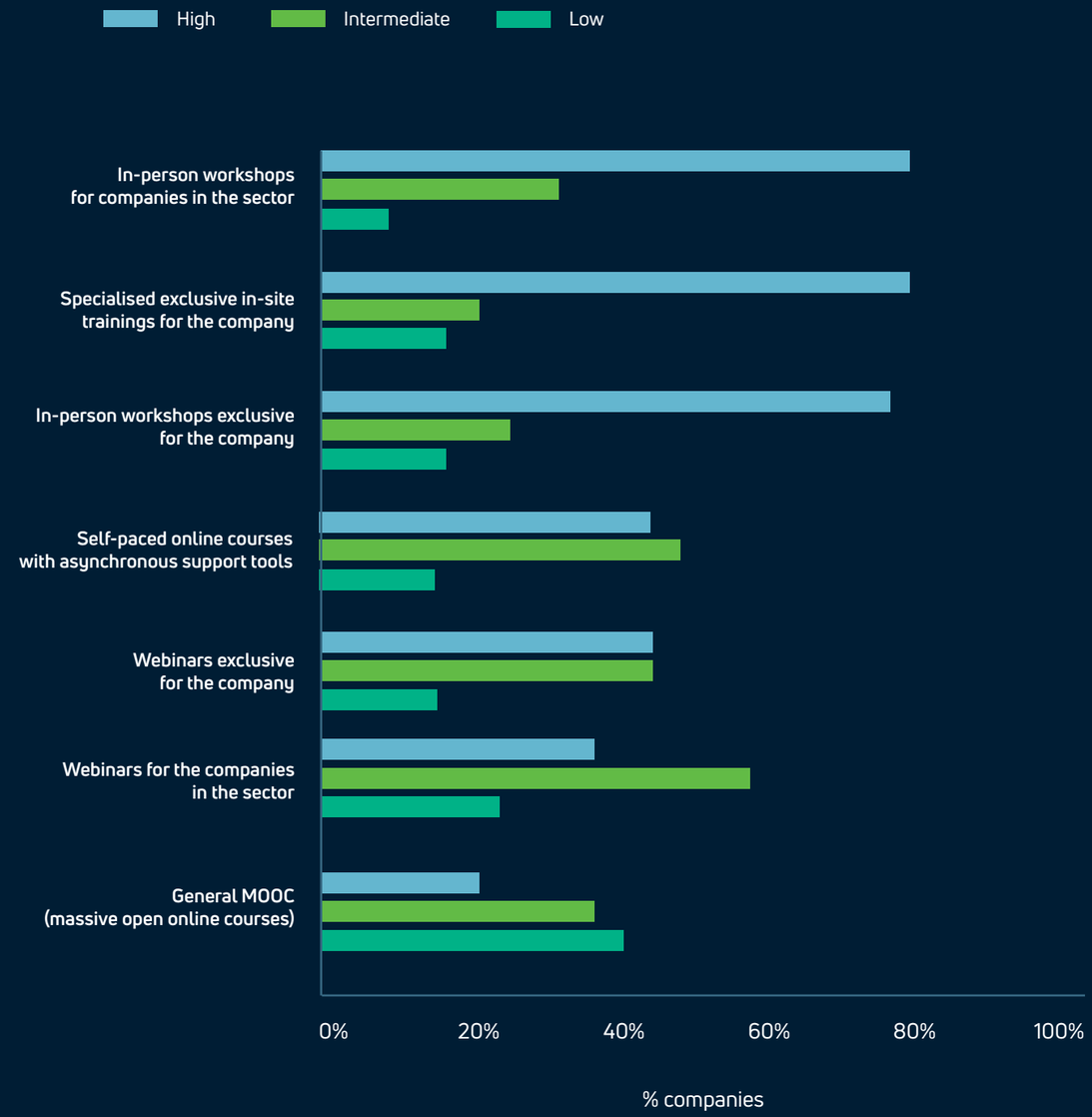


*(**Figure 14:** Companies' view on staff that would need upskilling in digitalisation)*

Finding: Companies consider that digital training needs are high. Senior and middle management especially need upskilling in digitalisation.

According to the survey responses, companies seem to consider that digitalisation upskilling should focus primarily on senior management (73%), middle management (83%), senior technical staff (77%) and non-senior technical staff (80%), with a lower priority for operators (40%).

Companies' preferred digitalisation **training and upskilling formats**



(***Figure 15:** Companies' preferred digitalisation training and upskilling formats.*)

Finding: For upskilling, most companies prefer in-person workshops (including shared with other companies in the sector), and specialised exclusive on-site training.

The preferred formats include in-person workshops (exclusive for companies, or with others in the sector), and specialised exclusive on-site trainings. There is also an appetite for other formats (e.g. self-paced online courses, webinars, MOOC).

6.3 Survey conclusions

The survey conducted among Irish food and drink companies provides several actionable insights into the current state of digitalisation within the sector and highlights the challenges and expectations faced by these companies in adopting digital technologies.

The key survey findings are the following:

Current levels of adoption of Digital Solutions

Predominant digital solutions include automation (sensors, actuators, process automation), data analytics, IoT, and robotics. Fewer companies have ventured into advanced technologies like AI, digital twins, and blockchain.

Data Management

While most companies have infrastructure for data storage and analysis, data-related issues persist. There is a reluctance to share data due to concerns about GDPR and unclear benefits, indicating a need for better data governance and education on data sharing advantages.

AI and Emerging Technologies

AI is expected to have a high impact, highlighting the sector's awareness of this technology's potential. However, there is a need for education on more established AI capabilities like predictive modelling.

Talent Shortage

A significant talent shortage is a major barrier, driven by the sector's lack of appeal, career prospects, and remote locations. This calls for strategies to enhance the sector's attractiveness and targeted efforts in international talent recruitment and local training.

Training Needs

There is a strong demand for digital upskilling, particularly for senior and middle management, as well as technical staff. Preferred training formats include in-person workshops and specialised on-site training.

A combination of survey results and associated comments produced the following recommendations to create the conditions for improved digitalisation in the food and drink industry:

Government and Industry Support

- Increased government investment in central facilities for demonstration and adoption of digital technologies in food and drink processing.
- Development of a shared digitalisation roadmap for regulatory and support bodies to enhance efficiency and compliance and the potential benefits digital tools can enable.

Education and Training

- Tailored training programmes focusing on the digitalisation needs of management and technical staff.
- Promotion of the sector's digital opportunities to attract new talent.

Data Strategy

- Implementation of robust data governance structures to encourage data sharing and leverage its benefits for decision-making.
- Integration of data collection from various sources and the enhancement of central data analytics capabilities.

Research and Development

- Facilitate R&D projects that boost usage of cutting-edge technologies (e.g. AI, blockchain) in industry, which would create attractive opportunities for talent to join.

By addressing these areas, Irish food and drink companies can overcome digitalisation barriers and fully harness the benefits of new technologies, supporting the sector's global competitiveness as one of Ireland's major industries.

07

Insights, Conclusions and Recommendations

07 | Insights, Conclusions and Recommendations

The long-term sustainability of the Irish Food and Drink sector as a global industry is dependent on its ability to remain innovative and competitive as well as the continued delivery of a strong value proposition to its customers. It is clear that digital transformation must, and will, play a key role in the future success of the industry.

The opportunities for digital transformation are wide and extend across the full spectrum of functions within food and drink businesses including production, supply chain, logistics, quality, innovation, new product development, sales, marketing and Human Resources.

Benefits of digitalisation include:

- Enhanced quality and safety
- Increased efficiencies and productivity
- More efficient supply chain and inventory management
- Measurement and improvement of sustainable practices
- Higher speed RD&I, with faster time to market at lower cost
- More informed and effective decision making throughout the organisation
- Retention and attraction of a talented workforce

Companies in the Food and Drink sector are generally well informed regarding the available digital tools on the market and spend time considering adoption, however the levels of digitalisation vary significantly. While there are some excellent examples of successful digitalisation in the industry, current levels of adoption are low with many companies stuck in "pilot phase". Common initiatives are in areas of automation (sensors, actuators, process automation), data analytics, IOT and robotics. However, few companies have ventured into advanced digital technologies like AI, digital twins and blockchain.

7.1 Challenges industry faces in the adoption of digital transformation

Challenges within food and drink in the adoption of digital technologies include:

High Cost of adoption and unclear Return on Investment (ROI). Lower margins compared to other industries makes investment decisions with uncertain outcomes more difficult. Major barriers to adopting more digital tools are related to the time required to realise an adequate ROI. For SMEs, uncertainty related to the scaling of operations sufficiently to justify the investment is a particular challenge.

Integration of new technologies into existing legacy systems, particularly as most often equipment is utilised 24/7 and the risk of downtime is too high. Data access and quality can also be an issue when integrating systems across multiple equipment vendors, resulting in less insights and value than expected. Data governance issues and a lack of standards can further impede new technology integration.

Complex supply chains and high levels of customisation needed in food processing can increase cost, time and resources when attempting to introduce digital transformation projects.

Uncertainty regarding the impact on regulatory compliance. Existing sector regulations may not account for the capabilities or requirements of new digital tools. This leads to uncertainty and discouragement in adopting advanced digital systems, for instance AI and blockchain, which might be misaligned with requirements regarding food legislation, food safety, labelling and traceability.

Lack of an over-arching digitalisation strategy with adequate resourcing in place. Many examples of adoption focus on niche areas of the organisation, rather than being a part of an overall strategy. Ringfencing key employee resources to fully dedicate their efforts to the design of a digitalisation strategy and to internally lead digital transformation projects is a challenge.

There is a **scarcity of proof points** and success stories in the food and drink sector, particularly for SMEs, which could serve as research examples and a roadmap for decision making around adoption.

Digital Skills gaps and uncertain talent pipeline. Skills gaps related to developing business intelligence in digitalisation is a barrier to investment. In addition, there is a lack of awareness and understanding of digitalisation opportunities within the industry, which restricts opportunities to attract the right talent. This is particularly evident in relation to AI and the need to develop capabilities such as predictive modelling. The talent pipeline of new staff and the retention of upskilled staff will favour companies that have embraced digitalisation in a strategic way, further putting those who have not invested at a disadvantage.

7.2 Recommendations

To support increased levels of digitalisation within the sector, key enablers include:

Increased education and awareness regarding how to make smart investments in digital technologies, underpinned by a standardised ROI framework. Training and upskilling for senior management would improve the decision-making process regarding the digital transformation journey. Part of this training would include education on an ROI framework for digitalisation investment in Food and Drink companies.

The framework would take global best practice and local challenges into account. This approach would include investing in predictive simulation tools to model the impact of new technologies The overall approach would consider incremental innovation and risk management, beginning with small technological adoptions (sensors, automation) while maintaining a long-term digital transformation strategy.

Increased collaboration within the industry and between industry and key stakeholders on developing skills programmes and piloting new technologies. Development of successful case studies and availability of physical prototyping facilities to assess new digital technologies, as in the Cobotics and First Polymer Skillnet examples in Section 5 of the report, would significantly de-risk the business decision on investment for many companies. Leveraging industry clusters and research and innovation centres where businesses can collaborate on digital transformation projects, share best practices, and access advanced technologies would be beneficial in this regard.

An example is the shared challenge of integrating data collection from different equipment/vendors into usable data streams for central or federated data analytics, which could be addressed in large-scale research projects and co-developed skills programmes. In general, joint projects and partnerships to define technical and training solutions between food and drink companies and technology providers, leveraging existing state supports, would enable the development of industry-specific digital solutions and the corresponding skills development initiatives.

A shared digitalisation and skills development roadmap between industry and regulatory bodies. A shared digitalisation and skills development roadmap for industry, regulatory and support bodies, would facilitate digital adoption in compliance and reporting, in tandem with industry transformation. Increased education and upskilling in cutting-edge technologies such as AI and digital twin development could drive increased innovation and productivity for company operations as well as increase the speed and efficiency of regulatory compliance, which is an area of increasing concern for the competitiveness of European companies [1].

As highlighted in Section 5, there are a range of digital training programmes currently available within Skillnet Ireland and across a number of Irish education institutions. Consideration should be given to combining aspects of these existing programmes with content, which is specifically targeted at addressing the training needs of those working in the Food and Drink sector.

7.3 Implication on skills and talent

The key catalyst for increased levels of digitalisation centres around skills and talent, as ultimately, digital transition is a skills transition. Digitalisation will have an impact across all functions in business and those with responsibility in all of these roles will need to move to a "digital-first mindset" over the next 2-3 years. This will require a commitment to lifelong learning as well as a strong openness to change. However, there is a clear message that standard training courses are not of optimum use and bespoke digital training programs tailored to companies' specific needs, would have a greater impact.

From a business perspective, companies need to move from ad-hoc digitalisation projects to the development and implantation of digitalisation strategies spanning their entire business.

Specific skills to support this include:

- Business intelligence and strategic thinking
- The ability to more accurately determine ROI on digital investment projects
- Communication, leadership and team effectiveness skills, which are key ingredients in supporting a digital transformation journey.
- HR and talent management skills to support talent attraction and retention and to ensure the right skills are in place across all functions in business. Key to this will be the appointment of an innovation manager.
- In addition, to support the attraction of staff with digital skills, businesses need to better promote the innovation and transformation that is taking place within the industry.

Regarding technical skills, key skills include:

- Data Management and Analytics, including data entry, data tracking and data visualisation tools
- Customer Relationship Management (CRM),including management of customer feedback, loyalty programs and personalization of customer experience through digital tools
- Safety and Compliance systems, including traceability tools for supply chain management (e.g., blockchain solutions), IoT-enabled sensors for monitoring food storage and transportation and predictive maintenance tools for equipment
- Process Automation systems including programming and operation, basic understanding of APIs for system integrations and exposure to user-friendly programming languages (e.g., Python, SQL)
- Cybersecurity Awareness, including basic knowledge of data protection and GDPR compliance, training on secure use of digital tools and platforms and recognizing and preventing phishing and other cyber threats
- Supply Chain and Inventory Management Systems such as inventory software, integration of digital tools for demand forecasting and real-time supply chain monitoring systems
- Sustainability Tools for tracking waste and optimizing sustainability
- Predictive modelling tools for accelerated product and process development
- Artificial intelligence tools – which can be applied across all categories to deliver step change increases in productivity and accurate decision making

By addressing these challenges and leveraging the outlined opportunities, the Irish Food and Drink sector can position itself as a global leader in innovation, efficiency, and sustainability. A unified approach to digitalisation, supported by industry collaboration and skills development, will be key to achieving these goals.

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