Food Manufacturing – Are You Ready for Industry 4.0?
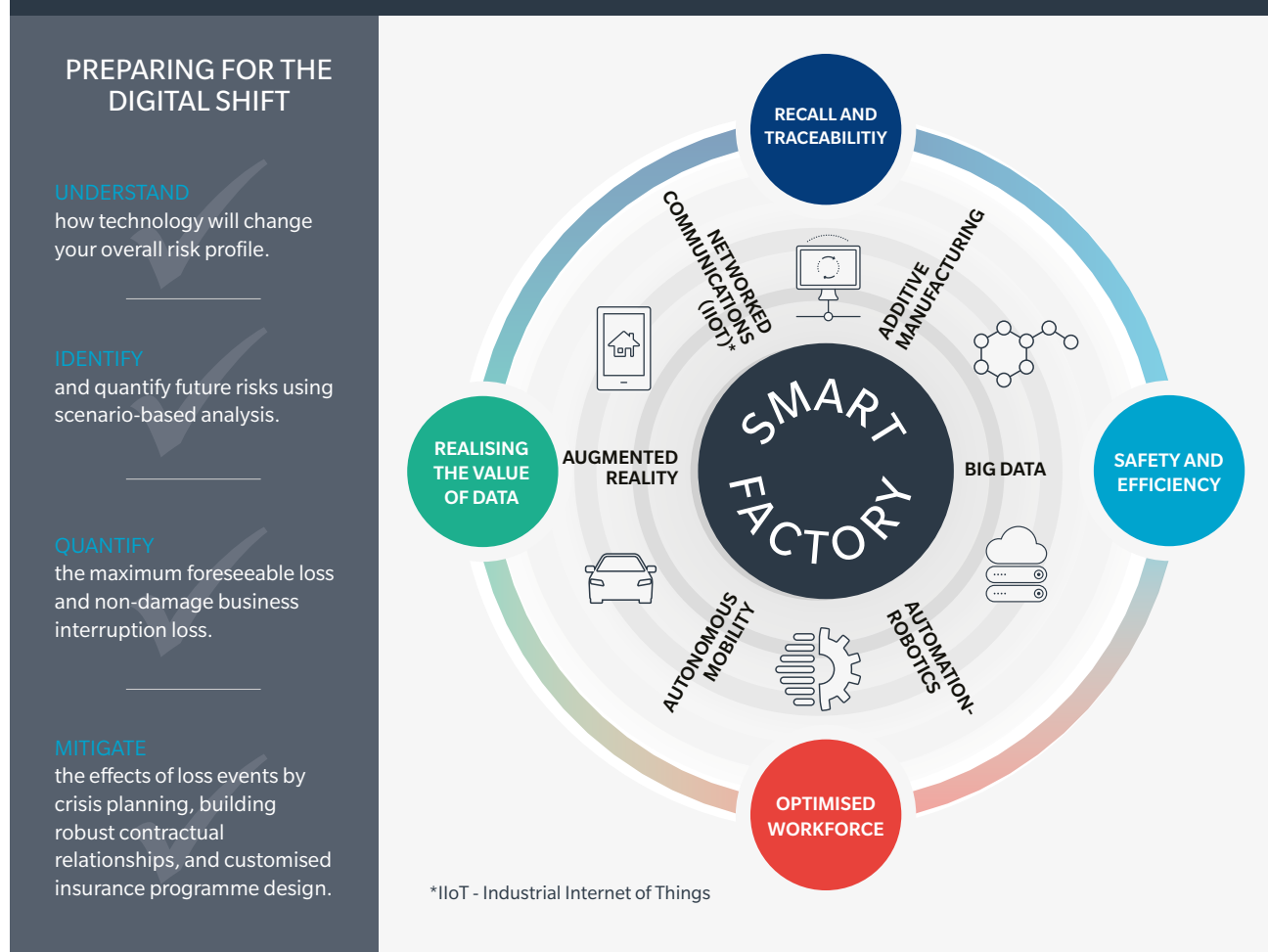
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EXECUTIVE SUMMARY

The food and beverage industry is evolving rapidly. Increasing connectivity is propelling the sector into a new digital age. From handmade products and assembly lines, to mass production and high-tech systems, food manufacturing is continuously seeking to find faster and more efficient ways to meet consumer demand. This new reality will undoubtedly change the risk profile of the industry, and organisations will need to prepare for the increasing move to automation. The question is, to what extent?

FIGURE 1   A New Business Model for Industry

PREPARING FOR THE DIGITAL SHIFT

UNDERSTAND
how technology will change your overall risk profile.

IDENTIFY
and quantify future risks using scenario-based analysis.

QUANTIFY
the maximum foreseeable loss and non-damage business interruption loss.

MITIGATE
the effects of loss events by crisis planning, building robust contractual relationships, and customised insurance programme design.

RECALL AND TRACEABILITIY

NETWORKED COMMUNICATIONS (IIOT)*

ADDITIVE MANUFACTURING

REALISING THE VALUE OF DATA

AUGMENTED REALITY

SMART FACTORY

BIG DATA

SAFETY AND EFFICIENCY

AUTONOMOUS MOBILITY

AUTOMATION-ROBOTICS

OPTIMISED WORKFORCE

*IIoT - Industrial Internet of Things

The food and beverage industry is the manufacturing sector most directly exposed to changes in patterns of household consumption.[1] Although overall demand fluctuates very little, consumer preferences alter considerably over time, requiring manufacturers to respond and adapt to these changing needs.

Healthy foods continue to rise in popularity, and a growing number of brands now have a selection of low-calorie, low-fat, 'free-from' products, as well as gluten/allergen/sugar-free options. The desire for healthier lifestyles is leading consumers to eat greater amounts of fruits, vegetables, nuts, seeds, and grains. Meanwhile manufacturers are increasingly adding protein, vitamins, and antioxidants to appeal to the more health conscious consumer. The industry is also working closely with the UK Government to address the health challenges posed by an ageing population and childhood obesity, and is developing improved food labelling to help consumers make more informed choices about the products they choose.

This transformation in the supermarket retail environment has also had an effect on manufacturers. The need to constantly innovate is driving demand for new product ranges at lower prices, placing the UK's 'big four' supermarkets under pressure from discount retailers. Branded manufacturers may therefore see a fall in demand, as supermarkets develop their own label lines in order to compete.

Given its size, the food and beverage industry invests a small amount in research and development (R&D) compared with other sectors, mainly linked to margin pressure.[2] However, with shifts in consumer preferences, and a greater focus on supply chain agility, transparency, and safety, harnessing new technology should be seen as an opportunity. There is important scope for transformation, not only in the production process through increased automation and the reduction of waste, but also in the development and introduction of new products — with an increased use of technology providing the flexibility to run prototypes and bring new products to market at the same time.

FIGURE 2   Does Opportunity Await Food and Beverage Manufacturers?
Percentage of total R&D expenditure by sector.

PHARMACEUTICALS   AUTOMOTIVE   FOOD AND BEVERAGE

28%   18.6%   2.9%
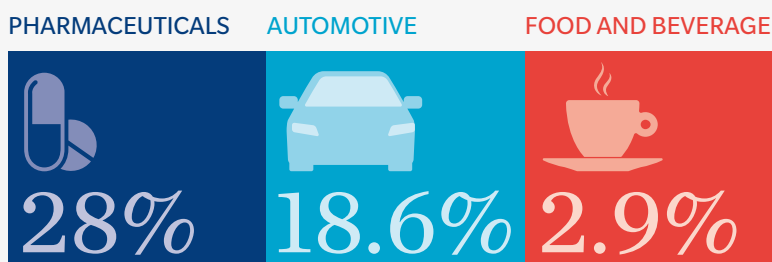
Source: Office for National Statistics - Business Enterprise Research and Development, UK, 2016.

BOOSTING SAFETY AND EFFICIENCY

One area where technology can make a huge difference is in enhancing product safety. Product shelf-life is a real issue for many food manufacturers, who must be careful to control the flow of products and not over-produce.[3] Electronic traceability can play a significant role in solving this issue, allowing producers to track items from delivery to the supermarket shelf. Connected systems will result in more efficient planning, allowing a quicker response to customer needs, and also shorter setup and changeover times, with remote self-diagnostics for preventive maintenance and reduced downtime. Meanwhile, interoperability will allow a smoother connection through the supply chain, enabling businesses to take a product to market much more quickly. Recognising patterns in product usage through data will also allow businesses to anticipate customer demand and adapt processes accordingly.

In the confectionary industry, R&D times have been reduced through the use of technology, with manufacturers utilising 3D printing to produce new, editable prototypes. As a result, a prototype that would have traditionally taken weeks to produce can now be created in a matter of days. This allows consumer testing to be carried out in a much shorter timeframe, providing vital feedback before significant investment in a new product is made. Similar prototyping is also being used to design new packaging, where consumer testing is essential for products to have shelf desirability. Also, smart sensors are being included in food packaging to measure changes in microbial activity, temperature, pH, oxygen, CO_2 levels, which will provide a more accurate method for detecting food spoilage compared to less accurate best before dates.

RECALL AND TRACEABILITY

An increasingly integrated supply chain will allow for the greater traceability of ingredients. Therefore, if there is a need for a recall, manufacturers will have the ability to act in a much more timely manner. With increasing pressure on companies to initiate product recalls in ever decreasing timeframes, it is essential for manufactures to be able to trace raw ingredients throughout the supply chain. Technologies such as radio-frequency identification (RFID) are now making it possible to trace raw ingredients from the original source.[4] This increased traceability and supply chain integration will also prove invaluable in reducing the level of counterfeit goods that infiltrate the supply chain.

3D PRINTING IN ACTION

Aerated Cadbury Dairy Milk chocolate was created in 2012, the new design was developed with 3D printing, which reduced the time taken to reach consumer testing.

FIGURE 3	Efficiency and Safety Benefits Abound
✓	HIGHLY SELECTIVE SORTING TO REDUCE FOOD WASTE AND INVENTORY HOLDINGS.[5]
✓	SMALLER BATCH PROCESSING MACHINERY AND MORE COMPACT MANUFACTURING.
✓	INSPECTION EQUIPMENT FOR EASIER DETECTION AND THE SEPARATION OF EVER-SMALLER FOREIGN PARTICLES.
✓	MONITORING OF FRIDGES AND OTHER TEMPERATURE-CONTROLLED ENVIRONMENTS WITH AUTOMATED ALERTS.
✓	GREATER SUPPLY CHAIN VISIBILITY FOR THE TRACEABILITY OF INGREDIENTS, ALLOWING FOR FASTER RECALLS.
✓	HIGHLY FLEXIBLE EQUIPMENT WITH EASIER CHANGEOVER.
✓	MACHINERY THAT REDUCES AND CONSERVES ENERGY USAGE.

REALISING THE VALUE OF DATA

The foundation of Industry 4.0 is automation and data exchange. For the benefit of investment in technology transformation, manufacturers will need to automate their data collection processes and ensure that data doesn't get lost in siloed databases after it is collected. Taking the time to implement a system where data collection is automated and centralised will pay dividends and enable real-time visibility across the organisation, from the manufacturing and distribution process, including, raw ingredients, suppliers, and in-process diagnostics, to manufacturing floor operators and R&D, including data processing, packaging, and delivery. This will enable manufacturers to identify opportunities to increase output, decrease costs, and improve quality, as well as identify issues across all manufacturing operations.
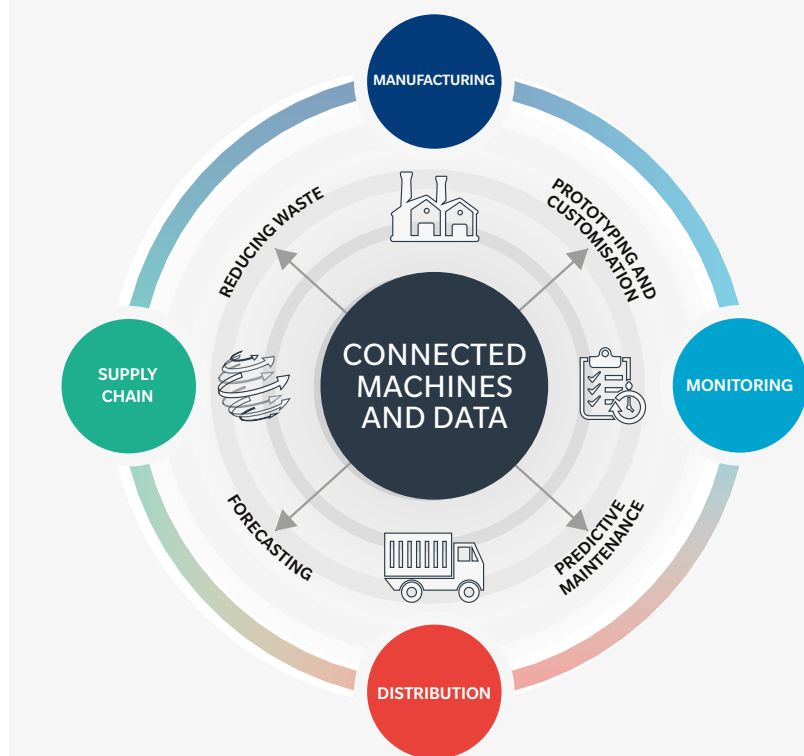
AN OPTIMISED WORKFORCE

Technological change will diminish the contribution of labour to GDP growth, as machinery will be able to perform a wider range of tasks. New technology has historically increased labour productivity and created new and better jobs, but as machines become more proficient at cognitive as well as physical tasks, there is uncertainty about the types of roles that will exist for humans in the future.[7] A move to automated processes in the industry could result in lower personnel costs, optimised personnel deployment through the use of more skilled employees for R&D and machinery set-up, and of course reduced human error.

REDEFINING AN INDUSTRY – THE OPPORTUNITY OF AUTOMATION?

Responding to this dynamic environment will require manufacturers to be more agile and develop new production methods and more efficient procedures to meet today's demands. The digital transformation should therefore be seen as an opportunity to create the smart factories of the future, with advanced digital and manufacturing tools and systems, robotics, process control systems, and automated vehicles via Wi-Fi networks and the internet.

Figure 4   Technology Defined [7]

MANUFACTURING

PROTOTYPING AND CUSTOMISATION

MONITORING

PREDICTIVE MAINTENANCE

DISTRIBUTION

FORECASTING

SUPPLY CHAIN

REDUCING WASTE

CONNECTED MACHINES AND DATA

Smart processes have the ability to be run with minimal human intervention, with operations using smart components that can autonomously make adjustments based on the data collected from the plant floor. With less human intervention at this level, there will be fewer defects and errors, resulting in higher-quality products, less room for error, and increased customer satisfaction. As well as an increasing use of automation and robotics, manufacturers will also look towards the new functionality gained from these systems, such as flexibility in changeover and operator safety, self-diagnostics for preventive maintenance, and more connectivity and interoperability between systems. Companies will gradually move toward embedding the IIoT and data collection to better manage production schedules, resources, labour, and maintenance.

PREPARING FOR THE DIGITAL SHIFT

A new way of working will be essential in order to understand the challenges posed by Industry 4.0 (Figure 4) and ensure its potential benefits are achieved. Food and beverage manufacturers should consider creating a digital roadmap, to assist in defining their future data and technology requirements. Conducting a detailed audit will build a greater understanding of the ways in which data is collated, how it is stored, and the technology already in use. Consideration will also need to be given to the systems that will be required in the future to meet customer, product, manufacturing, data capture, and employee training needs.

While the benefits of technological progress will be seen across the organisation, new risks and challenges will need to be navigated as new working practices take hold. As connectivity between systems and third parties increases, ensuring the integrity and security of interconnected systems will be paramount. For food and beverage companies, perhaps the biggest cyber risk is the disruption of normal operations from a technology failure. In June 2017, a ransomware, Petya, infected more than 2,000 companies, and several major food and beverage companies publicly announced that they had been attacked. As food and beverage companies increasingly move towards the smart factory, the enlarged attack surface will expose organisations to more and more cyber threats.

UNPACKING THE CYBER THREAT

Although it will always be difficult to eliminate the cyber threat completely, organisations can take steps to minimise the potential loss of income, reputational damage, and other adverse effects that may result from a cyber-attack. It is therefore vital that the manufacturer and businesses across the supply chain have effective cyber-risk financing programmes in place to enable them to better manage their cyber exposures. Organisations will need to become "cyber resilient", which means having the ability to understand, prepare for, respond to, and successfully recover from cyber breaches.

In order to manage direct and business interruption losses from a cyber-attack it is important to estimate the potential financial impact of a cyber event. Every cyber scenario is different, and the business model of the affected organisation will impact how it responds. By using a scenario-based analysis to quantify cyber business interruption risk, an organisation can estimate the potential costs. It is often useful to define what the potential loss scenarios are composed of and break them out into:

- Relevant actors – for example, hacker, employee.

- Who are the network owners and systems – first- or third-party?

- Varying intent – malicious or accidental.

- Data exposures – both in terms of types and volume.

- Business interruption scenarios.

CONVERTING RISK INTO OPPORTUNITY

As companies increasingly adopt new technologies throughout the manufacturing and supply chain, manufacturers and processors should look to use a scenario-based analysis to identify and quantify the future risk in order to make informed decisions on treating these new exposures. A scenario-based analysis should focus on the following factors:

IDENTIFY

The adoption of Industry 4.0 technologies will mean manufacturers and processors will increasingly use technology to run production lines and track the movement of products and ingredients throughout the production process, which will subsequently impact many facets of the business. These risks should be built into robust and detailed loss scenarios that clearly articulate the scope of the risk and the potential financial impact in simple terms. By using a scenario-based analysis to quantify these new risks, a business can estimate the resulting costs, focusing cyber security on the major sources of harm.

QUANTIFY

Many businesses are struggling to quantify Industry 4.0 risks, as they are, by definition, new and emerging. Examining existing coverages and determining the likely impact of a cyber event will provide essential insight for any business. There are several solutions available to quantify key risks, including:

- Assess the potential financial cost of a cyber-attack. While all businesses have assessed the potential maximum loss of revenue following a property damage event (for example, a fire or flood), many have not quantified the revenue they would lose if their systems were hacked or taken offline for a significant period of time.

- Build a model to quantify the financial costs of a data breach. This should include customer and employee data being compromised and could also include an

algorithmic assessment of cyber-attack vulnerability.

- Build an actuarial assessment to identify the one–in-ten or one-in-twenty-year costs arising from a data loss event.

Almost all firms are now acting on cyber risk, typically by investing in technical defences, hiring security experts, and training staff. Adding a quantitative overlay to the work being done and shining a light on the impact of those investments while helping to direct them is essential in order to build a robust defence.

TREAT

After businesses have quantified these new risks, they can then take action to mitigate them. Food and beverage companies should consider taking the following steps to enable informed decision making with regards to the treatment of Industry 4.0 risks, focusing on:

- **Stress-testing financial capacity:** The impact of a cyber-attack can be acute, putting pressure on revenue and sources of funding. Understanding the effects of different loss-scenarios on your capital and cash-flow provides a financial basis for making decisions as to how much to spend on defensive measures and on the adequacy of your financial soundness to different forms and levels of attack.

- **Insurance programme design:** As cyber-attacks become larger and more sophisticated, the use of insurance for risk transfer will become more important. Customised programmes can be based on:

  – Identified cyber loss scenarios, in terms of coverage and limits.

  – A gap analysis of the cover provided within existing programmes, for example, property/business interruption, general liability, crime, and directors and officers liability.

- **Crisis management planning:** Inevitably, any alteration to the organisation's risk profile will drive the need for changes to be made to existing crisis management and business continuity plans. The potential for reputational damage and business disruption are such that firms want to take steps to avoid a breach happening in the first place.

- **Contractual risk:** Supplier and customer relationships will also alter and may require terms and conditions to be amended (for example, an error by a technology supplier could create a significant exposure to fines and penalties under the European Union's General Data Protection Regulation (GDPR)). If so, have contractual conditions and limits been amended accordingly?

- **Risk benchmarking:** A practical cyber risk management assessment should be carried out, and include a review of control maturity assessments, remediation strategy development, and threat monitoring.

CONCLUSION

Although the notion of Industry 4.0 or 'smart manufacturing' may have previously had greater application to perceived high-tech industries such as aerospace and automotive, the opportunities for the food and beverage industry are significant.

Most food and beverage businesses are moving towards higher and often game-changing levels of digitisation/automation and, as with any change in business process, this will present opportunities as well as challenges. Cyber is already a prominent risk for food and beverage companies and will only continue to grow in importance. Organisations will therefore need to take a more strategic approach to identify, manage, and treat these new and emerging Industry 4.0 risks in order to protect themselves and their customers.

About Marsh

At Marsh, we have substantial experience in assisting retail companies to identify and evaluate the risks a company faces. Our Cyber Resilience team will work with your own cross-functional team, including members of your business, legal, IT, and risk management department. We will help you develop a clear picture of the key risks you face, understand what insurance coverage you may or may not currently have to protect you, and a plan to develop a bespoke cyber risk management programme that fits your needs.

About this report

This report examines how technological change is redefining the nature of risk in the in the ever-evolving supply chains of retailers. Marsh's UK Food and Beverage Practice believes that understanding and keeping at the forefront of technological change is key to providing the best client advice and enhancing the benefits we can deliver to clients' businesses.

NOTES

MARSH

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