



White Paper  
**A SPOTLIGHT ON FOOD SAFETY AND INDUSTRY 4.0**



# CONTENTS

1. Executive summary
2. Food safety trends
3. Challenges for the food and beverage industry
4. Connectivity in food manufacturing
5. Solutions and practical steps
6. Data protection and systems
7. Looking into the future

# EXECUTIVE SUMMARY

Standing still is not an option. As food safety moves up the global agenda, demands are being made by consumers, retailers, regulators and stakeholders to raise the level of food protection around the world. Food safety has risen to prominence for several reasons including growing population, scarcity of natural resources, globalisation, sustainability and advances in modern technology.

According to the UN Food and Agriculture Organization's (FAO) 2019 Food Safety report, unsafe food containing harmful bacteria, viruses, parasites or chemical substances, causes more than 200 diseases – ranging from diarrhoea to cancers. An estimated 600 million – almost 1 in 10 people in the world – fall ill after eating contaminated food and 420,000 die every year.

Unsafe food practices can have devastating consequences. A food safety incident in one part of the world has the potential to go global within hours. The human and business costs of failure can be catastrophic: harm to consumers, loss of trust, damage to the brand, costs in terms of product recalls and redesign.

Everyday, food and beverage manufacturers face demands for ever-higher standards of food safety and quality from consumers, retailers, regulators and shareholders.

Consumers expect that packaged food they buy will taste good and be safe to eat or drink. Retailers need to make sure that the packages on their shelves are attractive and have not been damaged on their way through the supply chain. Regulators are demanding, and increasingly legislating, to make sure manufacturers meet ever-higher food safety standards. And shareholders want to make sure their company's reputation, growth and profitability are not put at risk by excessive waste or costly quality issues.

So how can the food and beverage (F&B) manufacturing industry adapt? How can it become smarter and more proactive through digital solutions to prevent food safety issues before they occur? Working together with partners, using smart technology will secure its transformation to meet the food safety challenges of the rapidly changing world of the future.

One of the key solutions is for the industry to start looking at opportunities like preventive food safety and quality checks. Industry 4.0 and digital solutions allow a food and beverage producer to take a fresh and more sophisticated approach to the way it runs its operations.

The good news is that the integration of the processes offered by the technologies behind Industry 4.0 can help food manufacturers meet many of the demands being placed on them, be they about enhancing food safety, better managing their supply chains or ensuring the greatest profitability in a complex and competitive world.

This white paper offers food manufacturers help in how to meet food safety challenges. It will share insights on some of the practical ways to prevent food safety issues and detect problems before they occur through digital technologies. It's not a one-size-fits-all approach but working together as an industry with partners, using smart technology, there are opportunities to transform and to meet challenges of the rapidly changing world of the future.





02

## FOOD SAFETY TRENDS

- Regulation
- Changing consumer eating and buying behaviours
- Increasing digitalisation
- Supply chain traceability



Food and drinks manufacturers are facing a growing labyrinth of food safety regulations from governments, national and international bodies, covering every aspect of the food chain from ingredients to processing, supply chain traceability and product recalls.

Environmental and sustainability legislation is also increasing. Sustainability is becoming a licence to operate rather than a brand differentiator for manufacturers. Companies everywhere are under pressure to reduce environmental impacts above and beyond the regulations.

Meanwhile changes in consumer attitudes are driving more regulations around food safety and sustainability. There is a desire to know more about a product and its journey – traceability is demanded. Hygiene is also a major preoccupation, with Covid-19 front of mind. Consumers want to know food production processes are safe and contaminant-free.

Surveys by the US Food & Drug Administration (FDA) and the European Food Safety Authority (EFSA) show that consumption trends and buying patterns are changing, driven to a large extent by a globalised, digitalised world.

In the future, products will need to be more convenient, more personalised and more sustainable. Small batch production is likely to grow to meet rising requests for personalised options.



The number of days between production and consumption for shelf stable products will probably drop dramatically brought about by changes in consumer buying patterns. As a result, this will put more pressure on food and beverage producers to increase their quality performance.

The way to do this is by using data, harnessing the power of connected manufacturing and creating proactive processes. If performance remains reactive then all the current issues will remain and producers will find themselves responding to potential consumer claims and demands. This means the margin for error by food and beverage manufacturers is narrowing, and where manufacturers hold fragmented and incomplete data about their operations, this can pose a risk.

The FAO estimates that 66% of food waste occurs on the way from production to retailing, while the FDA notes that food recalls are continuing to rise and were up by 10% between 2013 and 2018.

Pioneering Industry 4.0 sectors don't wait until late in the lifecycle of a product or production method to root out waste and inefficiencies but build in smart processes at the start, high up the supply chain. They aim to be proactive not reactive.



As a result, Industry 4.0, smart manufacturing, the Industrial Internet of Things (IIoT) and the idea of connected manufacturing are becoming increasingly pervasive. F&B manufacturers are using robots to automate tasks, virtual reality for machine maintenance, track and trace technology for better traceability and transparency. Going digital is seen as a positive way to transform food safety and make food safe and available.

Smart manufacturing provides opportunities to tackle potential food safety issues because fully integrated collaborative systems can respond in real time to meet the changing demands and conditions in the factory. Manufacturers can be proactive in everything from hygienic design and new cleaning in place (CIP) technologies like electro-chemically activated water to quality control systems that measure compliance to food safety regulations such as good manufacturing practices (GMP).

One area where this has been adopted to great effect is with the use of blockchain technology (record of transaction/data distribution/share and validate data) to grow trust in food safety and transparency across the supply chain making traceability much better for consumers and producers alike.

All parties in the food chain share responsibility for food safety. Any materials or parts that come into contact with a food product must also be taken into account. There must be a reliable flow of information for the integration of products, processes and partners for traceability to work.

Effective traceability is the result of structured data acquisition, where the acquired data is accessible and searchable. Traceability is essential when a product needs to be recalled.





## 03

### WHAT ARE THE CHALLENGES FOR THE F&B SECTOR?

- Which technologies to use? What first steps to take?
- How to make food safe without increasing operational costs?
- Change the mindset: from reactive to proactive food safety; being a late tech adopter
- Growth and competitive advantage
- Securing food safety and quality while cutting waste and using less resources



In this tough and fast-changing operating landscape there are many challenges for F&B producers, not least those that have emerged with Covid-19 and how smart technology might be used to overcome them. Now may well be the time to make decisions over how to keep up and not be left behind when it comes to industry 4.0.

For many F&B manufacturers it is not only cost that makes them think again about investing in new systems or processes but the daunting task of knowing which of the new smart technologies will work best for them and what are the first steps they should take.

Globally the food and agribusiness is a \$5-trillion industry, representing 10% of global consumer spend according to McKinsey, but margins are tight as is the margin for error. Working out how to retain a competitive advantage and maintain growth is key.

The automation and integration of systems can help food manufacturers to document food safety and compliance to create transparency by tracking a product's journey from the farm to consumers. Most of these consumers are in urban settings and rely on global supply chains. This is a growing trend. The world's urban population is expanding by 60 million people a year according to the FAO, which is three times the rise of that seen in rural communities.



By 2050 the global population is predicted to reach nine billion people. Food production will need to be ramped up by 70% to meet this extra demand, says the FAO. But simultaneously there will be pressure on food manufacturers to decrease waste, emissions and the amount of resources used.

One potential way to reduce waste from processes is to rethink how goods are tested. Tetra Pak research shows that between 700 million and one billion euros worth of Tetra Pak packages filled with food are destroyed every year for food quality testing purposes.

Might it be better to understand and change quality management systems, so they resemble those in the automotive or pharmaceutical sectors to cut down on testing by wasteful methods? If processes are changed earlier in the supply chain, this might eradicate the need to destroy so many goods for food quality testing purposes. Today many of the checks around food safety come at the end of the manufacturing process rather than at the start. They tend to be reactive rather than proactive.

Food product recalls and customer complaints are on the up while there is also a shrinking time gap between something being produced and consumed.

Food recalls are a critical step in ensuring that a nation's food supply is safe. In many cases, large-scale recalls can bankrupt a company, not only because of losses when the food is destroyed, but also due to the loss of confidence by consumers in its products. Smart technology can aid a rethinking of how to produce a product more safely and sustainably cutting costs and reducing recalls.



# CONNECTIVITY IN FOOD MANUFACTURING

Digital technologies help ensure food safety and quality. To date F&B manufacturers have been much slower to adopt smart technology than other industries like the aerospace or automotive sectors.

In Volume 1 of Industry 4.0 we showed there are many successful uses of artificial intelligence (AI), robotics, blockchain, IIoT and augmented reality (AR) already in use by the industry. Around the world, governments are encouraging businesses to digitalise as part of their industrial strategies as they recognise the opportunities that it brings. The World Economic Forum (WEF) estimates that the fourth industrial revolution will create up to \$3.7 trillion in value by 2025 but that much more needs to be done by all industries to unlock this value. For the F&B industry, simple steps like better data management will improve quality standard processes by cutting food safety risks. It allows companies to keep precise records and do root cause analysis which can be used to streamline compliance while reducing food safety risks.

Automated record keeping also contributes to a higher standardisation level, time and money savings on compliance and meeting the demands of regulators and consumers for more stringent safety standards.

Technology is a clear and increasingly urgent focus area for industry investment because there are IT and OT technologies within food manufacturers which are outdated or running on legacy infrastructure.

Meanwhile, Covid-19 has thrown up its own challenges as food processing plants are forced to close and the lockdowns that aim to stop the spread of the coronavirus have prevented farmers across the globe from delivering food products to consumers.

Are there ways to incorporate smart tech into the processes to make them safer and enable plants to keep operating? Why not consider ways that technology can be used to help food production plants improve their implementation of GMPs and maintain high sanitary standards?

A smart factory can be built one piece at a time, as long as the vision of the final goal is discussed at the outset. Steps can be small like adding sensors and data logging solutions which deliver many of the benefits of Industry 4.0 without the need to replace existing equipment.

Robots are being used more often in process and assembly situations as they are now easier to programme, are more flexible and can work alongside human operatives easily without the need for physical guarding systems.

Since the Covid-19 crisis, there has been a reduction of workers at some F&B manufacturing plants. It makes sense to consider having equipment that is easier to operate or needs less specialisation so that quality and productivity do not drop when resources are squeezed.

Using available data is the first step to creating a smart food factory which is the key to increasing productivity, efficiency and food safety.

How data can be used to solve challenges & provide new opportunities.

## 05

### SOLUTIONS AND PRACTICAL STEPS

Real time vs historical  
Data vs paper  
Partnerships vs alone  
Safe vs insecure  
Proactive vs reactive

Digitalisation enables food security to be improved. The F&B industry needs to gather, understand and use data – move from paper to digital ways of working to satisfy its goals and consumer demands. The real power of Industry 4.0 cannot be tapped without data, and lots of it, to feed algorithms for AI, robotics and for the creation of better process management systems.



Partner



What data?



Which  
technology  
where?



Connect



Analyse



Decide



06

## DATA PROTECTION AND SYSTEMS

- Insecure means unsafe
- Data and IP is a valuable resource that needs protecting
- The cost and damage to a brand by not taking protective measures can be immense



Stay safe, keep protected. Once a device is connected to an outside external network, there is a risk. Globally cybercrime is on the rise and the food industry is not immune to attack. The University of Minnesota's Food Protection and Defense Institute says food companies need to beef up their security and IT systems. The overarching, most important step is for companies to extend their food safety and food defence culture to cybersecurity, because insecure = unsafe. As the industry moves towards a more digital world, securing systems and data is vital.

The systems that food companies use for processing and manufacturing are already being targeted by criminals like transnational criminal organisations engaged in large-scale food fraud, counterfeiting, theft and smuggling, with many cargo thefts involving cyber attacks.

Food companies often have significant intellectual property (IP) in the form of recipes and processing parameters embedded in their systems, which have already been subjected to cyber attack.

The predictions are for more attacks, not least because many of the industrial control systems used in the food industry are quite old and have not been designed with the ability to be made secure through updating.

Many of these legacy systems are being connected to workstations on corporate networks, offering an entryway for hackers to other vital systems. Given the vulnerabilities identified in the food industry and the increasing threats to industrial control systems, it is critical that food companies have the tools, techniques and knowledge to protect themselves.

One way to do this is through technology and partnerships with experts. Protect process data through better connectivity and data exchange through IoT.





07

## LOOKING INTO THE FUTURE

- Trends like the growth of e-tailing and connecting the food value chain from end to end
- New tech like DNA sequencing for traceability and rapid testing for food safety or the use of nanoencapsulation for quality issues
- Increased use of robotics, remote sensors and drones
- Powerful partnerships
- Convergence of nano-, bio-, information and cognitive sciences to generate new product markets



Before the onset of the Covid-19 pandemic, e-commerce or e-tailing for food and beverages was already expected to become mainstream. Industry estimates predicted it would gain 15% market share within 5-10 years. Those numbers are now under review as e-commerce has become the main way for many to shop for food during the crisis. The geographies leading this revolution are the United States, Western Europe and the more developed parts of Asia like China. As a result of the Covid-19 pandemic, e-tailing has spread.

While globally there's only 2% adoption now, e-tailing is predicted to grow at 24% a year over the next 10 years. E-tail will be as big as hypermarket channels, bringing more cross-border trade and shaking up the supply chain. We have already seen the signs of this as consumers have turned to e-tailing as a major source of food purchasing in response to national lockdowns.

E-tailing is accelerating the need to know more about products and where they are. E-tailing is changing the way that people buy things and how companies supply goods. Companies like Amazon and China's Alibaba are making more demands on the F&B sector around packaging so that products are not damaged, contaminated or recalled.

This means there is more strain on the packaging. Packaging protection and robustness become much more important when products go through the e-tailing channel.

While the F&B industry is just starting to use AI, blockchain and other Industry 4.0 tech, new technology like DNA sequencing is on the horizon. It provides the possibility for advanced traceability and rapid testing for food safety that we don't have today.

DNA sequencing technology is maturing so that it might be able to be used economically in the manufacturing process. Potentially, it could be a revolutionary technology for the food safety industry and make it easier for producers to be proactive rather than reactive.

Elsewhere, the convergence of nano-, bio-, information and cognitive sciences to generate new product markets will shape the F&B sector.

As the Global Food Safety Institute (GFSI) says, higher consumer expectations mean companies throughout the supply chain must adapt their operations and reconsider how they collaborate — both internally and externally—to accommodate the needs of this new era.

Food manufacturers need to forge new partnerships across industries and seek new allies to navigate the new world. Together, with targeted smart technology used early in the food manufacturing ecosystem, food safety can be improved so that costly contamination and recalls can be controlled and eliminated before they become an issue.

