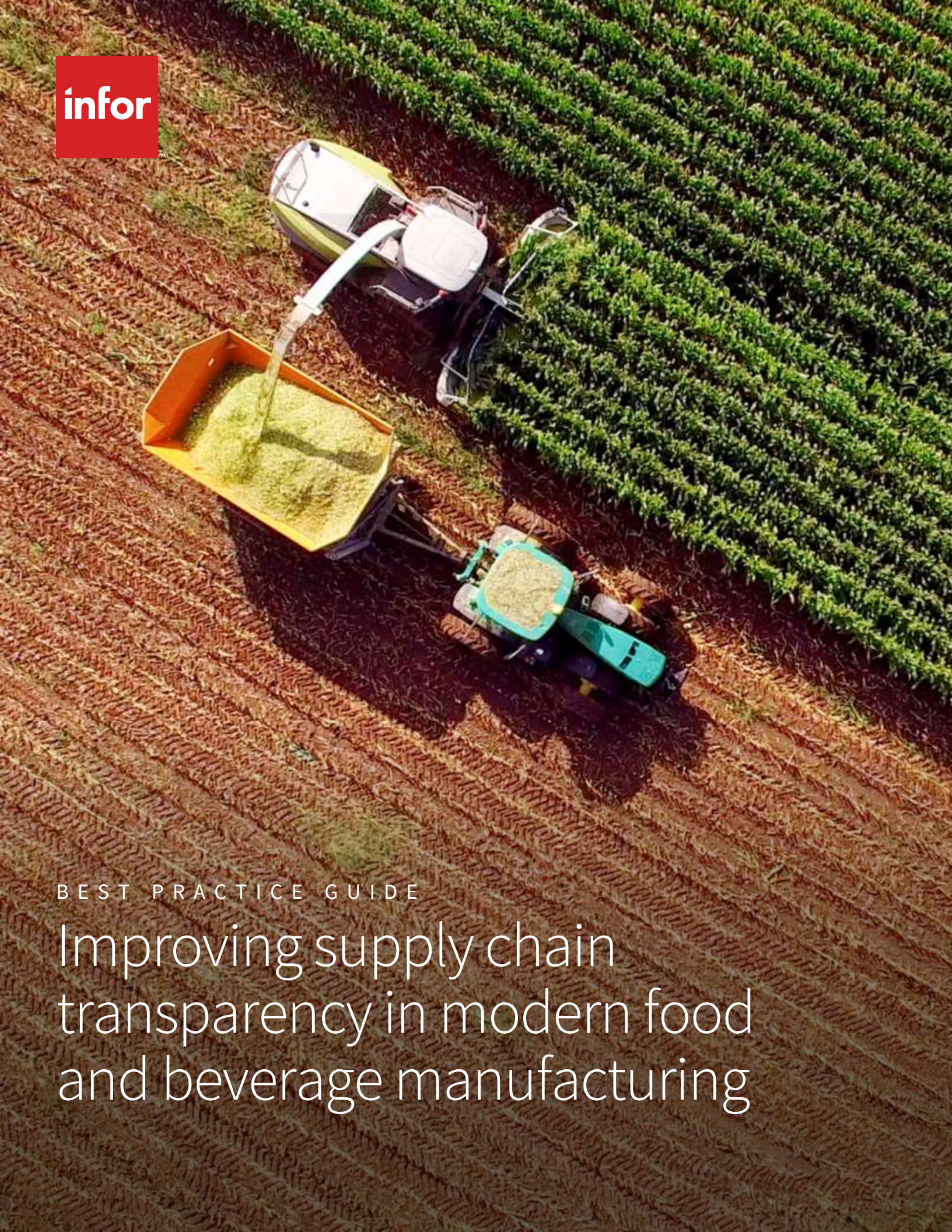

BEST PRACTICE GUIDE

Improving supply chain transparency in modern food and beverage manufacturing

Contents

Executive summary

Today's consumers demand more and more information about what they eat. They're not only conscious of the ingredients and the nutrition facts, they also want to know where the food originated, whether animals were treated humanely, and what kind of environmental impact the food has had. Consumers are also interested in learning more about the company's environmental sustainability policies and efforts. This is in addition to disclosing information that has already become commonplace, such as if a product is certified organic, gluten free, and locally grown. The list of requested information is long and continuing to grow.

Along with the transparency required to build and maintain consumer trust, food safety, quality, and compliance are critical issues for global food and beverage producers. And while increasing globalisation of food sourcing and distribution enables manufacturers to have more supply chain options and reach a greater number of customers, globalisation also means that risks—like the spread of contamination or disease—can often be more prevalent and complex. In fact, the World Health Organization (WHO) estimates that every year, **roughly 600 million people fall ill after eating contaminated food, with 420,000 of them ultimately dying**.[1] It's because of the risks—and the ensuing consequences—that the food and beverage industry is so highly regulated.

Efficiently catering to the needs of modern-day consumer demand for transparency, maintaining food safety, and meeting ever-changing regulations are major challenges for virtually all food and beverage manufacturers regardless of size. At stake are the health of consumers, damage to the brand, and exorbitantly costly recalls. Having a transparent supply chain and the ability to track and trace ingredients can provide confidence, while detailed documentation of all ingredients and processes can provide the foundation of public trust.

The key to enabling and leveraging these capabilities is to take advantage of the technologies made available by "Industry 4.0"—also known as the "fourth industrial revolution."

What is Industry 4.0?

While definitions for Industry 4.0 are numerous, it's essentially: "The marriage of physical and digital technologies such as analytics, artificial intelligence, cognitive technologies, and the Internet of Things (IoT). This marriage of the physical with the digital allows for the creation of a digital enterprise that is not only interconnected, but also capable of more holistic, informed decision making," according to **Deloitte**.[2]

Many food and beverage manufacturers are realising that their current technology systems and business processes are unable to support the level of supply chain transparency and traceability required in today's highly competitive, global market. The key to enabling and leveraging these capabilities is to take advantage of the technologies made available by "Industry 4.0"—also known as the "fourth industrial revolution" (see the sidebar, "What is Industry 4.0," for a brief definition of Industry 4.0).

Integrating Industry 4.0 into the supply chain ecosystem requires digitally transforming the supply chain to be able to trace ingredients and products upstream and downstream across a number of suppliers, logistics providers, and partners. Integral to tracking and locating suspect ingredients and isolating problems is reliance on internet of things (IoT) technologies—combined with end-to-end, network-based supply chain traceability.

When done right, supply chain transparency and traceability have the added benefits of building consumer trust and strengthening brands, securing food safety, reducing waste, and overall supporting sustainability claims.

The benefits of gaining full supply chain transparency

An efficient and transparent food supply chain requires extensive collaboration and coordination between stakeholders. Preferably in real time. This can be challenging as many food and beverage companies rely on factories and other parts of the supply chain that are owned by suppliers or trading partners—and those partners source from several suppliers themselves—creating multiple layers of complexity in the quest for transparency. From a food and beverage manufacturer's perspective, the benefits of supply chain transparency are generated within their own production processes but also upstream and downstream along the supply chain. Modern technologies that enable transparency will also have the added benefits of meeting consumer demand for product information, identifying and responding to food safety issues, reducing food waste, and supporting sustainability claims.

Meeting consumer demand for transparent food supply chains

Conscientious consumers care about health, wellness, and social issues as they shop for family meals. They consider clean nutrition labels, functional benefits, visibility into suppliers, humane treatment of animals, and environmental sustainability. They also want fresh, locally grown, and quality produce. While these expectations put added pressure on food and beverage companies, meeting the demands of today's socially aware consumers can be a valuable differentiator.

Consumers today want to learn more about the origins of their food and its journey from farm to table. During the 2019 Integrity Systems Company Stakeholder Forum, **Anastasia Lloyd-Wallis, Retail Doctor's General Manager**, said: "Customers are looking for transparency and trust much more than they were. Customer trust has reduced, and we need to amplify that trust via end-to-end transparency."[3] The brands that consumers prefer have also become an expression of who they aspire to be, which is why they seek out a company's origin story, sustainability efforts, social consciousness, and corporate transparency, **writes Forbes**.[4]

Integral to tracking and locating suspect ingredients and isolating problems is reliance on internet of things (IoT) technologies—combined with end-to-end, network-based supply chain traceability.

Food safety events in the news

- **Listeria in rock melons**[6]
- **Needles in strawberries**[7]
- **Hepatitis A in frozen berries**[8]
- **High iodine levels in soy milk**[9]
- **Salmonella in mayonnaise**[10]
- **Salmonella in juice**[11]
- **Salmonella in peanut butter**[12]

Being proactive is essential. Not only can a consumer's health be at risk, but so can a company's reputation.

One initiative that connects consumers to easy and instantaneous access to detailed information about thousands of products is the **SmartLabel®** initiative. By scanning a QR code, a website page full of information such as nutrition, ingredients, allergens, third-party certifications, social compliance programs, usage instructions, advisories, and safe handling instructions opens. In the future, it's reasonable to assume that the depth of information about the product could even include where each of these ingredients came from, how old each ingredient was before utilised, and a whole host of additional information that could never fit on a label.

Identifying and responding to food safety issues

There are approximately 4.1 million cases of foodborne gastroenteritis in Australia every year, **according to the OzFoodNet network**.[5] Foodborne illness breakouts are obviously an important public health issue, but they also represent one of the greatest financial risks that food and beverage companies face—the estimated cost of foodborne illnesses in the country sits at $1.2 billion.

Australia's Food Standards Australia New Zealand (FSANZ) is frequently updating its rules and regulations for food and beverage operations through the region. According to Minister for Agriculture, Drought and Emergency Management David Littleproud, Australia has some of the highest food safety standards in the world. He told **ABC in a June 2020 interview**, "With the COVID-19 pandemic, our food production and distribution chains have stepped up and lifted their standards even higher."[13] These enhanced standards require food and beverage companies to be more proactive in preventing food safety problems. Not only does this mean establishing preventive controls, but also validating and verifying those rules—while also documenting each step along the way.

When a food safety problem arises, batches, lots, and shipments need to be identified within minutes. Manufactures must be able to trace all aspects of products throughout the entire supply chain—with complete visibility at the ingredient level—from farm to table, and everything in-between. This is made even more challenging when complex supply chains traverse across multiple international borders, and when ingredients are sourced from remote locations.

While the direct impact and cost of a recall can be calculated, the indirect damage to a brand is much harder to quantify. Business partners, both on the supply and demand side, may start to move their business elsewhere because being associated with the issue is a potential risk for their brand. This could force a company into having to focus on survival efforts, instead of proactively developing the business.

Fortunately, not all food safety issues occur on a catastrophic scale involving huge recalls (or litigations). More typically, the producer or processor discovers that quality controls have been accidentally breached, contaminating raw materials or lots of the finished product. Technology can provide the tools to track and trace origins of ingredients quickly and accurately, so containment of adverse quality events can be coordinated and executed quickly across the supply chain. This level of transparency can also help build trust across the supply chain.

Customers, consumers, and regulators all expect food and beverage manufacturers to take both a proactive and responsive approach to quality and food safety. When something goes wrong, it's imperative to quickly find the root cause, identify which customers were impacted, notify regulators, and contain the issue.

Reducing food loss and waste

In a world where up to 800 million people are chronically undernourished **roughly one-third of food produced for human consumption is lost or wasted across the entire supply chain every year**.[14] In a report by the **World Resources Institute (WRI)**, "The most immediate reasons food leaves the human food supply chain tie back to concern about a food's safety or suitability for consumption, or there being no perceived use or market for it." These causes are further exasperated by "deterioration or suboptimal quality, or issues such as the food's appearance, excess supply, and seasonal production fluctuations."

To minimise food waste, it's important to understand not only why it occurs, but also where in the supply chain it occurs.

On the farm—As many raw materials are agricultural or harvested from nature farmers are very reliant on weather conditions. In fact, global climate change threatens up to 25% of crop yields according to a report by **World Economic Forum and McKinsey & Company**.[15] Availability may be seasonal, and quality, purity, and nutritional attributes may vary too much. Needless to say, a lot of food or raw materials are wasted already on the farm.

In the factory—Poor food handling skills, lack of proper training, aging manufacturing equipment, and product line changeovers are the biggest causes of waste in the factory.

Transportation—Food waste can occur if proper temperatures aren't maintained during transit from the farm to the factory, or from the factory to the warehouse or the retailer. Unplanned delays can also add to the spoilage of fresh products or products with limited shelf life.

In the warehouse—Poor planning and scheduling can produce excess inventory, resulting in products with limited shelf life sitting in the warehouse too long. Proper temperatures, humidity levels, and storage containers need to be maintained in the warehouse to reduce food waste.

In the store—Most food waste in retail stores are linked to limited shelf life, or the lack of the food's appearance (texture, color, freshness).

At the table—**Australians waste around 7.3 million tonnes of food each year**—or around one out of every five shopping bags.[16] We buy more than we can eat, we throw away food that has reached its expiration date, and we throw away fresh food because we don't know how to store it properly to keep it fresh longer.

A sustainable food future through the supply chain

For companies in the food and beverage industry, sustainability is often associated with farming or the environment. The reality is that it is impacted throughout the entire food supply chain. Food processing, or transforming agriculture into edible food, exists to meet the goal of feeding the world—a primary driver for sustainability initiatives. This goal, however, is complicated due to a growing world population and scarcity of resources. According to **the World Bank**, "Global population was around 3 billion in 1960. By 1987, in less than three decades, it had surpassed 5 billion and there were around 7.6 billion people in the world in 2018."[17] At the same time, **60 to 70% of the world's ecosystem is degrading more rapidly than it can recover**.[18]

Because of this, the food processing industry itself has made attempts to create awareness around issues or enact policies to protect the environment. On the farm, crop rotation is being used to combat the effects of soil erosion, while **ongoing research is being conducted to reduce methane gas emission from cow farts and burps**.[19] In the manufacturing process, companies boast about their attempts to lessen energy consumption and reduce waste, especially in factories. At the same time, **Australia has cut its usage of plastic bags by 80%** in recent years, while agency programs are encouraging consumers and restaurants to make use of "ugly produce" to avoid food waste.[20] Without a doubt, the sustainability and eco-friendly movement has gone from niche to mainstream. More so, food and beverage enterprises no longer treat sustainability as a "feel good" fad, but a fundamental necessity for long-term viability and improved profitability.

By leveraging the accelerated, analytical, and flexible functionality of cloud solutions, food and beverage companies can move sustainability efforts forward throughout the entire supply chain. Using end-to-end capabilities, cloud technology can provide the speed, scalability, global reach, and agility required to ensure greater food for people and the planet while optimising profitability for the organisation.

A modern traceability solution will address food safety issues with precision by providing detailed information to quickly isolate and recall all finished goods and raw materials associated with any suspected product quality or safety issue.

Ensuring food safety and compliance–from farm to table

The United Nations proposed seventeen **Sustainable Development Goals** for the world in 2015, which it positions as "the blueprint to achieve a better and more sustainable future for all"—with the aim of achieving these goals by 2030.[21] The second prioritised goal is "Zero Hunger". To feed a world population that is estimated to **grow to 10 billion by 2050**, we need to ensure sustainable and safe food production systems.[22] According to the **WHO**, "Governments should make food safety a public health priority, as they play a pivotal role in developing policies and regulatory frameworks and establishing and implementing effective food safety systems."[23]

As government agencies (and major retailers) implement increasingly stringent rules and require more detailed information, complying with these food safety regulations is becoming more complex.

Maintaining food safety compliance is made even more complicated by growing risks from the globalisation of food sourcing and distribution, as well as the increased likelihood of contamination and disease that rapidly spreads across borders. This reinforces that food safety and traceability are more important now than ever before—and likely to become even more important over time. Taking steps to ensure the safety of food products from raw materials to consumers' tables must be a top priority for food and beverage manufacturers.

Although most food and beverage manufacturers continuously improve their food handling operating procedures, it's virtually impossible to foresee every possible event that can lead to a food safety issue. And equally important to preventing these issues from arising in the first place, is swiftly and precisely handling critical situations once they do occur. Customers, consumers, and regulators all expect food and beverage manufacturers to take both a proactive and responsive approach to quality and food safety.

When something goes wrong, it's imperative to quickly find the root cause, identify which customers were impacted, notify regulators, and contain the issue.

Companies that are prepared, will be able to minimise production downtime and cost, as well as reduce damage to the brand. A product recall is a reactive measure and does not bring the organisation forward—except to potentially learn from the issue to avoid an even bigger recall in the future. Most times, there's no advance warning that a recall is going to occur, and any recall an organisation experiences can have **enormous financial consequences**,[24] bringing down the whole company. Being a step ahead is the only viable option.

It doesn't take much to nullify a company's traceability efforts. For instance, if a specific lot is allocated for production, transfer, or shipping, but another lot is pulled instead and that change isn't entered into an enterprise resource planning (ERP) system, the company's tracking is now inaccurate.

Full visibility and transparency into the entire supply chain will help expedite a recall process and prevent contaminated products from reaching consumers—a safeguard that can protect a brand's integrity, consumer confidence, and bottom line. A modern traceability solution will address these issues with precision by providing detailed information to quickly isolate and recall all finished goods and raw materials associated with any suspected product quality or safety issue.

Traceability—A step towards Industry 4.0

At the core of supply chain traceability is the opportunity for food and beverage companies to take a truly proactive approach to food safety. As food and beverage manufacturers develop or update their food safety goals—both inside and outside of the organisation, integrating supply chain traceability as a key component of those goals should be top priority and will enable companies to:

- **Be prepared for quality audits**—Manufacturers can consolidate traceability data in one place and make it accessible with easy-to-understand visualisations. A company can share the information with suppliers, customers, and other third parties during a quality-audit process. This can help create a more collaborative environment within the organisation, as well as externally with the stakeholders in both the downstream and upstream supply chain.
- **Be prepared for recalls**—Data can be quickly mined backward to find the lots, batches, intermediary products, or raw materials that are the cause of a problem. Tracing forward can find all the finished products in the supply chain that might be contaminated. All impacted customers can be identified, so they can be immediately contacted and instructed to remove the affected products from shelves. Once new and safe products are manufactured, companies can ensure that those stores' shelves get replenished. Being proactive allows for quick and efficient action and helps to minimise negative media coverage. Proactive routines aimed at lowering risk for recalls and minimising risk for impact once they occur will improve customer and consumer trust.
- **Build a stronger supply chain network**—Including and actively collaborating with suppliers on creating supply chain transparency will benefit all supply chain participants, forming long-term relationships. For smaller farmers, implementation of technology can sometimes be challenging but at the same time can result in new business opportunities. Traceable products will reach a larger market and consumers are **more willing to pay a higher price point** when they know where their products came from and what they contain.[25]

- **Create new revenue opportunities**—Traceability capabilities can be leveraged as a competitive advantage with new market-entry opportunities. Proof points on secure and responsible sourcing patterns of ingredients and raw materials can be supplied. Traceability capabilities can also be used as part of a company's social responsibility initiatives to create transparency and trust.

Additional opportunities with Industry 4.0

Industry 4.0 technologies that once seemed like science fiction are now a reality and can bring significant opportunities to the food and beverage industry. Industry 4.0 can help increase productivity, improve food safety, reduce food and resource waste, and provide full supply chain transparency from farmers to consumers.

The cumulative effect of technological advancements, adaptations, and optimisations have combined to shape the manufacturing landscape. And it has only now matured enough to provide the promise of a prosperous future for manufacturers willing to make the incremental, foundational, and operational changes necessary to flourish. This new era has created a digitised world within which manufacturers must actively work to learn, adapt, and evolve.

The Internet of Things (IoT) is fundamentally the idea of utilising sensor-embedded technologies to capture, analyse, and transmit volumes of data from all types of sources. Modern IoT tracking technology, combined with network-based supply chain traceability, are the key ingredients for tracking and locating suspect ingredients and isolating problems. But before food and beverage manufacturers can achieve complete supply chain transparency, they must first ask some key questions, including which IoT parameters should be collected, where is the data coming from, and how frequently should readings be saved.

Modern asset management systems are designed to integrate with Industry 4.0 technologies, such as smart factories and IoT. Affordable sensors can monitor equipment for signs of performance deficiencies, downtime, or impending maintenance. These sensors can measure anything from temperature and vibration to rotation. As part of an IoT strategy, the data aggregated in enterprise asset management (EAM) systems can detect mechanic deterioration and downtime risk before they become an issue for production.

Combined with alerting technologies, an EAM system can provide manufacturers with warnings when conditions arise that can compromise food safety—such as when the temperature is too low, or the humidity is too high. When utilised effectively, these technologies can not only significantly reduce the risks for contamination, they can also help reduce waste, more reliably safeguard product quality, and contribute toward sustainability initiatives. Some modern EAM systems are also designed to provide specific data points required by certification for the **Global Food Safety Initiative** (GFSI)'s Safe Quality Food (SQF), and British Retail Consortium (BRC) standards.

Building end-to-end supply chain transparency

Creating end-to-end supply chain transparency is a major task. Trying to get there in one giant leap might be biting off more than you can chew. Instead, companies should start by focusing on integrating traceability into internal operations, and then over time look to expand upstream and downstream the supply chain.

Supply chain transparency and traceability should be part of the overall food safety initiative—as opposed to pursuing a traceability endeavor all on its own. This level of commitment increases the odds that a company will not only make forward progress on traceability capabilities, it also demonstrates that the company regards lot traceability as an integral part of food safety. Everyone from the executive level to the factory floor need to be trained and involved.

Supply chain traceability is a first step towards Industry 4.0. Here's how to get started:

1. **A modern, robust ERP system**—To start with, determine what, if any, traceability functionality is already present in your enterprise resource planning (ERP) system. A modern, robust ERP system is likely to have this functionality built in. Ease of use is also critical because the very people who would need it the most—internal quality assurance managers—rarely use the ERP system otherwise, and they must be able to search the database quickly. An easy-to-use interface with a graphic representation of trace lines makes it simple for them to quickly find root causes.
2. **Determine data to track**—Traceability is a full system that combines data collection with unique identifiers for tracking, all of this data can be shared and analysed. Determine how granular the data needs to be. The data can be tracked at a very broad level, such as capturing an individual truck load as a single lot, or at a deeper level, such as recording the day and time that pallets of fresh ingredient shipments arrive. If a manufacturer produces products that are marketed as organic, non-GMO, or free-range, the company might even choose to track ingredients at the farm level.

3. **Agile recall readiness**—Because food safety regulations change frequently, it's important to have the agility to quickly adapt processes. Increasingly, regulations include standards for recall speed, so manufacturers must prove that they can find and withdraw all potentially contaminated food from the supply chain within a specified time, including the identification of where the raw materials and packaging came from, how they have been transformed, how the raw materials were consumed, and where the finished products were shipped.

4. **Be one step ahead**—Even when traceability systems and processes are in place, organisations should not consider their jobs done, and just "wait for trouble." Instead, they should perform recall "fire drills," with employees assigned well-defined roles. This way, should an actual food safety issue happen, organisations will be much better prepared to quickly limit the impact of the recall.

A sustainable food supply depends upon a sound supply chain. Traceability concerns should be extended into the supply chain as food safety and quality issues can be managed more readily if each partner in the supply chain can identify the direct source and direct recipient of traceable items.

Conclusion

The global population is rapidly growing. Ongoing climate change can jeopardise food production. Meanwhile, one third of the world's food is going to waste. Additionally, consumers are demanding more information about the food they purchase. A transformation within the food and beverage supply chain is therefore essential. But change doesn't happen overnight. It happens little by little.

Industry 4.0 technologies provide significant opportunities to the food and beverage industry, including increasing productivity, improving food safety, reducing food and resource waste, and providing full supply chain transparency from farmers to consumers.

Manufacturers are already in Industry 4.0 territory. Supply chain transparency and traceability, asset management, and IoT are building blocks in the vision towards Industry 4.0. This new business paradigm doesn't require an all or nothing approach. Upgrading a single segment of the operation is enough of an evolutionary catalyst to propel manufacturing plants and organisations into a more efficient, sustainable future. From here, the possibilities are limitless.

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