

# FOOD TRACEABILITY



**MOBILE SOLUTIONS FOR THE FOOD SUPPLY CHAIN  
FROM FARM TO TABLE**

# EXECUTIVE SUMMARY



The Food and Drug Administration (FDA) Food Safety Modernization Act (FSMA), signed into law in 2011, is the most sweeping reform of U.S. food safety laws in more than 70 years. The objective is to ensure that the safety of the U.S. food supply is safe by shifting the focus from responding to contamination to preventing it.<sup>1</sup> These standards aim to prevent as well as help reduce the effects of foodborne illnesses, which affect 48 million Americans each year—including 3,000 deaths and 128,000 hospitalizations.<sup>2</sup> Under the FSMA, the FDA has rules, oversight responsibilities and new enforcement authorities for implementing the new food safety system, specifically in the areas of prevention, inspection, compliance and response.

Why is this important? The law significantly impacts the entire food supply chain, which may involve food manufacturers that use domestic and imported ingredients, transportation companies, distribution centers and retail outlets. Evolving business models such as ecommerce can involve an even more complicated delivery system that includes air, rail and trucking, as well as last-mile delivery with bikes, cars and even robots. Without standard safety processes in place, the food supply is at risk. And without visibility into the supply chain from food source to destination, outbreaks of foodborne illnesses will continue, with limited ways to locate the tainted food and hold food manufacturers and their suppliers accountable.

The FSMA has created economic as well as work process demands on manufacturers and their suppliers. These regulatory challenges further compound manufacturers' existing concerns, such as maintaining product quality, lowering costs and meeting the distribution demands of retailers—all while satisfying consumers' evolving tastes and desire to know the source of their food.

## **NEW TECHNOLOGY CAN INCREASE INSIGHT INTO THE SUPPLY CHAIN—FROM FARM TO TABLE—HELPING TO EASE THE REGULATORY COMPLIANCE BURDEN.**

As a result, the law has been implemented in phases. Larger companies had to comply first while smaller companies were given longer periods to conform. Now the deadline for small businesses of less than \$1 million in sales of human food is looming. These businesses have until January 2020 to create and document their food safety procedures.

An important part of the regulations requires the food industry to adopt more reliable, accurate and robust track-and-trace processes upstream and downstream—from sourcing to delivery. Food producers, manufacturers and distributors are looking to technology to help them modernize their operations and create a system that provides accurate data to track food back along the supply chain to the original source.

The FDA is considering, and in some cases testing, technologies such as blockchain-distributed ledgers, Internet of Things (IoT) sensor devices or labels, data analytics, and artificial intelligence. Mobile solutions—ideally using rugged and reliable enterprise-grade mobile devices with automatic identification and data capture (AIDC) systems, such as barcodes, radio-frequency identification (RFID) or IoT sensor technology—are another critical component of a modern track-and-trace system. Mobile-enabled, cloud-based enterprise software solutions can increase insight into the supply chain through all stages of food production—from farm to table.

This paper looks at track-and-trace technology with a focus on the role of mobile solutions.

# A FULLY INTEGRATED, AUTOMATED TRACK- AND-TRACE PROCESS



As food supply chains grow increasingly complex, it becomes more difficult for each element of the supply chain to remain visible to other elements in a single, comprehensible view. An automated track-and-trace process that is fully integrated with the supply chain will address existing business challenges and compliance with the FSMA regulations.

Ideally, an automated track-and-trace solution would contain several key elements:

- Automated data collection using barcodes, RFID technology and IoT devices
- Data aggregation in a cloud-based system to provide supply chain data intelligence
- Integration into existing processes or a redefinition of processes to incorporate track and trace

Many agriculture and manufacturing organizations' data collection methods rely on legacy systems and paper-based processes that typically identify a food source and destination. The industry continues to use these systems due to costs associated with developing and implementing new approaches or reluctance to change standard operating procedures. These legacy processes can contribute to inaccuracies during data transcription and make real-time auditing for compliance or discovery for a recall nearly impossible.

An integrated solution would connect all the dots and create an unbroken digital chain from food origin to destination and points in between.

With the FSMA's compliance requirements, the U.S. food industry can no longer afford to delay modernizing its technology infrastructure. While the individual regulations vary based on product category, nearly every juncture in the food supply

chain—from farms to retailers—must increase and improve record-keeping standards.

Organizations implementing a fully automated track-and-trace process along the supply chain must be prepared to address additional complications introduced by this process.

Automating data collection will increase the volume of available data. This data overload can result in data mining issues in which stakeholders cannot find, analyze or report on relevant data. An automated data management system can help address these problems. However, to be truly effective, it must meet three key requirements:

1. Automated data capture must take place across the food supply chain in a consistent, secure and reliable manner.
2. Data must be processed in real time.
3. Data capture and delivery must be accessible anywhere and under all conditions, from the farm field to the factory floor, distribution center, retailer or corporate boardroom.

These challenges require a robust data management system consisting of data capture hardware such as rugged mobile devices, Wi-Fi and/or mobile broadband connectivity, IoT sensors, and track-and-traceability software built on technologies such as blockchain-distributed ledgers, machine learning and artificial intelligence.

**THE FOOD INDUSTRY SUPPLY  
CHAIN—FROM FARMERS TO  
RETAILERS—MUST BE  
PREPARED TO ADDRESS  
CHALLENGES CREATED BY  
DATA OVERLOAD FROM NEW  
TRACEABILITY SYSTEMS.**

# MOBILE SOLUTIONS ENABLE BETTER TRACEABILITY



Understanding possible solutions can help organizations know how to start. The idea of traceability is better understood when broken down into two parts:

- Track follows a specific product through the supply chain, primarily helping with logistics and inventory management.
- Trace, on the other hand, identifies the origin of a specific product or ingredient. This is essential for product recall and investigation.

Traceability allows organizations to consistently, accurately and quickly identify product origins in order to better manage product integrity. This helps organizations identify areas for process improvement so they can deliver products that are both superior in quality and at a better price point.

The following technologies are currently being used in food tracking and traceability solutions throughout the supply chain.

## Barcodes

Barcode technology is a cost-effective option for FSMA compliance. Barcodes are small, light and inexpensive. They are also widely used, helping to reduce costs for implementation, training and cross-system integration. Barcode scanners can be ergonomically designed, such as angled rear scanners for use at different levels with easier screen viewing that makes the scanner more comfortable to use in the long term. Unlike RFID, barcodes have no privacy implications due to stored data.

One way barcodes enhance food manufacturing is by improving inventory management. Whenever a product is stored, moved or shipped, a barcode scan can record the product information and update the storage location. This provides an accurate snapshot of current inventory data for production and sales. This data can be used to automatically generate manifests during shipment to customers.

Though barcodes provide many benefits, the technology also has its limitations. Barcodes are only static, one-way communication; they can be scanned, but additional information cannot be written into barcodes as they move along the supply chain. Another limitation is that barcodes require a direct line of sight between the code and the scanner. Barcodes must be close to the scanner and scanned individually. This means additional human labor as compared to RFID systems.

## RFID smart tags

RFID reads smart tags or labels via radio waves. The technology provides many advantages for food traceability. The tags can be read from a great distance and do not require a line of sight between themselves and the sensor. Up to 40 RFID tags can be read at once, allowing data to be gathered in bundles rather than one at a time. This delivers a much faster read rate than other approaches. Physical RFID tags are quite rugged and are more reusable than barcodes.

RFID tags can also use read/write technology, making them even more versatile. Information about an object can be stored on its RFID tag, then read



### **Consider the example of a batch of tomatoes contaminated with listeria.**

With manual-based systems, accurately tracking whether the ingredients came from an affected source was difficult and time-consuming. Spreadsheets and other documents would have to be carefully reviewed, and the process could be so time-intensive that tainted ingredients might be on the way to store shelves or consumers' kitchens before it was completed. With traceability solutions, however, information on ingredient sourcing for specific lots can be recorded at the source, stored in the cloud and instantly retrieved from nearly anywhere, enabling food manufacturers to intervene earlier to prevent consumer illness and avert or minimize the cost and bad publicity of a recall.

# MOBILE SOLUTIONS ENABLE BETTER TRACEABILITY



later by a different user. Data can also be encrypted or erased as needed for added security. For example, RFID tags could be used with pallets to track shipments of foodstuffs. Adding data about the ingredients' source could be written to the RFID tag, thus enabling specific pallets to be easily located in case of recall. Because data about ingredients is tracked along the entire supply chain, only affected shipments would need recalling. This insight helps significantly minimize the total cost of recalls and can even eliminate the need to pull unaffected products from store shelves.

Reading RFID tags requires minimal human participation, resulting in less error and more real-time reporting. However, liquid or metal between the RFID tags and the reader can weaken the signal (such as in very moist environments), making accurate readings difficult in these scenarios. An RFID system is also more expensive than some other solutions.

## Internet of Things

The IoT can provide real-time monitoring and tracking capabilities, improving accuracy and scale. Sensors can monitor environmental variables such as temperature, moisture and gas levels that affect freshness, quality and safety of perishable foods. For example, a truck full of fruit can be monitored for temperature, light and humidity, and conditions that fall outside of the desired standard are recorded and alerts can be sent. This enables better food supply management and has been shown to reduce food waste. Ingredient sourcing, manufacturing and final delivery to retailers can all provide IoT data and create a real-time, holistic view of manufacturing operations.

The food industry is rapidly adopting IoT track-and-trace solutions. According to Allied Market Research, traceability technology sales are on pace to exceed \$22 billion by 2025, with annual growth of nearly 9.3% from 2018 to 2025.<sup>3</sup>

## Blockchain ledgers

Blockchain's distributed ledger format provides a secure way to document transactions along the supply chain. Anyone involved in the supply chain can access detailed information on food origin, process, packing, delivery and storage conditions, and ingredients. Even customers can access this information by scanning QR codes or labels. Walmart has experimented with blockchain via the IBM Food Trust network and found that the amount of time to trace a food item from store to farm was reduced from seven days using the legacy system to only 2.2 seconds.<sup>4</sup> Combined with IoT solutions, blockchain ledgers enable supply chain stakeholders to gather information from multiple sources accurately and at scale with a detailed electronic ledger of supply chain transactions.

## Artificial intelligence

The FDA is currently piloting the use of artificial intelligence (AI) to improve the inspection process for food imports. Using machine learning and predictive analytics, the FDA hopes to identify the greatest risk of contamination for consumers. Companies from every sector of the food industry, including perishable foods, dairy and dry foods, are using AI to improve quality assurance, provide better forecasting and keep up with consumer tastes. For example, one in three grocers reports using AI capabilities in its supply chain,<sup>5</sup> enabling better planning for where and when to send inventory based on remaining freshness. With this level of visibility into the food supply chain, retailers can streamline inventory management and significantly reduce spoilage and waste, often considered an insolvable cost of doing business. Combined with IoT sensors that can accurately measure the condition of items, AI can accurately measure shelf life for better supply chain management.

# MOBILE SOLUTIONS ENABLE BETTER TRACEABILITY



## Rugged mobile devices

Food manufacturing and supply chain activities take place in harsh environments—on the farm, at a processing plant, in cold chain warehouses and distribution centers, and at the store. Consumer-grade mobile devices do not stand up well in these work locations or conditions. Rugged mobile devices are purpose-built to withstand a variety of harsh environmental conditions, including temperature extremes, humidity, inclement weather, dirt, sand, vibrations and accidental drops.

### On the farm

Agricultural field workers need devices with weather-resistant screens visible in bright sunlight, long battery life, locking controls, reliable network connectivity and the ability to handle dirt, dust and grime. The devices also need security features to prevent accidental or intentional data loss.

By deploying rugged devices based on enterprise versions of the familiar Android® or Windows® operating systems, farm workers can gather FSMA-compliant data with minimal training. Devices with HazLoc certification can be used in agricultural operations where hazardous conditions are present. For example, the environment in and around grain silos is highly flammable because of the fine particles that are in the air. Having rugged mobile devices that conform to iSafe/ANSI standards provides a level of protection from sparking or electromagnetic discharge that could cause an explosive event.

### At the plant

Manufacturing plants also need durable mobile devices purpose-built for line workers, operation managers and other shop floor employees. In these environments, fully rugged tablets and handhelds, especially those with long battery life and low failure rates, can significantly reduce costly downtime and boost efficiency. In addition, food manufacturers often need to consider sanitization requirements when selecting mobile devices. For example, a

facility that produces products with and without nut ingredients needs to be extremely diligent in sanitizing the production lines as workers switch from one product to the next. Cross-contamination issues create potentially life-threatening allergic consequences for the consumer. Because this maintenance process typically involves hot water and/or additional chemicals for wipe down, devices must be able to survive repeated exposure to water and chemicals.

### In the warehouse

In shipping-and-receiving or distribution centers, workers need real-time access to critical inventory and location information. From receiving to storing, order picking and shipping activities, rugged handheld devices with an angled rear barcode reader can help streamline warehouse operations. In addition, forklift operators can use rugged tablets or handhelds that can be easily detached so they can use a single device whether they are on or off the truck.

### At the store

Responding to a recall notice quickly is critical for food retailers. Not only do they need to determine whether affected shipments arrived in their stores, but they need to compare what is left on the shelf with what has already been sold. Using rugged handheld devices, food retailers can quickly scan existing stock and learn how many of the affected items are in the hands of consumers. Individual recalled food items can be identified in a matter of moments, even if they are intermingled with non-affected items. This reduces the potential risk to consumers during a recall.

## RUGGED AND VERSATILE

Panasonic offers a broad portfolio of rugged mobile devices, including laptops, 2-in-1s, tablets and handhelds. We work closely with our food industry customers to help them plan and deploy the right solution for the job and supply chain environment.



## THE BENEFITS OF MOBILE DEVICES FOR FOOD MANUFACTURERS

The right mobile solution using purpose-built rugged laptops, tablets and handhelds offers food manufacturers several benefits:

- 1. Production costs decrease and operational efficiencies improve by automating data-collection processes.** Data collected from barcode and RFID technologies can be automatically used to inform supply decisions, thereby decreasing delays due to sourced material shortage. This real-time information allows food manufacturers to optimize existing processes and maximize resource allocation.
- 2. Using track-and-trace technologies improves safety and quality control.** Good traceability systems minimize the production of unsafe or poor-quality food products, helping to protect the public and improve quality and compliance for manufacturers. The systems also help maintain food authenticity by verifying ingredient sourcing.
- 3. Customer satisfaction improves thanks to faster, more efficient recall management.** With track-and-trace technology, the exact source of affected ingredients can be traced during recalls, improving recall accuracy and timeliness, reducing costs, and helping to preserve brand reputation. According to the Grocery Manufacturers Association, an average recall costs \$10 million, and takes 14 days to identify and 34 days to enact. By the time product recalls are enacted, only 40% of affected products can be collected.<sup>6</sup> Enacting recalls more quickly enables an organization to improve the public perception of the brand's responsibility and removes more affected product from circulation, reducing the risk of foodborne illness.

Combining traceability technologies with rugged, purpose-built mobile devices enables companies to have the exact hardware for their specific production processes, improving operations and minimizing downtime, as well as benefitting the entire food supply chain—from farm to table.

# PANASONIC MOBILE SOLUTIONS FOR FOOD TRACEABILITY

Specializing in purpose-built devices for manufacturing and supply chain businesses, Panasonic delivers solutions in a variety of easy-to-use form factors, including laptops, 2-in-1s, tablets and handheld devices.

Whether employees collect data from a remote field or a distribution center, the reliable performance of Panasonic TOUGHBOOK® devices is unmatched. Panasonic leads the industry for reliability with a failure rate of 2.5%. That

means our devices are more than five times more reliable than the average laptop used by businesses across the United States, lasting longer and contributing to a low total cost of ownership. Panasonic TOUGHBOOK computers, tablets and handheld devices remain functional and connected in the harshest environments, including extreme weather, hostile field conditions and proximity to heavy machinery and equipment.

**For more information on how Panasonic TOUGHBOOK mobile solutions benefit all types of businesses along the food supply chain, speak to one of our experts.**

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