



Improving the safety of the food supply chain: The value of RFID and traceability on a growing problem





THE BENEFITS OF RFID IN THE FOOD CHAIN

RFID provides highly accurate data by automating data capture, improving the safety as well as the efficiency of the food chain.

Food safety benefits:

- Real-time visibility into product condition during temperature-sensitive transportation
- Reduced opportunity for spoilage, contamination and foodborne illnesses
- Real-time track and trace for cost-effective and accurate creation of electronic pedigrees
- More narrow — and more successful — recalls from on-tag sourcing identification

Supply chain benefits:

- Increased productivity — workers no longer need to manually write information on paper forms
- Reduced shrinkage due to the increase in supply chain efficiency
- Cost-effective regulatory compliance through automated data capture
- Brand protection and liability reduction through a reduction in scope of spoilage and contamination incidents



In Food Marketing Institute's U.S. Grocery Shopper Trends, 2007 report, consumers that are 'completely confident' or 'somewhat confident' in the safety of food on supermarket shelves declined from 88 percent in 2006 to 66 percent in 2007 — the lowest point since 1989.⁴

Keeping food safe: a growing global challenge

Keeping food safe as it moves through the supply chain is a significant challenge. Perishables such as produce, meat, fish, milk and more can change hands ten to twenty times before reaching the consumer. This fact alone presents many opportunities along the supply chain for accidental or malicious mishandling that can lead to contamination or spoilage. And a host of new issues and trends, from the globalization of the supply chain to the type of foods that are imported, takes the challenge of protecting the safety of the food in the supply chain to new heights.

Increasing globalization of the food supply chain

The growth in the globalization of the food supply chain also has a major impact on the ability to protect consumer health. According to the CDC, food imports to the United States have almost doubled in the past decade, from \$36 billion in 1997 to more than \$70 billion in 2007.² In response to consumer demand for year-round access to out-of-season and exotic produce, 60 percent of all fresh fruits and vegetables are now imported from over 150 countries all over the world,¹ including kiwi from New Zealand, apples from Canada, strawberries from Mexico and grapes from Chili.

Additionally, the type of food imported is changing. In the past, imported products were primarily food ingredients that were then processed into various types of food inside the U.S. borders. Since the actual processing took place in the U.S., FDA regulations provided maximum protection for consumer health. But today, many food items that are imported are 'ready-to-eat', from fruits and vegetables to seafood, further increasing the opportunity for foodborne illness to enter the food supply chain. For example, in 1980 less than half of the total seafood consumed was imported— today that number has increased to over 75 percent.¹ And

since the regulatory systems of the many countries of origin differ significantly, the safety regulations that determine how imported foods are handled vary widely.

Sharp increase in contamination incidents

While enterprises struggle to improve safety as food moves through the supply chain, the incidence of food contamination is on the rise. Recently, major contamination outbreaks included peanut butter, spinach, tomatoes and lettuce. The U.S. Center for Disease Control estimates that approximately 76 million illnesses per year are caused by foodborne illnesses, and reports E. coli infections have increased 50 percent since 2004, while Vibrio infections (caused by ingesting raw shellfish) have increased by a colossal 78 percent in the last ten years.³

As a result, consumer confidence in the safety of food at the local grocery store is shaken. In Food Marketing Institute's U.S. Grocery Shopper Trends, 2007 report, consumers that are 'completely confident' or 'somewhat confident' in the safety of food on supermarket shelves declined from 88 percent in 2006 to 66 percent in 2007 — the lowest point since 1989.⁴

And a single contamination incident can cause financial devastation throughout the food supply chain, affecting growers, distributors and stores. The recent outbreak of salmonella in tomatoes is estimated to have cost the industry \$500 million dollars.⁷ The recent spinach contamination incident generated estimated losses of \$50 million to \$100 million for growers, processors, restaurants and grocers — provided the source of the contamination was identified and contained within a month.⁵ For some companies in the supply chain, the losses are too great to survive. AP Military Group, a small produce broker in Brevard County, FL was forced into bankruptcy. This chief supplier of bagged spinach for the U.S. military filed for bankruptcy, stating a 50 percent decline in revenue following the FDA spinach advisory.⁶

Changes in consumption trends

Today's busy consumers often rank convenience over price — a trend that can translate into increased opportunities for food contamination. For example, many consumers today would prefer to purchase a bag of prepared ready-to-eat lettuce instead of a head of lettuce that must be prepared. As a result, bacteria in a tainted head of lettuce that may have only affected one family in the past might now end up in multiple of bags of lettuce, potentially causing foodborne illness in hundreds of people.

Another challenge in the food chain: increased government regulations

In response to growing food safety issues, new government regulations have been developed to help protect food as it travels through the supply chain. While these regulations do improve consumer safety, they also translate into a substantial increase in recordkeeping requirements for companies throughout the food supply chain.

For example, federal regulations in the U.S. such as The Federal Public Health Security and Bioterrorism Preparedness and Response Act of 2002 (enacted after September 11, 2001) and the U.S. FDA Good Manufacturing Practice Regulations as well as the EU food laws defined by the European Commission (EC) now require the collection and maintenance of detailed specific information as food moves through the supply chain. In order to remain profitable, enterprises in the food industry need to accurately and cost-effectively collect, filter and react to this massive amount of information — a task at which RFID excels.

RFID — a critical new link in the food supply chain

RFID can help improve the efficiency and safety of the food supply chain by enabling the collection of the vast amount of data required to ensure the safety of food as it moves through either the national or international food supply chain. Passive RFID tags provide cost-effective tracking and traceability as food moves through the supply chain, while temperature-sensing and data logging RFID tags capture information about the conditions the food is subjected to on the journey from field to fork.

The heavy automation afforded by RFID can also error-proof the information collection process, providing the granular and accurate information needed to make the right decisions at the right time to ensure the safe handling of food — and to help spot potential spoilage or tampering incidents before food reaches the grocery store shelves. And in the event a recall is necessary, the serialized data associated with the product and its movement through the supply chain enables more narrow recalls. Potentially tainted batches can be rapidly located and removed from shelves, minimizing health risks. In addition, the ability to execute narrow recalls eliminates the need to pull unaffected food from the shelves, reducing the massive costs associated with broader recalls.

In the following pages, we examine how RFID can ultimately improve the quality and safety of food throughout the many processes involved in bringing perishable items to the retail grocery store shelves.

RFID and produce: from harvest to market

Without RFID, tracking produce starts with paper and pen in the fields, where workers complete forms in order to collect minimally required data. This information is eventually entered into a computer. Issues with this process include the increased opportunity for error:

- The data is touched twice (captured manually on paper and then keyed into the computer), further compounded by the need to transcribe handwriting
- The lag times between when product is picked, when data is collected and transcribed, and when it is visible hampers the ability to make better business decisions that can protect food safety and extend produce shelf life

And as produce continues its trip through the supply chain from the processing plant to the distributor to the market, the lack of real-time visibility continues to hamper decision making that could improve food safety — and profitability.

RFID completely eliminates the need for paper and pen. In the field, instead of completing a paper-based form, workers simply apply an RFID tag to the collection bin. After the bin is full, an RFID-enabled mobile computer is utilized to read the tag, automating and accurately capturing the unique identifier associated with the bin. The date



With RFID, food is tracked from the moment it is picked in the field. RFID tags are applied to collection bins, and when a bin is full, an RFID-enabled mobile computer is utilized to read the tag. The unique identifier associated with the bin is captured the date and time are automatically recorded, and any other additional information needed to enable full traceability back to the origin of the product is entered, such as the picker's name and the picking location. The automation of the data collection process protects the integrity of the data set, and encourages the capture of a richer set of information due to the simplicity of data input. And when combined with a locationing technology such as GPS, RFID can automatically record the exact location in the field where the produce was picked, allowing growers to pinpoint the source of contaminated produce quickly and more cost-effectively — protecting the health of consumers as well as the business.

and time are automatically recorded and additional information to enable full traceability back to the origin of the product is entered, such as the picker's name and the picking location. Drop down menus and an intuitive interface can simplify and automate the data collection process, protect the integrity of the data set, and encourage the capture of a richer set of information due to the simplicity of data input.

A locationing technology such as GPS can also be combined with RFID to automatically record the exact location in the field where the produce was picked, further automating the data collection process. In the event tainted product is discovered, growers can pinpoint the area where the contaminated produce was harvested. Armed with this information, growers can immediately begin to analyze the soil, water and more in the specific area where the offending produce was grown. As a result, the problem can be isolated and contained faster and more cost-effectively — helping to minimize the potential number of consumers that could be affected.

After the produce is picked and the bin logged into the system, the produce is trucked to the processing plant for immediate cooling. As the bins are unloaded, RFID reader portals on the dock automatically capture the information on the RFID tags, further reducing manual labor and associated

logging errors. RFID also enables the analysis of a richer set of metrics, enabling better decision making upon arrival at the first stop in the produce supply chain — the processing plant receiving dock. Instead of processing bins as they are received (first in, first out), bins can be processed based on pick time (earliest pick time, first processed). Since every hour of delay in cooling significantly decreases shelf life, this capability helps reduce the opportunity for spoilage as the produce makes its way through the distribution channel to the grocer shelves. And in the event that the length of time the produce took to travel from field to the processing plant exceeds acceptable limits (if, for example, the truck broke down), the system can automatically record the exception and reject the bin, preventing unsuitable produce from continuing down the supply chain.

After initial processing has been completed, the pallets of produce are then placed in cold storage to await shipment. When selected for shipment, an RFID reader at the shipping dock automatically captures the information on the RFID tags on every box, confirming that the correct product has been selected and logs each case ID to create an Advanced Shipping Notice (ASN), to alert the next processing point that product is on its way. The pallets are then loaded onto trucks, continuing their journey to distributors. On the path to the grocer's

shelf, RFID readers at docks and other transition points capture the final product movements and append additional transit data to the records of each case. As a result, when boxes reach the grocer, a quick scan of the RFID tag on any box or pallet can instantly reveal the complete history for that particular batch of produce — all the way back to the exact location in the field where the product was grown, and which worker picked the product.

EPC Gen 2, Class 3 RFID temperature sensor tags will soon add a major new functionality that will significantly improve the safety of the food supply chain. These sensor tags will monitor and record the temperature, and other environmental conditions, of the individual pallets while they are in the truck en route to a distributor or grocer. Any pallet that strays out of a defined temperature range can generate an alarm to alert the truck driver, who can then take immediate action to ensure that all pallets in the load remain in compliance with acceptable temperature ranges. In addition, the temperature information can be recorded — and either sent wirelessly to the appropriate business system or accessed when the truck arrives at its next destination. The result is instant visibility into the conditions of the load during transit, immediately upon arrival at the dock — something that is not possible today.

This visibility allows recipients to determine if the load was properly handled and should be accepted or refused. In other cases, temperatures may have been acceptable during transit, but still outside ideal temperature ranges — a situation that can significantly reduce shelf life. Instant visibility into this condition upon shipment arrival provides distributors and grocers alike with the information needed to make the best decision: refuse the shipment or re-negotiate the acceptance terms. Since grocers are aware of the reduced shelf life, they can act accordingly and place the item on sale to prevent shrinkage due to spoilage. And finally, access to this granular temperature data during ‘end-to-end’ transit can provide the basis for important analytical information that can pinpoint the location of any consistent ‘trouble’ spots in the supply chain. Enterprises can then proactively take the necessary steps to help prevent spoilage, foodborne illness and shrinkage.

RFID and seafood: from net to market

RFID tags can enable the easy tracing of any contaminated seafood anywhere in the food supply chain. For example, when a load of raw shrimp arrives at the dock, RFID tags can be applied to the

holding bins. That identifier can then remain with the shrimp, whether they are bound for market ‘as is’ or whether they become an ingredient in processed foods, such as frozen fried shrimp or shrimp stuffed fish fillets. In the event a compromised batch of shrimp is discovered, the shrimp and any products containing the shrimp can be located and removed from the supply chain rapidly — regardless of whether the products are located in a manufacturing plant, in a distribution warehouse or in the freezer section at the grocery store.

In addition, temperature sensing tags will play the same role as in produce, ensuring that this highly perishable product remained within safe temperature ranges throughout transit to distributors and grocers — again protecting consumer health and reducing spoilage.

The RFID advantage: improving food safety — and supply chain efficiency

In the food supply chain, consumer safety and enterprise profitability are both dependent upon how rapidly product can move from the field, pasture and sea to the grocer’s shelves — as well as visibility into how the product was handled along the way. RFID improves both.

Food safety improvements

Superior visibility into the movement of products through the supply chain provides the real time granular data required to make better business decisions that increase the safety of the food supply at every junction in the supply chain:

- Visibility into harvest times and product temperature condition enables FEFO (First to Expire, First Out) inventory management’, helping product move more rapidly from field to fork as well as reducing the opportunity for spoilage, foodborne illness and loss of product.
- Distributors and grocers now have visibility into the length of time a product has been traveling through the supply chain, condition during transit and remaining shelf life. More volatile perishables can be processed first, accuracy of “Best By” date stamps is increased; and distributors and grocers can recognize and refuse any product where quality may have been compromised — again improving food safety and quality.

The U.S. Center for Disease Control estimates that approximately 76 million illnesses per year are caused by foodborne illnesses, and reports E. coli infections have increased 50 percent since 2004, while Vibrio infections (caused by ingesting raw shellfish) have increased by a colossal 78 percent in the last ten years.³

- Visibility into the whereabouts of contaminated product enables manufacturers, distributors and local grocers to issue more narrow recalls — recalls that are focused on the specific lots that are potentially tainted rather than a broad recall of a specific class of item. As a result, tainted food can be quickly identified and removed regardless of where it may be in the supply chain, reducing the opportunity for inadvertent consumption and the resulting food-related illnesses — and improving the success rate of recalls.
- More reliable data — The ability to automatically collect data by reading an RFID tag helps to error proof data collection. And the improved accuracy of the data in your system helps increase product safety.
- Brand protection — RFID can help enterprises in the food supply chain prevent brand damage by providing the information needed to instantly spot and contain incidents before they can impact sales and brand value. The impact of outbreaks and the effect on the food industry as a whole cannot be underestimated. In response to recent recalls, 38 percent of consumers stopped buying certain food products in 2007 — a 400 percent increase over the 9 percent in 2006. Of the 38 percent: 71 percent avoided spinach, 16 percent avoided lettuce, 9 percent avoided bagged salads and 8 percent avoided beef.³ RFID can help enterprises prevent and mitigate incidents, reducing the potential negative impact on brand equity and sales.

Supply chain efficiency improvements

The same information that helps protect food as it moves through the supply chain also increases the efficiency of the supply chain, protecting profitability through:

- Loss protection — The ability to move perishables through the supply chain as quickly as possible helps maximize product shelf life – and prevent shrink due to spoilage.
- Productivity improvements — The automated data capture eliminates the need for workers to capture information on paper forms, which in turn increases throughput — existing staff can now process more product per day.
- Substantial reduction in the cost of recalls — Real-time visibility into the exact whereabouts of any contaminated product enables a targeted recall effort that can be executed at a fraction of the time and cost associated with a traditional widespread recall.
- Cost-effective regulatory compliance — Complying with new government regulations can be a costly endeavor. Through automated collection of regulatory data and more, RFID enables businesses to easily comply with new regulations without a substantial impact on margins.

- Reduction in liability — The ability to rapidly identify and remove potentially tainted food items from the supply chain minimizes the opportunity for foodborne illness — and the associated liabilities.

Summary

Protecting today's food supply chain has become evermore critical — but evermore difficult due to an increasingly complex and global supply chain. Countries all around the world must determine how to monitor the food supply chain for accidental contamination and purposeful bioterrorism, as well as validate that product was handled safely from initial processing to receipt, regardless of the country of origination.

Achieving this level of visibility will require the collection of a massive amount of data — including the collection of customized data for specific food verticals such as produce, seafood and cattle. RFID's powerful and flexible automated data collection capabilities make the compilation of this data set financially feasible. Powerful data filtering capabilities can ensure the instant delivery of information to the right business systems, enabling real-time alarms for timely reaction to potential safety threats. With real-time visibility into concrete proof of product authenticity and handling procedures, enterprises

are armed with the information needed to improve the safety of the food on our shelves — and to protect the health of our citizens. That same information can also be leveraged to improve overall operational efficiencies to protect brand equity, margins and profitability.

To find out how you can leverage Motorola's RFID solutions to improve food safety and supply chain efficiency, please visit us on the web at www.motorola.com/rfid, or access our global contact directory at www.motorola.com/enterprisemobility/contactus

About Motorola's Enterprise Mobility Solutions

Motorola offers true end-to-end mobility solutions that include: a comprehensive portfolio of mobile devices with extensive wireless communications

capabilities; affiliations with the leading wireless public network providers; comprehensive RFID infrastructure, including fixed, mobile and handheld RFID readers; a portfolio of private wide area and local area network infrastructure; management solutions that provide granular and centralized control over your entire enterprise mobility solution — including the mobile devices and the wireless network infrastructure; a partner channel delivering best-in-class applications; and a complete range of pre- and post-deployment services to help get and keep mobility solutions up and running at peak performance. And as an industry leader, you can count on proven industry expertise through proven customer success stories throughout the globe, all built on proven technology.

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