



Item-level RFID Tagging and the Intelligent Apparel Supply Chain

Overview

This paper provides an overview of item-level radio frequency identification (RFID) tagging in the apparel supply chain. It explains the evolution of RFID technology and details key benefits when utilized by retailers, distribution and logistics providers, and manufacturers. When used throughout the apparel supply chain, item-level RFID provides an intelligence-rich environment that enables businesses to better transport goods, predict demand, efficiently promote stock, avoid write-downs and markdowns, and ultimately drive revenue and profit margins.

Introduction

The amount of apparel imports brought into the U.S. has increased significantly over the past few decades and now exceeds \$100 billion annually. The growth is a result of clothing manufacturing moving from industrialized countries to developing ones. This increasing trend introduces new challenges in logistics, asset protection, demand forecasting, and supply chain inventory visibility.

A key tool emerging with this significant trend in the apparel supply chain is RFID. RFID is an inventory tracking technology that provides superior inventory intelligence that can be used to improve business processes throughout every link in the supply chain.

RFID tagging provides visibility of product movement, streamlines distribution, improves demand forecasting, and makes manufacturing more responsive. Some of the greatest advantages of RFID have been demonstrated in item-level deployments at apparel retail stores. Item-level tagging, where small non-descript RFID tags are typically embedded in existing apparel hang tags, are helping solve retailers' challenges including out-of-stock levels, inventory accuracy, and helping customers quickly and easily find the size, style and color they are looking for.

Similar benefits can be derived in other links of the apparel supply chain with item-level tagging. For example, a manufacturer might choose to focus its RFID efforts first on improving raw materials management to better meet demand forecasts.

After achieving its primary goals, the manufacturer can then reap additional benefits in areas such as loss prevention, shipping logistics, and managing work in progress.

Item-level RFID can be deployed in a targeted manner, and almost immediately begin delivering meaningful, tangible benefits due to the efficiency, accuracy and automation it provides. When utilized by each constituent in the supply chain, benefits of item-level tagging are magnified as the intelligence derived from every partner can be leveraged to improve processes, reduce costs, and increase profit margins.

Businesses have found item-level RFID tagging has improved inventory accuracy to 98 to 99.9 percent accuracy rates, and apparel retailers have increased sales anywhere from 4 to 21 percent using item-level RFID tagging.¹

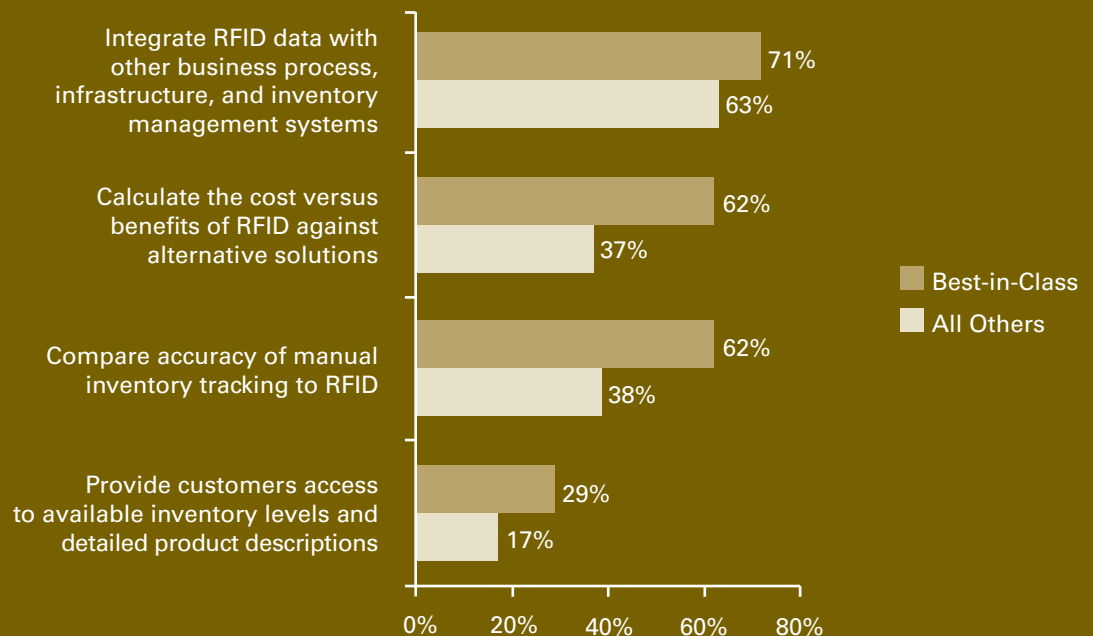
The Evolution of Item-level RFID Tagging

RFID has experienced significant advances over the past decade. In recent years, lower cost of ownership, improved reader form factors, greater global standardization, innovations in passive ultra high frequency (UHF) tags, and implementations with a proven return on investment (ROI) are all furthering RFID interest and adoption.

In fact, Aberdeen's 2010 Report, *Item-Level RFID Tagging in Retail*, noted best-in-class enterprises are using item-level RFID to optimize business performance: "Through integration, cost/benefit analysis, and performance measurement, the best-in-class were able to deliver better information and higher-quality customer service, make their employees more productive, and conduct more successful in-store campaigns."

And, those best-in-class companies are increasingly pursuing item-level RFID tagging to achieve these and other business goals. When implemented with a targeted approach, businesses within the apparel supply chain can improve their operations and realize a positive ROI.

Strategic Actions Leading to Best-in-class Performance



Source: Aberdeen Group, June 2010

RFID Standards

Today, most businesses are able to smoothly integrate RFID technology into existing operations. Standards for usage have been developed and significantly matured, and regulations have been implemented to support interoperability for tags, reader interfaces, and the exchange of RFID-related data between trading partners.

From Case- and Pallet- to Item-level Tagging

Historically, the intended first stage use of RFID within the supply chain was to automate the identification and tracking of cases and pallets. Case- and pallet-level tagging was found to improve product movement visibility, streamline distribution, and aid in forecasting. Item-level tagging also began to be adopted – in many instances without

the (assumed) prerequisite case- and pallet-level tagging – by many apparel retailers and is proving to be a success. Retailers including American Apparel, Bloomingdale's, Jones Apparel Group, Falabella, Marks & Spencer, Macy's and others are actively implementing item-level RFID solutions.

Item-level Tagging throughout the Apparel Supply Chain

Item-level RFID adoption represents perhaps one of the greatest near-term opportunities for businesses to improve operations throughout the supply chain. With many recently documented and achievable use cases, item-level RFID tagging has become widely viewed as a key competitive advantage and business differentiator.

Item-level tagging provides significantly greater visibility within the supply chain due to its ability to track and trace, at a granular level, products from production through sales. Item-level tagging is able to extend visibility deeper and provide more actionable intelligence throughout the supply chain. It can virtually eliminate shortages and associated charge-backs, and shipping and stocking errors.

Item-level RFID tagging occurs when an RFID tag is placed on each individual item at a determined point in the supply chain. The earlier in the supply chain an item is tagged indicates an intent for increased and additional tracking and visibility capabilities. Item-level tagging can be used in conjunction with new or existing case- and pallet-level tagging operations. The item-level tags can then be associated with the case and pallet tags to provide a heightened level of checks and balances, ensuring that every item in every lot or pallet is what and where it needs to be.

The technology has shown it can increase sales and reduce labor costs. It also significantly aids in asset protection and counterfeiting. The intelligence it provides can greatly benefit every business within the supply chain as they search for ways to be more efficient, run a leaner operation, grow revenue, and expand profit margins.

Item-level Tagging in Retail

Item-level RFID provides a key missing ingredient to in-store intelligence. When used with complementary technologies such as bar code scanning and payment terminals, inventory management systems, loss prevention, and people counting, it enables improved decision making. Using the collective information from these systems allows for improvements in many key retail operations that create efficiency and improve margins. Data from Motorola and partner implementations show that item-level RFID deployments can increase sales between 4 and 20 percent.

Proven Business Benefits	
Reduction in OOS by	60% to 80%
Better Inventory Accuracy	Between 98% & 99.9%
Reduction in Cycle Count Time	75% to 92%
Reduced Inventory Carrying Costs	30% to 59%
Reduced Receiving Time	Up to 91%
Improved Conversion Rate	Up to 92%
Increase Units/Transaction and \$/Transaction	19%, 6%
Increase Sales	From 4% to 21%

Source: Data from Motorola and Motorola partner implementations

Benefits of Item-level Tagging in Retail Store	
Improved Inventory Accuracy	With more accurate and frequent counts, retailers can quickly identify replenishment needs, misplaced items and out-of-stocks. It can also improve search and location capabilities and ensure plan-o-gram compliance. Studies have shown inventory accuracy improves to 98 to 99.9 percent. ¹
Reduced Inventory Management Labor	Apparel and footwear retailers report inventory labor reductions of 75 to 92 percent. In tests, only 200 items were counted per hour via a manual process, while 5,000 items were counted on average per hour via a handheld RFID process. ² In addition, research shows inventory receiving time is improved by up to 91 percent. ¹
Reduced Out-of-stocks	Retail apparel companies can increase revenues while decreasing out-of-stocks. On average, eight percent of items in retail stores are out of stock. In 2004, studies reported the top 100 retailers lose approximately \$69 billion due to out-of-stocks. Out-of-stocks can be reduced by 60 to 80 percent with item-level RFID. ¹
Just-in-time Replenishment	Retailers can implement leaner operating procedures. With significantly more accurate stock counts, just-in-time replenishment becomes possible.
Transition/Impact Door	RFID enables a significantly improved stock flow between the stockroom and sales floor. Studies show that 25 to 40 percent of retail out-of-stock merchandise was in the stockroom or fitting room and not replenished in a timely manner. ¹
Efficient Returns Management	After-sales activities such as returns and warranty issues are handled more rapidly, without receipts, and provide a lifelong proof-of-sale.
Reduced Inventory Carrying Costs	Because RFID enables an easier, faster and more accurate way to conduct inventory counts, more frequent inventory counts become possible so retailers are able to maintain leaner inventory levels and reduce the associated carrying costs by 30 to 59 percent. ¹
Improved Customer Service	Two major causes of customer dissatisfaction are items being out of stock and not being able to locate an item. In a survey conducted by Kurt Salmon and Associates, less than 30 percent of all shoppers find and buy items for which they had a clear need and want. And 49 percent of respondents are not willing to spend more than 10 minutes looking for a specific item.
Faster Checkout	With RFID-enabled point-of-sale terminals, retailers can have faster and more efficient customer checkout processes, shortening wait times and initiating auto-replenishment activities.
Information-rich Shopping Experience	By improving product visibility and automating manual inventory, retailers are able to improve the shopping experience and increase sales. One customer-facing application is interactive shopping. RFID-enabled mirrors and kiosks that identify items and instantly display information about each piece of attire and may even be used to cross-sell and up-sell to complement the item. Item-level RFID has shown an increased sale of items per transaction by as much as 19 percent and an increase in the amount of transaction by as much as 6 percent. ¹
Enhanced Loss Prevention	Item-level RFID can be leveraged as an electronic article surveillance (EAS) tool by identifying the exact item moving through a read point, allowing timely identification of shrinkage. RFID provides detailed information about particular items, not just that something passed the threshold.

Item-level RFID Tagging in the Retail Store

FITTING ROOMS

for Left Behind and Exception Items

RFID-enabled dressing rooms augment customer service by enabling cross/up selling; automated physical attendance and item tracking; loss prevention; and the collection of valuable merchandising metrics to aid in merchandise recovery and restocking.

RECEIVING

for Inventory Accuracy

Receiving verifies shipments, providing visibility to newly received items or outgoing transfers for real-time on-hand inventory accuracy.

Commissioning areas identify items received as direct store shipments or customer returns, associating items with RFID tags if necessary.

SALES FLOOR

for Accurate Floor Inventory

Continuous real-time inventory via ubiquitous RFID read points reach beyond “smart fixtures” to provide real-time inventory visibility for accurate ‘on-hand’ information — eliminates stock-outs, enables location of misplaced items, and identifies merchandise that requires replenishment, complete with exact shelf location.

At-will cycle counting augments traditional annual physical inventory and easily ensures accuracy with reduced labor.

POS

for Inventory Decrement,
Automatic Replenishment

Checkout RFID reads decrement inventory at time of sale, tying into backroom/back office inventory systems for replenishment, restocking, return or warranty, and loss prevention.

Exit/employee door reads provide unique granular detail of items leaving the store to enhance merchandising and loss prevention initiatives.

FRONT/BACKROOM TRANSITION POINTS

for Inventory Locationing

Selling floor/backroom impact doors track product movement between selling floor and stock area, providing inventory visibility between cycle counts for restocking, replenishment and product location for customer service and increased sales.

Counterfeit Protection and Intelligent EAS

Advances in RFID technology have made it a strategic tool in thwarting the counterfeit apparel market and in advancing the concept of retail electronic article surveillance (EAS) systems. Item-level tagging provides a level of intelligence that has never existed with traditional EAS. With RFID as EAS, businesses can track and authenticate products from cradle to grave, and save considerable costs due to shrinkage and illegal activities.

Counterfeit Protection

Estimates have shown that counterfeit fashion apparel alone may cost designers more than \$10 billion annually.³ Typically, counterfeit items enter the supply chain at the manufacturer or distributor.

In order to protect apparel brands, item-level RFID has emerged as an ideal solution. “When source tagged at the item-level you can prove an item’s legitimacy,” said Jim Burger, founder and innovating principal, Burger Consulting. “The increased visibility provided is the important thing. It allows for better track-and-trace capabilities at every link of the supply chain.”

Counterfeit items tarnish a brand-owner’s image of exclusivity. If counterfeit items are detected, item-level tagging provides the necessary intelligence to identify where items were introduced so supply chain partners can take immediate action to protect the brand, their businesses and bottom line.

Intelligent EAS

Passive UHF RFID technology is driving some retailers to consider item-level RFID as an EAS replacement technology. Passive RFID tags continue to become less expensive, and integrated with item-level RFID, do not require the additional labor costs needed by traditional EAS systems.

“Retailers not using item-level RFID take physical inventories every six to 12 months,” said Burger. “When they do that they are looking into the past. With RFID, they have a real-time view of inventory levels. RFID enables daily counts that provide them with timely, actionable intelligence.”

Traditional EAS systems will inform retailers how many times they went off, but they do not tell them what left the store. With RFID, retailers know exactly what was stolen and what needs to be replenished.

Once deployed for greater inventory and supply chain intelligence, the next step for item-level tagging is to utilize it for intelligent EAS.

“It’s usually the best-selling items that get stolen. It’s essentially like guaranteed sales walking out the door,” said Burger. “With RFID, a business knows what items are missing, when they went missing, and what needs to be replaced.”

Item-level Tagging in Distribution and Logistics

The conflux of shipping and receiving at distribution centers, as well as the putting away and picking of inventory make them an ideal place to introduce item-level RFID tagging. Distribution center management can significantly reduce the amount of travel time lost in the picking and putting away of inventory, as well as dramatically improve the accuracy of inventory counts, order fulfillment, shipping, order delivery and the verification and proof of delivery. Item-level tagging provides a level of visibility that helps eliminate shortages, disputes and costly write-downs.

Item-level RFID provides the warehouse with an

ideal tool to close the gap to “perfect order” where product delivery is complete, on time, and damage free, and essentially applies a principled philosophy to achieve increased efficiency like manufacturing has with Six Sigma. The reason that manufacturing can achieve such high levels of efficiency is because of the levels of automation that are associated with assembly. Item-level RFID enables a new set of automation tools to increase efficiency in its primary objective, receiving and shipping product.

The intelligence derived from this new philosophy, enabled by item-level RFID, can be used to improve business processes, reduce workloads, improve decision making, and increase efficiencies that ultimately drive down costs and provide a competitive advantage.

Benefits of Item-level Tagging in Distribution and Logistics	
Increased Inventory Visibility	Distributing inventory is a labor-intensive, expensive, and time-consuming challenge. Item-level RFID tagging provides an unprecedented level of visibility of a distribution center’s overall inventory. With it, businesses can have accurate, near-real-time intelligence into inventory records, and know where items are in a facility at all times.
Lean Inventory Management	RFID provides the intelligence necessary to maintain a smaller safety stock which equates to reductions in holding costs and provides for greater efficiency in the distribution center.
Electronic Proof of Delivery	Item-level RFID extends electronic proof of delivery beyond order delivery of cases and pallets. It provides item-specific confirmation that can reduce costs associates with shortage disputes, write-downs and labor.
Shorter Invoice and Payment Cycle Times	The granular detail of item-level proof of delivery can significantly reduce the number of shortage disputes. Due to this increased order accuracy, invoices can enter procurement payment processes faster at the retailer.
Improved Shipment Accuracy	Order accuracy and fill rates are improved with instant verification that the right items are picked and loaded for shipment. Order integrity is essential because claims and returns are costly to process and settle. In addition, as transportation costs rise, item-level RFID helps businesses automatically track shipments to ensure they are transported cost-effectively to their proper destination.

Reduce Concealed Shortages and Improve Shipping Accuracy

Concealed shortages represent one of the largest deduction classes for many businesses within the supply chain. In fact, in the 2009 Customer Deduction Survey conducted by the Credit Research Foundation (CRF) in collaboration with Attain Consulting Group, concealed shortages were found to be the costliest compliance reason when it came to shortage deductions.

Top Compliance Deduction Reasons and Prevention Steps

Top Compliance Deduction Reasons (Deduction \$ - All Respondents)

- #1. Concealed Shortages
- #2. Freight / Routing Errors
- #3. Early / Late Deliveries
- #4. ASN / EDI Errors
- #5. Full Carton Shortages

Key Prevention Steps (All Respondents)

- #1. Improve Order Accuracy
- #2. Better Communicate Policies to Customers
- #3. Improve Cross Functional Teams
- #4. Make Sales / Other Departments Accountable
- #5. Perform Root Cause Analysis

"Concealed shortages can consist of so many things," said Jessica Butler, founder, Attain Consulting Group, "from substitutions, mispicks, packaging and conversion issues, ticketing issues or ASN errors – the list is long, and there are many things for businesses to consider."

Butler recommends:

- Fully documenting shipping processes
- Inviting customers to participate in an on-site process review
- Ensuring purchase orders (POs) and advance shipping notices (ASNs) show the same shipping configuration on packing labels
- Comparing shortage claims between fleet trucks and vendor trucks
- Identifying whether certain distribution centers or retailers are more prone to reporting problems
- Using sell through, in-stock and on-hand reports to dispute concealed shortages

Item-level RFID takes order verification to a whole new level. Used in conjunction with Butler's recommendations, it provides an unparalleled level of intelligence and data that can be used to confirm and dispute concealed shortage claims. The ability to aggregate data and track the history of individual items provides businesses with an excellent proof-of-delivery tool that can be used to dramatically improve and validate shipping accuracy.

"Chargebacks and disputes are expensive for all businesses within a supply chain. It can be hard to monetize due to the soft costs, but the amounts are enormous," said Butler. "If item-level RFID was adopted across an entire supply chain, most of it would go away."

Item-level Tagging in Manufacturing

Similar to the transformation retailers are undergoing with item-level tagging, dramatic improvements can be achieved within manufacturing. Item-level RFID enables manufacturers to implement leaner business practices that result in greater revenue and profits.

Increased accuracy and efficiency provides for better storage processes that guarantee material and product inventories are correct, stored where they belong, and properly prepared to be shipped to distributors. The technology can also be used to monitor work in process and help implement lean manufacturing principles and other best practices throughout the manufacturing process.

Benefits of Item-level Tagging in Manufacturing	
Better Raw Materials Forecasting/Management	<p>Manufacturers are able to better manage raw materials based on data that informs them of first-in-first-out material and product availability information.</p> <p>With a deeper understanding at the item-level, manufacturers can better forecast demand at the distributor level. This intelligence leads to leaner inventory which equates to reduced holding and labor costs.</p>
Improved Shipping Verification	Item-level RFID extends electronic proof of delivery beyond order delivery of cases and pallets to distributors. It provides item-specific confirmation that can reduce costs associated with shortage disputes and labor.
Streamlined Financials	Improved accuracy in inventory and order shipments equates to a reduction in mis-shipments and chargebacks. The granular detail of item-level proof of delivery can significantly reduce the number of shortage disputes.
Increased Automation Via WIP, Kitting	Item-level RFID enables manufacturers to better monitor work in progress in order to ensure the right materials are being used to produce the right products for the right orders. This increase in floor-level intelligence reduces labor costs through improved processes and business practices.
Reduced Counterfeiting for Enhanced Brand Protection and Product Authentication	Estimates have shown that counterfeit fashion apparel alone may cost designers more than \$10 billion annually. ³ Item-level RFID tagging has emerged as a promising solution for companies due to its ability to automate high-volume authenticity checks. The ability to control product authenticity protects high-value brand reputations.
Reduction in Concealed Shortages	The automated intelligence provided by item-level RFID enables manufacturers to quickly understand and respond to breakdowns in processes to reduce and eliminate accidental shortages.

The Intelligent Apparel Supply Chain

The entire retail supply chain consists of an immensely diverse range of products, supplied by hundreds of manufacturers and distributors. The complexity of managing the massive inventories at every link of the chain and providing actionable intelligence regarding products and the shipping logistics is enormous. It takes a collaborative effort for all businesses involved in order to successfully improve processes, meet customer demand, reduce costs, and increase profitability.

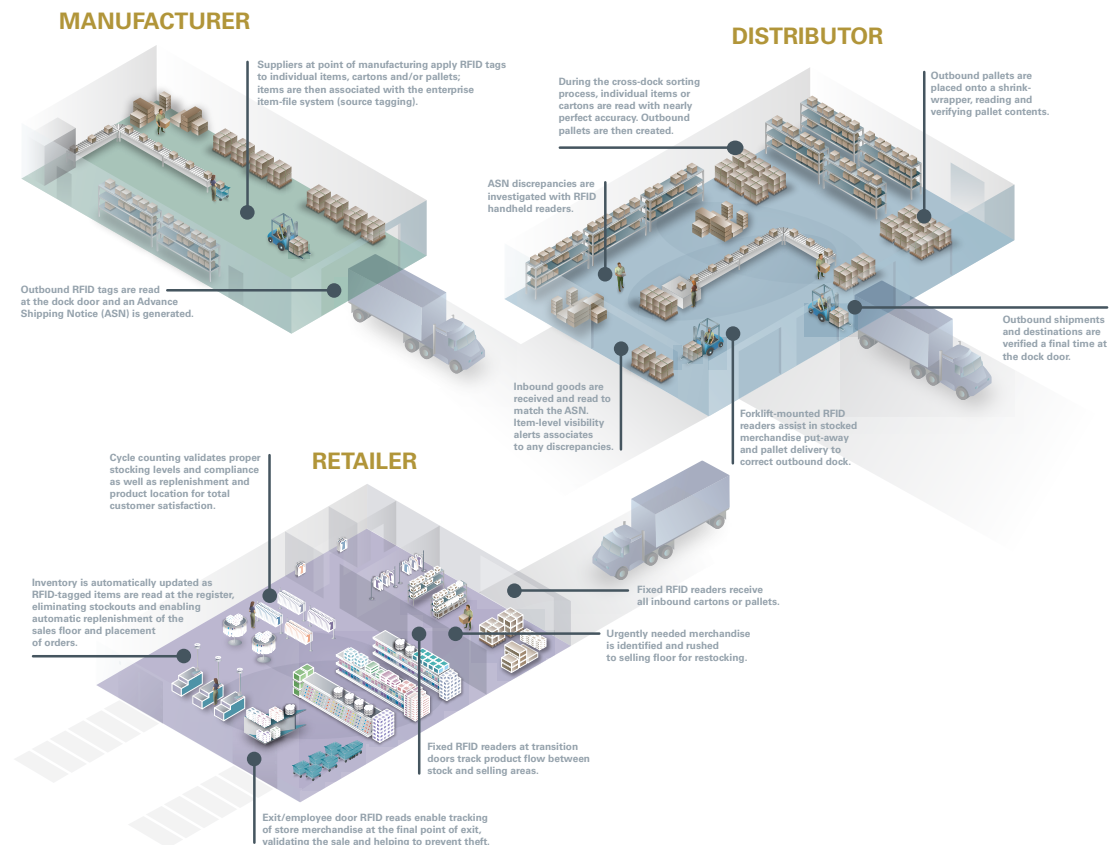
“For successful supply chain partnerships, each party must clearly understand its partners’ goals, business and customer requirements,” said Kim Zablocky, founder and chairman, Vendor Compliance Federation, an advocacy for retailer-supplier trading synchronization. “Clearly communicating goals and objectives helps to

build mutual trust by establishing roles, defining mutual expectations, and identifying performance measures and resulting outcomes.”

Through the use of item-level RFID tagging, communication and information barriers can be eliminated so the synchronization and sharing of valuable information among trading partners occurs. Success depends on the real-time visibility of products within the supply chain. Benefits will be realized in regard to inventory management, process improvements, faster payment cycle times, reduced disputes and better asset utilization.

“Other intangible benefits include reduction in lost sales due to increased visibility into existing inventory (knowing what’s in your backroom so you can eliminate out-of-stocks), improved customer service due to timely delivery of orders, and more confidence in managing the supply chain due to accurate, real-time knowledge of location of products moving in the supply chain,” said Zablocky.

Item-level RFID Tagging in the Supply Chain



Benefits of the Intelligent Apparel Supply Chain	
Real-time Inventory Visibility	Using item-level RFID, businesses throughout the supply chain can precisely track product as it moves through the supply chain and the exact time it passes key points at every link of the chain.
Stronger Supply Chain Collaboration	The intelligence derived from knowing what products exist and where they are can be used to improve business processes and get products into the hands of consumers faster.
Demand Visibility	In the retail industry, most products are seasonal or have only a limited window of opportunity to be sold. Item-level RFID provides immediate value through the insights gained from real-time data so businesses can respond to fulfill demand on time.
Improved Business Agility	Through the use of real-time intelligence enabled by RFID, businesses have greater flexibility and agility when it comes to managing their business to meet demand and control inventory costs.
Lean Operations	With a holistic, real-time view of the multi-leveled inventory network of a supply chain, businesses are better equipped to reduce safety stock levels, introduce postponement strategies, improve demand forecasting, reduce operational costs, introduce more automated processes, improve workflow issues, and expand capabilities within their operations.
Reduced Shrinkage and Theft	Item-level RFID provides the advantage of knowing exactly what was stolen, when it was stolen, and from where it was stolen within the supply chain. In addition to using this information to improve loss prevention methods, businesses can know when to produce, ship, and order more products as needed.
Counterfeit Product Protection	Item-level RFID provides significant protection against the introduction of counterfeit items into the supply chain. If it does occur, supply chain partners have a greater ability of identifying where and when it happened.
Competitive Advantage	Not only will item-level RFID help products flow to consumers more efficiently, but it can also be attractive when looking to establish new partnerships. As RFID adoption continues to grow, more manufacturers, distributors, logistics companies, and retailers will look to partner with technologically compatible businesses due to the inherent benefits the economies of scale deliver.

Item-Level RFID and Customs Efficiency

Product promotions and the seasonality of items make it imperative that products travel through supply chains quickly and onto retailer shelves in order to maximize profits. This has never been more complicated than it is today since the amount of apparel imports brought into the U.S. has grown to over \$100 billion annually. Fortunately, item-level RFID can help alleviate some the burdens of moving shipments through U.S. customs so store shelves can be stocked and consumer demands can be met.

Businesses that participate in the Customer Trade Partnership Against Terrorism (C-TPAT) program are required to work on an ongoing basis with U.S. Customs and Border Protection (CBP) in order to receive C-TPAT validation. In exchange for participation, CBP provides reduced inspections at ports of arrival and expedited processing at the border.

Due to the inherent benefits of C-TPAT participation, many businesses are making it a requirement for their supply chain partners. All business partners in the supply chain should be engaged in order to improve security and ensure the integrity of their supply chain. RFID provides a significant capability for C-TPAT members to achieve the elevated and more efficient customs processing.

Item-level tagging provides a granular-level view that is not accomplished with crate and pallet tagging. When item-level tags are applied at the manufacturer, businesses can track individual products every step of the way. Item-level RFID provides greater validation in order to efficiently inspect contents and verify them against manifests and official paperwork.

Summary

The global economy is reshaping the supply chain and introduces new challenges in logistics, asset protection, demand forecasting, and supply chain inventory visibility. Item-level RFID technology has emerged as a key tool to help provide a superior level of intelligence for managing the flow of items throughout the supply chain. It provides visibility of product movement, streamlines distribution, improves demand forecasting, and makes product supply more responsive.

Item-level tagging is already helping solve many retailers' challenges, including out-of-stock levels, inventory accuracy, and helping customers quickly and easily find the size, style and color of what they are looking for. Similar benefits can be derived by other constituents in the apparel supply chain with item-level tagging. When used by each party within the supply chain, benefits of item-level tagging are magnified as the intelligence derived from every partner can be leveraged to improve processes, reduce costs, and increase profit margins.

About Motorola

With an innovative portfolio of RFID readers and antennas, Motorola helps businesses gain increased visibility through automation. A Fortune 100 company with global presence, Motorola extends the value of your RFID solution with a mobility portfolio that includes wireless infrastructure, advanced data capture, and mobile computing products. Our comprehensive offering simplifies deployment, lowers costs, and maximizes return on investment. Inspired by our vision of transforming the enterprise, Motorola is committed to helping you seamlessly connect to the people and information that drive your business. For more information about our company, our people and our innovations, please visit www.motorola.com/rfid.

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