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Shrinking the Supply Chain Expands the Return: The ROI of RFID in the Supply Chain

An Alinean White Paper

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***Analyst: Thomas Pisello, author of IT Value Chain Management:
Maximizing the ROI from IT Investments (Alinean Press - 2004)***

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EXECUTIVE SUMMARY

Many organizations that produce, distribute, handle or sell various goods are researching what RFID can do to improve operating efficiency, reduce business risk and drive additional revenue opportunities. According to Alinean Research, these early RFID projects could cut supply chain costs by 3-5% and achieve a 2-7% increase in revenue thanks to the better visibility and accuracy that RFID provides¹.

These benefits are good news, as with the current focus on bottom-line results, every project is under intense scrutiny to generate tangible business value. On average, over 90% of projects require a formal business case justification in order to gain approval². For an organization considering RFID projects that might require significant up-front investment, how can these general early adopter guidelines and case studies be used to ensure that individual programs will generate positive business benefits and a tangible ROI? The bottom-line: Does the value of RFID tagging exceed implementation cost?

This white paper was developed by Alinean, the IT value experts to explore the business case for RFID, quantifying the potential value of RFID for various industries and business processes. The results are derived from simulations using Alinean's RFID ROI tools, specific organization case studies and third party research. The purpose of this paper is to review various business benefits of implementing RFID, and discuss various typical ROI results, providing a guide to the value typical organizations can expect from streamlining supply chains using RFID implementations. With over a decade of researching and developing technology return on investment (ROI) and total cost of ownership (TCO), the Alinean team are the experts leading solution providers, consultancies and CIOs turn to for IT value advice, research and assessment / benchmarking tools.

RFID DEFINED

RFID is being implemented, along with key business process improvements in many industries, to reliably track goods of all kinds: from cases, pallets and individual items in manufacturing, wholesale distribution and retail applications, to equipment and supplies in government applications, to overnight mail packages and passenger luggage in transportation and shipping. Many of these early adopters have experience with the benefits of bar codes, but realize that RFID can take supply chain management to the next level. The network effects of a synchronized supply chain will result in numerous benefits, including improved scan

reliability, process automation, and real-time information access.

RFID provides persistent, real-time identification information with minimal human intervention, allowing more frequent data collection and greater information capture. With RFID, a dock door, conveyor, forklift or workstation becomes an important data collection instrument which can read and help reconcile the location and status of goods in the supply chain. Armed with RFID, businesses can benefit from more accurate insight and improved decision making capabilities.

The key to an effective RFID business case is to find applications and processes where bar code scanning efficiency can be increased. The capture of information on products and assets in motion, reduction of human errors from manual scanning operations, and improvement of integrity and security are some of the incremental benefits RFID can provide over existing systems.

HOW DOES RFID DRIVE TANGIBLE BENEFITS?

RFID technology as a key component of an enterprise mobility solution, combined with appropriate business process improvements, can result in clear benefits in the following key areas:

- **Automation** - reducing manual processes through automated scanning and data entry improves productivity, allowing resources to be reallocated to higher value activities.
- **Integrity** - improving the integrity of real-time supply chain information with increased authentication and security and tracking capabilities reducing errors, shrinkage, and counterfeiting while improving customer satisfaction — information is only valuable if it is correct.
- **Velocity** - reducing workflow issues by minimizing the time spent finding and tracking needed assets, in turn increasing product flow and handling speeds.
- **Insight** - providing the real-time information needed to make faster, better and more informed decisions and the ability to be more responsive to the customer.
- **Capability** - providing new applications and quality to meet supply chain partner demands and enhance customer experiences.

How Are The Benefits Realized?

RFID can deliver tangible benefits for many types of enterprise businesses:

- **Improve Warehouse and Distribution Productivity from 7% to 40%:** Companies can replace the point-and-read, labor intensive process of tracking pallets, cases, cartons and individual products with an RFID process. RFID sensors can track these items as they move from various key locations. Because the process is automated, labor costs can be reduced, improving productivity, and enabling the reallocation of resources for more strategic tasks and better scale operations.

Productivity improvements can be significant, delivering realized labor costs reductions of 7.5% or more in warehouse applications, and 5 to 40% in regional distribution centers³. As one example, Wal-Mart experienced a dramatic reduction of pallet build from an already fast 90 seconds to an amazing 11 seconds, a reduction of almost 90%⁴.

- **Improve Retail and Point of Sale Productivity by up to 20%:** The use of RFID at the product level can help retailers reduce the labor costs and service fees of regular stock management and store shelf inventory.

As one example, handling out-of-stock restocking and replenishment tasks can be reduced by 15% to 20% with RFID⁵.

- **Reduce Out-Of-Stock by up to 50%:** When an item is out-of-stock, 20% of the time the customer either does not buy or buys a competitive product⁶. In grocery stores, as much as 8.3% percent of revenue is lost each year due to out-of-stock conditions⁷. In broader studies of the retail marketplace, the overall economic impact is estimated to be \$69B in lost revenue due to out-of-stocks⁸.

Eliminating out-of-stock conditions via better RFID product tracking, inventory visibility and forecasting can have an immediate top-line revenue impact by retaining lost sales and recapturing lost market share. AMR Research of Boston, Massachusetts suggests item level RFID tagging can yield significant benefits today if managed correctly. When targeted at specific consumer goods categories, item-level tagging can yield an astounding 50% improvement in stock availability according to these studies⁹.

And the benefits are not isolated just to select consumer goods. RFID is proven to deliver an average 16% reduction in product out-of-stocks. If an out-of-stock does occur, RFID enables a retailer to restock three times faster than that of the non-tagged items within the same store¹⁰. At the retail level, out-of-stock savings can yield a 3 to 4% increase/recapture of sales¹¹.

Item-level tagging can yield an astounding 50% improvement in stock availability.

- **Improve Inventory Management:** Inventory accuracy is important to help improve visibility and insight into what specific raw materials have arrived, helping to assure the right materials are available and to better manage just-in-time production models, track work in process, and speed finished goods through the supply chain. The use of RFID improves these processes, and helps minimize costly inventory errors, reducing production delays and lowering production reconfiguration costs that often result from material or demand planning issues.

Additionally, visibility can be improved into distribution and retail channels to more accurately and in real time track delivered goods and better manage and match demand. Accurate and real-time visibility throughout the supply chain helps to improve inventory forecasting, manage just-in-time workflow and eliminate excess inventory. Savings are realized by reducing required inventory via lower safety stock requirements, a net 10-30% savings¹². Better inventory management also leads to proportional reductions in out-of-stock, lower inventory carry costs and reduced write-downs on obsolete inventory.

- **Reduce Shrinkage (loss and theft) by 18% or more:** Losses due to theft are estimated to cost retailers over \$30B per year, and are estimated conservatively at 1.7% of overall sales¹³. With RFID, pallets, cartons and individual products can be tracked through the supply chain to pinpoint product location and eliminate inventory errors that can cause shipments to go missing. Better yet, it enables one to find where in the process the product was lost. AMR Research estimates an 18% average reduction in shrinkage using RFID¹⁴.

- **Reduce Supply Chain Errors:** By replacing manual bar code scanning with automated RFID information capture, data entry errors can be eliminated, reducing not only inventory and tracking mistakes, but also the costly labor required to resolve such mistakes. Additionally, because RFID automates data entry, more collection and tracking can occur throughout the process, helping to more specifically pinpoint asset location and workflow. And not just labor costs are driven higher by mistakes — retailers and manufacturers each lose \$2M for every \$1B in sales due to bad data and predict that eliminating bad data could save \$10B per year¹⁵.
- **Improve Capital Asset Tracking and Management:** In many businesses important assets such as shop equipment and containers are often difficult to track, maintain and secure. RFID can be used effectively to better locate movable assets, ease maintenance scheduling and assure maintenance performance, as well as help prevent loss. In applications such as warehousing and distribution where containers and tugs need to be tracked, scheduled and maintained, workflow can be optimized by 20% or more and losses prevented¹⁶.
- **Reduce or Eliminate Counterfeiting and Improve Security:** In many industries, counterfeit or non-secure goods introduced into the supply chain cause large direct losses of revenue. RFID increases brand protection and helps mitigate safety, security, regulatory and liability risks. Improved tracking using RFID can identify and isolate issues more efficiently and effectively than manual bar code scanning by introducing automated and more frequent checks and balances.
- **Improve Accounts Receivable (AR):** With more accurate and real-time tracking of what has shipped, the accounts receivable process can become much more efficient, with shorter billing and payment cycles. For example, RFID allows vendors to automatically produce customer invoices as soon as items are shipped and enables payment automation as well. This helps to reduce the time to collect and the improved accuracy and elimination of manual data entry or tracking errors helps reduce AR disputes. The results surveyed include a dramatic reduction in accounts receivable down from 30-45 days to just minutes¹⁷.
- **Meet Market Mandates and Protect Revenue Opportunities:** Many industry leaders have set the stage by making RFID functionality and compliance a prerequisite for to participating in their ecosystem. RFID can help meet these mandatory requirements, or provide an advantage for those who proactively implement the technology over those that are struggling to meet these new market demands. Longer term, RFID can help create new revenue generating applications

and innovation to help grow market share. In many cases, RFID is not just a business benefit, but a requirement for doing business.

- **Improve Customer Experience:** RFID can help to improve the overall customer experience. First, RFID enables better management of inventory, ensures proper deliveries and shipments, better forecasts demand, better manages promotions and new product introductions, and reduces out-of-stock conditions. Elimination of supply chain issues and product availability results in customers getting what they want, when they want it. In one case, a documented 29% increase in promotional execution resulted in a projected 20%-60% increase in sales¹⁸.

THE ROI OF MANUFACTURING SOLUTIONS

Business Opportunities

Manufacturers are evolving to confront new challenges and opportunities, such as implementing and managing a lean supply chain, adapting to expanding globalization, and dealing with increasing competition, labor costs and compliance requirements. To help meet these challenges, manufacturers are looking to implement RFID solutions to reduce costs, improve asset utilization, and improve business quality, flexibility and scalability. RFID can specifically help manufacturers advance from current bar code systems (or fragmented solutions) to help drive lower costs, improve decision-making, and streamline processing and tracking of raw materials, work in process, and finished goods throughout the just-in-time supply chain.

The RFID Solution

RFID implemented throughout the manufacturing environment can help streamline the processing of raw materials, work in process and finished goods, resulting in improvements in many business areas:

- **Receiving:** RFID Portals at dock doors and points of ingress allow instant verification of the entire contents of a shipment by reading an RFID-tagged case, container or pallet. The content's status and information is updated and automatically communicated to the factory's WMS/ERP system at the point of entry. Proof of receipt and accounts payable processing can all be automated, improving accounts payable productivity and reducing payment inquiries and disputes.
- **Routing:** RFID-tagged shipments are identified and routed to be unpacked and sorted. RFID-enabled forklifts deliver them to staging or directly to production in just-in-time environments. With better, more automated real-time tracking, production coordination and delays can be avoided.

- **Tracking Work-In-Process:** RFID-tagged raw material and sub-assembly parts are routed and tracked throughout work stations along the assembly line and the entire production process. RFID automates the validation of sequence and components and speeds build times. If an issue is found, accurate tracking can help to reduce quality issues and errors. Customization requirements can be built into the system and validated immediately, eliminating costly reworks.
- **Tracking History:** RFID can track the history of the production and finished goods - important information for shipping and possible recalls.
- **Shipping:** RFID tags on outgoing pallets and containers can associate vast amounts of information with the finished goods being shipped. This information can include shipment contents, product history, origin and destination points, order information and handling instructions. RFID can track "pedigree" information - where the product is, where it has been, who accepted it and at what stage. RFID helps to eliminate shipping delays by increasing staging accuracy and ensuring that the right shipment is on the right outbound truck. RFID allows you to "certify" the shipment. Establishing agreements with trading partners to leverage RFID data as "proof of delivery" can speed the processing of accounts receivable invoicing and significantly reduce disputes, claims or returns.
- **Asset Tracking and Management:** RFID can streamline the processes of asset location, maintenance and support, assuring that assets can be located and maintenance is being performed. Proper shop floor asset tracking and maintenance can reduce loss, reduce costly repairs and extend service life. In many industries reusable containers are standard, and are easily misplaced and lost during transportation. Tracking the assets can help to meet compliance regulations and reduce shrinkage.
- **Inventory and Net Fixed Asset Optimization:** Increased knowledge of raw materials, work in process and finished goods, as well as increased visibility into manufacturing assets used to transport and produce these goods, can help to improve scheduling, better manage inventory, reduce carrying costs and improve net fixed asset utilization.
- **Compliance:** Customers are mandating that items shipped to them be tracked and secured. RFID helps meet these new compliance programs to meet customer mandates.

- **Counterfeit Prevention:** In many industries it is vital to track goods in order to prevent the insertion of counterfeit goods into the supply chain. In pharmaceutical manufacturing, it is especially important to track the entire lifecycle of raw materials, production and shipment. RFID can help to assure that only properly tagged and uniquely identified and tracked items are introduced into the supply chain and sold and distributed.
- **Visibility:** Real-time information collected throughout the manufacturing process can help improve accuracy and visibility, enabling the accurate measurements of key performance indicators, optimized performance and improved production and inventory planning.

The RFID Benefits

RFID solutions can ultimately help manufacturers reduce operating expenses and improve margins by:

- Reducing labor costs and improving productivity via automation of current manual inventory tracking tasks and reducing handling errors.
- Improving product quality as line-sequencing and parts verification applications are improved.
- Reducing the number of production reconfigurations by assuring the right inventory is available to meet production and shipment schedules and demands.
- Lowering required inventory levels (working capital savings) and associated carry cost expenses by optimizing inventory levels and reducing safety stock.
- Reducing obsolete inventory write-downs through better planning and visibility.
- Improving production asset visibility helping to track their location and reduce maintenance issues.
- Reducing claims and returns by assuring the right goods are sent where they should be.
- Lowering inventory shrinkage by keeping better track of goods helping to eliminate losses and theft.
- Proactively mitigating accounts receivable and accounts payable disputes.

- Improving revenue opportunities, reducing out-of-stocks and improving promotional execution by having the right inventory available to match demand.
- Meeting new customer mandates and regulatory compliance.
- Improving customer experience and satisfaction by improving timeliness, quality and availability.

MANUFACTURING CASE STUDY

Company: \$400M U.S. based business to business manufacturing operation

Project: Deployed RFID to improve the tracking of received goods from vendors, raw material, work in process and finished goods — helping to automate key production management, accounts payable, accounts receivable and inventory management processes.

The following scenario-based case study was developed by Alinean to explore the business case for RFID, quantifying the potential value of RFID for various industries and business processes. Alinean used RFID ROI modeling tools based on specific organization case studies, third party research and information from numerous manufacturing case studies to simulate the potential benefits and ROI of an RFID implementation for a typical \$400M US-based business to business (B2B) power generation manufacturing operation. In this scenario, the company is implementing RFID to improve the tracking of received goods, raw material, work in process and finished goods - helping to automate key production management, accounts payable, accounts receivable and inventory management processes. The solution helps to optimize processes currently being managed by 400 full-time equivalents (FTEs). It delivers a significant competitive advantage by reducing errors, enhancing visibility and decision-making, and improving operations.

In this scenario, the manufacturer realized:

- An 18% productivity improvement through automation for receiving, production, change order/management, production management, quality management, shipping, transportation and logistics management staff — improving productivity by over 75 FTEs/144,000 hours annually. As a result, the manufacturer would expect \$3.5M in annual labor cost savings.

- Reduced production-related exceptions such as reworks, order and fulfillment errors, support calls, customer returns, backorders, change orders, production stops, production expediting/changeovers, transportation errors and recalls, reduced incidents and handling costs by 21%, for over \$8.4 million in annual error handling labor and cost avoidance.
- Reduced purchase order processing costs by 30% and reduced errors by 50% (currently 5% of total purchase orders), resulting in over \$860,000 in annual productivity improvements/potential labor cost savings.
- \$500,000 in inventory working capital savings and an associated \$55,000 annual operating expense reduction in carry costs.
- Reduced days sales outstanding (DSO) by 8% from an average of 65 to 60 days, resulting in a \$5.7 million accounts receivable working capital improvement.
- Reduced accounts receivable disputes by 40% or more, resulting in \$2.3 M in annual write-down cost avoidance.
- Reduced inventory scrap by 45%, from current 2.0% levels to 1.1% reducing write-down expenses of \$540,000 annually.
- Optimized facility utilization and production forecasting helping to improve net fixed asset utilization by 2-3%.
- Lost asset recovery - the organization was losing some of its manufacturing assets throughout the year by misplacing or shrinkage of tools, carts and totes. Better tracking of these items facilitated loss elimination of over \$25,000 per year.
- Improved plant asset maintenance - manufacturing assets were not being maintained to adequate levels due to poor tracking of maintenance and not verifying that scheduled maintenance was being performed. Tracking assets and usage via RFID helped to tighten schedules for maintenance and help to locate assets when maintenance was required. Additionally, when maintenance was to be performed, maintenance personnel were tracked and verified as to having visited the asset and performing the maintenance. Major repair costs were reduced 48% for savings of \$75,000 annually, with a significant reduction in unplanned downtime incidents.
- Improved customer satisfaction by improving timeliness and quality, resulting in a 1.5% increase in customer retention, and \$1.5M customer attrition processing cost avoidance (direct customer off-boarding and replacement costs).

Goals	Typical Savings	Tangible Benefits with Manufacturing Case Study
Productivity improvements through automation	18% productivity improvement	\$3.5M annual recurring labor cost savings
Reduce production-related exceptions	21% reduction in exceptions	\$8.4M annual recurring labor and cost avoidance
Reduce purchase order processing costs	30% productivity improvement	\$860,000 annual recurring productivity improvements/potential labor cost savings
Inventory savings	10% inventory reduction (safety stock)	\$500,000 one-time working capital savings \$55,000 annual recurring carry-cost reduction
Reduce inventory scrap	45% write-off avoidance	\$540,000 in annual savings
Reduce days sales outstanding	8% DSO improvement	\$5.7M one-time accounts receivable working capital improvement
Reduce accounts receivable disputes	40% dispute avoidance	\$2.3M annual write-down cost avoidance
Improve net fixed asset utilization	2-3% NFA utilization improvement	\$2M one-time working capital improvement
Lost asset recovery	40% reduction in lost assets	\$25,000 annual recurring savings
Improve plant asset maintenance	48% cost avoidance	\$75,000 annual recurring savings
Improve customer satisfaction*	1.5% improvement in customer retention	\$1.5M annual recurring customer attrition and replacement cost avoidance

* Indirect (soft) benefits are risk adjusted to 10% of original value before calculating ROI.

The Bottom-Line: An investment of \$17 million over three years would deliver net present value of over \$26 million in cumulative net benefits, an ROI (calculated as net benefits/total costs) of 188% (for every dollar spent on RFID, the company received their original \$1 back, and an additional \$1.88 in incremental benefits), with an 11 month payback period (including 6 months of development, integration and deployment).

Total investment:	\$17M
NPV of benefits:	\$26M
Project time span:	3 years
ROI:	188%
Payback period:	11 months

THE ROI OF RFID FOR WAREHOUSE AND DISTRIBUTION SOLUTIONS

Business Opportunities

The warehouse and distribution sector requires new insight and advanced business models to drive competitive advantage and achieve supply chain agility and velocity. Today's warehouse and distribution systems manage global supplier relationships, virtual trading networks, and more complex customer relationships and require more automation and accuracy. Streamlining processes, improving operation velocity, reducing errors and improving productivity are key success factors and focus areas where RFID can provide measurable benefits.

The RFID Solution

The entire inventory handling process can be improved via RFID-tagged pallets, cases, cartons and individual items, eliminating error prone manual reads with fixed RFID readers at ingress and egress points, mobile RFID readers on warehouse automation equipment, and RFID asset and location tags on waypoints and assets provides greater levels of automation, error reductions, and decision support, including:

- **Receiving:** Incoming RFID-tagged shipments can be automatically identified as they pass through RFID-enabled dock doors. Shipments are verified against the purchase order and instructions to the worker are sent, back orders are cross docked to shipping, damaged goods are staged for return, and shipments bound for inventory are staged for put-away. Accounts payable processes are alerted as to receipt of the goods for processing.

- **Put-away:** Finding the right location (from receiving to storage) can be automated, assuring that the right items are placed in the right location. Perishable goods and priorities can be more accurately and intelligently managed.
- **Cross-docking:** RFID can help improve just-in-time management of inventory, helping to drive process improvements, productivity, visibility and accuracy. This enables the immediate transporting of goods — from inbound trucks and receiving to shipping and customer transport.
- **Picking and packing:** RFID can increase the accuracy of the picking process, ensuring that the right goods are picked from the right locations and packaged in the proper way. This increases productivity, provides for better management of priorities and minimizes errors.
- **Shipping:** RFID can ensure that the right items are placed on the correct trucks and in the right order. With the use of intelligent prioritization, repackaging becomes minimal. Billing can be automated so that invoices are sent as soon as goods leave the facility, helping to minimize days sales outstanding (DSO).
- **Yard management:** RFID enhances scheduling and trailer utilization efficiency, ensuring that the right trailers arrive at the right location at the right time, minimizing idle time for the trailer assets and reducing receiving and shipping wait time.
- **Transportation:** Once the goods leave the distribution center, RFID can help ensure that the right goods reach the right destination at the right time and in the most efficient manner possible.
- **Customer experience:** Current online portals for package tracking contain information on package location, but at best, the accuracy is only as good as the last update or the last manual scan or touch. With RFID, tagged packages will identify their own location, even when a worker is not able to physically scan or locate the package. Lost packages may become a problem of the past and improve customer visibility, helping to drive an enhanced customer experience.
- **Security:** Shrinkage can be reduced with secure, item-level goods tracking, assuring that items only leave the secure location when authorized.

- **Visibility:** Significant competitive advantage can be realized by maintaining up-to-the-second inventory records via RFID — inventory can be tracked from the moment it is received to the time it leaves the shipping dock. This helps to better forecast high-demand goods, reduce out-of-stock conditions, reduce safety stock (more accurate demand models), and improve data integrity and accuracy.

The RFID Benefits

The process improvements and bottom-line benefits that RFID can provide are significant:

- Reduce labor required for almost all primary warehouse worker functions including receiving, put-away, inventory, pick/pack/ship and transportation management.
- Increase receiving, picking and order accuracy - reducing error handling, reworks and returns.
- Reduce stock levels by helping to implement cross-docking, improve inventory accuracy and demand generation visibility.
- Reduce out-of-stock items by assuring inventory is available to meet orders and demand.
- Increase error-free shipments and improve delivery times.
- Reduce theft by helping to assure that goods are tracked and secured throughout the warehouse and distribution process.
- Increase customer satisfaction by ensuring that the right goods reach the right customer at the right time.

WAREHOUSE AND DISTRIBUTION CASE STUDY

Company: \$20.5B U.S. based technology solutions distributor

Project: Mandated by multiple retailers to adhere to new RFID tagging initiatives, which directly affected around 30% of the managed inventory, but 60% of the company operating margin.

In this simulation, a \$20.5B technology solutions wholesaler and distributor in the U.S. with 8,000 full-time employees wanted to improve its operating efficiency and effectiveness at over 20 different distribution centers worldwide. With over 6,000 of the staff involved in supply chain and related finance and customer management, labor costs were growing. In order to remain competitive, automation to reduce costs was key. Costs needed to be reduced, but not at the expense of meeting or exceeding customer expectations regarding timely and accurate delivery.

This large wholesaler and distributor was mandated by multiple retailers to adhere to new RFID-tagging initiatives, which directly affected around 30% of the managed inventory, but 60% of the company operating margin.

RFID would help streamline the highest value operations — reducing labor costs, reducing shrinkage and improving customer service on high-end merchandise. At the 20 distribution centers, RFID tags were placed on individual items, cases and pallets, to be read by forklifts, conveyors, transporters and portals. This enabled goods to be tracked consistently from receiving to shipping, assuring the right goods arrive as planned and that inventory and tracking errors were minimized. Additionally, the accounts payable process was automated to help assure that payments were processed correctly so as to match receiving and sell through. Finally, the order-to-cash process was automated to help speed up the invoicing of shipped items and reduce cycle times on payments and collections.

Under this scenario, the benefits for the distributor on this select group of high value inventory yielded the following results:

- The automation of receiving, put-away, inventory, pick/pack/ship and transportation management tasks reduced labor costs, helping to reallocate the budget for 125 FTEs, saving over \$8M annually.
- Increased receiving accuracy reduced the receipt of errant inventory from suppliers, helping to avoid accounts payable disputes by 70% and generating over \$450,000 in dispute labor savings per year.

- Increased order, picking and transportation accuracy, reducing shipment errors improving delivery times, and reducing order reworks and returns by 40%. This saved over \$1.8M in labor and shipping costs.
- Reduced stock levels by 5% by implementing cross-docking, improving inventory accuracy and allowing demand generation visibility. This resulted in \$80 M in one time inventory and working capital savings and a \$10.4M reduction in annual inventory carrying costs.
- Reduced out-of-stock items by 8%, assuring inventory was available to meet orders and demands resulting in a measurable increase in customer satisfaction by ensuring that the items needed were in stock and delivered to meet sell through demand. Out-of-stock was eliminated, particularly when addressing unique seasonal and promotional demands. This led to a conservative \$150M revenue/\$1.5M margin benefit gained from order delay reduction, reclaimed orders and improved customer retention value.
- On the items covered by the RFID solution, days sales outstanding was reduced by 5% by automating the invoicing and accounts receivable process, resulting in a reduction in DSO from 65 to 62 days — a \$54M one-time working capital benefit.

Goals	Typical Savings	Tangible Benefits with Manufacturing Case Study
Automate receiving, put-away, inventory, pick/pack/ship and transportation management tasks	2% productivity improvement	\$8.0M annual recurring labor cost savings
Increase receiving accuracy/avoid accounts payable disputes	70% productivity improvement	\$450,000 annual recurring dispute labor savings
Increase order, picking and transportation accuracy and reduce errors	40% productivity improvement	\$1.8M annual recurring error handling labor and shipping costs
Reduce stock levels	5% inventory (safety stock) reduction	\$80M one-time inventory and working capital savings \$10.4M annual recurring inventory carrying costs
Reduce out-of-stock items	8% reduction in out-of-stock exceptions	\$150M annual revenue/\$1.5M annual incremental margin benefit from order delay reduction, reclaimed orders and improved customer retention value
Reduce days sales outstanding	5% reduction in DSO	\$54M one-time working capital benefit

The Bottom-Line: An investment of \$27M over three years delivers net present value of over \$131M in net benefits and an ROI (net benefits/total costs) of 580%. For every dollar spent on RFID, the company received in three years their original \$1 back, and an additional \$5.80 in incremental benefits, with a 7 month payback period.

Total investment:	\$27M
NPV of benefits:	\$131M
Project time span:	3 years
ROI:	580%
Payback period:	7 months

THE ROI OF RFID FOR RETAIL

Business Opportunities

Stocking the right products in the right quantity at the right time is key to ensuring that the customer enjoys a superior shopping experience. Customers are increasingly demanding that merchandise and offerings be tailored and customized to their needs, forcing stores to more quickly react to unique aspects of each market and consumer base. As a result, almost all retailers are struggling with the ability to deliver superior customer service while keeping rising operating expenses under control — particularly labor, the largest operating cost contributor.

The RFID Solution

Retailers have experience with the benefits of bar code technologies, and RFID can complement and extend these benefits. RFID is an important evolution in data capture and management, providing the ability to further increase visibility, automation, and integrity, while opening the door for a host of new customer service improvements and applications. The initial move to RFID tagging makes the most sense in areas where additional tracking and automation can provide added value to retail businesses.

In retail, RFID can help to:

- Exponentially improve the customer experience through investments in new POS systems.
- Synchronize the multiple channels in their business to deliver single views of customers, vendors and products.
- Implement sophisticated revenue optimization technologies.

In Retail, RFID can help improve each step of the supply and customer management value chain.

- **Back Room Operations:** First, RFID further automates data-collection operations performed in receiving, stock-room management, sales floor inventory management and checkout. Where bar-coding enabled visibility via manual operations, such as scanning arriving pallets and crates or

automating checkout, RFID can help retailers track the movement of merchandise throughout the store and beyond via automated waypoints or transports, or even real time, any place/any location monitoring.

To gather information and track inventory, unattended, fixed readers, reader portals, and handheld and vehicle-mounted RFID readers provide real-time information from RFID-tagged boxes, cases, containers and pallets that move through critical points of retail distribution — from receiving and shipping to the retail store backroom. Automating the scan and track operations with scanners in transports (such as forklifts and carts), or in strategic locations helps to automate manual scanning and reduce labor costs. Manual scanning resources can be reallocated to higher value customer service operations and the risk of missed and duplicate scans can be eliminated.

- **Back-Office Application Empowerment:** The use of RFID tags and automated scanning further enables applications, such as advanced shipping notices and proof-of-delivery, to speed up the entire transaction process, eliminating errors, reducing the labor hours associated with reconciling back room inventory and processing returns or credit claims due to supplier mis-ships.
- **Store Operations:** The impact of RFID extends beyond the retailer's backroom operations and onto the store sales floor to help empower the next generation of customer experience applications. The business case is strong for new in-store RFID solutions, particularly item level tagging. RFID-tagged items allow intense item-level tracking, reducing shrinkage on the store floor and providing a framework for existing EAS integration or EAS replacement. It also helps speed restocking, improve returns processing, improve inventory control, as well as streamline seasonal and promotional sales.
- **Improved Customer Satisfaction:** RFID enables retailers to better manage inventory and assure that items are in stock, merchandised properly and provided for sale.
- **Improved Customer Experience:** Directly improve the customer experience with RFID by enabling a new generation of front-office customer-facing applications including:
 - Pre-sales assistance such as automated price verification and intelligent/guided advertising and promotions such as instant rebates, coupons, and guiding selling to assure that the right accessories are promoted).

- New or additional and more automated brand loyalty programs such as frequent shopper information and loyalty card specials.

- RFID-enabled self checkout.

RFID-based automation provides greater visibility into what products are on shelves, what products are out-of-stock and what products are on the way. RFID empowered automation helps to reduce labor costs, eliminate errors and reallocate staff from mundane tasks to high value customer support. Demand insight can help eliminate out-of-stock conditions, improve sales floor stock replenishment, and enhance promotion and new product introduction. Greater efficiency, customer-focus and improved merchandise availability helps deliver top and bottom-line benefits to the retailer implementing RFID.

The RFID Benefits

Several major retailers and consumer packaged goods companies have deployed successful RFID pilot and first-stage implementations of RFID applications, yielding impressive business results. Alinean examined these case studies, modeled improvements and impacts, and quantified the results, determining that the leaders achieved the following benefits:

- As sell through occurs, in-demand items are not always on the shelves available to sell, especially to meet promotional or seasonal demand, and as a result, important sales are lost. Improved visibility into ordered and arriving product, back-room stock and most importantly current shelf stock, helps to avoid out-of-stock conditions by up to 16%, driving a 10% or more improvement in overall sales.
- In many retail establishments, products are not available for sale because they are located in stock rooms or misplaced in fitting rooms or on the sales floor. RFID tracking can help to get these items in the right location for sales, or to on-demand locate these items to meet sales requests, improving replenishment three times faster, and helping to drive an additional 5% up-sell.
- Reduce labor requirements for time-consuming manual stock room and store level inventory management tasks such as physical inventory counting, receiving, and merchandise locating. These manual tasks can be reduced by 30-40% by automating the tracking of inventory at the case or package level. Retailers could install RFID readers at the portal from stock-room to sales floor, automating the tracking of items

being placed for sale. For fashion retailers, RFID readers could also be installed from sales-floor to fitting rooms, tracking items that are being tried on, or waiting to be restocked to the sales floor.

- Improve supplier management and accounts payable processes by automating processes like validation and payment on received goods, or tracking returns to vendors to assure proper credit.
- Improving product displays and promotions helps to validate proper placement to sponsoring vendors, assuring promotional placement.
- Lack of proper inventory management not only leads to out-of-stock conditions, but write-downs of obsolete inventory or the introduction of counterfeit items. RFID can enable real-time department level inventory tracking to reduce these losses and write-downs. Examples include better managing perishables and promoting items prior to expiration, or assuring that goods are validated prior to being placed for sale.
- Losses due to theft are estimated to cost retailers over \$30B per year, and are estimated conservatively at 1.5% or more of overall sales. With RFID, carts and totes can be tracked to avoid these from being lost or stolen. Boxes or pallets can be tracked through the supply chain to pinpoint product location and eliminate inventory errors that can cause shipments to go missing. It can also be used to discover where and when in the process the product was lost. Within the retail store, RFID can and has been successfully deployed, particularly on higher margin items, to help prevent theft.
- RFID can help to empower new applications — mini-kiosks, smart carts, portable devices: up-sell/cross-sell recommendations, registry, and instant promotions.
- Improve customer experience by having the right products at the right time and in the right location, and improve the accuracy on inquiries.

RETAIL CASE STUDY

Company: \$650M U.S. based specialty retailer with 180 stores and 1200 employees

Project: Reduce operating costs, shrinkage losses and improve customer experience with RFID empowered retail solutions.

In this simulation, a \$650M specialty retailer with 180 stores and 1200 employees had impressive gross margins — 50% more than the industry average, but was challenged by labor costs and other operating expenses with negative operating margins. In addition, the company was struggling with negative revenue growth and same store sales declines.

At the tactical level, this company was looking to deploy RFID at the pallet and case level to initially help reduce labor and overhead costs for receiving and stock room management. It needed to address the high \$200K sales, general and administrative (SG&A) expenses per employee. Additionally, the retailer needed to address an unusually high shrinkage rate of 5% annually (more typically 1-2%) — an issue due to the desirable nature of the products being sold and the ineffectiveness of other theft prevention methods in securing the goods.

From a strategic perspective, RFID was viewed as a way to improve demand visibility and sell-through in order to reduce out-of-stock conditions and improve the overall customer experience, ensuring the right products were in the right stores at the right times.

The proposed RFID practices included:

- Integrate RFID tagging with the security system to help reduce shrinkage of pallets and cases from the stock room.
- Manage promotions and displays more effectively to drive sales and reduce rebate/discount errors.
- Understand better what is on its way to the store, what is in stock room inventory and what sell through is, to better recognize and react to out-of-stock conditions.

- Quickly handle product inquiries, location and accuracy.
- Automate receiving and stockroom management with RFID tagging of pallets and cases.

Under this scenario, the benefits include:

- Reduced inventory levels by 15% via improved visibility, forecasting and integrity, yielding \$33M in one-time working capital savings, and \$3.6M in annual carry cost reductions.
- Reduced inventory management labor costs and fees by 24% including receiving, stock room management and restocking savings, providing an ability to save or reallocate 48 full time equivalents (FTEs) to less manual/customer oriented tasks.

This labor savings is generated across the 180 stores (of the total 1200 employees), and delivers a \$2.3M in annual labor cost avoidance.

- Reduced the currently high 5% shrinkage (usually 2% or so, but in this case of high margin/high demand goods much higher than average) by 35%, a \$3.75M annual write-off reduction.
- Reduced errors on checkout, saving \$124,000 annually.
- Improved staff retention by automating mundane inventory management tasks, saving \$150,000 in annual off-boarding, recruiting, re-hire, on-boarding and training fees.

Goals	Typical Savings	Tangible Benefits with Manufacturing Case Study
Reduce inventory levels	15% inventory savings	\$33M one-time working capital savings \$3.6M annual recurring carry cost reductions
Reduce inventory management labor costs and fees	24% productivity improvement	\$2.3M in annual labor cost avoidance
Reduce the currently high 5% shrinkage	35% shrinkage reduction	\$3.75M annual recurring loss avoidance
Reduce errors on checkout	10% reduction in checkout errors	\$124,000 annual savings from reducing checkout errors
Improve staff retention*	8% improvement in staff retention	\$150,000 savings in annual recurring off-boarding, recruiting, re-hire, on-boarding and training fees

* Indirect (soft) benefits are risk adjusted to 10% of original value before calculating ROI.

The Bottom-Line: An investment of \$12.3M over three years delivers net present value of over \$21M in net benefits, an ROI (net benefits/total costs) of 190% (for every dollar spent on RFID, the company received their original \$1 back, and an additional \$1.90 in incremental benefits), with a 10 month payback period.

Total investment:	\$12.3M
NPV of benefits:	\$21M
Project time span:	3 years
ROI:	190%
Payback period:	10 months

RFID COSTS AND CONSIDERATIONS

RFID is a significant business investment for most organizations, requiring a commitment to a particular solution and the dedication of resources and funding to implement the project. There are several considerations for RFID solutions today, including:

- **Cost per tag:** The cost per RFID tag has come down significantly over the past several years, reaching 10 cents per tag in 2006 versus 25 to 30 cents per tag in 2004. The good news is that with demand increasing, yielding economies of scale and production costs declining, tag prices are expected to reach even lower levels over the next few years. For the short term, it typically only makes sense to place the tags at the packaged product level (pallet or carton) and on high-margin products, with the current standard being where the tag represents less than 1% of the total cost of good sold.
- **Cost for readers:** Reader costs are modest, between \$2,000 and \$3,000 per reader including installation and accessories such as repeaters, multiplexers and networking costs.
- **Cost for software and integration:** The cost for software and integration is higher, averaging \$500,000 for a small deployment to \$2M plus for a large installation. An additional 18-20% should be budgeted for ongoing maintenance and support. Special customization can drive the initial costs higher, depending on the complexity of the application development and integration project.
- **Data warehouse:** Many organizations may not be ready to transmit, store, process, interpret or integrate with current supply chain management and enterprise systems, the mountains of real-time data that RFID will produce — the location of pallets, cases, cartons, totes and individual products in the supply chain, the activities of picking, packing and shipping, the tracking of expiration dates and recalls are just a few examples. An investment in RFID requires modification investments in data warehouse/database systems and the business intelligence applications and dashboard systems they support in order to analyze the metrics to turn data into information.
- **Business process and systems integration:** The business processes around the data collection and information processing are often not in place, and key systems need to be connected and integrated with the collection and database systems. The process changes and integration need to be developed in order to take advantage of many of the benefits.
- **Limited edge computing power:** At the distributor or retail level, most remote systems are not powerful enough and configured to handle the data and information workload required to make RFID effective at the product level. In order to reap the rewards, a large investment in computing power, bandwidth, storage, IT operations and administration per location will need to be made.
- **Redundancy with existing bar code systems:** Often the RFID solution does not replace current bar code systems, requiring that companies maintain both data collection systems and processes. In some applications, RFID will eventually supersede the bar code system. In others, the investment will be maintained. It is important not to overstate the system cost avoidance or current bar code scanning labor savings if both systems are still maintained.
- **RFID tag and reader equipment survivability:** Many warehouse, distribution and retail environments are hostile and can result in damaged tags or readers. These damaged systems might fail to work as expected. Error detection, repair and repair budgets should be in place to help minimize the impact and costs of downtime. The most resilient RFID solutions should be purchased from RFID suppliers with proven reliability. Over time, dealing with equipment failures or errors on the backend will be more expensive than making the proper up-front investments in reliable equipment and solutions.
- **Complexity and required investment level:** RFID implementation is often a complex integration of systems and process re-engineering. It is important to partner with the right supplier and service providers to help supplement in-house planning and implementation resources.

The competitive advantage and bottom-line business benefits are significant to the supply chain which implements RFID to their advantage. Early estimates indicate that a comprehensive RFID solution can generate an additional 2-7% increase in revenue, improve handling productivity by 20-30%, reduce operating expenses by 2-5% and reduce days in inventory by 1-2%. Financial improvements such as these are significant, and it is for this reason that many companies are moving forward with RFID, sooner than later.

THE BOTTOM-LINE

In these hypothetical case studies, RFID is shown to reduce costs, improve operating efficiency and deliver strategic advantage. Although RFID implementations are not without costs and risks, the demonstrated 200% ROI or more from these projects provides adopting organizations with the financial justification to prioritize these projects over many other investment alternatives. For manufacturing, warehouse and distribution and retail, the high ROI and relatively short payback periods provide the fuel to move from having RFID as a project under consideration, to one where a pilot program is mandatory.

CASE STUDY NOTES

Case studies developed in this white paper were developed by Alinean to explore the business case for RFID, quantifying the potential value of RFID for various industries and business processes. Alinean used RFID ROI modeling tools based on specific organization case studies.

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About Alinean

Since 1994, the Alinean team has been the pioneering builder of tools to help quantify and improve the ROI and TCO of IT investments. Alinean was named for the Spanish word for "Align", matching the Alinean mission as the leading developer of analytical tools to help IT vendors, consultants and IT executives align IT investments with business strategies. The Alinean team has over a decade of experience in the practical development and application of ROI and TCO methodologies, models and tools to optimizing IT investment decision making. In 1994, the Alinean team formed Interpose, the original pioneers of ROI tools, developing analytical software for over 50 major IT vendors and consulting companies worldwide, and creating the industry standard TCO Manager and TCO Analyst software. Interpose was sold to Gartner in 1998, where the team continued their developments and marketing of ROI and TCO software tools. The original team reunited to form Alinean in 2001, once again becoming the leading pioneers and developers of ROI sales and analytical tools. Current customers include leading IT solution providers such as HP, IBM, Dell, Intel, Symantec, NetIQ, EMC, SAP, Oracle, SBC, and Microsoft, as well as leading consultancies and Global 1000 companies. Additional information about Alinean and helpful ROI educational resources can be found at <http://www.alinean.com>.

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Alinean, Inc. • 201 S. Orange Ave • Suite 1210 • Orlando, FL 32801-3406
Tel: 407.382.0005 • Fax: 407.382.0906 • Email: info@alinean.com • Web: www.alinean.com