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Total Supply Chain Visibility with RFID

Benchmark Report

November 2006

— Underwritten, in Part, by —

Total Supply Chain Visibility with RFID
Executive Summary

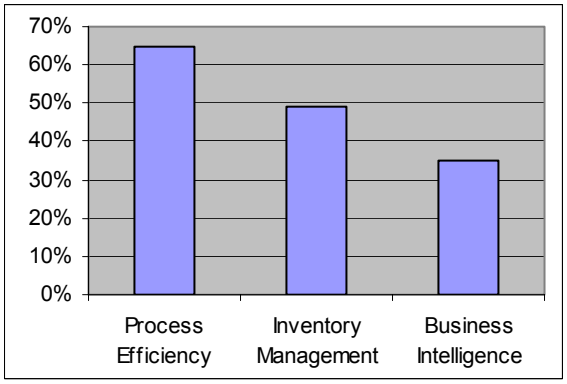
During the last six months, Aberdeen's Emerging Technologies Practice has surveyed more than 300 organizations using or planning to adopt RFID technology. Of those, 68% indicate that their primary objective in adopting the technology is to enable or optimize business processes related to the supply chain. Why are the majority of RFID projects related to the production and movement of goods? In a single word, the answer is: ***Visibility***.

RFID is an enabling technology, not a solution. With education and standards, RFID can complement and extend the core business applications that make up the integrated supply chain. From raw materials, manufacturing and packaging, to transportation logistics, warehousing and distribution, out to the consumer and beyond to field service, repair, returns and recalls, positive ROI is available. Strategically applying RFID technology to business challenges and leveraging its data has the potential to optimize critical processes, enhance business intelligence, and improve collaboration across industries.

The Supply Chain Conundrum

Achieving total supply chain visibility is still an elusive goal for most enterprises, even those with mature RFID initiatives. The proposition is costly, time-consuming and requires unprecedented cooperation and collaboration among the organizations involved, many of whom have competing objectives and incompatible requirements for the technology. Some anticipate immediate rewards from the endeavor; others have trouble seeing any value for themselves at all. However, some enterprises have begun to develop standards-based approaches to this conundrum and are publicly acknowledging that applications of RFID to the supply chain can avoid loss, speed time-to-market, insure quality, facilitate service, reduce paperwork, improve workforce efficiency, and provide forward visibility to demand. This report illuminates the early successes and describes a roadmap to achieving total supply chain visibility.

Figure 1: Top 3 Objectives of Supply Chain RFID Programs



Key Business Value Findings

A successful cross-enterprise RFID initiative uses the right flavor of the technology to address each of the business challenges, collects data at key choke points, makes use of that data to enable visibility and to inform business analytics applications, and makes collaboration among organizations seamless.

Looking at use cases in fields where RFID is already contributing a high degree of value into the supply chain, we can learn how to leverage existing network infrastructure, adapt to existing best practices in supply chain management, apply specific domain expertise to solve challenges unique to each industry, maximize ROI in the obvious places and discover ROI in unexpected ones.

Implications & Analysis

An RFID initiative may begin with a narrow focus and a phased approach; but it will not realize its full potential unless the adoption strategy includes multiple business units and multiple applications. As product travels through supply chain, attribute and sourcing information is augmented with handling, checkpoint and chain of custody data at each step along the way. In the best case, the flow of data precedes the arrival of the product, giving each handler a forward view into the product before it arrives. At the same time, data flows backward through the supply chain, delivering lifecycle visibility all the way back to the manufacturer. As a result, the entire supply chain benefits from the control and the business intelligence that RFID data provides.

Recommendations for Action

In addition to the best-in-class actions illustrated by the case studies presented in this report, organizations should evaluate their RFID initiative planning using the following guidelines:

- Start early and collaborate with your supply chain partners. Implement a data-sharing policy that protects and empowers both you and your partners.
- Understand your objectives and the objectives of the entire chain. Start small but think about how the solution will scale across business processes and enterprises.
- Pick the right technology vendors. Selecting the proper "flavor" of RFID and technology vendors with domain expertise is essential to a successful program.
- Don't "self-integrate" unless you are a data integration specialist. Edge devices, middleware and applications must work in concert. This is no small challenge.
- Conduct a pilot or proof-of-concept trial. It is easy to miscalculate during the design process or underestimate the costs, especially with data integration across enterprises. A validation exercise greatly reduces the risk of developing an unworkable solution.
- Test "what-ifs" up and down the supply chain. RFID is a way to reduce the cost of exceptions. If you design using the "80% rule" the other 20% can negate the ROI.

This report will discuss each of these points and many others in detail. Given the state of the RFID industry today, every supply chain organization has the opportunity to emerge as a best-in-class company and realize the promise of this emerging technology.

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Chapter One:
Issue at Hand

Key Takeaways

- RFID takes many forms throughout the supply chain, creating integration challenges for those who wish to leverage the technology across the entire chain.
- A collaborative RFID solution intended to address cross-enterprise visibility challenges is a more costly and time-consuming proposition.
- The lure of short-term ROI in any one part of the supply chain can mislead an organization into adopting a solution that does not scale well and does not support trading partners upstream and downstream.
- The correct combination of technologies (tags, edge devices, network management, data capture and management, vertical applications, analytics, and alerting) in a flexible organization has the potential to deliver positive ROI across the entire supply chain.

Recent Aberdeen research shows that achieving total supply chain visibility is a top priority for most enterprises, but remains elusive, even for those with mature RFID initiatives. The proposition is still costly, time-consuming and requires unprecedented cooperation and collaboration among the organizations involved, many of whom have competing objectives and incompatible requirements for the technology. Some anticipate immediate rewards from the endeavor; others have trouble seeing any value for themselves at all. However, some enterprises have begun to develop standards-based approaches to this conundrum and are publicly acknowledging that applications of RFID to the supply chain can avoid loss, speed time-to-market, insure quality, facilitate service, reduce paperwork, improve workforce efficiency, and provide forward visibility to demand.

Competitive Framework Key

The Aberdeen Competitive Framework defines enterprises as falling into one of the three following levels of practices and performance:

Best in class (20%) — practices that are the best currently being employed and significantly superior to the industry norm

Industry norm (50%) — practices that represent the average or norm

Laggards (30%) —practices that are significantly behind the average of the industry

During the past six months, Aberdeen has produced several benchmark reports describing our primary research into the RFID technology solutions available in the market, end-user methods for leveraging the technology to solve critical business challenges, and the metrics they use for measuring the success of their RFID programs. In the research, 68% of end users are found to be applying RFID technology to supply chain applications. In support of that finding, RFID technology vendors agree that most of the activity they are seeing in the market falls into the supply chain category.

Dissecting the Supply Chain

Dissecting the supply chain, we find that the objectives, opportunities, and best-in-class RFID solutions change as product travels from one organization to the next in the chain. This creates disparity among partner organizations and the danger that individuals will develop solutions that do not lend themselves to col-

laborative leveraging of the technology. It also creates an opportunity for a new class of solution providers with products and services suitable to every stage of the supply chain.

Manufacturing

Manufacturers have three primary motivations for implementing RFID: raw materials management, workforce and production efficiency, and demand chain visibility. The ability of a manufacturing organization to track assets across facilities, locate tools, materials and people within the facility in real time, reduce scrap, improve quality and adapt processes to business intelligence gained from RFID data is compelling and relatively easy to measure. However, Aberdeen research suggests that the benefits that a manufacturer may realize from forward visibility to demand, pedigree assurance to combat counterfeiting, returns processing, field service and by reducing the impact of a product recall will far outweigh the benefits of materials, workforce and production optimization.

The first two motivators can be described as applications "*within the four walls*". For these, active tags make sense. Active tags are typically deployed, used, removed and reused, never leaving the factory premises. However, the third motivator requires the manufacturer to release item-level RFID-tagged product into the supply chain, typically a passive tag solution. This disparity often prohibits the manufacturer from making the most of RFID and suggests that procedures must adapt before the factory is ready to fully leverage RFID.

We will revisit the value proposition of RFID to the manufacturer in the next chapter; and a deeper investigation into the application of RFID in manufacturing will be published by Aberdeen in January, 2007.

> "If the cost of tags goes to zero, we will begin to tag every item: raw materials, finished goods, minor assets, tools, even critical paperwork and other supplies."
>
> - Bud Tabor, Owens & Minor

Transportation/Logistics

RFID is finding its greatest adoption levels in transportation logistics. Real-time location systems (RTLS) which combine global positioning systems (GPS) for tracking and RFID for monitoring allow shippers to move products from source to destination more securely, more efficiently, and with reduced risk of shrinkage, spoilage or damage. The ROI for a transportation logistics company can be found in:

- improved time-to-market;
- yard workforce and equipment optimization;
- proactive equipment service;
- economical and environmentally sound berth management in port facilities;
- prevention of damage to sensitive goods from heat, light or shock;
- theft prevention;
- intelligent routing of vehicles;
- streamlined passage through customs and security checkpoints;
- reduced insurance costs; and
- faster payment turnaround

A deeper investigation into the mechanics and value proposition of RTLS in transportation and logistics is part of Aberdeen's 2007 research agenda; however, for the purposes

of this study, we focus on the role of the shipper in the greater supply chain and how RFID enables visibility into the entire process.

> 'Encoded on the RFID tag, we would like to see a duplicate of the information that appears on the printed pallet/box label, such as weight, cube, and special storage or handling instructions, like "keep refrigerated"'
>
> - Don Goddard, GA Aeronautical Systems, Inc.

Here, again, the business case for the logistics organization suggests that active tags affixed to the vehicles and ID badges for the drivers are the optimal use of RFID. While item-level tagging could help in compiling manifests and controlling the quality and security of the contents, it is not currently in the interest of the transportation company to affix passive tags to the product. It is however, very useful to the shipper when the manufacturer provides forward visibility to jobs, a way to insure that the right product is loaded, and electronic delivery of the manifest and any special handling instructions. RFID can provide these capabilities.

Warehousing

According to "*The Supply Chain Innovators' Technology Footprint*" (Aberdeen Benchmark Report, May 2006), 57% of warehouse companies that say they are striving to create brand new supply chain innovations in the warehouse are looking to RFID as an enabling technology to achieve that goal. Predictive inbound and outbound slotting, intelligent movement of product, equipment and people within the four walls for efficient breakup, storage and forwarding, cross-dock visibility and put-away labor management are a few areas where the warehouse management system can benefit greatly from the visibility that RFID offers. In the warehouse, it is essential to control the edges of the plant, making sure that product does not sit on the dock and does not get loaded improperly. Items put away improperly can get lost for weeks; items picked and shipped improperly can also take weeks to correct. With RFID, palette-rack association time can go from 6 seconds per palette to nearly zero and the risk of data-entry errors goes down by an order of magnitude.

PACE Key — For more detailed description see Appendix A

Aberdeen applies a methodology to benchmark research that evaluates the business pressures, actions, capabilities, and enablers (PACE) that indicate corporate behavior in specific business processes. These terms are defined as follows:

Pressures **—** external forces that impact an organization's market position, competitiveness, or business operations

Actions **—** the strategic approaches that an organization takes in response to industry pressures

Capabilities **—** the business process competencies required to execute corporate strategy

Enablers — the key functionality of technology solutions required to support the organization's enabling business practices

Distribution

To distribution companies, the value proposition of RFID is similar to that of transportation and logistics with the addition of chain of custody and e-Pedigree applications. Distributors carry the burden of insuring that the product is not lost or stolen on its way from the warehouse to its final destination.

Retail and Field Deployment

It is in the field that we find the greatest diversity of RFID technology, the most variation in terms of best of breed technology from application to application, and the highest sensitivity to cost and ROI. Retailers are focused on inventory turn, loss prevention, tracking promotions, and improved customer service. Pharmacies are concerned with chain of custody, product pedigree, and ensuring proper handling. Grocers are concerned with aging, temperature control en-route, freezer space management, merchandising, and line-busting applications. And in the theatre of battle, the department of defense is focused on asset track and trace. Each of these carries with it specific demands on the tags, the readers, and the data management systems controlling and managing the flow of information.

> "In the best case scenario, we would apply tags to pallets at the plant which would include the item, description, best before date, lot, pallet quantity, date of manufacture, and details of the batch (blend, total qty produced, etc) to assist traceability throughout the distribution process.'"
>
> - Chris Young, Supply Chain Analyst for a Global Food Manufacturer

Field Service

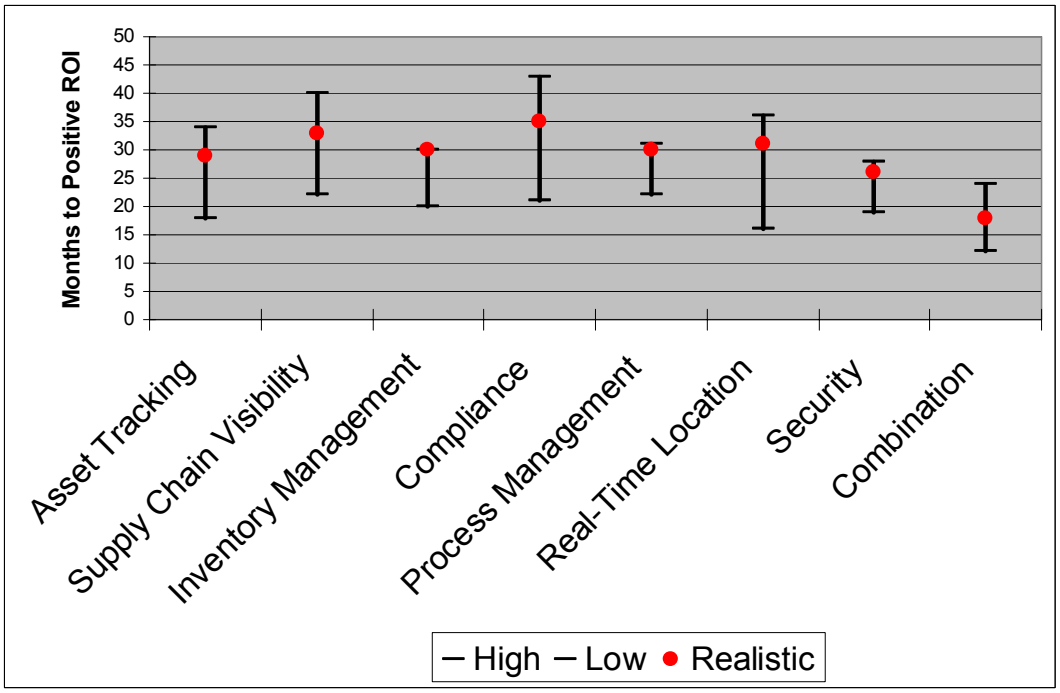
In the recent Aberdeen benchmark report, "*Location-based Mobile Field Service",* it was reported that RFID technology deployment in field service will grow at a rate of 100% per year over the next two years. Fleet optimization, proactive service call enablement, expedited returns of equipment and tools to inventory, minimizing the impact of product recalls, and intelligent preventive maintenance are some of the capabilities that RFID brings to the field service organization.

Knitting it All Together

It is a rare technology that can address all of the myriad objectives and constraints described above. A successful cross-enterprise RFID initiative makes use of the right flavor of the technology to address each of the business challenges, collects data at key choke points, makes use of that data to enable visibility and to inform business analytics applications, and makes collaboration among organizations seamless.

Each supply chain company approaches the challenge with a different set of primary objectives and each will have its own expectations for the time it takes to realize positive ROI. Figure 2 illustrates this concept and reveals that supply chain organizations looking to multiple sources for ROI will find the time to positive ROI is shorter. The same is true across enterprises. When partners collaborate to develop compatible and complementary solution sets, everyone in the chain achieves positive ROI in less time.

Figure 2: Path to Positive ROI for Supply Chain RFID Initiatives



Source: Aberdeen Group, November 2006

Key Summary Point 1

Aberdeen is seeing leading consultants and vertical application providers developing integrated approaches to achieving total supply chain visibility solutions. Despite the seeming disparity among organizations from different parts of the supply chain, there is common ground and an opportunity for master data management solutions to leverage RFID data to the benefit of every part of the chain. The following chapters illuminate early successes and describe a roadmap to achieving total supply chain visibility.

Chapter Two:
Key Business Value Findings

Key Takeaways

- A successful cross-enterprise RFID initiative uses the right flavor of the technology to address each of the business challenges and includes a value proposition for every participant.
- Best-in-class companies have a near-term strategy for recovering the investment for themselves and a long view recognizing the competitive advantage of improved visibility at every point in the supply chain.
- Domain expertise and domain-specific technologies are required to solve the challenges unique to each industry.

Two prominent supply chain implementations of RFID have received a lot of press during the past year; one mandated by the **US Department of Defense**, and the other mandated by **Wal-Mart**. While it can be said that such mandates are necessary to move a technology from the "emerging" category into the mainstream, the business case does not serve to inform others -- beyond what is learned about the performance of the technology itself. Such compliance-driven initiatives are generally designed to give the lion's share of the advantage to the organization setting the mandate. Those who choose to comply take it upon themselves to find some way to justify the cost of compliance, whether by finding what benefit they can from the exercise, or merely for the privilege of continuing to do business with the behemoth, or both.

As indicated in Figure 1, RFID contributes value to the supply chain enterprise through process efficiency, inventory management, and business intelligence. To understand how RFID can enable total visibility in the supply chain, we must look to use cases in which every participant benefits from increased visibility. For the purposes of this research, we will look at the following use cases:

- An aerospace firm looking to streamline operations;
- A retailer wanting visibility into a line of high-value apparel;
- A port facility management initiative with far-reaching benefits; and
- An end-to-end pharmaceuticals supply chain implementation.

Each is a real-world example of RFID in the supply chain, with lessons applicable to other similar configurations of supply chain companies.

Use Cases from the Field

Streamlining Aircraft Delivery

In a complex manufacturing and assembly process where there may be thousands of costly parts, the manufacturer can identify three areas where RFID significantly reduces cost and dramatically improves time-to-delivery: controlling delivery of materials into the plant and deployment of raw materials across locations; managing the tools, parts and

people involved in the assembly process; and, embedding tags into the completed products to facilitate field service and track the movement of stock through the supply chain.

Boeing and Federal Express became among the first to cooperate on a program to tag aircraft parts during assembly. Boeing's incentives include: improved control over parts that arrive at the assembly facility from many suppliers; faster time to locate the equipment and tools required in assembly, saving hours in their vast complex; and, security within the plant.

With Boeing satisfied that the solution provided the intended benefits, Federal Express began to leverage the technology to improve their performance. With the ability to query the identity and service history of internal parts without the need for line-of-sight visibility, field service technicians can now complete aircraft maintenance in less than a third of the time, and valuable equipment back into the air much more quickly.

High-Value Apparel in the Retail Supply Chain

When a retailer has the luxury of high margins and control over the product design and manufacturing process, there is an opportunity to include RFID tags embedded directly into the merchandise. This is the case for fashion apparel, some footwear lines, big box items and some consumer electronics.

In an effort to improve warehouse picking times, track distribution through the supply chain, and eliminate counterfeit merchandise, Goldwin Sportswear decided to have RFID tags sewn into their winter sportswear line. They asked the factory in China to encrypt product, batch, color, size and, in some cases, customer information onto the tag, making the clothing nearly impossible to duplicate.

The packaged and boxed product goes to Nippon Express where it passes through a sensor-equipped conveyor tunnel which automatically creates a detailed manifest. The rest of the distribution process happens without data-entry, without error and without having to re-open the boxes. Upon arrival in Milan, the goods are scanned again and loss or shrinkage is reported immediately.

Once the technology was deployed to the satisfaction of Goldwin Sportswear, the manufacturer, distribution partners, warehouse facilities and even customers were able to leverage the technology to the advantage of everyone in the supply chain.

Handling Perishables in the Shipping Yard

A major port facilities management company realized that there was room for optimization within their enterprise management system. The addition of real-time data analytics provided visibility into the movement of vehicles and people around the facility and improved workforce efficiency dramatically.

NYK Logistics manages a 70-acre yard with 250 dock doors and 50,000 inbound freight containers at the Port of Los Angeles. But when Target demanded better on-time performance and the Department of Homeland Security tightened security regulations, the home-grown yard management system could not keep up. To improve yard throughput, on-time performance and better gate efficiency, NYK decided to adopt an RFID solution.

Once the yard was fitted with RFID and management was confident that the technology provided the intended operational efficiencies, it became clear that the shippers and distributors (particularly those carrying perishables) could also benefit enormously by lever-

aging the same infrastructure. From that point, the technology advantages continued up and down stream to the suppliers and to the retailers who were able to realize benefits of their own from RFID.

International shippers experienced fewer delays waiting for open berths at the port and were able to schedule more accurately. Domestic distributors spent less time on unnecessary one-way trips, waiting at yard gates, and returning incorrectly loaded cargo. Manufacturers enjoyed less uncertainty in getting product through customs and improved visibility into the disposition of shipments all the way to the retailer's dock door. Finally, retailers, especially Target, achieved satisfactory visibility and reliable turns from their suppliers.

Beginning with a yard management initiative, NYK used RFID technology to improve time-to-market and operational efficiency, reduce inventory shrinkage and give every organization in the chain improved visibility and business intelligence. Most importantly, NYK was able to satisfy its $10 billion customer.

End-to-End Visibility in the Pharmaceuticals Supply Chain

Today, RFID offers arguably more benefits to the pharmaceuticals supply chain than to any other vertical industry. The value proposition is compelling from both ends of the chain, from the manufacturer who needs to control the handling and ensure the authenticity of the product to the retail pharmacy where expiry management, quality control and loss prevention are crucial to business success. In this case, item-level tracking with RFID becomes an attractive solution providing visibility throughout the supply chain.

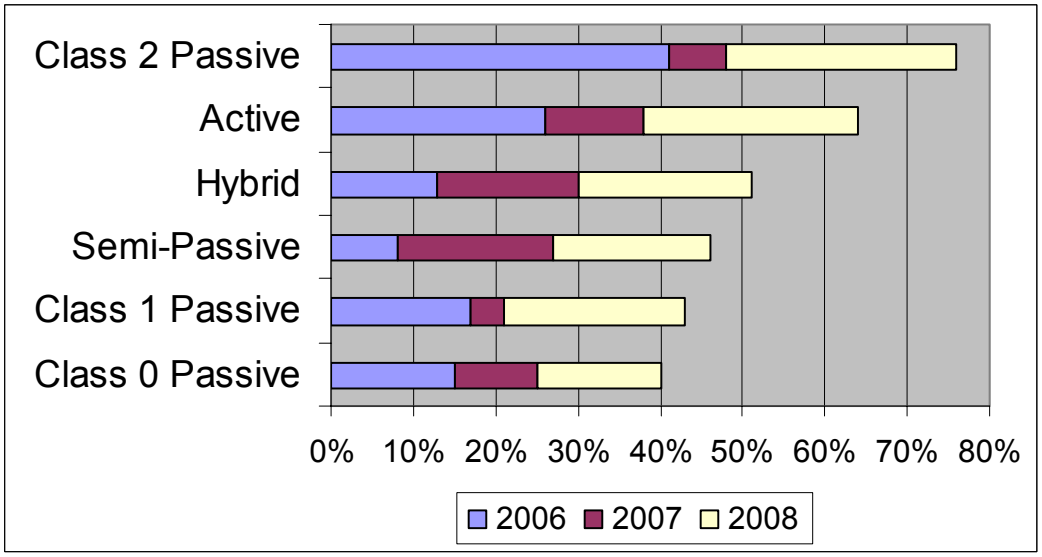
Drug-makers Abbott Labs, Johnson & Johnson, Pfizer, and Proctor & Gamble have begun using HF passive tags for bottles and UHF passive tags for cases to insure quality, track chain of custody, and to combat the rising scourge of counterfeit drugs in the market. At the same time, Rite-Aid decided to use RFID to reduce theft and the mishandling of drugs in their distribution centers and retail locations.

The incentive to adopt RFID came from the drug manufacturer and from the retail pharmacy, meeting in the middle at the distribution center. Passive tags are affixed directly to the product by the manufacturer and tracked throughout the network, delivering chain of custody data back to the manufacturer and forecasting information to the retailer at every stage. The sophisticated, integrated system creates seamless visibility and delivers business intelligence to the analytics systems throughout the supply chain.

Technology Selection

Domain expertise is essential in selecting the correct RFID technologies. As was reported in the recent Aberdeen benchmark report, "*Finding the ROI in RFID*", a combination of the line of business manager, the IT staff and senior management is the best approach to setting an effective deployment strategy and making the right technology decisions. In addition, in the case of the supply chain, close collaboration with supply chain partners is essential to achieving total visibility. As we have seen in the cases presented, the right technology for one organization might not be the right technology for all players. Nevertheless, all their needs can be met by adhering to industry standards and leveraging the middleware and application layers specific to each.

Figure 3: RFID Tag Technology Growth in the Supply Chain



Source: Aberdeen Group, November 2006

EPC Class 2 tags are proving to be the most popular choice among supply chain organizations for their cross-platform compatibility, their ability to carry substantially more data than Class 1 and Class 0 tags, to take updates as they move through the processes, and function in more types of environment (Figure 3). Active tags are also gaining traction in applications where the product is of high value and the tags can be re-used.

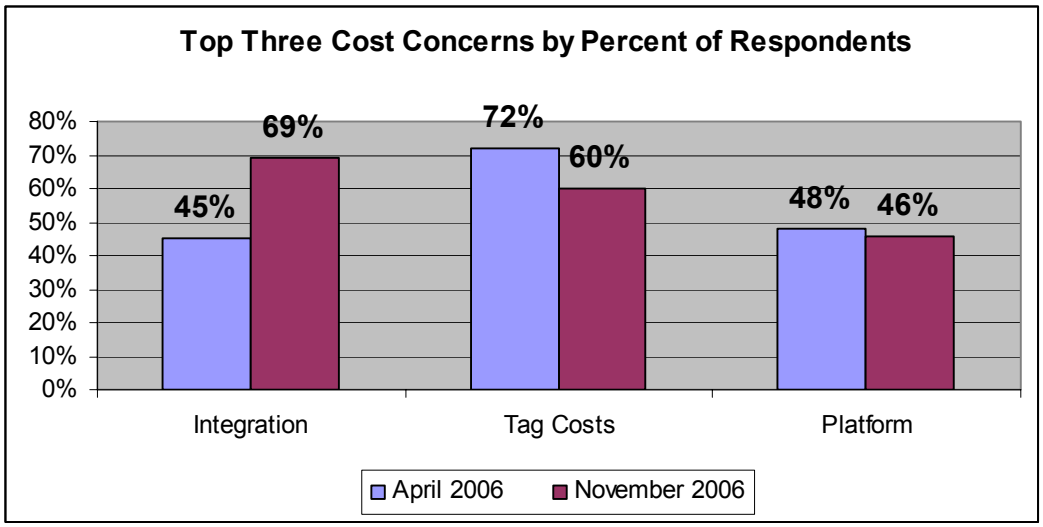
Combating the Cost

Across all RFID application areas, tag costs emerged as the top concern among companies planning to adopt the technology. As the cost of tags and readers continues to fall, integration and data analytics will emerge as the greatest economic barrier to entry across all application areas. In the supply chain, however, tag costs are already second to systems integration (Figure 4).

"We're preparing for the future. We believe in this technology and are hopeful that it will get to the point where we can benefit internally by lowering cost, and not just benefit from improved on-shelf availability in the store."

- Randy Peterson, VP of Technology, World Kitchens

Figure 4: Expense Factors Considered by Supply Chain Organizations

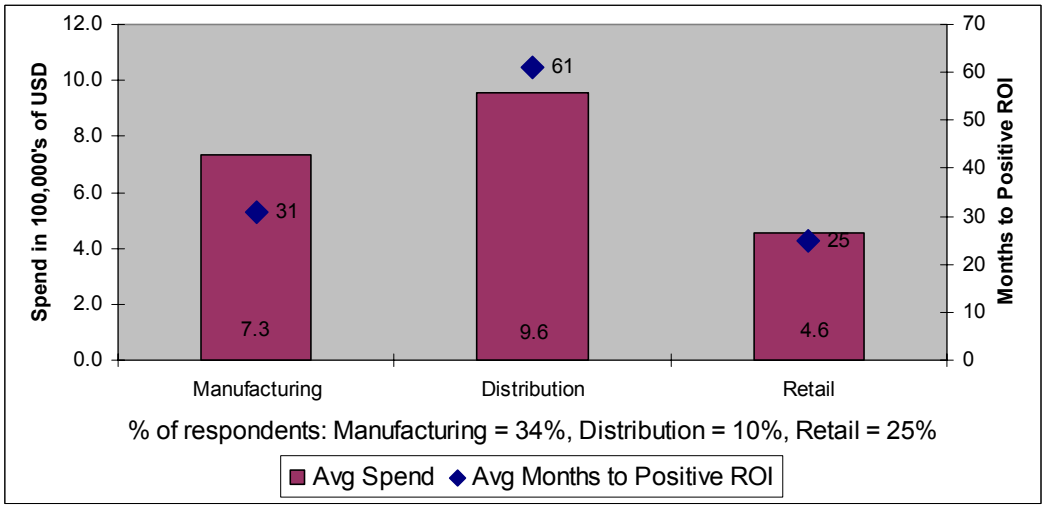


Source: Aberdeen Group, November 2006

Recovering the Cost

Supply chain organizations approach RFID with very different expectations regarding the cost and returns (Figure 5). Distribution companies typically spend nearly 30% more than manufacturers and more than twice what the average retailer spends. At the same time, distribution companies anticipate full recovery of the investment in just over five years, as compared with the others who tend to see positive ROI after 2-to-3 years.

Figure 5: Investment and Projected Time to Positive ROI



Source: Aberdeen Group, November 2006

As a result, manufacturing and retail account for nearly 60% of the supply chain RFID initiatives while distribution accounts for only 10%. This disparity has dramatic implications in the field, where, as we saw in the pharmaceuticals case in chapter 2, retailers and manufacturers must offer incentives to the distributor sitting between them in order to fulfill their ambitions for total visibility.

Key Summary Point 2

Looking at use cases in fields where RFID is already contributing a high degree of value into the supply chain, we can learn how to leverage existing network infrastructure, adapt to existing best practices in supply chain management, and apply specific domain expertise to solve challenges unique to each industry. Using these successes as a roadmap, it is possible to develop a strategy that minimizes the investment, maximizes the ROI in the obvious places and discovers ROI in unexpected ones.

Challenges and Responses

Standing in the way of total visibility, according to survey respondents, are insufficient metrics to understand whether the solution is working, difficulty quantifying the improvements, the perception that the ROI is a moving target, and that RFID is still maturing, (Table 1).

Table 1: The Challenge of Achieving Total Visibility

Challenges	% Selected	Responses to Challenges	% Selected
1. Integration with existing systems or with trading partner systems	59%	1. Build internal expertise in RFID	45%
2. Difficulty quantifying specific improvement	48%	2. Retain outside services	43%
3. The technology is still maturing	32%	3. Set up a lab to evaluate and benchmark RFID technology	25%
4. Inability to measure pre-initiative benchmarks	27%	4. Use service provider ROI models to build a business case	23%
5. RFID is tied to other initiatives and inseparable from them	32%	5. Give trading partners incentive to adopt RFID	23%
6. The initiative will not mature sufficiently to make a determination any time soon	14%	6. Wait for technology vendors and standards organizations to release product updates and definitions	23%

Source: Aberdeen Group, November 2006

After integration, all of the challenges cited by survey respondents centered on Business line managers' difficulty measuring the performance improvement as a result of an RFID implementation. No clear response to this challenge emerged in the research. However, in one form or another, *education* is the answer. Whether that means internal knowledge-building, contracting with outside experts, or lab-testing to develop performance bench-

marks prior to and post-deployment, organizations across the board, from laggard to best-in-class, agree that education is key to success. Best-in-class companies prefer developing internal expertise, understanding that the long-term ROI depends on turning data into actionable business intelligence, a challenge best undertaken by internal experts. However, almost every organization indicated reliance on technology vendors or 3rd-party service providers to provide ROI models and help design a roadmap to achieving visibility.

Key Summary Point 3

A successful cross-enterprise RFID initiative uses the right flavor of the technology to address each of the business challenges, collects data at key choke points, makes use of that data to enable visibility and to inform business analytics applications, and makes collaboration among organizations seamless.

Chapter Three:
Implications & Analysis

Key Takeaways

- RFID adapts to the business process, not the other way around. However some business processes can be improved to better leverage RFID.
- Best in class companies develop an internal strategy for RFID deployment, then collaborate with trading partners on data integration strategy and master data management.
- RFID data has tremendous value as an enabler for actionable business intelligence. Sharing that data makes the entire supply chain more intelligent.
- Incompatible technology infrastructure across enterprises is the biggest barrier to true collaborative supply chain management.

As shown in Table 2, survey respondents fell into one of three categories – Laggard, Industry Average, or Best in Class — based on their characteristics in four key categories: (1) process (ability to address exceptions, turn data into actionable business intelligence, and to innovate); (2) organization (collaborative strategy, design expertise, and staff training); (3) knowledge (enterprise data management strategies, visibility, and real-time process management); and (4) technology (infrastructure excellence, analytics and performance improvement).

In each of these categories, survey results show that supply chain firms exhibiting best-in-class RFID usage characteristics also enjoy best-in-class financial performance.

Table 2: RFID Competitive Framework

	Laggards	Industry Average	Best in Class
Process	• RFID initiative driven by mandate or regulatory compliance. Process remains ignorant of the potential improvements introduces by RFID.	• RFID initiative motivated by need to solve a particular set of business problems. ROI is calculated using point solution-based metrics	• RFID initiative is part of a general technology strategy with ROI based on actionable real-time business intelligence and forward visibility to demand.

	Laggards	Industry Average	Best in Class
Organization	• IT or business has sole responsibility for the RFID initiative, expecting RFID solution to conform to existing business processes. Management is passive.	• Business and IT likely to centralize the adoption process, willing to adjust business process to take advantage of the technology. Senior management has regular involvement.	• Multiple business units, senior management and IT share strategy and actively seek involvement of trading partners in design and implementation..
Knowledge	• Least likely to build internal expertise, to innovate, to leverage the data, or to share business intelligence outside the business process group	• Internal expertise developed as required to complete and maintain the solution, data shared within the enterprise for improved business intelligence	• Internal expertise rewarded for innovation. Real-time visibility into business process data is leveraged to facilitate extra-enterprise collaboration
Technology	• Focus on minimal impact to existing technology infrastructure. Lowest cost solution even at the expense of domain expertise. Management at the site level with little or no attention to performance measurement	• Priority placed on technology compatible with existing infrastructure, standards compliance, data integration with internal systems, security, reliability, flexibility and scalability	• Interoperability and integration with external systems to optimize data capture and distribution to trading partners. Sees RFID as an enabler to be measured, leveraged and propagated across the enterprise.

Source: Aberdeen Group, November 2006

Process, Organization and Knowledge

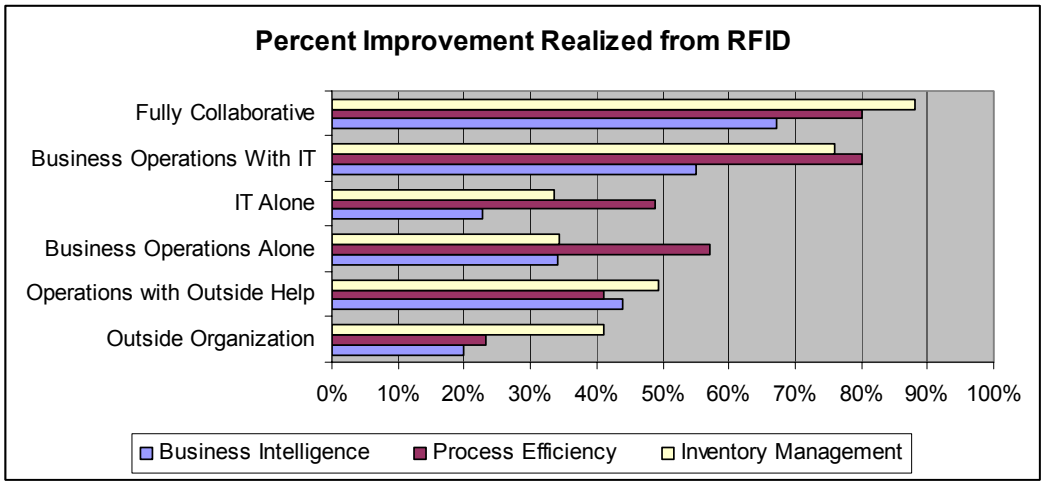
- In the process category, best-in-class firms consider RFID to be a part of an overall strategy for performance improvement and focus on data analytics to turn RFID data into actionable business intelligence. At every stage, RFID data is considered for its ability to enable for-

65% of supply chain firms that have had an RFID initiative in place for more than one year report an improvement in process efficiency traceable directly to the technology.

forward visibility both for the organization itself and for its trading partners.

- As reported in "*Finding the ROI in RFID*", firms that include a combination of senior management, IT and line of business managers in the design and implementation process enjoy a 26% shorter average time to positive ROI than firms that take a less collaborative approach.
- Organizations that include supply chain partners in the design and implementation of their RFID solutions report 68% more value from their business intelligence and analytics systems derived from the technology than those that do not collaborate. Similar performance improvements were realized in process efficiency and inventory management. (Figure 6).

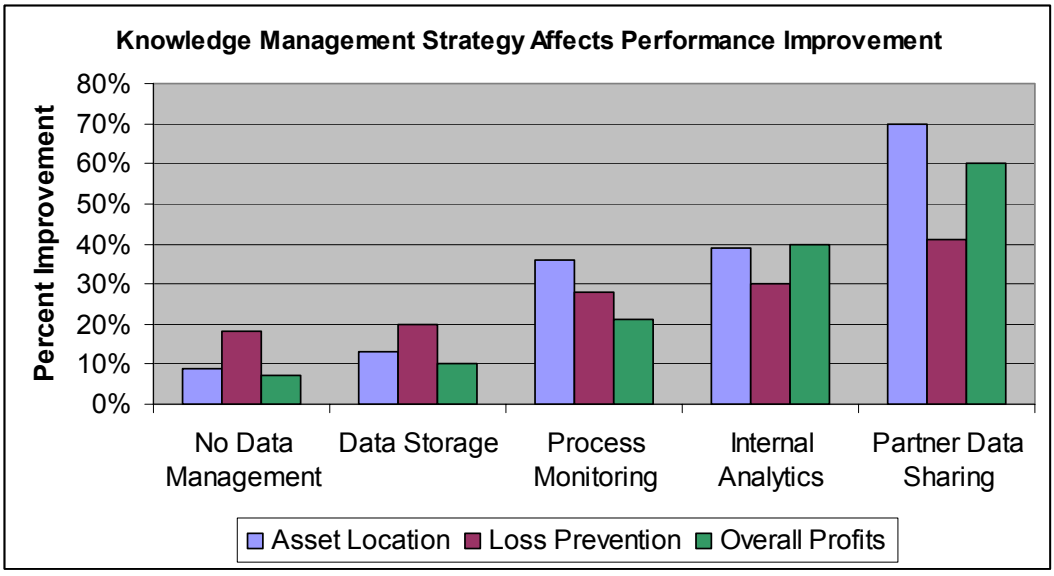
Figure 6: Collaborative Design Improves Results



Source: Aberdeen Group, November 2006

- Equally important to total supply chain visibility is a cross-enterprise approach to knowledge management. As reported in "*Finding the ROI in RFID*", the long-term ROI is in the value of the data and its conversion into actionable business intelligence. The maturity of an organization's approach to knowledge management has a direct impact on improvements to timely location of critical assets, objects and people, to loss prevention, and to overall profitability (Figure 7).
- A coordinated approach to data sharing requires collaboration, both in the format and integration of the data itself and in the policies governing data ownership. When supply chain partners agree on the basic principles and the data is captured and stored advantageously for all concerned, visibility improves, intelligence and agility improve, and value is discovered in unexpected places. Leading supply chain application vendors understand these concepts and have created tools to facilitate the harvesting of knowledge.

Figure 7: Organizational Approach to Knowledge Management



Source: Aberdeen Group, November 2006

Technology Usage (Industry "Ah-ha")

Across all polled industry categories, RFID adoption is increasing in the supply chain. Integration, tag and platform costs are top of mind for a majority of the companies using the technology. Mandates and regulatory compliance is waning as a primary driver, highlighting an increased focus on visibility and process optimization.

The use cases cited in this research reveal several dominant configurations of hardware, software and business rules, each appropriate to addressing certain supply chain challenges (Table 3).

Table 3: Solutions Depend on the Product and the Organization

Supply Chain Objective	Tag Type	Collaboration	Integration
Manufacturer-driven materials and assembly systems	Active	Low	Simple
Manufacturer or warehouse-driven inventory visibility systems	Passive	Low	Simple
Retail-driven inventory management system	Passive	Medium	Moderate
Distributor-driven RTLS system	Active	Low	Moderate
Total visibility system driven jointly by manufacturers and retailers	Passive	High	Complex

Source: Aberdeen Group, November 2006

The specific combination of tag and reader hardware, edge device management systems, middleware and vertical application architecture will vary based on the type of product, the ability of the supply chain partners to achieve consensus on standards, and the degree to which data is shared. When the objective is total supply chain visibility, generally the simpler the tag technology, the more complex the middleware and software integration becomes. As the tag itself carries more data, it replaces the applications as the "system of record" and integration requirements are relaxed. When collaboration among partners is difficult to achieve or constraints dictate the use of passive tags, one way to avoid the cost of complex integration is to move to an SaaS (software as a service) model, as we saw in the fashion apparel example in chapter 2. However, while SaaS can eliminate some of the integration efforts, it also compromises some of the potential value that an integrated analytics engine brings into the equation.

Clearly, no one solution will fit in every case. It is up to the domain experts to determine the correct set of technologies for the particular challenge at hand. The good news is that no matter what the challenge is, there is a correct RFID technology available to address it.

Chapter Four: Recommendations for Action

Key Takeaways

- Plan your company's RFID solution to scale across the entire supply chain.
- Select standards-based, scalable solutions that address your needs and that do not compete with the requirements of your trading partners up or down the supply chain.
- Adopt a master data management strategy that leverages your RFID data to the benefit of everyone in the supply chain and a data sharing policy that both protects and empowers you and your partners.
- Turn asset, product, customer, supplier, product, and employee visibility data into actionable business intelligence

The promise of RFID to deliver visibility into the supply chain applies to all firms that are committed to optimizing their use of the technology. Aggressive activity around planning, technology selection, collaboration, prototyping and deployment will yield results across industries, for companies large and small, whether competing in fresh flowers, apparel, health care, aerospace, or elsewhere.

In certain industries — such as high-volume consumer packaged goods, pharmaceuticals, and distribution of perishables — where sensor technology is critical to business continuity, the competitive advantage will be won and lost based on differentiated operations. A well-formed master data management strategy and a robust data analytics engine will turn RFID data into actionable business intelligence that can be leveraged within each organization and shared across the supply chain.

Whether a company is trying to gradually move its contact center from "Laggard" to "Industry Average," or "Industry Average" to "Best in Class," the following actions will help spur the necessary performance improvements:

Laggard Steps to Success

1. *Adopt and Adapt.*

   RFID is designed to fit into your existing business processes. You should not have to modify the way you conduct your business in order to incorporate RFID technology into the enterprise. However, RFID does introduce opportunities to improve your business processes once it is implemented. Be on the lookout for process optimization opportunities.

2. *Encourage collaboration between departments and with trading partners.*

   Even if RFID is being employed in a very limited scope to solve a specific business challenge, the implications of the technology to other parts of the organization and outside the enterprise should not be ignored. Meaningful conversations among line of business managers and the IT groups in partner organizations can yield valuable long–term strategies.

3. *Leverage the technology.*

   Even if RFID is strictly a matter of compliance for your organization, keep in mind that the data may have tremendous value to you and toy our partners. Do not overlook the importance of intelligent data capture, storage and analysis.

Industry Norm Steps to Success

1. *Increase collaboration.*

   Encourage collaboration between business and IT to share strategy and actively seek process optimization. Include trading partner objectives in the architectural design to improve the long-term value of the technology.

2. *Seek real-time visibility.*

   Real-time business process data and visibility into the location and condition of assets becomes actionable business intelligence when it is used well. Performance analytics and process monitoring can catch and handle exceptions before they become problems.

3. *Build in-house expertise.*

   Industry consultants with deep domain expertise are invaluable in the early stages of any RFID initiative. Continue to watch the industry and communicate with experts but focus on building in-house expertise.

4. *Focus on interoperability and master data management.*

   Once RFID is in use in the organization, look for ways to leverage the technology. RFID technology in one part of your organization or one part of the supply chain can greatly enhance efficiencies elsewhere. Implement a data management strategy that opens the possibility for innovative uses of the data in the future.

Best in Class Next Steps

1. *Strive for total supply chain visibility.*

   A well-designed RFID solution provides a distinct competitive advantage in the supply chain. The challenge is not trivial and, once accomplished, represents a significant barrier to entry for your competition. As laggards and average companies begin to adopt best practices, RFID will stop being a differentiator. Study the opportunities for value-added extensions of RFID in the enterprise to maintain a leadership position.

2. *Participate in standards organizations*

   Organizations which participate actively in standards-development organizations have the opportunity to direct the future of the technology. RFID is still developing. Don’t miss the opportunity to leverage a position of leadership.

3. *Build In-House Expertise*

   Your staff is the key to maximizing the value of RFID. Develop in-house expertise and company-wide awareness around the initiative so that everyone, from senior management and line of business managers to IT personnel understands

the advantages and potential of the technology. If your supply chain partners perceive you to be a leader, you can help them to adopt systems and procedures that are compatible with yours.

4. *Share Your Data*

   Design a data-sharing policy that is advantageous to your organizations, that delivers value to your supply chain partners and returns even more value back into your organization. Actionable business intelligence is the holy grail of RFID. Leverage a best-in-class master data management strategy with a robust analytics engine and knowledge discovery toolset.

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Russ Klein is the senior research analyst in the Emerging Technologies practice at AberdeenGroup, Inc., a Boston-based market research and positioning services firm. In this role, Klein provides analysis and assessment of software and services that automate and streamline business operations. He also keeps a close eye on emerging technologies and their impact on the organization, its key processes, and its knowledgebase.

Klein specifically focuses on emerging technologies, data integration, collaboration, and e-commerce, and on best-practices in knowledge discovery. His passion is in realizing potential value in corporate data warehouses and employing emerging technologies to enhance data capture and directed data analysis from the edges of the enterprise to the central databases.

He has more than 20 years of experience developing database software applications, advising companies on developing and refining knowledge acquisition systems, and harvesting business intelligence from transaction data.

He brings a wealth of knowledge and experience to Aberdeen in the areas of online transaction technologies, business intelligence systems and data warehousing as well as familiarity with emerging technologies, some of which have yet to find applications in the real world.

His current research efforts include Aberdeen's benchmark studies on voice recognition, RFID, GPS, and VoIP technologies, pervasive retailing and supply chain logistics, as well as real-time process monitoring, handheld database application technologies, and information architecture.

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Appendix A:
Research Methodology

From August to October, 2006, Aberdeen Group examined the procedures, experiences, and intentions of 320 enterprises in the supply chain, in manufacturing, transportation/logistics, warehousing, distribution, retail, and field service. The research focused on many specific industries, such as health care, pharmaceuticals, cold chain, apparel and footwear, grocery, chemical, CPG, and consumer electronics.

Responding business line managers, IT executives, and corporate application developers completed an online survey that included questions designed to determine the following:

- Where RFID technology fits into the supply chain;
- Current and planned use of RFID technologies;
- Risks and challenges in adapting RFID to supply chain processes;
- The benefits that have been derived from RFID;
- The importance and methods for measuring the ROI.

Aberdeen supplemented this online survey effort with telephone interviews with select survey respondents, gathering additional information on RFID strategies, experiences, and results.

The study aimed to identify emerging best practices for maximizing the benefits of RFID in supply chain initiatives and provide a framework by which readers could assess their own deployment strategies and performance.

Responding enterprises included the following:

- ***Job title/function:*** The research sample included respondents with the following job titles: line of business managers (34%); C-level officer (13%); director (18%); development staff (14%); and consultants (9%).
- ***Industry:*** The research sample included respondents predominantly from consumer packaged goods companies, transportation, high-tech, and retail. CPG represented 18%, transportation and retail followed with 11%. Telecom, health/medical, high-tech and software each came in with 7% of the survey pool. Distribution, mining/oil/gas, metals, automotive and computer equipment each accounted for 5% of respondents. Other sectors responding included aerospace, industrial equipment, pharmaceuticals and medical equipment.
- ***Geography:*** 41% of the study's respondents were from North America, 34% were from Europe, 18% from Asia/Pacific, and 7% from the Middle East and Africa.
- ***Company size:*** 40% of respondents were from large enterprises (annual revenues above US$5 billion); 28% were from midsize enterprises (annual revenues between $50 million and $1 billion); and 33% of respondents were from small businesses (annual revenues of $50 million or less).

Table 5: PACE Framework

PACE Key
Aberdeen applies a methodology to benchmark research that evaluates the business pressures, actions, capabilities, and enablers (PACE) that indicate corporate behavior in specific business processes. These terms are defined as follows: *Pressures* — external forces that impact an organization's market position, competitiveness, or business operations (e.g., economic, political and regulatory, technology, changing customer preferences, competitive) *Actions* — the strategic approaches that an organization takes in response to industry pressures (e.g., align the corporate business model to leverage industry opportunities, such as product/service strategy, target markets, financial strategy, go-to-market, and sales strategy) *Capabilities* — the business process competencies required to execute corporate strategy (e.g., skilled people, brand, market positioning, viable products/services, ecosystem partners, financing) *Enablers* — the key functionality of technology solutions required to support the organization's enabling business practices (e.g., development platform, applications, network connectivity, user interface, training and support, partner interfaces, data cleansing, and management)

Source: Aberdeen Group, November 2006

Table 6: Relationship between PACE and Competitive Framework

PACE and Competitive Framework How They Interact
Aberdeen research indicates that companies that identify the most influential pressures and take the most transformational and effective actions are most likely to achieve superior performance. The level of competitive performance that a company achieves is strongly determined by the PACE choices that they make and how well they execute.

Source: Aberdeen Group, November 2006

Table 7: Competitive Framework

Competitive Framework Key
The Aberdeen Competitive Framework defines enterprises as falling into one of the three following levels of RFID performance: *Laggards (30%)* — RFID practices that are significantly behind the average of the industry, and result in below average performance and little or no ROI. *Industry norm (50%)* — RFID practices that represent the average or norm, and result in average industry performance. *Best in class (20%)* — RFID practices that are the best currently being employed and significantly superior to the industry norm, and result in the top industry performance.

Source: Aberdeen Group, November 2006

Appendix B:
Related Aberdeen Research & Tools

Related Aberdeen research that forms a companion or reference to this report includes:

- RFID Benchmark Report: Finding the ROI in RFID (September 2006)
- RFID Benchmark Report: Finding the Technology Tipping Point (December 2005)
- RFID Benchmark Report: Scaling RFID Implementations from Pilot to Production (June 2006)
- Benchmark Report: The Supply Chain Innovator's Technology Footprint (May 2006)
- Benchmark Report: The Extended Warehouse (*coming* December 2006)
- Candid Comments: RFID in Health Care (June 2006)
- Service Oriented Architecture is Key to Scaling RFID Deployments (March 2006)
- Mandates Temporarily Drive Mid-Size Manufacturer RFID Adoption (March 2006)
- Average Change in Mobile Fleet Productivity as a result of Mobile Computing (January 2006)
- RFID's Biggest Non-Issue Now Resolved; Consortium Launched (September 2005)
- RFID-Enabled Logistics Asset Management: Improving Capital Utilization, Increasing Availability, and Lowering Total Operational Costs (June 2004)
- RFID in the Consumer Industries: Being a Winner, Not a Follower (March 2004)

Information on these and any other Aberdeen publications can be found at www.Aberdeen.com.

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