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RFID in the Consumer Industries: Being a Winner, not a Follower

By
Thomas K. Ryan
Principal

TKR Consulting Associates
103 Arbor Ave.
West Chicago, IL 60185

Phone: 630.876.0607
Email: tomryan@tkrconsulting.com

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Executive Summary

The benefits of implementing Radio Frequency Identification (RFID) tags in products promise to go well beyond those already achieved with barcodes. Because RFID systems can identify the individual instance of a product (not just its stock keeping unit, or SKU) as well as "watch" when a product physically moves via continuous monitoring — they bring a new level of detail to product tracking. Accordingly, RFID adoption will drive improved inventory management, process efficiencies, data accuracy, enhanced asset utilization, and reduced leakage.

These potential benefits have created a sense of urgency for many companies — particularly those in the consumer industries — to understand, assess, and deploy RFID systems. The initial mandates focus on the supply chains that feed product to major retailers. Unfortunately, the results for the few pilot projects that have been executed indicate that the maturity of RFID technologies lag industry requirements. Retailers channel masters will be the early beneficiaries of the RFID movement. Manufacturers, particularly those producing low-value items, understand that they are the ones making the financial commitments to enable RFID-driven benefits for the retailers. Although manufacturers understand the potential benefits of RFID systems, they are concerned about what the financial demands (RFID project and recurring tag costs) will do to their bottom line. They are focused on executing the minimum to compliance first and foremost.

New mandates from Wal-Mart and the U.S. Department of Defense require leading manufacturers to be RFID-enabled by 2005.

Those manufacturers that have to comply with the mandates issued by organizations such as Wal-Mart and the U.S. Department of Defense (DOD), by 2005 need to act now to ensure compliance. Because this kind of RFID is new in scale and scope, manufacturers must be willing to work through the challenges of a new technology, anticipate and manage roadblocks, as a strategy of waiting for others to solve early deployment problems will leave little room for meeting the compliance schedules.

Because of the deployment and unit cost increases, manufactures implementing RFID must quickly get beyond compliance to more than recoup their costs by reaping the operational efficiencies and customer service improvements that can be delivered by this technology. Early adopters should learn from the retailers' RFID best practices and attack their own distribution networks and then look to extend the technology throughout their own supply base.

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Issues at Hand

RFID technology fits two value chain business needs

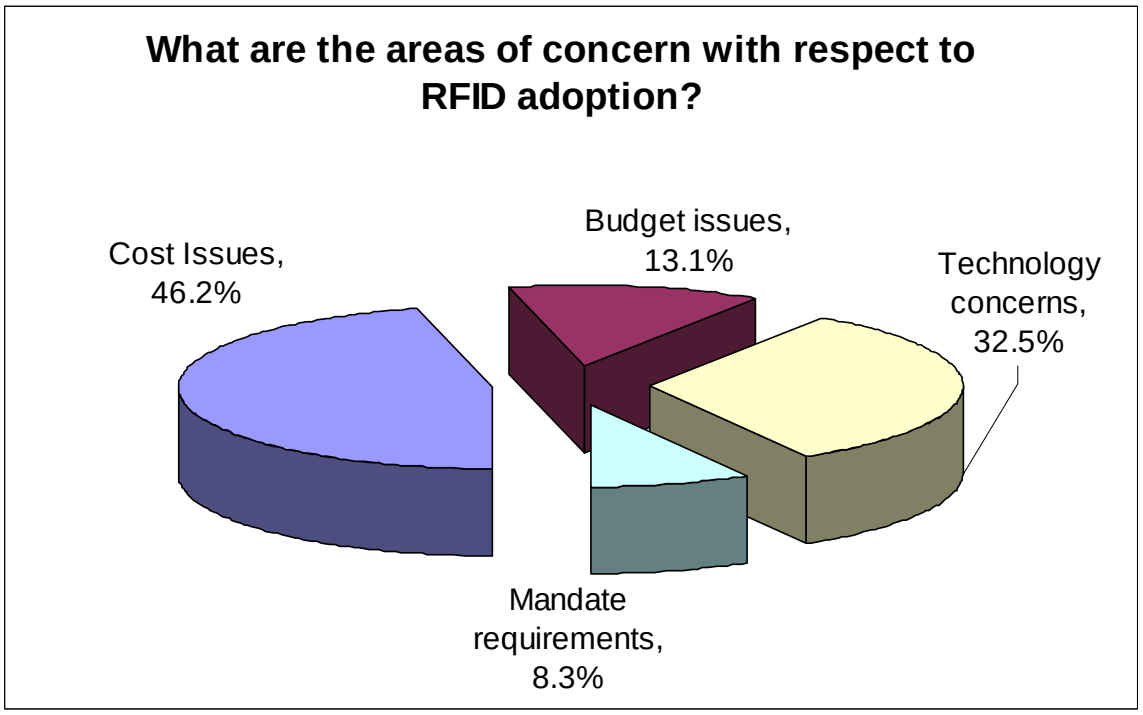
RFID technology enables two separate applications focused at solving two different supply chain problems:

- *Monitoring Supply Chain Velocity: Tracking High Volume/Low Value Items* — this solution monitors high volumes of inventory (low value items) in their one-way flow from the manufacturer change to the retailer. This application is the principal focus of the benchmark study and characterized by a broad inclusion of trading partners, initially competes with established mechanisms (bar coded cases and pallets coupled with EDI transactions), and uses limited capability, low cost passive tags.
- *Asset Management: Tracking Low Volume/High Value Items* — The solution — the one with the greatest deployment experience — tracks and manages assets used in tightly coupled supply chains. It is characterized by high value items at relatively low volumes, limited trading partners, and/or assets used in a captive environment within one enterprise. The classic examples are the tagging of bins used to move parts from a manufacturer to an assembler (parts bins from OEMs to assembly lines in the auto industry), tracking containers in a transportation environment (rail cars in North America, overseas shipping containers) or tagging containers that are reused (beer kegs, spare parts/components containers, portable shelving). Our survey indicates that 6.1% of the respondents have RFID systems and that 53% of those implementations are asset management focused. Also 90% of these projects are pilot systems. Aberdeen Group will be conducting an additional benchmark survey later in 2004 that will be focused on these RFID applications.

The real value has gotten lost in the compliance drum beat

The benchmark results indicate that the manufacturer's principal focus is retention of the mandating customers and the associated costs, rather than achieving operating efficiencies an improved customer service (see Figure 1). They are acutely aware of the unit cost increases ranging from $.50-.75/case today that will erode margins. Manufacturers also incur significant project costs to enable them to tag their goods. These costs range from $15,000 per tagging station to more than $150,000 per shipping facility. Without changes to warehousing and transportation processes, manufacturers will not recognize any immediate gain since they already have processes in place that apply traditional bar-codes.

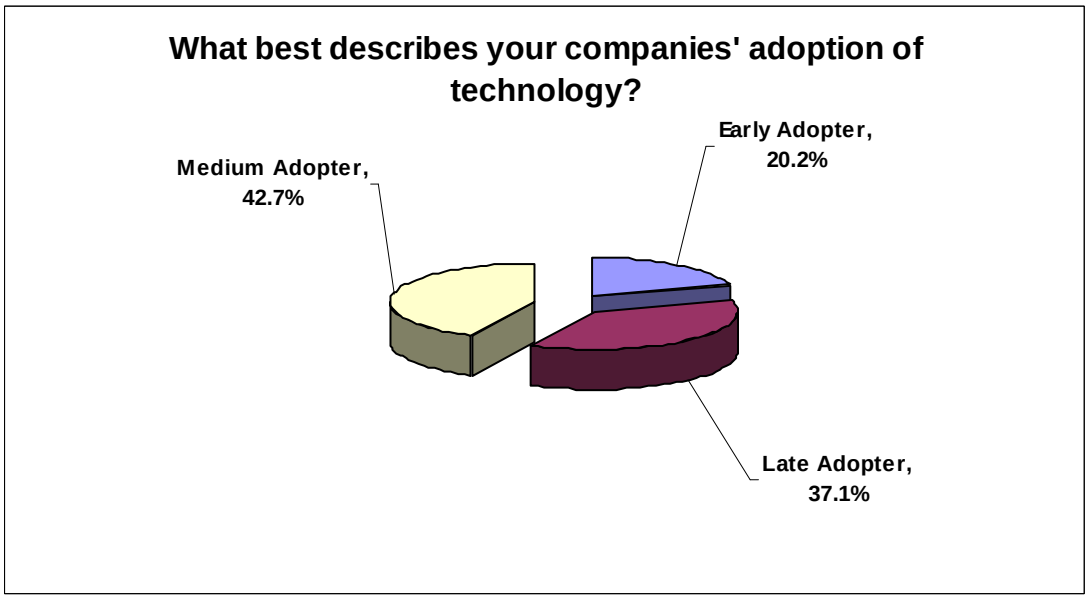
Figure 1: Concerns about RFID adoption



Source: TKR Consulting Associates, August 2005

The mandates are putting tremendous pressure on companies that do not have histories of early adoption of technology and the risk associated with those new technologies. In our survey, they describe themselves as technology neutral or a late adopter of technology, waiting for technology to be proven and widely adopted before adopting it themselves (Figure 2). While these companies would prefer to wait for the technology to further mature, the compliance timelines make waiting a greater risk for a number of reasons, such as a shortage of experienced resources and still evolving technology over the next 18 months. Instead, manufacturers must change their technology deployment strategy – at least for RFID compliance and understand that there will be "bumps in the road" as they roll out their solutions.

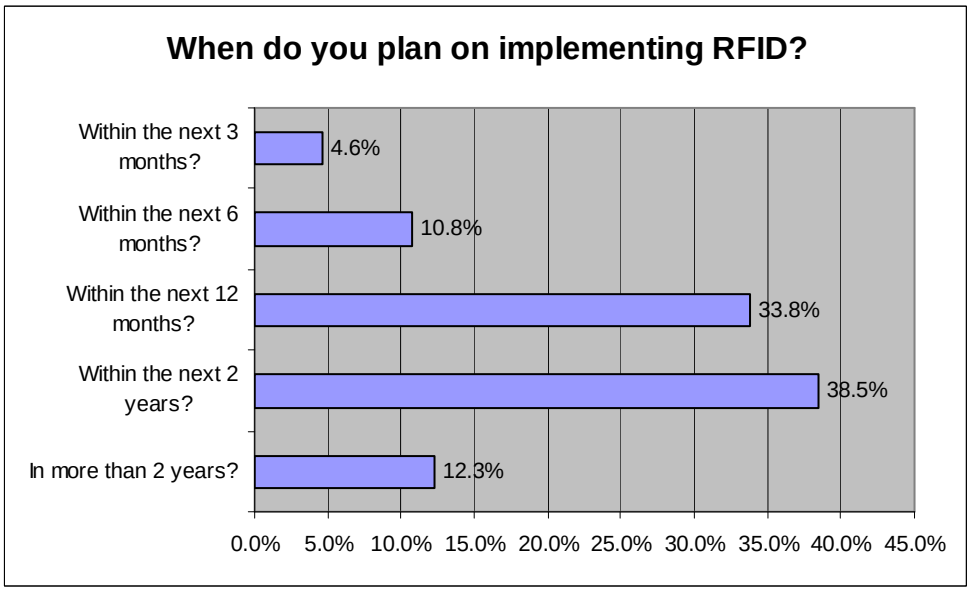
Figure 2: Technology Adoption



Source: TKR Consulting Associates, August 2005

Manufacturers indicated clearly that they understand where the business value for RFID implementations is, but not necessarily how to proceed. They recognize how their customer will benefit from the technology in improved productivity, asset management, and inventory accuracy improvements. They understand that to receive the same benefits they need to extend their implementation beyond the slap and ship, minimal installations planned and they need to get their manufacturers (where appropriate) to provide tagged product/materials to them in the same way that they are for their customer. They do not necessarily understand how all the hardware and software components come together for RFID implementation, what modifications to their processes will be necessary to take advantage of the technology, what changes to their existing systems will be necessary, and who is well positioned - based on domain expertise and previous project success - to actually provide them the help they need to make their project successful. Not surprisingly, the benchmark points to plans that are limited to pilot actions or minimal "slap and ship" implementations, as only 46% plan on doing anything and of these 90% of the contemplated projects are pilots. A significant portion of the group is holding off as long as they can (Figure 3). When asked to indicate directly the priority RFID compliance has in comparison to other technology and company initiatives, only 28% of the respondents indicated that it was a high priority. 54% indicated it was a medium priority while 18% indicated it was of low importance.

Figure 3: RFID Implementation timing



Source: TKR Consulting Associates, August 2005

Aberdeen believes that "the minimal effort to comply" approach is a self defeating strategy. Its intent is to defer capital expenditure till the business and implementation risks are reduced (e.g. Wal-Mart doesn't change the scope of the requirements, the standards are confirmed, the technology solves its performance and reliability issues, etc.). This direction presumes that all these things will be resolved in time for the mandates to be met. It ignores the enterprise's own need for time to work out the usual implementation issues in their own organization. Time is clearly the big enemy here and the minimalist view just bakes in reduced margins. Failure to proceed aggressively in parallel with industry events/actions could result in a failed compliance effort, no way to recover incremental operating costs, and potential loss of revenue or increased charge backs.

Excelling despite RFID limitations

The testing activities and pilot operations that have been executed to date have identified operational issues (e.g. read success rate, scanning speeds, read range) that need to be resolved as manufacturers roll out the technology. First, the scanning process requires significant attention to tuning during installation and monitoring effectiveness as a maintenance function to equal the read success rates for barcodes (98%). Second, the scanning speed can be much slower, if not addressed during implementation design. This could add 2-5 seconds per scan **with a hand held but pallet portal scans are much faster**. Third, the effective scanning distance of an RFID tag is affected, often dramatically, by the material it is attached to and one of the most significant reasons why manufacturers must understand their own RFID environments now. For example, high moisture content material or metal will reduce scanning distance by as much as 50%. In some of these situations, a tag on case in the middle of a pallet will probably not be scannable. Wooden pallets, especially those made of green wood, have high moisture content. A study conducted by Virginia Tech indicated that attaching an RFID tag directly to a pallet without providing at least 5/16" standoff from the pallet cut read distance in half. They also learned that high impact plastic resins (the material often used for reusable pallets) absorbs the RF

energy almost as much as green wood. Manufacturers must plan to slog through these issues to ensure at least timely compliance, if not gain additional benefits from their investments.

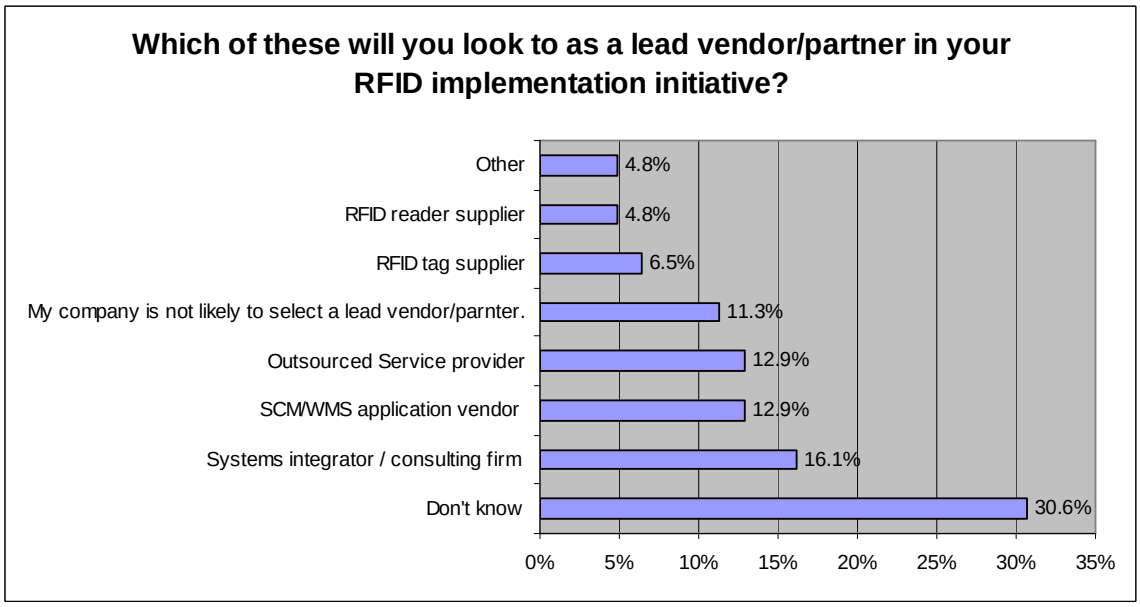
Mandates' deadlines force aggressive timelines

The advent of the mandates, especially Wal-Mart's, is forcing the industry to meet some very aggressive timelines. RFID technology in logistics functions, with the exception of expensive hardened tags in use by North American railroads, has never had a broad scale industry wide implementation. For compliance by January 2005 for Wal-Mart and the DoD alone, the number of manufacturers that must be ready to attach "one-way" tags to cases and pallets is 250 or more and represents approximately 1,000 sites during 2004. During 2005 we expect the number to escalate to 25,000 vendors at 50,000, given the current Wal-Mart, DoD, FDA, Target, etc. plans. We expect that any one of the mandating companies and organizations will have some degree of set back, given the technology immaturity. However, playing "wait and see" could be a deadly game for those vendors that have to act in 2005 as RFID domain expertise will be in very short supply.

Where to turn for help

Manufacturers are struggling with selecting partners to help them with their RFID implementations, as the largest number of respondents (30%) indicated that they had "no idea" who to use (see Figure 4). Having an experienced partner will go a long way to mitigating the risks associated with this evolving technology. However, "evolving" is the operative word as the number of experienced resources is limited. Manufacturers need to consider more than hardware, as business process changes and supporting applications are required to get the business benefits. Evaluating RFID reader, programmer/printer, or tag suppliers for project guidance is OK, if all that is needed is added technical skill with the RF physics and hardware related installations. Going alone, as some companies are planning, is only OK if the company is willing to commit the resources now and feel that they have the where-with-all to learn how to manage all the technology (hardware, software, and integration) issues. Using a 3PL, or outsourced service provider, is a sound strategy if the compliance related business is a minimal part of the enterprise's total revenue and profit and if the 3PL has good track record with other manufacturers selling to the same or similar retailers. Application vendors can be a sound choice if they have demonstrated a track record of successfully implementing total solutions including software, business practice and hardware changes. Finally, systems integrators or consulting firms are also strong candidates for those companies that have highly customized or heterogeneous technology environments.

Figure 4: RFID Implementation Partners



Source: TKR Consulting Associates, August 2005

Industry standards – a moving target

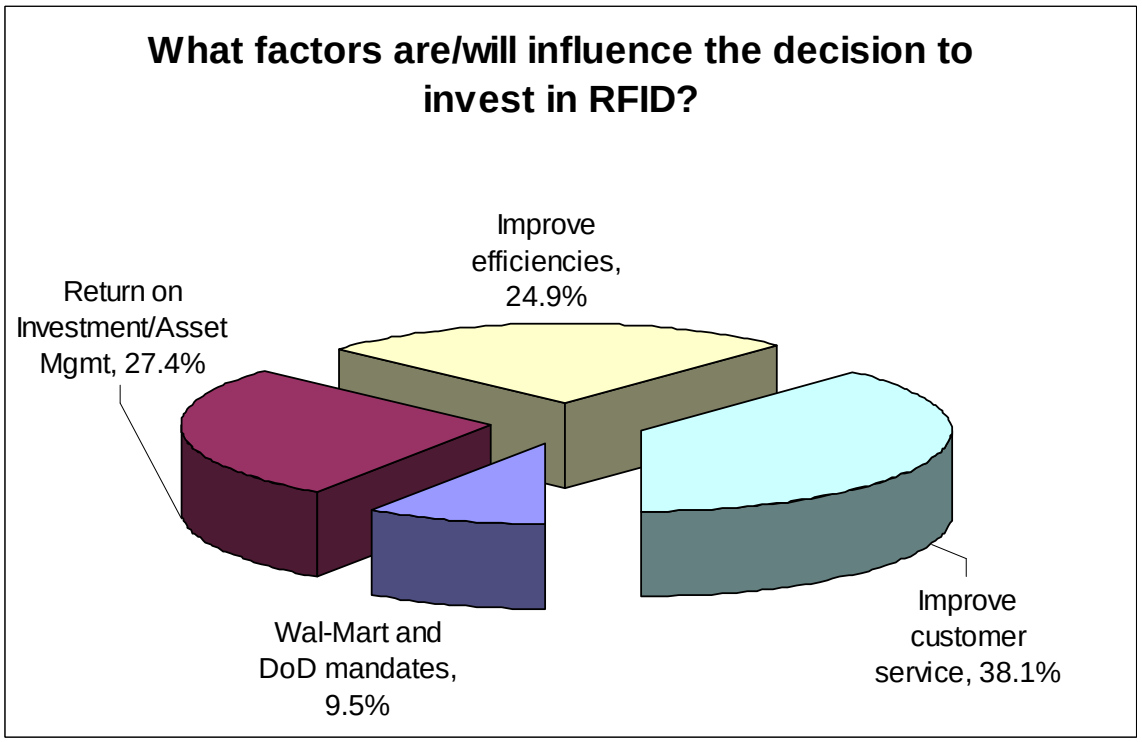
Further, the standards for data content and structure as well as the RF communications technology have not been finalized or accepted within the consumer goods/retail industry. The good news is that the mandates (Wal-Mart, Target, DoD, and FDA) agree on the same EPC Global standard. The bad news is that the exact content to be on the tag, to include its format, is still being negotiated. This could result in a change in the amount of data on the tag, driving a change in the memory requirements for the tag, impacting the unit cost of each tag. Also to be consolidated are the global RF standards. Initially, the North American standards — Class 0 and 1, have been used in the pilot projects that have been executed. However, they are not acceptable in the rest of the world. Only the UHF Generation 2 standard, a superset of Class 0 and 1, promises to win global acceptance and does not appear not be officially ratified until Q3 2004. UHF 2 is also an early stage technology. Manufacturers that do not plan on shipping product outside North America can adopt a wait and see attitude for the next 2 years with respect to the adoption of Generation 2 equipment and tags. The lessons here are that manufacturers should have flexibility in their standards, technology and deployment adoption strategies to address the evolving standards.

Key Business Value Findings

Getting beyond the mandates

Mandates aside, manufacturers are looking for improved customer service (38%), improvements in asset management or return on invested capital (27%), and improved operational efficiencies (25%) and (Figure 5). They expect operational improvements to come from reduced leakage/theft, reduced labor costs, and faster processing time. Reduction in labor will only come a if manufacturers get beyond the compliance approach that most are contemplating now. Only when they optimizing tag placement in their production processes and then utilize the tags in their own operations will they see labor benefits. Improvements in customer service are expected from improvements in inventory availability and reduced stock-outs as well as streamlining shipping and advanced shipment notification (ASN) processes and improved responsiveness to customer needs. Again, only when the capabilities of RFID are incorporated into the distribution center and customer communications aspect of the manufacturers operations will much of this materialize. Also, reduced stock-outs require greater collaboration with the retailers to understand what their consumption patterns are so that the manufacturer can anticipate accordingly. Finally, improvements in asset management and return on invested capital are all derived from greater visibility to inventory and shipments while in-transit. This benefit requires that trading partners, especially carriers and transportation providers, improve their infrastructures to capture this information and then make it available to the manufacturers and retailers. See Figure 5 for the detailed breakout of manufacturer motivations.

Figure 5: Motivations for RFID Initiatives

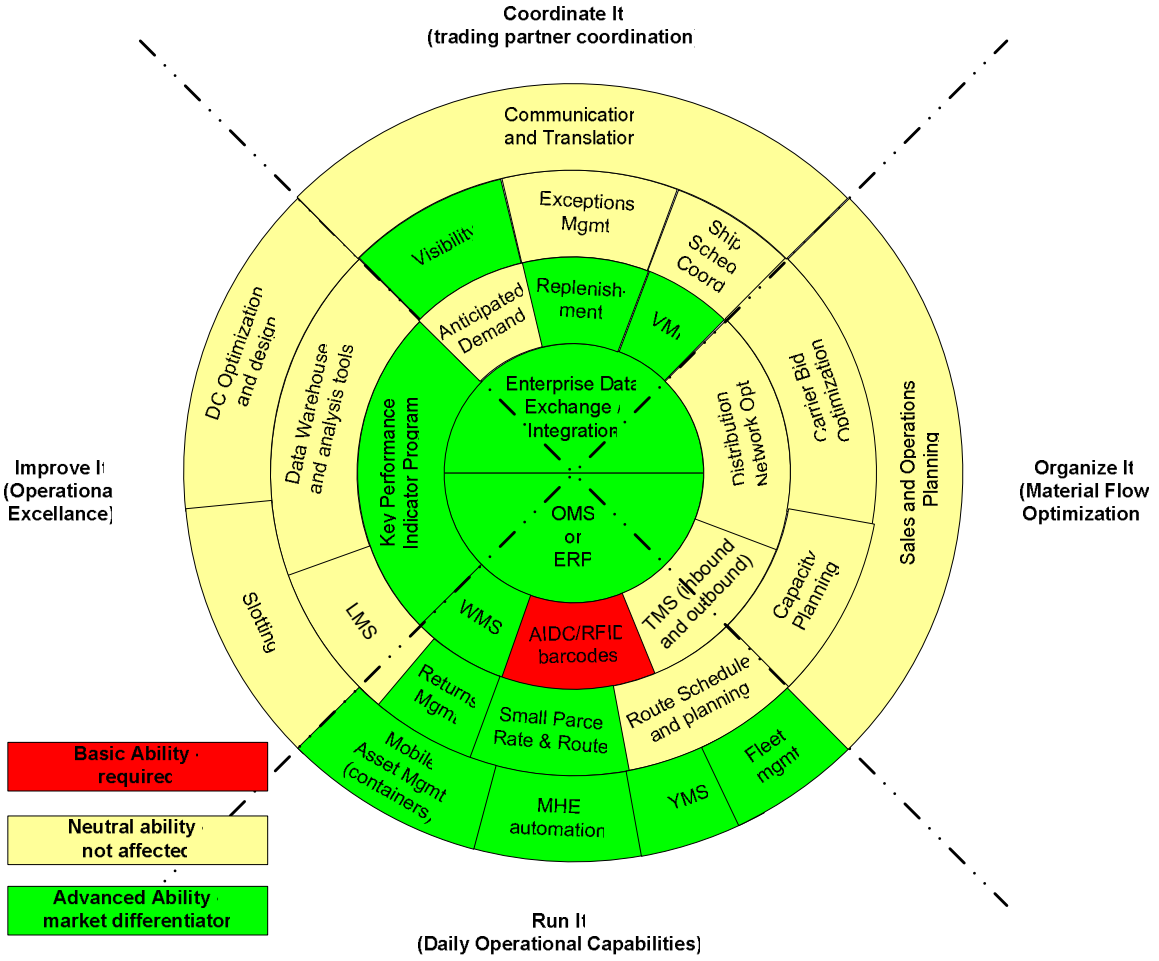


Source: TKR Consulting Associates, August 2005

Finding the right value levers (1)

Aberdeen (and Tom Ryan) developed the Fulfillment Solutions Framework to help manufacturers understand where RFID can add the most value and how to think about their investments (see Figure 6).

Figure 6: Fulfillment Solutions Framework (RFID)



Source: TKR Consulting Associates, August 2005

The Fulfillment Solutions framework lays out the possible functional solutions into four areas of emphasis; trading partner coordination (Coordinate It), material flow optimization (Organize It), daily operational capabilities (Run It), and operational excellence (Improve It).

Trading partner coordination functions deal with the coordination of communications with the enterprise's supply chain trading partners (customers, manufacturers, regulatory agencies, etc.).

Material flow optimization represents those functions within the enterprise that help the enterprise examine, evaluate, and optimize the organization and its utilization of supply chain assets.

Daily operational capabilities focus on those functional areas that most affect the daily execution and management of supply chain transactions.

Operational excellence focuses on those solutions and/or practices that are used to monitor, analyze, and improve the operational capabilities of the supply chain.

The color coding indicates the impact that RFID provides to the enterprise. Red indicates an area that is basic to an RFID implementation that is focused on meeting the demands of the mandates from Wal-Mart and DoD. Green indicates solutions that provide differentiating capabilities or greater business value to the enterprise when RFID technology is incorporated into their usage or processes. Yellow indicates a solution that has limited or no additional impact to the enterprise because of RFID.

Basic compliance ability (color code red in Figure 6) is found strictly in the capability to place a compliant, appropriately programmed, RFID tag at the prescribed location on the items to be shipped. In the context of today's mandates, this means the ability to affix RFID tags to each carton/case and to every pallet of tagged cartons/cases being shipped to the retailer. For manufacturers, this capability is a direct duplication of existing usages of automatic identification technologies (AIDC), such as bar codes.

Differentiated ability (color code green in Figure 6) is found in those functions that represent a "winner's" approach to RFID implementation. These manufacturers will aggressively pursue the alteration of existing processes, procedures, and technologies to minimize the cost of business associated with compliance. In addition, these manufacturers will use the capabilities to improve their own operations in a fashion similar to those enterprises that have issued the mandates. Altering warehouse operations to receive RFID tagged product and streamline its disposition within the distribution center (DC) is one example (warehouse management system (WMS) in the chart). Utilizing the tag information to improve customer returns management, carton sortation, freight rating and routing for small parcels, carton location and management in the rail or truck yards associated with the DC are all additional operational examples.

Tracking product or carton movement within the facility and feeding that information into a KPI management application is a way that RFID would add greater detail to the KPI program without adding a data collection and posting burden.

Utilizing the RFID tag information to populate advanced shipment notifications, to track product usage and then drive replenishment plans or vendor management inventory (VMI) programs are excellent examples of RFID enhancing the coordination aspects of order fulfillment operations. Finally, using the RFID information in conjunction with trading partner's (especially carriers) infrastructure improvements can radically alter the frequency and richness of visibility related information as the product moves through the supply chain.

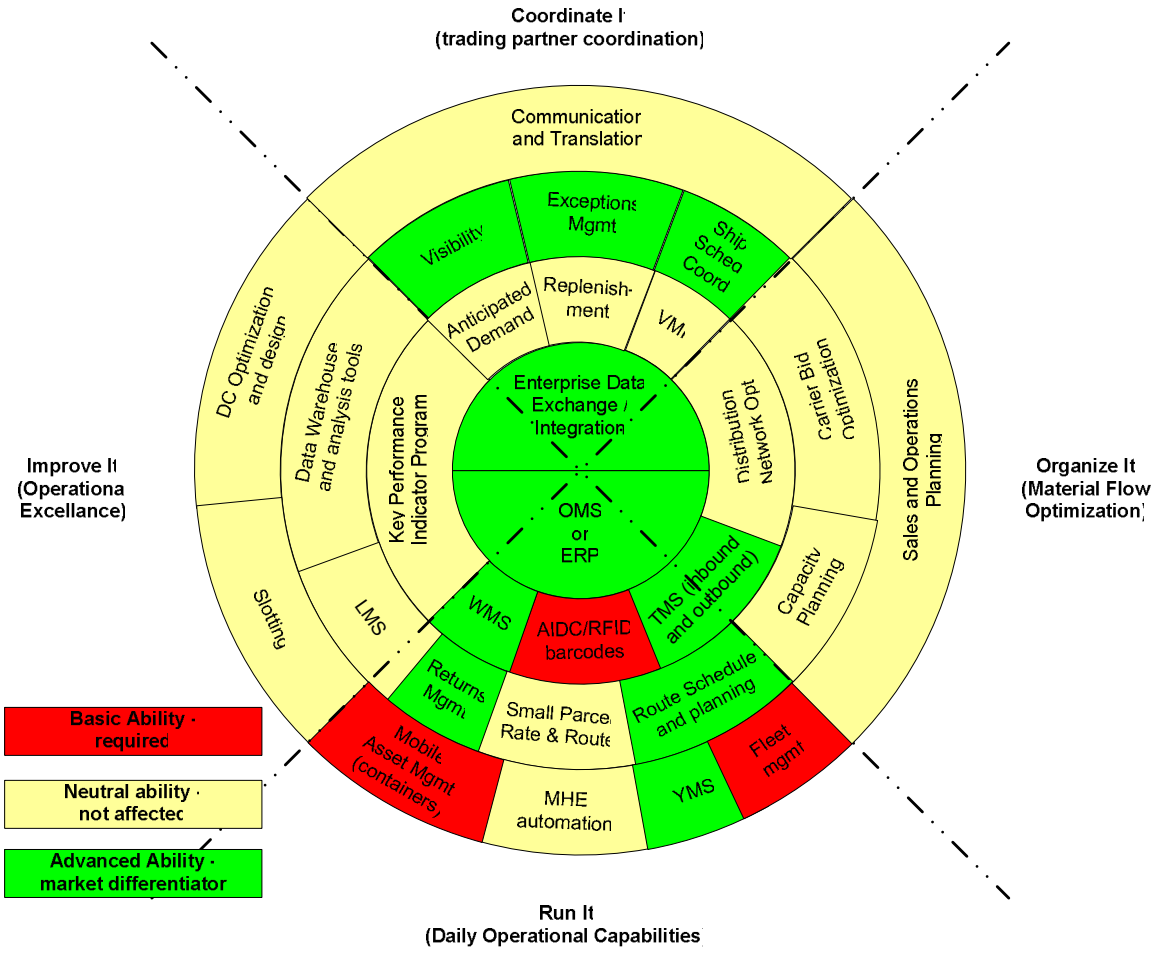
Finding the right value levers (2)

As we mentioned in Section 2 above, there is another application of RFID that focuses on asset management and is not within the scope of this report. We plan on executing a study specifically targeted at asset management, tracking low volume/high value items and the value that RFID brings to that need. This survey indicates that 6.1% of the respondents have RFID systems and that 53% of those implementations are asset management focused.

When we examine the Fulfillment Solutions framework in this context, we see a different range of impacts for those applications that are characterized by high value items at relatively low volumes, limited trading partners, and/or assets used in a captive environment

within one enterprise (Figure 7). We will examine this situation in more detail in our subsequent benchmark study, Logistics Asset Management Strategies.

Figure 7: Fulfillment Solutions Framework (Logistics Asset Management)

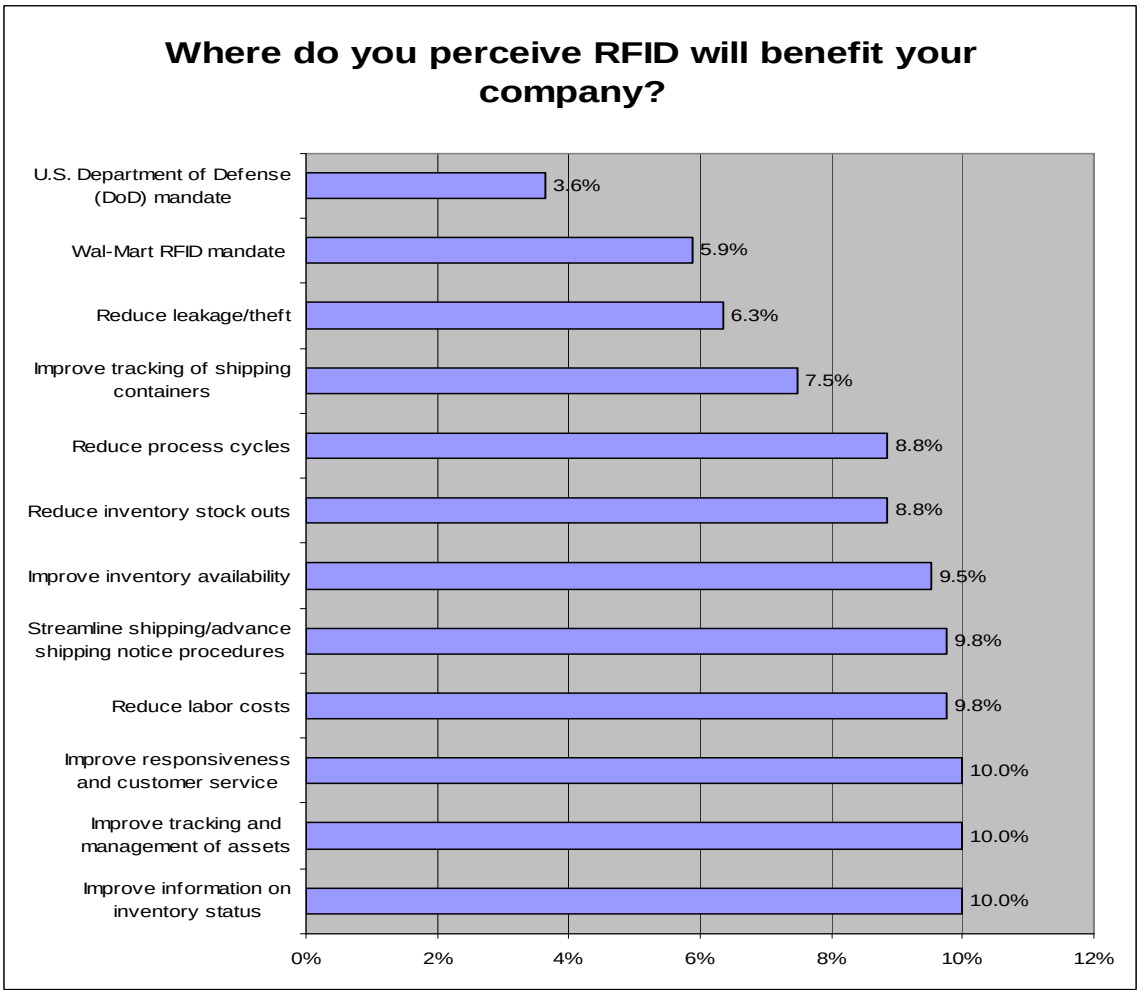


Source: TKR Consulting Associates, August 2005

Implications & Analysis

Moving the discussion from compliance to value is the key to success. Compliance represents a small percentage of the total RFID benefit for manufacturers (see Figure 8).

Figure 8: Anticipated Benefit Areas for RFID



Source: TKR Consulting Associates, August 2005

Enterprises that change processes to take advantage of the technology's promise can leverage RFID's breakthrough capabilities. The following are examples of scenarios of where RFID will and will not add significant value to manufacturers.

- *Manufacturer of high volume cased goods: high value* — Due to the need for case level information, manufacturers can produce the cases and palletize them already tagged. This eliminates the need to tear the pallet apart in shipping to apply the tag and avoids the added labor and coordination expense. Additionally, the manufacturers' own distribution centers can receive the tagged product from their plants in much the same way the retailers DCs will function. High volume consumer

packaged goods (CPG) manufacturers like Procter and Gamble, Kimberly Clark, Lever Brothers, etc. are all classic examples of this scenario.

- *Manufacturers of high value products that need to be protected or controlled: high value* — One of the more promising application areas is for manufacturers of high value products that ship in relatively low volumes, and where the products are subject to counterfeiting, theft, recall, or FDA regulatory control. Pharmaceutical distribution is a great example of this. An additional benefit is that the cost of the infrastructure to apply smart shelves and other RFID scanning devices into a pharmacy unit of a retailer is much lower than it will be to outfit the entire store location.
- *Retailers creating mixed SKU pallets: high value* — Those distributors/retailers providing high volume builds of single case picks onto mixed SKU pallets to ship to their own stores or stores of the customers can gain incredible productivity and picking/shipping confirmation of the pallets. Grocery picking for stores is a perfect example of this scenario.
- *Distribution centers receiving mixed SKU pallets: no value* — Those distribution centers that received mixed SKU pallets in high volumes and have an automated sortation system based on barcode labels applied by the manufacturer will have no added value. This type of system is common for retailers or garment manufacturers receiving cases of garments in mixed color, size, and style lots in irregular cartons shipped on mixed SKU pallets.

Recommendations for Action

Manufacturers should consider a logical progression to realizing true enterprise value. Aberdeen recommends the following steps:

Compliance

Compliance is not as straight forward as it seems. Determine the best way to attach a tag and the best place to insert this production step into your work flow. If you are a manufacturer of a high volume of cases shipped in single SKU pallets, you will probably want to attach the tags in manufacturing, probably at the point upstream of pallet formation. To accommodate a mixed RFID compliant and non-compliance environment, the manufacturer will probably want to create a "parallel SKU" that separates RFID compliant packaging from non-compliant packaging. Based on the evolution of the costs of tags, it will probably be more cost effective to manage the two SKUs than it will be to tag all production and eat the cost for the non-mandating customers.

The other end of the spectrum would be the distributor that ships cartons of eaches where each carton is a mixed SKU container. In this environment, a slap and ship application station at the end of the picking process (similar to a small parcel scale and shipping label station) might be the best approach.

In either extreme, minimal compliance needs to include integration with the existing ERP or WMS systems. This integration will insure that the tag content is in sync with the appropriate order and inventory systems and that the data these systems package into ASN messages to the customers will also be consistent with the tag.

Specific project execution strategies will vary based on the enterprises internal understanding of the technology and their own domain expertise in managing complex technology implementations. Make no mistake, this is a complex project. Truly integrated solutions are still evolving. The chip makers want to manufacture and sell RFID compliant tags. The hardware manufacturers are focused on readers and programmers. The ERP and best of breed specialist software vendors are focused accommodating the additional process steps necessary for RFID into their solutions workflow. Finally, the major integrators are looking more to the business process changes than the technology. If the enterprise does not have or want to make the necessary leadership investment, they should seek out a solutions provider that has demonstrated the complete spectrum of RFID implementation successfully (and how many of those exist today – virtually none). If the manufacturer/distributor wishes to variablize their investment in RFID infrastructure, they should look to third-party logistics providers who are executing the RFID compliance functions for other manufacturers of the manufacturer/distributor's mandating customer.

Extension

Extension is the process where the compliant RFID technology is infiltrated into more of the manufacturer's business processes. The high volume single SKU pallet manufacturer should look to mimicking the retailer's methodologies in their own distribution centers. For those shipments that do not go direct to the retailer, they can learn how to receive and distribute the tagged product.

Transformation

Transformation is the process where the compliant technology is utilized in more processes than just order fulfillment. The integration of the data collection to inform KPI programs, the application of tag information to facilitate visibility across the supply chain, the extension of the consumption and re-supply information to enhance the effectiveness of a VMI program are all examples. The green coded processes/applications in Figure 6 detail the possibilities that can be pursued as a part of this transformation. The enterprise should prioritize these opportunities and pursue them methodically as a part of a continuous improvement program.

Cohabitation

Cohabitation with the retailers really starts at the compliance and extension stages. In this stage, cohabitation extends more deliberately to the enterprise's manufacturers and their transportation agents. The intents here are two fold. One, pass along the mandate to your manufacturers so that you can have the same benefits as the retailers on the inbound side of both your manufacturing and distribution sites. Second, mandate that your transportation providers have an infrastructure that will feed the tag and shipment data into your visibility systems. The former will help distribute the costs of tagging while extending the opportunity for benefits. The later will help the enterprise be more aware of and responsive to disruptions in the flow of goods and thus provide better overall service to its customers.

Appendix A: *Research Methodology*

Between November 2003 and January 2004, Aberdeen Group, *Logistics Management*, and *Modern Materials Handling* magazines examined the RFID solutions and providers, experiences, and intentions of more than 200 enterprises in CPG (11%), retail (9%), manufacturing (14%), distribution (16%), and other industries.

Responding supply chain, logistics, and operations executives completed an online survey that included questions designed to determine the following:

- The degree to which RFID initiatives impact corporate strategies, operations, and financial results
- The degree to which the mandates of Wal-Mart and DoD are driving the application of RFID
- Current and planned use of RFID
- The benefits, if any, that have been derived from RFID
- The obstacles, if any, standing in the way of the rapid and broad acceptance of RFID

The study aimed to identify emerging best practices for use of RFID technologies and provide a framework by which readers could assess their own capabilities.

Responding enterprises included the following:

- ***Job title/function:*** The research sample included respondents with senior level responsibilities; 30 % were senior level executives including vice presidents and CEOs. Additionally, 33% were line warehouse operations managers. These individuals have responsibilities that include operations (41%), broader logistics areas (26%), and supply chain and procurement responsibilities (16%).
- ***Industry:*** The research sample indicated that 56% distributed high volumes of low cost goods (e.g. dry groceries) and 44% distributed lower volumes of higher cost goods (e.g. electronics and OTC drugs). The CPG (11%), retail (9%), manufacturing (14%), distribution (16%), and other industries were included in the survey responses.
- ***Geography:*** Many of the respondents indicated an international nature to their supply chain operations. Only 37% limited distribution of their products to North America while 36% distributed in up to 50 countries.
- ***Company size:*** 14% of the respondents worked for tier 1 companies with revenue over $1 billion. 59% came from companies with less than $250 million revenue while only 14% had revenue greater than $250 million and less than $1 billion.

Solution providers recognized as sponsors of this report were solicited after the fact and had no substantive influence on the direction of the *RFID in the Consumer Industries Benchmark Report*. Their sponsorship has made it possible for Aberdeen Group, *Logistics Management*, and *Modern Materials Handling* to make these findings available to readers at no charge.

