CHAINLINK RESEARCH

RFID for Consumer/Retail Supply Chains

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About ChainLink Research

ChainLink Research is a Supply Chain research organization dedicated to helping executives improve business performance and competitiveness through an understanding of real-world implications, obstacles and results for supply-chain practices, processes, and technologies. The ChainLink Inter-Enterprise Model is the basis for our research; a unique, real-world framework that describes the multi-dimensional aspect of links between supply chain partners.

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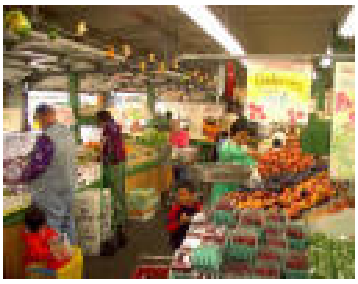
Consumer Supply Chain Transformation through RFID



Serving *markets of one* (consumer demand) requires rich assortments. The concept for success is managing supply chains at an item level, at the macro market, in fine time slices, in geographies, by customer. Multi-dimensional management. This is the direction of the consumer supply chain.

The extended Consumer Supply Chain is driven by serving the demands of the ultimate customer. Since consumers have no obligation to present forecasts to their merchants, that means businesses need to create ways to see and sense—in real-time, all the time—product consumption, as well as evolve their offerings over time, to continue to meet the needs of an ever more sophisticated and demanding consumer.

The consumer supply chain is ultimately a partnership between retailers and their suppliers—both win if they have the right selections, price points and freshness on the shelf. When customers enter the store, they delight in the best presentation with the best selections.

Multi-dimensional Supply Chain Models

But how did all that stuff get there? To do this, behind the scenes, outside the four walls of the store, the gears of the supply chain must be synchronized. The supply chain processes, through the whole chain, have to recognize and interpret these markets of one—customer demand—at the item level. But the consumer products supply chain does not buy and ship in units of one. That is economically unfeasible. So, new processes and technologies must be created to fulfill customer demand, linking this customer demand dimension to an economic

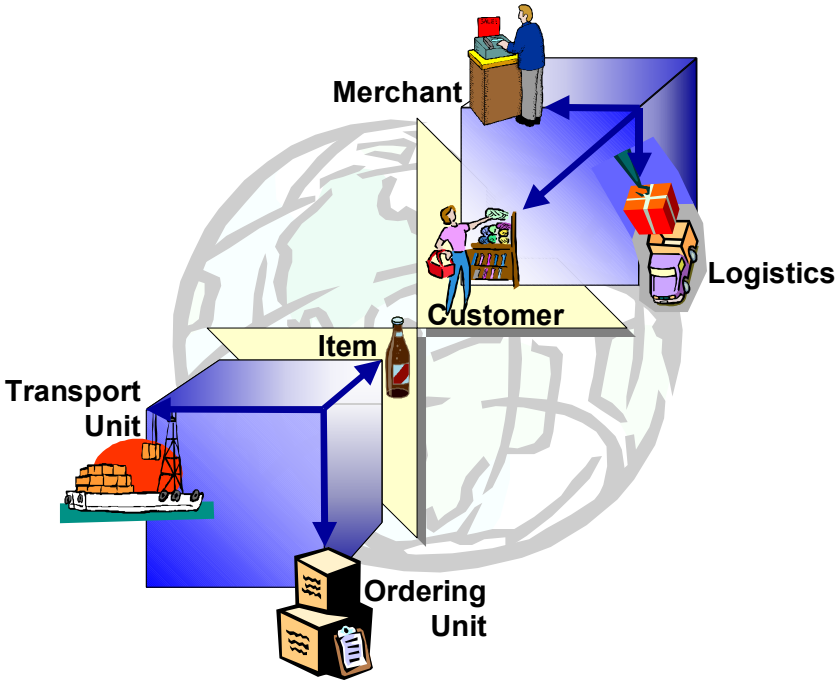


Figure 1 - Multi-Dimensional Model

Item and Conveyance Level Intelligence links your Customers, Product, and Supply Chains to create Global Intelligence.

ordering quantity dimension (an order to shipment). And then actually move the stuff to where it needs to be at the right time, linking the order to a physical logistics dimension (pallets and containers) all the way through the chain. Creating this multi-dimensional approach requires coordination—not just these product dimensions—but in the linkages to the entities and enterprises across the extended chain. This means every one who has a role in bringing that product to market—from that manufacturer in Asia, to the carriers, port handlers, truckers, and the stock clerk, to finally arrive at the shelf in Peoria.

Models in supply chain have to be multidimensional, to fulfill the consumer retail supply chain vision. And they have to be dynamic. Decisions and adjustments must be made *now*, in real-time, to respond to the constant fickleness of the consumer marketplace. So, your chain doesn't operate on that fine a timeline? Read-on!

Regardless of your product category, change is a constant in the supply chain. Supply lines from Asia, Europe and Latin America are not inherently flexible. And many consumer product manufacturers have designed processes to buffer against rapid changes.

They assume they cannot impact the long backend supply chain. But that assumption results in lost business opportunities—empty shelves and stockouts, or through stale or excess inventory. So many firms lose money along the whole supply chain, at the warehouse, as well as lose margins at the cash register through markdowns.

Rather than accepting the inevitable—unresponsive 18-month apparel chain, or seasonal sales that don't happen according to plan—we *can* create chains that are more visible and more dynamic in response to the markets they serve. If we had the tools to dynamically manage the coordination of multiple trading partners, we could make better decisions—now—and sell more and save more by turning the supply chain on a dime.

RFID Unlocking Value in the Inbound Chain

RFID can enable this vision of real-time, multidimensional coordination for all the players in the chain. Where is that shipment? We need that product in our Dallas store today, rather than our Kansas City store. If we can identify the shipment in motion—from origin to destinations—we can reroute to where the customer—the money—is!

RFID will link these previously isolated dimensions—the customer, to the product, to logistics and to *time*—through the global supply chain network, in ways never before thought possible! Smart technologies

are not just about supply chain coordination and asset management. They will unlock tremendous value to the whole chain of players, enabling new business opportunities and growth. They have already made the inbound trade routes inherently more visible, reliable and secure.

Smart companies know that the design of their supply chains is now the greatest factor in revenue growth and market dominance. That is why the leaders are pushing to implement this next enabling solution with RFID. Smart companies know that it is the supply chain design that will make that ultimate sale all the more possible. Wal-Mart, Target and other retailers understand that the first place to drive RFID is before product gets to the shelf—the global inbound chain.

This white paper will explore the solution for RFID in the Consumer/Retail supply chain. The paper is organized in four sections:

- *Beyond Compliance*—What are the major compliance drivers for Consumer Products suppliers? How you should think beyond that compliance mandate
- *RFID Business Solutions*—We then describe the *whole* RFID solution, not just the tags
- *The Roadmap*—*C*reating a roadmap for your RFID solution that takes you beyond compliance to an end-to-end solution that adds value for your enterprise
- *Conclusion*—Final summary considerations

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What Wal-Mart Wants

Milestones:

- 2003, October: Pilots went live
- 2004: Test RFID in select DC/Store/Clubs
- 2005, January: Rollout RFID (case and pallet level) to top 100+ suppliers—three DCs in Texas, representing 5% of U.S. market
- 2005: Domestic expansion for Wal-Mart ramps up
- 2006, Year-end: Rollout RFID (case and pallet level) to all suppliers, all Wal-Mart facilities
- Class 1.0 (96 bit EPC code data standards) now
- Will move up to 1.2 when available
- Will move up to 256 and read/write programmable for certain goods
- Local suppliers must meet global standards
- All business units and all products
- Q1 2004 Don't limit your RFID definition to tags—you will not gain tangible benefits beyond compliance

Moving Beyond Compliance

The Information Advantage

Today, suppliers have dozens of compliance policies piled upon them by the big retailers who represent about 80% of their channel revenue. Don't comply, and you are fired as a supplier. No matter what the cost of the new edict, we must do it. "So, slap on some RFID tags and get on with it?" "It's just another cost of doing business with Wal-Mart … and with Federated, Target, Ahold, etc., etc., etc.!"

But you must move beyond a compliance mentality in order to leverage your investments, to gain value for your customer and *yourself*. Smart companies focus on process and technologies that keep their firms competitive.

Think about your ability to improve your performance and leverage your supply chain technology investments through *significantly improved information*. There is significant ROI associated with information accuracy across this multi dimensional model—from accurate demand data, on-time deliveries and smooth rapid border crossings!

Facing the Mandates

Whatever your product is, selling through channels (retailers and distributors) means managing the linkages swiftly, intelligently, and as seamlessly as possible. Managing the inbound chain—across the globe—to the retailer's receiving dock, and frequently right to the shelf is your responsibility. This cannot happen without the *big IT play*—end-to-end visibility.

You might not be able to accomplish this mandate without rethinking and investing to change the processes that drive your supply chain. But whether you like it or not, the fact is established—you will have to implement some kind of RFID strategy to stay competitive and meet the mandates such as:

- Global retailers—Target, Wal-Mart, etc. require identification at key points in the retail chain (today).
- The Cold Chain[1]—This includes quality, as well as legal mandates, for all encompassing trace and track—not just the item/carton/pallet location, but also such things as temperature, expirations, security issues, etc.

[1] Food and Pharmaceuticals

- FDA—Driving *secure business practices* for pharmaceuticals to address nontampering, etc.
- Grocers and Drug chains—European firms like Tesco, Mark and Spence, and now US firms like CVS (an early MIT Auto-ID member) and Albertson's are getting into the act.
- Supplier Initiative—To stay competitive, large suppliers in these chains are already deploying or piloting with these technologies—from Bayer and Gillette, to Unilever and P&G, as well as consumer electronics firms like HP.
- U.S. Customs—U.S. Customs and Border Protections has stated that shippers using smart containers with electronic sensor devices will likely get faster inspection clearances.

So, what approach will meet your needs? Will tagging cartons be sufficient to go beyond compliance and also meet your needs? What should be considered a complete RFID solution? These are important questions!

Hierarchy of an RFID Business Solution

Currently, much of the focus in the press is about tags and data standards. While these issues are important, there is much more. In the supply chain, more than any other business process, results are based on successfully managing the interdependences—the links—between trading partners. That is why focusing end-to-end across the chain is key to successful implementation of RFID. Realizing this multi dimensional opportunity requires a new end-to-end, top-to-bottom data model and solution. Understanding this will help you implement not just compliant RFID but a solution that works for you. This means going beyond merely slapping on tags to implementing a comprehensive trace and track system, from product origin, throughout the lifetime of your processes and products.

The New Data Model—Nesting

There is a broader data model, called nesting, that is required for multi-dimensional businesses—in fact, for effective global logistics and customer care in any industry. Nesting[2] is the ability to identify and aggregate product data from the item up through all the packing and shipping units (cartons, pallets, containers, etc.), to the transportation mode[3], whether it's an ocean carrier, railcar, air cargo plane or truck, all across the chain (see figure 2). Nesting supports the entire complex views in the chain – horizontally and vertically -- reflecting all key product, conveyance, and logistics structures.

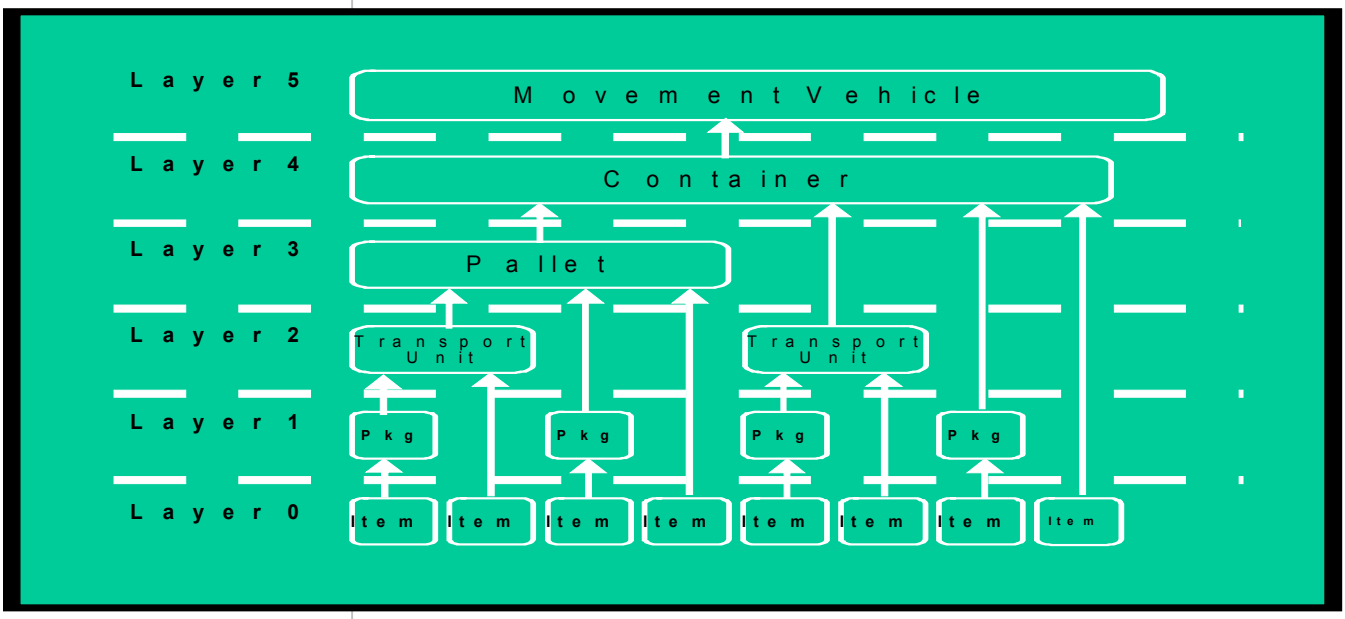

Figure 2

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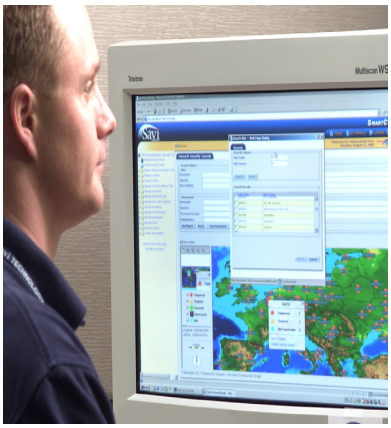
[2] Nesting, analogous to the hierarchical stacking of a "Russian Doll"
[3] From sku to logistics conveyance. Think about the intersection of BOMs, with network routings, or pipelines

So, a total shipment (conveyance and its contents) will ultimately utilize the whole nested stack, using an integrated range of data collection methods. A good example is shipping medical supplies. A barcode imprinted on each medication package, a passive tag on the carton, an active tag with the pallet, and then shipped by sea in a container with an active RFID tag that acts like an electronic shield to ensure nontampering, as well as trace and track. This tag can be equipped with sensors to monitor temperature or humidity changes throughout the shipping process.

Each of these levels may have different business owners/custodians, but each entity in the chain will have access to relevant information on the tags and in the software. As a shipment travels through the chain, each process owner will add access data to the pool of knowledge about that product and shipment. Rather than a haphazard series of disparate data models to access that knowledge, nesting unifies levels from top to bottom, end-to-end, and enterprise-to-enterprise. So, a single item, or a whole shipment can now be located accurately in real-time.



End-to-end visibility from point of origin through to final destination is the mandate in many supply chains.

End-to-End Chains Rely on Network Solutions

Most firms are managing their business—freight, sales channels, etc.—through a myriad of trading partners and, hence, their data through many IT systems, diffusing the trail of information. These complex rubrics cubes of systems introduce all sorts of latencies and errors into the process due to legacy architectures, poor data standards and just plain human frailties (errors). They also lose visibility to their shipments and products as they move closer to the end customer—the entity most crucial in the whole chain!

Here is where the concept of applying nested visibility within a network solution becomes essential. Network solutions are beginning to get a justifiable foothold in the logistics arena. Just as in the banking system, all the members utilize one highly secured clearinghouse for their data exchange. Errors are eliminated. Logistics networks utilize these concepts—web centric, always on, end-to-end network architecture. The value of RFID can be maximized through an end-to-end network that starts at the point of manufacturing, which is in Asia for many U.S.-bound shippers, on to the point of sale. This creates end-to-end visibility of the shipments through to the *end consumer.*

This enables realization of your customer's mandates as well as *your own* objectives. Coupled with nesting, true trace and track is enabled—not just for shipments, but also for products throughout the life of the product, so solutions like replenishment, merchandizing and reverse logistics (returns) etc. can be supported[4].

[4] Technology buyers must ensure that their network solution is architected for nesting.

RFID Solutions Include:

- Nested Data Model
- RFID Specific Middleware and Software Apps
- Internet Enabled Network
- Intelligent Local Solutions
- Tags and Readers

RFID Solution Elements

There are other requirements[5] for RFID that complete the solution:

- Integrated intelligent Local applications—local data collection solutions can be highly dynamic and varied, and yet have a large task to perform from data capture, to data and user authentication, to identifying, aggregating and publishing data. From readers, to the desktop, to intransit carriers (equipment such as GPS), lots of intelligence is being embedded in these small, agile and smart technologies. Most environments will be hybrids of data collection techniques, so look for devices that can address, for example, both bar-coding and RFID.

- New generation of middleware. RFID middleware must perform many functions such as *security*—authentication at multiple layers; *filtering*—the volume of data from tags and readers can overwhelm most enterprise-level software systems, as well as publish data to other IT systems across the supply chain. Middleware must cope with the anomalies of wireless environments such as redundant reads, data conflicts and collisions, as well as enable context-specific knowledge that can support local business rules and processes. This new generation of middleware must simultaneously be an event and network management system and a data transformation and integration platform. Traditional enterprise integration solutions do not address these challenging requirements.

- *Ok, and a word about tags!* In spite of the buzz about the *EPC Class 0 and Class 1 passive* tags, their ability to support the global supply chain vision we are talking about is limited to applications within warehouses and on the shelf because of their short range of several feet and their read only capability[6]. Active tags, with ranges of 300 feet or more, *may* not be required for your packaged or boxed products, but surely they're needed for tracking pallets, transportation containers and modes. You already should expect your carrier to have active and secured tags on containers (smart containers) to address security and regulatory compliance mandates.

Collectively, these requirements may sound daunting, but the *experienced* solutions providers do have compliance ready solutions that address these issues. The business benefits of implementing this whole approach—not just slapping on tags—are extremely attractive. There are successful existing implementations that point the way. Creating an RFID roadmap, based on the trail already cleared, will reduce the challenges and enable strong project management to achieve the goal.

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[5] We will not dissect all the requirements in this short paper, but focus on the essential elements

[6] Class 1 passive tags are not read/write

So, the solution is not just about the tag, but integrating the data up and down the chain

Better Decisions:

- Packing size
- Replenishment levels and restocking frequencies
- EOQ
- Pricing by customer/ geographies, store, etc.
- Shipping optimizations
- Warehouse layout and optimization/optimized picking
- Product Design
- Product Life Cycle
- EOL
- Supply Chain Network Optimizations
- Channel vs. consumer visibility

Unlocking Supply Chains:

- Trace and track
- Packaging
- Security/anti-counterfeiting
- Lifetime product quality, etc.
- Regaining customer intimacy
- Demand Driven business Models
- Maintaining dominance at the shelf
- Profit and yield
- The right portfolio of products
- Reduction in supply chain glitches

Creating an RFID Roadmap

No doubt, the push to RFID is coming from the customer. So, how do suppliers meet compliance requirements as well as make this solution add value to their supply chain? We will discuss the key process areas you need to address now and then create a roadmap to implement these as a lifetime solution.

How I Can Make RFID Work for Me Now

In the short-run there are many opportunities to act on. It should be noted that for now, most implementations of auto-id at the item and carton levels will be hybrids—barcode plus RFID, driven by inbound requirements of the customer. So, what are the key focus areas now?

Logistics: Outbound Applications: PickPackShip, Inventory Management

Multiple points in the global chain deal with complex hand-offs, where custodial responsibility often changes. These are danger points from visibility, security, trade, product quality, handling and paper work accuracy perspectives. Hand-offs between equipment, enterprises, IT systems, countries, regulations and data standards, and people, all induce errors, disruptions and latencies. Today there are significant inbound receiving and reading errors, as well as inventory accuracy issues. Without accurate identification, products don't make it to the shelf to be sold. In addition, issues such as validation of quantities, disputes on shipper load and count, vs carrier, inventory accuracies, etc., clog up the paper trail, leading to chargebacks. Woolworth's, for example, has already implemented active RFID with other automatic identification technologies, and is improving receiving operations, data quality, and shrinkage.[7]

This is the area you will need to be ready for *now*. Timetables vary in retail, but Wal-Mart expects the top 100+ to be fully compliant by January of 2005. The others will follow suit. You must address receiving enabled labeling and tags and you must do your own testing to ensure success.

Logistics Integration to Third Parties:

Logistics entities—carriers, freight forwarders, port/intermodel facilities/ distributors, and 3PLs—all touch your shipment on its way to the marketplace. Now is the time to think about finally making these hand-offs seamless. Significant delays today are likely to be compounded by the implementation of more regulations. You need a fight-back strategy. An important pilot was just conducted called Smart & Secure Tradelanes, or SST. SST is a private/public partnership initiative committed to improving the efficient management and

security of the ocean tradelanes, ports, and containerized cargo. SST is testing the value of RFID technology enabled processes. (See side bar) Fundamentally, this pilot demonstrated that the fully integrated RFID solutions approach has significant positive impacts on the whole supply chain process[8], security, multidimensional management, information accuracy and reduced cycle times, total real-time visible shipments, and asset optimization. Here is where the power of the network integration is indispensable. A number of major retailers and their suppliers participated in SST Phase 1 to test security enhancements, but they also discovered the potential value of end-to-end, real-time visibility in improving operational efficiency.

SMART & SECURE TRADELANES

- SST is a private/public initiative to help secure the global supply chain
- The goals of SST include:
  - Implementing **baseline capability in container security** consistent with government requirements
  - Ensure no reduction in **efficiency** for supply chain participants
  - Synchronize with **CSI, OSC, C-TPAT**, as well as the **24 Hour Advance Manifest Information Rule**
  - **Based on open standards** and existing U.S. Department of Defense Total Asset Visibility (DoD TAV) solution and network
  - Participants represent 85% of US Container Trade

The Link to the Merchant: Applications—In-Store Operations, Replenishment

No doubt in the short run, RFID will focus at the back of the store, but it is only a short trip to the cash register. And for *e*stores, the *merchants' last thousand feet* are already traversed! Club merchants like Costco and Sam's stock in cases, and in garden shops, frequently the pallet is *the shelf*. So in-store operational should be considered now as well. Most consumer products companies have little to no knowledge of the end consumer—most importantly at the point of consumption. Merchandizing and replenishment will vastly improve with accurate and timely information from RFID solutions.

Product Traceability Applications: Security, International Trade, MES, SRM

Lifetime traceability will be the watchword here, from pharmaceuticals to consumer electronics. The multidimensional context here extends to the history of lots, items, shipment routes (secure routes, and storage facilities), repair history, product configurations, etc. In addition, to see who has touched your shipment under what circumstance! Solutions to meet FDA requirements will use passive and active tags—from item, to tracking of pallets and containers. Bill-of-Material (electronics) requires identification of the components. In these product areas, you will need to exercise the full extent of the nesting data model.

Mass serialization of most pallets and cases of pharmaceuticals and product packages that can be counterfeited or tampered with, as well as some pallets and cases of other pharmaceuticals is expected to be enacted by January of 2006.

These verticals and process areas point to a series of rollouts. But your RFID solution should work for both product focused applications as well as logistics. The value of an RFID roadmap, rather than a knee-jerk reaction to the current mandate, will ensure extensibility.

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[7] The Woolworth solution won the European Retail Systems Award
[8] For the white paper reviewing the strategies and benefits go to http://www.chainlinkresearch.com/parallaxview/whitepapers/SST_PhaseOneReport_Synopsis.pdf

Building a Solution for a *Lifetime*

RFID will ultimately be like any other enabling technologies, requiring several iterations of innovation, so think about RFID as a lifetime solution—a portfolio application. However, there are some things that are required *now.* So, creating a portfolio roadmap that addresses the lifetime, as well as the current compliance requirement is key:

RFID Roadmap Critical Thinking:

- Create the business imperative
- Create the Solution Portfolio Plan
- Select experienced providers who can short circuit your implementation and reduce your risk
- Establish inter-enterprise working teams

1. *Create the business imperative*. Identify the business process, performance requirements and benefits for your customer and *your* enterprise.
2. *Create a Solution Portfolio Plan:*
    - *Assess the technology*—the RFID total solution, again, needs to be included. Your requirements should be for a next generation Automatic Identification Data Collection (AIDC) capability. Many technologies in the market today are not scalable and were not designed to extend[9]. New generations of AIDC/RFID-based applications are becoming available that can absorb the whole range of AIDC requirements—from bar-coding through to sophisticated smart technologies.
    - *Evaluate the technology providers*—What technology solutions providers have the knowledge, RFID experience, staying power and breadth of solution to take me *the distance*? Since the biggest customers in the world are requiring this, you need to mitigate risk!
    - *Leverage RFID information for other Applications—Which applications can benefit from this richer, more accurate and timely information?* WMS and TMS, as well as smarter replenishment solutions are early starts. Use the nested RFID data model to unlock the multidimensional business views across the whole value chain.
    - *Leverage an existing RFID network*—This can significantly reduce start-up costs, supply chain integration costs and time, and the total cost of ownership. Since the solution is more than the tag, encompassing end-to-end intelligence across the whole trading network to the customer, the idea of signing on to an industry standard pre-built network solution is a huge advantage[10].

[9] Read and write, many types of tags, frequencies and from many different manufactures of labels and tags

[10] Savi solutions provide the option for firms to sign on to its secure smart network, for example.

- *Review and implement next generation Applications that are designed to natively integrate and leverage real-time information.* New generations of AIDC/RFID-based applications are becoming available. Designed for managing global supply chains in real-time, these Applications will allow planning and execution systems to be driven concurrently by real-world supply chain events.

3. *3Establish working teams* with your customers and your suppliers. RFID has compounding benefits when viewed across the chain. Look at:
    - What partners will we work with and how will we work going forward?
    - What improved decisions will RFID enable for our trading community?
    - What role will my trading partners play in enabling improved processes?
    - How to integrate trading partners' applications to provide end-to-end capabilities? What are the joint investments we can make together?

In addition, there are some critical considerations and actions to be taken now:

- *Get informed on standards and policies!* What are the key associations[11] that I must participate in to influence and learn from? Participate and learn from active pilots and existing operations, such as SST and the DoD's pioneering deployments in this field. What are the standards, government regulations, etc., that must be dealt with?
- *Work with your service provider partners on building out RFID capabilities*—Scrutinize and participate in your carriers' and 3PLs' RFID studies, decisions, and investments to ensure they are building in the required capabilities to support your needs.

[11] AIM, UCC, ISO, EPCglobal, etc.

Conclusion:

Creating the end-to-end, top-to-bottom supply chain is a vision in implementation for many supply chain managers. It requires responsive real-time visual smart solutions. Business capabilities in customer service, supply chain, merchandizing and logistics are but a few processes that will be enabled by RFID. But if you limit your definition of RFID to compliance—tags only—and don't use it to improve your business processes, your enterprise will not gain tangible benefits, beyond compliance[12].

Frenzied market environments bring new entrants, including many who do not have the experience required to deliver the results. Technology buyers today seek providers of complete, end-to-end solutions that map to the buyer's global business problems and have the depth and breadth of experience to successfully lead the buyer's enterprise forward. Mistakes will be made, so it's wise to work with solution providers that already have learned from them. You must gain a deep understanding of what the solutions providers' real capabilities are—not only to serve your firm—but also in the context of a huge market that may be competing for resources.

Wal-Mart is moving rapidly through their pilots and will be online soon. And the other big players in retail have mostly joined the fray. So, *start now*! *2005* is upon us! Early projects will gain the knowledge required for success. Like all new programs, significant new concepts and changes will be introduced into the organization. Embedding knowledge *now* will take the organization a long way *later!*

Conclusions:

- Don't limit your RFID definition to tags—you will not gain tangible benefits beyond compliance
- Seek out experienced technology firms who can provide a whole RFID solution
- Start Now! There are significant changes that will be introduced. Gaining knowledge *now* will take you a long way *later*

[12] And that, in itself, will be a challenge without your focus on your own business performance. These projects are funded by you, with the expected outcome by your customer—improved service and delivery at no additional costs.

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