

**An Analysis of Technical, Process and Organizational Challenges
Confronting Corporations Implementing Radio Frequency
Identification (RFID) Technology Projects.**

Executive Summary – Thesis Project
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Executive Summary

The purpose of the thesis is to identify challenges that are being addressed by companies implementing RFID related technologies in a variety of supply chain management applications. The test engagements undertaken by companies are intended to investigate the economic, functional and process related benefits that might be derived from adoption of this emerging technology.

Field research uncovered challenges and possible solutions being developed by companies, in addition to understanding the impact of challenges may have on wide spread adoption of RFID technologies. The challenges observed in this research project were evaluated using a simple analytical framework, and case studies were developed to provide summaries of current RFID pilot project activities.

Research Project Background

Recent attention on RFID technology applied to supply chain management within the boundaries of an enterprise and between trading partners is causing companies to experiment with this technology by initiating proof of concept projects. These test engagements look to investigate the economic, functional and process related benefits that might be derived from adoption of this emerging technology.

The purpose of the thesis is to identify challenges that are being addressed by companies implementing RFID related technologies in a variety of supply chain management applications. Field research was conducted via interviews with a ten companies in a cross section of industries. Interviews were conducted with individuals who are responsible for the technical implementation of RFID during pilot projects, and with representatives who were accountable for project management aspect of the RFID pilot. As a result, a number of interviews were performed with vice-presidents who oversee entire departments, as well as with managers responsible for the operations of the field tests.

Industries represented in this study include pharmaceuticals, consumer packaged goods, consumer retail, heavy manufacturing and food manufacturing.

Applications Areas of Technology

The possibility of applying RFID technology to various functions within an organization, and between linkages among companies, is expected to lead to more efficient operating procedures within a company's extended supply chain. The research efforts focused on the application of RFID technology in the following functional areas:

- Inventory Management – company using EPC/RFID technology in order to automate the outbound shipping process which will lead to a reduction in warehouse labor that spends time counting stock that will be departing a company's distribution center.
- Product Pedigree – company using EPC/RFID technology to associate raw material and transportation history of products in order for stakeholders to understand the pedigree of the product. Improving "Track and Trace" abilities for products from point of production to point of consumption is an interesting area of investigation.
- Facility Security – company using RFID technology to allow for employees to move around and between company facilities, and associating physical assets to particular employees.
- Security Management – company using EPC/RFID technology to increase certainty about secure delivery of containers of product procured certain countries in South East Asia.

Classification of Challenges Identified

The challenges uncovered during field research were grouped into the following classifications:

- Technical – challenges that pertain to physical performance of RFID equipment performance, and local information systems performance issues.

- Process – challenges that impact procedural activities, from an enterprise wide systems perspective and from a labor process perspective, within a firm.
- Organizational – issues that focus on educational and/or interdepartmental involvement efforts associated with deploying RFID technology, both during the pilot effort and when dealing with wider spread adoption activities.

In addition of classification of challenges into technical, process and organizational grouping, another analytical framework was developed in order to help further categorize challenges based upon the following questions suggested during field research:

- How will the challenge identified impact wider spread adoption of RFID technology at my firm in the intermediate term?
- How difficult will the implementation effort be in order to attend to this challenge?
- Is the issue going to be addressed in the short term (less than one year), or can it be addressed at some point in the future (greater than one year)?

Three Key Reasons for Adoption of RFID

The data suggested that there are three primary reasons that are motivating companies to test RFID related technologies in a variety of applications throughout the supply chain.

The three reasons driving adoption are as follows:

1. **Adoption to Reduce Costs of Specific Functions within Supply Chain Management** - application of RFID technology to reduce operating costs.
2. **Adoption in Order to Identify Benefits** – application to understand how technology could be used to develop competitive advantage in the market, or enhance the relationship with an end user of the product sold.
3. **Adoption to Satisfy Customer Requirement** - response to customer request or mandate concerning use of RFID technology.

It is important to note that reasons listed as to why companies are considering using RFID technology will greatly impact the scope, timeline, function of individual pilot projects.

Summary of Challenges Uncovered

The following challenges were discovered and grouped according to the aforementioned analytical framework.

Technical

- Case and unit signal interference
 - packaging
 - product contents
- Tag placement for case level tracking
- Impact of radio frequency solutions on consumer health
- EPC data capture integration effort with existing Warehouse Management System

- Interference from existing Radio Frequency signals in distribution centers
- Understanding database storage system requirements at both Savant (Edge) and Corporate levels

Process

- Automation of RFID tag application process at case level
- Understanding customer's RFID requirements and selection of standards
- Creation of product groups for RFID test period
- Association of EPC enabled case and pallet information into traditional electronic transaction processes such as EDI

Organizational

- Creation of cross functional steering committee for RFID efforts
- Budgeting process and involvement of finance department during pilot
- Managing unrealistic expectations about RFID within "four walls" of enterprise

Highlights of Case Studies Developed from Research

Field research uncovered a great deal of information about pilot project specifics. The following table provides a comparative snapshot of five case studies that were developed during the research process to highlight project information.

Industry	RFID Pilot Driver	Region	Key Stakeholders	Level of Test	Third Party	Key Challenges	Takeaways
Food Manufacturing	Customer Mandate	United States	Supply Chain Strategy, Information Technology, Production, Quality, Warehousing, Packaging	Pallet, Case	Yes - management consulting firm	1. Signal interference from some SKUs tested - metallic packaging bags/wrappers provided decrease in performance 2. Understanding economic case for unit level tag application 3. Keeping attention of senior management	1. Interference from contents of product and type of packaging did not develop to be a significant issue when conducting field testing at case level. 2. Cross functional representation on pilot team is vital. 3. Communication & executive support required. 4. Need to determine how various product groups/locations are going to become compliant
CPG Retail	Discovery of Benefits - Asset Protection	United States, Philippines	Asset Protection, Distribution Strategy, Store Operations, Finance	Container, Pallet, Case	Yes - C-TPAT (US Government)	1. Determining type of tag needed for various functional applications 2. Getting cross functional team involved in various pilot efforts, especially finance group 3. Developing corporate RFID adoption plan for 2005 and beyond	1. Provide limited scope for each pilot project 2. Ensure finance department is represented on steering committee 3. Create business case for each function impacted by pilot
CPG Grocery Retail	Discovery of Benefits - Asset Management	Holland	Information Technology, Supply Chain Management, Store Operations, Transportation	Unit	Yes - uniform vendor, laundry services vendor	1. Managing flow of new EPC generated data between vendor and company ERP system 2. Proving ROI for specific functional application	1. Asset management reason for adoption can show strong ROI.
Heavy Manufacturing	Discovery of Benefits (Competitive Advantage through Product Differentiation) + Customer Mandate	United States	Logistics, Information Technology, Quality Assurance, 3 Business Unit Reps (light truck, truck, earthmoving)	Container, Unit	Yes - system integration consulting firm and 3PL vendor	1. Developing proprietary solution for "curing" active EPC tags into products (at unit level) 2. Understanding customer requirements	1. Firm believes that EPC/RFID compliant product will become a customer need/want in the future 2. Involve as many business unit heads as possible during all aspects of pilot projects 3. Get finance involved early in process in order to budget appropriately.
CPG Toy Manufacturing	Customer Mandate	United States	Supply Chain Strategy, Information Technology, Operations	Pallet, Case	Yes - systems integration firm	1. Determining how to populate EPC generated data at case level into EDI documents (ASN) 2. Developing economic business case for adoption at international plant locations	1. Interference at case level did not pose problems for toy and game product groups tested 2. Little investigation made into how firm can leverage investment in infrastructure to benefit ERP and other enterprise wide systems

Table 1 - Case Study Comparison Snapshot

Framework for Analysis

Two concepts were used to create the analytical framework in this research project. First, a classification schema was created in order to sort the issues uncovered during research (technical, process, and organizational challenges). Second, in order to develop a visual guide of challenges, a graph was developed which allows for issues to be plotted based on time horizon, impact on RFID adoption at company, and difficulty of implementation.

The following example shows one classification, in this case technical challenges, that may be confronted by the team working on implementing RFID technologies in a pilot project. This diagram is for illustrative purposes only, and can be considered hypothetical example where challenges are plotted according to the aforementioned framework for analysis.

The size of bubble indicates the difficulty of implementation from a human resource or financial commitment perspective. Research indicated that companies judge difficulty of implementation based different factors, including, but not limited to, budget commitment requirement, full time resources required to complete project, and involvement from number of functional groups with in the firm.

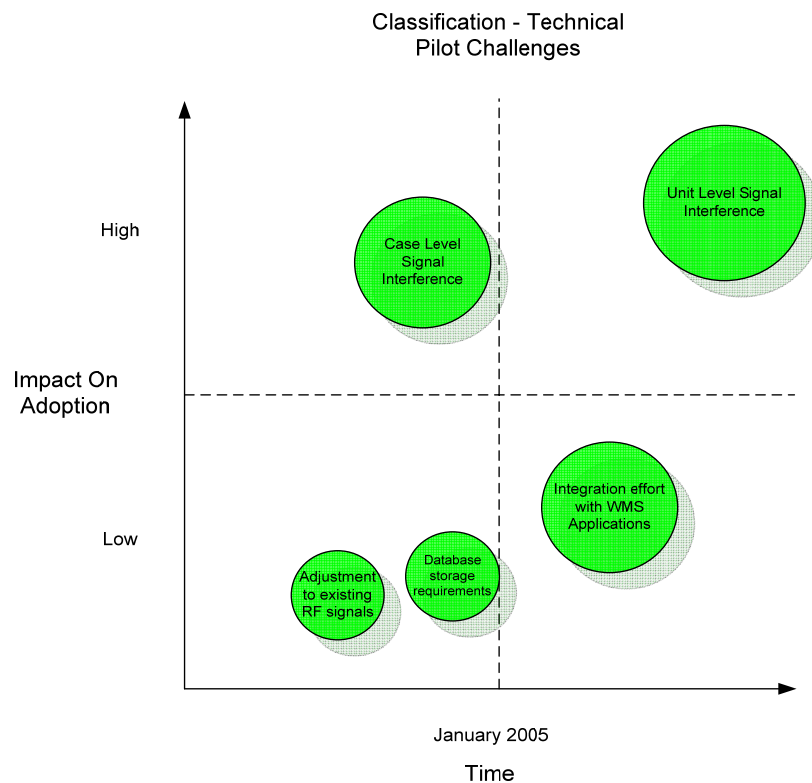


Figure 1 - Example of Applying Framework – Sample Analysis of Technical Challenges Expected During RFID Pilot

This framework might be useful at companies that are about to initiate a RFID pilot project. The challenges that may be expected could be plotted on the graphs in order to visually represent how the issues are related to one another.

Understanding the expectations of your audience which will be contemplating RFID pilot challenges is important. The proposed framework allows the manager to identify and help prioritize challenges that might be confronted while working on a pilot project. The following figure provides an example of how all identified issues could be plotted on distinct graphs, and how this form of visual comparison may be considered useful when prioritizing potential or current challenges.

Various perspectives may want to be considered as various levels of the organization get involved in pilot activities. Therefore, the recommendations are grouped according to the interests of the following audiences:

Director/Vice President Level – representatives who are considering the intermediate and long term objectives of RFID technology, and are responsible for functional units within an organization.

Project Manager Level – representatives who are responsible, or will be responsible, for implementing RFID pilot projects, from both a technical and business perspective, in the field.

The framework suggests that there are two important perspectives to understand: strategic and tactical views of the pilot project. The following graph visually describes how different groups could view all challenges that have been identified.

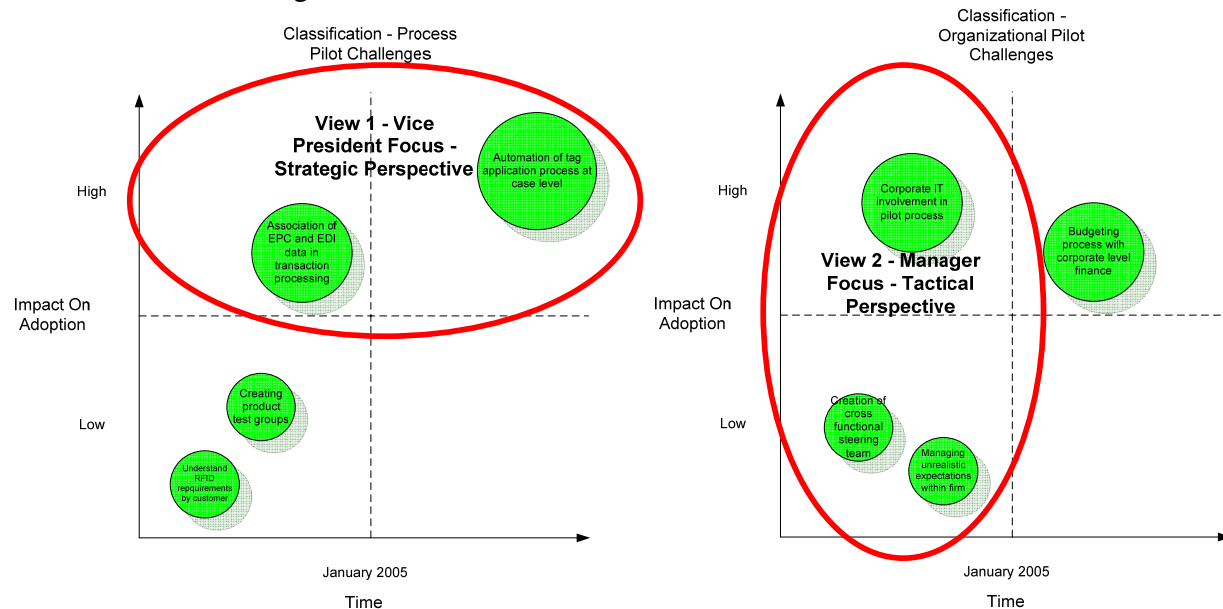


Figure 2 - Example of Strategic and Tactical Perspectives for RFID Pilot Projects

The strategic view, or view 1, could be for vice president level representatives who might want to understand intermediate to long term challenges that the team might face, in addition to the challenges that may have a high impact on intermediate term adoption at the company. The tactical view, or view 2, might be more appropriate for managers who are currently working on RFID pilot implementation efforts. This perspective places more emphasis on current issues that are likely to be faced in the short term, which are expected in the current year of activities.

Recommendations from Field Research

The proposed framework provides a method to sort potential challenges might be confronted during the project, and may allow a manager to develop an understanding of the strategic and tactical nature of the issues that will be addressed. As previously discussed, suggestions in this section have been drawn from the development of case studies and observation of challenges during the research assignment.

The following suggestions might be useful to members of various audiences who are considering engaging in RFID technology related, pilot activities:

Suggestions - Director/Vice President Level

- Attempt to get high level support for RFID projects – Try to involve those above you in the organization.
- Try to involve your finance department in RFID pilot projects and on corporate strategy/steering team – Return on Investment may need to be proved to finance department before budgeting can occur for wider spread adoption of this technology. Get corporate finance department to take active role in pilot projects.
- Begin to engage sales and account management teams during RFID pilot projects – Try to spread RFID responsibilities across functional groups, and not let only a small number of groups drive the effort within your company. Customer facing functional groups may want to be involved in pilot testing activities.
- Consider leveraging RFID investment to derive internal process efficiencies if responding to customer mandate – Some pilot projects focused on retailer mandate are taking up resources, but try to develop business cases for additional benefits from EPC and RFID generated data.
- Create RFID education materials that can be distributed to various audiences – Groups within your organization might have a different understanding about the technology, and RFID application needs. Perception of uses of RFID technology, and how it will impact the organization, might be different across sales, production, quality assurance, and materials management departments.

Suggestions – Project Manager Level

- Attempt to proactively develop strategies to rollout technology to other plants and regions – It might be useful to not to wait for additional adoption plans from one customer, such as Wal-Mart, who might be encouraging RFID requirements in the form of a mandate. Attempt to plan as if your company is looking to embrace RFID technology without pressure from customers.
- Create separate pilot projects for application of RFID to various functions within corporation – A number of different groups within the enterprise might want to conduct pilot projects on their own. Managers may want to encourage various project teams to share pilot objectives and results with other groups involved in the testing of RFID technologies.

- Consider developing new classification of products when thinking through RFID testing in the field at case and unit level – some companies might not be able to rely upon traditional product groupings for the purpose of RFID testing during pilot activities, so new classifications might be useful for testing purposes.
- Try to think that adoption of EPC/RFID technology will be different to adoption life cycle of bar coding in retail environments – RFID technology has the potential to impact more processes within your company, may cost more to adopt across your distribution and production network, could require more attention around privacy and information ownership issues, and will vastly multiply your data storage requirements in some enterprise wide systems applications.
- Address privacy issues with employees, and then with customer groups – end customers of certain products may be concerned about privacy issues with the use of EPC and RFID technology.

During research, it became apparent that the process and organizational challenges may require the most attention in order to increase RFID adoption within an organization. While the technical challenges that are important and should not be minimized, there are significant issues concerning change management around internal functions and enterprise procedures that should be recognized at this point in time.

Research Summary

The research assignment was captured current RFID implementation challenges from field research, and provided a simple analytical framework with which challenges can be examined. The listing of challenges identified was not exhaustive, but has been depicted in order to provide some insight into the current technical, process and organizational challenges that are prevalent in RFID pilot projects today. In addition to uncovering challenges, three key adoption drivers were discovered and these reasons for adoption are driving the structure of RFID pilots in the field.

Several field case studies were developed to provide anecdotal summaries of current RFID pilot project activities, and provide context for the technical, process and organizational challenges that were uncovered during the field research process.