Determining justification for rfid technology

Technology

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RFIDTECHNOLOGYDetermining Justification for RFID Technology Bahram

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Ottawa, Ottawa, Canada Abstract " What are the benefits? " is a common

question for any organization considering implementing a new technology.

This is an especially important question for small or developing companies,

where an error in investment could result in unrecoverable operating capital

loss.

As Radio Frequency Identification (RFID) systems are making deep and

impressive improvements in manufacturing, distribution, and supply chain

management and military logistics, it is time to consider the quantifiable

financial and operational benefits of RFID in an organization's competitive

strategic plans. This article will review the benefits of RFID implementation

against its costs, and demonstrate how the introduction of an RFID system

can reduce production, distribution, and warehousing costs, while

increasing the operational efficiency of an organization.

Through financial metrics, value equations, and numerical analysis this

article will demonstrate how RFID implementation can improve not only

an organizations bottom line, but also intangible benefits such as internal

focus, industryleadership, and differentiation from its competitors. A sample

businesscase studywill be presented to demonstrate to the reader valuable

insight to both real-world advantages and limitations associated with RFID

adoption. 1. Introduction The focus of this paper is how to develop an RFID

strategic plan to quantify RFID justification through return on investment (ROI).

RFID offers strategic advantages for businesses, private or state organizations because it can improve efficiency, cost savings, and yield greater returns in virtually all areas of business processes and operations. However due to the complexity associated with an RFID system, its uncertain proven capabilities, and high costs of implementation, it is crucial to create solid a business case and justification in terms of ROI, either quantifiable or intangible, which offer the greatest benefit to the company. 2. Background - What is RFID?

Radio frequency identification, or RFID, is a wireless automatic data collection technology which uses electronic tags for data storage. An RFID system consists of an RFID tag, a reader/writer unit with antenna, and a computer, as shown in Figure 1. [pic] Figure 1 RFID System The reader/writer emits radio signals from its antenna to power the tag, and can read or write data to the tag without a direct line of site. Reader/writer units are available in various shapes and sizes depending on requirement or application.

Similarly RFID tags are available to suit most any application orenvironmentfrom unobtrusive paper thin tags suitable for traditional barcode applications, to large heavy-duty brick sized tags to track heavy machinery. The computer or middleware allowscommunicationbetween the RFID hardware and system applications. 3. RFID Benefits and Costs RFID offers strategic advantages for businesses because it can improve

productivity, efficiency, cost savings, and yield greater returns in virtually all areas of business operations.

As an example, Air Canada was losing $2 million USD worth offoodcarts per year. This initial problem of asset tracking resulted in the deployment of RFID systems which yielded a 2% reduction in total inventory, 5% reduction in maintenance costs, 20% to 50% in trucking charges, 80% reduction in shrinkage, 100% reduction in costs for auditing yearly inventory counts and ROI within 18 months. [Internet, 4] In general some of the main advantages of RFID usage are: • Reduced warehouse and distribution labor costs due to increased data automation • Reduced inventory by omitting inventory errors Improved forecasting and planning due to improvements in visibility of supply chain • Reduced theft by tracking the products point to pint • Reduced out-of stock conditions via better RFID product tracking RFID is used for everything from tracking cows and pets to triggering equipment down oil wells. The most common applications are payment systems, toll collection systems, access control, track people, assets and products without the need for human intervention or direct line of site. [Internet, 5] All of the applications listed have been deployed because they haven proven ROI. . RFID Costs When considering RFID costs a company must consider the total cost of ownership rather than just the initial RFID hardware and tags costs. A complete RFID system includes not only hardware infrastructure, but also service such as design, development, deployment, maintenance, ongoing support, and training. Also to consider are the future costs as the system is scaled beyond its initial pilot or trial phase. Costs should also be associated

with restructuring or introducing new business practices. 5. Creating Justification for RFID

The potential applications and benefits of RFID are only constrained by a company's level of innovation. However, before rushing to adopt RFID technology a company can ensure the greatest rate of return and success by having in place a comprehensive strategic plan which quantifies all encompassing aspects of RFID including technology and business processes in order to deliver its benefits for maximum value. In order to justify the costs of an RFID system it is vital a companies RFID strategic plan contains quantifiable metrics assigned to values of each area which RFID impacts.

Therefore when a company does decide to implement RFID, such a strategic plan will allow them to proceed confidently to their strategic objective while ensuring the maximum potential value areas are achieved. By contrast a poor RFID strategic plan without careful and insightful study, risks to dilute the focus and resources of the business and may prove to be detrimental and wasteful, instead of beneficial. Each RFID deployment will have its unique application varying with the application of the company and the company'sgoalsso there is no single ROI or total cost of ownership criteria for RFID.

On the other hand, ROI in many cases is not only found financially but also in intangible factors. For example a distribution center may place value on increasing efficiency throughput in order to savemoneyon labor and reduced shipping errors, where a hospital or healthcare center would place value on increasing visibility of surgical equipment so to have a better chance to save

a persons life due to increased response time – economic cost would not be so much as a constraint in this case, but rather the service is of more importance than straight financial justification. . Creating a RFID Strategic plan to determine ROI justification As previously mentioned, there are often uncertainties and reservations when an organization first considers introducing RFID, such as concern of high price or hesitation at the risks of being an early adopter and risking mistakes and learning costs. This is usual behavior in small companies and especially in developing countries where an error in investment could result in unrecoverable operating capital loss.

To overcome this uncertainty and to proceed confidently with the company-wide acceptance of RFID deployment, a plan must include strategic thinking and financial justification. [Sweeney, Patrick J II, Chapter 16] By thinking strategically, we uncover the hard data and information that enables members of organization to make informed decisions and to communicate the rationale of RFID deployment effectively. Performing an ROI study on RFID will allow a company to become reacquainted with current business processes and to identify opportunities for optimization (if RFID is decided to be used or not. Through analysis and calculations, in this process we examine every RFID affected area and assign to them associated value metrics in terms of quantifiable or intangible returns. However in order to obtain the information and data necessary to perform ROI calculations and value equations it is necessary to create a solid and detailed rich strategic plan comprised of but not limited to the following sections, Figure 2. [pic] Figure 2 Involved Steps of an RFID Strategic Plan 6. 1 Form Business Team

Since an RFID implementation will affect business process as well as technological change, it is beneficial that the business team includes internal management personnel capable of RFID analysis from all related functional departments. Internal team members, working closely together with external experts and consultants, will be able to offer valuable procedural insight to the development and design of an RFID system. 6. 2 Define Scope and Assumptions A strategic plan should clearly define how RFID will affect the business and define key elements of RFID operation.

A clear understanding of affected processes, departments, and areas of coverage, is essential. Assumptions are necessary to ensure a common understanding of how the RFID system will be implemented and what processes will be affected. 6. 3 Identify Strategic and Economic Benefits Benefits represent one of the most important factors in building an RFID business case. To determine justification and feasibility of an RFID system a company must summarize its expected strategic impacts and quantifiable benefits obtained through more efficient RFID enabled processes.

Since strategic or intangible benefits can not be easily quantified, it is important for the company to articulate why an RFID introduction is important to business and have a clear understanding of its associated value. This is especially important for companies which place value on product or data visibility. Examples of strategic benefits include internal focus, industry leadership, and differentiation from its competitors, and product visibility. Quantifiable economical benefits can be tested through metrics and measured with calculations.

Quantifiable benefits will vary with industry and RFID application but will generally be attributed to time or process improvements through automation and improved efficiency. 6. 4 Develop Business Process Models Process modeling consists of creating business-flow diagrams and use-cases to determine and quantify how RFID will impact those processes and associated applications. Adoption of RFID technology will most likely create new additional processing steps, and therefore modified business use cases will be introduced to reflect optimized RFID use.

Some sub processes might get streamlined and thus provide efficiency gains, whereas some other sub processes might need to include additional processing steps, which might impact their efficiency rates. The use cases associated with the impacted and newly introduced processes can then be analyzed for benefit [Lahiri, Sandip, Chapter 8]. 6. 5 Determine Costs When considering ROI, one must consider the total cost of ownership rather than just the initial RFID hardware and tags costs.

A complete RFID system includes not only hardware infrastructure, but also service such as design, development, deployment, maintenance, ongoing support, and training. Also to consider are the future costs as the system is scaled beyond its initial pilot or trial phase. Costs should also be associated with restructuring or introducing new business practices. 6. 6 Create an Implementation Road Map An implementation roadmap breaks up the complete RFID solution into a series of objective milestones within set time-frames.

The main tasks involved in completing this step are developing a scale of implementation from trial or pilot stages to full deployment, and assigning associated metrics of costs and benefits with each stage of milestone. 6. 7 Create Business Case Finally all information should be compiled to form a business case. Each benefit should be associated with a level of impact and time to realization. The level of impact takes three factors into account: whether a benefit generates revenue, mitigates risk, or reduces cost.

We may assign low-impact to benefits that meet one factor and high-impact to benefits that meet two or more factors. Time frame is a time period in which the business will see benefit. Short term could be one to two years and long term three to five years. It is difficult to forecast beyond five years. 7. Criteria and Justification Metrics to Justify ROI In order to justify the costs an RFID system it is vital a company complete RFID strategic plan contains quantifiable metrics assigned to values of each area RFID impacts on including procedures and personnel to ensure RFID investments yield the greatest rate of return.

Through study numerical analysis value equations and modeling, the value of various RFID systems can be made apparent and determined to be financially feasible or cost prohibitive. It is important to present a cost benefit analysis in order to justify the investment in an RFID system and establish a clear ROI. Upon the completion of the strategic plan, the quantified figures and resultant findings can be processed through value equations to justify and determine feasibility of an RFID system.

However, ROI in many cases is not only found financially but also through intangible factors. In this case, VOI (Value of Investment) should also be considered. Value of Investment is much more holistic approach to the benefits delivered and includes, next to the hard costs figures, the soft and difficult to measure benefits such as improved quality, staff moral and service perception, and customerloyalty. 8. Sample of RFID Justification through Case Study 8. 1 Introduction

This example will show the Return on Investment (ROI) of an RFID solution for a company which sends shipments from its manufacturing plant to its distribution center. The system will be closed loop which means that the tags and their data will be limited to internal company use and will not be used beyond the limited area of distribution center. RFID technology will be used to help automate the transfer process. The overall objectives are: • Demonstrate how RFID technology may be utilized to improve the efficiency of the transfer of shipments. Demonstrate a case which is justifiable in cost due to positive ROI analysis. 8. 2 Background A company's distribution center is plagued by errors and inefficiencies when receiving shipments from the manufacturing plant. Especially problematic areas are delay in receiving pallets and loss of pallets to be returned. 8. 3 Assigning Metrics to Processes Estimation time to completion (ETC) of items entering the distribution center, without and with RFID is described as in Table1. | No. Process | ETC | Process with RFID | ETC with RFID | |- |- |- | Precondition – RFID tags are| 0 sec | | | | | affixed to pallets and | | | | | | individual items at the | | | | | | manufacturing plant. | | 1 | Personnel scans barcode on pallet| 30 sec | Pallet is placed in RFID | 5 sec | | | to validate order and manually | | reader portal and scanned

| | | | compares to expected manifest | | along with all contained | | | | list. | | items.

Order is checked | | | | | | automatically. | | | 2 | If pallet is valid expected | 3 min | If pallet is valid but found| 3 min | | | personnel enters pallet as | | to have exception it is | | | | received and breaks open the | | broken own, all items are | | | | pallet | | automatically scanned and | | | | | | noted, and extra item is | | | | | | brought to return area. | | | 3 | Else pallet is invalid it is | 4 min | Else pallet is invalid it is| 4 min | | | moved to return area. | | moved to return area. | | 4 | Personnel scans all individual | 6 min |- |- | | | bar-coded items to validate the | | | | | | pallet contains all ordered items| | | | 5 | If item is invalid personnel | 2 min per item |- |- | | | manually notes this and places | | | | | item in return section. | | | | | 6 | Else item is valid and is placed | 6 seconds per item| Else pallet valid and all | 1 min | | | into received area to be moved | | contained items are present,| | | | into inventory section. (Pallet | | entire pallet is placed in | | | | contains 20 individual items.) | | received area to be moved to| | | | | inventory. | | | Time to unload a pallet with no | 11min, 30sec |- | 1min, 5sec | | | invalid items | | | | Table 1 Estimated time to completion to process pallet at distribution center From Table 1, the estimated completion times (ETC) of Time to unload a pallet with no invalid items is 11min, 30sec without RFID, compared to 1min, 5sec with an RFID system. 8. 4 RFID Solution and Process Detail Placing RFID reader portals at the distribution centers dockside gate allows for automatic identification of all pallets and included pallet items to be scanned upon arrival.

This would eliminate the manual steps of unpacking and checking each individual item separately before adding to inventory. An additional

processing step of placing RFID labeling on items and pallets before them leave the manufacturing plant would be occurred; however this would not affect distribution center processing time. 8. 5 RFID Benefits Incorporating RFID into the distribution center process provides the following quantifiable and intangible benefits: • Quantifiable benefits include: Pallet processing time increased of 90%, Reduction of loss as all pallets due to total visibility, Labor savings, and Reduced keyboard entry errors • Intangible benefits: Neater docking area, Improved work atmosphere 8. 6 Risks and complexity

Potential risks and complexity associated with RFID implementation may include Tag Misread due to damaged tag, moisture on the pallet tag, or proximity to metal surfaces. Site evaluation and proper RFID technology can minimize this risk as well as running barcodes in parallel with the RFID tags. 8. 7 RFID Components and System Costs The proposed RFID system will require estimated infrastructure and services consisting of the following: | Description | Costs Low $ | Costs High $ | | Hardware/Software | | | | RFID gate portal reader (4) | 28, 000 40, 000 | | RFID handheld readers (4) | 6, 000 | 8, 000 | | Accessories: Cables, etc | 1, 000 | 1, 000 | | Servers and Accessories (5) | 10, 000 | 15, 000 | | Software | 30, 000 | 50, 000 | | RFID tags (10, 000) – Closed loop system, tags can be recycled | 2, 000 | 5, 000 | | | | | | Integration | | | | Engineering, Installation and Integration services, training, | 60, 000 | 100, 000 | | maintenance (60 person days) | | | | | | | | Business Process Modification | | | | RFID tag application retooling at the manufacturing plant | 35, 000 | 55, 000 | | | | | | Total | 172, 000 | 274, 000 |

Table 2 Estimated RFID Costs 8. 8 Summary of Results Through RFID implementation if you compare the pallet processing times of Table 1, you

can see that a savings of 10min, 25secs can be realized per pallet. This is equivalent to a 90% increase in processing throughput times with the condition of a valid pallet and items. If the distribution center receives 500 pallets per day it can realize investment between 10 and 16 months depending on RFID costs, with assumed personnel costs of $10 hour and a 261 working-day per year calendar. If the distribution center is free of invalid pallets 95% of the time return on investment can be seen as in Table 3, as follows: Pallets received per| Savings per day | Savings per day | Savings per year | ROI with low RFID costs| ROI with high RFID costs | | day | |(in $USD) | (in $USD) |(in months) |(in months) | | |(in hours) | | | | | | 300 | 49. 5 | 495 | 129, 140 | 16 | 26 | | 500 | 82. 5 | 824 | 215, 234 | 10 | 16 | | 700 | 115. 5 | 1155 | 301, 328 | 7 | 11 | Table 3 Time to ROI Sample calculations are as follows for 500 pallets received per day: 11min, 30sec * 500 pallets = 690sec * 500 = 345000sec. 1min, 30sec * 25 pallets = 690sec * 25 = 17250sec. 1min, 5sec * 475 pallets = 65sec * 475 = 30875sec 17250+30875 = 48125sec 345000sec - 48125sec = 296875sec 296875sec/3600 = 82. 46hr, round to 82. 5hours 82. 46hr*$10=$824. 65/day , round to $824 824. 65*261=$215, 233. 65/year 215, 234. 38/172, 000= 1. 27 0. 79*12= 9. 58, round to 10months 215, 234. 38/$274, 000= 0. 799 1. 27*12= 15. 27, round to 16months Once RFID familiarity has been gained and estimated metrics have been realized, RFID may be moved to other areas of the company such as the picking from inventory at the distribution center, or some other RFID application at manufacturing center itself.

However, the processes, equipment, results, and lessons learned will be applicable to other distribution centers, and acquired knowledge may be

applied to other potential cost saving areas. 9 Conclusion The capabilities and limitations of RFID much be understood on a technical level, but also on a business procedural level to determine how RFID will ultimately impact on business. The decision to implement an RFID system must be carried out diligently with ROI equations. Also important to consider is intangible value which may not be apparent on a balance sheet. RFID is ultimately a business tool like many other IT options and to access its maximum capability, a company must have solid business procedures and plans in place. References Lahiri, Sandip (2005, August). RFID Sourcebook. Prentice Hall PTR.

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