RFID: The Buzzword in Supply Chain

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Abstract: **RFID is all set to be the technology of the future, especially in supply chain management. It is slowly gaining acceptance among various players. This is said to be the next breakthrough technology after bar codes. It has several advantages over bar codes and will replace them in next few years. RFID helps the retailers in tracking the movement of products from the suppliers to the warehouses and the store. It can also help in better inventory control and hence, cost reduction. In this paper, it is discussed in detail how RFID can help at store level in replenishing the shelves, prevent shoplifting, and gain valuable customer information.**

Keywords: **Bar codes, PIM, RFID, Supply chain**

1. INTRODUCTION

Radio Frequency Identification (RFID) is an analog-to-digital conversion technology that uses radio frequency waves to transfer data between a moveable item and a reader to identify, track or locate that item. It is a technology which uses an electronic transmitter to tag the items and products which have some unique identification and customer information. It helps in knowing exactly the position of goods at any point of time and can also develop processes to capture and act on their information. Generally this type of data, which is generated by RFID, is huge and valuable. This information, which is a real time enabler, helps the executives to make business decisions. The companies can ensure that their clients can derive the best from RFID technology and optimize their business needs.

RFID is a method of automatic identification which relies on strong and remotely receiving data using devices known as RFID tags or transponders. An RFID tag is a tiny object that is either attached to or incorporated into a product or person. These tags have antennas to enable them and receive and respond to radio waves.

Supply chain management is a large umbrella under which previous separate disciplines such as sales forecasting, purchasing, operations, information management, transportation and logistics are integrated for the greater good of the markets to which they operate. SCM also owes its genesis to total quality management and continuous improvement.

2. HISTORY OF RFID

The history of RFID can be traced to its existence as a technology since the 1920s. The first known application of the technology was an espionage tool invented by Leon Theremin for the Russian Government in 1945. This tool was a passive, covert listening device and not an identification tag. A similar technology, known as IFF transponder, was invented by the British in 1939 and was used by the allies in World War II to identify the friendly aeroplanes. In 1948, Harry Stockman in his paper entitled, "Communication by means of Reflected Power", predicted that considerable research and development in the problems of reflected-power communication will lead to the understanding of its application. RFID made its entry in the tracking access applications during 1980s.

3. THE MAKING PROCESS OF RFID

An RFID tag is made of three parts----an antenna, a substrate and an integrated circuit. The circuit has coded information and it extracts power from a magnetic field to transmit the information to a reader. The antenna transmits and receives radio waves to and from the mobile tracking device. The controller receives this communication and moves it to a personal computer or a Programmable Logic Controller (PLC) device. A PLC device has an internal antenna and a controller can read and write data from the RFID. The reader, mounted near lifts and dock entrances, not only in its radio signals to a tag and detects products in the range, but also captures data. So, when the RFID tags pass through an electromagnetic zone, the activation signal is detected and the reader receives the data and processes it.

RFID readers vary in terms of frequency from low frequency (125 to 134 kilohertz) to high frequency (13.56 megahertz), ultra high frequency (868 to 956 megahertz) and microwave tags (2.45 gigahertz), and thus, support a broad range of protocols. UHF tags can be used across the country, while microwave tags, which are three times stronger, can be used across countries. But, government regulations are not in place in most of the countries, which limit usage of these tags. High frequency tags are generally used in library books, bookstore packing pallet tracking, access controls in buildings, airline baggage packing and apparel item tracking. UHF tags are used in pallet and container packing as well as

truck and trailer tracking in shipping yards. Microwave RFID tags are used in long-range access control for vehicles and in toll booths as an electronic pass system. While 134.5 kilohertz is the international standard, in the US, RFID tax of the frequency 125 kilohertz used as a standard within the country. Similarly, readers can also be low-power and high-power depending on the kind of operations.

There are two types of RFID tags---active and passive. Active RFID tags are powered by an internal source and have longer range and larger memory than passive tags. They can store additional information sent by the transceiver and can also emit information in the form of radio signals, when queried by the reader. These tags can have a range of tens of meters and a battery life of 10 years. Active tags show better performance in environments like water or metal and their reliability is much better than passive tags. Passive RFID tags have no internal power supply and they cannot broadcast information. Electrical current is induced in the antenna by the incoming radio frequency signal for the tag to transmit a response. Since there is no power supply, the device is small and can be even embedded under the skin. The smallest RFID device available, measures 0.4mm x 0.4mm, which is thinner than a sheet of paper. The range of these tags varies from 10mm to 6 meters. Passive tags are cheaper to manufacture ($0.40 at high volumes) and hence, are widely used. Analysts feel that a price less than $0.10 is acceptable and will lead to widespread adoption. This is possible in the next few years.

4. ADVANTAGES OVER BAR CODES

Bar codes revolutionized the retail industry 25 years ago. Today, RFID is said to repeat the history. RFID has several advantages which compels the retailers to replace the existing bar codes. Bar codes require line of-sight to the read and they also contain very less information. They cannot survive harsh environments such as high temperatures, moisture, rough handling and they cannot be read through obstacles such as dirt or paint. Further, when a bar code is scanned the information stored in the database is limited to name and price while, RFID technology enables more information to the stored like expiry date and product ID apart from the price and name of the product.

5. THE POWER OF VISIBILITY

International retailers like Wal-Mart, Tesco, Metro and Target operate on very thin margins. The market is highly competitive and undifferentiated and a technology like RFID can create opportunities that have a positive impact on the bottom line. Application of this technology can help reduce stock-outs and improve the visibility of the inventory.

Retailers want visibility at every stage of their operations. This helps the companies gain the knowledge to evaluate the inventory, transportation and logistics tradeoffs which eventually will make their operations more efficient. The initiative in adopting RFID technology is under way. Some of the retailers, who have completed the pilot phase of technology, have started experiencing tangible benefits of lower cost, higher revenues and enhanced customer satisfaction.

6. THE ATTRACTION OF RFID ON SUPPLY CHAIN

The attraction of RFID is on the supply chain side while the advantages of using it in other areas cannot be ignored. It is believed that the supply chain applications are the fastest growing segment of RFID. The real-time data generated by the RFID tags provide the latest details on inventory, logistics and freshness dates throughout the path of the product from the suppliers to the manufacturers and finally to the distributors and retailers.

Most of the pilot projects of retailers involve placing RFID tags on cases, pallets or reusable plastic containers. Research indicates that the majority of loss occurs before a product reaches the store. The benefit of using RFID begins at the warehouse where the RFID tag is attached to the pallet or the case. The data from the tag is captured by a reader and this helps the retailer to record information at the very first stage of the item's journey. When a tag is fastened to a reusable plastic container, the tag can be reused, thus eliminating labour costs and the costs of repeated bar coding. The tags, thus used, can be read/write tags which can offer the ability to read and overwrite the stored information.

As the product moves from the distribution centres to the trucks, RFID can be used to conduct inventory and match goods with the order manifest. This helps in controlling both averages and account discrepancies. Another reason for RFID being tested is the warehouse is the smaller number of shipping containers, pallets, cases, use of reusable tax and thereby, lesser cost to bear in the initial stage.

During transit, when the truck passes through a large radio transceiver, the retailer can know whether what is ordered is on the way, the exact quantity of the product that is in transit, and it is moving to the right store or not. If, in case the truck is proceeding to the wrong store, with active RFID tags, the retailer could send a signal and change the product's

destination on the tags. This can save days and weeks of rerouting and thereby, the const.

A few companies have experimented with item-level tagging. As the item is picked from the shelf, the reader captures the data and it is transmitted to the store manager. This enables the store manager to monitor the product movement, and determine when the stock is low and shelf needs replenishment. If a retailer does not have the information about the in-store or on-hand inventory, he will end up adding safety stock, extend the lead time, and order larger quantities to ensure that he does not deal with out of stock situations. Added to that, if the hefty insurance premium the company might have to pay to avoid such risks. This is a major cost factor in the supply chain. By using RFID, the retailer is guaranteed certainty about the inventory. This improves inventory control, reduces labour costs, increases accuracy and reduces shrinkage.

One of the most acclaimed smart-shelf pilots in super markets is Gillette razor trails. This has motivated categories in electronics, fine jewellery, designer apparel and accessories to follow suit. These high-end goods can easily adopt the technology as shrinkage is an issue and the tag's cost is offset by the high value of the item. In such categories, the retailer cannot afford the uncertainty about the product.

Metro group, the Germany-based retailer, is also testing item-level applications. Its project involved placing RFID readers beneath the standard shelves. As the customer picks the tagged item from the shelf, movement data is transmitted to the back office and this helps in restarting the shelves. Other international retailers in Europe like Marks and Spencer, Woolworth and Tesco are using RFID tags to track the movement of the product at the item level in the store. Marks and Spencer used RFID technology in its fresh food supply chain. Near 230 perishable suppliers have placed RFID tags on the trays of sandwiches, sushi and other fresh food supplies that are delivered to Marks and Spencer stores.

In early 2003, Michelin embedded RFID tags in tires to comply with the United States Transportation Recall Enhancement Accountability and Documentation Act (TREAD). This was to make sure consumers are regularly changing tires and the risk of accidents arising out of automobiles using control on roads is reduced.

Apart from the retailers and the manufacturers, third party logistics companies and shipping partners like DHL, Federal Express and UPS also will need to tag their products as they enter and leave their supply chain. To prepare for the adoption of RFID, retailers would have to start getting things in order with respect to data collection and data management.

7. BOTTLENECKS IN ADOPTING RFID

The biggest challenge faced by retailers is to prepare for the adoption of RFID. Retailers already have mounds of data to deal with and many admit that they use only a fraction of the data they already have in their data warehouses. So, they have to start by getting things in order with respect to data collection and data management. Companies have to begin by effectively managing data within the company and then, with key business partners should move closer to data integration. Many companies are trying out Product Information Management (PIM) solutions while others are focussing on global data synchronization applications. These applications manage the publication of data related to the product into proper formats so that it can be read easily by data pools. This is not an easy task since products may have somewhere from 12 to 600 attributes that needs to be synchronized. On the whole, it has been identified that integration is of prime importance for most retailing companies, which will eventually enhance the efficiency and speed of supply chain. It can also offer other benefits in the form of cost reduction and increased customer satisfaction. The consolidation of data is one reason why retailers are slow in moving from the pilot stage to a broader adoption stage.

Another problem is the master files for the product are usually not configured to hold the set of data carried and communicated by the RFID tags. RFID uses electronic product codes (EPCs) which are programmed to hold more data in addition to the item's serial number, colour, size, price and manufacture date. It is believed that retailers do not have an item master file that can handel the EPC which is a 96-bit character field. Hence, experts opine that conversion code must be written for every application that uses item master file information, which is a Herculean task.

It is very clear that the benefits of RFID are significant, but they are not compelling enough for the retailers to invest mega bucks in the technology. The cost of the RFID tag is daunting for many retailers to give a second thought to adopt the technology. The price of the tags varies between 9 cents to a few dollars, depending on the type of the tag, i.e., active or passive and the size of the tag. Many retailers compare the price factor of the tags with that of bar codes. But, this is not a logical comparison since an RFID tag has read/write capabilities and can be reprogrammed and used several times. This is not the case of the bar codes.

8. BENEFITS OF RFID

The benefits of RFID are significant; but they are not compelling enough for the retailers to invest mega bucks in the technology. The best way of analyzing the cost would be to look at the opportunity cost that arises when the retailer is not aware of the position of his products in the supply chain and the stock position on the shelf. This perspective clearly defines the supremacy of RFID tags over bar codes and the cost factor does not seem a priority. It is believed that over a period of time, RFID tags will become cheaper too, like all emerging technologies.

The focus is on tag cost primarily, but the capital investment to build RFID infrastructure is also important issue to be considered. A RFID system requires new hardware and software in addition to a cost commitment on system integration. AMR Research estimates the costs to install RFID per warehouse to somewhere from $1mn to $2mn. This is the cost scenario at the back-end. At the front-end or at the store level, scanners have to be replaced with a new set of devices that can capture data from RFID tags and bar codes. For a retailer like Gap, with more than 3000 stores across the world, RFID is no doubt, an expensive investment.

AMR's research reveals that out of 500 companies surveyed for RFID adoption, a majority feel that the return on investment does not justify the RFID investment. It is felt by 28% of the companies that ROI is a major deterrent in adopting the technology. On the contrary, the protagonists of RFID opine that leading-edge technologies are worth taking the risk because of their high-return opportunities.

It is also felt that hurdle for adopting the technology was that companies were waiting for the standards to fall in place before investing heavily in RFID. The industry has started the production of the Generation 2 tags and readers and this seems to be a sign of better times ahead for RFID adoption. Concerns are also raised about the technology's illicit tracking, especially with respect to personal location privacy as well as corporate and military security. This comes in the wake of the United States Department of Defence's adoption of RFID tags to manage their supply chain.

9. CONCLUSIONS

The momentum to adopt RFID gained strength because of two reasons. The first being the announcement of Wal-Mart Inc., in 2003 making it mandatory that its top 100 suppliers place RFID tags on cases by January 2005 and its suppliers to use RFID by 2006. In this context, Indian exporters to retailers like Wal-Mart can gain the benefit of better and more real-time visibility in the supply chain and hence, become more competitive. The second reason is the initiative of the Auto-ID Centre of the Massachusetts Institute of Technology to establish industry standards and develop a business case to use RFID in the manufacturing/retail supply chain. Besides Wal-Mart, the United States Department of Defence made it mandatory for the vendors to place RFID tags on all their shipments. If the market grows at the same speed, it is expected that the current market of $13bn for RFID hardware, software and services could grow to $33.2bn by 2018.

Companies have a lot of work to accomplish before RFID gets accepted as a common place technology. Many agree that supply chain optimization is possible only with the effective collaboration of trading partners. To this extent the initiatives are focussed on on-line cikkabiratuin if trading partners. To this extent the initiatives are focussed on on-line collaboration and communication of the standards with the supply partners. But this is not enough. The problem is in the sharing of data between the retailers and suppliers. Achieving and maintaining collaboration between retailers and their suppliers helps reduce cycle times and moves retail companies a step ahead to deliver the right product to the right place and at the right time.

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