Organizational Integration for the Implementation of RFID: A Case Study of Philips Semiconductors

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Abstract

Managing the supply of a business is integral to the success of any competing supply chain in today's marketplace. The advent of RFID as technology has several potential associated tradeoffs concerning greater visibility of products/ huge investments involved. These tradeoffs need to be made on both the sender and receiver side. But sometimes parties are not willing to make such commitments, keeping in view that the success rate of such initiatives is low. The main objective of the research is to find out what organizations are confronted in terms of interorganizational relations with the various tiers of suppliers in a given supply chain. The research indicates that RFID is still in the rudimentary stages of its development. The study discusses the case of Philips integrating RFID into its operations. But it suggests that more research in needed to improve the success rate of RFID to ensure that the success stories outweigh the failures.

Key Terms: RFID, Supply Chain, Semiconductor, Philips, Taiwan, Hong Kong

1. Introduction

It is crystal clear that the effective use of technology is crucial for businesses aspiring to create superior value. It is by the effective use of technology deployment that firms are able to create satisfaction for its target market and achieves a sustained competitive advantage (SCA) in the face of fierce competition. Amongst the several new and innovative technological applications is the use of Radio Frequency Identification (RFID) which is improving at such an unprecedented pace that managers sometime become wary of return on their investments (ROI) and this situation makes development of inter-organizational aspects of the supply chain most important than ever realized before. The reason to pick the RFID as our undertaking to try and know about RFID and its ramifications in a real time scenario.

The research paper is divided into seven parts. It starts with the history of RFID, process of RFID functioning by highlighting the key components, then barcodes technology is compared

with RFID, afterwards the data carried with the product via RFID tags is described, the inter-organization flow of data is elaborated and finally a discussion on as to how RFID has the potential to affect inter-organizational relationships, along with the various tradeoffs associated with the implementation of RFID.

2. RFID Background

According to Forrester research the emerging trend which links the physical supply chains to the digital world is called (X Internet) or Extended Internet. There are several technologies that fall in the domain of this trend. To name a few some of these technologies are Optical recognition systems, Barcode technologies, Smart cards and most recently RFID. As like many other innovations RFID as a technology was first introduced in the military for identifying "Friend or Foe" operations (Melanie, 2006). Later it was used for toll collection and library book tracking (Langley, 2008). Radio frequency identification has been applied increasingly in inter-organizational supply chain operations. However, it was not until the year, (2005) when Wal-Mart a US retailer started developing RFID mandates. Since then German-based Metro Group, Tesco and

Target (UK-based) have started focusing more on RFID in supply chain management (Langely, 2008). According to Forrestor research, in the beginning RFID were introduced to retailing sector, ever since then it has been widely used in industrial automation, asset management and track-and-trace applications.

Radio frequency identification is defined *"A data collection and identification technology that uses electronic tags to store and transmit identification data, transmission data, and – in the case for active tags- condition data (Christine, 2006)."* RFID has the potential of bringing changes in inventory management cost and efficiency in supply chain areas such as greater product availability, reduced product shrinkage, and improved product integrity. Results from RFID implementation have so far been positive with many firms. For instance, recent research shows that RFID sales for supply chain purposes are predicted to increase by almost 38% annually. (Carr, A, Zhang, M, Klopping, I, Min.H, n.d) and Wal-Mart proclaims a 16 percent decrease in out-of-stocks on RFID tagged items (Langley, 2008).

3. How RFID Works

According to Langley, (2008) RFID technology utilizes tags to transmit data/information via waves of radio. Beynon, (2009) contends that the nature of these tags is such that they can be made part of a finished product, passenger, animal and many others. The tags are classified as active and passive. The later has no or limited power battery and requires the decoder to create current for transmission of data. Further there are three types of micro chips in RFID apparatus ie (i) Read-Write; (ii) Read-Only and (iii) "Write Once, Read Many" (WORM).

So far we have been talking about information storage in RFID tags, so it is interesting to know what kind of information RFID tags deliver with the products. Most of the tags used by firms in supply chains possess an electronic product code (EPC) which can be connected with online database with some general information accessible to everyone. However, crucial information such as who made it and when it was made can only be retrieved if the manufacturer desires. For instance, Willys, or Netto will not be able to gain access data of products sold by ICA or any other retailer. In the supply chain context companies desire to use RFID to make sure that their products are available on shelf as soon as they are replenished. Nowadays, companies are thinking of "smart shelves" with RFID interrogators embedded in them, which would let the staff knows when the inventory reaches reorder point and to act as a theft deterrent when some unusual shelf activity takes place.

4. RFID versus Barcodes

According to Ray, (2008) with the increasing popularity of Radio Frequeny identification makes logisticians and Supply chain members start thinking of which technology to utilize. RFID is not better than barcodes as choice of technology depends largely on the context of use; the only difference is that bar code is a line-of-sight technology, meaning that a scanner has to be oriented towards the bar code to read it. (aimglogal.org). For instance, one dimensional (1D) barcodes are best for supply chain applications when very limited number of data is needed to be stored. However, codes may become unreadable if any wear and tear occurs (Ibid). Two dimensional (2D) barcodes can serve greater data storage needs. As far as RFID technology is concerned, it is best suited for applications where there is no direct line-of-sight, is vulnerable to wear and tear or requires greater levels of process automation (Ray,2008).

5. Information Carried by the Product

As per definition of Chritine, (2006) radio frequency identification tags can store and transmit (a) identification data; (b) transmission data and if active tages; (c) condition data. This transmission of information along the product has enabled several changes in the supply chains. For instance, paramount Farms, uses RFID to manage its harvest in a most effective and efficient manner.

Let us explain with help of an example how information carried by the product with the help of RFID can change as the product flows from ups and downstream in the supply chaining function. In the first place in the ground field data about quantity of produce details of olives are identified with the help of tags of RFID. In the second step at the factory, production related condition data are added to product. In the third step during the process of shipping, transmission data are added to the tags. In fourth step, distribution associated loading and receiving information is entered. In the fifth stage data at the retail or shelf level is added. Afterwards the consumer purchases the product, still the tags can be identified and traced. It is at this stage that consumer privacy laws come into play and companies must adhere to these standards code of conducts, finally, when the product is consumed and disposed even then the packaging carries recycling information date and so on. For instance, Benettons and Gillette customers did not like RFID initiative to the extent that some consumer activist appealed to general public for boycotting these brand with interesting slogans like, "I would rather grow a beard". These consumers were aware of the fact that their purchases would become traceable and the information might be used by spammers. As a result many businesses are adapting this technology mainly at warehouses. These changes in the supply chains and unlimited access to information is enabled by using RFID tags and thus changing the way business is to be conducted in future.

6. Inter-and Intra-Organizational data/Information Flow Mechanism

When the information is captured with the help of human interaction increases transactions costs and may result in excessive or less levels of inventory (Fleisch & Tellkamp, 2995). This is even more relevant to the retail sector which is confronting challenges such as shorter- life cycles, stringent traceability requirements and temperature control (Karkkainen, 2003). Due to these RFID and its associated EPC network have the potential to serve as enablers in the

ever changing supply chain landscape by enhancing visibility and lowering inventory carrying costs. Proper flow of information can result in more collaboration and cooperate among supply chain partners and decrease the so impact of bullwhip effect.

The figure below as a special case represents inter and intra-organizational activities concerning to information flows in a typical supply chain settings. By looking closely at the figure it becomes obvious all that information flow is needs human element or intervention. For instance, at the suppliers place during"shipping" a worker is suppose fill a Bill of lading. Similarly, at the central "Firm X" distribution center during the process of "receiving" and "shipping" several human interventions are needed such as checking the number of quantities shipped to customers. However, to err is human and there are often complaints from customers regarding incomplete volume of quantities. Therefore for the focal firm "X" removing these mistakes has become a matter of great strategic importance.

7. How RFID affects Inter-organizational Relationships

In the words of Lambert et al, (1998), *"SCM is the integration of business processes among companies that collaborate in an effort to bring a product, service or unit of information from the initial supplier to the final customer"*. According to Spekman et al, (1998) SCM renders many benefits to businesses in the form of lesser costs and according to Chen, (2004) a collaborative advantage can result in place of a competitive advantage. An IOS is an *"An automated information system shared by two or more companies. An IOS is built around information technology, that is, around computer and communication technology, that facilitates the creation, storage, transformation and transmission of information. An IOS differs with an internal distributed information system by allowing information to be sent across organizational boundaries"*. Wal-Mart's introduced the concept of RFID as an inter-organizational project and nowadays RFID is being used in both closed –loop and open-loop settings. In closed loop supply chains it is normally used for internal systems and in open loop settings to improve supply chain productivity. For instance, Wal-Mart and other retailers like Target, Tesco and Metro normally use the later approach. This implies that the application RFID clearly qualifies the requirements for an inter-organizational system.

Other IOSs, commonly used in retailing are electronic data interchange (EDI), internet and intranet and Bar-coding which through information technology enabled (ITes) services enable

new logistics strategies such as JIT for manufacturing and Quick response for fashion retailers (Wilson & Vlosky, 1998). This signifies the potential of RFID as supply chain management technology. However, it must be kept in mind that mutual trust must co-exist for RFID to be carried out successfully. Some of the key issues that affect inter-organizational relationships are. RFID benefits both downstream customers and upstream to suppliers. Supply Chain members are more inclined to push tagging process upstream in the supply chain. Inter-organizational relationships can be improved with the help of RFID implementation. For instance, providing evidence to product shrinkage issues. With the arrival of new RFID developments it would be hard for suppliers to adapt the changes and may lead to conflict.

8. Disadvantages in Inter-organizational Relationships

Initially, RFID might seem to support the idea of moving from adversarial stance towards a more collaborative approach in relationships. Ironically, though, it is not always the case (LoPrinzi, 2006). This is nowhere more evident than in the retailing sector (Fogarty, 2004) where RFID implementation creates problems with suppliers by retailers trying to influence suppliers from a position of strength (Williams & Moore, 2007). With RFID more information is accessible to the members of supply chains as a result more opportunities for collaboration in comparison with those partners who do not use this technology and they may start feeling a sense of deprivation. An interesting case in point which RFID creates is that it has the potential to disturb the balance of power and interdependence among partners in a supply chain. For example, suppliers may think that relationship-specific investments in RFID will confine to specific buyers. On the other hand, buyers might feel that suppliers with RFID technology will become more competitive in the domain of competition. Finally, the continuous improvements of technology will make the relationships more adverse as suppliers will be required to make changes by buyers and too while bargaining from a position of strength. This might cause conflict of interests among supply chain partners relationships.

9. Case Study Philips Stages a Mega Roll out of RFID: Handling global challenge in Semiconductor industry

Being one of the top ten semiconductors manufacturer in the world, Philips is also the the third in RFID technology market. Philips distributes its semiconductors through its Hong Kong facility which takes products from its Taiwan based manufacturing plant. This enormous amount of product leads to in-efficiencies, greater lead time and loss of track of products for the millions of wafers it product on annual basis. The company thought of the most modern RFID technology to bring about these desired improvements in its supply chain. As a market leader in RFID, the company was dealing in business solutions ever since 1988. The Chief Operating Officer decided to use the technology to its own advantage as the company has been offering solutions for a number of years with good expertise. Carrying out RFID cost in supply chain setting was still high, and a lot of time was required for achieving benefits, majority of the vendors were waiting for the prices to come down and as a result were following a wait-and-see approach. The company was well aware of RFID advantages for achieving better levels of customer satisfaction.

For Philips it was a worthwhile plan as it could have brought maximum returns on investment and serve as a testimonial how RFID can be successfully applied in a huge supply chain setting. Philips first tried to find out the areas which benefit the most from RFID initiative. Philips identified many processes that could be improved and decided to do a pilot roll out in Hong Kong and Taiwan. Philips then went on to develop a future course of action for its processes to manage the transition stage to RFID enabled practices in the supply chain. Since RFID is directed to achieving operational efficiencies, therefore the company started quickly with these areas.

9. 1. Solution

This was a mega project for Philips and it needed a partner that has experience with RFID. This criterion was met by Zebra Technologies, as it was the leader in the technology. Both the companies already had a collaborative history in the domain of international markets for over ten years. An RFID pilot lab was installed in one Philips warehouses to carry out preliminary tests, which were then analyzed and the return over investment were made. After the successful trial of RFID, Philips top management decided to use the technology throughout the both facilities supply chain operations. Wafers where traced (Both in cartons

and in individual cases) during their flow between Kaohsiung, Taiwan and Hong kong's distribution center for Asia Pacific. Though RFID has many advantages over simple bar code Philips used a combination of both to get optimal results and greater value addition to its supply chain.

Before shipping the cartons to Hong Kong, a microchip would be placed in a box. Later two boxes would be placed in a carton and barcodes would be printed on the cartons where RFID information would also be encoded on it. The cartons would be later placed on a pallet where it would be decoded manually using handheld decoders. At arrival in Hong Kong the pallets would again be decoded using handheld decoder to update the inventory status. Before the implementation of this mechanism, each barcode would be printed, and each box and pallet read individually, making the workers do twice as much work.

9. 2. Results

Semiconductor manufacturers, including Philips, have a grave need to track wafers, either in shipment or in the manufacturing facility. They have been using different techniques for some time, which made this industry an ideal venue for the grand roll out of RFID. Another reason that made semiconductors an ideal industry was the flexibility necessary by this industry. It has high value of goods and needs to quickly coup with changing customers demand. Now, these firms use product level tagging by tagging each wafer box that has a single product in it.

Using RFID, Philips achieved many noteworthy improvements in its asian operations of semiconductors of supply chain. These benefits included, but were not limited to increased accuracy of orders shipped, reduction of manual interventions in material handling and lead time that resulted in more time being dedicated to customer care. This case makes RFID an ideal candidate for further study in the field of inventory management.

10. Summary

Radio Frequency Identification is promising technology and many firms are recently improving the value performance of their firms. Managers should consider how this RFID technology adds the value of their supply chain operations and affect inter-organizational relationship. The popularity of barcodes that has been entrance hinder the spread of RFID,

additionally it results some problem within collaboration such as imbalance of power and interdependence among partners as well as technical collision that might happen during the process. However the advantages RFID implementation both downstream and upstream to suppliers, such as reduces shrinkage, production tracking, increased data accuracy, improved information sharing and some are some areas of consideration for firms to implement RFID technology.

Our finding shows that there is some changing from the effect of RFID implementation in inter-organizational relationship. The effects of RFID implementation results the change of some aspects in inter-organizational within supply chain. Product information and the movement which RFID system stores, have given a mutual development of the firms and higher performance value to stay in the competitive market. Moreover, a proper flow of information and the right strategy can helps a better result in collaboration between supply chain partners. Hence it's clear that there is still need of human intervention.

Finally, a case study from Philips which adopted RFID technology. Together with Zebra technology as a joint partner results show some significant benefit for both firms such as reduction in lead time, a more efficient inventory management, increase shipping reliability and reduce the human intervention. As the example of study case, this has shown what the expectation of RFID implementation with the increasing of accuracy data and the changes within inter organizational relationship has given some advantages and a successful result.

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