RFID Technologies and Warehouse Applications: Case Studies

Alan D. Smith, smitha@rmu.edu

ABSTRACT

RFID is a technology that continues to evolve, improve, and grow. The number of ways the technology can be used to help companies stay efficient increases in a highly competitive environment. For companies that are still looking for ways to improve their supply chain and their warehouse operations, RFID technology is something worth exploring. It can save companies time and money and can be an especially great technology to adopt for companies that are growing at a rapid pace. Case studies comparing large health care systems provider in Pittsburgh, PA with a large manufacturing company, Boeing, located Everett, WA were cited to highlight best business practices of RFID applications to the warehousing function.

INTRODUCTION

RFID Technologies

Although Radio Frequency Identification (RFID) technology has been around for some time, the use of the technology in supply chain management (SCM) and its associated operations is still being explored and adopted by many companies. Basically, RFID uses electromagnetic fields to help with identifying and Tracking objects. And the number of ways that the technology can be used is almost endless as many examples can be found in preventing theft, expediting inspections, keeping Track of surgical sponges, safeguarding pharmaceuticals, helping farmers with vital crop and social moisture information, to name a few. RFID technology used in warehouses for receiving product, picking orders, packaging shipments, and Tracking deliveries can save a company time and money. For growing companies such as the University of Pittsburgh Medical Center (UPMC) and Boeing, the introduction can help them remain efficient during these times of prosperity and growth.

Overview of RFID Technology

RFID is defined any method of identifying unique items using radio waves. This is usually done when a reader (or an interrogator) communicates with a transponder (Radio Frequency Identification, n.d.). This transfer of information happens without the devices making any actual physical contact and is used in items we use every day like car keys, employee identification cards, medical history, highway toll tags, and security access cards (Radio Frequency Identification (RFID): What is it?, 2017).

Radio frequency identification also known as RFID is a modern and impactful technology that is changing the way a logistics operates. As this research paper has shared in earlier sections, the technology surrounding RFID technology has existed since the earlier 1900's and has more recently been implemented to support the transportation industry due to technology and cost improvements. Formally, according to the RFID journal is "any method of identifying unique items using radio waves such as through a reader which communicates with a transponder and holds digital information in a microchip. There are chipless forms of RFID tags that use material to reflect back a portion of the radio waves beamed at them (Radio Frequency Identification)." RFID has been a way of continuing to evolve in many practices specifically as it relates to supply chain management. Historically, as this course has demonstrated, supply chain management productivity evolved from the human based way of Tracking and transporting inventory for companies to more automated systems such as bar codes and RFID technology. The first venture began with bar code technology as a way of Tracking and transmitting information. "The optical nature of barcode requires labels to be "seen" by lasers. That line-of-sight between label and reader is often difficult, impractical, or even impossible to achieve in industrial environments. In order to function properly, a barcode reader must have clean, clear optics, the label must be clean and free of abrasion, and the reader and label must be properly oriented with respect to each other" (Advantages of RFID). RFID-enabled technology helps to solve many of the issues and challenges caused by direct line of sight technology by allowing information to be transmitted through a receiving device. Improvements in such technology has allowed tag reading from greater distances and in harsh environments. RFID technology is the next wave, arguably the current wave, of being able to efficiently Track and transmit information in order to provide greater efficiency improvements to logistics and supply chain management.

Low-frequency systems were developed first then products moved up the radio spectrum to high frequency which means there is a greater range and data can be transferred at much higher rates (Roberti, 2005). High-frequency systems are used to Track cargo containers, payment systems, and contactless smart cards. In the 1990s, IBM developed ultra-high frequency (UHF) RFID systems which offered even greater ranges and faster data transfers. They originally worked with Wal-Mart in their development and then in warehouses and farming. UHF RFID technology was taken to the next level in 1999 when the Uniform Code Council, EAN International, Procter & Gamble, and Gillette funded the establishment of the Auto-ID Center at MIT. They developed a low-cost RFID tag to put onto all products to Track them through the supply chain and then linked this information to the Internet (Roberti, 2005). This was the first time that information contained in an RFID tag was available beyond the tag and reader themselves. The Auto-ID Center received support from over 100 large companies between 1999 and 2003 including the Department of Defense. It then opened up facilities in Australia, the United Kingdom, Switzerland, Japan, and China. Protocols, a numbering system called Electronic Product Code (EPC), and a network were developed and in 2003 the technology was licensed to the Uniform Code Council.

Currently, many companies are trying to develop smaller and smaller tags, some containing just two components (Landt, 2005). This means that RFID tags can now be found even in paper-like

labels which can be affixed to almost anything. Advancements in RFID technology continues to grow at faster rates and the applications for use continue to grow as well.

CASE STUDIES

Overview of UPMC Central Distribution Center

The University of Pittsburgh Medical Center (UPMC) is a $17-billion-dollar healthcare provider and insurer based in Pittsburgh, PA. UPMC currently operates over 30 hospitals, more than 600 doctors' offices and outpatient centers, has over 4,000 physicians employed, along with a variety of rehabilitation centers, retirement communities, and long-term care facilities. To operate and run all of these locations UPMC needs a lot of supplies and to maintain their operating margins, they need the supplies in the most efficient means. The goal of UPMC's supply chain is simple: establish the most cost effective and efficient means of supporting UPMC facilities and their patients. Part of this goal includes the utilization of a Centralized Distribution Center. Having a centralized warehouse allows supply chain to purchase products at lower prices by eliminating traditional healthcare distributors such as Cardinal Health or Owens & Minor. With one warehouse supporting all hospital locations, savings are also found in consolidating products such as all facilities use the same brand of exam glove which again gives supply chain the ability to leverage contract prices.

The UPMC Central Distribution Center has over 60 employees, is 150,000 square feet and maintains over 4,000 SKUs. The distribution center operates 24 hours a day five days a week and picks, packs, and ships over 2.3 million lines per year (T. Nedley, personal communication, February 23, 2018). It also manages over 250,000 cross-docked non-stock parcels annually (T. Nedley, personal communication, February 23, 2018). There are 9 delivery vehicles which run over 490,000 miles per year (T. Nedley, personal communication, February 23, 2018). The distribution center also utilizes Voice Directed Picking which helped them reduce their picking errors by 25%, leaves the pickers hands free for picking and labeling, and is environmentally friendly with the reduction of paper (T. Nedley, personal communication, February 23, 2018). All of these numbers are for UPMC at its current size but UPMC just bought an additional 18 hospitals from Jamestown, New York to Harrisburg, PA. The addition of these new facilities will mean an increased need to be even more efficient and effective. Part of this would be to explore the option of using RFID technology.

Overview of Boeing Factory in Everett, WA

The Boeing Company Factory based in Everett, WA is a highly coordinated logistics and manufacturing operation that helps produce commercial and military aircraft for the worldwide aviation market. The Boeing Company is the "world's largest aerospace company and leading manufacturer of commercial jetliners and defense, space and security systems. A top U.S. exporter, the company supports airlines and U.S. and allied government customers in 150 countries. Boeing products and tailored services include commercial and military aircraft, satellites, weapons, electronic and defense systems, launch systems, advanced information and

communication systems, and performance-based logistics and training. Boeing is noted as having the largest manufacturing building in the world, producing the 747, 767, 777, and the 787 airplanes. Their manufacturing product facilities employs thousands in aircraft fabrication and production, product development, aviation safety and security and airplane certifications. This factory covers nearly 100 acres of land under one roof in order to assemble and coordinate the various components required to build aircraft with over 30,000 people supporting the daily construction of this aircraft.

There are numerous logistical and transportation needs to build the aircraft. The 747 and 767, the older and original aircraft of this factory, follow a traditional assembly process that combines components such as wings, elevators, rudders, and other parts at one of four stage of assembly. The parts of this aircraft are assembled in a nearby bay which arrives via rail and truck from various U.S. suppliers from across the world. However, through this assembly process which dates back to the mid-1960s, Boeing has been able to innovate their logistics and assembly practice with modern processes. The 777 and 787 process, mostly in part due to the aircraft being new and one of the first in the world to be designed completely using a computer rather than an actual model, implement just-in-time (JIT) practices for the delivery of the various components and assemble the aircraft on a slow moving assembly line.

This process is successful due to a very close and transparent partnership with suppliers from across the world which are engaged to ensure the parts - as large as an aircraft fuselage - arrive exactly when they are required. From this point, each task and step of assembly is precisely timed out for workers to complete in order to maximize productivity. The parts for the workers assembling the various aspects of the aircraft are delivered through mobile robotic carts in the factory which are delivered to the exact location of the workers as the aircraft assembly line ever so slowly moves. This orchestra of various parts and workers ensure the products are assembled on time as well as uses barcode and RFID technology to ensure products are able to be Tracked and easily moved throughout the factory.

Managerial Implications

For companies such as UPMC and Boeing which have been reviewed in this chapter, these two companies operate in two separate industries though hold various applicability of how RFID technology can impact managerial decisions. RFID technology, through its evolution since WWII technology to benefit managers in various types of industries who are looking to quickly, efficiently, and accurately Track the inventory of their product. In particular, companies with large amounts of individual components to complete a service or products, such as UPMC and Boeing respectively, have numerous benefits for managers. First, the reduction of human errors and implementation of consistency that RFID technology can provide is impactful for managers. RFID allows the constant and consistent flow of information through an established system of transmitters and receivers that is not dependent on humans who may collect information differently. This also ensures that human errors, even by the best of employees, can be reduced and even eliminated.

Secondly, RFID technology allows for the delivery of information and components exactly when it is needed. At the Boeing factory, the right amount and type of components is delivered precisely when workers require the components which reduces errors and ensures maximum efficiency. For a company such as UPMC which is growing the number of hospitals in their network, RFID can provide the company a consistent source of data collection across a wide range of employees and staff. Overall implications of RFID technology to manager in supply chain management and to leaders in companies such as UPMC and Boeing is noticeable with the ability to be quantified in time, costs, and efficiency savings. The efficiency of RFID technology to collect this information with reduced errors translates into more accurate information for managers to make decisions at often a much lower potential cost.

Research has been done on the effectiveness and success of introducing RFID technology into the supply chain. A study Wu and Ku (2013) investigated what happens in upstream and downstream firms when RFID technology is brought into the supply chain. The authors used the Adaptive Structuration Theory and Structural Equation Modeling to analyze upstream and downstream firms who had business in manufacturing, logistics, warehousing, retailing, and selling. Due to the benefits of RFID technology including reducing costs and reducing data entry errors, which have their own downstream effect, Wu and Ku wanted to see if there were any difficulties upstream and downstream that firms encountered when RFID technology is introduced. They researched 7 different ways RFID could prove difficult for firms including its effect on operation structure, group cooperation, and influence on issues derived from RFID technology. Although almost all of their findings confirmed that RFID technology has a positive influence on supply chains, there were a couple of negative outcomes. These were mostly around the changes that would take place with the introduction of RFID technology to a firm and the extent of this change is largely unknown.

RFID technology applicability can be applied to an even greater sense at both companies. UPMC for example has a large hospital system with multiple staff members covering a wide variety of shifts at the hospital. This dynamic in the healthcare industry is also more complex with all the various supplies and tools needed to treat patients in a hospital. While much of the supplies are Tracked with bar codes today, RFID tags can help to collect data and perform an inventory in real time. This inventory can be more easily known as needed as well as Tracked through its usage throughout a time period to better predict when supplies or tools may be needed for predictable procedures or treatments. UPMC as a result can better predict when a supply may be needed and can also reduce storage space in a hospital. In turn, Boeing Company is moving more towards RFID technology from the bar coded technology that was historically used at the factory. Boeing today uses the RFID chips to Track and guide the movement of robots with the components for their aircraft. However, for Boeing their use can also be far greater by being able to integrate RFID technology not only in the logistical process to assemble the aircraft but also in the actual maintenance of an aircraft. For example, safety checks for inspections of aircraft can be more efficient and accurate if RFID technology could be implemented to monitoring the existing systems of their aircraft. Mechanics could then know precisely where to look onboard an aircraft with this more accurate information to better

maintain their fleet. While RFID technology at Boeing cannot fully take the place of a human inspection, it can help to ensure the accuracy and speed at to which inspections could occur. For companies such as UPMC and Boeing, surveying the work force that interacts with these components and the management can be an important step to understand the potential impact and scope of RFID technology at both these companies.

GENERAL CONCLUSIONS AND IMPLICATIONS

RFID technology has demonstrated its ability to evolve into a logistics solution since its inception in the 1900's. As technology has improved by becoming less expensive on a per chip basis and through a much smaller size, RFID technology is a competitive advantage for managers involved in supply chain management. Various aspects of the supply chain process are now able to be more accurately and easily Tracked based upon their location and the data associated with the chip rather than through line of sight technology that exists through bar code technology. Managers can now be empowered with time and a constant flow of data that allows them to make fact based decisions and projections which have helped to save time and money through efficiency for their companies. Companies such as Boeing are demonstrating the existing potential of RFID technology while companies such as UPMC can take RFID technology the next level by Tracking thousands of supplies that exist in a hospital.

As with any technology, there is an investment that is required to implement RFID technology. While this group recognizes the benefit of RFID technology, performing a case study on individual companies to understand the cost-benefit of this technology is important. Additionally, completing a detailed survey of UPMC and Boeing is a key aspect of future work that would allow for a strong understanding of RFID at each of the companies. Overall, the benefits of RFID technology are likely to improve as the technology for transmitting and receiving devices continues to be more cost efficient and widely implemented in the supply chain management system.

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