Abstract

Radio Frequency Identification (RFID) is a technology that has been in use since the 1940’s; however, practical business applications are more recently being developed. Dell Computers looked at their Xiamen, China manufacturing facility to see if RFID technology could result in improved efficiencies with quick payoff. The resulting scorecard showed areas within their facility that RFID technology could improve.

Keywords: Radio frequency identification

RFID History and Development

Radio Frequency Identification Device (“RFID”) is a wireless system that works in conjunction with a company’s information technology infrastructure to facilitate the tracking of objects. Although some proponents of RFID think that the first device of this type may have been invented as an espionage tool for the Russian Government in 1945, the first real usage of RFID devices predates that. During World War II the United Kingdom used RFID to distinguish returning English airplanes from inbound German ones. Radar was only able to signal the presence of a plane, not the type of plane (“History of RFID tags”, 2005). Although this instance was one of the first recorded usages of this type of technology, it would take thirty more years of work in different fields and applications involving RFID for it to become a viable business technology.

The development of RFID came about through the need to enhance tracking and access applications in the 1980’s in manufacturing and other environments. The process of utilizing RFID allows a company to improve its business processes, such as inventory management and supply chain management, through reduced labor costs, errors and handling costs (“Cisco Delivers RFID Solution”, 2005). With more timely and accurate answers to inventory control, companies can run much more efficient forecasting, production, and distribution operations. It allows companies to know exactly where their inventory is, how much of it is on hand, and when to re-order or supply.

As RFID continues to develop, so do its applications in industry. Standards are changing enabling different companies will be able to co-link their products and tracking will be across product lines and company lines. Along with technological developments, declining prices are allowing more companies to take advantage of the technology.
Technology Description

As the field is known, Automatic Identification (“Auto-ID”) is a technology used to help machines identify objects and provide information about those objects through automatic data capture (Carlisle, 2004). The data must be converted into a digital form to be used by computer systems. Examples of Auto-ID which we see today include bar codes, smart cards, voice recognition, retinal scans, optical character recognition, and radio frequency identification. “RFID” is a generic term for the Auto-ID technologies that use radio waves to automatically identify individual objects.

RFID uses a three-part technology comprised of a reader, a transceiver with decoder, and a transponder tag. The reader, which is typically attached to a computer, emits a radio signal that activates the tag and reads and writes data to it. As products are shipped, received, or stored, the information can be read and received by the reader. RFID has also been integrated into the EPCglobal Inc™ through the set of technologies known as the EPC Global Network™. This organization is developing standards for data synchronization and communication of RFID data through the Electronic Product Code (“EPC”). The EPC stored on the RFID tag is a unique number that is specific to a product. The reader can retrieve the EPC from the tag and obtain information about the product not only specific to its location but also information on its production date, or origin (Carlisle, 2004).

Generation 2 for RFID (“Gen2”) is an upgrade of the existing tags from the original RFID technology that allows the tag specifications to be standardized across platforms. Most of the upgrades to Gen2 technology were customer-driven because of the different systems utilizing RFID. The benefits of this Gen2 technology will mostly be falling prices of tags and more stable technology. Some of the other benefits of Gen2 tags are open standards which will allow tags to be available from multiple sources, and thus bring the price tag down. Additional benefits are memory and password enhancements, higher reliability, better security, and a read rate which is ten times faster than today’s current tags (York, 2005). The importance of Gen2 is that prices should start to fall due to more competition, more stable technology to deploy, and the strong potential to cost-justify RFID projects based upon normal cost-benefit analysis. We are only just beginning to see the benefits and reaches of the RFID technology.

RFID as Applied at Dell

By establishing its integrated sales, manufacturing, and customer call center in Xiamen, China, Dell Computer Corporation became the second largest integrated computer manufacturer in the Asia-Pacific region. This facility manufactures Dell's OptiPlex desktop PCs, Latitude notebook PCs, and PowerEdge servers for customers and distributors in China. When initially established, the facility was challenged by the lack of data capture automation for its production operations. This situation created bottlenecks throughout different production points that impacted productivity. A system was needed to increase productivity and efficiency and to track inventory throughout the plant (“RFID Brings Computers up to Speed,” 2003). RFID was already a known technology and became a candidate for review. The challenge for RFID is making the case to ensure financial success. The supply chain management implementation of RFID will impact many divisions within one corporation. Being able to assign a benefit value requires a broad look at the entities that might gain or lose from implementation.

Dell has instituted a “scorecard” for measuring what tool might be most beneficial for assisting in the supply chain management at its facilities. This scorecard weighs the benefits against cost and future projections (“Building a Business Case for RFID at Dell,” 2004). From a benefits perspective, the scorecard looks at the current processes and requires evaluation of whether those processes will be improved by the use of RFID. These processes might include the amount of labor currently required to manage the supply chain. The implementation of RFID is expected to reduce the man hours required for management. Additionally, the user error rate, while not currently perceived to be at risk, can also be expected to decrease. Finally, the use of Auto-ID tags (optical scanning) is also reviewed. In the case of Dell’s facility, the use of optical scanning as a way of managing and reducing inventory is not perceived as improvable by RFID technology.

During RFID implementation, the first inclination is often to conduct a very limited rollout in an effort to minimize implementation costs. This strategy may result in poor RFID performance because of the limited implementation. Conversely, with effective implementation planning, restricted rollout may result in significant benefits while controlling initial costs. Dell decided to identify some limited project areas in which the potential for financial success is greatest. The fact that the implementation will be in a limited footprint is viewed in a positive light from a cost perspective and receives the appropriate points on the Dell Scorecard.
The future benefit of using RFID is considered as the third category on the Dell Scorecard. As with any technology, every effort must be made to ensure future growth and scalability of a product, as well as the ability of that tool to be used on a broader and quicker scale. The cliché of getting your technology in just enough time for it to be obsolete is unacceptable in today’s business environment.

Table 1. Dell RFID Process Analysis Table

<table>
<thead>
<tr>
<th>Process Improvement</th>
<th>Advantage</th>
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<tbody>
<tr>
<td>Amount of Labor Required</td>
<td>Yes</td>
</tr>
<tr>
<td>User error rate</td>
<td>Yes</td>
</tr>
<tr>
<td>Optical Scanning</td>
<td>No</td>
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<table>
<thead>
<tr>
<th>Cost</th>
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<tbody>
<tr>
<td>Limited Footprint</td>
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<tr>
<td>Limited Number of Products</td>
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<tr>
<td>Within One Company</td>
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<table>
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<tr>
<th>Future Benefit</th>
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<tr>
<td>Scaleable and Repeatable</td>
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Dell China found a benefit from RFID for two processes—manufacturing and shipping. The manufacturing process consists of trays that have tags attached to the bottom. The production cycle starts with writing the tracking code and computer assembly instructions to the tags. This determines the specific assembly line the trays travel down. These trays then convey the computer components to one of several assembly sections. At each section, the tags are read by an antenna for specific work instructions. After the computer is assembled and tested, production information, such as date, time, section and employee code, is written to the tags. The tag reader and writer send the tag data to the control PC, where a shipping station is chosen for the computer. The fully assembled computer is diverted to the appropriate shipping section where it will be boxed, labeled and ready to ship (RFID brings Computers up to Speed, 2003).

At each shipping station, RFID is used to transfer tag data to the control PC. This data then instructs the automatic label printer to print on the corresponding box. The label contains information about the configuration of the PC, serial number and other information required for customer service. Final inspection is done at this point to compare the bill of materials to the actual computer. In case of any discrepancies, the computer is returned for corrective action (RFID brings Computers up to Speed, 2003).

Even with only a limited implementation at Dell, the benefits of RFID are apparent; however, the cost implications are preventing full scale immersion into its use. In the case of manufacturing facilities, re-tooling is required to implement the tags, readers processing computers, and to manage the data produced. At a user level, RFID is becoming an option although not fully implemented. As with all developing IT technologies, it is only a matter of time until the costs reduce to a point at which RFID will be the status quo.
Conclusion

The study into RFID use at Dell Computers reveals benefits and challenges that users of RFID must consider before utilization. The biggest benefits from RFID implementation at Dell were seen in three areas: production stops, returns and labor redundancy according to Dell RFID Leader Mark Dinning (Hoffman, 2005). Production stop times for cancellations have been cut dramatically as have returns from shipping wrong products. RFID has also helped allocate labor resources more effectively through cutting repetitive activities.

The main consideration with RFID use in any business is money, because it still remains fairly expensive to implement and maintain. Dell looks for immediate payback when implementing new initiatives so the RFID team looked to areas that could result in rapid improvements. The use of the scorecard helped pinpoint areas that would produce improved efficiencies. While Dell is still utilizing this technology internally without mandating supply-chain RFID adoption, they are strongly encouraging their partners to examine the potential benefits. The future of RFID is looking bright, and within the next ten to twenty years RFID technology could conceivably be everywhere providing convenience, efficiency, and cost-effectiveness for consumers and businesses worldwide. It will be as easy as Dell.

References


