Journal of Advances and Scholarly Researches in Allied Education
Vol. 20, Issue No. 1, January-2023, ISSN 2230-7540

A Study on benefits of Utilizing RFID in Business Operations

Akhilesh Kumar Srivastava[1]*, Dr. Kailash Chand Seval[2]

[1] Research Scholar, Department of Management, Sunrise University, Alwar-Rajasthan

[2] Associate Professor, Department of Management, Sunrise University, Alwar-Rajasthan

Abstract - The research focuses on the various elements that drive technology adoption and the challenges firms face while implementing new technologies in business operations. In addition, numerous RFID applications for industrial businesses are acknowledged, along with the benefits of doing so. The data demonstrate that RFID technology has a wide range of possible industrial applications. Several factors influence technology adoption, but the perceived benefits of RFID technology are frequently the most significant. Since RFID technology offers several benefits, efforts should be made to establish implementation guidelines. All applications improve operational and supply chain management efficiency. According to the conclusions of the study, RFID technology has increased the productivity of industrial firms. This study seeks to comprehend how RFID technology usage impacts businesses.

Keywords - Benefits, Effectiveness, Utilizing, RFID, Business Operations, Technology Adoption

----------X----------

INTRODUCTION

Radio Frequency Identification technology, a kind of automatic identification and data capture technique, uses low-power radio waves. Data is gathered and transferred in real-time, making it simple to use and ideal for robotic processes. Despite the fact that RFID has been around for more than 50 years, organizations continue to discover innovative methods to utilize it to enhance supply chain effectiveness. Any new technology will always have drawbacks or limitations (Hamilton, 2010). Similarly, RFID technology is not inexpensive despite its numerous benefits. One barrier to adoption is quantifying the return on investment of acquiring the technology, while the other issues related to the technology include security and privacy concerns. Although RFID technology may have moved the emphasis of supply chain management theory, it is unreasonable to think that all organizations would embrace it since managers are still unsure about its applicability for their own operations. RFID technology's genuine benefits and risks will depend on how rapidly it is adopted by businesses. Numerous scholarly studies examining this technology and its numerous possible uses have been published over the last several years. Depending on the business case justifications provided, each organization will have different reasons for using RFID, however operational improvements, manufacturing efficiency, and security are often mentioned (Green, 2019).

The broad use of this technology is hampered by a number of reasons, including the high implementation costs, the poor or unclear return on investment, the lack of security and privacy, the lack of standards, and environmental concerns. Despite the challenges, companies are using RFID because of the benefits of utilizing the technology in real-time, which will increase production and efficiency. Operational efficiency in this sense refers to effectiveness at the operational level, or maximizing output with the fewest resources. The most common kind of electronic data-carrying device used in everyday life is a smartcard, which is probably based on the contact field (Ertunga, 2008). However, these kinds of contact cards are often less adaptable and practical. A contactless card with wireless data transmission capabilities would be far more flexible. This interaction will take place between the reader and the data carrier. The situation may appear even more amazing if the reader uses contactless technology to charge the data-carrying device. These systems are referred to as radio frequency identification systems because they use radio waves to communicate data and power. The fact that so many companies are now spending time and money on research, development, and sales of RFID systems is compelling proof that this sector merits attention. RFID is also challenging to identify since it has evolved into a separate, unique area in recent years. Contactless automatic identification technology has grown in popularity as a consequence of combining elements from many other industries, including cryptography, HF

technology, telecommunications, semiconductors, data security, and much more (Dimitris, 2010).

Benefits of RFID

An RFID-based layer over the internet is being developed, tested, and implemented by the Auto-ID Center. It is envisaged that this extra layer would allow computers to recognize items in real-time regardless of where they are physically located. The resultant network would provide a number of avenues via which top-notch, current data might be injected into existing company software. In addition, it will start a brand-new era of development and opportunity. This portal for RFID research and development offers white papers, business cases, and a tool that simulates return on investment for supply chains. The RFID community deals with everything from tags to readers to software to the development of an electronic product code. The main issues are identified as research and development, performance optimization, cost, and standards (Das, 2005).

This technique is referred to by its acronym, radio frequency identification. The act of transmitting and receiving data wirelessly is referred to as "radio" in this context. RFID devices may operate on a wide range of frequencies, each of which has benefits. The decoding of a series of codes that identify a certain item involves the employment of a data carrier (based on memory) and a radio frequency reading. The term "radio frequency identification" (RFID) is often used to describe a device that may be sensed or detected at a distance with minimum interference. The moniker "RFID" was given to these tags to denote their application in the area of radio-frequency identification. These tags have the ability to reflect or retransmit signals. The radio frequency identification (RFID) system is completed by the radio communication between the RFID tag and the RFID reader. It is possible to break down radio-frequency identification into its component frequencies and data formats (Bhattacharya, 2012).

Tags, readers, and computers are only a few of the many pieces of gear required by the RFID system. An RFID tag's components include a power supply, operating conditions, antenna for communicating with a reader, applicable standard, memory, logic put on the chip, and application method. Radio barcodes, transponders, and "smart labels" are other names for radio frequency identification tags. A microchip is a silicon device that is put on a substrate and connected to a tiny flat antenna. Depending on the device's intended usage, it could be housed in a protective enclosure. An RFID tag may be affixed to a product, shipping container, or pallet after it has been finished. After then, the location, owner, and condition of the object may be determined by remotely scanning this tag. RFID tags may be worn, inserted, taken out, or affixed indefinitely. The RFID tags also need a power source, such as a battery for active tags or an RFID reader for passive tags.

When preparing for the tag's deployment, factors like the operational temperature and humidity level become critical. A scanner or an interrogator are other names for a radio frequency identification reader. Radio frequency (RF) is used to communicate with RFID tags in order to get information from them. An antenna, polarization, protocol, interface, and mobility are just a few of the parts that make up a radio frequency identification (RFID) reader. The RFID reader may have one, several input ports, and an internal or external data-transfer antenna. RFID readers may use a single protocol or a variety of protocols, and they can be polarized either linearly or circularly. RFID readers may have a variety of interfaces, including Ethernet, serial, Wi-Fi, and USB. A reader may be used either as a portable device or one that is permanently installed. Host computers are an additional tangible element of an RFID system in addition to RFID tags and RFID readers. The data collected by RFID readers is transferred to a host computer for further processing. The host computer may utilize middleware or RFID software to filter and direct the data to the appropriate application (Attaran, 2012).

RFID in Logistics

Resources and commodities pass through a number of actions that make up the logistics concept on their way from the provider to the consumer. A logistics system must take into account a number of aspects in order to remain flexible. Different logistics jobs were classified as "main" or "supporting" duties within logistics management according to how important they were. Although there are many distinct aspects of logistics, customer service, transportation, inventory control, and order processing are some of the most crucial ones. Inventory and supply management, purchasing and shipping items, packaging and shipping goods, planning and scheduling production, and record keeping are all examples of supporting activities (Alqahtani, 2012).

- RFID and visibility in Logistics
- RFID and Inventory control
- RFID and Warehousing
- RFID and Order fulfillment
- RFID and Return management

When preparing for the tag's deployment, factors like the operational temperature and humidity level become critical. A scanner or an interrogator are other names for a radio frequency identification reader. Radio frequency (RF) is used to communicate with RFID tags in order to get information from them. An antenna, polarization, protocol, interface, and mobility are just a few of the parts that make up a radio frequency identification (RFID) reader. The RFID reader may have one, several input ports, and an internal or external data-transfer antenna. RFID readers may use a single protocol or a variety of protocols, and they can be polarized either linearly or circularly. RFID readers

may have a variety of interfaces, including Ethernet, serial, Wi-Fi, and USB. A reader may be used either as a portable device or one that is permanently installed. Host computers are an additional tangible element of an RFID system in addition to RFID tags and RFID readers. The data collected by RFID readers is transferred to a host computer for further processing. The host computer may utilize middleware or RFID software to filter and direct the data to the appropriate application (Heese, 2007).

Beyond its physical components, an RFID system's related frequencies may provide information about how it functions. Additional frequency categories in RFID systems include coupling, reader-to-tag, tag-to-reader, and signal distance. The read and write ranges are both included in the signal range. RFID systems use a variety of frequency bands, and this is reflected in the signal range of the systems. The tag reader may deduce a single frequency or a number of frequencies depending on the situation, which adds another layer of complexity. Frequencies from the tag to the reader might be sub harmonic, harmonic, or harmonic. Data sub classification is used in a variety of settings, including data processing, multi-tag read coordination, and RFID system security. Similar to this, the security of an RFID system may be preserved by using a public method, a private approach, or even no algorithm at all.

RFID System Components

Radio frequency identification systems use a number of unique components that work together to detect and identify objects or persons. These are the pillars of any RFID system, no matter how complex. The following are some of the most crucial components of RFID systems, apart from any potential auxiliary components like sensors (Hozak, 2008):

- **RFID Tags:**

The microchip of an RFID tag houses a unique identification number. This microchip is built using a silicon chip with embedded logic and an integrated circuit. This ID number is saved in the tag's memory for further use. The detachable or permanent nature of this memory chip will depend on its read/write capabilities. RFID tags come in a broad range of shapes and sizes, each one tailored to a certain application or setting. These labels methodically encompass many types of diverse materials. In the world of credit cards, little plastic pieces are often utilized. RFID is now present in a broad range of objects, including fabrics, paper, animals, and even people. Even smaller than a grain of rice, human RFID chips are often constructed of a particular kind of plastic (Ibrahim, 2010).

- **RFID Reader:**

Every RFID system is strongly dependent on its reader to work. Its main job is to run and control an RFID system at a certain frequency. Through an antenna, it could be able to communicate with a radio-frequency identification tag. Depending on the kind of RFID tag and its storage capacity, it can either read the tag or perform a series of actions on the tag. While wired connections between an RFID reader and a computer system require RS-485 or RS-232 USB cords, wireless communications use Wi-Fi. Given the scope of this chapter, the next section will informally contrast RFID with one of its most often mentioned competitors, the barcode.

- **RFID Applications:**

Despite the fact that RFID technology is still in its infancy, a vast array of applications have already surfaced. If we didn't talk about the possible advantages of RFID technology in such situations, the point of this chapter would be missed. To make the lesson more understandable, let's utilize a real-world example. Consider a situation that may arise in the present (2011) as a result of visiting any retail complex. Customer goes grocery shopping, taking time out of their hectic schedule to choose different things and put them in a basket. Long checkout queues at major supermarkets, especially on the weekends, quickly become an evident cause of frustration with the shopping trip (Junling, 2011).

Advantages of Radio Frequency Identification Technology

- **Tracking assets and managing inventory:**

Most organizations have a hard time keeping track of their assets and resources, such as components on a production line, transported items, industrial containers that need to be returned, or tools, laptops, and other high-value equipment that frequently goes missing. RFID devices offer a fast and precise alternative to manual counting in situations where inventory has to be monitored. Using RFID applications, you can easily track where and at what stage of manufacturing your inventory is at any given time. From the time goods enter stores, during production, and up until the point at which they are used in a finished good, their whereabouts may be monitored in real time. Having this information makes it easier to manage stock, conduct audits, and reduce instances of shrinkage. You may utilize RFID to track down any misplaced items you already have on the premises (Khalil, 2012).

- **Saving time and money through automation:**

Applications that use radio frequency identification (RFID) technology to track items in transit may automatically update an enterprise resource planning (ERP) or financial management system with the relevant data. Consequently, they may eventually supplant archaic spreadsheets and do away with the necessity for manual form filling.

Putting stationary readers in key spots can save even more time; for example, they can fully remove the need for human involvement in a production line.

- **Improving data accuracy and availability:**

Since data is captured and uploaded electronically, RFID eliminates the possibility of transcription errors, duplicate data, and "missing items" when used to simultaneously record data on several objects. When a business uses cloud computing, everyone in the company has instantaneous access to the most up-to-date details on the whereabouts and condition of any given asset. Information for the customer base is possible (Li, 2006).

- **Enhancing health and safety:**

Businesses may keep tabs on when inspections are due or have been completed with the use of RFID devices, which may result in restrictions on the use of equipment and vehicles if certain conditions are not met. In order to show insurers or regulatory agencies that processes are being followed, a system like Checked OK can be quite useful.

- **Enhanced quality and traceability:**

Likewise, RFID devices may help verify that items have been subjected to all mandatory inspections and testing. In the case of boilers, for instance, they may aid in making sure that the unit has been installed, tested, and authorized before being shipped out to the client, which boosts product quality and reduces the amount of items that need to be returned. RFID tagging might aid in product traceability by allowing its location to be tracked back to its factory of origin.

Benefits Of RFID For Supply Chains

Read on for a more in-depth analysis of RFID technology's benefits for logistics chains. RFID is used throughout the supply chain.

- **Better Inventory Management:**

One of the biggest challenges facing warehouses and online stores is managing their inventories effectively. Using radio frequency identification (RFID) devices provides a rapid and precise method for monitoring inventory levels. Using a WMS, you may track your stock in real time and schedule automatic reorders (WMS). Progress in Asset Tracking With the use of RFID tags, a company can keep tabs on its assets in the same way that it does its stock. Forklifts, mobile computers, and packaging supplies are just a few examples of the kinds of things that may go missing or be stolen, and this solution could help prevent those situations.

- **Saves Time:**

RFID is an important part of the automation puzzle. Incorporating RFID scanners and a WMS into a well-designed system has the potential to automate many manual processes, such as the registration of incoming and outgoing goods.

- **Boosts Accuracy:**

There is more room for inaccuracy in data that is entered manually. When utilized for data collecting, RFID technology eliminates the possibility of typos, forgotten objects, and unnecessary repetition.

- **Enhances Health and Safety:**

With the use of RFID technology, businesses can check the repair and inspection history of their cars and machinery, and even limit their usage if certain criteria aren't satisfied. In addition to improving the company's health and safety, this kind of asset management also helps it adhere to a wide range of standards.

- **Better Production Control:**

RFID's unique identification capability makes it an ideal device for individualized or intricate warehousing and production methods. This contributes to more productivity and less waste.

- **Improved Traceability:**

The demand for supply chain openness and visibility is rising. Customers want to be able to trace their orders back to the warehouse. Supply chain bottlenecks and poor customer service can only be mitigated with more transparency between retailers and distribution facilities. Tracking an object in real time has never been easier than using RFID technology (Modrak, 2010).

Benefits of Radio Frequency Identification Technology for Business Operations

- **Optimum Utilization of Assets:**

In most organizations, RFID is being used for asset management. Companies use asset tags to keep count of their assets and keep tabs on their management. Companies commonly use RFID technology for this purpose. It makes assets more reliable by allowing managers to keep tabs on things like maintenance schedules, prices, and availability. The maintenance records and other relevant data for tagged machines, for instance. The assets of every business must be carefully monitored. RFID asset management allows companies to better organize their resources. In addition to decreasing costs and maximizing usage, keeping tabs on a company's assets also provides a comprehensive image of the business as a whole.

- **Visibility in flow of Items:**

RFID technology improves operational transparency and lessens the need for human intervention in stock management. Increasing product flow visibility helps businesses reduce wasteful spending and boost efficiency. During its journey through the supply chain, an item is tagged with RFID technology. Each tag has a special ID number that corresponds to the data on its integrated circuit. A manual tracking system is unnecessary while the item travels through the supply chain. For instance, in the retail industry, RFID has the ability to increase transparency, decrease the need for human intervention, and make the process more reliable. The distribution chain of the tagged items might be followed by retailers.

- **Inventory Audit / Management:**

There are several issues that can arise with inventory that organizations confront, but RFID inventory monitoring software can help with all of them. Manually keeping track of stock takes a lot of time and is prone to mistakes. The use of RFID technology, which enables automated tracking and management of data, is one solution to this issue. Businesses often do inventory counts to ensure they have enough of the things they need on hand, while also cutting down on stock that won't be used soon and saving money by not having to store it. RFID-based inventory tracking helps organizations overcome these obstacles by allowing them to monitor stock levels and manage inventory at every stage of the supply chain, from individual item to whole crate to pallet to moving conveyor belt. RFID-based inventory tracking, for instance, reduces the price of confirming the contents, locations, and availability of necessary products at warehouses and distribution centers (Mohsen Attaran, 2011).

- **Identification of human or object:**

Scanning an RFID tag with a reader connected to a secure access database, which contains extra identification/authorization information, significantly increases safety. RFID also makes it possible to improve the security of people across the world. It goes without saying that it is crucial to administer the right treatment to the right patient in a medical setting. Even with the widespread use of wristband identification, errors still occur. RFID is utilized to offer secure identifying techniques for people and things, and this authentication is done through the use of cryptographic hashes. Employee ID badges, public transit passes, electronic passports, and official identification cards are all prime examples of personal authentication tools.

- **Automatically recording and managing Information:**

Companies that rely on a team of people to accomplish a single activity might also benefit from RFID tags. There may be inefficiency in the process as a whole if numerous workers are required to do a single activity. When information is recorded manually, it may be impossible to keep track of who did what to what asset or document and how often. RFID gets around this problem by letting companies save data on tags that can be scanned before every transaction. A hospital, as an example, has numerous players, medications, rooms, and paperwork all playing a part in the patient's care. Through the use of RFID tags, the procedure may be considerably simplified by automatically updating the patient's medical history and planned therapies at each stage. A higher level of efficiency may result from the decreased possibility of mistake (Pramatari, 2010).

CONCLUSION

RFID technology and its potential uses in a variety of settings are well-documented, indicating that this is a viable subject of study. While there have been several case studies of individual organizations employing this technology, research articles examining multiple companies simultaneously are quite uncommon. In the near term, firms may be hesitant to engage in the technology due to concerns regarding return on investment, but the long-term benefits may make the high initial expenditures worthwhile. Organizations will be motivated to use the technology and spread the word if they discover that doing so has increased their productivity. RFID technology uses a very low radio frequency, thus businesses are not required to register to utilize it. However, it would be advantageous for other businesses to gain access to extensive information regarding RFID-using organizations. RFID deployment entails a substantial up-front investment, but the technology has been proved to improve operational efficiency in a wide range of scenarios.

REFERENCES

1. Alqahtani S. et al. (2012). Determinants of RFID Technology Adoption Intention in the Saudi Retail Industry: an Empirical Study. 45th Hawaii International Conference on System Sciences, pp. 4720-4729.
2. Attaran, M. (2012). Critical success factors and challenges of implementing RFID in supply chain management. Journal of Supply Chain and Operations Management, 10(1), pp. 144.
3. Bhattacharya, M. (2012). Effect of RFID on the retail value chain: An exploratory study using a mixed method approach. Journal of technology management & innovation, 7(4), pp. 36-49.
4. Das, R. and Harrup, P. (2005). RFID Forecasts, Players & Opportunities 2005-2015.IDTechEx, Cambridge, MA.
5. Dimitris Papakiriakopoulos, Katerina Pramatari, (2010). Collaborative performance measurement in supply chain.

Industrial Management & Data Systems, Vol. 110 Iss: 9, pp.1297 – 131
6. Ertunga C., Agnes G. (2008). When Does RFID Make Business Sense for Managing Supply Chains? International Journal of Information Systems and Supply Chain Management (January-March 2008), 1(1), pp. 15-47.
7. Green, K.W. Jr, Whitten, D. and Inman, R.A. (2009). The impact of RFID technology utilization on supply chain productivity and organizational performance. International Journal of Innovation and Learning, Vol. 6 No. 2, pp. 147-62.
8. Hamilton, D., Michael. K., & Fosco., S. (2010). Overcoming Visibility issues in a small- to-Medium retailer Using Automatic Identification and Data Capture technology: an evolutionary approach. International Journal of E-Business Research (April-June 2010), 6(2), pp. 21-44.
9. Heese, H.S. (2007). Inventory record inaccuracy, double marginalization, and RFID adoption. Production and Operations Management, Vol. 16 No. 5, pp. 542-53.
10. Hozak, K. and Hill, J.A. (2008). Issues and opportunities regarding replanning and rescheduling frequencies. International Journal of Production Research, 47 (18), pp. 4955– 4970.
11. Ibrahim Al Kattan, Taha Al Khudairi, (2010). Simulation Of Inventory Control System In A Supply Chain Using RFID. International Journal of Information Systems and Supply Chain Management, 3(1), pp. 68-86, January-March 2010.
12. Jie Z., Junling W. (2011). Optimize Supply Chain Management Applying active RFID Technology, pp. 543-545.
13. Khalil, I. (Ed.). (2012). Contemporary Challenges and Solutions for Mobile and Multimedia Technologies. IGI Global.
14. Li, D., Kehoe, D., and Drake, P. (2006). Dynamic planning with a wireless product identification technology in food supply chains. International Journal of Advanced Manufacturing Technology, 30, pp. 938–944.
15. Modrak, V., Knuth, P., & Novak-Marcinein, J. (2010). Advantages and risks of RFID in business applications. International Business Management, 4(1), pp. 28–34.
16. Mohsen Attaran (2011). The Supply and Demand for RFID, Tracking technology and may be everything else. Industrial Engineer, pp. 26-31.

Corresponding Author

Akhilesh Kumar Srivastava*

Research Scholar, Department of Management, Sunrise University, Alwar-Rajasthan