

Effects of RFID Practices and Advantages

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Abstract - RFID technology may have multiple applications inside a business. The cumulative effect of all these solutions is greater operational and supply chain management productivity. However, when applied to WIP management, WHS management, and inventory management, it may aid firms in keeping better track of their inventories. Different sets of characteristics led to diverse behaviors and advantages, as determined by the research. However, the deployment of RFID technology will increase operational efficiency and supply chain management effectiveness. Consequently, firms that utilize RFID technology increase their operational efficiency. The most striking outcome of this study is that it is possible to save money through theft prevention and safety enhancements. Additionally, the majority of businesses find improvements in operational efficiency and inventory management. All of the best practices for using RFID stem from the desire of businesses to gain the same benefits from RFID as their competitors.

Keywords - Effect, RFID, Practices, Advantages, productivity, management, supply chain.

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INTRODUCTION

The prospect of technological advancement and the essential part that it would play in the growth of his business. And as can be seen, in order for businesses to maintain their level of success over time, they need to consistently adjust to the ever-changing global environment and improve the efficiency of their operating processes. Information serves as the driving force behind both the modern economy and culture. As a result of their increasing global footprint, manufacturing organizations have an increased demand for real-time information exchange in order to enhance the level of collaboration that exists among their numerous departments and locations (Aydin, 2012). This encourages the purchase of superior technology that makes coordination easier, lowers the level of uncertainty in the market, and enhances market management by increasing the amount of information that is exchanged and reducing the amount of stock held. In recent times, there has been a lot of focus placed on the benefits that Radio Frequency Identification technology can bring to organizations, particularly in the areas of their day-to-day operations, supply chains, and other areas of their operations. It is possible that the use of RFID technology will promote transparency and the flow of information across the entirety of the production process, from the supply chain to the shop floor (Mehrerji, 2011).

The decrease in size of RFID tags has resulted in a reduction in their prices. RFID has many applications despite the fact that, unlike other technologies such as barcode and magnetic card systems, it does not require direct physical contact between a detector and

the object being scanned. On the other hand, RFID readers that are used in RFID systems are able to scan tags without actually touching them. Utilizing RFID technology could very well result in an increase in overall productivity. When we talk about operational efficiency, we are talking to the efficiency at the operational level, which is when the greatest output can be produced with the least amount of input (Alqahtani, 2012).

Definition of RFID?

The usage of more traditional techniques of identification, such as barcodes, has been eclipsed by the use of radio-frequency identification, or RFID, technology. Due to the fact that barcodes are built on the fundamental principle of assigning a unique number to each item, they are applicable to a wide variety of products, including those that are comprised of many parts. When trying to comprehend the significance of a barcode in the logistics and supply chain, it is helpful to think about how it may assist businesses in keeping track of the quantity of things that have been sold while also accelerating the process of checking out customers. Unfortunately, barcodes have a number of drawbacks, including the inability to identify specific items within a type, the requirement for manual tracking in which the barcode is scanned on each item, the fact that they only include a product type code, and the inability to be updated or expanded (Bhattacharya, 2012).

Radio-frequency identification, or RFID, is a technology that enables the automatic recognition of tagged goods, the determination of their position,

and the reading of the information contained within the tag with very little intervention from a human being. The information that is gathered from a device that is equipped with RFID is transmitted wirelessly and stored in a database (Cheung, 2008).

Effects of RFID on Logistics

During the early modern period, the French army is credited with being the first to use the term "logistics." During World War II, the effective control of the flow of resources, manpower, and military hardware was an essential component of logistics, which was a vital component in the overall conduct of military operations. In today's world, logistics is used for everything, from tracking down suppliers of raw materials to delivering finished products to customers. In the field of logistics, inventory management is considered an essential step in the process, regardless of the nature of the objects at hand (stuff, people), whether they are hard (stuff) or soft (people) (information). If goods were not being moved from one location to another, logistics would be for nothing (Green, 2009). One definition of logistics describes it as "the process of strategically managing the procurement, movement, and storage of materials, parts, and finished inventory through the organization and its marketing channels to maximize current and future profitability through cost-effective fulfillment of orders." This definition is based on the idea that logistics is "the process of strategically managing the procurement, movement, and storage of materials, parts, and finished inventory."

This technique is sometimes referred to by its abbreviation, RFID, which stands for radio frequency identification. The method of transmitting and receiving data without the need of wires is referred to as "radio" in the industry. RFID devices are able to operate on a wide range of frequencies, and each of these frequencies offers a unique set of benefits when utilized. The reading of a radio frequency combined with a data carrier, which is dependent on memory, is used to interpret a series of codes that are used to identify a certain object. The phrase "radio frequency identification" (RFID) is frequently utilized when referring to a device that has the ability to be sensed or detected at a greater distance with a reduced amount of interference. The abbreviation "RFID" was given to these tags to denote its application in the field of radio-frequency identification. These tags are able to either reflect or retransmit signals, hence the term. In order for the radio frequency identification system to function properly, it is necessary for the RFID tag and the RFID reader to be able to exchange information with one another using radio waves. The process of radio-frequency identification can be broken down into its component parts, which can be broken down into a variety of frequencies and data formats (Curtin, 2007).

Tags, readers, and computers are only few of the essential pieces of equipment that are required for the RFID system. An RFID tag has many components,

including its power supply, operational conditions, antenna for connecting with a reader, applicable standard, memory, logic put on the chip, and method of application. Radio barcodes, transponders, and "smart labels" are all names that are used interchangeably to refer to radio frequency identification tags. The term "microchip" refers to a device that is created by mounting a silicon microchip on a substrate and connecting it to a small flat antenna. Depending on what the gadget's ultimate purpose is, it may have a protective casing that encloses the entire unit. After being finished, an RFID tag can next be fastened to a product, a shipping container, or a pallet. After that, this tag can be scanned remotely in order to find out where the item is, who owns it, and what its current state is. It is possible to carry RFID tags, insert them, remove them, or permanently attach them. In addition, RFID tags call for a power source, which can either be a battery in the case of active RFID tags or an RFID reader in the case of passive RFID tags (Brintrup, 2010).

When planning for the deployment of the tag, it is essential to take into account important factors such as the operational temperature and humidity level. A radio frequency identification reader is also sometimes called a scanner or an interrogator. These are all names for the same device. You can obtain information from RFID tags by exchanging messages with them using radio frequency, also known as RF. An antenna, polarization, interface, protocol, portability, and radio frequency identification (RFID) are just few of the many components that make up an RFID reader. The RFID reader may have one or more input ports, and the data-transfer antenna may be located either on the interior or the exterior of the device. RFID readers can use a single protocol or multiple protocols, and they can either have a linear or circular polarization. Additionally, they can use just one protocol. There are a variety of interfaces that can be found on RFID readers, including Ethernet, serial, Wi-Fi, and USB. A reader can either be installed in a fixed location or carried around in a portable version. A RFID system is comprised of a number of different physical components, the most notable of which being RFID tags, RFID readers, and host computers. The information that is acquired by RFID readers is transferred to a host computer so that it can be further processed. The host computer may make use of RFID software or middleware in order to filter the information and direct it to the appropriate application.

LITERATURE REVIEW

Aydin, Kenan, and Seda Yildirim (2012), The purpose of the case study was to demonstrate how radio frequency identification (RFID) technology could be applied to library operations. A case study methodology was utilized in order to investigate both the positive and negative aspects of implementing RFID in library systems. In-depth interviews,

document analysis, and first-hand observation were the primary sources of data for this study. This case study makes a significant contribution by highlighting prospective applications of RFID technology in library settings, as the conclusion will explain. It was also observed that, throughout the course of the years, libraries, similar to retailers and manufacturers, have benefited from numerous advancements in RFID paperwork. Based on the findings of interviews and observations, it appears that RFID technology has made the library's security system more effective, accelerated the circulation of library goods, decreased the need for personnel, and enhanced the accuracy of inventory counts. RFID technology might be advised for usage in libraries in order to boost both productivity and the level of satisfaction felt by customers.

Mehrjerdi Yahia Zare, (2011), He suggested investigating the possibility of developing an automated Radio Frequency Identification (RFID)-based system for library search, as well as examining the existing literature to determine whether or not such a system would be feasible given the available technology and the systems that are already in place. Finding out and analyzing the fundamentals of radio frequency is necessary in order to acquire a comprehensive comprehension of the subject's essential characteristics, adoptions, risks, and benefits. Following a brief analysis of the applications of radio frequency identification in library management systems and other types of companies, there will be a look at four case studies that are connected to this topic. Evidence suggests that the implementation of RFID technologies in libraries could result in cost reductions due to a reduction in labor costs, an increase in automation, improved monitoring and tracing, and the elimination of material loss. All of these factors are essential to the efficient operation of library systems.

Nash, Trina A (2010), In conclusion, he summed up everything in his dissertation. The implementation of this technology and the beginning of the next generation of stock management will, without a shadow of a doubt, be beneficial to the expansion of businesses. The challenges and obstacles can be overcome if greater research and development effort is invested in the technology. As a result of what we've discovered, it's quite evident that technology advances are not going away any time soon, and the effect these developments have on supply chains will have on economies in the future. Globalization is already taking place, and this will only speed up the process; businesses need to be prepared for the new age of rapid transformation. There is little question that some companies will arrive to this conclusion far too late, but there will also be others that will welcome the move and experience expansion on a scale never seen before. The time has come to make some modifications and acquire a comprehensive understanding of supply chain management and the ramifications of this topic.

Kim et al, (2009) Within the framework of their proposed lightweight RFID Authentication protocol, a new group of keys is generated at each stage of the communication process. The problem that they wanted to fix was one that was associated with privacy and monitoring in general. AES is utilized throughout the authentication processes carried out by them. Random number generators on the tag, reader, and server all work together to ensure that the symmetric keys are always kept in their most recent state during each transaction. As a result, the same set of encryption keys will not be used for more than one communication at a time. They have made the assumption that the communication medium between the tag and the reader is open to attack, but that the communication route between the reader and the server is safe. The proposed procedure is broken up into two different stages. The initial stage, often known as the startup phase, is when everything begins. To get things started, the symmetric key used by the tag and the server are the same. The tag may compare its secret number with the one that is stored in the reader in order to determine whether or not the server is legitimate.

Alqahtani (2012) The management of demand, the fulfillment of orders, the monitoring of production, and the processing of returns are the four areas of business operations that stand to benefit enormously from RFID's implementation. It is possible that the effectiveness and efficiency of supply chain management could be significantly improved as a direct result of the applications being discussed. They also emphasized the necessity of incorporating RFID efforts into an organization's overall supply chain strategy in order to maximize the technology's genuine commercial value and speed up profits as businesses build their RFID plans. This was done with the intention of maximizing the potential of the technology.

Bhattacharya,. (2012) A theoretical framework for the adoption of RFID and its benefits is presented, with data taken from enterprises in the United States. According to the findings of their study, the most immediate benefits from both activities will go to businesses that have both a sizable budget for the deployment of IT applications and an equally sizable budget for the installation of RFID technology. They also came to the realization that the requirement of a partner strengthened the expectation of an immediate return on investment (ROI) on the RFID investment. According to the findings of the research, a delayed ROI was also associated with the lack of standardized RFID standards.

Brintrup, (2010) According to the findings of the research, RFID technology has proven very advantageous to libraries all around the world, despite the expensive expense of implementing it. It has the ability to make the administrative processes of the library more efficient. The only thing that is holding us back is the extremely high expenses involved, but every new piece of technology comes

with its own price tag. Additionally, RFID applications lower the need for a large number of staff, increase service quality, and give more effective outcomes, all of which lead to a facility that is more secure, convenient, and has access processes that are more simplified. In addition to providing services in real time, it guarantees that the library's collections are kept up to date at all times and that holdings are handled in the appropriate manner. In conclusion, when cutting-edge technology like RFID are integrated into library systems, magical things happen that are to the advantage of both library users and library employees.

Curtin, (2007) Describe the testing that was done in addition to the research that was done in order to include RFID into the current LMS used by CDAC. Following are some sections that provide background information on libraries, the challenges that librarians face, and how radio frequency identification (RFID) technology is being used to automate some of those tasks; the hardware and tags that are being used in the project (an RFID-based library management system); the modules that are being developed for that system; and the experiments that were conducted to determine where on a book's spine the tags should be placed. They came to the conclusion that implementing RFID technology in the library speed up the processes of borrowing, monitoring, and looking for books. As a result, librarians were able to dedicate more time to the care of library users. Nevertheless, the functionality of an RFID reader and tag can vary from manufacturer to manufacturer. A successful application of the technology also depends on the information that will be written on the tag. The continual development of RFID technology has a number of advantages, some of which include increased store capacity, greater scan ranges, and shortened processing times.

RESEARCH METHODOLOGY

A quantitative methodology is used in the research. The basis for the entire study is comprised of both primary and secondary data. The main focus is on primary research using structured questionnaires.

Research Design

The research has an exploratory and descriptive approach. The initial phase of the inquiry focused on RFID technology. The technology has a wide range of applications and advantages for industrial businesses. A research of 52 manufacturing enterprises in Rajasthan, India that use RFID technology was carried out in order to gain a complete understanding of the use of technology and its impact.

Sample

Convenience sampling was used to choose the sample. The organizations that at least partially integrate RFID into their business processes were considered the sample universe for this study. Various

employees from each organization will complete each section of the questionnaire in accordance with their respective areas of responsibility in order to preserve the accuracy of the replies given.

Data Collection Techniques

Primary Data

A systematic questionnaire was used to gather primary data. The two stages of the research process are as follows:

First phase: Exploratory research is used to examine the macro-environment in which RFID applications are used in businesses. Focus group interviews and depth interviews will make up the majority of this exercise. To investigate the essential components of RFID adoption in organizations, a literature review of the pertinent literature is also undertaken.

Second phase: A thorough field study is conducted to test the hypothesis and ascertain the significance of each individual aspect that was found through exploratory research as a major component.

Secondary Data

The secondary data came from a number of previous public data sources. Along with literature from other sources, such as periodicals, newsletters, magazines, and industry group reports, e-libraries and online material are explored.

Procedure

The questionnaire will be pre-tested on a limited sample of people. In total, six respondents were contacted, including three consultants working on RFID deployments in enterprises, managing directors, senior managers, and departmental heads of companies using RFID in their operations. Their responses were used to change the questionnaire, which involved taking out a few of the low-rated items and adding a few of the suggested questions from the pre-testing phase. Human contact was used for the final conversation and questionnaire completion by respondents who had sufficient knowledge of the drivers, procedures, and benefits of RFID installations. The surveys are given out to the respondents before being finalized so they have time to study them thoroughly. Additionally, any inquiries the responders may have are answered personally, improving the accuracy of the responses they give.

Proposed Analyses

- **Descriptive Statistics:** The significance of RFID drivers, practices, and benefits are described using descriptive statistics, such as mean and standard deviations.

- **Factor Analysis:** The drivers, practices, advantages, and difficulties of RFID deployment in enterprises are investigated using factor analysis.

RESULTS

Table 1: RFID's acceptance status

	Pilot Stage	Full Stage
Frequency	52	0
Percentage (percentage)	100	0

None of the 52 units questioned had confirmed full-stage adoption, while all have confirmed adoption at the Pilot level.

Table 2: RFID Implementation in Commercial Settings

	Frequency	Percentage (percentage)
B2B logistics	8	15.38
Internal operations	52	100.00
B2C marketing	13	26.92
B2C after-sales service	10	19.23

Fifty-two of the units confirm internal operations; fourteen, or 26.72percentage, confirm B2C marketing and logistics; ten, or 19.23percentage, confirm B2C after-sales service; and eight, or 15.38percentage, confirm B2B logistics. Respondents were encouraged to check more than one box if they felt it applied, therefore the above percentage is based on 52 units for each variable rather than 100.

Table 3: Different RFID Tags Available

	Read Only	Active	Passive	Semi Passive	Reusable read and write	Read and write
Frequency	0	0	35	0	40	0
Percentage (percentage)	0.00	0.00	67	0.00	77	0.00

There were multiple choices available to the participants. The use of reusable read and write RFID tags was confirmed by 40 of the 52 units (or 77 percent of the sample), the use of passive RFID tags by 35 units (or 67 percent of the sample), and the use of read-only RFID tags, active RFID tags, and read and write RFID tags by none of the units (or 0 percent of the sample). The following question allowed respondents to check more than one box if it applied to them; hence, the computed percentage uses 52 units for each independent variable instead of 100.

Table 4: Varieties of RFID Tags in Use

	Paper	Smart card	Smart chip
Frequency	0	30	40
Percentage	0	58	77

Participants were given the option of selecting several responses. There were 52 units in the sample, and 40 (or 77percentage) were confirmed using smart chip tags, 30 (or 58percentage) were verified using smart card tags, and 0 (or 0percentage) were confirmed using paper tags.

The following question allowed respondents to check more than one box if it applied to them; hence, the computed percentage uses 52 units for each independent variable instead of 100.

Table 5: Current RFID applications in business

	0-10 percentage	11-20 percentage	21-30 percentage	31-40 percentage	41-50 percentage	Over 50 percentage
Frequency	2	12	18	10	9	1
Percentage	3.85	23.08	34.62	19.23	17.31	1.92

From a total sample size of 52, 18 (35percentage of units) reported that they had tagged between 21percentage and 30percentage of their data, 12 (23percentage of units) reported that they had tagged between 11percentage and 20percentage of their data, 9 (19percentage of units) reported that they had tagged between 31percentage and 40percentage of their data, 2 (4percentage of units) reported that they had tagged between 0percentage and 10percentage of their data, and 1 unit reported that it had tagged more than 50percentage of its data.

Table 6: the current state of RFID implementation

	Itemlevel	Caselevel	Palletlevel	Containerlevel
Frequency	52	24	0	20
Percentage	100.00	46.15	0.00	38.46

There were multiple choices available to the participants. All 52 samples were confirmed to have adopted the item level, while 24 samples, or 46.15 percent, had adopted the case level, 20 samples, or 38.5 percent, had accepted the container level, and 0 samples, or 0%, had adopted the pallet level. The following question allowed respondents to check more than one box if it applied to them; hence, the computed percentage uses 52 units for each independent variable instead of 100.

CONCLUSION

Numerous RFID applications and benefits have contributed to its widespread adoption. Considering the literature review, this study has only examined a small number of drivers, behaviors, and benefits. In addition, the focus is limited to four industries within the Indian state of Rajasthan: cement/ceramics, boilers, textiles, and tubes/pipes. The research may be repeated, but this time in a different state and with a different sector in mind. As a strategy for RFID Adoption, Employee Management has been omitted from this study due to its manufacturing-specific nature. Multiple studies have demonstrated that the most major application of RFID in business is staff management. The service business is an ideal setting for future research, and one use of radio frequency identification technology is staff management. Consequently, additional research can be undertaken in a variety of subjects, with a variety of applications, and in a variety of locales; thus, its future potential is immense.

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