Impact of Information Technology on Internal Supply Chain Management Implementation of RFID Tags

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Abstract—This research is related to the effects produced by Information technology on the Internal Supply Chain Management of the companies. It tells how the organization works through IT. RFID tags within the organization are associated with multiple advantages especially it is beneficial for managing the supply chain. The cost efficiencies & cost-effectiveness are promoted by multiple elements. RFID is a path towards the future. The future wants everything which is not only flexible and innovative but also the least expensive in order to give the best customer service. It is represented by the study that through RFID tags the major benefit attain is that data transfer is easy. Furthermore, it has better data capturing quality.

Keywords—Information Technology; Supply Chain Management; RFID Tags

I. INTRODUCTION

The store network the board is a significant idea for overseeing and arranging all exercises that are remembered for procurement and sourcing, coordination the board and change exercises. It regularly includes cooperation and coordination with accomplices that might be middle people, providers, clients, outsider help offerors. The RFID Known as Radio Frequency Identification (RFID) is a significant innovation that aids in following the stock inside an inventory network. It can help in physical stream and synchronizing the progression of merchandise over a store network from a producer to the outlets and buyers at the perfect time and spot. RFID can follow products by store network and secure fake. It additionally supports to diminish down the stock things [1] [7]. There is no such doubt that RFID is not valuable for promoting supply chain efficiency and inventory management. The RFID promises in transforming the supply chain management by offering information on products flow by a value chain. The tags can be utilised at phases within the supply chain on pallets, containers, packaging, individual products and boxes [5] [8]. There are several challenges faced by adopting RFID, these are dual system management commitment, operational automation, cost challenges, patent and legal challenge, selection of software and hardware, support of technology for purpose of adoption. The goals of this research are:

1. To explore the understanding of IT, internal SCM and RFID Tags
2. To evaluate the common challenges and barriers faced by implementing RFID tags
3. To examine the steps involved in the implementation process
4. To understand standards, components and the frequencies of RFID

The main two research questions for the study are:

- What is the major impact of IT on ISCM through implementing RFID tags system?
- What are the challenges commonly faced for implementing RFID tags?

The research holds a significant place in understanding supply chain management within an organization. The companies require IT techniques and methods for enabling the integration of internal functions of the business. This can support companies for becoming efficient, promoting productivity and responding rapidly to a need of customers [2] [25]. The SCM system is the information process for transportation management, warehousing, logistics management, manufacturing, inventory and customer management. The organizations can heed the advances within IT techniques and methods that can enable the addition of external business operations. The companies may become extended through enabling a process of connectivity, suppliers, business partners and the customers [4].

There are three main levels such as strategic, operations and tactical. These levels of relationships are characterized by sharing information and behaviour of supply chain organizations. The RFID is a well-known tool used in a business for some perspective of business including the SCM. The SCM within an RFID is a developing technology that supports for making and being capable of close cooperation of SCM partners through visibility on a real-time basis [5] [23]. This research holds a significant importance because various companies have adopted IT technologies and systems, such as Barcode system and RFID to improve its operations, this has made the research to become essential for being conducted to identify various areas, and evaluate pros and cons for adopting and implementing RFID tags system within an internal supply chain management system [7] [10].

II. LITERATURE REVIEW

This section of the research study presents the evidence and data from previous researches from well-known journals, and articles. Number of studies that are carried out helps to identify various factors that contribute to impacting ISCM within an organisation, specifically the process of implementing RFID tags [8] [25].

The IT sector is realised as a problem holding importance for the system of RFID for supporting SCM. It also presents various perspectives through modelling item-level data and information visibility in general [12] [10]. The enterprises also use RFID for attaining an organisational change and managing the development in a competitive environment.
The technology of RFID is significant for supporting a discussion based on time in a SCM. While, RFID is also considered to produce various benefits within supply chain management and providing insight into the competitive sight as the value of RFID.

The research study reveals RFID tags to improve visibility and traceability of processes and products, with the speed of the process, increasing efficiency, decreasing the losses of inventory, and improving the accuracy of information [15] [21]. The applications of RFID within SCM takes the advantage of technology that has an objective for accelerating process and decreasing down the cost but RFID characteristics are found within a latest information with respect to time and helping in process of making a decision. For purpose of executing a RFID system, the organisation is required to present the issues of cost, rules, technology development and international standards. The RFID technologies can promote the performance of the supply chain at various ratios [22] [25].

Within the context of the supply chain, RFID has various benefits, the readers can read various tags in a simultaneous way without needing a line of sight or the involvement of the individual. This may cut inventory control, cut checkout, and loss of the prevention cost. The RFID can promote a performance of supply chain by asset tracking, product recall and product origin tracing [19].

The demand planning is a common challenge that presents a lack of reliable, timely and adequate data. RFID can provide information related to inventory of work in processes finished goods and the transit. The RFID enables a process of automation for instance, cross-docking, picking, and shelving [17] [23]. The functions are consolidated and logistic is costly if it is not dispatching a correct customer at the right time.

In total the existing areas are three classifications of RFID tags these are familiar to the consumer that uses the technology, these are active, passive and semi-passive. Taking the purchase of tags for various scenarios, pinpointing the type of tag to integrate and use in operation may be tricky [9]. The active tag has its own power source and transmitter that is an availability of batters present on a tag. It is a UHF solution and the range of reading may extend to 100 m in certain instances. The active tags are expensive and larger but commonly used in tracking a large asset, such as cargo containers, machines, and vehicles. The active tags have a sensor that measures, light, transmit temperature, humidity, vibration data and other objects [15].

The passive RFID tag solution presents the reader antenna for sending the sign to the tag and used to control over the tag and mirroring the vitality to a peruser. There is different latent including low recurrence. High recurrence and ultra-higher recurrence framework [10] [13]. Its read range is regularly shorter than a functioning tag and restricted through the intensity of radio sign. The third kind of tag is a half and half sort, known as, battery assistive latent, that joins a force source in an uninvolved label arrangement. The force source underpins guaranteeing the vitality that is caught from the peruser that may mirror the sign and improves for perusing the distance and transferring rates. Unlike the active type, BAP tags do not have their personal transmitters [20].

There are various benefits of implementing RFID technology in ISCM few among them are improved quality for capturing the data, the RFID approach helps to capture data in an accurate and rapid way. The electronic data collection with RFID use to avoid transcription when used for collecting data on a large number. The second benefit is decreased capital costs, it helps to decrease down the cost for providing control of assets or stocks. This can help for keeping on track for business, for example, computing technology, portable devices and test equipment [16] [21]. Using an RFID system can help in attaining access to the control system by using RFID and contributing to the business premises and improved security. The tagging of assets and stock makes simple for tracking the inventory shrinkage and tags that may be used to fight in opposition to product counterfeiting [14].

The major challenge regarding RFID technology is the costing of the RFID system. The recent study revealed RFID

**Table I: Active and Passive RFID Tags** [6]

| RFID Tags | Active RFID Tags | Passive RFID Tags |
|-----------|------------------|------------------|
| Tag power source | Internal to tag | Energy transferred from the reader |
| Availability of tag power | Continuous | Only when there is no change of the reader |
| Required signal strength from reader to tag | Low | High |
| Available signal strength from tag to reader | High | Low |
| Communication range | Long range | Short range |
| Multi-tag collection | Scanning up to a thousand tags simultaneously | Scanning up to a few tags simultaneously |
| Sensor capability | Ability to monitor continuously sensor inputs | Maintenance inputs when tag is powered from the reader |
| Data Storage | Large | Small |

![Fig. 1. RFID Benefits and Challenges in Supply Chain Management](image)

The most known selection of tag for using a supply chain is a passive tag that takes impacts in the UHDF is a range of frequency. The tags also use to differentiate through the capability of data storage. The tags differ through a data storage capability there are most common two main classifications of RFID tags these are READ-ONLY TAGS and READ/WRITE TAGS [4].

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RFID innovation can produce store network combination because of the joint effort sum and trust it requires. The innovation is a data sharing framework, that licenses accomplices to trade data about interest stock and estimating, from crude materials are done merchandise. In the event that an organization is incorporated with providers on the off chance that they work either in resistance or support for the selection of RFID [5] [17].

It also allows the It additionally permits the stockroom stock administration, guaranteeing that sent item adjusts to genuine transportation request, restocking the stock-outs at a degree of offers, refreshing administrators with period of generation, improving a degree of efficiency, reducing the paperwork, current phase of a production, enhancing a clarity of process in context of product development by mean of supply chain reducing cost of lab our, rendering an inventory forecasting adequate [18] [23]. This technology supports for tracking an item that is tagged transversely a supply chain.

Instead of the advantages of RFID, there are a few disservices corresponded with an innovation that should be handled through firms. The RFID labels include a huge scope of information that in certain raise protection concerns [14] [21]. The exact investigation did present that 73% of 129 clients might want RFID labels on the item acquired for evacuating at a checkout level because of worries of clients with respect to information put away on labels. Notwithstanding protection concerns, while information put away on a tag doesn't observe the standard arrangement that can be known through different firms over the inventory network that can bring about bogus information stockpiling on a database of firms [20].

The usage of RFID permits to monitor the elements as they use to move among organisational divisions, Tags are able to take the information, a tagged material and product may be tracked at various positions. The data is stored in the RFID tag’s microchip that is associated with an antenna [22] [25]. The tag chip includes a memory that stores an item's electronic item code and data of factors. The RFID reader is a system that is associated gadget with receiving wire and peruses and tracks data from labels of RFID. The data gathered from labels is then Data is put away inside the RFID label's microchip that is associated with a reception apparatus

- The label chip contains a memory which stores the item's electronic item code and other variable data
- The RFID peruser is a system associated gadget with a reception apparatus that peruses and tracks the data from RFID labels [6].
- Information gathered from the labels is then moved through a PC framework, where the information can be put away in a database and dissected later.
- RFID is utilized in many enterprises however it is the core of the production network the executive’s procedure.
- It is moved through an arrangement of the PC where information can undoubtedly be spared in a database and deciphered. RFID is used in ventures yet it is the core of the SCM procedure [5].

There are some important considerations for executing an RFID, this information might be capable to read through anyone that is well-matched reader and outcome in less privacy and security. It is difficult to attain commitment from a professional and partners of the supply chain due to without them a project is sure for being failed [11]. The pricing for implementing RFID in a SCM is high and it may result in roadblock for purpose of undertaking of technology. The new technology may not be present to a supplier. The RFID system includes three main components [4]:

- The coil or antenna
- The transceiver with having a decoder [17]
- The RF tag element transponder is programmed in an electronic way with having a particular information

The radio signs are additionally transmitted by reception apparatus enacts a tag and guys to compose and understand information. The reader sends the rushes of radio dependent on a force result to a removed spot from an inch to a hundred feeds. The RFID tag at the hour of entering an electromagnetic zone, it looks at the initiation sign of a readers [7]. The data is encoded in an integrated tags circuit that is decoded through sent and reader to a host computer for the purpose of processing. The transmitted data also present information about a price, location, colour of product and date of purchase etc. The RFID tag has a microchip that is connected to the radio receiving wire that can peruse two kilobytes of information. The peruser
explicitly has at least one radio wire that supports recovering information that is put away in the tag [5].

The RFID has an effective contribution to the execution of the inventory network. It deals with a procedure of production network adequately and bolsters the organization to develop. The procedure of the store network might be alluded to as a chain comprising of the provider, producer, transporters, merchants, retailers and retail clients [13].

The inventory network the board might be alluded to as overseeing exercises that can be completed for changing an assistance or item from a degree of the production network to another. The suitable coordination and arranging are expected to arrive at clients and fulfill them. The significant issue is a degree of stock is for keeping up at a degree of the production network [16] [20]. The issues that are identified with stock, for example, stock-outs, abundance stock, wastage of materials, wellbeing, loss of offers and burglary and so forth may affect the adequacy of the store network strategy. The procedure of the inventory network can have various providers, stockrooms, retailers, transporters and merchants [16]. It introduces an entangled procedure of store network and level of trouble for being overseen. The administrations and items from the maker to end-clients it’s expense and qualities at included a degree of inventory network process. The proficient and viable store network has a plausibility if there is a sufficient progression of data at the degree of the production network technique and satisfactory stock being regulated. Every level has a track of expected and actual sales and stock [12]. The customers have become trendy and demanding. They desire the service and products that they use to purchase. So, they have a maximized efficiency to meet the customer demand over time. The RFID is basically a technology that permits for solving some problems to meet the customer’s demand in an efficient way [14] [20].

RFID technologies and applications are evolving and diverse in a rapid way. RFID technologies vary in the context of abilities for instance, memory capacity, size and range of capacity. The individual RFID application involves a range of various operations and sectors of industry [14]. The attempts to concentrate and support effort over specific technologies or applications it may diminish the resource for revenues and distort the market for equipment and elements. The government policies help in expanding and using the benefits of RFID and it must not favour technology or the application over another [2] [12].

RFID can result in autonomous warehouses and centers of distribution. This is observed in warehouses with an increased automation level, in which picking machines transport the bind of products to a central area of sorting prior to returning to its location [9]. A frequency that is used for the application of RFID is a significant characteristic of RFID Systems. The diversity by regulation through the country for purpose of RFID allocation while it is being placed. The major problem in an RFID system is the presence of various standards., The national allocation for the RFID is a main issue to an application of system of RFID in the world and it is a major problem to technologies in the context of standardization. The high frequency presents reading distances and fastens the communication. The lower-recurrence inactive labels have a viable kind range that is around 30cm, the high-recurrence latent labels are essential in range for 1m [4]. The UHF is known as ultra-high frequency passive tags that have the appropriate range of 8m. The dynamic labels are self-controlled and costly than uninvolved labels however it can achieve a scope of 100m [5] [21].

RFID innovation is conceivable and present in the territory of human action. The assortment of undertakings is using RFID for improving the productivity of tasks and accomplishing an upper hand. The advancement inside RFID is absent in innovation however its utilization within the process is a real business [7] [25]. The quick development and growth of advancement and development of Information innovation and diminishing costing of RFID framework segments has introduced a steady extension of use areas. The utilization of RFID innovation in inventory network the board have accomplished explicit consideration in years. The common RFID applications are real-time warehouse operation planning process, product development, solving the materials of production and demand for the issues within a manufacturing environment [9]. However, it can be said that emerging IT and implementation of RFID within an organisation either within different sectors have a positive impact on the internal supply chain management. However, categories of the tags are available while it also has various benefits and challenges that are most commonly faced by the industries by adopting RFID technologies and implementing them in their supply chain sector [4].

III. METHODOLOGY

This chapter presents the understanding of the method that is adopted by the organisation and IT sector to affect the internal SCM through implementing RFID. This also presents the research design, qualitative approach, validity, reliability, sampling size, the method used, and ethical considerations that are undertaken for promoting the authenticity of the research.

It is an action plan that helps in providing the adequate efforts and understanding, enabling to carry out the research in a systematic way and on schedule to provide the quality result and detailed reporting for showing the research [3]. The quantitative survey is referred to as a method in the research of a business, or research related to an organisation.

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that supports and permits access to a high number of participants. The quantitative method is an appropriate method of research that provides a response through a wide or small range of participants [17]. The development of the question also seems to be simple, and develops the meaningful questionnaire that supports answering the research question is tough. The questionnaire requires appealing to respondents that may not belong and intrusive but tough to understand [6]. They also require to measure an accurate way, the issue in an investigation. It is also advised while possible for using a questionnaire that is present on the market and has already been validated. Using the decisions of the questionnaire, it is important to take the sample size under consideration and representative as the population studied. The surveys may be administered to a whole population for employees of a specific organisation [19].

The total number of participants selected for the study is 50 in number. The simple random sampling method is used for the research study. It is a subset of a statistical population in which every member of the subset has the same probability of being elected [7]. It is meant to be an unbiased representation of the team or group. This method is used for smaller sample sizes from the larger population and uses it to research and making the generalization about a larger group. The privilege of this sampling strategy involves its ease of use, accurate representation of a large population.

The content chosen for the study is a literature review and quantitative research that is an objective study carried out through survey responses. The content for literature is chosen from an accessible site, these included books, journals, articles and published materials within libraries. The data is reliable and valid because all data gathered is from the previous seven years of published materials.

The data was gathered from participants by distributing the survey questionnaires among 50 participants. There was a total of 52 participants, among which two of them have declined to participate within a research while, the data for questioner or survey was selected from SPSS and presented in geographical and chart formats.

Ethics is an important part of the research study. The ethical consideration includes five different elements [5]. The confidentiality of the participant was maintained during the survey, the participants were given autonomy to decline to be a part of research if they face any harm or issue, the principle of non-maleficence and beneficence were maintained, this presents that no participants were harmed either physically or psychologically. The research was carried out for the benefits of organisations instead of benefiting researchers [7]. While the fidelity principle was also maintained. However, all participants had voluntary participation, no participant was forced to be a part of research every individual by its own willed to be a part of a research study. However, to ensure this, informed consent was distributed and signed which is a permission letter and assured of the safety of personal information.

A. Research Hypothesis

- **H1:** Internal SCM of an organization has been enhanced by RFID due to its Automatic Identification
- **H2:** Internal SCM of an organization has been enhanced by RFID due to its Mass Scanning System
- **H3:** Internal SCM of an organization has been enhanced by RFID due to its Efficient Integrated System

IV. Analysis

This section presents the interpretation through SPSS this reveals the statements and analysis on basis of Likert’s Chart.

A. Findings of Survey

The histogram below presents that RFID technology supports reducing the overproduction by mean of being aware of goods and materials present within the stock. It is true as evaluated from literature, 17 participants strongly agreed with this statement. Because it can help to reduce down the overproduction and save from wastage.

The second histogram presented below shows a high score of strongly disagreeing for which 15 participants said that supply chain supports in determining the category of product that is needed as a product or service that customers use to predict the amount and timing demand of the customer. Only 13 participants disagreed and only 6 of them agreed with the statement.
The 17 participants agreed with the statement that supply chain uses to meet the demanding needs while, managing a cost of inventory in an effective way, 14 participants sat neutral, 8 disagreed, 7 strongly disagreed and 4 strongly agreed with the statement.

The total 12 participants disagreed with the statement, that RFID does not possess’ advantages for example, the increased capability for storage, repeated writing, remote reading, and improved data security. The 10 strongly disagreed, 11 agreed and 9 set neutral while, 8 strongly agreed with the statement.

The 17 participants in total presented that It adds value to services and products is a common advantage for adopting RFID. The 15 presented that it improves customer service and decreased time, 9 said that it helps in cost distribution material handling and poor quality while rest 9 also presented that it helps to change a business.

The 19 participants revealed that IT RFID improvements help to improve the inbound services for managing a supply chain, 19 participants agreed that it needs to make improvement by integration and adoption of easy services, while, 12 participants agreed that improvement can be bought in ISCM by processing a need for improvement.

The below graph shows, the majority of 13 participants sat Neutral that the use of RFID technology support reduces down the unnecessary inventory through improving the visibility.

The below graph shows 18 participants said that supplier relationship management is a category, 18 presented CRM, and 14 revealed internal supply chain management.
The below graph shows 16 participants strongly disagreed with the statement that SCM of the organisation has improved by RFID due to the purpose of Automatic Identification. While the scores for other participants were minimum that responded to the question.

The 17 participants in total agreed that SCM of an organisation has been promoted through adopting RFID due to a MASS SCANNING SYSTEM, they revealed it as an effective method, while 14 also strongly agreed with the statement.

The 16 participants in total agreed with the statement, that SCM of organisation support for enhancing RFID by an efficient integrated system. While, 10 strongly agreed, and 9 set neutral, 7 strongly disagreed and 8 only disagreed with the statement.

The 19 number of participants strongly disagreed that they do not believe in a Mass scanning system to be adequate for tags detectability.

The graph below shows the total 24 participants strongly Disagreed with the statement that automatic identification helps in the time efficiency and constraints. While 14 agreed with the statement.

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communication through a two-way mean can make possible for shipment orders, as a priority for the customers. It helps to mitigate the cost through decreasing labour and time needed for manual input of data. These systems help to promote the accuracy of data, that benefits operations and sales planning and practical way to support firms afloat the economic climate. The cost saving is another element the estimated saving of 30% of 2 to 4% in operation expense that is typically spent over costs of distribution and warehouse.

VI. CONCLUSION

The paper addresses the effect of IT on ISCM of an organisation and its functioning, the implementation of RFID tags has various benefits within supply chain management, it promotes, cost efficiencies, effectiveness and various other elements. According to the research studies, RFID is a way to future, while the future belongs to a solution that is innovative, flexible and affordable and offers enhanced customer service. RFID is perfect and matches the futuristic solution. It is a most promising, anticipated and evolving solution that is executed within the recent duration while, demand and the rise in the technological advancement has supported the E-commerce and concept of M-commerce needs management, inventory and RFID is one that has a core potential for increasing the return on investment to serve the customer in a faster way, it increases accuracy and reliability, at the similar time, it improves an SCM process. The survey interpreted that the major benefit of RFID tags implementation is data transfer can easily be done, However, there are three main activities of supply chain management as interpreted from the survey.

There are various areas in which the research can be carried out. These include a bar code system, RFID system and implementation process, improvements that could be made in chip and other areas. However, the research can also be carried out in the healthcare sector, aviation sector, wholesalers and various other industries of food chain restaurants and suppliers. The future implications have various benefits to be evaluated. Implementing RFID systems and RFID tags are effective for promoting the worth and value within the interior supply chain sector.

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