Rfid-Reshapes the World of Supply Chain Management

Rajkumar Sharma[a] and Piyush Singhal[b]

[a] Department of Mechanical Engineering, GLA University, Mathura, India.
[b] Department of Mechanical Engineering, GLA University, Mathura, India.

_____

Abstract: The significance of RFID for problem solving of the supply chain is underlined. RFID is an excellent element for all industries to work smoothly. The overwhelming utility of RFID technology is widely used. There is hardly a sector where we do not use RFID, whether it is manufacturing, retail, marketing and sales, shipping, etc. Each pallet, container and commodity to be manufactured, supplied and sold is defined from RFID. It ensures quite simple and error-free business operations. It allows the industry to achieve the right quality, the right price and the right time for end users. In terms of sales and customer satisfaction it gives full benefit. The paper proposes an efficient conceptual model RFID in procurement process. Furthermore, they define attributes which facilitate the choice of RFID. Finally, the section presents the problems and advantages businesses will achieve from using this application. The supply chain mechanism is carried out through various phases called supply chain stages.

Keywords: manufacturing code (MC), electronic product code (EPC), radio frequency identification (RFID), Supply Chain Management (SCM), rendering of investment (RI).

_____

1. Introduction

Uncertainty in supply chain was handled by a small amount of data – a serial number or other special characteristic for a product – is found in a radio frequency identification unit. The data can be read remotely – no touch or even sight line is required. The main body for how simple Product Knowledge is protected in the RFID chips is the EPC -Electronic Security Code. The value of an EPC is essentially the idea that products and records may be stored in an expanded organization immediately. Passive, semi-passive and active RFID tags are forms.

Its goal is to optimize consumer satisfaction and reduce expense, to improve long-term market efficiency and the overall supply chain [1]. Much of the advice gained from modern companies suggests that the "supply chain vs the supply chain" rivalry is being waged rather than "society versus business." Therefore, it is of that significance that products and services are provided entirely, timely and error-free to consumers with every company, irrespective of the scale or industry. Visibility in the supply chain is an essential element in any commercial process from market forecasts to the purchase of raw materials, to development and dispatch. Executives are worried about how to exploit new information technologies, such as RFID, to create innovative opportunities for service innovation, management and marketing. This special issue invites papers on RFID, information systems and supply chain management in the broad field. RFID technology is often used by retailers very extensively because it helps to minimize contact differences between manufacturers and retailers by converting the correct information in time [2]. The increase in the electronic retail in the form of bar code scanning has accelerated the marketing function of the majority of retail organizations, as well as in the global mobile system, the adoption of RFID and other electronic gadgets. In addition, essential customer information can be gathered and operations can be coordinated via RFID. RFID is reliable and efficient in the inventory management system.

The usage of RFID technologies would enable the development of a manufacturing plant in real time that is linked to a sensor. Through applying RFID tags to each component, device, resource and piece of equipment for the management of materials, manufacturers may obtain better consumer and business demand signals [3]. At its heart, RFID is essentially a technology that enables marketers to produce the right product at the right moment, optimizing revenues and profits. In RFID, power and stability is a unique combination. RFID buying firms have a fresh degree of flexibility in the supply chain. This revolutionary development enhances the chain-wide and beyond vision of products. In the future, management of the supply chain would need more than just crates. Manufacturers learn more about their products than just figures use REID technologies.

2. The Real Sense - RFID:

Bulk reading is not accurate under operating conditions. Mass reading can be a rough guide for assessments in logistics. However, it is not (yet) (when?) ideal for business processes due to the high ratios of reading errors. But if a single RFID tag is considered to not guarantee proper reading, multiple RFID tags, in which at least one is responded to, could serve as a safer way to detect a known grouping of items. Mass reading is a fluid

approach for supporting processes in this regard. From a cost-effective aspect [4], bulk reading is not mentioned as an economical approach to secure procurement process control.

   • Radio Frequency Identification Tool carries a limited amount of identifying details-a serial number or another specific feature of the object. The data can be read remotely – no touch or even sight line is required.

   • RFID-is a device using radio waves that allows for the detection and remote monitoring of objects, pets, and even humans.

   • RFID aims to substitute barcodes.

2.1 Working of RFID

   The "Machine" RFID includes a single string. Per product has its own "Identification" with an RFID sensor. In order to transfer the identity of an object wirelessly, RFID uses radio waves (as a specific product code). Garment, human body and non-metallic materials may be used to access RFID data.

   There are three components in a simple RFID framework:

   A spiral or an antenna;

   A decoder-induced Transceiver;

   Digitally controlled transponder (RF tag) with unique details.

   The radio signals emitted by the antenna allow the tag to be read and comprehend information. The reader transmits wireless signals from an inch to a hundred feet or more on the basis of its output power [5]. RFID tag detects the reader's activation signal when entering the electromagnetic field.

3. Electronic Product Code

   The global Tag Data Standard specifies the URI syntax and digital code framework as well as encoding and decoding rules that permit conversion of these images. The EPC is developed as a modular platform to complement a variety of existing coding schemes, with several new bar-code coding systems. Currently, EPC identifiers support 7 GS1 ID system identification keys, as well as general IDs and EPC IDs which can be used for the encoding of the U.S. Department of Defense supplies [6].

   • EPC National, the standard association establishes guidelines for the encoding in RFID chips of specific product details.

   • A radio frequency identification tag encodes the specific number, called an EPC (electronic product code). Three forms of RFID tags are usable, which can be read first or read later.

3.1 Electronic Product Code Benefits

   Improve control of the supply chain. Because at each delivery stage, the position of a component is precisely known, the whole supply chain may be verified with almost 100% precision. Health, authentication and protection. The identification picked by the client will be used to construct an RFID identifier. It can be used to authenticate component or record with this special identity. The RFID technology also allows for cryptography and other security models, making it impossible to double or counterfeit a tag quickly.

   • The value of the EPC code is largely derived from the ability of an expanded organization to instantly identify the exact place of the products or records everywhere [7].

   • The following benefits are obtained from this ability:

   • Customer satisfaction enhanced. Customer service can be improved through the implementation of RFID technology by providing quicker tests, refunds and customized service.

4. RFID Types

   RFID tags can be characterized according to the frequency spectrum used (low, high or very high) and the manner in which the tag interacts with the reader (active or passive). Below are the various forms of Sensor technologies, their ability and drawbacks and their application programs [8].

   • Global Supply Chain RFID-Reshapes

   • RFID reader can search and document the serial IDs on screens and in a server for RFID tags.

   • Writes tags with customized details.

4.1 Active RFID

   Active RFID tags have a separate emitter and battery source on the tag. These remedies often are UHF, and in certain instances reading limits can reach up to 100 m. Active tags are typically bigger and more costly than passive ones and track major assets. Even the active RFID tags also include devices to monitor certain climatic conditions and shock/vibration data of the objects to which they are attached. Active RFID is operated by batteries that enables the tag to obtain very low signals, and the tag can return high-level signals [9].

Two kinds of active tags are available. Transponders can only "wake up" and relay data when a radio signal is received from a reader. For example, a transmitter connected to the automobile at a toll or control point will be activated only when a certain door was passed. It helps to maintain the life of the battery.

Advantages

• Long distance communication with an active transmission may take place. Active tags can be used to communicate over 300 feet, somewhere around 3 times as many as semi-passive tags.

• As active tags use a powerful antenna, they need not rely for all their signal strength on a powerful surveyor.

• You can also use an efficient software, additional detectors, extra storage by adding a larger battery, and even more elements as a whole.

Disadvantages

• Cannot run without the control of the battery that restricts tag existence.

• It is normally more complex, sometimes costing $20 or more.

• is wider visually and can hinder implementations.

• If batteries are removed the long-term maintenance costs with an active RFID tag that be higher than that of a passive tag.

Battery failures will result in costly mis readings in an active tag

4.2 Passive RFID

Passive RFID expresses energy absorption from the reader and stores very powerful messages that need little electricity. The receiver and reader antenna issue commands to the tag in passive RFID solutions and this signal is used to operate the tag and display the reader's power. The Low - frequency, High frequency and UHF modules are passive [10]. The spectrum of readings is less than that of active tags, and the strength of the wireless signal is reduced. There is no need for passive RFID device tags as they receive their energy from the question signal of the reader. A reader sends a strong signal to all tags in the read frequency range to read tags within this configuration. The tags receive this signal from your receivers and use their energy to power your ICs. The tags use inferential and backscatter connectivity to interact to the reader after their processors finish their tasks. All these features suggest that there are a number of pros and cons with the use of passive RFID tags

Differences occur in

Influence mode of interactions,

Room for multi-day compilation

Room for attaching sensors and

Logging of data

Advantages

• Additional tags using a battery can last only 3-5 years. The durability of passive tags varies with the type and the environment in which they are produced. They will work up to 20 years when put in a friendly environment

• Usually, processing is often easier.

• The compact structure of a passive tag ensures that there's always minimal weight.

• Printed circuit board without active antenna produce virtually no noise from inductive and radiative coupling.

Disadvantages

• Maintaining power is needed in most sensors and data storage is possible. This means that passive tags are inappropriate for most sensors.

• Passive RFID tag types need an even powerful reader.

• A passive tag has an extremely limited frequency spectrum because of the lack of an active antenna

5. Supply Chain Management

Supply Chain Management (SCM) is as effective as practical to schedule, execute and track supply chain activities. Supply Chain Control includes from point of production to point of use both transport and supply of raw materials, inventory of job in-process and finished products [11]. The administration of the supply chain is a cross-functional method for handling deliveries of raw resources through an enterprise, other elements of the internal transition of commodities through finished items and also movements of finished goods from the company.

Supply chain execution controls the transfer of knowledge and services across the supply chain and schedules it. The movement is two-way. Its goal is to optimize consumer satisfaction and reduce expense, to improve long-term market efficiency and the overall supply chain. Information systems form the backbone of every supply chain and are focused on robotic data acquisition strategies in order to achieve the purpose of information collection. RFID is a unique technology that improves data collection processes along the supply chain. It has unique features as shown in fig:1.
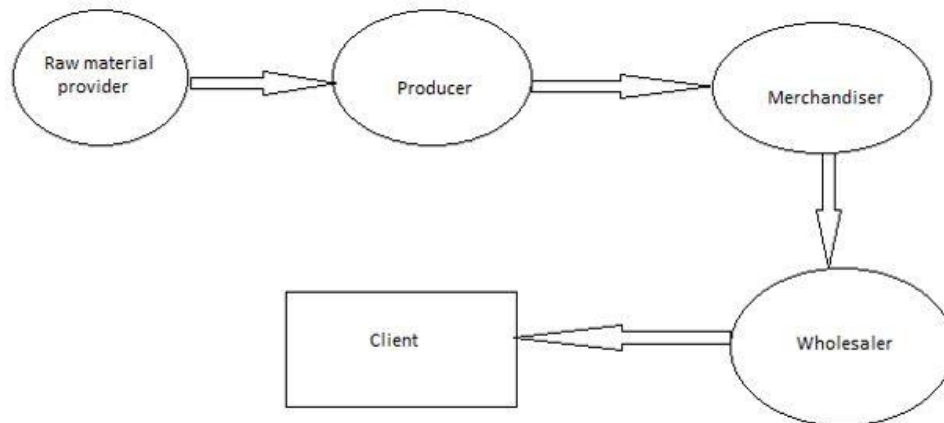
Fig.1. Flowchart for Supply Chain Management

5.1 Impact of RFID in Supply Chain Management

Every aspect of the supply chain administration, from simple tasks, for instance moving goods through charging doors to complex ones as data management terabytes as information on the goods on hand is gathered in real time, will be significantly affected by RFID. The company can improve the supply chain dramatically by reducing costs, inventory levels, lead times, inventories and reductions [12]; increasing output, quality, production flexibility, visibility of stocks, accuracy of inventory records, accuracy of order and customer service and co-operation between supplier companies.

5.2 Benefits of RFID in Supply Chain

RFID can boost organizational and technological monitoring, transparency, performance and operation pace, accuracy of information and loss in supply. Although the authors have shown some advantages in supply chain RFID technology, they also highlight the constraints of past research and need more practical study of the supply chain. Applications are available in manufacturing, storage / dealing centers, logistics and retail environments. FID system ERP combine a variety of enterprise services that involve quick and precise access to data. In different industries, interoperability of the distribution network and ERP system are also essential.

5.3 Manufacturing

The use of RFID makes it possible for materials, goods, equipment, or staff to communicate better. It allows more individualization since the product communicates at every point in the chain what it wants. The status of the product can be stored and automatically updated on the mark itself at the end of any stage in the production line. Diagnostic or analytical software may access tag data in real time. At any step in the cycle, the on-chip safety mechanism serves as a measure for authenticity, consistency and safety. You calculate the rendering of investment (RI) through increasing visibility and work-in - process (WIP) inventory accuracy to understand the effect of RFID on the production floor environment. The operating cost is reduced and the profit is therefore increased. Due to increasing manufacturing speeds and reduced inefficiency of the production line, driving times and total cycle times are shortened.

5.4 Warehousing

In factory and logistics center settings the automated recognition of RFID-containing items results:

Enhanced product awareness and precision in effect boost warehouse performance and order consistency, and reduce retrenchment, retail inventory supplies and rates.

• Reduced running expenses, which implies better income

• Shorter lead times indicates improved client satisfaction and lowered supply chain supplies. In the end, decreased stocks raise ROI as shown in Table 1.

Table 1. RFID implementation with their advantages and effects on various parameters

Supply chain factor	Current state	RFID opportunity and challenges
Type demand	Predictable	Improve leanness capabilities

Contribution margin	5 to 20 %	Early adopters can increase the margin, need cheap tags
Product variety	Low (10-20 variants per category)	Suitable to track products by pallets or cases
Average margin of error in demand forecast	10%	Room to improve forecasting through visibility of inventory and demand
Average stock out rate	1- 2%	Opportunities for reducing stock out and increase margin significantly"

A distinguishing advantage is the usage of RFID systems to monitor properties. FID tags enable the asset pool to be more transparent and precise. Six primary fields are influenced by this clarity and precision: Price, reduction, lead times, visibility and specific inventory, customer care and parental integration. The automated detection of items inside the shop will improve the efficiency and reliability of the inventory. In four fronts this will have an effect: Shrinking, company care, inventory rates and stock outs Reduce rate of loss, boost sales. The availability of complementary applications provided by RFID improves customer support and the shared experience. As a result of improved product availability, stock out rates may be decreased. Reduced stock production reduces revenue and gradually raises earnings. Reduced product production often improves customer satisfaction. Finally, stock rates may be decreased and the ROI may be raised.

6. Conclusion

This paper examines the effect of use of RFID technology in business management processes. This proposal recently reveals considerable benefit for the business in enhancing efficiency across the supply chain. The sum of R&D dollars spent would increase the efficiency and consistently decrease costs. RFID is currently in operation as an integral part in supply chain strategies. Such RFID businesses are winning comparative edge early on. However, the implementation must be carried out properly by specifically identifying the method and ensuring that the appropriate equipment is used. In the future, management of the supply chain would need more than just crates. Manufacturers should learn more than just statistics regarding their inventories through RFID technology. Accuracy of data across the supply chain increased on implementation of RFID in business processes.

References

1. Sharma, Rajkumar & Singhal, Piyush. (2014). An Optimal Treatment to Supply Chain Disruptions Using
2. Model Predictive Control.
3. V. Kumar, R. Sharma, P. Singhal, Demand Forecasting of Dairy Products for Amul Warehouses using
4. Neural Network, Int. J. Sci. Res. (2019). www.winkipedia.com.
5. S. Garg, R. Sharma, P. Singhal, Forecasting of Demand for Small Medium Enterprises Using Fuzzy Logic,
6. Int. J. Sci. Res. (2019). www.ijsr.net.
7. Khoo, Benjamin. (2013). RFID Technology in the Supply Chain: Issues, and Implications for Research and
8. Practice.
9. Pal, Amit & Tripathi, Akanksha & Saigal, Anupam. (2020). RFID TECHNOLOGY: AN OVERVIEW.
10. International Journal of Research -GRANTHAALAYAH. 5. 176-182. 10.29121/granthaalayah.v5.i12.2017.491.
11. Korošak, Žiga & Suhadolnik, Nejc & Pleteršek, Anton. (2019). The Implementation of a Low Power
12. Environmental Monitoring and Soil Moisture Measurement System Based on UHF RFID. Sensors. 19. 5527. 10.3390/s19245527.
13. Ermolov, Vladimir. (2019). Screen-printed and spray coated graphene-based RFID transponders. 2D
14. Materials. 7.
15. Kong, Hongshan & Yu, Bin. (2019). Modeling and Optimization of RFID Networks Planning Problem.
16. Wireless Communications and Mobile Computing. 2019. 1-7. 10.1155/2019/2745160.
17. Saadi, Hadjer & Rachida, Touhami & Yagoub, Mustapha. (2019). Role and Application of RFID
18. Technology in Internet of Things.
19. Spiridonov, Iskren & Shterev, Kosta & Bozhkova, Tatyna. (2018). Future Development of Security Printing
20. And RFID Marks. 71-76. 10.24867/GRID-2018-p8.
21. Dinarvand, Negin & Barati, Hamid. (2019). An efficient and secure RFID authentication protocol using
22. elliptic curve cryptography. Wireless Networks. 25. 10.1007/s11276-017-1565-3.

23. Naranje, Vishal & Swarnalatha, Rajguru. (2019). Design of Tracking System for Prefabricated Building
24. Components using RFID Technology and CAD Model. Procedia Manufacturing. 32. 928-935. 10.1016/j.promfg.2019.02.305