Role of RFID in Machinal Process of Manufacturing: A Critical Review of Contemporary Literature

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Abstract

RFID (radio frequency identification) is a new technology that is being utilised more and more in supply chain management. RFID technology, with its capacity to recognize, detect, as well as monitor data along the supply chain, has a tremendous impact in facilitating logistics and supply chain procedures. The system can give suppliers, manufacturers, wholesalers, as well as retailers with exact real-time inventory details. This precise stock information would result in decreased cost of labour, mechanized corporate protocols, as well as enhanced supply chain effectiveness. It has the ability to reduce ordering wait period as well as Inventory management expenses, improving the quality of inventory data, assist minimise stock outs, as well as increase the cadence of stock movements, if performed appropriately.The adoption of RFID technology has sparked significant discussion and conjecture regarding their potential consequences.RFID is an emerging technological innovation that permits supply chain colleagues to collaborate closely by offering real-time knowledge transparency.A sample of 189 respondents from the manufacturing section of different industries were surveyedknow the Role of RFID in Machinal Process of Manufacturing.It is found that there is a significant role of RFID in the mechanical process of manufacturing.

Keyword:RFID technology, Supply Chain Management, smart technologies, manufacturing companies, consumer application.

Introduction

Radio frequency identification (RFID), an innovation relying on the transmission of knowledge via electromagnetic signals, is one of the most extensive yet intriguing wireless non-contact technologies. RFID is being utilised in a variety of applications due to its capacity to recognize as well as monitor items, including aerospace, architecture as well as building administration, healthcare, ecommerce, transportation, as well as surveillance, among others. Since it openly manages produced items, resources, as well as procedures, radio frequency identification (RFID) technology empowers industrial organisations to achieve quick tracking as well as transparency. RFID has emerged as a key motivator in manufacturing as well as supply chain operations. Supply Chain Management (SCM) is becoming more complicated as well as unpredictable.RFID as well as the Internet of Things are expected to play a big role in meeting client expectations in the supply chain. RFID has piqued the interest of business and academics in recent years, despite the fact that technology has been around for a long time. The reason for development is that the components of this technology have gotten tiny, less costly, and more effective, making it easier to deploy in a wide range of application. RFID is a wireless communication medium that, in its most basic form, may be utilised as system interfaces for perceiving, recognizing, distinguishing, recording, as well as analysing various items. The benefit of RFID is that it connects physical as well as informational domain and uncovers the linkage between physical as well as information space entities.RFID is a subset of Automatic Identification and Data Capture (AIDC), which uses wireless connection to scan numerous RFID tags at the same time.

Chaudhuri, et al. (2018) concluded that in the food sector, it is crucial to track the historical context and localisation of commodities in order to guarantee quality as well as stability across the food chain. In the meat-processing sector, an RFID technology is used to establish product authenticity. Additionally, some major firms in customer bundled products management demand their suppliers to embed RFID tags in palettes or containers in order to optimise warehousing, inventories, and personnel security.

According to **Caizzone & DiGiampaolo (2015)**,RFID technology are being utilised to handle several areas of a hospital in the realm of health sector. RFID technology are used to regulate some processes, such as plasma donations, in order to find the sufficient blood sack for a particular patient. An RFID technology is used to gather data on the mobility of trauma victims.

Abdirad & Krishnan (2021) stated thatmonitoring the location of components in a manufacturing chain is a popular RFID technology application. For example, in the manufacture of robots, the incorporation of an RFID chip allows gathering data on the accompanying duties.Infineon Technologies, one of the world's top semiconductor producers, has developed an authentication and segmentation system based on RFID and ultrasonic sensors with the goal of improving logistics in the wafer production phase.

Literature Review

Zeba, et al. (2018) examined and concluded that the manufacturing industry faces strong rivalry from adversaries as well as high client expectations. Industry 4.0, as a new production framework, mandates its own set of requirements. The fundamental impetus of Industry 4.0 is the emergence of new technological innovations, such as communication as well as information technologies, which have accelerated the advancement of automatic data gathering systems. RFID is one of the main innovations for industrial automation, which includes modern technologies of information and manufacturing. Despite RFID technology is employed in

Croatia, it is not widely used in industries where the major challenge of poor performance is triggered by a lack of inventive competencies and old technological equipment.To attain this aim and boost competition, the utilization of RFID technology in industry as the foundation for digitization must be expanded. The study has two objectives: to give a bibliometric academic assessment on RFID technology, and to illustrate the benefits of RFID technology in the perspective of industrial automation with emphasis to the Croatian sector.

Costa, et al. (2013) concluded and evaluated that the present growth of the Internet of Things (IoT) supports improvements in contemporary industry, energy, agribusiness, as well as transport, in addition to opening up creative possibilities in gaming, amusement, and home automation. Furthermore, the ability to wirelessly integrate persons, things, as well as machines delivers tremendous technological as well as commercial potential in many industrial sectors. Real-time surveillance of manufacturing infrastructure as well as procedures using RFID passive technology is a relevant and usable tool. It is now feasible to implement sophisticated wireless sensor networks precisely into items in production or across equipment and machinery, thanks to new perceiving ICs.RFID technology's pervasiveness provides novel surveillance frameworks as well as methodologies in which the networks are re-configurable, the number of acquisition sites is highly extensible, and single-use applications are viable. In addition, by physically integrating RFID sensors in items, it is feasible to construct smart-objects capable of autonomously interacting with the external environment during their entire existence, from manufacture as well as validation through in-use as well as disposal.

According to **Liu, et al. (2017)**, a Just-In-Moment (JIT) production system is a manufacturing strategy that produces what is needed at the correct time and in the appropriate amount. When a demand comes at a phase, this mechanism allows for the prompt creation of a new portion of that stage. The Kanban management system is a well-known 'pull' control method. A Kanban is a 'visible card' that acts as a management as well as information device in the production and assembly processes to regulate the material flow and optimize the Work-In-Process (WIP) stocks. This study initially explored the significance of real-time automated gathering of shop-floor field measurements during production implementation, as well as current RFID technology breakthroughs in this area.To accelerate the design of WM solutions, a theoretical paradigm was portrayed. A case study is used to show how the suggested RFID-based Kanban system may be implemented in a specialized manufacturing scenario, such as a product assembly line. RFID-based Kanbans are well-suited for adaptive production management and control because to their accessibility as well as transparency of real-time information. Adaptive decision - making process and better organised assembling processes have the potential to improve product assembly as well as part fabrication efficiency as well as reliability on shop floors. This study's sole objective is to demonstrate how RFID technology may be used in Kanban-based shop floor administration. To define and assess the advantages, genuine manufacturing businesses must be involved.

Tzeng, et al. (2008)concluded and stated that RFID system is a very steamy as well as useful innovation in manufacturing as well as supply chain management, which is anticipated to substitute bar-code in stock command, management of materials, dispersion network, online payment, and so on, since a minimal cost RFID tag is competent in terms of reading or writing details of an enterprise without body interaction, has a quick identification pace, and has a considerably larger storing competence when especially when compared to bar-code. RFID readers employ radio frequency signals to connect with back-end databases in auto identification systems. RFID (Radio Frequency Identification), a technology that has been around for a while, offers potential application in a wide range of fields.Though not without faults and obstacles, RFID is a viable technology which researchers predict to become pervasive in the next years, helping firms resolve difficulties in supply chain management, surveillance, interpersonal identity, as well as asset monitoring. The purpose of this research is to employ RFID innovationin manufacturing planning and supervision in the case of a discrete production mechanism that requires real-time control of the manufacturing process as well as boostproduction management level effectiveness as well as reliability. In specifically, we create a RAMS (RFID Activity Monitor System) for hygienic equipment production, which is linked to the pre-existing ERP System via a database to meet the necessity for real-time management.

Rafique, et al. (2016) researched and found that contemporary manufacturing shop floors have a congestion in the capture and gathering of real-time field data. Mechanical paper-based methods are time-consuming, error-prone, laborious, and prevalently destroyed, stolen, or forgotten. As a result, the data does not precisely and timely represent real-life conditions and changes because of disruptions. It is hard to make appropriate shop floor judgments lacking up-to-date information. This study describes a low-cost strategy to improving shop-floor performance through the fabrication of wireless devices, an upcoming futuristic production innovation. For the gathering and synchronisation of genuine field data from production workplaces, WM heavily leans on wireless technologies such as RFID or auto-ID sensor systems, as well as wireless information networks. The reliance is on how to use WM technology to manage work-in-process (WIP) inventory in the manufacturing industry facilities with standard operational designs. This method prevents switching from streamlined to intracellular patterns in order to maintain currently operating agility while increasing throughput as well as effectiveness. Sample WIP logistic operations will be utilised to show how manufacturing and logistic workers, as well as their administrators, complete their jobs on a WM shop floor. If wireless manufacturing factory platforms are to exceed expectations, additional scientific research are required.

According to **Raut, et al. (2020**), lean manufacturing is one of the most popular strategies in manufacturing organisations due to its strong performance in improving the organizational effectiveness by decreasing inefficiencies. Lean Production is one of the major conceptual frameworks for rapid and efficient manufacturing, but its effective deployment is a priority owing to various hurdles that affect agile and may be overcome when RFID technology is used. With this in mind, the goal of this investigation is to educate and offer a comprehensive literary analysis that can demonstrate how Lean manufacturing based on RFID is useful for overcoming hurdles to lean production in consideration of existing studies.The goal of this comprehensive research study is to first identify the challenges to lean adoption, and then to describe the qualities of Lean manufacturing based on RFID that are

highly practical for overcoming those obstacles. Lean manufacturing based on RFID qualities like as functional transparency, inventory management, manufacturing management, reduced response time, as well as data in real time are particularly beneficial in controlling these hurdles. The uniqueness of this study is the clarification offered to both academics and researchers by mentioning and applying past research that unquestionably reveals favourable benefits of RFID on lean deployment.Nevertheless, in the future, RFID complexity difficulties may be addressed by incorporating newest functions such as "RFID integrated cloud based systems," which has evolved as a major perspective in the world of IT and may be highly advantageous to assist RFID-based lean manufacturing. Moreover, various technology-enhanced lean deployment strategies may be provided in the future to reduce interoperability concerns and accomplish correct initial commitments.

Objective of the study

1. To know the Role of RFID in Machinal Process of Manufacturing.
2. To know the significanceof RFID in Machinal Process of Manufacturing.

Research Methodology

A sample of 189 respondents from the manufacturing section of different industries were surveyed to know the Role of RFID in Machinal Process of Manufacturingwith the help of a questionnaire particularly designed for this study. The primary data was collected through random sampling method and the data was analysed with help of statistical tools like mean and t-tests to get the appropriate results.

Findings of the study

Table is showing demographic details of the respondents in which is found that in total 189 respondents 56.6% are male and 43.4%are female. Among them 28.6% are from the age group 30-37 years, 47.1% belongs to age group 37-42 years and rest 24.3% are above 42 years of age group. 26.0% of the respondents are from textile industry, 30.2 are working in paper industry, 36.4% are from automobile industry and rests 7.4% are from other manufacturing industries. 28.0% of the respondents are working as production managers, 32.3% are unit mangers, 25.9% are working as transport managers and rest 13.8% are working on other position in manufacturing section of different industries.

Table 1 Demographic details

Variables	Respondents	Percentage
Gender		
Male	107	56.6
Female	82	43.4
Total	**189**	**100**
Age		
30-37 years	54	28.6
37-42 years	89	47.1
Above 42 years	46	24.3
Total	**189**	**100**
Industry type		
Textile	49	26.0
Paper	57	30.2
Automobile	69	36.4
Others	14	7.4
Total	**189**	**100**
Designation		

Production Manager	53	28.0
Unit Manager	61	32.3
Transport Manager	49	25.9
Others	26	13.8
Total	**189**	**100**

Table 2 Role of RFID in Mechanical Process of Manufacturing

S. No.	Role of RFIDin Mechanical Process of Manufacturing	Mean score	t value	Sig
1.	RFID is used to collect the data on mobility of trauma victims	4.17	17.48	0.00
2.	RFID helps in reducing the amount of paper required to create the product	3.07	0.87	0.19
3.	The technology empowers industrial organizations to achieve quick tracking as well as transparency all through their Machinal Process of Manufacturing	3.62	8.67	0.00
4.	RFID permits supply chain co-workers to collaborate closely by offering them real-time knowledge transparency in business	3.91	12.12	0.00
5.	RFID helps in reducing the ordering wait period, expenses of Inventory management, improves the quality of inventory data, assist minimize stock outs and increase the stock movements	4.03	12.41	0.00
6.	RFID facilitates the logistics and supply chain procedure	3.96	14.35	0.00
7.	RFID recognize, detect and monitor data along the supply chain	3.17	2.11	0.02
8.	RFID is used to optimize warehousing, inventories, and personnel security systems	3.39	5.46	0.00
9.	RFID provides accurate status of WIP	4.00	13.32	0.00
10.	RFID is used to reach to root cause to analysis a case of damage or manufacturing flaws	3.97	11.69	0.00

Table is demonstrating the role of RFIDin mechanical process of manufacturing in which it is observed that RFID is used to collect the data on mobility of trauma victims with the mean score 4.17 and RFID helps in reducing the ordering wait period, expenses of Inventory management, improves the quality of inventory data, assist minimize stock outs and increase the stock movements with the mean score 4.03. The respondent also says that RFID provides accurate status of WIP with the mean score 4.00. RFID is used to reach to root cause to analysis a case of damage or manufacturing flaws with the mean score 3.97 and RFID facilitates the logistics and supply chain procedure with the mean score 3.96. It is also observed that RFID permits supply chain co-workers to collaborate closely by offering them real-time knowledge transparency in business with the mean score 3.91 and the technology empowers industrial organizations to achieve quick tracking as well as transparency all through their Machinal Process of Manufacturing with the mean score 3.62. RFID is used to optimize warehousing, inventories, and personnel security systems with the mean score 3.39, RFID recognize, detect and monitor data along the supply chain with the mean score 3.17 and RFID helps in reducing the amount of paper required to create the product with the mean score 3.07. After t-test it is found that value under significance column for all the statements is below 0.05.

Conclusion

RFID is used for a diverse variety of uses, including supply chain traceability, congestion charge compendium, vehicle parking access control, general merchandise inventory tracking, chairlift availability, library book tracking, robbery avoidance, vehicle immobiliser systems, as well as railway rolling stock recognition as well as mobility monitoring. RFID and IoT have been comprehensively discussed, including their progress through time and the integration of both innovations to augment SCM. RFID technology is being used at a rapid pace for a variety of commercial as well as consumer application. This technology's true capacity has yet to be fulfilled in reality.There is enough opportunity for systems administrators who must meet client needs and assist in the integration of RFID-based solutions into enterprise-wide Management Information Systems networks. Business executives should take a closer look at this modern technology because it has the potential to provide worth to any company

involved in large-scale information analytics in any form. So far, the innovation has made a name for itself in retail as well as supply chain management. Its application in production has not yet achieved saturation point, but it is just a matter of a few years.

The study concludes that there are different roles of RFID in the mechanical process of manufacturing like RFID is used to collect the data on mobility of trauma victims, RFID helps in reducing the ordering wait period, expenses of Inventory management, improves the quality of inventory data, assist minimize stock outs and increase the stock movements, RFID provides accurate status of WIP and RFID is used to reach to root cause to analysis a case of damage or manufacturing flaws. It is also found that there is a significant role of RFID in the mechanical process of manufacturing.

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