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IoT: Key Automation Solution to Efficate the Lean System in Manufacturing Industry

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Abstract

The research paper is based on the secondary data of the published literature review. The paper is informative to the current and future techno-functional trends and transformations required in the industry for its growth. The research study is to make aware of the use of automation technologies like the Internet of Things (IoT) as an efficient and effective solution to lean implementation in the manufacturing and engineering industry. The research study is done to understand the strategic techniques and their applications of lean manufacturing systems. And add to it the use of technologies like Industrial IoT (IIoT), which will help the manufacturing industry to smoothly implement lean system. The study uses secondary data only and is kept for future research on quality and quantitative survey aspects to study the impact and effectiveness on financial performance and human resource productivity using automation for lean manufacturing systems.

Keywords: Internet of Things (IoT), Industrial IoT (IIoT), Lean, Automation, Manufacturing.

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Introduction

Technology plays an important role in organizational growth in today's knowledge economy. In addition, Human Resource Performance and Productivity can be increased and supported by automation in the Business Process of the Organization.

Figure 1 represents three major aspects: Culture, Business, and Technology. In, culture represents the value system in the organization, whereas business represents the organizational financial outcomes of the strategic functional processes achieved along with the support of different Automation Technologies like Enterprise Resource Planning (ERP), Human Resource Management System (HRMS), Artificial Intelligence (AI), Internet of Things (IoT) and many other such technologies used for Engineering and Lean Management System. The mentioned modern technologies, if adopted for right problems related to organizational business process, then the Human Resource performance can be strategically achieved.

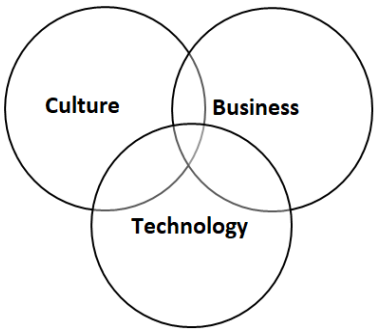

Figure 1: Relationships among Culture, Business & Technology

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From the resource-based theory of Wright and McMahan (1992); Barney (1991), it is concluded that Human resources and Information Technology are the two key resources to improve the financial performance of the organization, also said by Bhuiyan, Mahbubur Rahman, & Osman Gani (2015). J Vyas Yagneshnath, O Junare Shankarrao, (2019) and JSO Vyas Yagneshnath J, (2018) have also talked on technology utilization for HR business function transformation for financial performance and increasing productivity. Based on some published literature, this research paper is written to explore on the applications of Internet of Things utilized as an automation solution for Lean Manufacturing Process.

Literature Review

The world economy is moving from an era of isolated national economies to a connected world economy. The upcoming globalization from Liberalization and Privatization has brought profound techno-functional economic, social, environmental and technological demands among

organizations. Competition has become stronger and more critical where the customers are more demanding. The result is that organization performance is severed in all aspects of production such as cost, quality of service product and technology (Poksinska, 2010; Pekuri *et al.*, 2012). In such a case, the organization's common goal would be to implement Lean Management System to achieve continuous improvement in Cost Reduction, the quality of product or services, and to optimize the process of all the business functions within the organization. Lean Management System in Engineering and Manufacturing is an efficient solution for optimizing business flow within the organization. Lean Management System helps the organization improve its manufacturing operations and grow the industrial employment jobs and leads to customer satisfaction, says Singh *et al.*, (2010). According to Gupta, S., & Jain, S. K. (2013), the successful implementation of a lean management system brings up good growth in the quality of services and product, also improves the productivity of all resources and results into a reduction in the completed wares inventory and work process. Usually, the key goal of lean management system is to help the engineering and manufacturing firms who wish to progress the industry operations and improve their quality with good customer satisfaction at optimum cost. Lean management system has better strategic philosophies to produce maximum quantities by helping organizations to eliminate unwanted business processes. According to Soriano-Meier *et al.*, (2002); Singh *et al.*, (2010); Rose *et al.*, (2013), Lean management system improves in the overall outcome of production and increases the satisfaction level among the customer and employees. The organization must transform their business process from traditional practices to lean management practices. According to Forza (1996) and Chahal *et al.* (2013), lean management has more benefits than traditional business practices. Like, the Business processes remain highly flexible in Lean System. Inventories are managed as per demand. Production is managed based on the order from the customer, lead time is short, 100% inspection by stakeholders and overall improves customer satisfaction and cost reduction that leads the organization to achieve better financial performance. According to Paez *et al.* (2005), Mahdiloo *et al.* (2014) Miller *et al.* (2010) and Anand and Kodali, (2009), in lean management system there are some important strategic techniques like 5S, Automation, Continuous Improvement, Kan-Ban, Kaizen, Single Minute Exchange to Die (SMED), Six Sigma, Total Quality Management (TQM), Flexible Manufacturing System (FMS), etc, for improving the overall performance of an organization. The utilization of right automation technologies like Enterprise Resource Planning (ERP), Human Resource Management Systems (HRMS), Artificial Intelligence (AI), IoT, Robotics, and many other such technologies will be able to play a strategic role in implementing lean systems efficiently within the organization. With the world economic globalization, the different enterprises are facing tough competition across worldwide that counterparts in terms of cost, business function, quality, lead-time, etc. This competition is resulting into growing demand to meet higher quality standards, says P. Wright *et al.*, (2014). Z. Bi, L. D. Xu, C Wang *et al.*, (2014) says that consumers have more diversified and demanding needs. These challenges push the organization to embrace new technologies to meet user demands. To overcome such diversified demands, the technologies like IoT has great potential in transforming the business process with lean management system.

Authors, L. Atzori, A. Iera, G. Morabito, *et al.*, (2010) and D. Miorandi, S. Sicari, F. De Pellegrini, *et al.*, (2010), has written that the technologies like IoT provides the easy and reliable connectivity framework between the physical infrastructure and the cyber world.

The IoT architecture consists of tiny embedded electronics into physical objects and their network connectivity, making them "intelligent" and smoothly integrated within the resulting cyber-space infrastructure. The IoT can lead to great enhancement in the performance of business processes across the different levels of organizational structure, says J. Lee, B. Bagheri, H. A. Kao., *et al.* (2015) and H. Kagermann, J. Helbig, A. Hellinger, *et al.* (2013). It can be said from the study of D. Singh, G. Tripathi and A. J. Jara., *et al.*, (2014), that we are still in promising levels where there is a demand to deduce IoT according to the needs in the organization. According to the insight study of the authors, V.A. Yerra, S. Pilla., *et al.*, (2017) and P. Zhan, S. Wang, J. Wang, L. Qu, K. Wang, Y. Hu, X. Li., *et al.*, (2021), it can be said that IIoT will revolutionize almost all the business processes from production to transmission and distribution. The solution providers for different business processes recognize the needs and benefits of the interlinked IIoT solutions. The infrastructure of IoT provides a linked world of edge with computer applications, and network connectivity with internet infrastructure that increases and improves the efficiency and productivity of each of the business processes of the different industries. Benefits of Automation Technology in Lean System is that technology

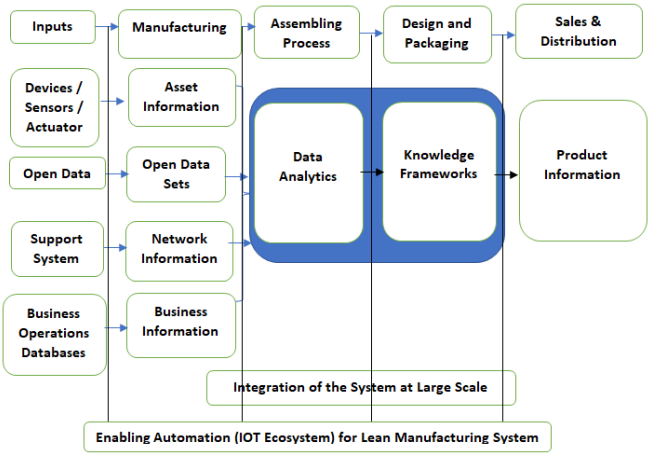

Figure 2: IoT automation framework for supporting lean system in the manufacturing Industry.

like Industrial IoT helps engineering and manufacturing firms to achieve progress in Inventory Management, Increased Quality Control, Enhanced Health and Safety, Smart Metering, Predictive Maintenance, Smart Packaging Digital Industrialization and many other better results for improving business processes within the organization, as said by Sreenivasulu & Rao, (2019).

Lean Management System for Improving Business Process

Sreenivasulu & Rao, (2019) says, Lean System into Engineering and Manufacturing has become very much necessary in today's market scenario to achieve competitive success for business goals. Lean manufacturing also focuses on achieving zero waste concept and provides better quality and benefits to customers and industry. That's why, this paper tries to give a good review of lean manufacturing for those industries that are following Lean manufacturing or wish to implement Lean in industry. The authors James P. Womack, Daniel Roos and Daniel T. Jones, (1990) has thoroughly described in the book "The Machine That Changed the World", the thought process of lean system for different industry sectors. Again, in a subsequent volume, of the book "Lean" published in 1996 by the authors James P. Womack and Daniel T. Jones.

These books described about the principles of Lean to create a value system for the different Industry Sector. The books explained about the Lean Principles like:

- Define the value as desired by the customer.
- Identify the value system for each product and services that provides such values and challenges in the business process.
- Set continuous flow of the product and services into the remaining value-added steps.
- Bridge all value steps where continuous flow is possible.
- Seek to manage the continuous improvement to lead perfection to optimize the number of steps, time to perform those steps and the information required to serve the customer regularly improves.

Different Business Strategies of Lean System for Engineering and Manufacturing:

Many lean techniques are used to optimize the wastes in the organizational business processes. By studying previous research study, it has been noticed that many authors have used different lean techniques to show the current status of developing countries. As Bayou and Korvin (2008) have mentioned in their paper, it shows manufacturing leanness with less input to better output. The author has identified that the leanness measurement can be calculated by seven characteristics: relative, dynamic, long-term, fuzzy logical, objective, integrative and comprehensive. Using the lean tool, a value stream mapping (VSM), Singh *et al.* (2010) presented a study of lean implementation and its benefits in the industry.

According to Paez *et al.* (2005), Mahdiloo *et al.* (2014) Miller *et al.* (2010) and Anand and Kodali (2009), there are so many lean techniques available in research studies but among all of those techniques, there are some important strategies discussed here by the author Sreenivasulu & Rao, (2019). According to the study performed for the previous research literature, it is found that there are many different business strategies for Lean Management System applicable for Engineering and Manufacturing Industries. The research study shows that the lean concept is a flexible system in which different business strategies can be added, merged and further explored per business needs. Among these, there are some lean strategies identified as below in Table 1.:

Table 1: List of Different Lean Strategies for Business Process of Engineering and Manufacturing Industry.

5S System	Cellular Manufacturing	Work Standardization
Automation	Six Sigma	Flexible manufacturing System (FMS)
Continuous Flow Process	Learning & Team Development	Production levelling
Continuous Improvement Process	Total Productive Maintenance	Inventory Management (JIT)
Kan-Ban System	Total Quality Management (TQM)	Zero Defect System
Kaizen System	Value Stream Mapping (VSM)	WIP (Work in Process)
Single Minute Exchange to Die (SMED)	Visual Management	Lean Thinking Process

Different types of Lean Industrial Wastes

Hines and Rich, (1997) have identified that there are basically seven lean industrial wastes that can be eliminated. According to them, these lean industrial wastes create an impact on industrial performance and human productivity and reduce industrial output. Waste is an undesirable action happening to execute business functions within the industry. Hence, lean implementation is incomplete until all wastes are eliminated along with their root cause. Before implementing Lean System, it is important to understand those seven lean industrial wastes. According to Taiichi Ohno, the following are the seven lean industrial wastes categories:

- **Overhead production** – Overproducing due to advance or excessive demand creates wastes of all four types of resources like manpower, money, material and time & method. So, overproduction without any strategic plan creates overhead of the waste. Most producers have a reason to keep a buffer but most of time it causes loss.
- **Waiting Time**- Processes of the business function is not effective and time is wasted when the waiting time for the next process increases although the previous process in completed. It is required that the flow of operations should be smooth and continuous. Waiting time is critical among all other lean industrial wastes.

- **Logistics and Transportation** – The movement of tools and equipment like machine parts, product and manpower between workstations which are considered to be Key Performance Indicators in these operational activities. The wastes are generated in form of cost when it is caused due to accidents during transportation. Movement of material within the warehouse and inventory store from one workplace to another is a waste of time and money when not considered in Standard Operational Procedure (SOP).
- **Unsuitable or over-processing** – If any extra processing makes the product or services perfect, that results in expense. Sometimes, such an extra effort brings an extra waste in form of material, manpower, time and over cost. In any case, extra effort will create extra waste that will disturb the whole system.
- **Excessive stock**- Maintenance and storage of excessive stock management about raw material and finished goods, will create waste if not cleared on time. Many such cases can be found in perishable food items, becoming waste for not clearing it for longer.
- **Unnecessary moving of the resources** – Unnecessary moving of the resources must be avoided, like Movement between two workstations/workplaces must be considered in SOP, keeping all required tools, notes and stationaries at right places so that they are available easily without any extra time. Moving resources unnecessarily is a waste.
- **Defective ratio** – Defective ratio must be reduced. Defects should not be repeated. They lead to provide poor quality of product, services, dissatisfied customer and overall loss to industry that also affect the sales and impact on the price of product or services. Industries implement lean system to reduce this waste in form of defects.

Effective steps for lean system implementation using automation technologies:

- **Identify the Wastes existing in happening Business Processes**

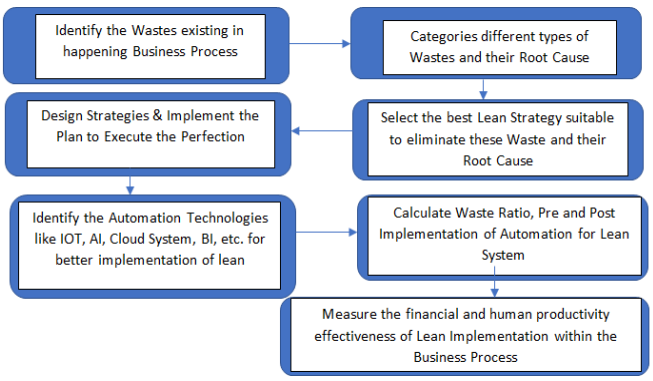

Figure 3: Implementation Flow of Lean System with automation in Manufacturing Industry, as discussed by Chahala & Narwalb, (2017)

Every industry usually faces some common problems in waste that may finally lead to the overhead costs impacting the company's financial performance. Some areas of waste in the business process can be easily identified, whereas some critical areas remain hidden. To identify all types of waste, it is advisable to implement lean system in those industries who want to reduce the waste in their business processes. The first basic step of implementing lean system is to identify the Waste Existing in the current business process in the organization.

- **Categories different types of Wastes and their Root Cause**

Once the Wastes are identified, Categorize those wastes into different key types and their root causes. Identifying the root cause of each waste is very important, as when you try to eliminate the cause, the related waste will decrease automatically. Many lean strategies and techniques exist to eliminate different wastages in business processes.

- **Select the best Lean Strategy suitable to eliminate this waste and their Root Cause**

Among different lean strategies, we must select a suitable lean strategy for the identified wastes in relevant business processes. The selected lean technique will give optimum solution to reduce the wastes and their root cause.

- **Identify the Automation Technologies for better implementation of lean**

Before you implement the plan, selecting suitable automation technology like IOT, Artificial Intelligence, Business Intelligence, Cloud Computing, Data Analytics, etc is advisable. The automation technology is beneficial for better implementation of the plan to execute lean system in eliminating wastes and their root cause. Collect the strategic data about the waste status before implementation.

- **Calculate Waste Ratio, Pre and Post-Implementation of Automation for Lean System**

Once the implementation is completed, check the effectiveness of the implemented plan to see whether the results are achieved or not. Compare the post-implementation waste status with pre-implementation waste data.

- **Measure the financial and human productivity effectiveness of Lean Implementation within the Business Process**

Once the comparison of the waste data during pre and post-implementation is completed, check the measured data to identify the level of leanness achieved with different lean measure techniques.

Use of Automation Technology for effective implementation of Lean System

As seen in the implementation of lean systems in engineering

and manufacturing firms, automation will play a key role in making the lean system successful in achieving the productivity and financial performance of the industry. To support several lean techniques, there are different and advanced automation tools and technologies related to IoT, artificial intelligence, business intelligence, cloud computing, data analytics, natural language processing, machine learning, deep learning, computer vision, robotics engineering, and many other such technologies.

Potential areas of Manufacturing Processes in the Industry for Lean System supported by Automation Technologies

Below are the some of the business processes with possibilities of Automation:

- **Business Operations of Manufacturing:** To produce rapid prototypes, implement Additive Manufacturing. Strategic advanced planning and scheduling using real time data of production and inventory to optimize the waste and improve cycle time. Use of suitable Kan-Ban supporting tools and technology can be used, like Trello. Chatbots for customer support and feedback can be used. Autonomous robotics system to effectively manage routine processes at minimal cost with better accuracy and performance can be achieved.
- **Business Operations of Warehouse system:** Robotics Systems, RFID and Augmented reality to assist the personnel to effectively manage the pick and place task.
- **Stock Management:** Using IoT technologies like RFID, Sensors, BLE (Bluetooth Low Power Energy) devices can be used to track real-time movements and locations of raw materials, work in progress and finished goods and high-value tooling within the inventory store. Big Data Analytics, to optimize inventory store and automatically signal for replenishment by providing the business statistical data for better decision making. Using Web and Mobile Applications to provide the portable and flexible solutions of all these technologies used for lean process.
- **Managing Quality Assurance:** Inline quality testing using optical based computer vision technologies. Portable Dashboards available on Web and Mobile Applications that shows statistical analytics for real time equipment monitoring to predict potential quality issues.
- **Maintenance:** Multimedia Animation Visuals like AR/VR (Augmented Reality) can be used to assist maintaining personnel while repairing equipment. Using IoT-based sensors on equipment to drive predictive and cognitive maintenance analytics and decision making.
- **Environmental, health and safety:** Using IoT and sensors for safety purposes like geofence and alert dangerous equipment from operating close to personnel. Using sensors-based IIoT devices to assist personnel in monitoring environmental conditions, lack of movement and other potential threats at workplace.

Need of IoT as an efficient automation solution to support lean system in the Manufacturing Industry

With reference of some literatures by authors, P. Zhan, S. Wang, J. Wang, L. Qu, K. Wang, Y. Hu, X. Li, (2021), R. Contreras-Masse, A. Ochoa-Zezzatti, V. García, L. P_erez-Dominguez, M. Elizondo-Cort_es, (2020) and V.A. Yerra, S. Pilla, (2017), it is said that Industrial IoT can bring a good revolution among all different energy businesses, i.e., from production to distribution and transmission and overall logistics and supply chain system, and can transform the interaction between energy firms and customers. As from the research of the authors P. Zhan, S. Wang, J. Wang, L. Qu, K. Wang, Y. Hu, X. Li, (2021), and V.A. Yerra, S. Pilla, (2017), it is found that in order to improve the efficiently and extend the productivity of human performance in a wide variety of instances, IoT defines a widely connected world of the edge with digital applications. Each IoT device is unique for wired, wireless, and cellular connectivity in the fastest-growing internet infrastructure. Using IoT the manufacturing industry can boost up financial performance and human resource productivity. According to Shanay Rab, Sanjay Yadav, S.K jaiswal, Abid Haleem and Dinesh Kumar Aswal, (2021), Industrial IOT solution provide a more integrated framework which is robust, reliable, efficient and secure. Many manufacturers have begun to estimate the utilization of smart manufacturing, says J. Sasiain, A. Sanz, J. Astorga, E. Jacob, (2020)

According to authors J. Leng, G. Ruan, P. Jiang, K. Xu, Q. Liu, X. Zhou, C. Liu, (2020), The Industrial IoT provides the possibility of supporting lean system implementation and connecting companies to facilitate with all different manufacturing operations like production, HR and Administration, Quality Assurance, Inventory, Packaging, Sales & Order and handling supply chain management. The IoT ecosystem between all business functions of the plant will provide a smooth and easy system for management to monitor employees' productivity, track the financial performance at regular time, and easily maintain the efficiency of installed machinery and tools, vendor and customer satisfaction. A.S. Lalos, A.P. Kalogeras, C. Koulamas, C. Tselios, C. Alexakos, D. Serpanos, (2019) Industrial IOT adds intelligence to the industrial equipment that enhances facility of maintaining speed and quality. Sensors with the IoT device, can monitor temperature and other parameters of those machineries that are sensitive towards the minor changes in the surrounding environment. In critical situations, IoT sensors play an important role by

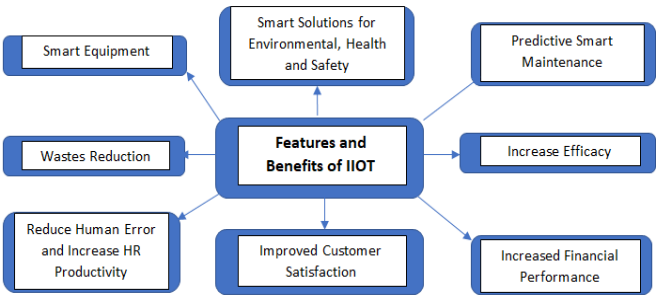

Figure 4: Multiple features & benefits of IIOT for lean manufacturing system.

sending an immediate notification to the supervisors and line managers and quickly alerts the warning to facilitate management as quickly as possible enabling safety and precaution during production or any other business processes. The implementation of lean system using the automation solution like IIoT systems enables automatic stock inventory monitoring, smoothens the compliance handling system, and immediately notifies with quick alert when any kind of deviations occur during the execution of any business process. The systematic and hassle-free monitoring, tracking and controlling is made possible at the shop floor in production lines that will help all personnel that are engaged directly or indirectly in that process right from the assembling process to the packing of the finished product. Thus, IIoT as an automation technology plays a key role in supporting lean system in manufacturing firms and IIoT is a comprehensive real-time monitoring system for manufacturing operational transformation to improve the business function cost management, says A. Jayaram (2016) and B. Yang, X. Cao, X. Li, Q. Zhang, L. Qian, (2019).

Applications of Industrial IoT for Lean Manufacturing Systems

Utilizing automation technologies like IoT can be very useful for Manufacturing Industry. IoT can provide solutions for efficiently managing manufacturing operations, warehouse operations, stock management, verification and validation in quality assurance process, environment health and safety and maintenance of the tools in production process.

Key benefits of IoT for Lean Manufacturing system in industry are identified and explained well as below:

Smart Stock Management

Using Industrial IoT solutions, remote tracking and monitoring of stock at inventory across the globe on a multiple plant level is possible and the customers get notifications of any kinds of updates for prior arrangements of the stock and can easily coordinate with other Business Functions in making decision about the Production, Order, Purchase, etc. This up-to-date information helps the stock managers cross-check inventories and are provided with real-time estimates of the available material, work in progress and the expected arrival time of new raw material. Using IoT, overall business function of inventory can be finally optimized and nullify the overhead costs in the value of supply chain management.

Smart Quality Control System

In IoT device, the sensors collect information as per the product functionality and other external group information from different levels of a product life cycle. This information relates to the entire function of materials utilized for operations like location, humidity, temperature, pressure, velocity, etc, and impact of complete product life cycle and its supply chain process. Utilizing IoT device we can generate functional data that can be available at different stages of product life cycle based on customer requirements. IoT devices are utilized for Smart Infrastructure to efficiently manage daily business functionality smoothly, easily and sometimes possibly remotely.

Smart Health and Safety

The data collected by IoT Devices can be stored in using Cloud Infrastructure. This data is continuously recorded in some database tool. This data is later used to generate some patterns for making business decisions. There are tools available for analyzing these collected data. The concept is called Big Data Analysis, which can be also used for developing Smart Products that notify us about the performance indicator of our health and safety, such as checking the status of gluco-level, oxygen level, body temperature, pulse rate, heart rate, calorie rate, infection rates, detect smoke, toxic gas, radiation level and many other smart functionalities related to Health and Safety.

IIoT based Meter Readers

With the use of IIoT device it is easily possible to remotely monitor and track the business operations happening in industries. By utilizing meter reader with IoT features, it is possible to track and monitor the utilization of different utilities like electricity, fuel, gas, water or any other raw materials used in the manufacturing industry for different objectives. Usage of IIoT Devices like Smart Meters, will notify the user with accurate and timely data about business function queries like "What kind of utilities are used to perform the business operations, how much and when it was used". Using such Smart Metering Devices, the wastes can be monitored and controlled over the period of time.

Smart Trafficking

The IoT devices can be useful to monitor, track and control the offences happening at the city's public parking lots. The monitoring devices like CCTV camera can be used to scan the vehicle's Number Plate that performs the kind of offence at the public parking lot. Using technologies like image processing, computer vision, machine learning, deep learning, and related Artificial Intelligence concepts, the Number from the Vehicle Number plate is verified from the existing ERP system. All the vehicle owner details can be identified by scanning the number on the vehicle number plate. And remaining actions can be taken on the owner of the vehicle depending upon the kind of offence performed.

Predictive smart maintenance of industrial machinery

Within manufacturing industry, it is very much required to regularly maintain the machineries, tools and equipment. Especially, the production or operation manager needs to get prior alert about any kind of maintenance issues with those machines. In this case, IIoT provides a relief to

the managers by providing a reliable feature to regularly monitor and track the status of the equipment maintenance structure. Using IIoT device, the status of the equipment can also be remotely monitored and tracked using web and mobile applications available along with IIoT Devices. Smart predictive maintenance techniques determine the equipment's current working condition to repair or get al.ert about possible breakdowns raised in the shop floor. Predictive maintenance not only provides quick alerts about the equipment's working condition but also provides the safety feature at the workplace and cost reduction over business operations.

Similarly, there are many such smart solutions like smart packaging, smart system for farm to fork for authenticating perishable food items, smart irrigation, smartwatch like Fitbit, that can be efficiently applicable to different business operations of the industries.

Conclusion

Real-time manufacturing operating efficiency is driven by enabling periodical transformation in production processes, inventory, logistics & supply chain, robotics & embedded systems, and connected equipment. Lean System is mainly implemented in engineering and manufacturing to reduce waste in business processes. And the utilization of suitable automation technologies like IIoT, in lean implementation can be useful to reduce the waste. If used efficiently, automation technologies can improve an organization's financial performance and human resource productivity. The research paper is based on the secondary information of literature review. The objective of the author is to make the manufacturing industry aware and guide about the importance of lean system and utilization of automation technologies for achieving the long -term business goals. The transformation from Machine-to-Machine (M2M) towards Industrial IoT will reduce the risk level of waste impact and, at the same time, result in the innovation for betterment of the manufacturing industry. From the studied literature, it can be concluded that automated plant factories are becoming increasingly productive by waste reduction with the availability of smart infrastructure for lean manufacturing system. As a techno-functional solution, IIoT can soon be used for maintenance and repairing manufacturing equipment and assembling lines of production unit. This can contribute to reduce downtime, make efficient use of the all types of resources, reduce wastes cost, reduce human error and improving workforce productivity, reduce overhead operating expenses and convert the cost centres into profit centers. Inbuilt embedded systems, sensors, actuators, data analysis, and cameras in IIoT enable equipment to notify the risk of failures in advance. Through IIoT technology, more rapid and efficient production and supply chain processes reduce the product development life cycle time. IIoT is identified to be as a best fit insight into the current technological transformations in the manufacturing industry. In the near future, this technology will enable industrial businesses to make efficate and quicker business decisions.

Limitations and Future Scope

Technology transformation is never a simple task; it needs serious strategy building. IoT technology has some limitations, such as data loss, data theft, data security, physical theft, unfavorable network conditions, and physical damage. Industries much look to cybersecurity standards. Although there are some solutions to cyber security like using Blockchain technology, but in such case the cost of technology may not be feasible to many other industries. Even there are possibilities that the implementation of lean system using automation may fail due to the wrong strategy or not able to identify the right waste areas and their root cause. To make this research more effective, it is advisable to move forward with qualitative and quantitative research based on primary data obtained from manufacturing industries who have successfully implemented lean system using automation technology like IIoT. Due to some technological challenges and feasibility issue with cost, IIoT in small scale industries cannot be implemented. Although there are some limitations to the utilization of automation technology, in the future, IIoT can still increase efficacy, performance, productivity, health & safety, and transform business strategic models for implementing lean system in manufacturing industry.

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