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Impact of IoT on Manufacturing and Supply Chain

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Abstract - *To survive and stay competitive, manufacturers are turning to IoT technologies and data analytics. Manufacturing is being transformed by the Internet of Things (IoT), which is making factories more efficient, productive, and intelligent. In light of this, the current research focuses on gaining a better understanding of the concepts of IoT and smart manufacturing. Manufacturers are beginning to leverage IoT technologies and data analytics in order to thrive, be competitive in the market, and obtain a competitive advantage. The Internet - Of - things (IoT), its significance, and its impact on the industrial process. Global competitive challenges are forcing industrial and manufacturing businesses to manage labor skills gaps, eliminate inefficiencies from their systems, and find new business opportunities as a result of globalization. After using new technology, organizations are able to double their previous production amount, ushering in a new era of deep data interconnectivity. The worldwide IoT industry is expected to expand from $1.3 trillion in 2013 to $3.04 trillion in 2020, according to International Data Corporation (IDC), while Cisco expects a $14.4 trillion market by 2022. This secondary research is being conducted to learn more about how the internet of things can be applied to manufacturing. According to some estimates, there will be up to 25 billion internet-connected items by 2020, with more corporations investing and making an influence in smart technology. As a result, the study concentrates on the Internet of Things, its significance, and its impact on the manufacturing process.*

Key Words: Internet of Things, Smart manufacturing, Importance, Impact on manufacturing process

1. INTRODUCTION

Manufacturing is on the verge of a revolution around the world. New information technologies are suddenly promising to make not only factory management more effective, but also work itself smarter. Technologies based on the Internet of Things have the potential to dramatically improve industrial visibility, allowing each unit of production to be "seen" at each stage of the process. Visibility at the batch level is being phased out in favour of visibility at the unit level. The era of smart manufacturing has arrived. The truth is that the Internet of Things opens up nearly unlimited possibilities and connections, many of which we can't even imagine or completely comprehend today.

1.1 Information Sharing in Supply Chain

In supply chain management, information sharing has been critical. An empirical study by Baihaqia and Sohal in 2013 demonstrated the influence of information sharing on the supply chain. They discovered that exchanging information among partners is vital but insufficient for considerable progress. The key is to focus on making supply chain partners more cooperative and strengthening internal integration by working together to complete tasks so that their relationship is built on trust. Managers should identify the information that needs to be communicated as well as the appropriate method for doing so, with the goal of increasing overall supply chain performance. Choy et al. (2014) created a hypothetical model with seven assumptions to investigate the impact of implementing Information Technology (IT) applications in the supply chain, such as information and communication technology (ICT), logistics information system (LIS), and business intelligence (BI). For a market-based perspective, service quality was considered, and for a resource-based perspective, competitive advantage was considered. The findings revealed that, although being advised by various academics, most logistics service providers (LSPs) do not use many approaches, such as radio frequency identification (RFID). LSPs can use the provided hypothetical model as a road map to increase their competitiveness.

Grabara et al. (2014) outlined the function and impact of information systems on transportation activities in the organization, including increased transportation efficiency, greater driver utilization, more efficient information interchange, and improved financial results. They stated that without excellent information systems management, firms will be unable to make appropriate transportation decisions, putting them at danger of failing to satisfy market demands. By employing re-order point approaches, Jonsson and Mattsson (2013) developed a simulation model to assess the value and impact of sharing four forms of planning information (point-of-sale data, stock-on-hand data, customer projections, and scheduled orders) on inventory capital. The value of shared information was discovered to be dependent on whether demand is stationary or not; while demand is stable, stock-on-hand data is valuable, whereas when demand is not stationary, demand forecast and planned order data are valuable. Sharing point-of-sale information has little utility whether demand is stationary or not, thus deciding how and when to communicate planning information is critical. Vanpoucke et al. (2017) created an analytical methodology to see how well supply chain and IT

integration can be used to make operational choices. When IT is employed for upstream integration rather than customer integration, it has a greater impact on operational performance. This can improve delivery performance by increasing speed and precision. However, many supply chains, according to Azab et al. (2016), still suffer from miscommunication between diverse stakeholders and ineffective information transmission. As a result, new approaches and strategies for more efficient information sharing should be adopted.

1.2 Smart Manufacturing

Effective factory management is critical as global market and industry trends force enterprises to rethink their manufacturing operations. To optimise asset utilisation and efficiency, smart manufacturing necessitates IoT-driven data analytics. Manufacturing workers will have the flexibility and decision-making skill they need to deal with increasing market complexity and demand fluctuation by combining new and old data with analytics-driven insight. Smart manufacturing is about creating an environment where all available data is recorded in real time, made visible, and turned into actionable insights, both on the plant floor and throughout the supply chain. Plant operations, supply chain, product design, and demand management are all part of smart manufacturing, which blurs the lines between them. Smart manufacturing provides organisations with comprehensive visibility by enabling virtual tracking of capital assets, processes, resources, and goods, allowing them to streamline business processes and optimise supply and demand.

Smart manufacturing is, at its core, a decision-making environment. Smart manufacturing, for example, combines proactive and autonomic analytics capabilities, making it an intelligent and self-healing environment. Organizations can predictably address business needs with smart manufacturing by taking intelligent and automated actions based on previously unavailable information from the physical environment. Smart manufacturing makes firms more proactive and autonomous, allowing them to anticipate and resolve potentially disruptive situations, adapt processes, and delight customers while improving profits.

Connectivity technology (the network that allows objects to connect to the Internet), the cloud (the computing and storage environment where assets may communicate), and Big Data analytics are all part of smart manufacturing (the intelligence of the system that is able to analyse data and provide insights on the fly). The goal is to link factory automation assets (e.g., production equipment, robots, RFID, etc.) to end-user apps (e.g., MES, PLM, ERP, etc.) and mobile devices via connectivity technologies (e.g., industrial networks, wife, M2M, etc.).

2. REVIEW OF LITERATURE

- The Internet of Thing study which was based on a study of some of the leading manufacturers which has been interviewed by the most leading manufacturers and despite such a high level of planning and intriguing facilities there have been only a few members who have implemented the IoT program.
- More than 50% of the members are still planning to merge the IoT technicalities into their products and the remaining more than 30% of the manufacturers or the product testers are saying that they are going to improve their products and their qualities which according to them will be the most prime objective for the enhancement of their IoT based products.
- By assimilating smart devices or submerging intelligence using the embedded systems technology the product manufacturers say that their biggest obstacle is their insufficient knowledge regarding the IoT.
- Some of the viewers or the manufacturers say that the IoT will have an impactful situation which will signify the businesses over the next coming 6-10 years in spite having a pretty much insufficient knowledge over it with the statistics of the people knowing varying in numbers.
- While most of the manufacturers value the importance of IoT there is a significant void of the number of virtues which they have towards IoT which will, in turn, hinder the finance of the various business companies and most of them will use the smart devices and the embedded systems into the manufacturing processes.
- Warehouse management, as well as the documentation of it, is considered to be a different opportunity for the improvement of performance and operational precision. Enabling the products with IoT would be the best opportunity for the members of the manufacturing respective companies or the business-related inquiry.
- Most of the improvements which involve in the manufacturing and the learning of IoT process will be the greater value addition for the companies, client/consumer gratification, and a major contribution to the higher qualities of products which will, in turn, affect the income profits of the company as well.
- Dependence on machines, high-speed delivery, and uptime service innovation will be some of the major factors which can also be tacitly kept into consideration.
- Since only a few people are used to accounting the machine to machine communications today it has been

concluded that the machine to machine communication system needs to be renovated and there need to be present the number of upgrades which might boost up the production level and add the required value to time as well as the company's profit.

- Increasing the level of performance by using the methods which can be sustainable and by this survey, there can be a method to keep up with the following requirement for the upgrade of the survey.

3. COMPONENTS OF IOT INFRASTRUCTURE

IoT is one of the primary pillars of Industry 4.0, which helps businesses create and increase their market competitiveness while also having a significant impact on the modern economy's transition (Wielki 2017). The sensing layer, the transmission layer, the computing layer, and the application layer are the four essential levels of IoT architecture. Each layer comes with its own set of security concerns. Each layer's components and function are depicted in Figure 1.
The perception layer, also known as the sensors layer, is responsible for identifying, tracking, and collecting data from objects using a variety of technologies such as RFID tags, wireless sensor networks (WSNs), and actuators for monitoring and tracking the status of objects, and then transmitting the collected data to the transmission layer.
The transmission layer serves as a connection between the items and the cloud, allowing data to be sent over the network. This layer employs a variety of protocols; including low-power wireless personal area networks (LPWPANs), which offer high connection while consuming little energy and allowing for self-organization. Zigbee, a wireless network technology with cheap costs, low energy consumption, low complexity, reliability, and security, as well as Wi-Fi and 3G, can all be employed. The computing layer provides the transmission layer and the application layer with efficient and secure services. This layer employs interface technologies to assure the security and efficiency of the data being communicated. Service management is also used; it is in charge of services such as data gathering, exchange, and storage (Lin et al. 2017).

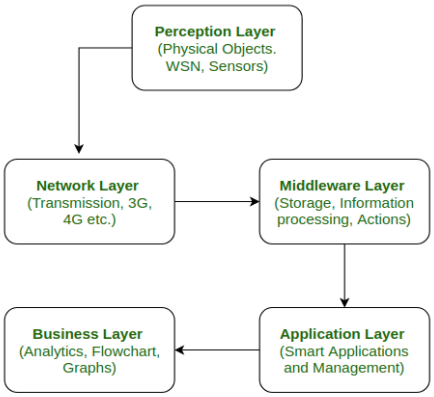

Fig -1: Architecture of IoT Application

The application layer, where data is managed, is the final layer. It is critical to choose the right protocol for network management. Message queue telemetry transport (MQTT), advance message queuing protocol (AMQP), constrained application protocol (CoAP), and extensible messaging and presence protocol (XMPP) are some of the protocols that can be employed (Swamy et al. 2017).

3.1 Importance of IoT and its impact on manufacturing process

The applications that connect the factory floor, machinery, equipment, and production lines are listed below, along with their impact on the manufacturing process.

i. Assists in increasing operational productivity and profitability, as well as optimizing performance and efficiencies throughout your factory's industrial devices, manufacturing lines, and overall operations.
ii. By utilizing cloud-based technology to monitor and enhance equipment performance while maintaining industrial operations.
iii. Draw insights from data generated by linked devices to operate at peak efficiency**.**
iv. To increase efficiency, streamline operations, and reduce waste. Hershey, for example, is expanding their Microsoft IoT Solution, which includes everything from intelligent sensors on the factory floor to packaging, transportation, and customer behavior.
v. To help improve the scalability and global tooling solutions it delivers to its customers, Sandvik optimized its manufacturing process and created a predictive maintenance schedule.
vii. Combining predictive analytics and preventive maintenance, Rockwell Automation created an IoT option to display precious capital assets—which include mining, transport, refining, and income operations equipment—and higher offer its clients with real-time insights at each factor of the deliver chain, supporting expect issues earlier than they occur.
viii. To help ensure the power stays on when customers need it most, Cummins Power Generation used IoT solution to help create a cloud-based, remote monitoring that provides new insight into data to predict and avert problems.
ix. Because dealing with energy resources is a priority, ABT Power Management decided on Azure IoT Suite to offer insights and predictive upkeep for extra than 6,000 controlled assets, supporting avoid operations coming to a standstill because of defective commercial forklift or truck energy resources.
x. To enhance operational performance for its companions with side the field, MARS DRINKS constructed an Azure IoT Suitebased the answer that makes use of predictive analytics and collects real-time information from merchandising machines to lessen the frequency of downtime and out-of-inventory products.

3.2 Benefits of using IoT

Warehouses can contain thousands of products that are why it should be optimally utilized to ensure accurate and fast performance in all functions to meet customers' demands. Applying IoT to warehousing promises a significant impact as it can be used to monitor several processes in the warehouse in real-time and can eliminate manual interferences. It can make everything connected to each other and hence enable the analysis of the vast amount of data captured from these connections and turns them into insights to support decisions and improve the total performance.

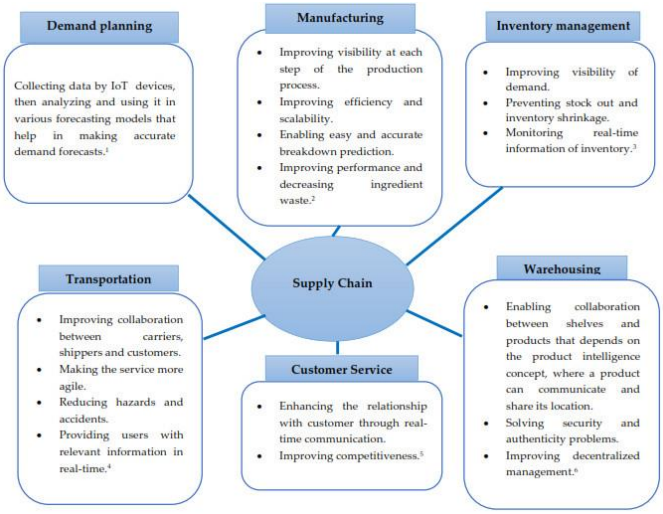

Fig -2: Benefits of IoT

Figure 2 summarizes a few ability advantages of this implementation. In today's enterprise world, warehouses have a widespread function in assembly customers' expectations. The function key reasserts of competitiveness measured through who can supply the goods quicker with higher price performance and flexibility.

4. CONCLUSIONS

IoT is a key generation of the fourth business revolution Industry 4.0. IoT is taken into consideration one of the maximum promising technology to govern and enhance the overall performance of deliver chains; warehouses are key elements of deliver chain that make contributions to the achievement of any business organization, so new technology are gaining huge interest from a huge variety of organizations to enhance overall performance, popularity and consequently advantage extra clients and profit. IoT has been step by step bringing a sea of technological adjustments in our everyday lives, which in flip allows making our lifestyles easier and greater comfortable, thru numerous technology and applications. The Internet of Things has a catchy ring to it, however for many, the opportunities are nearly too far-achieving to imagine. For producers, the probably effect of IoT in clever production seems very massive indeed. In the destiny producers will depend on related merchandise to offer merchandise as a service. They will discover the viability of micro logistics networks to make higher enterprise selections thru investments in operational intelligence and permit the promise of extended transport for pick merchandise and customers.

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