International Journal of Early Childhood Special Education (INT-JECSE)
DOI:10.48047/intjecse/v14i2.1071 ISSN:1308-5581 Vol14, Issue02 2022

Benefits of Technological Innovations in Logistics and Supply Chain in Manufacturing Section

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Abstract
Manufacturing logistics and supply chain procedures have undergone a considerable technological transformation that has boosted productivity, reduced costs, and increased customer satisfaction. Better inventory management, fewer stockouts, and more accurate demand forecasts are all made possible by the accurate information that this improved visibility gives manufacturers about stock levels, locations, and product conditions. As a result, firms can improve the production procedures, lower surplus inventory, and enhance customer service. Order fulfilment and warehouse operations have changed dramatically since automation and robotics were adopted in logistics and warehousing. Material handling, order picking, and packaging procedures are streamlined by automated technologies, such as autonomous guided vehicles (AGVs) and robotic pickers. This increases operational effectiveness, lowers labor costs, and reduces human error. These innovations give manufacturers the ability to process orders more quickly, increase order accuracy, and achieve quicker delivery dates, eventually increasing customer happiness.
Keywords: Cost Savings, Efficiency, Automation, Productivity, Internet of things.

Introduction:
The Internet of Things (IoT) makes it possible to connect real-world items, including cars and physical goods, to the internet, making it easier to gather and share data. This connectivity makes it possible for goods, equipment, and vehicles to be tracked and monitored in real time throughout the whole supply chain in logistics and supply chain management. Sensors and RFID tags are examples of Internet of Things (IoT) devices that offer useful data on variables like location, temperature, humidity, and other environmental conditions. By automating repetitive jobs, boosting speed and accuracy, and enhancing overall operational efficiency, robotics and automation technologies have completely changed the way logistics and supply chain operations are conducted. By removing the need for manual involvement from a variety of processes, these technologies increase productivity while lowering human error rates **(Tijan et al. 2019).**
Traditional manufacturing processes have undergone a transformation because of automation and robotics, which has resulted in shorter lead times, quicker production cycles, and higher levels of productivity. Intelligent warehouses with automated systems for order fulfilment, inventory management, and material handling have greatly improved logistics processes by lowering costs and errors while raising overall effectiveness. Improved supply chain visibility and openness is another important benefit. The manufacturing supply chain now has more opportunities for sustainability and green initiatives because of technology. Manufacturers may lessen the carbon footprint and encourage environmental stewardship with the advent of electric vehicles, renewable energy sources, and inventive packaging solutions **(Witkowski, K. 2017)**.
Faster response times, simpler transactions, and effective communication are made possible by the supply chain's digitization. To improve overall coordination and shorten lead times, manufacturers can work with partners, handle orders, and track shipments in real-time. Finally, technical advancements have aided in the development of sustainable manufacturing practices. The environmental effect of logistics operations has been reduced because of efficient route planning, eco-friendly transportation methods, and energy-efficient warehouse management systems. Manufacturers can realize cost savings while showcasing

dedication to corporate social responsibility by lowering emissions, maximizing fuel consumption, and putting forth greener practices **(Kouhizadeh, M., & Sarkis, J. 2018).**

As a result of technological improvements, there has also been a major improvement in accuracy and precision. Modern data analytics systems can now handle enormous volumes of data and reveal insightful information on the effectiveness of the supply chain, consumer demand patterns, and consumer preferences. Utilizing this data, firms are better able to manage the inventories, cut down on waste, and improve production and logistical processes. The manufacturers benefit more financially because of these optimizations, which also reduce costs. Technology has also aided in the development of digital markets and collaborative platforms, which seamlessly link producers with distributors, suppliers, and buyers **(Hahn, G. J. 2020).** Figure 1 shows Benefits of Technological Innovations in Logistics and Supply Chain

Figure 1 Benefits of Technological Innovations in Logistics and Supply Chain

Literature Review:

Technology breakthroughs have significantly transformed the industrial sector, leading to substantial improvements in supply chain management. These innovations have increased operational effectiveness while also providing many benefits for businesses. Manufacturers are embracing innovative ways to optimize the supply chain and logistics procedures in the current era of rapid technology innovation. Manufacturers have reaped significant benefits from the incorporation of cutting-edge technology like artificial intelligence, robots, the Internet of Things (IoT), and data analytics, which has allowed them to reconfigure the business models and acquire a competitive edge in the market **(Rüßmann et al. 2015).**

Overcoming resistance and securing staff support are essential for ensuring the success of an implementation. Suppliers, manufacturers, distributors, and retailers are just a few of the companies involved in supply chains. It can be quite difficult to integrate data and systems between these parties. Legacy systems, different data formats, and varying technological capabilities may make it challenging to achieve end-to-end visibility and optimization. These elements may make it difficult to integrate and communicate data seamlessly. Ensuring the security and privacy of sensitive information becomes a crucial problem as dependence on technology and data sharing increases **(Gunasekaran et al. 2017).**

Large data sets can be analyzed by AI algorithms to find patterns, trends, and anomalies that can be used for demand forecasting, inventory optimization, route optimization, and risk management. Real-time tracking and monitoring of items throughout the whole supply chain is made possible by technologies like IoT sensors and RFID tags. With this level of information, manufacturers are better able to manage the inventory, foresee changes in demand, and proactively deal with any delays or bottlenecks in the logistical chain. Manufacturers may optimize the supply chain and make data-driven decisions to increase customer satisfaction by using accurate and current information **(Govindan et al. 2018).**

The expense of integrating and putting into practice technological improvements in supply chain operations is one of the biggest obstacles that businesses confront. It frequently takes large investments in hardware, software, infrastructure alterations, and training to integrate new technologies. The return on investment (ROI) and the associated costs must be carefully evaluated and justified by manufacturers. Resistance to change among employees is a typical barrier to integrating technology developments in an organization. Employee reluctance to accept new technologies can be attributed to worries about job security, unfamiliarity with the technology, and familiarity with current workflows **(Ghadge et al. 2020).**

Picking, sorting, and material handling duties in warehouses and distribution centers are made more efficient by automated equipment such conveyor belts, autonomous guided vehicles (AGVs), and robotic arms. While reducing the need for manual labor, these technologies not only make transportation easier but also speed up and improve the reliability of delivery. Supply chain management and logistics are being transformed by AI technologies like machine learning, natural language processing, and predictive analytics. The way organizations conduct themselves in this field is changing because of these developments, which enable intelligent decision-making and process optimization **(Barreto et al. 2017).**

Utilizing predictive analytics, manufacturers can forecast client demand, enhance production schedules, and enhance inventory control. It also makes it possible for proactive risk management by allowing for the early detection of prospective disruptions and the mitigation of those disturbances. The manufacturing industry has undergone a transformation because of the supply chain management and logistics integration of technological developments, which provides several advantages for firms. Manufacturers can benefit from utilizing technology in several ways, including higher operational effectiveness, improved visibility, increased accuracy, better collaboration, and sustainability **(Fatorachian, H., & Kazemi, H. 2021).**

Cybersecurity hazards, data breaches, and adherence to privacy laws are some of the main issues. Manufacturers must commit significant resources to establishing rigorous data protection policies and strong security measures to reduce these risks. Operations in the supply chain may change because of the integration of artificial intelligence (AI) and machine learning (ML). Massive amounts of data may be analyzed by AI-enabled systems, which can also spot trends and produce insightful forecasts and suggestions. As a result, it may be possible to automate tedious activities, manage inventory more effectively, estimate demand more accurately, and improve decision-making throughout **(Zhong et al. 2016).** Figure 2 presents the applications of the Innovations in the supply chain:

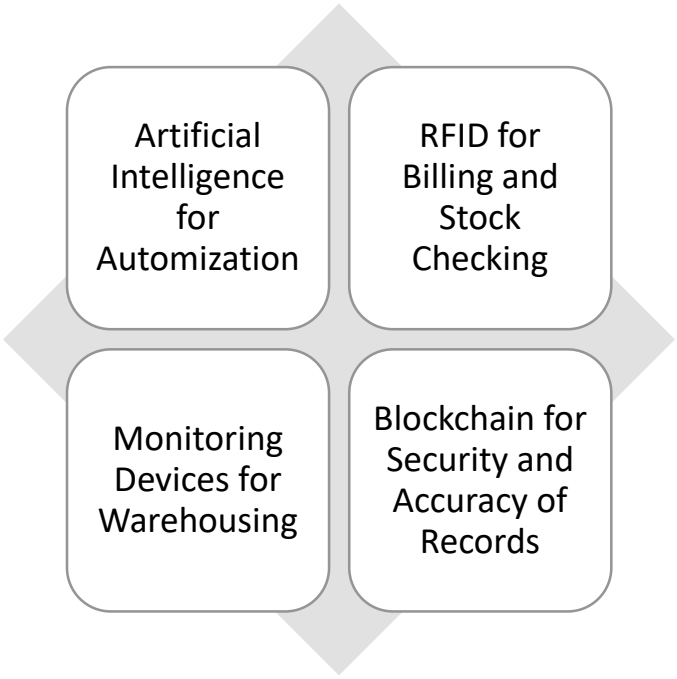

Figure 2 Applications of the Innovations in the Supply Chain

Conclusion:

In conclusion, the manufacturing industry has greatly profited from technological advancements. Traditional approaches have undergone a technological revolution, allowing manufacturers to streamline the businesses, boost productivity, and gain a competitive advantage. The transformation of the manufacturing supply chain and logistics has also been greatly aided by automation and robotics. Tasks like picking, packing, and shipping have become faster and more accurate because of automated technologies like conveyor belts, sorting machines, and robotic arms. As a result, orders are filled more quickly, errors are decreased, and overall efficiency is increased. Efficiency gains, cost savings, and enhanced customer satisfaction have all been made possible by better visibility, automation, cooperation, data analytics, and sustainability initiatives. Manufacturers should embrace and take advantage of these developments as technology develops to stay competitive and satisfy the changing needs of the global market. Implementing sustainable practices satisfies legal requirements while also enhancing corporate reputation and attracting eco-aware customers.

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