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Design and Analysis of Iot Ecosystem for Freight Management System

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Abstract

At the moment, research and applications focused on vehicle-to-vehicle communication are highly significant. Transportation management and vehicle-to-vehicle communication systems were the focus of this article, which detailed the inner workings, implementations, and applications of the Internet of Things (IoT). The reduction of traffic and accidents on the road is the primary benefit of this Internet of Things (IoT) technology based on Industry 4.0. The development of mobile-based V2V communication—which is more effective, error-proof, result-oriented, and smart—has resulted from the shortcomings of GPS, such as accuracy, precision, effective analysis, etc. Proper analysis of traffic requires the establishment of vehicle-to-vehicle communication. Random Information gleaned from cars through a network of sensors. The info may be easily shared between any two autos in the vicinity if it came in its variation. We can assist emergency vehicles get where they need to go faster by allowing them to communicate with one another. The V2V software allows for the marking of red and green lights on the road according to traffic density, allowing emergency vehicles to choose the quickest, least congested routes. The present study document provides similar instances to aid the researcher in identifying the research gap for future optimization, development, analysis, and invention.

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Introduction

Modern supply chain management (SCM) benefits from the Internet of Things (IoT), the most recent widely employed technology in industry. It wasn't until the 1990s that the phrase "Internet of Things" was first used. "Kevin Ashton," a trailblazer in the Internet of Things and co-founder of MIT's Auto-ID Laboratory, did the bulk of the work. He coined the phrase "The Internet of Things" to characterize a network that links digital and physical objects through pervasive sensors like radio-frequency identification (RFID).

[1]. Because of its practicality in corporate operations, the Internet of Things (IoT) finds widespread usage in many fields, including commerce.

[2]. The Internet of Things (IoT) typically has three layers: the Perception layer, the Network layer, and the Application layer.

[3]. Figure 1 shows the Internet of Things (IoT) layered architecture.

Figure 1.1 IoT Architecture

1. Perception layer: The Internet of Things is often designed with a bottom-up approach. At the very bottom of the stack is the perception layer. The Internet of Things (IoT) physical layer is this one. This layer's primary function is to gather environmental data and physical characteristics through the use of various sensors, actuators, and smart devices.

2. Network Layer: Through the network layer, the data gathered by the perception layer is conveyed and sent to other servers, apps, and network devices for additional processing.

3. Application Layer: As the very top tier of Internet of Things (IoT) architecture, this layer is responsible for providing the user with services that are tailored to their individual application. With this layer's assistance, end-users may enjoy an intelligent IoT-based environment. Businesses and companies utilize the programmers and modules included in this layer to access data in real-time and make smart decisions about their operations.

Every physical item that has sensors, software, and technology is part of the internet of things. It includes interconnected gadgets that facilitate the transfer of data from one location to another. The introduction of several smart devices—including smartphones, wearables, household appliances, drones, and many more—has contributed to the rise in popularity of the Internet of Things (IoT). Industries that supply goods and services, however, elevate it to a higher degree. They seized the chance to streamline their company processes and achieve more success. There has been a lot of focus on IoT. Transportation and supply chain management have been revolutionised by the Internet of Things. The logistics industry used paper records for stock data preservation a few years ago. Then, after computers are in place, the data is saved in Excel. However, IoT is a whole other ballgame. The adage "do smart

work, not hard work" is genuinely borne out by this generation. This generation has reduced not just humans to machines, but also humans to machines. Statistics that do not include people are commonly replaced by this generation. These days, businesses employ smart cabinets to keep their products. Radio Frequency Identification (RFID) is another well-known and important technology that allows for the identification, connection, adaptation, localization, and song and reveal of such items on an open, self-configuring, and dynamic internet-based network. This technology is helpful for logistics and business. Because of the industry's use of computer-primarily based structures and networks, efficiency, accuracy, and financial profitability are all enhanced without human participation. With the use of IoT features, all logistics functions, such as correct products, quantity, location, time, pleasantness, and cost, can be fully supported. In order to transform traditional logistics assets into intelligent logistics products, Zhong et al. have developed an environment that is ready to use various Internet of Things (IoT) interface devices. The next generation of Internet of Things (IoT) devices, which take into account technologies like radio frequency identification (RFID), near field communication (NFC), and global positioning system (GPS), not only give real-time visibility for operations, but also generate value for both sellers and buyers. Improve your competition with this top-notch equipment that helps logistics provider vendors make quick decisions about how to disclose, route, and supply products to their buyers. This happens because the traditionally long reaction time in traditional logistics is cut in half for Logistics Internet of Things (L-IoT) thanks to autonomous and computerized shipment from origin to destination. Thus, green logistics provider solutions provided by IoT are charged.

Considering the importance of IoT in the modern world. Logistics firms are capitalizing on this technology as a means to increase their income. Their services are in demand, and people are prepared to pay for them. When it comes to logistics, DHL is among the world's top companies. They made it clear why they deserve to be at the top. They capitalized on the Internet of Things to make money. Logistics and transport network enhancements were their target. The logistics, transportation, and warehousing systems of DHL have started to work together. Afterwards, the business may analyze the data collected at each stage, allowing for better supply-chain risk management, predictive equipment maintenance, and intelligent stock management. Looking at giving value throughout the ecosystem while preserving accurate information about individual product needs, such as temperature, humidity, handling care, source, and destination, is essential when adopting IoT applications for value creation and new income. It should be possible to construct custom-designed transport routes for each package when they understand customer requirements for temperature-controlled goods and have access to refrigerated trucks and planes. Such personalized optimized routes would naturally justify a premium price, opening up new avenues of revenue for the business and providing value to clients. The condition of the customers' parcels was another area of interest. DHL is creating new avenues for collaboration with shippers as a delivery chain guarantor, which is leading to even more lucrative new prospects. Resilience 360, a customer-facing tool for monitoring supply-chain risk, is another way the organization has advanced this idea. Customers may observe the effects on their supply chain in real time with this tool, which takes use of up-to-the-minute information gathered from a global fleet on postal strikes, road closures, and natural calamities. They may even utilize the technology to

change the way goods are sent or when they are sent in order to lessen the impact of global events. With the use of smart sensors, operational efficiency may be enhanced, leading to less effort, better logistics, and better charge management. With the use of smart sensors, formerly manual processes like stock counting and material sorting have become more automated, which helps to increase the efficiency of human labour. Whenever a truck pulls up to a logistics company's warehouse, whether it's a transshipment or delivery facility. To begin, the system is updated by operation managers utilizing Unique the challan is created when the materials are loaded into the vehicle. That challan number is then updated in the system when the car arrives at the other site. There is still one more device where the operation manager has logged in. At the time of loading and unloading, the gadget automatically counts the amount of material that has been loaded and received by scanning each material through a barcode written on a sticker. That way, we know for sure if the correct quantity were sent out. We can tell if the quantity of materials sent has been received or not when the same thing happens when items arrive at another site. Lessening idle bodies of workers is another benefit of sensor-enabled exertions tracking through the optimization of assignments. Also, through dynamic routing and improved safety, self-sustaining riding allowing sensors can help reduce transportation costs. In addition to maximizing manufacturing best practices, smart sensors may identify production errors at their source and drive improvements in method.

RFID sensors have revolutionized traditional inventory management by enabling touch-free item identification and tracking. Radio frequency identification technology enables a more automated system that can offer real-time inventory tracking at a nominal cost with increased precision. One possible benefit of these upgrades is a reduced risk of stock shrinkage or loss due to improved inventory traceability. Better, more up-to-date statistics can also help. Improved capacity for demand planning, which might reduce stockouts and surpluses. Savings in stock theft prevention and spoiling have resulted from advancements in smart sensor technology. More flexible distribution schemes are also available with smart sensors. Omnichannel commerce is made possible by smart sensors that provide customers more than one option when purchasing through the flow of real-time data. Automated refills and reorders are made feasible by products and packaging that are equipped with smart sensors. Companies in the logistics industry in India are also constantly innovating. Their transport system was greatly enhanced by the easy adoption of new technology. Regardless, when contrasted with DHL, a world leader in logistics, the tracking systems utilized by Indian enterprises are somewhat simplistic. If other logistics businesses want to improve transportation and their customers' experiences, they should follow DHL's lead and implement new technologies.

Literature Review

Saleh Alyahya et al (2016), The logistics and supply chain industries rely on precise stock-keeping operations, product line planning, and the administration of incoming and exiting items. Online shopping has had a meteoric surge in popularity in the UK throughout the last decade. Online shopping has grown in popularity, and with it, the expectation of lightning-fast, doorstep delivery of purchased items. Therefore, these industries are eager to find better

ways to automate and integrate their warehousing systems so that they can store, select, and ship items from more centralized distribution centres. This article details the results of a research into a technique for next-generation warehouses that include an RFID-based inventory management system that can communicate with a suggested RFID-enabled automated storage and retrieval mechanism in a hands-free manner. In order to find the best way to manage RFID-tracked items according to pre-established rules, the RFID-inventory management system implemented a selection algorithm. This algorithm prioritizes the travel of selected items to a designated collection point, thereby minimizing operational costs and maximizing efficiency in material-handling operations. Using the created selection algorithm, a pilot test was conducted to investigate the practicality and usefulness of the RFID-based management system. It is theoretically possible to add any pre-defined selection parameters to such a system and make it more comprehensive.

John T. Mentzer et al (2015), Among the many marketing services offered by top-tier companies, logistics expertise has emerged as a key differentiator. There is a dearth of empirical data on the significance of logistics service quality to consumers and whether it varies for different customer categories, despite academics' suggestions that logistics capabilities supplement marketing efforts. The author provides evidence for a logistics service quality process and presents nine related constructs of logistics service quality. They show that these constructs are unidimensional, valid, and reliable across four client segments of a big logistics organization. The authors discover that the relative parameter estimates differ for each segment, indicating that enterprises ought to customize their logistics services by customer segment. This is despite structural equation modeling offering help for the logistics service quality process across client segments.

Research Methodology & Research Design

My position as supply chain coordinator at Om logistics LTD makes me a good candidate for primary research. Being able to see firsthand how logistics businesses in India utilise the technology in their daily operations made this study much easier for me. To ensure that I am well-versed in all aspects of a corporation, I am required to complete training in each area throughout my training time. But I spent most of my time learning the ropes in the operations department, which includes things like updating the arrival time of vehicles, booking, and scanning all materials before loading and unloading them into vehicles. I paid close attention to every detail as our organisation used technology to streamline the process.

Based on secondary sources, DHL is a leading global logistics provider. We learned about their research collaboration with Cisco through our online research. For information technology (IT) and networking needs, no one does it better than Cisco. A 2015 trend study on logistics and the internet of things was published by Cisco Consulting Services' James Macaulay and DHL's Dr. Markus Kiickelhaus, who both found that the logistics industry was greatly affected by the internet of things. The Internet of Things (IoT) ensures substantial benefits for logistics providers, their business clients, and end users. Warehouse operations, freight transportation, and last-mile delivery are all part of the logistics cost chain that benefits from these. They have an impact on areas including new business models, consumer

experience, operational efficiency, and security and protection. There are exciting new methods to tackle tough operational and corporate challenges with the help of the Internet of Things. Logistics operations that use IoT are expected to make a significant difference. At various points along the value chain, we may check the standing of properties, parcels, and those in real time. We may use their current actions to gauge how well those properties are doing and make adjustments as needed. We can automate business processes to reduce costs, improve quality and predictability, and delay guide interventions. Through careful planning and optimization, we may enhance the interplay and coordination of people, systems, and property. The ability to use analytics across the board in the supply chain opens up new avenues for growth and reveals previously unknown best practices.

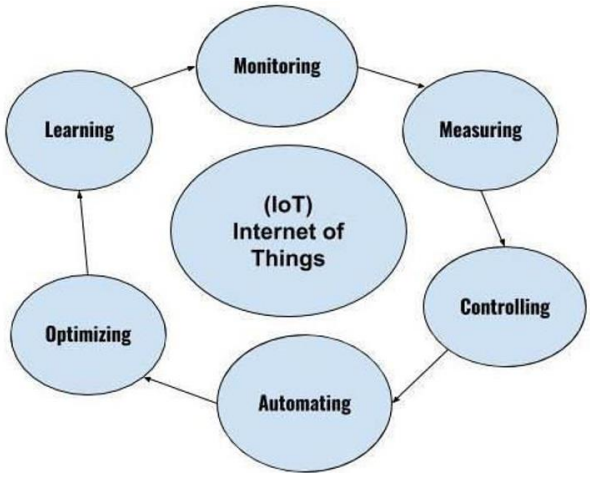

Figure 1.2 IoT Capabilities

To put it simply, "sensing and experience making" will be at the heart of the Internet of Things for the logistics industry. In a supply chain, "sensing" refers to the monitoring of unique assets using unique technologies and channels; "experience making" refers to the management of large data units produced by this, and the subsequent transformation of these data units into insights that facilitate the development of new solutions. Am I, however, at the right moment to use the Internet of Things in logistics. Most favourable conditions for the Internet of Things to explode inside the sector are already present. A new generation is emerging thanks to developments like mobile computing, IT consumerization, 5G networks, and big data analytics. There's also a pull from customers who are increasingly demanding solutions based on the internet of things. When taken as a whole, these factors are speeding up logistics firms' use of IoT.

Freight Transportation

Freight transport presents Internet of Things (IoT) networks with enormous potential thanks to its abundance of sea, air, and road assets. The Internet of Things will go beyond tracking and music in goods transit. Singing and screening a package on a vessel in the middle of the Pacific or a cargo in the air is now a real possibility. We anticipate that the Internet of Things will provide the following song and trace technologies: more rapid, more accurate and predictive, and more secure. With a focus on ports and rest areas, FreightWatch documented

946 cargo robberies in the US and 689 in Europe in 2012, with 37 of those crimes being premeditated. Shippers and logistics companies lose billions of dollars annually due to theft, which impacts stock delays and the value of stolen commodities. To guarantee sure things arrive on time, at the right location, and undamaged, logistics carriers can use IoT to acquire clear vision at the moton of items - metre by metre and second by second, in addition to item stage situation tracking. Among logistics security providers, Freight Watch stands head and shoulders above the competition. Their active monitoring solutions safeguard supply chains by providing visibility from origin to destination based on real-time location and sensor data. Our multi-tiered solutions allow businesses to keep tabs on their shipments at every stage of the international supply chain, reducing the likelihood of theft, spoilage, counterfeiting, and other problems. We now know that the Internet of Things (IoT) will allow for location and situation tracking, which will provide a new level of delivery visibility and security. Vehicle telematics sensors and multi-sensor tags collect location data. The Smart Sensor is a product of DHL that provides comprehensive condition monitoring. This smart sensor can detect changes in humidity and temperature as well as shock and light events, guaranteeing total safety while in transit. DHL Unbreakable360 In order to help its clients, DHL has launched DHL Resilience360, a platform that analyses the global scenario to help suppliers manage the production and transportation of their products. For example, if severe weather, political unrest, a strike, or any other hazard may impact their company. Supply Chain Risk Management is the main name for DHL Resilience360. Application Areas Delivery to the Final Mile Logistics firms are facing new issues due to the reliance on labour in the last leg of the shipping route, sometimes known as the "final mile." Additionally, buyer needs are becoming more sophisticated and transportation variables are continuing to expand. They are on the hunt for creative, new solutions for this crucial stage of the supply chain, ones that are both cost-effective and beneficial to the end user and the logistics provider's operational performance. As the Internet of Things propels innovative new business models, it has the potential to bridge the gap between the logistics provider and the end user in intriguing ways inside the last mile. Optimised series creation from postal boxes is one last mile use case provided by the Internet of Things. When sensors placed on the field detect that it is kilometres empty, they send a signal that is analysed in real time. By avoiding that field for series, the shipping person may optimise daily series routes. The proximity sensors developed by startups like Postybell42 detect when mail has been placed in a personal mailbox and may also show the level of moisture within the mailbox. Afterwards, a shipment notification is sent to the recipient's telecell or smart phone via GSM. For instance, people may set a reminder to check their mailbox or keep an eye on it while they're away. Customers of DHL Paketkasten or Parcel Box, two solutions to the e-commerce boom, will be able to build a private parcel locker right outside their front door according to the same principle. The German market is now releasing this. We might imagine a future when temperature-controlled smart lockers replace traditional mailboxes and guarantee the on-time delivery of perishable items, foodstuffs, and other ecologically sensitive commodities as letter volumes decline and parcel quantities rise. What Makes Internet of Things (IoT) Succeed in Logistics Along with the supply chain, the Internet of Things (IoT) in logistics has focused on person-use cases. However, it is by no means an exhaustive list of applications. In order to reap the benefits of the Internet of Things (IoT) in their operations, companies can't limit themselves

to just one use case in logistics, transportation, or last-mile delivery. Knowledge on how such use cases merge with one another is the key to success. A smart pallet may be useful for inventory management in a warehouse, but it has limited application outside of the warehouse and away from the store. Consequently, the establishment and management of a knowledgeable community of property pertaining to distinct verticals and horizontals in the supply chain would be the core of the Internet of Things (IoT). However, we need to link inside the logistics business first, before we can remember the requirements for connectivity throughout various lease businesses. Logistics is often a fragmented and low-margin industry, especially in the street freight sector where tens of thousands of suppliers meet varying needs for local, national and international operations. It will be necessary to modify whole networks prior to introducing new solutions in logistics, which is a networked industry, and this suggests that substantial investment is necessary. Strong cooperation, high levels of engagement among specific players and rivalry inside the supply chain, and a typical place's desire to spend are all necessary for an efficient implementation of IoT in logistics. Perhaps the common goal is to have a robust Internet of Things ecosystem. Although the logistics industry may face new security challenges brought about by the Internet of Things (IoT), these challenges may be met by implementing new security measures, particularly when paired with analytics. Furthermore, there are other positive outcomes that may be achieved by effectively addressing these challenging situations. These outcomes can include improved efficiency and effectiveness; increased financial development, productivity, and job creation; enhanced health and wellness; and enhanced environmental sustainability. The Internet of Things is crucial to the growth of India's logistics industry. These days, it seems like every business has its own app that drivers may use. As soon as the driver receives the seal or stamp from the client on the consignment paperwork, it serves as evidence of delivery. The driver may then take a photo of it and submit it with the same docket number, updating the delivery status instantly. When drivers return to the warehouse, they often only submit the documents to the branch after receiving the seal. This is the time it takes for a shipment to go from "out-for-delivery" until the moment the receiving copy is submitted by the driver. Afterwards, the driver sends it to the POD department, which updates the system. Lastly, the consignment status is recorded as delivered after being marked out for delivery.

Result And Discussion

Research on the Internet of Things and supply chain management (RQ1), options on where to publish Media outlets for IoT and SCM publications are covered in this area. According to Table 5, it compiles information on publishers, their journals, and their impact factor from the Journal Citation Report (2022) and a number of studies on the Internet of Things (IoT) and supply chain management (SCM). Our sample size was 43 papers; 35 of them appeared in journals with an impact factor, while 8 appeared in journals without an impact factor or with an Emerging Science Citation Index (ESCI). Figure 5 displays the results of the literature review on the top 10 publishers for SCM research based on the Internet of Things. 3.2. Publications concerning IoT-based supply chain management during time (RQ2) The provided figure allows one to observe the publishing frequency of all the retrieved papers, allowing one to determine if the research trend is increasing. It is clear that the publishing

frequency in 2019 was higher than in 2018, but it will be lower in 2020. It could be because of the COVID-19 epidemic. Research on Internet of Things (IoT)-based supply chain management has been more popular since 2020, when the frequency of publications began to rise. There are not many publications found for the year 2022. It is anticipated that further research will be released on the Internet of Things by the end of this year, and there may be a rationale behind doing the search for SLR at the beginning of 2022. Figure 6 displays the data for the frequency of publication for research on SCM based on the Internet of Things throughout time. Publishers, journals, and the impact factor of each are correlated with the number of research discovered for SLR. Review of Relevant Research In this part, we provide a comprehensive review of relevant research that addresses the domains of application, SCM areas, technologies, sensors, and devices that make up IoT-based supply chain management systems. Table 6 displays the results of the chosen research.

Application domains for research on IoT-based SCM (RQ3)

Here we go over some of the areas where research on IoT-based SCM has already been conducted. These include the following: Additive Manufacturing Supply Chain, Food and Agriculture Supply Chain, Asset Supply Chain, Cold Supply Chain, E-Commerce Supply Chain, Healthcare and Medical Supply Chain, Electric Vehicle Supply Chain, Reverse Supply Chain, and E-Commerce Supply Chain. Research based on the Internet of Things finds its primary use case in Fig. 8.

The Supply Chain for Additive Manufacturing: 3D printing, or additive manufacturing, is a relatively new development in the industrial sector. The Internet of Things (IoT) and blockchain technology have made the additive manufacturing supply chain more secure and traceable, which has led to its rapid growth. Internet of Things (IoT)-based additive manufacturing supply chain was aided by the authors of. Supplying raw crops and food goods to manufacturers and merchants is the process known as the agricultural and food supply chain. "From the farm to the table" is just the beginning of the agricultural and food supply chain process. The agricultural and food supply chain ensures meticulous management of all operations pertaining to crops and food. The introduction of Internet of Things (IoT)-based food supply chains and agriculture has greatly improved the efficiency, transparency, safety, and dependability of these industries. Freshness and food waste were also addressed by SCM based on the Internet of Things. The vast majority of published works focus on some aspect of food production or distribution, with some writers making contributions to these fields using the Internet of Things (IoT). Additionally, the authors utilized AI, Block chain, RFID, and the cloud to facilitate the Internet of Things in the food supply chain and agriculture.

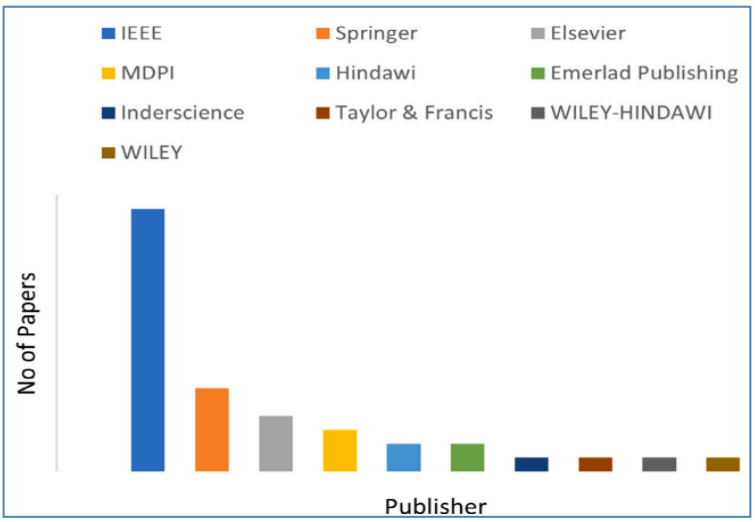

Figure 1.3 Top 10 publishers for IoT-based SCM research.

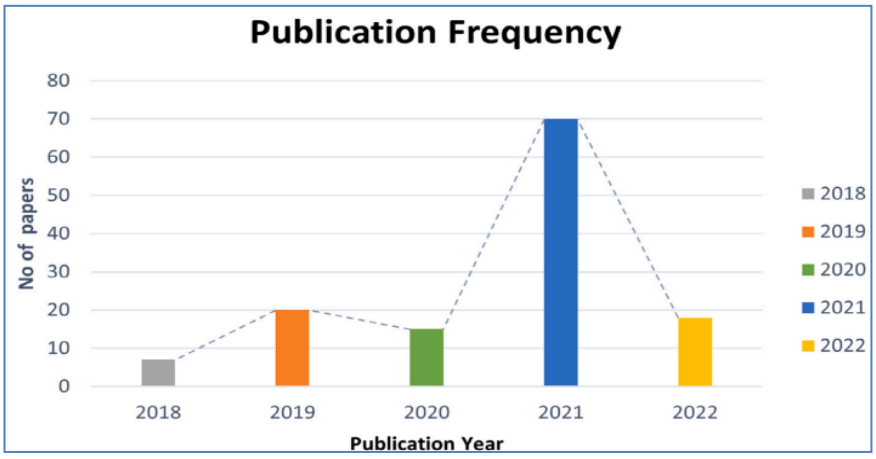

Figure 1.4 Year-wise publication frequency.

Figure 1.5 Application domains for IoT-based SCM research.

One of the numerous problems with traditional SCM was the difficulty in real-time tracking of items and the lack of transparency in the supply chain activities. Problems like fake goods arising from an opaque supply chain process are also part of it. A new method of bringing the time-honored SCM procedure into the current era is known as IoT-based SCM. Because products can be easily tracked in modern SCM, it is more transparent. Keeping track of the finished goods from the procurement of raw materials to distribution is also a breeze. It was discovered that there was a lack of thorough SLR in the literature. Using a literature review covering the previous five years, this article offered the first SLR on SCM based on the Internet of Things. By delving into the topic's primary areas including application domains, technologies, sensors, and devices needed to build such systems this study adds to our understanding of IoT-based supply chain management. The results of the SLR are encouraging and useful, and they can serve as a concise overview of IoT-based SCM for academics in the future. This research shows that there are new technologies in this sector that may be investigated to make IoT-based supply chain management more robust. These technologies include AI, Blockchain, and cloud computing, which are all IoT-enabling. The assessment also paints a detailed picture of the domains where the applications are used. The Industrial and Manufacturing supply chain has received comparatively less attention than the Agri-Food and Medical and Healthcare supply chains. Internet of Things–based supply chain management would be well-suited to the industrial and manufacturing supply networks that would be the subject of future research into Industry 4.0 and Industry 5.0. Purchasing and delivering products and services in a manner that minimizes their adverse impacts on society, the economy, and the environment is increasingly becoming more of a priority for businesses. Given the above, Sustainable Supply Chain Management (SSCM) has piqued the interest of academics and businesses alike for its focus on social, economic, and environmental responsibility on the part of corporations. For long-term success with IoT-based SCM, studying SSCM is another interesting avenue to pursue.

Conclusion

The need for real-time information and the complexity and variety of client requests need adjustments to warehouse operations. Makers in the age of Industry 4.0 can't afford to utilize the antiquated methods of manual warehouse operation any more. Consequently, in order to increase productivity and enable personalized order fulfillment, a cutting-edge WMS is crucial. This research presents a workable solution for warehouse management systems (WMS) that incorporates fuzzy logic to improve order picking efficiency by selecting the best approach. Based on the findings of the case study, this research suggests that the WMS has the potential to improve the performance of warehouse operations in terms of both practical and abstract advantages. Real benefits include an increase in order accuracy and a decrease in order fill rate. In addition, it has the potential to improve order picking efficiency, inventory accuracy, and receiving time. The intangible benefits include improved packaging methods and the ability to track inventories via RFID. The morale of the employees can also be boosted. We have skipped over the routing and storage regulations because this research is all about the order choosing procedure and real-world applications. But improving warehouse performance is all about space allocation and cutting down on journey distance. This opens

the door to more research into fuzzy logic's batch-the-zone, sequential-zone, and wave-picking applications in the future. Further research on smart robotics is necessary because it changes the pick-and-pack operations in warehouses from picker-to-goods to goods-to-picker using robots. Meanwhile, integrating AI will be a future direction for smart logistics and information automation, which will streamline warehouse operations with higher efficiency, performance, and lower costs in the long run. Generally speaking, the most promising area for future research into optimizing warehouse efficiency is the integration of IoT and robots.

References

[1] Q. Wang, R. Mclntosh, and M. Brain, "A new-generation automated warehousing capability," International Journal of Computer Integrated Manufacturing, vol. 6, pp. 565-537, 2010.

[2] M. K.Lim, W. Bahr, and S. C.H.Leung. "RFID in the warehouse: A literature analysis (1995-2010) of its applications, benefits, challenges and future trends," International Journal of Production Economics, vol. 145, pp. 409-430, 2013.

[3] E. Sahin, Y. Dallery, "A literature review on the impact of inventory data record inaccuracies on inventory management and the potential of the RFID technology to tackle this issue," Ecole Centrale Paris, 2007.

[4] H. Wang, S. Chen, and Y. Xie, "An RFID-based digital warehouse management system in the tobacco industry: a case study," International Journal of Production Research , vol.48, No.9, pp. 2513-2548, 2010. [5] H. K.H. Chow, K.L. Choy, W.B. Lee, and K.C. Lau, "Design of a RFID case–based resource management system for warehouse operations, " Journal of Business Logistics, vol. 30, pp. 561-576, 2006.

[5] G. Liu, W., Yu, and Y. Liu, "Resource management with RFID technology in automatic warehouse system, " IEEE/RSJ International Conference On Intilegent Robots And Systems, Beijing, pp. 3706-3711, 2006.

[6] T.C. Poon, K.L. Choy, H.K.H. Chow, H.C.W. Lau, F.T.S. Chan, and K.C. Ho, "A RFID case-based logistics resource management system for managing order-picking operations in warehouses," Expert Systems with Applications, vol. 36, pp. 8277-8301, 2009.

[7] J.SL. Ting, and A.H.C. Tsang, "Design of an RFID-based inventory control and management system: A Case Study," The West Indian Journal of Engineering, vol.34, pp. 70-79, 2012.

[8] A.D. Ross, D. Twede, R.H. Clarke, and R.H. Ryan, "A framework for developing implementation strategies for a radio frequency identification (RFID) system in a distribution centre environment," Journal of Business Logistics, vol. 30, pp. 157-183, 2009.

[9] Z. Xu , X.G. Ming , J. Zhou , W. Song , L. He and Miao Li, "Management optimisation based on dynamic SKU for RFID-enabled warehouse management in the steel supply chain," International Journal of Production Research, vol. 51, pp. 2981-2996, 2013.

[10] Y. Liu, and , D. Wang , "An RFID middleware business process integration framework based on EPC modeling and complex event processing," International Conference on Computer Sciences and Convergence Information Technology, Seoul, pp. 64-69, 2009.

[11] L. Wang, L.D. Xu, Z. Bi, Y. Xu, "Data cleaning for RFID and WSN integration, " IEEE Transactions on Industrial Informatics, vol.10, pp.408 – 418, 2014.

[12] X. Zhou, and W. Long, "The research of network architecture in warehouse management system based on RFID and WSN integration," International conference on automation and logistics, Qingdao, pp. 2556- 2560, 2008.

[13] W.K. Jehng, S. Peng, and W.H. Huang, "Using LabVIEW to integrate RFID system and database for supply chain efficiency improvement, " International Journal of Intelligent Control and Systems, vol. 13, pp. 189-195, 2008.

[14] C. Zhai, Z. Zou, Q. Zhou, J. Mao, Q. Chen, H. Tenhunena, Z. Lirong, and L. Xu, "A 2.4-GHz ISM RF and UWB Hybrid RFID Real-Time Locating System for Industrial Enterprise Internet of Things (IoT),"Enterprise Information System, puplished online, 2016.