

THE IMPACT OF IOT ON SMART LOGISTICS

Nisha Ravi¹, A. Seetha Raman²

¹Researcher, (DS21DBA008), S.P. Jain School of Global Management – Mumbai.

²Dean Research, SP Jain School of Global Management- Singapore.

Email :¹ nisha.ds21dba008@spjain.org, ² seetha.raman@spjain.org

ABSTRACT: The main objective of this study is to ascertain how the Internet of Things (IoT) can be used effectively in smart logistics. The logistics industry can harmonize the function rather than applying manpower to entire procedures. Globalization presents challenges to smart logistics. The development of smart logistics focuses on the assessment of outcomes to realize the surveillance of logistics functions. Modern IoT will provide a broad opportunity in supply chain forecasting. Artificial intelligence, machine learning, and deep learning all play a major part in smart logistics. Machine learning applications with predictive system designs are used for inventory control, especially to address the material backorder problem. IoT has been identified as the most dominant tool in future logistics; its common name is intelligent logistics. Smart and structured operations currently exist in smart logistics. The entire logistics function improved with the support of IoT.

KEYWORDS: Smart warehousing, hybrid human-machine, smart living, supply chain management, intelligent transportation system.

1. INTRODUCTION

Smart logistics have become intelligent logistics, and Internet of Things (IoT) applications are very popular in supply chain management. Smart logistics has led to extraordinary results and customer response in terms of tracking and monitoring; it is an unavoidable IT mechanism that contributes to the improvement of the entire logistics function. In nutshell, smart logistics allows the real-time tracking of movement and the on-time delivery of goods and services. Smart warehousing functions with the support of IoT, which enables smart service. As far as the customer is concerned, on-time pickup, tracking and delivery are the most important factors. Using the latest technology will ensure smooth handling and mutual benefits (Song et al., 2021).

Unquestionably, IoT plays a key role in the execution of smart logistics. Over time, this will transform the logistics operations method and the architecture of the logistics system and will eventually result in risk-free and prompt service, including end-to-end visibility, expanded logistics transportation, warehousing, distribution, and information services, and it can save time and money (Chin et al., n.d.; Pandian, 2019).

The movement of perishable cargo plays a major role in logistics; minute mistakes can cause the cargo to be spoiled, and that will end up causing losses to customers as well as suppliers. When handling perishable goods, movement sensor devices are connected via IoT and provide real-time data, thereby supporting immediate action if any changes are needed (Mythily, 2020)

2. RESEARCH PROBLEMS AND QUESTIONS.

This research is based on the feedback from clients, logisticians and logistics management teams on the advantages and the crisis. The following research questions were presented:

- What are the effects of smart logistics in warehouse management?
- How can a human-hybrid machine be utilized in the supply chain?
- How can machine intelligence effectively be used in smart logistics?
- How can cost be reduced without any compromise in service?
- How can intelligent transportation systems be applied to increase customer satisfaction?

3. RESEARCH OBJECTIVES

To explore the research problems, the following objectives were developed:

- Discover the efficiency of smart logistics,
- Study the effectiveness of IoT at the management level
- Analyze freight costs before and after the implementation of IoT
- Focus on travel time improvement with the support of intelligent transportation, and optimize warehouse management.

4. LITERATURE REVIEW

In every industry, growth depends on efficient trade support and structures. Logistics is an unavoidable part of commercial activities, closely related to the advancement of technology. Logistics performance and correlation that is progressive and qualitative will eventually lead to results and more opportunities. The expansion of logistics in business can enhance the national economy. Smart logistics will have a positive effect on Logistic performance. We can apply IoT in smart logistics for the advancement of management. End-to-end users will reap the benefits of the implementation of smart logistics. Technology implementation will positively impact results, which will help out the entire industry. The supply chain contains several elements that are interconnected and that are fundamental to any logistic function. The integration of smart solutions will enhance supply chain management through systematic resource utilization, cost efficiency, simplicity, flexibility, and system sustainability. Digitalization plays a vital role due to the increase in customer demand (Chin et al., 2020). A literature review is differentiated as sections correlating to the independent variables. Six independent variables include:

- Smart Warehousing
- Hybrid Human Technology
- Smart Living
- Supply chain Management
- Intelligent Transportation system

4.1 Smart Warehousing

IoT goes well beyond radio frequency identification (RFID) technology in logistics. RFID can provide updates on deliveries when a product arrives at a destination, but it cannot make frequent statements about the events that happen along the way. However, IoT solutions can play a major role in that. IoT makes the impossible possible, from shipping to delivery (Mythily, 2020). IoT can create smart warehousing, where inventories can be monitored by sensors under real-time conditions. The efficiency of smart logistics mainly depends on system security. Therefore, supporting technology in IoT acts as a human–material interface. Potential uses of AI, Big data and IoT includes decision support and decision–making capabilities. (Woschank, 2020).

4.2 Hybrid Human-Machine Technology

It has been proven that smart and efficient operations can be performed by robots as well as cyber-physical–human systems and human-machine interactive technologies (Cavelieri, 2020). Human computers and human machines are controlling new devices. Hybrid human–machines play a role in decision-making and can be placed in autonomous vehicles, which will eventually upgrade the system and make it widely usable (Liu, 2018).

4.3 Smart Living

Many contemporary challenges exist in the area of smart living. Smart living enhances the user-friendly dimension rather than the intelligent dimension (Bagheri, 2018). People are interested in having user-friendly technologies at their fingertips, and this can lead to the creation of smart environments (Bhat, 2019). The characteristic of smart logistics is meaningful, and it is used in many logistics operations. To improve the quality and sustainability of life, smart cities integrate both digital technology and data analytics (He et al., 2018). The integrated smart solutions will develop supply chain management through efficient resources utilization, cost efficiency, simplicity, flexibility, and system sustainability (Issaoui et al., 2019).

4.4 Supply Chain Management

The integrated smart solutions will enhance supply chain management through methodological resource utilization, economic sustainability, intelligibility, flexibility, and system sustainability (Jabeur et al., 2017). Blockchain technology can deliver key components, i.e. transparency and traceability, to the supply chain. In supply chain management, blockchains should enhance information security and trust. System sustainability in transportation is assured when it implements smart logistics. Sustainability is one of the powerful elements in the supply chains (Jeon et al., 2016).

4.5 Intelligent Transportation System

Globally, the intelligent transportation system plays a vital role. It is one of the most powerful transportation systems in the smart logistics (Jabeur et al., 2017). In the intelligent transportation system, the transit

management system enhances operating efficiency, and the intelligent management system is a significant area of improvement (Pham et al., 2016). By using the intelligent transportation system, the timely operation, competent provision, and utilisation of the fleet can be managed (Yoon et al., 2016).

5. RESEARCH METHODOLOGY

The research framework was designed based on the deductive approach and the literature review of 50 articles, published from 2018 to 2021, which were thoroughly reviewed and summarised. The findings, methods, problems, and solutions were properly identified, and the research gap and future research scopes were highlighted. In the context of this current research, five independent variables were identified about the impact of IoT on smart logistics. The direct connection between the five independent variables and the dependent variables is outlined within the research framework in the section below. The main focus of the research methodology identifies the research approach, which emphasizes the key variables. The methodology adopted in this research is based on secondary data. The data have been collected from relevant research articles

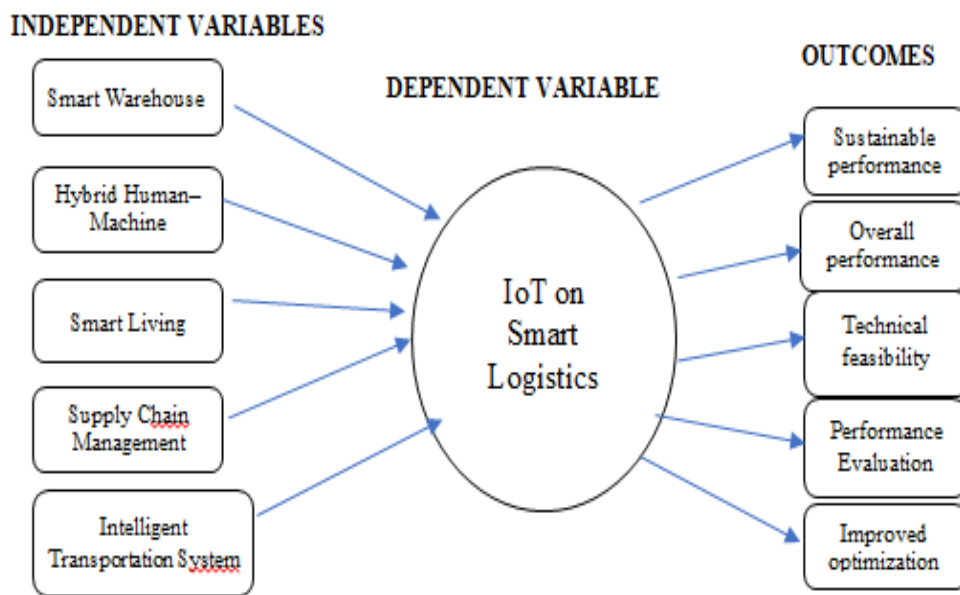


Figure 1-Research Framework

6. ANALYSIS OUTCOME AND PROPOSITION

The introduction of new and efficient technologies helps customers save time and money. Especially when it comes to essential commodities, on-time departure and arrival are mandatory. Previously, customer tracking was based on the expected departure time and expected arrival time only. However, with the implementation of smart logistics, cargo tracking is monitored by IoT. Hence, customers are updated without assistance from the shipping or logistics companies. Smart logistics is an effective way to meet the challenges of fast-changing customer expectations, take advantage of opportunities brought by new technologies and facilitate new business models.

6.1 Smart Warehousing

The logistics business is entirely dependent on on-time delivery and service. Therefore, online management is its main focus, and that has to be developed using IoT technology. Warehousing plays a key role in smart logistics.

A primary focus on customer service and customer satisfaction help the logistics companies to build up customer satisfaction and increase their business, enabled by daily activities for pick up, packing, loading, shipping, trucking and warehousing. Throughout the process, monitoring is the key factor, updating customers accordingly (Chin et al., n.d.).

Outcomes

The goal of smart warehousing is the ability to create customer value. Improving the service and efficiency through IoT will be reflected in future business, and there is much opportunity for growth. Prioritizing operations like cargo movement, warehousing, and on-time delivery will be the gateway to business

opportunities. With the support of sensors miscommunication from the warehousing, part can be rectified. (Pham et al., 2016).

The sustainable performance will happen only with the support of emerging technologies that add smart logistics for remarkable business gain.



Figure 3 Smart Warehousing

Source: www.boscom.com supply-chain-management&psig

Proposition: Smart warehousing has a significant relationship with the application of IoT on smart logistics through warehouse management systems, management efficiency, tracking, robotics, and automation, which result in improved smart warehousing scalability.

6.2 Human Hybrid–Machine

The factors affecting businesses in any field are accuracy, data collection and transparency. How effectively and efficiently the business handles these is key. Accuracy in demand forecasting and inventory greatly improved with the support of hybrid human–machine technology (Wang et al., 2017).

Outcome

While past research demonstrated the benefits of combining machine predictions or combining human predictions – the so-called 'wisdom of the crowds' – this work forges a new direction by demonstrating the potential of combining human and machine predictions, pointing to new and improved approaches to human–AI collaboration.

Hybrid human–machine technology has a significant relationship with the application of smart logistics through computation, hybrid data, data base, human intelligence task and crowd sourcing, which results in the prevention of miscommunication and the safeguarding of system security.

6.3 Smart Living

Smart living includes having goods and services delivered on time. The rapid development in information and communication technologies (ICT) promises excellent timing and quality service.

Outcome: Technical feasibility is the major factor in smart living, which shows the enhanced functionality with the influence of data and technology. (Grundy, 2020).

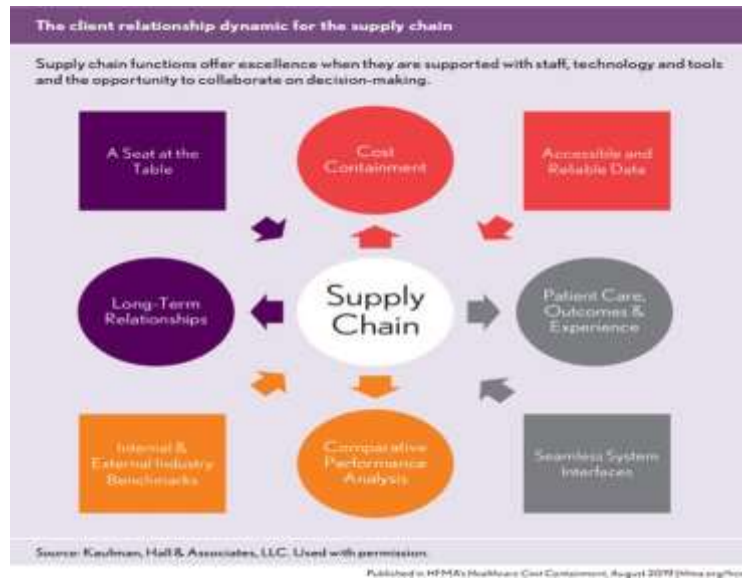


Figure 4. Supply Chain Management Flow

Source: www.hfma.org/content/hfma/www/topics/operations-management.



Figure 5-Smart Logistics

Source: www.springer.com

Proposition: Smart living has a significant relationship with the application of smart logistics. It is emerging technology that provides technical feasibility through the sub-variables of community, individuality, freedom of choice, regulation and accessibility.

6.4 Supply Chain Management

In supply chain management, IoT refers to connecting various data points (devices used as part of the supply chain) to achieve a final outcome, such as higher operational efficiency or better forecasting of product demand. It is a growing practice, even in small businesses.

Outcome and measures

Performance evaluation (Lu, 2018).

Proposition

Supply chain management is process-based management. Sustainability in the supply chain is most important, resulting in performance evaluation through the following sub-variables: mobility, safety, environment, big data and data analytics.

6.5 Intelligent Transportation System

Experts concerned with pollution, energy consumption and global warming issues have also cautioned us about the effect of technologies that make driving much more pleasurable and less difficult. This may lead to an increase in travel because drivers will feel comfortable going to unknown destinations due to a decrease in uncertainty, leading to an undesired increase in the use of motor vehicles.

Outcome and measures

Integrating radical communications technologies will improve optimisation (Pustokhina, 2020). Improvement in travel time and reduce delays in transportation is another benefit.

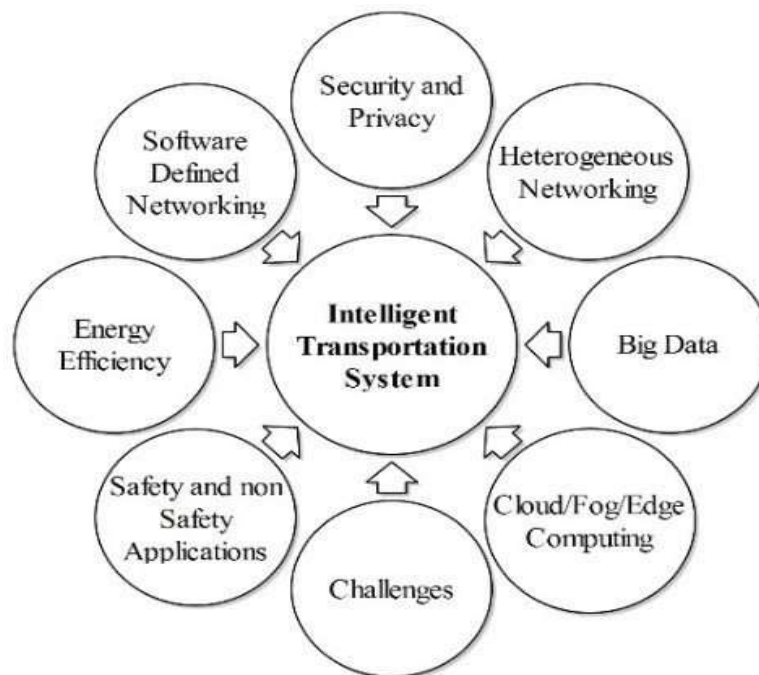


Figure 7 Intelligent Transportation System.

Source: https://www.researchgate.net/figure/Integration-of-intelligent-transportation-system-with-SDNs-and-the-other-technologies_fig4_341210309

Proposition

The intelligent transportation system has a significant relationship with the application of smart logistics, which can reduce delays in transportation, thereby improving the travel time and avoiding delays in cargo arrival. The overall service can be assured as a result of AI, ML and Social Network Analysis (SNA), allowing logistics companies to promise better transit time. The economic and social dimensions result in improved optimisation.

7. THEORETICAL AND PRACTICAL IMPLICATIONS

This study informs service providers in the field of logistics to address the increase in freight costs, the quality of customer service and the tracking and tracing of the movement of goods. Smart logistics plays a key role when it comes to city logistics and urban freight, which will lead to economic growth. Due to the increased demand and rapid growth in the logistics industry, the development of smart cities is the only possible and effective way to gain business and achieve goals.

8. LIMITATIONS AND FUTURE RESEARCH SCOPE

One limitation of this study is the qualitative method adopted with the analysis of secondary data. The secondary data was collected from recent research papers. One of the limitations is the questionnaires, which were not answered properly. Hence, similarities from previous research reviews have been reflected. Further studies can focus on adopting a quantitative methodology, in which the data are collected from primary sources and involve genuine respondents, such as people who are in the logistics industry or supply chain management.

9. CONCLUSION

Instead of a simple upgrade, smart logistics should have a comprehensive upgrading system.

Reasonable and user-friendly data collection, visualisation, warehousing and time management have to be implemented. Although many Arab countries can offer trade logistics at a fraction of the cost of their Western counterparts, they are hindered by inefficiencies at various stages of the logistics chain. As a result of poor service provided by third parties, companies typically utilise their own logistics services, which increases costs. Inefficient transportation infrastructure is a hindrance to overall trade performance. It is imperative that all kinds of barriers preventing access to foreign markets be addressed to support firms in the region to thrive there.

10. REFERENCES

- [1]. DrMythily, AjinAnto, Arun Kumar, Naveen Kumar R.S &Vignesh E. (2020). An RFID based smart logistics management system for monitoring perishable goods using Internet of Things
- [2]. Hamid Bagheri, Abdulsalam Abdullah Shaltooki. (2018). Big Data challenges, opportunities and cloud-based solutions.
- [3]. Bo Feng, Qiwen Ye (2021). Operations Management of smart logistics- A Literature review and future research
- [4]. Chiara Cimini, Alexandra Lagorio, David Romero, Sergio Cavlieri& John Stahre (2020.12.2818)
- [5]. Himanshu K. Shee, Shah.J.Miah (10-12-2019) The impact of smart logistics on smart logistics performance
- [6]. WaiPeng Wong &ChorFoonTangGurusamy,(2018) International Journal of Logistics Research and Applications, 21:4, 431-443, DOI: 0.1080/13675567.2018.1438377
- [7]. Yangke Ding, Mingzhou Jin, Sen Li &DingzhongFengTo cite this article: Yangke Ding, Mingzhou Jin, Sen Li &DingzhongFeng 2021) Smart logisticsbased on the internet of things technology: anoverview, International Journal of Logistics Research and Applications, 24:4, 323-345, DOI: 10.1080/13675567.2020.1757053
- [8]. Izwan Azmi¹, Norlida Abdul Hamid², MdNasarudinMd Hussin³ and NikIbtishamiah Ibrahim logistics and supply chain management: the importance of integration for business processes (2018)
- [9]. The effect of internet of things on supply chain integration and performance: An organizational capability perspective Tharaka De Vass HimanshuShee&ShaMiah(2018)
- [10]. Smart Logistics as a basis for the development of the smart city- Sabina Kauf-(2019)
- [11]. The Diffusion and the international context of logistics performance - Pei- Chun Lin &T.C.E.Cheng (2020)
- [12]. The major determinants of Logistic performance in a global perspective: evidence from panel data analysis, WaiPengWong&ChorFoon Tang(2018)
- [13]. Automation and artificial intelligence in business logistics systems: human reactions and collaboration requirements. Matthias Klumpp(2017)
- [14]. Application research of smart logistics based on blockchain technology Haidi Tang (2020)
- [15]. Artificial Intelligence Application in the new model of logistics development based on wireless Communication Technology Shuaiqi Wang (2021)
- [16]. The Application of Artificial Intelligence in Logistics and supply chain ZhandarkKhalifeSoltani (2021)
- [17]. Artificial Intelligence Application in Smart Warehousing Environment for Automated Logistics Dr.A.Paumpandian (2019)
- [18]. Smart Logistics in Evolution of the Logistics- IzabelaDembinsca-(2018)
- [19]. Research on the impact of Big Data on Logistics- Yaxing Wang, LijieFeng – Heyu Chang and Min Wu(2017)
- [20]. Logistics for Business Defined: Importance Role & Benefits-Abby Jenkins-(2020)
- [21]. Logistics and supply chain management: The importance of integration for business processes-(2018)
- [22]. Smart Logistics- A Literature Review Andrea Resch and Thorsten Blacker-(2021)

- [23]. Examining the drivers of competitive advantage of the international logistic industry. Chia- Hsun Chang, Chin

AUTHORS:

Nisha Ravi is a research scholar at S.P. Jain School of Global Management – Mumbai, having 15+ years experience in Shipping and Logistics industry and currently Business Development Manager with Kohinoor General Trading. She is an MBA in International Business from SMU. Her research interest is to study the effectiveness of IoT at the management level..



Dr Seetha. A is Dean of Research in SP Jain School of Global Management, Singapore, having experience of 30+ years in research in multi-disciplinary areas and has produced more than 300+ papers for publications.

