SMART LOGISTICS: TRANSFORMING THE FUTURE OF SUPPLY CHAINS

Alen BIJU, Vytautas Magnus University Agriculture Academy, Faculty of Bioeconomy Development, email: alen.biju@vdu.lt

Abstract

Smart logistics is emerging as a result of the swift development of digital technologies, which is changing supply chain management. This idea combines big data analytics, blockchain, automation, the Internet of Things (IoT), and artificial intelligence (AI) to increase sustainability, efficiency, and visibility. With an emphasis on cost reduction, operational resilience, and enhanced decision-making, this study investigates the revolutionary effects of smart logistics on supply chains. There were used scholarly literature review, secondary data gathering approach, case studies methods. The findings highlighted that smart logistics improves last-mile delivery efficiency, reduces carbon footprints, and strengthens supply chain resilience. Better performance and sustainability are facilitated by blockchain-supported transparency, IoT- enabled real-time tracking, and AI-driven predictive analytics. However, obstacles like differences in digital infrastructure, high implementation costs, and cybersecurity threats make mainstream adoption difficult. Despite these challenges, smart logistics is anticipated to establish itself as a key component of supply chains in the future, helping companies better handle the challenges of international trade. To optimise the advantages of smart logistics, this study emphasises the significance of strategic investments in digital infrastructure, cybersecurity safeguards, and staff upskilling.

Keywords: smart logistics, supply chains, IoT, AI, blockchain, automation, big data, efficiency, sustainability.

Introduction

According to Chauhan et al. (2022), supply chain management is changing as a result of the rapid development of digital technologies, and smart logistics is emerging as a key driver of efficiency, agility, and sustainability. Since traditional logistics models, which rely on manual processes and traditional transportation networks, frequently struggle with inefficiencies, high costs, and limited real-time visibility, businesses are adopting smart logistics solutions that integrate big data analytics, blockchain, and artificial intelligence (Liu et al., 2021). Besides, Issaoui et al. (2019) remarked that blockchain technology ensures safe and transparent transactions, lowering fraud risks and bolstering trust among supply chain stakeholders and big data analytics enables precise demand forecasting, helping businesses optimise inventory and reduce operational inefficiencies. Also, IoT-enabled real-time tracking improves supply chain visibility, minimising delays and losses and AI-powered predictive analytics improves demand forecasting and inventory management, reducing excess stock and shortages. Thus, it was clear that all of these technologies work together to save costs, increase efficiency, and increase supply chain resilience (Humayun et al., 2020).

Furthermore, in addition to enhancing operations, smart logistics also helps with sustainability initiatives. AI-powered route optimisation reduces fuel usage, and blockchain improves supply chain traceability and ethical sourcing. Therefore, businesses can reduce their ecological impact and adhere to sustainability standards throughout these developments (Yan et al., 2022). Nevertheless, even with its advantages, adopting smart logistics is fraught with difficulties, such as cybersecurity threats, large upfront expenses, and disparities in technology infrastructure between geographical areas. In order to fully benefit from smart logistics, firms must address these obstacles (Azab et al., 2025). Although existing studies discussed specific applications of smart logistics, comprehensive research evaluating the synergies between these technologies as well as their combined effects on supply chain sustainability and performance is less. Likewise, few studies provide practical solutions into how companies can overcome implementation obstacles and completely incorporate smart logistics into their supply chain models. This study aims to fill this gap by providing an in-depth analysis of smart logistics, its impacts, challenges, and practical recommendations for companies to transform their supply chains.

Research aim: To analyse how smart logistics can affect the future of supply chain.

The following **objectives** have been set to achieve the aim:

1. To analyse the key components and technologies of smart logistics.
2. To evaluate the impact and challenges of smart logistics on supply chain.
3. To provide recommendations for businesses to adopt smart logistics for the future of supply chains.

Research object and methods

The research object of the study – Smart logistics.

Secondary data analysis method was used to meet the research aim and objectives. Secondary data was gathered from industry publications, web sources, journals, articles, and academic literature. For this, databases, like Google Scholar, Science Direct, ResearchGate and journals, like International Journal of Construction Supply Chain Management, were searched. Statistical data collected from sources, like *Statista*. The important keywords used to search data are 'smart logistics', 'supply chain', 'components', technologies', 'impact', and 'challenges'. The data published after 2017 were included and the remaining excluded. Thematic data analysis was used to analyse the collected data secondary data. As part of this, the data were coded based on similar patterns, themes and meanings, and from this, important themes were generated for the analysis. Once the themes were prepared, the related data was put under them and later the data began to analyse, intepret and examine by comparing with previous literature. This eventually helped to address the objectives with proper conclusions.

Research results and discussion

Components and technologies of smart logistics

As per Alzahrani & Irshad (2023), Supply chain optimisation is greatly aided by the Internet of Things (IoT), which makes it possible to manage and monitor inventories, transportation, and items in real-time. By giving supply chain managers better insight into asset mobility, IoT devices like GPS sensors and RFID tags enable them to optimise delivery routes and lower losses due to theft or poor management. Demand-driven logistics operations and the reduction of inefficiencies have been made possible by the use of IoT. The growing dependence on IoT, however, raises questions regarding network vulnerabilities and data security since hackers can take advantage of these networked systems, potentially resulting in breaches and interruptions to operations.

Additionally, Woschank et al. (2020) found that by improving demand forecasting, route planning, and warehouse automation, artificial intelligence (AI) and predictive analytics reinforce smart logistics even more. Large-scale datasets are analysed by AI-driven machine learning algorithms to find trends, enabling businesses to make data-driven decisions that enhance logistical operations. Likewise, Shobhana (2024) demonstrated that AI-powered logistics systems increase delivery speed and thereby lower transportation expenses. These enhancements help supply networks become more flexible, which helps companies effectively adapt to changes in customer demand. Furthermore, fulfilment procedures are streamlined by AI applications in technologies such as automated picking and sorting, which lower operational bottlenecks and delays. However, integrating AI poses difficulties for small and medium-sized businesses (SMEs) because it necessitates a large investment in infrastructure and experience (Schönberger, 2023).

Furthermore, Raja Santhi & Muthuswamy (2022) noted that supply chain transactions are made more secure and transparent by blockchain technology, which offers an unchangeable log of logistics operations. By doing this, fraud is reduced, tamper-proof documentation is guaranteed, and customer, logistical, and supplier trust is increased. For instance, the advantages of blockchain in logistics are best illustrated by Maersk's TradeLens platform, which shows a 20% increase in transaction speed and a 40% decrease in administrative expenses (Jensen et al., 2019). Also, blockchain increases global trade efficiency, decreasing dependency on middlemen and boosting supply chain resilience by doing away with manual paperwork and automating verification procedures. However, scalability issues and high processing costs continue to hinder the adoption of blockchain. Likewise, interoperability problems across various blockchain systems also make it difficult for them to be widely used in intricate international supply chains (Rejeb et al., 2019).

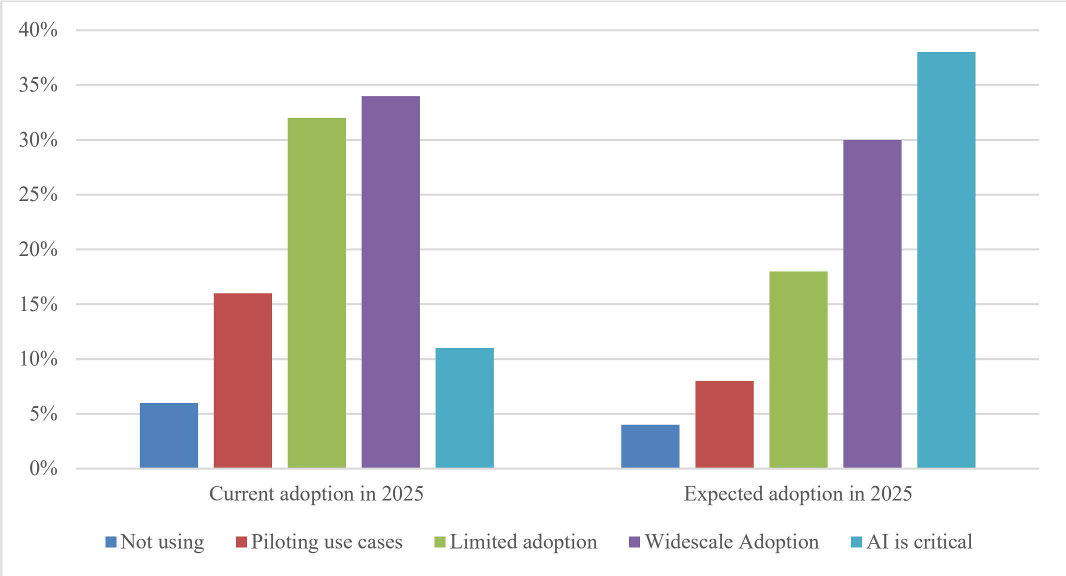
Additionally, Bag et al. (2021) claimed that large-scale supply chain data processing for improved decision-making is made possible by big data analytics, which is another essential element of smart logistics. Wolniak (2024) argued that businesses may reduce stockouts and enhance demand forecasting accuracy by utilising sophisticated analytical techniques. These skills enable businesses to better predict client needs, maximising stock levels and reducing surplus. Similarly, logistics managers can also proactively reduce supply chain risks by using real-time data analysis to gain insights into possible disruptions (Aljohani, 2023).

Moreover, Nantee & Sureeyatanapas (2021) reported that logistics operations are further revolutionised by automation and robotics, which increase efficiency and lower costs. Automated guided vehicles (AGVs), robotic pickers, and autonomous sorting systems are just a few examples of technologies that improve warehouse productivity and drastically reduce the need for manual labour. For instance, one prominent example is the robotic fulfilment centres operated by Amazon. During the years 2014, 2015 and 2016, Amazon's robo-workforce has grown by 15,000 per year, and now there are 45,000 robots operating at fulfilment centres, including the 340-kilogram-lifting Kiva. Nonetheless the necessity for specialised labour to operate these technologies and worries about workforce displacement lead to socioeconomic issues (Statista, 2017).

Figure 1, taken from Statista (2023), shows how AI is being used more and more in production and supply chains. This bolsters the claim that automation powered by AI enhances productivity, demand prediction, and warehouse optimisation. The industry's transition to smart logistics solutions is highlighted by the continual increase in AI integration.

The impact of smart logistics technologies significantly enhances supply chains.

According to Rehman Khan et al. (2020), by increasing transparency, cutting expenses, and encouraging sustainability, the use of smart logistics technologies greatly improves supply chain efficiency. Improved transparency and real-time visibility, made possible by IoT and blockchain, are among the most important advantages. These technologies give companies end-to-end supply chain awareness by allowing them to track the flow of commodities at every point. This enhanced openness promotes confidence across stakeholders and reduces delays. For example, Amazon forecasts demand, optimises last-mile delivery, and streamlines warehousing using AI-powered algorithms. By cutting down on delivery times, its IoT-enabled supply chain network increases the effectiveness of order fulfilment (Alimahomed-Wilson, 2022). Nevertheless, Jamal et al. (2024) pointed out that data security is a risk when relying on digital tracking devices. Supply chain integrity may be jeopardised by cyberthreats including hacking and data breaches, necessitating expenditures in cybersecurity.



Source: Statista (2023)

Fig. 1. AI adoption rate in supply chain and manufacturing business worldwide

Likewise, Issaoui et al. (2022) commented that another significant effect of smart logistics is cost reduction and improved operational effectiveness. Route planning, inventory control, and warehouse operations are all much improved by AI-driven automation, which has significant financial advantages. Ping et al. (2024) found that transportation costs are reduced by 15–20% on average for companies that use AI-based logistics solutions. Furthermore, this was further evident from the argument of Cosma et al. (2025) that automated warehouses increase productivity by boosting order accuracy and lowering labour costs by up to 40%. By streamlining logistical procedures, these innovations enable businesses to better deploy resources, cut down on wasteful spending, and boost profitability. However, on the converse, SMEs find it challenging to compete with larger firms due to the significant capital expenditure required to make the shift to smart logistics. Furthermore, operations can be disrupted by software bugs or system failures, which could result in higher expenses rather than savings (Matt & Rauch, 2020).

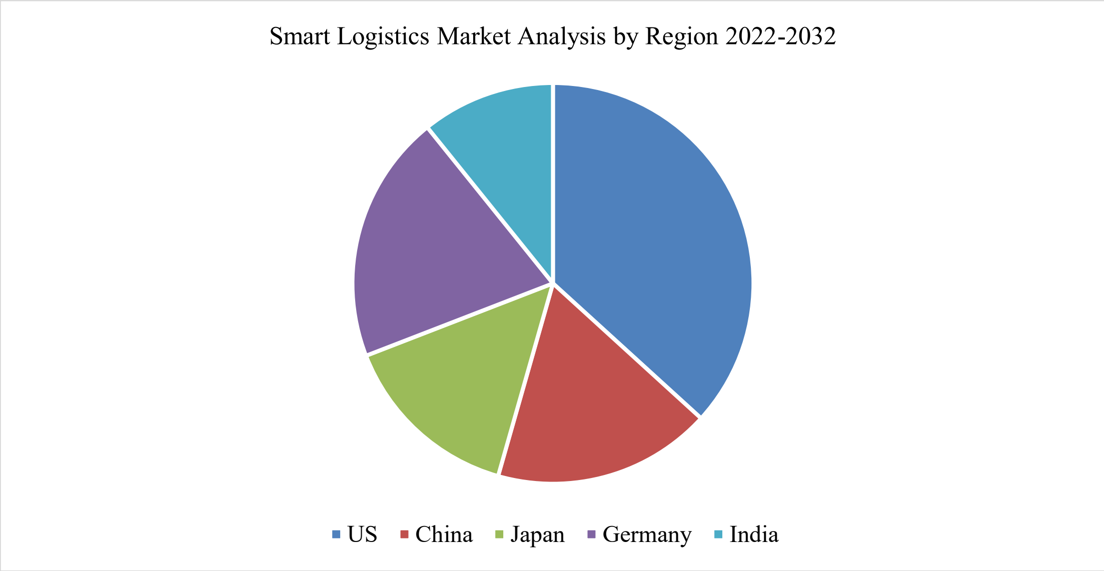
In addition, the findings of Shee et al. (2021) demonstrated that by cutting waste, optimising energy use, and minimising carbon emissions, smart logistics goes beyond economic effectiveness to help sustainability goals. For example, logistics operations can become more ecologically friendly by using AI-driven route optimisation, which can reduce fuel usage by 10% to 15%. Additionally, ethical sourcing and acceptable production processes are guaranteed by blockchain-based supply chain transparency, reducing environmental harm (Chen et al., 2024). These intelligent logistics technologies offer a viable option to lessen the environmental impact of supply chain operations as businesses come under increasing pressure to implement greener business models. On the converse, Inderwildi et al. (2020) noted that digitalisation does, however, lessen the waste of physical resources, but the energy usage of AI servers and blockchain networks raises questions about their potential effects on the environment.

Moreover, just like the above-mentioned findings Al Doghan & Sundram (2023) also pointed out that improving supply chain resilience and risk management is another important advantage of smart logistics. Businesses can use predictive analytics to foresee possible interruptions and put proactive risk mitigation measures into place. This was in line with the argument of Grover (2025) that supply chain disruptions can be predicted accurately by AI-driven models that examine market trends and historical data, assisting businesses in lessening the effects of unanticipated catastrophes like natural disasters or geopolitical conflicts. As a result, because of this predictive ability, companies can create backup plans that guarantee business continuation even during emergencies.

Figure 2 provides market analysis for smart logistics, demonstrating the growing investment in AI-driven logistics solutions. Persistence Market Research's (2022) analysis of the smart logistics market is shown in Figure 2. It illustrates how quickly blockchain-driven logistics, IoT, and AI technologies are growing. This expansion emphasises how smart technologies are being used more and more to improve sustainability and streamline global supply chain operations.

The challenges of adoption of smart logistics in supply chains.

According to Paužuolienė et al. (2024), the pricey initial expenditure is one of the main obstacles to implementing smart logistics. Implementing automation technologies, AI-driven predictive analytics, and IoT-enabled tracking systems necessitates significant financial resources. Larger companies thus benefit from the fact that many SMEs find it difficult to finance these investments. Costly robots and AI software are required for warehousing automation, for example, which makes the shift to digital operations challenging for companies with tight budgets. Businesses are deterred from making the switch by the fact that smart logistics can take years to pay for itself.



Notes: 2022 – US$ 30.6 Bn. 2032 - US$ 201.2 Bn
Source: Persistence Market Research (2022)

Fig 2: Smart Logistics Market analysis

Furthermore, Sobb et al. (2020) noted that supply chains are more susceptible to hacking attempts, data breaches, and cyberattacks as they grow more integrated and dependent on digital technologies. Blockchain networks, cloud-based data storage, and IoT-enabled logistics systems all need strong cybersecurity frameworks to guard against unwanted access. One example of the dangers of digitalised supply chains is the 2017 Maersk cyberattack, which interfered with international shipping operations (Weaver et al., 2022). Therefore, smart logistics systems may end up being a liability rather than an asset if companies don't make the necessary security investments. To reduce these risks, businesses must use AI-driven threat detection, frequent security audits, and robust encryption procedures.

Similar to this, infrastructure constraints are a major obstacle to the implementation of smart logistics, particularly in developing nations. High-speed internet, extensive IoT sensor networks, and sophisticated data centres for real-time processing are necessary for smart logistics (Ding et al., 2021). It is challenging to deploy AI-driven logistics solutions in many areas, though, because of issues with limited transit networks, inconsistent electrical supplies, and poor internet connectivity. Additionally, inadequate digital infrastructure creates bottlenecks in rural supply chains, limiting businesses' ability to fully utilise automation and real-time tracking (Shoomal et al., 2024).

Furthermore, the Jefroy et al. (2022) study made clear that workers with experience in blockchain, AI, big data analytics, and cybersecurity are necessary for the shift to smart logistics. Nevertheless, many logistics experts lack the technological know-how required for efficient management of digital supply chains. Therefore, in order to provide employees with the skills they need, training programs and reskilling initiatives are crucial. Despite these obstacles, companies are increasingly embracing smart logistics as they see its long-term advantages.

Recommendations for Smart Logistics Adoption

To overcome the obstacles to the adoption of smart logistics, companies should

1. Make investments in affordable digital transformation plans to accommodate future technological innovations and evolving supply chain demands.
2. Make cybersecurity frameworks stronger to prevent data breaches with a focus on blockchain-based security solutions and AI-powered threat detection.
3. Create a strong foundation for the smooth integration of AI and IoT advancement of the future..
4. Provide workers with cutting-edge technology training so they can manage digital supply chains efficiently in future.
5. Adopt circular economy and sustainable models, using smart logistics to cut waste, improve resource efficiency, and satisfy future legal and environmental requirements.

Conclusions

1. The sustainability, efficiency, and resilience of the supply chain are greatly increased by smart logistics and it will become more crucial as global supply chains evolve toward digital ecosystems.
2. Logistics operations are currently optimised by technologies like blockchain, IoT, AI, and big data analytics and in future, this will lead to increased automation, predictive capabilities, and real-time decision-making..
3. Infrastructure constraints, high implementation costs, and cybersecurity threats are some of the main obstacles, however, these difficulties will be lessened by developments in affordable technologies and worldwide digital infrastructure in future.

4. To fully utilize the potential of smart logistics and create supply chains that are more intelligent, flexible, and sustainable in the future, companies, governments, and technology providers must work together.

References

1. Al Doghan, M. A., & Sundram, V. P. K. (2023). Agility and resilience in logistics management: supply chain optimization. *International Journal of Construction Supply Chain Management*, 13(1), 1-16. http://dx.doi.org/10.14424/ijcscm2023130101
2. Alimahomed-Wilson, J. (2022). The E-Logistics Revolution: Amazon, Labor, and the Future of Logistics Work. In: *Platform Labour and Global Logistics* (pp. 15-27). London: Routledge. https://www.taylorfrancis.com/chapters/edit/10.4324/9781003351764-3/logistics-revolution-jake-alimahomed-wilson
3. Aljohani, A. (2023). Predictive analytics and machine learning for real-time supply chain risk mitigation and agility. *Sustainability*, *15*(20), 15088. https://doi.org/10.3390/su152015088
4. Alzahrani, B. A., & Irshad, A. (2023). An improved IoT/RFID-enabled object tracking and authentication scheme for smart logistics. *Wireless Personal Communications*, 129(1), 399-422. https://doi.org/10.1007/s11277-022-10103-7
5. Azab, N., Elsherif, M., & Sayed, H. (2025). Investigating the Adoption of Artificial Intelligence in the Logistics Sector in Egyptian Organizations. In *AI in the Middle East for Growth and Business: A Transformative Force* (pp. 237-261). Cham: Springer Nature Switzerland. https://doi.org/10.1007/978-3-031-75589-7_14
6. Bag, S., Luthra, S., Mangla, S. K., & Kazancoglu, Y. (2021). Leveraging big data analytics capabilities in making reverse logistics decisions and improving remanufacturing performance. *The International Journal of Logistics Management*, 32(3), 742-765. https://doi.org/10.1108/IJLM-06-2020-0237
7. Chauhan, S., Singh, R., Gehlot, A., Akram, S.V., Twala, B. & Priyadarshi, N. (2022) Digitalization of supply chain management with industry 4.0 enabling technologies: a sustainable perspective. *Processes*, *11*(1), 96. http://dx.doi.org/10.3390/pr11010096
8. Chen, W., Men, Y., Fuster, N., Osorio, C., & Juan, A. A. (2024). Artificial intelligence in logistics optimization with sustainable criteria: A review. *Sustainability*, 16(21), 9145. https://doi.org/10.3390/su16219145
9. Cosma, A. M. I., Zangara, G., Silvestri, L., & Filice, L. (2025). Sustainability Impact of Automated Warehouses in Industry 4.0 scenario. *Procedia Computer Science*, 253, 3196-3205. https://doi.org/10.1016/j.procs.2025.02.044
10. Ding, Y., Jin, M., Li, S., & Feng, D. (2021). Smart logistics based on the internet of things technology: an overview. *International Journal of Logistics Research and Applications*, *24*(4), 323-345. https://doi.org/10.1080/13675567.2020.1757053
11. Grover, N. (2025). AI-Enabled Supply Chain Optimization. *International Journal of Advanced Research in Science, Communication and Technology*, 5(3), 28-44. https://doi.org/10.48175/ijarsct-23103
12. Humayun, M., Jhanjhi, N. Z., Hamid, B., & Ahmed, G. (2020). Emerging smart logistics and transportation using IoT and blockchain. *IEEE Internet of Things Magazine*, *3*(2), 58-62. http://dx.doi.org/10.1109/IOTM.0001.1900097
13. Inderwildi, O., Zhang, C., Wang, X., & Kraft, M. (2020). The impact of intelligent cyber-physical systems on the decarbonization of energy. *Energy & Environmental Science*, 13(3), 744-771. https://doi.org/10.1039/C9EE01919G
14. Issaoui, Y., Khiat, A., Bahnasse, A., & Ouajji, H. (2019). Smart logistics: Study of the application of blockchain technology. *Procedia Computer Science*, *160*, 266-271. http://dx.doi.org/10.1016/j.procs.2019.09.467
15. Issaoui, Y., Khiat, A., Haricha, K., Bahnasse, A., & Ouajji, H. (2022). An advanced system to enhance and optimize delivery operations in a smart logistics environment. *IEEE Access*, 10, 6175-6193. http://dx.doi.org/10.1109/ACCESS.2022.3141311
16. Jamal, H., Algeelani, N. A., & Al-Sammarraie, N. (2024). Safeguarding data privacy: strategies to counteract internal and external hacking threats. *Computer Science and Information Technologies*, 5(1), 46-54. http://dx.doi.org/10.11591/csit.v5i1.pp46-54
17. Jefroy, N., Azarian, M., & Yu, H. (2022). Moving from Industry 4.0 to Indsmall and: what are the implications for smart logistics?. *Logistics*, 6(2), 26. http://dx.doi.org/10.3390/logistics6020026
18. Jensen, T., Hedman, J., & Henningsson, S. (2019). How TradeLens delivers business value with blockchain technology. *MIS Quarterly Executive*, 18(4). http://dx.doi.org/10.17705/2msqe.00018
19. Liu, W., Shanthikumar, J. G., Lee, P. T. W., Li, X., & Zhou, L. (2021). Special issue editorial: Smart supply chains and intelligent logistics services. *Transportation Research Part E: Logistics and Transportation Review, 147,* 102256. https://doi.org/10.1016/j.tre.2021.102256
20. Matt, D. T., & Rauch, E. (2020). SME 4.0: The role of small-and medium-sized enterprises in the digital transformation. In *Industry 4.0 for SMEs: Challenges, opportunities and requirements* (pp. 3-36). Cham: Springer International Publishing. http://dx.doi.org/10.1007/978-3-030-25425-4_1
21. Nantee, N., & Sureeyatanapas, P. (2021). The impact of Logistics 4.0 on corporate sustainability: a performance assessment of automated warehouse operations. *Benchmarking: An International Journal*, 28(10), 2865-2895. http://dx.doi.org/10.1108/BIJ-11-2020-0583
22. Paužuolienė, J., Kaveckė, I., & Pyra, M. (2024). Smart Technologies Integration and Challenges in the Context of Logistics Companies. *European Research Studies Journal*, 27(4), 2081-2100. https://doi.org/10.35808/ersj%2F3631
23. Persistence Market Research. (2022). *Market Study on Smart Logistics* .

https://www.persistencemarketresearch.com/market-research/smart-logistics-market.asp

24. Ping, G., Zhu, M., Ling, Z., & Niu, K. (2024). Research on optimizing logistics transportation routes using AI large models. *Spectrum of Research*, 4(1). http://spectrumofresearch.com/index.php/sr/article/view/7

25. Raja Santhi, A., & Muthuswamy, P. (2022). Influence of blockchain technology in manufacturing supply chain and logistics. *Logistics*, 6(1), 15. http://dx.doi.org/10.3390/logistics6010015

26. Rehman Khan, S. A., Ahmad, Z., Sheikh, A. A., & Yu, Z. (2022). Digital transformation, smart technologies, and eco-innovation are paving the way toward sustainable supply chain performance. *Science Progress*, 105(4), 00368504221145648. https://doi.org/10.1177/00368504221145648

27. Rejeb, A., Keogh, J. G., & Treiblmaier, H. (2019). Leveraging the internet of things and blockchain technology in supply chain management. *Future Internet*, 11(7), 161. https://doi.org/10.3390/fi11070161

28. Schönberger, M. (2023). Artificial intelligence for small and medium-sized enterprises: Identifying key applications and challenges. *Journal of Business Management*, *21*, 89-112. https://doi.org/10.32025/JBM23004

29. Shee, H. K., Miah, S. J., & De Vass, T. (2021). Impact of smart logistics on smart city sustainable performance: an empirical investigation. *The International Journal of Logistics Management*, 32(3), 821-845. https://doi.org/10.1108/IJLM-07-2020-0282

30. Shobhana, N. (2024). AI-powered supply chains towards greater efficiency. In *Complex AI Dynamics and Interactions in Management* (pp. 229-249). IGI Global. http://dx.doi.org/10.4018/979-8-3693-0712-0.ch01.

31. Shoomal, A., Jahanbakht, M., Componation, P. J., & Ozay, D. (2024). Enhancing supply chain resilience and efficiency through internet of things integration: Challenges and opportunities. *Internet of Things*, 27,

32. 101324. http://dx.doi.org/10.1016/j.iot.2024.101324.

33. Sobb, T., Turnbull, B., & Moustafa, N. (2020). Supply chain 4.0: A survey of cyber security challenges, solutions and future directions. *Electronics*, *9*(11), 1864. https://doi.org/10.3390/electronics9111864.

34. Statista. (2017). *45000 Robots Form Part Of Amazon Workforce.* https://www.statista.com/chart/7428/45000-robots-form-part-of-amazon-workforce/

35. Statista. (2023). *Adoption rate of AI in global supply chain business 2022-2025.* https://www.statista.com/statistics/1346717/ai-function-adoption-rates-business-supply-chains/

36. Weaver, G. A., Feddersen, B., Marla, L., Wei, D., Rose, A., & Van Moer, M. (2022). Estimating economic losses from cyber-attacks on shipping ports: An optimization-based approach. *Transportation Research Part C: Emerging Technologies*, *137*, 103423. http://dx.doi.org/10.1016/j.trc.2021.103423.

37. Wolniak, R. (2024). Forecasting demand–utilizing business analytics in Industry 4.0 environments. *Silesian University of Technology Scientific Papers. Organization and Management Series*, 196, 609-624. http://dx.doi.org/10.29119/1641-3466.2024.196.41.

38. Woschank, M., Rauch, E., & Zsifkovits, H. (2020). A review of further directions for artificial intelligence, machine learning, and deep learning in smart logistics. *Sustainability*, 12(9), 3760. https://doi.org/10.3390/su12093760.

39. Yan, X., Liu, W., Lim, M. K., Lin, Y., & Wei, W. (2022). Exploring the factors to promote circular supply chain implementation in the smart logistics ecological chain. *Industrial marketing management*, 101, 57-70. http://dx.doi.org/10.1016/j.indmarman.2021.11.015