

# ANALYSING SOLUTIONS TO ENHANCE DIGITAL TRANSFORMATION IN INDIAN LOGISTICS

**Shameerali OVUNGAL**, Vytautas Magnus University Agriculture Academy, Faculty of Bioeconomy Development,  
email: [shameerali.ovungal@vdu.lt](mailto:shameerali.ovungal@vdu.lt)

## Summary

The article explores the digital transformation of the logistics sector in India, recognising its pivotal role in the global market. Emphasising the necessity of technological advancements for sustained competitiveness, the research employs a systematic review methodology to analyse the current state and challenges of digital transformation in Indian logistics. The logistics market in the Asia-Pacific region, led by India, is substantial, yet there is a compelling need for enhanced digitalisation. The research identifies key challenges such as infrastructure limitations, digital skill gaps, interoperability issues, regulatory compliance, and data security concerns. Despite notable progress, the article suggests that an integrated approach involving predictive analytics, AI-powered route optimisation, blockchain, autonomous vehicles, IoT, digital collaboration platforms, robotics, augmented reality, and digital documentation is essential for overcoming these challenges and unlocking the full potential of digital transformation in Indian logistics. The conclusion underscores the importance of addressing these challenges to propel Indian logistics into a new era of efficiency, connectivity, and responsiveness in the global supply chain landscape.

**Keywords:** digital transformation, logistics, challenges, digital logistics

## Introduction

In the current business landscape, logistics plays a pivotal role in ensuring seamless supply chain operations, optimising distribution networks, and enhancing overall operational efficiency. As a cornerstone of economic development, efficient logistics not only fosters business competitiveness but also contributes significantly to a nation's growth by facilitating timely and cost-effective movement of goods, thus bolstering trade and economic activities (Pan et al., 2021). Therefore, conducting comprehensive research across various facets of logistics is crucial to enhancing and refining the logistics sector, fostering continuous improvement and efficiency. Digital transformation is gaining popularity across various business sectors, with a particular emphasis on logistics businesses, as they increasingly recognise the transformative potential of technology in optimising operations and improving overall efficiency.

The logistics market in the Asia-Pacific region boasts a substantial size of 3,908 billion US dollars, surpassing that of North America, Europe, Africa, and South America (Statista, 2023). India significantly contributes to this impressive figure, underscoring its pivotal role in the growth and development of the regional logistics sector. Despite the substantial contribution of India to the Asia-Pacific logistics market, there exists a compelling need for enhancing the digital transformation of Indian logistics to ensure sustained growth and competitiveness in the evolving global landscape (Sullivan and Kern, 2021). As a result, the article analyses digital transformation in Indian logistics, leading to enhancing the overall logistics performance of the country.

**Research aim:** to analyse solutions for elevating digital transformation in Indian logistics.

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

1. To understand the digital development of Indian logistics.
2. To find out the challenges of improving digital transformation in Indian logistics.
3. To suggest effective digital transformations in Indian logistics.

## Research object and methods

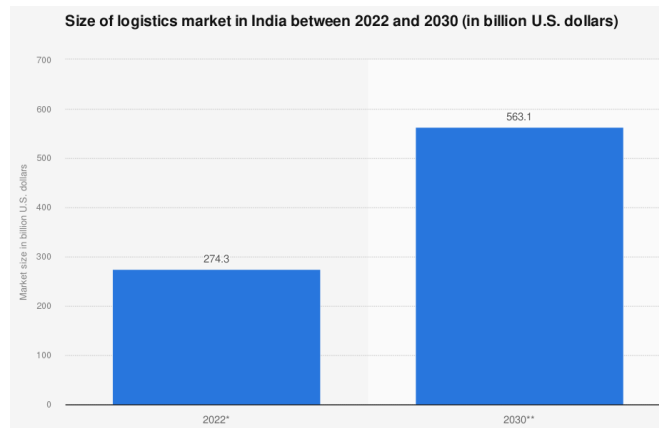
**Research object:** digital transformation in Indian logistics

In this article, a systematic review methodology is employed to delve into the digital landscape of the logistics sector in India, aiming for a comprehensive understanding of its current state and prospects. The research methodology involves the meticulous analysis of secondary sources, employing a structured approach to examine existing literature. A keyword strategy guides the data collection process, with a primary focus on terms such as 'digital development of Indian logistics', 'Indian logistics', 'challenges of Indian logistics', and 'digital transformation of logistics'. To ensure a broad and diverse perspective, data is sourced from reputable academic databases including Google Scholar, JSTOR, ELSEVIER, and Science Direct. The systematic review approach enables a thorough exploration of the subject, providing insights into the key trends, challenges, and opportunities within the Indian logistics sector's digital transformation. Content analysis serves as a vital tool to dissect and interpret the collected data, facilitating the identification of patterns, themes, and critical findings.

## Research results and discussion

### Digital development in Indian logistics

As per Statista (2023), The logistics sector in India has witnessed substantial improvement, with the market reaching 274.3 billion US dollars in 2022 and projected to surge to 563 billion US dollars by 2030, (See Figure 1). This remarkable growth underscores India's commitment to adopting contemporary trends in logistics, a crucial step to remain competitive in the dynamic global landscape. The significant increase in market size reflects ongoing efforts to enhance infrastructure, streamline operations, and embrace digital transformations, positioning Indian logistics for sustained progress in the coming decade.



**Fig. 1.** Size of logistics market in India in 2022, in Billion US Dollars (Statista, 2023)

In recent years, India's logistics sector has witnessed a significant transformation propelled by digital developments. These advancements aim to streamline processes, reduce costs, and enhance overall efficiency in the supply chain. One notable digital development in Indian logistics is the widespread adoption of Warehouse Management Systems. These systems enable real-time monitoring of inventory, optimizing storage space, and enhancing order fulfilment (Sai Chitti Subrahmanyam et al., 2021). Companies like Flipkart and Amazon India have implemented sophisticated WMS, allowing them to manage large volumes of products efficiently (Bhattacharya et al., 2022). Despite these strides, there is room for improvement in terms of integration with other supply chain components, fostering a seamless flow of information from suppliers to end consumers. The integration of IoT devices in fleet management has been a game-changer for logistics companies. Real-time tracking, monitoring of fuel consumption, and predictive maintenance have become possible through IoT. Indian companies like Mahindra Logistics have adopted IoT for their fleet management (Tunk, 2023). However, there is a need for standardized protocols and greater collaboration among stakeholders to maximise the potential of IoT in creating a connected and efficient logistics network. Blockchain technology has been introduced to enhance transparency, traceability, and security in the supply chain. In India, examples like the 'Blockchain for Trucking' initiative by IBM and Maersk aim to streamline documentation processes, reducing delays and fraud (Lorenz-Meyer, 2022). Despite these initiatives, the widespread adoption of blockchain in the Indian logistics ecosystem is still in its infancy. Regulatory frameworks and industry-wide standards must be established to encourage the integration of blockchain across the supply chain.

With the exponential growth of e-commerce in India, logistics has evolved to cater to the unique demands of online retail. Companies like Delhivery and Ekart have pioneered last-mile delivery solutions to bridge the gap between sellers and consumers. However, challenges such as reverse logistics and optimising delivery routes persist. Continuous innovation and collaboration between e-commerce giants and logistics providers are essential to address these challenges and further enhance efficiency. Data analytics plays a crucial role in predicting demand patterns, optimising inventory levels, and improving overall supply chain efficiency. Indian logistics companies, including Blue Dart and DTDC, are leveraging data analytics to enhance their forecasting capabilities (Mondal and Giri, 2022). However, there is a need for skill development and investment in advanced analytics tools to harness the full potential of data-driven decision-making in logistics. While digital developments in Indian logistics have undoubtedly brought about positive changes, a critical analysis reveals areas that require attention and improvement. The seamless integration of various technologies, standardisation of protocols, and regulatory support are essential components for the holistic advancement of the logistics sector in India. Stakeholders, including government bodies, industry players, and technology providers, must collaborate to create an environment conducive to innovation and the continued evolution of the logistics landscape. By addressing these challenges, India can truly unlock the full potential of digital technologies and further elevate its logistics performance on the global stage.

### Challenges of improving digital transformation in Indian logistics

As digital transformation continues to reshape industries worldwide, the logistics sector in India is not exempt from the paradigm shift. While significant progress has been made, several practical challenges hinder the seamless adoption and integration of digital technologies. One of the primary challenges hindering digital transformation in Indian logistics is the existing infrastructure limitations. In many parts of the country, inadequate connectivity and outdated transportation networks impede the efficient deployment of digital technologies (Upadhyay et al., 2020). For instance,

real-time tracking systems and IoT devices rely heavily on robust network connectivity. Addressing these infrastructure limitations requires substantial investments in upgrading roads, railways, and communication networks, which may prove challenging given budget constraints. The successful implementation of digital technologies requires a skilled workforce capable of understanding and leveraging these tools. However, there exists a considerable digital skill gap in the Indian logistics sector (Chakraborty, Sharma and Vaidya, 2020). Many industry players lack employees with the necessary expertise to operate and maintain advanced technologies like blockchain, data analytics, and IoT. To address this challenge, there is a need for targeted training programs, collaboration with educational institutions, and industry-wide initiatives to upskill the workforce and foster a culture of continuous learning. The logistics ecosystem in India comprises numerous stakeholders, including manufacturers, suppliers, logistics service providers, and regulatory bodies. Ensuring seamless interoperability and data exchange among these diverse entities is a significant challenge (Pan et al., 2021). Many organisations operate on different systems and platforms, leading to data silos and inefficiencies. Standardising protocols and encouraging the development of open APIs (Application Programming Interfaces) are crucial steps to promote interoperability and facilitate the smooth flow of information across the entire supply chain (2021).

The logistics sector involves the handling of sensitive information, from inventory data to customer details. Stringent regulatory compliance requirements and concerns about data security pose challenges to the adoption of digital technologies. Navigating through complex regulatory frameworks while ensuring data integrity and confidentiality requires a strategic approach. Collaborative efforts between industry stakeholders and regulatory bodies are essential to develop comprehensive guidelines that balance innovation with data protection (Chakraborty et al., 2020). While digital transformation promises long-term efficiency gains, the initial costs associated with implementing advanced technologies can be a deterrent for many logistics companies, especially smaller players. Investments in IoT devices, blockchain integration, and data analytics platforms require a significant upfront capital commitment (Sai Chitti Subrahmanyam et al., 2021). Developing cost-effective solutions, encouraging public-private partnerships, and exploring government incentives can help alleviate the financial burden and make digital transformation more accessible to a broader range of logistics providers. The introduction of digital technologies often necessitates a fundamental shift in organisational processes and workflows. Resistance to change among employees, coupled with a lack of awareness and understanding of the benefits of digital transformation, can impede progress (Upadhyay et al., 2020). Effective change management strategies, comprehensive training programs, and clear communication about the advantages of adopting digital technologies are vital to overcoming this challenge. While certain technologies like GPS tracking and basic warehouse management systems are prevalent, the integration of more advanced technologies, such as artificial intelligence and machine learning, remains limited (Lorenz-Meyer, 2022). Unlocking the full potential of digital transformation requires a holistic approach that embraces emerging technologies to drive innovation and efficiency throughout the entire logistics value chain.

Digital transformation holds immense potential for revolutionising the Indian logistics sector, but it comes with its share of challenges. Overcoming infrastructure limitations, addressing the digital skill gap, promoting interoperability, ensuring regulatory compliance, managing costs, and fostering a culture of change are critical steps in advancing the digital transformation agenda in Indian logistics.

### **Effective digital transformation in Indian logistics**

Digital advancements in Indian logistics can significantly enhance efficiency, reduce costs, and streamline operations. So, it is important to focus on digital transformation to stay competitive in the current competitive world of logistics. Indian logistics can adapt to various digital transformations by mitigating the challenges. Implementing advanced predictive analytics can help logistics companies anticipate demand patterns accurately (Seyedan and Mafakheri, 2020). By analysing historical data, market trends, and external factors, companies can optimise inventory levels, reduce stockouts, and improve overall supply chain responsiveness. This would lead to better resource utilisation and cost savings. Moreover, Artificial Intelligence (AI) can be leveraged for dynamic route optimisation, especially in last-mile delivery. By considering real-time traffic conditions, weather, and other variables, AI algorithms can generate optimal delivery routes (Richey Jr et al., 2023). This not only reduces delivery times but also minimises fuel consumption, contributing to cost efficiency and environmental sustainability. Blockchain technology can enhance transparency and traceability in the supply chain. Implementing blockchain in logistics can provide a secure and immutable ledger for recording transactions and movements of goods (Raja Santhi and Muthuswamy, 2022). This ensures that all stakeholders have access to real-time, accurate information, reducing the chances of errors, fraud, and delays.

Investing in autonomous vehicles and drones can revolutionise transportation in logistics. Autonomous trucks can operate efficiently, reducing the dependence on human drivers and minimising labour costs (Kim, Kim and Park, 2022). Drones can be employed for last-mile deliveries in remote areas, speeding up the delivery process (Garg et al., 2023). However, regulatory frameworks need to be established to ensure the safe integration of these technologies into the logistics ecosystem. The Internet of Things (IoT) can be utilised for real-time tracking and monitoring of cargo. IoT devices can provide information about the location, temperature, and condition of goods during transit (Richey Jr et al., 2023). This not only helps in preventing theft and damage but also enables proactive measures to be taken in case of deviations from the planned route or environmental conditions that could affect the cargo. Creating digital platforms that facilitate collaboration among various stakeholders in the supply chain is crucial. These platforms can integrate suppliers, manufacturers, logistics providers, and retailers, allowing seamless communication and data exchange (Zdziarska and Marhita, 2020). Enhanced collaboration reduces lead times, minimises errors, and improves overall supply chain visibility. Robotics and automation can significantly improve warehouse efficiency. Implementing robotic systems for tasks such as picking, packing, and sorting can reduce human errors, enhance speed, and optimise space utilisation

(Seyedan and Mafakheri, 2020). Warehouse automation not only improves operational efficiency but also reduces labour costs over the long term.

Augmented Reality can be employed for employee training and optimising warehouse operations. AR applications can guide workers in performing complex tasks, improving accuracy and efficiency (Jumahat, Sidhu, and Shah, 2023). Additionally, AR can be utilised for remote assistance, allowing experts to guide field workers in real-time, reducing downtime and improving problem resolution. Moving towards digital documentation and paperless processes can eliminate paperwork, reduce manual errors, and enhance overall operational efficiency. Implementing Electronic Data Interchange (EDI) and digital invoicing systems can streamline communication between stakeholders, leading to faster processing times and improved accuracy in financial transactions (Zdziarska and Marhita, 2020). With increased digitisation comes the need for robust cybersecurity measures. Implementing strong data encryption, regular security audits and training programs for employees can safeguard sensitive information from cyber threats. Establishing a cybersecurity framework is essential to ensure the integrity and confidentiality of data in the logistics ecosystem. In conclusion, embracing these digital advancements in the Indian logistics sector can lead to a more connected, efficient, and responsive supply chain. However, it's crucial to address challenges such as regulatory frameworks, skill development, and infrastructure enhancements to fully unlock the potential of these technologies and propel Indian logistics into a new era of digital transformation.

## Conclusions

1. The digital development of Indian logistics is advancing rapidly, evolving technology to enhance efficiency, streamline operations, and meet evolving consumer demands. The implementation of digital development in Indian logistics not only optimizes supply chain processes and reduces costs but also fosters transparency, traceability, and sustainability across the entire logistics ecosystem, contributing to overall economic growth and competitiveness.

2. The article analyses the challenges faced and emphasises the need for effective digital transformation tailored to the specific context of Indian logistics. Given India's status as one of the leading countries with a substantial market share in logistics, it becomes imperative for the nation to embrace technological advancements to remain competitive in the global logistics landscape, where digital innovations occupy a prominent space. The examination reveals that while India has been implementing various digital practices in logistics, numerous challenges hinder the seamless adoption of digital transformation in the country.

3. The identified challenges are infrastructure limitations, digital skill gap, interoperability issues, regulatory compliance and data security, cost constraints, change management, resistance to adoption and limited integration of emerging technologies.

4. The article concluded that implementing effective technological solutions including predictive analytics for demand forecasting, AI-powered route optimisation, blockchain for supply chain transparency, autonomous vehicles and drones, IoT-enabled cargo tracking, digital platforms for collaboration, robotics for warehouse automation, augmented reality for training and operations, and digital documentation and paperless processes enhances the overall efficiency of Indian logistics.

## References

1. Bhattacharya, C., Saurabh, S., Sanyal, M., & Hudnurkar, M. (202). Warehousing and Facility Location in E-Commerce. In *Changing Face of E-Commerce in Asia* (pp. 227-253).
2. Chakraborty, S., Sharma, A., & Vaidya, O. S. 2020. Achieving sustainable operational excellence through IT implementation in Indian logistics sector: An analysis of barriers. *Resources, Conservation and Recycling*, Vol. 152, 104506.
3. Garg, V., Niranjana, S., Prybutok, V., Pohlen, T., & Gligor, D. 2023. Drones in last-mile delivery: A systematic review on Efficiency, Accessibility, and Sustainability. *Transportation Research Part D: Transport and Environment*, Vol. 123, 103831.
4. Jumahat, S., Sidhu, M. S., & Shah, S. M. 2023. A review on the positive implications of augmented reality pick-by-vision in warehouse management systems. *Acta Logistica*, Vol. 10(1), p. 1-10.
5. Kim, E., Kim, Y., & Park, J. 2022. The necessity of introducing autonomous trucks in logistics 4.0. *Sustainability*, 14(7), 3978.
6. Kumar, A., & Khatri, V. (2022). Fast and determined: innovative tech-enabled operating models of e-commerce last mile logistics in India. *IUP Journal of Supply Chain Management*, Vol. 19(2), p. 42-58.
7. Lorenz-Meyer, F. 2022. *Blockchain in the shipping industry-A proposal for the use of blockchain for SMEs in the shipping industry* (Doctoral dissertation).
8. Mondal, C., & Giri, B. C. 2022. Analyzing strategies in a green e-commerce supply chain with return policy and exchange offer. *Computers & Industrial Engineering*, Vol. 171, 108492.
9. Pan, S., Trentesaux, D., McFarlane, D., Montreuil, B., Ballot, E., & Huang, G. Q. 2021. Digital interoperability in logistics and supply chain management: state-of-the-art and research avenues towards Physical Internet. *Computers in industry*, Vol. 128, 103435.

10. Raja Santhi, A., & Muthuswamy, P. 2022. Influence of blockchain technology in manufacturing supply chain and logistics. *Logistics*, Vol. 6(1), 15.
11. Richey Jr, R. G., Chowdhury, S., Davis-Sramek, B., Giannakis, M., & Dwivedi, Y. K. 2023. Artificial intelligence in logistics and supply chain management: A primer and roadmap for research. *Journal of Business Logistics*, Vol. 44(4), 5p. 32-549.
12. Sai Chitti Subrahmanyam, V., Vasantha Raman, A., Sharrik Krishna, S. L., Sitharthan, I., Shaheen Basha, S., Prabavathy, B., & Angel Deborah, S. (2021). Smart Warehouse Management System. In *Recent Trends in Renewable Energy Sources and Power Conversion: Select Proceedings of ICRES 2020* (pp. 99-114). Springer Singapore.
13. Seyedan, M., & Mafakheri, F. (2020). Predictive big data analytics for supply chain demand forecasting: methods, applications, and research opportunities. *Journal of Big Data*, Vol. 7(1), p. 1-22.
14. Statista. (2023, December 8). *Total global logistics market size by region 2020*. Statista. <https://www.statista.com/statistics/1069868/total-global-logistics-market-size-region/>
15. Statista. (2023, December 18). *Size of logistics market in India 2022-2030*. Statista. <https://www.statista.com/statistics/1288177/india-size-of-logistics-market/>
16. Sullivan, M., & Kern, J. (Eds.). 2021. *The digital transformation of logistics: Demystifying impacts of the Fourth Industrial Revolution*. John Wiley & Sons.
17. Tunk, R. 2023. Digital Transformation A Game-Changer for Marketing, Manufacturing, and Supply Chain Management. *International Journal of Research in Applied Management, Science & Technology*, Vol. 3(2).
18. Upadhyay, C. K., Vasantha, G. A., Tiwari, V., Tiwari, V., & Pandiya, B. 2020. Strategic upturn of reverse logistics with Crowdshipping: Transportation explication for India. *Transportation Research Procedia*, Vol. 48, p. 247-259.
19. Zdziarska, M., & Marhita, N. 2020. Supply chain digital collaboration. *Integration of Information Flow for Greening Supply Chain Management*, 63-76.