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Role of Artificial Intelligence on optimizing Indian logistics networks

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ABSTRACT

This paper explores the evolving role of artificial intelligence in optimizing India's logistics networks, with a focus on how recent government policies and technological innovations are driving this transformation. The National Logistics Policy and initiatives like PM Gati Shakti, Unified Logistics Interface Platform, and the Open Network for Digital Commerce are fostering digital integration and efficiency across a historically fragmented sector. The paper examines AI applications such as predictive analytics, smart warehousing, route optimization, real-time tracking, and last-mile delivery, highlighting their contributions to reducing costs, improving delivery times, and enhancing customer experience. It also reviews the contributions of leading firms and startups, including Delhivery, Shadowfax, Rivigo, Zomato, Swiggy, LogiNext, Locus, and ElasticRun. Despite the potential, the adoption of AI in Indian logistics faces significant challenges, including high costs, regulatory hurdles, infrastructure deficits, cybersecurity risks, and workforce readiness. The paper discusses these challenges and emphasizes the need for collaborative platforms, targeted policy support, and ethical practices to ensure AI fosters inclusive and sustainable growth in India's logistics sector.

KEY WORDS

Artificial Intelligence, digitization, innovation, logistics, efficiency

INTRODUCTION

India's logistics sector is a major part of its economy, supporting trade, supply chains, and jobs across the country. As of 2024, the sector was valued at over USD 200 billion and handles around 4.6 billion tonnes of freight every year. But despite its size, the industry still faces serious problems like poor infrastructure, delays, and lack of coordination between different players. India's logistics costs are also quite high, accounting for about 13–14% of GDP, compared to the global average of 8–11%.

To solve these problems, the Indian government launched the National Logistics Policy (NLP) in 2022. This policy aims to lower logistics costs to below 8% of GDP by 2030 and improve India's rank in the World Bank's Logistics Performance Index. As part of the plan, the government introduced digital platforms like ULIP (Unified Logistics Interface Platform) and E-Logs, which help make logistics systems more transparent and better connected. But improving logistics isn't just about cutting costs. Speed, reliability, sustainability, and better service are just as important. In 2024, Indian companies made big moves to meet rising demand. For instance, Swiggy announced it would invest USD 115 million to expand its supply chain for quick deliveries while Ecom Express filed for a USD 310 million IPO to grow its logistics operations. At the same time, warehouse developers like Greenbase are investing in new infrastructure to support global supply chain shifts away from China.

Artificial Intelligence (AI) is thus playing a major role in improving logistics. Around the world, AI is being used to plan better delivery routes, manage warehouses, track shipments in real time, and predict supply and demand. In India, companies like Addverb Technologies are using AI and robotics to automate warehouses. The Indian government also proposed an AI-based platform to support MSMEs (small and medium businesses) in managing their supply chains.

AI is increasingly being integrated into India's logistics sector to tackle challenges like congestion, route planning, and warehouse efficiency. Companies such as Delhivery and BlueDart use AI to predict demand and optimize delivery routes. In warehouses, AI-powered systems improve inventory tracking and space utilization. These technologies help reduce costs and enhance the sector's capacity to meet growing demand from e-commerce and manufacturing.

LITERATURE REVIEW

1. Choudhuri, S.S. (2024), in his research titled "AI-driven supply chain optimization: enhancing inventory management, demand forecasting, and logistics within ERP systems", analyzes the integration of AI into Enterprise Resource Planning (ERP) systems in order to optimize supply chain operations in India. Utilizing a quantitative research design, the study surveyed 250 supply chain managers and IT professionals across various Indian industries between April and June 2023. Using Structural Equation Modeling (SEM), the analysis highlighted that higher levels of AI integration within ERP systems significantly improve inventory management efficiency, demand forecasting accuracy, and logistics operations. By focusing on India's unique supply chain challenges, like varied market needs and complex logistics, the study gives realized insights for businesses looking to improve efficiency and stay competitive using AI.

2. Bera, et al., (2025), in their study titled "The logistics AI revolution: from traditional operations to smart optimization", investigate the growing role of AI in transforming logistics operations in India. Employing a mixed-methods approach that combines case studies with quantitative data from logistics firms in both metropolitan and tier-2 cities, the research demonstrates significant improvements resulting from AI integration. The study reports a 25% reduction in delivery times through intelligent route planning, a 40% decrease in inventory stockouts due to enhanced forecasting, and a 35% decline in equipment failures enabled by predictive maintenance. In addition, the authors discuss key challenges, including data security risks, regulatory uncertainty, and the need for workforce reskilling. By focusing on India's unique logistical environment which is marked by infrastructural constraints, fragmented supply chains, and rapid e-commerce growth, the study offers relevant and practical insights for logistics firms seeking to enhance operational efficiency and competitiveness through AI adoption.

3. Rethinasamy et al., (2025), in their study titled "AI-enabled logistics: a key to achieving India's sustainable development goals", examine how AI can support the transformation of India's logistics sector in alignment with the country's Sustainable Development Goals (SDGs). The study discusses how AI technologies such as intelligent route optimization, predictive analytics for demand forecasting, and automation in warehousing can significantly enhance the efficiency of logistics operations. These advancements contribute to reduced fuel consumption, lower carbon emissions,

and faster delivery times, which are crucial for addressing both environmental and operational challenges in India. The authors link these improvements to specific SDGs, including SDG 9 (Industry, Innovation and Infrastructure), SDG 11 (Sustainable Cities and Communities), SDG 12 (Responsible Consumption and Production), and SDG 13 (Climate Action). Moreover, the paper points out how AI adoption in logistics can promote the use of energy-efficient transport systems, improve traffic management in urban areas, and create new employment opportunities aligned with technological development (SDG 8: Decent Work and Economic Growth). By focusing on India's logistical complexities and its sustainability agenda, the study offers practical insights for industry leaders and policymakers seeking to modernize logistics while supporting long-term development goals.

4. Gesing et al., (2018), in their collaborative report titled "Artificial intelligence in logistics: a collaborative report by DHL and IBM on implications and use cases for the logistics industry", examine how AI technologies can transform logistics operations across various functional areas. The report identifies four core domains where AI is expected to have significant impact: back-office automation, predictive logistics, intelligent logistics assets, and enhanced customer experience. It presents cases that demonstrate how AI can streamline administrative workflows, improve demand forecasting and routing, increase efficiency of logistics infrastructure, and deliver personalized customer services. The report emphasizes the shift from reactive to predictive logistics operations, highlighting the value of data-driven decision-making and intelligent automation. The report provides a balanced combination of strategic guidance and practical examples, offering a strong foundation for businesses and researchers exploring AI-driven innovation in the logistics industry.

5. Jagirdar and Pathak (2025), in their study "AI-driven transportation solutions: lessons from developed nations for emerging economies", examine how AI-based innovations used in developed countries can help solve logistics and transportation challenges in emerging economies, with a strong focus on India. The paper identifies critical issues in India's logistics sector, including last-mile delivery delays, poor infrastructure, and supply chain inefficiencies. By analyzing AI applications such as route optimization, predictive demand planning, and autonomous vehicle deployment, the authors show how these technologies have transformed logistics systems in the US, EU, and Japan. Using the Entropy Weight Method (EWM), they assess how similar approaches can be applied in India. Their findings suggest that India must improve its AI policy environment, build stronger data infrastructure, and support innovation through government–industry collaboration. The study offers

practical guidance for integrating AI into India's logistics network to enhance efficiency, reduce costs, and improve delivery reliability which is especially important in the context of fast-growing e-commerce and manufacturing sectors.

AI IN INDIAN LOGISTICS UNDER NATIONAL LOGISTICS POLICY

The National Logistics Policy (NLP) of India, launched in September 2022, aims to reduce the country's logistics cost from the current 13–14% of GDP to around 8% by 2030, aligning with global benchmarks. A core focus of the policy is the integration of technology, especially AI, to improve supply chain visibility, automate processes, and enhance last-mile delivery efficiency. AI-powered tools such as predictive analytics and real-time tracking are being promoted under the Unified Logistics Interface Platform (ULIP), a government-led digital infrastructure project designed to improve coordination across various segments of the logistics sector, including road, rail, cargo, warehousing, and EXIM services. It integrates data from 37 systems across 16 ministries using 118 APIs, aiming to centralize logistics information and improve tracking and planning. With over 900 private companies already registered, ULIP is expected to support better data sharing and decision-making in the logistics industry, similar in structure to how UPI functions in the financial sector.

Supporting this vision, e-logs allow logistics service providers to directly raise operational issues with government agencies for faster resolution. Additionally, the government's GI Cloud initiative, "Meghraj", uses cloud computing to maximize the effectiveness of public digital infrastructure and support e-governance. Logistics firms such as CJ Darcl Logistics have welcomed the policy as a much-needed step to innovate new routes, reduce costs, promote sustainability, and speed up deliveries for end consumers. This digital approach is expected to cut transit times and improve warehouse utilization significantly, helping India meet growing demands in e-commerce, manufacturing, and exports.

The Economic Survey 2024 highlights that initiatives like PM Gati Shakti and the NLP have significantly improved logistics efficiency in India. A key result is India's jump from 44th to 38th rank in the World Bank's Logistics Performance Index (LPI) in 2023. This improvement is partially driven by the integration of AI, data analytics, and digital platforms that streamline infrastructure planning and freight movement. These technologies support real-time coordination and decision-making, boosting both speed and cost-effectiveness in the logistics ecosystem. India's movement of goods relies mainly on three factors: route connectivity, mode of transport, and distribution channels. Currently, the logistics sector is heavily dependent on road transport, which holds a 65% share, far

above the global average of 25%. In contrast, railways contribute only 30% in India (versus 60% globally), and waterways have a very small share of 5%. To address this imbalance, the government is implementing large infrastructure projects like Sagarmala (to modernize ports) and Bharatmala (to enhance road connectivity). The broader vision is supported by Mission Gati Shakti, which brings together 16 ministries, including Railways and Roads, to create a unified, efficient logistics network by eliminating silos, improving communication, and enabling integrated project planning.

The NLP builds on this by encouraging a shift toward multimodal transport through fleet centralization. It focuses on solving last-mile delivery issues, reducing delays, and minimizing agri-wastage through new warehousing infrastructure. While India is already a major exporter of products like iron, steel, cotton, gems, aluminum, and automobiles, NLP will open up new opportunities for textiles, toys, electronics, and chemicals, improving the country's global trade competitiveness and boosting economic growth.

AI APPLICATIONS IN INDIAN LOGISTICS

India's logistics sector is undergoing rapid transformation, driven by rising digital adoption, consumer demand, and supportive policies like the National Logistics Policy. AI is playing a key role by improving delivery efficiency, lowering costs, and enabling smarter operations. Predictive analytics using machine learning helps Indian logistics firms anticipate demand based on trends, weather, and events.

For example, BigBasket uses AI to forecast high demand during weekends and festivals, adjusting inventory and delivery schedules. This approach reduces stockouts, prevents waste, particularly for perishables and cuts warehousing costs. In a country with diverse and seasonal demand patterns, such forecasting makes supply chains more adaptive, improving both service quality and business outcomes. In India, Blinkit and Zepto use AI to optimize human-driven fleets in real time. The combination of autonomous vehicles and drones could further reduce delivery times, especially in cities. As India updates drone regulations and invests in smart mobility, logistics automation is set to become a practical reality.

Also, major hubs like Delhi NCR, Mumbai, and Bangalore are adopting robotic systems for sorting, stacking, and packaging to meet rising e-commerce demands, which are projected to grow exponentially by 2026. The use of IoT and digital twins enables real-time inventory tracking and predictive maintenance, helping optimize warehouse space, cut costs, and make India's logistics infrastructure more agile and globally competitive.

AI-powered route optimization is also helping logistics platforms like Delhivery, Shadowfax, and Porter improve delivery efficiency in India's congested cities. These platforms use real-time data and machine learning to avoid traffic jams, saving both time and fuel. Faster, more reliable deliveries enhance customer satisfaction and brand trust. As instant commerce grows, AI-managed traffic solutions are becoming essential for maintaining timely and dependable logistics performance.

AI-powered real-time tracking is also transforming logistics into a transparent, customer-facing service, especially important in Tier-II and Tier-III cities where digital trust is still growing. With dynamic updates and geolocation, customers gain full visibility from dispatch to delivery. Startups like Rivigo, Blackbuck, and Shiprocket are driving this shift using AI for route planning, geo-tracing, and data-driven decision-making. These innovations are improving delivery accuracy, personalization, and operational efficiency.

In addition, Zomato has integrated AI into its logistics operations by using conversational AI to improve order placement and customer interaction. Zomato AI functions beyond a basic chatbot, using task-specific agents to retrieve real-time data, which helps streamline deliveries and improve efficiency. This innovation supports better order accuracy and faster fulfillment which are key components of logistics performance in the fast-paced food delivery sector.

Swiggy is also using AI to enhance its logistics operations by introducing neural search, allowing users to place food and grocery orders using natural language instead of keywords. It is also developing AI tools like in-house language models to help restaurant partners manage tasks like on boarding and payouts. For delivery efficiency and customer service, Swiggy plans to deploy GPT-4-powered chatbots, aiming to streamline both front-end interactions and back-end logistics workflows.

In addition, a growing number of Indian startups are leveraging AI to address inefficiencies in logistics and supply chain management. For instance, LogiNext uses AI to optimize routes and workforce tracking, reducing delivery costs. Pickrr supports D2C brands with real-time inventory visibility and fulfillment tools. GoBOLT applies AI to streamline B2B freight transport and route planning. Locus offers global clients AI-powered dispatch and logistics analytics, while Shipsy enables end-to-end visibility and automation in supply chains. Together, these companies are modernizing logistics with data-driven, AI-enhanced solutions that boost speed, accuracy, and transparency.

AI IMPLEMENTATION CHALLENGES IN INDIAN LOGISTICS SECTOR

AI holds strong promise for Indian logistics but faces challenges such as high costs, limited access to skilled talent, and unclear regulations, particularly around emerging technologies like drones and autonomous vehicles. Still, large-scale developments like the Western Dedicated Freight Corridor are helping improve freight efficiency, showing that with focused policy and investment, the gap can be narrowed. Also, last-mile delivery remains a complex issue due to congested cities, poor address accuracy, and varied customer needs. These gaps, however, create room for AI-driven tools to improve delivery coordination, adapt to consumer patterns, and boost service reliability.

In addition, AI systems demand strong computing power and ongoing upgrades, requiring significant investment in infrastructure and skilled talent. They also depend on large volumes of user data, raising concerns around data handling and privacy. With India's data protection laws still developing, businesses must manage data responsibly to stay compliant. India's logistics sector remains largely fragmented, with most players being small operators, making it harder to adopt advanced technologies.

To overcome this, collaborative digital platforms and active government support are needed. As the sector digitizes, cyber threats become a growing concern, requiring stronger data protection and security measures. The transition to technologies like artificial intelligence and automation also depends on workforce readiness. Government programmes like the Pradhan Mantri Kaushal Vikas Yojana (PMKVY**)** help with skill development, but private companies must also invest in up skilling to ensure sustainable growth.

FUTURE OF AI IN INDIAN LOGISTICS SECTOR

Hyperautomation, combining artificial intelligence, machine learning, robotics, and block chain, is transforming global logistics by enabling autonomous decisions, real-time tracking, and smart contracts. In India, AI is advancing rural logistics, with startups like ElasticRun helping small grocery stores connect efficiently to supply chains. Platforms such as the Open Network for Digital Commerce are turning small and medium businesses into competitive digital marketplaces, promoting smarter, more inclusive logistics across India's diverse regions.

However, AI's growth raises workforce and ethical concerns. Automation risks jobs for low-skilled workers, making up skilling essential. AI's use of consumer data also demands safeguards to prevent widening social inequalities. AI is thus driving growth in India's logistics with technologies like

predictive analytics, robotic warehousing, and smarter routing, supported by government initiatives like the National Logistics Policy and ONDC. Challenges remain in regulations, infrastructure, and ethics, but if addressed, AI can improve access, reduce delivery times, and connect India more deeply to global supply chains.

The future of logistics focuses on speed, inclusion, sustainability, and ethical intelligence powered by AI. Quick commerce platforms also continue adopting AI innovations, enhancing customer experience and inventory management.

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