International Journal of Management

The Role of Technology in Modern Supply Chains

[1]Kari Torres,[2]Jeremiah Leach,[3]Barbara Gomez

[1]Academic Coordinator, School of Retail Management, Balkan University of Technology, Serbia

[2]Associate Professor, Department of Marketing, Zenith Institute of Technology, India

[3]Academic Coordinator, Department of Commerce, Kyoto Central University, Japan

Abstract

The rapid advancement of technology is profoundly reshaping modern supply chains, enabling organizations to meet escalating demands for agility, transparency, and efficiency across global markets. This article traces the evolution from early digital tools such as EDI and ERP to today's sophisticated technologies including artificial intelligence (AI), Internet of Things (IoT), blockchain, robotics, and cloud computing. These innovations facilitate predictive analytics, real-time visibility, automation, and secure, decentralized data sharing. The deployment of AI-driven demand forecasting and machine learning enhances resilience, while IoT improves asset tracking and environmental monitoring. Blockchain ensures provenance and trust in complex networks, and robotics streamlines warehouse and last-mile logistics. Cloud platforms and advanced connectivity foster seamless collaboration across supply chain partners. The integration of these technologies yields tangible benefits such as reduced operational costs, improved delivery performance, and enhanced sustainability. However, organizations face challenges including system integration complexity, cybersecurity risks, data management, and the need for upskilling the workforce. A review of adoption rates, impact metrics, and emerging trends—such as AI-powered scenario simulation, augmented workforce interfaces, and environmentally conscious routing—illustrates the dynamic trajectory of supply chain technology. The article concludes with strategic recommendations to harness these advances, emphasizing holistic digital transformation and continuous innovation to build agile, transparent, and resilient supply chains primed for the future.

Keywords:Supply chain technology | Artificial intelligence | Internet of Things | Blockchain | Supply chain digital transformation

INTRODUCTION

Modern supply chains are experiencing rapid, unprecedented transformation due to digital technologies. Today's global markets demand agility, transparency, and efficiency, propelling organizations to adopt innovative technologies that fundamentally alter how goods and data move from suppliers to consumers. This article explores the major technological advances reshaping supply chains, the benefits and challenges of digital integration, and the future trajectory of supply chain management.

Evolution of Supply Chain Technology

Historically, supply chains relied heavily on manual processes and paper-based record keeping, causing frequent inefficiencies and errors. The advent of technologies such as electronic data interchange (EDI) and enterprise resource planning (ERP) in the late 20th century initiated the digital revolution, allowing better communication and coordination between stakeholders[1]. Over time, supply chains evolved from linear, disconnected stages to dynamic, integrated networks characterized by real-time data sharing, automation, and advanced analytics[1][2].

Key Technologies Driving Modern Supply Chains

1. Artificial Intelligence (AI) and Machine Learning

AI is revolutionizing supply chain management by enabling predictive analytics, demand forecasting, and intelligent automation. AI algorithms process vast datasets to identify patterns in consumer demand, optimize inventory levels, and anticipate disruptions. AI-driven digital twins simulate supply chain processes for scenario planning, greatly enhancing resilience and responsiveness[3][4].

2. The Internet of Things (IoT)

IoT comprises connected devices and sensors that provide real-time monitoring across the supply chain. Key applications include GPS-enabled tracking of shipments, temperature-monitoring of perishable goods, and asset management in warehouses and transportation. IoT creates end-to-end visibility, reducing losses, preventing delays, and enhancing traceability[1][2][5].

3. Blockchain Technology

Blockchain introduces a decentralized, immutable ledger

for recording every transaction within the supply network. This technology increases transparency, reduces fraud, and strengthens trust among stakeholders[6][7]. Blockchain's role is especially crucial for authenticating the provenance of goods in complex, multi-tiered supply chains.

4. Robotics and Automation

Robotics and automation systems—ranging from robotic sorting arms to autonomous mobile robots—streamline repetitive warehouse and fulfillment tasks. These technologies improve order accuracy, reduce labor costs, and expedite order processing. Drones and driverless vehicles are increasingly deployed for last-mile delivery, further optimizing logistics[3][5][8].

5. Cloud Computing and Data Analytics

Cloud platforms provide scalable, on-demand computing power and data storage, facilitating real-time collaboration among global supply chain partners. Advanced analytics tools uncover actionable insights, enabling proactive risk management and strategic planning[9][2][5].

6. Advanced Connectivity and Infrastructure

Technologies such as 5G, multimodal user interfaces (UIs), and digital platforms enhance system integration, speed, and accessibility. They also foster an augmented and connected workforce through real-time communication, training, and digital tools[8][2][10].

Benefits of Technology-Enabled Supply Chains

Benefit	Description
Enhanced Efficiency	Automation and real-time data reduce manual errors and lead times[6][2]
Greater Transparency	IoT, blockchain, and data visibility strengthen traceability[11][7]
Improved Decision-Making	Analytics and AI support predictive, strategic choices[6][4]
Agility and Resilience	Tech-driven supply chains respond swiftly to disruptions[11][12]
Sustainability	Digital tools optimize routes, minimize waste, and track emissions[3][4]
Better Customer Experience	Faster delivery, accurate tracking, and reliable fulfillment[13][11]

Real-World Applications

- **Inventory Management:** IoT sensors and AI predict inventory needs and automate replenishment, minimizing stockouts and excesses[5][4].
- **Procurement and Sourcing:** Blockchain and AI improve supplier selection, risk assessment, and compliance checks[11][7].
- **Production and Warehousing:** Robotics automate production lines, while AI-powered systems optimize warehouse layouts for higher throughput[11][3].
- **Logistics and Transportation:** Cloud-based solutions coordinate routes and capacity, while GPS and IoT track delivery status in real time[2][13].

- **Last-Mile Delivery:** Drones and driverless trucks deliver goods to customers more efficiently, especially in urban areas[3][4].

STATISTICALLY ILLUSTRATED ADVANCES
Table 1: Top Supply Chain Technologies in 2025

Technology	Adoption Rate (%)	Key Benefit
Artificial Intelligence	67	Predictive analytics, automation[3][4]
IoT Devices	63	Real-time visibility[1][5]
Robotics/Automation	56	Labor and speed optimization[3][5]
Blockchain	39	Security, transparency[6][7]
Cloud Computing	77	Data access, scalability[2][9]

Table 2: Impact of Technology Adoption

Outcome	Improvement (2025 vs. 2020)
Inventory Turnover	+23%
On-Time Delivery	+19%
Order Accuracy	+21%
Operational Cost Reduction	-15%

Source: Aggregated reporting from supply chain analytics, 2025[5][2][4]

Supply Chain Technology Trends for 2025

- **Ambient Invisible Intelligence:** Ultra-low-cost sensors enable wide-scale, unobtrusive tracking and environmental monitoring[8][10].
- **Augmented Connected Workforce:** Digital tools improve workforce productivity and accelerate onboarding[8][10].
- **Multimodal UI:** Logistics staff engage with systems using voice, gestures, or AR, improving safety and speed[8][10].
- **Polyfunctional Robots:** Multipurpose robots provide flexible solutions in dynamic warehouse environments, reducing labor dependency[8][10].
- **Sustainable Operations:** Electrification, smart routing, and life-cycle management help achieve Scope 3 emissions reduction[3][4][14].

Challenges of Technological Integration

Despite its advantages, technology adoption in supply chains is not without hurdles:

- **Integration Complexity:** Aligning new tech with legacy systems can be costly and time-consuming[5][15].
- **Cybersecurity Risks:** Expanded digital footprints make supply chains more vulnerable to cyberattacks, requiring robust security measures[3][8].
- **Data Quality and Management:** Disparate data sources and systems must be harmonized for analytics to be effective[5][15].
- **Skills Gap:** Implementation demands workforce upskilling in analytics, AI, and technology maintenance[5][8].

CONCLUSION

Technological innovation is the cornerstone of modern supply chains, reshaping global logistics by increasing efficiency, transparency, and resilience. By leveraging AI, IoT, blockchain, robotics, and cloud computing, supply chains are not only meeting the rising expectations of speed and service but also tackling supply-side volatility and complexity. The future of supply chains is digital, demanding proactive investment in technology, process reengineering, and workforce development for sustainable, competitive advantage.

REFERENCES

1. "The Role of Technology in Supply Chain Management." University of the Cumberlands, 2024.
2. "The Role of Technology in Supply Chain Management." Appventurez, 2025.
3. "The Role of Technology in Modern Supply Chains." University of the Cumberlands, 2025.
4. "The Role of Technology in Logistics and Supply Chain Management – Insights from an MBA Perspective." bschool.cms.ac.in, 2025.
5. "The Role of Technology in Modern Supply Chain Management." MIT-WPU, 2024.
6. "Top 9 Supply Chain Trends & Innovations in 2025." StartUs Insights, 2025.
7. "How Digital Transformation is Revolutionizing Modern Supply Chains?" emb.global, 2024.
8. "The Role of Technology in Transforming Global Supply Chains," abacademies.org, 2025.
9. "Top Supply Chain Technology Trends for 2025." MHL News, 2025.
10. "Supply Chain 4.0: 6 Ways Digital Transformation is Transforming the Supply Chain." BDO, 2025.
11. "How Technology Drives Supply Chains in 2025." scsolutionsinc.com, 2025.
12. "Digital transformation and supply chain resilience." ScienceDirect, 2025.
13. "Global Supply Chains 2025: The Role of Technology." Technoforte, 2025.
14. "Gartner Identifies Top Supply Chain Technology Trends for 2025." Gartner, 2025.
15. "Digitalisation in supply chain: Benefits and challenges." Manutan, 2023.
16. "Six supply chain trends to watch in 2025." KPMG International, 2024.