

Editorial: Rethinking efficiency and resilience: the role of AI and analytics in the future of supply chain management

For decades, companies have relied on a set of well-established metrics to evaluate supply chain performance, such as production quality, delivery speed, cost reduction, inventory turnover and order fulfillment time (Bozarth & Handfield, 2016). These metrics reflect the long-standing focus on efficiency in supply chain practices and worked well when business environments were relatively predictable. However, they are no longer sufficient in a world increasingly characterized by volatility, unexpected disruptions and rapid changes.

In recent years, events such as the COVID-19 pandemic, global supply shortages, geopolitical tensions and climate-related disruptions have exposed the vulnerabilities of global supply chains (Ivanov, Chen, Coit, & Altay, 2024). These challenges have underscored the importance of designing supply chains that are not only lean but also robust and responsive. As such, organizations must put equal emphasis on resilience, which refers to the ability to foresee, withstand and recover from shocks and disruptions while maintaining continuity in operations and service.

Resilience emphasizes adaptability, flexibility and risk mitigation, which can sometimes conflict with cost and speed, the focus of efficiency. Building such resilience requires enhanced visibility, the ability to model and prepare for complex scenarios and faster and more informed decision-making. Achieving both efficiency and resilience is possible, but requires more than just incremental improvements. It calls for a supply chain transformation powered by advanced analytics and artificial intelligence (AI), where their evolving capabilities can strike a balance between performance and preparedness.

Indeed, AI offers capabilities extending beyond basic automation and has emerged as a transformative force in supply chain management. Rather than working in isolation, AI is part of a suite of advanced analytical techniques rooted in mathematics, operations research and statistics, including machine learning, optimization and simulation. Together, they empower organizations to reveal hidden patterns, generate actionable insights and drive smarter decisions in real time using large volumes of structured and unstructured data.

When it comes to efficiency, AI and analytics are substantially improving demand forecasting accuracy by integrating diverse data sources, including historical sales, weather patterns and market data; see for, e.g., Liu, Chen, Yang, Xiong, and Chen (2022). For example, Walmart developed AI models to predict which products customers are more likely to purchase, at what time and their preferred delivery options. This initiative greatly improved the efficiency of its grocery and merchandise operations in ways that were impossible before (Silverstein, 2020). Similarly, Amazon uses AI to forecast daily demand for over 400 million products and predict order locations, enabling smarter inventory management and faster delivery (Van Cleave & Novak, 2023). In addition, to reduce customer complaints, Amazon's fulfillment centers have implemented AI tools that utilize generative AI and computer vision to detect damaged products before they are shipped out (Amazon, 2024).

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AI and analytics also hold strong promise in strengthening resilience, allowing businesses to predict, detect and respond to disruptions with greater speed and precision. For example, early warning signs of supply chains, such as supplier delays or geopolitical risks, can be identified from predictive analytics with real-time data, such that companies can take proactive actions before disruptions escalate (Johar, 2025). Another promising advancement is digital twins, which create virtual replicas of factories, warehouses and other assets in a supply network and perform real-time simulation, monitoring and optimization in a risk-free environment (Ivanov, 2023). With AI-powered digital twins, businesses can evaluate the potential effects of various disruption scenarios, test their contingency plans and make better-informed decisions. This capability to predict and adapt to change helps minimize downtime and financial losses and creates a more responsive supply chain that can succeed in uncertain conditions. Additionally, such systems are capable of learning from the most recent disruptions, establishing a continuous feedback loop to enhance future responses.

In conclusion, AI is helping shift supply chains from linear and siloed structures to interconnected and intelligent ecosystems. Technologies such as natural language processing, computer vision and reinforcement learning allow AI to interpret supplier communications, monitor production quality and adjust logistics dynamically in response to real-time conditions. Combining AI with other analytical tools, such as optimization algorithms and digital twins, organizations can move from reactive problem-solving to proactive planning, enhancing both efficiency and resilience of their supply chains. As supply chains become more digitized and data-rich, the integration of these technologies into supply chain management is no longer an option; rather, it is foundational to building future-proof supply chains that can adapt and thrive in a rapidly changing environment.

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