

# Digital-Intelligent Supply Chain Development Path and Resilience Mechanisms: A Case Study of JD Logistics

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## Abstract:

Global supply chains are increasingly transitioning from an efficiency-oriented paradigm toward a more resilient and sustainable model [1][2]. Recent disruptions, including geopolitical conflicts, extreme weather events, and trade policy changes, have exposed structural vulnerabilities in traditional supply chain systems, leading to higher operational risks and recovery costs [1][3]. In this context, digital-intelligent technologies—such as big data analytics, artificial intelligence, and digital twins—have become key enablers of supply chain resilience [4][5]. However, many enterprises, particularly small and medium-sized enterprises (SMEs), continue to face challenges such as data silos, fragmented technology adoption, and limited transformation capabilities [3][6]. This study examines JD Logistics as a representative case to explore the development path of digital-intelligent supply chains. The findings indicate that transformation typically follows a phased process, including infrastructure digitization, data integration, and ecosystem collaboration. Moreover, the integration of AI large models, digital twins, and edge computing forms a “prediction–simulation–execution” closed-loop mechanism that enhances adaptability and resilience. Based on these findings, this paper proposes lightweight transformation strategies for SMEs, offering practical implications for supply chain digitalization.

**Keywords:** digital-intelligent supply chain; supply chain resilience; JD Logistics; digital transformation; artificial intelligence

## 1. Introduction

In recent years, global supply chains have been repeatedly affected by a wide range of external shocks,

including geopolitical conflicts, extreme weather conditions, and adjustments in trade policies. These disruptions have not only increased operational uncertainty but also forced firms to reconsider tradi-

tional supply chain strategies. From a broader theoretical perspective, the concept of supply chain resilience has evolved significantly over the past decade. These disruptions have revealed the inherent limitations of traditional supply chain models, which are primarily designed to maximize efficiency rather than adaptability [1]. Consequently, problems such as supply interruptions, inventory accumulation, and logistics delays have become increasingly frequent [3].

Against this backdrop, supply chain resilience has gradually become a central concern in both academic research and industrial practice. In general terms, resilience refers to the ability of a system to anticipate potential disruptions, respond effectively, and recover within a reasonable timeframe [4][7]. Compared with efficiency-oriented supply chains, resilient systems place greater emphasis on flexibility, redundancy, and rapid responsiveness. This evolution reflects a growing recognition that supply chains operate in highly complex and uncertain environments.

However, the process of digital transformation remains particularly challenging for SMEs. Existing studies commonly identify three major obstacles: insufficient technological and human resource capabilities, high initial investment costs, and prolonged adjustment periods accompanied by uncertainty [3][6]. These factors often discourage firms from engaging in large-scale digital transformation initiatives. In addition, SMEs often face limitations in accessing high-quality data and advanced analytical tools.

To address these challenges, governments and industry organizations have promoted the development of shared digital platforms and Software-as-a-Service (SaaS) solutions. These approaches aim to lower entry barriers and

distribute transformation costs more evenly across firms. At the same time, digital transformation requires not only technological adoption but also organizational adaptation. Within this context, JD Logistics serves as a valuable case for examining how digital transformation can be implemented effectively at scale.

As one of the leading technology-driven logistics service providers in China, JD Logistics has accumulated extensive experience in digital transformation. Its continuous investment in intelligent logistics infrastructure and platform-based ecosystem development provides important insights into how digital technologies can be leveraged to enhance supply chain resilience.

Based on this background, this study aims to explore the development path of JD Logistics' digital-intelligent supply chain and analyze the mechanisms through which technological integration contributes to resilience enhancement. Specifically, this paper addresses the following aspects: (1) identifying key challenges in supply chain digitalization; (2) examining JD Logistics' phased transformation process; (3) analyzing the synergistic effects of core technologies; and (4) proposing practical strategies for SMEs.

## 2. Development Path of JD Logistics' Digital-Intelligent Supply Chain

JD Logistics' digital transformation did not occur overnight but evolved through a structured and progressive process. Based on publicly available reports, technical white papers, and industry analyses, its development path can be divided into three main stages. As shown in Table 1, JD Logistics follows a three-stage development path.

**Table 1 Three-Stage Development Path of JD Logistics' Digital-Intelligent Supply Chain**

Stage 1: Digital Infrastructure	Automation (AGV, Smart Warehouses) Data Collection (RFID, Sensors)
Stage 2: Data Platform	Data Integration Intelligent Decision-Making
Stage 3: Ecosystem Collaboration	Platform-based Integration Supply Chain Coordination

(Source: Compiled by the author based on JD Logistics reports.)

### 2.1 Stage 1: Digital Infrastructure Deployment

In the initial stage, JD Logistics focused on upgrading its core logistics operations through digitalization and automation. Technologies such as AGV robots, automated sorting systems, and smart warehouses were introduced to improve operational efficiency [8][9]. At the same time, RFID technology and sensor networks were deployed to

enable real-time data collection and monitoring across logistics processes.

Through these efforts, the company established a foundational linkage between physical operations and digital systems. This "physical-digital mapping" laid the groundwork for subsequent data-driven decision-making. Such foundational investments are essential for enabling large-

scale data generation and future intelligent applications.

### 2.2 Stage 2: Data Platform Integration and Intelligent Decision-Making

As business operations expanded, the volume and complexity of data increased significantly, leading to the emergence of data silos. To address this issue, JD Logistics developed a unified data platform to integrate heterogeneous data from different systems [9].

This platform enabled standardized data governance and improved data accessibility across the organization. As a result, supply chain processes became fully visible and analyzable, allowing data to evolve from a passive recording tool into an active decision-making resource. This transition marks a shift from localized optimization toward system-wide coordination.

### 2.3 Stage 3: Ecosystem Collaboration

After establishing strong internal data capabilities, JD Logistics extended its digital-intelligent capabilities to external partners. Through platform-based services, the

company facilitated system integration and data sharing among upstream and downstream firms [6][9].

This ecosystem-oriented approach significantly improved coordination efficiency and contributed to the construction of a more resilient supply chain network. By strengthening inter-organizational collaboration, the overall system became better equipped to respond to external shocks. This reflects a broader transition from firm-level optimization to network-level resilience.

## 3. Technological Synergy and Resilience Enhancement Mechanism

From a technological perspective, the effectiveness of JD Logistics' transformation can be attributed to the integration of multiple advanced technologies. This study proposes a conceptual framework consisting of AI large models, digital twins, and edge computing, which together enable full-chain intelligent decision-making. As illustrated in Figure 2, the system forms a closed-loop mechanism.

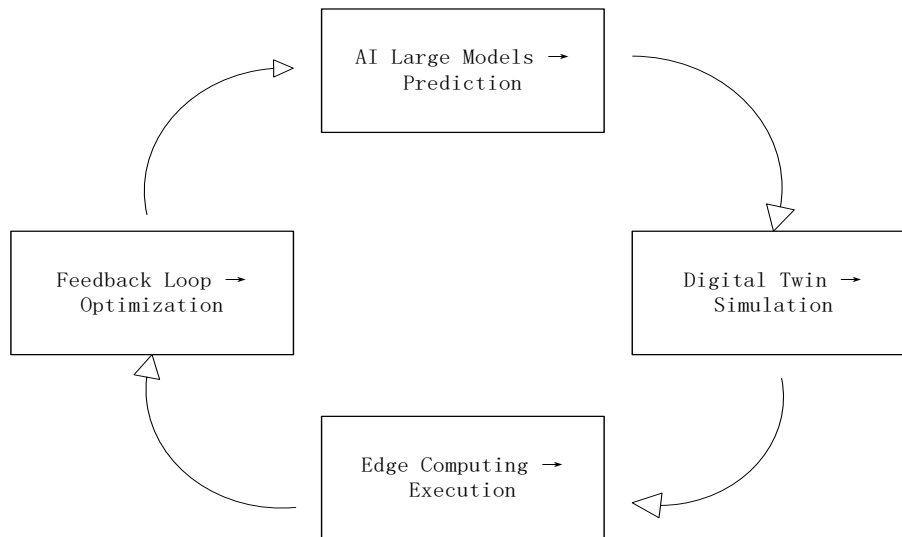


Figure 2 Closed-Loop Mechanism of Digital-Intelligent Supply Chain

### 3.1 AI Large Models: The Core of Intelligent Decision-Making

AI large models play a critical role in processing multi-source heterogeneous data and generating high-precision demand forecasts [10][5]. Compared with traditional forecasting methods, these models are capable of handling complex data structures and significantly improving prediction accuracy. These models can also continuously learn from new data, enhancing adaptability over time. Moreover, AI models support multi-agent coordination

and dynamic resource allocation, thereby enhancing the overall efficiency of supply chain operations.

### 3.2 Digital Twins: Simulation and Risk Management

Digital twin technology enables the creation of virtual replicas of physical supply chain systems, allowing firms to simulate complex operational scenarios [5][11]. In the face of disruptions, digital twins can be used to evaluate alternative strategies and predict system responses in ad-

vance.

This capability enhances decision-making under uncertainty and improves the system's ability to manage risks effectively. They also enable proactive scenario testing, allowing firms to prepare for potential disruptions in advance.

### 3.3 Edge Computing: Real-Time Execution Capability

Edge computing involves deploying computational resources closer to data sources, enabling real-time data processing and rapid response [5]. In logistics operations, this technology improves route optimization and task scheduling, thereby strengthening execution capabilities at the final stage of the supply chain. This improves response speed and ensures more efficient real-time operations.

### 3.4 Closed-Loop Mechanism

The integration of AI large models, digital twins, and edge computing forms a "prediction-simulation-execution" closed-loop system. This mechanism allows continuous feedback and dynamic optimization, which are essential for enhancing supply chain resilience. Such a mechanism supports continuous optimization and dynamic adjustment of supply chain operations.

## 4. Practical Challenges and Managerial Implications

### 4.1 Key Challenges in Transformation

Despite its success, JD Logistics encountered several challenges during its digital transformation process. These include high initial investment costs, difficulties in integrating new technologies with existing business processes, and organizational barriers related to cross-department collaboration. These issues highlight the importance of aligning technological innovation with organizational change.

### 4.2 Key Success Factors

The case of JD Logistics highlights several important success factors. First, a phased investment strategy helps reduce risk and improve return on investment over time. Second, strong alignment between technological development and business needs ensures that digital solutions effectively address real operational problems. Third, the establishment of a unified data platform facilitates data sharing and cross-functional collaboration.

### 4.3 Implications for SMEs

For SMEs, adopting a lightweight transformation strategy is more practical. This may involve leveraging SaaS-based solutions, sharing infrastructure resources, and focusing on key business scenarios where digitalization can generate the greatest value. Additionally, actively participating in digital ecosystems can help SMEs enhance their capabilities through collaboration. A phased and targeted approach is therefore more suitable for resource-constrained enterprises.

## 5. Conclusion

This study provides a comprehensive analysis of the digital-intelligent supply chain development path and resilience mechanisms of JD Logistics. The findings demonstrate that a structured and phased transformation approach can significantly enhance supply chain resilience. This indicates that structured and continuous transformation is essential for long-term competitiveness. Sustainability considerations have also been increasingly emphasized in JD Logistics' recent ESG practices [12].

At the technological level, the integration of AI large models, digital twins, and edge computing forms a closed-loop mechanism that improves system adaptability and responsiveness. At the managerial level, strategies such as phased investment, data platform integration, and ecosystem collaboration play a crucial role in ensuring successful transformation.

However, this study is subject to certain limitations. The analysis is primarily based on publicly available data and lacks access to internal operational details. Future research could incorporate empirical data and quantitative methods to further validate the proposed framework. In addition, emerging technologies such as blockchain and 5G/6G may offer new opportunities for enhancing supply chain resilience and deserve further exploration [5].

## References

- [1] Peng, Xinliang, Yu, Yun, Chen, Xiaofeng, et al. (2025). Global supply chain development trends and countermeasures. *Supply Chain Management*, 1–22.
- [2] Peng, Xinliang. (2025). Top ten supply chain development trends in 2025: AI-driven transformation of supply chains. *China Tendering*, (08), 17–22.
- [3] Peng, Xinliang, Liu, Tingting, Ma, Xiaoyu, et al. (2025). Characteristics, problems, and countermeasures of supply chain development in China. *Supply Chain Management*, 6(1), 10–18.
- [4] Jiang, Fan, & Shen, Feng. (2025). Digital-intelligence empowerment of supply chain resilience: Theoretical mechanisms and empirical analysis. *Supply Chain Management*,

1–15.

[5] Gartner. (2025). Top strategic supply chain technology trends.

[6] China Federation of Logistics and Purchasing (CFLP). (2025). China digital-intelligent supply chain development report (2024). Beijing.

[7] Pettit, T. J., Croxton, K. L., & Fiksel, J. (2013). Ensuring supply chain resilience: Development and implementation of an assessment tool. *Journal of Business Logistics*, 34(1), 46–76.

[8] Liang, Kangxin. (2024). Research on the motivation, path, and performance of JD Logistics' digital transformation (Master's

thesis). East China Normal University.

[9] JD Logistics. (2024). Digital-intelligent supply chain technology white paper (2024). Beijing: JD Logistics Technology Research Institute.

[10] Boston Consulting Group (BCG). (2025). AI-driven supply chain optimization: Reducing costs and enhancing resilience.

[11] Ivanov, D., & Sokolov, B. (2013). Control and system-theoretic identification of the supply chain dynamics domain. *European Journal of Operational Research*, 224(2), 313–323.

[12] JD Logistics. (2025). Environmental, social, and governance (ESG) report 2024. Beijing.