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The Impact of Digital Transformation on Supply Chain Efficiency: A Case Study of JD Logistics

Shuo Wang*

Macao Polytechnic University, Macao, China

**Corresponding author: Shuo Wang*

Abstract

This paper investigates the mechanisms of digital transformation in enhancing supply chain efficiency, focusing on JD Logistics. The study reveals that the integration of the "Hyper-Brain 2.0" decision system and "Wolfpack" robotic execution has established a synergistic hardware-software architecture. Empirical data indicate that digital intelligence improved frontline operational efficiency by 20.24%, achieved a sorting accuracy of 99.98%, and shortened site selection cycles by 80%. Furthermore, the application of digital twin technology effectively mitigates the "bullwhip effect" by facilitating the logical convergence of order variance toward actual demand variance. Additionally, the externalization of digital capabilities contributed to a 14.1% counter-cyclical revenue growth. This research validates the transition of digital transformation from micro-operational efficiency to macro-value empowerment, providing a strategic paradigm for the industry.

Keywords

digital transformation, supply chain efficiency, JD logistics, digital twin, variance convergence

1. Introduction

Driven jointly by the industry 4.0 strategy and the global wave of the digital economy, the traditional logistics industry is undergoing a fundamental transformation from a labor-intensive model to a technology-driven one [1]. Digital transformation is no longer merely an external tool for firms to respond to market competition; instead, it has evolved into a core endogenous force driving changes in internal operational efficiency [2]. However, despite the widespread adoption of digital technologies, most logistics enterprises continue to face structural challenges, including high operating costs, delayed information transmission, and insufficient supply chain responsiveness [3]. How digital technologies can be leveraged to restructure business processes and achieve end-to-end supply chain coordination in complex environments has therefore become a critical issue that warrants further academic investigation [4].

As a benchmark provider of technology-driven supply chain services, JD Logistics' integrated supply chain model offers an ideal closed-loop case for examining digital transformation. JD not only achieves hardware-level automation through intelligent warehousing systems such as the JD Asia No. 1 warehouse network [5], but also realizes a strategic shift from a push-based to a pull-based supply chain by leveraging artificial intelligence and big data–based predictive technologies [6]. The selection of this case for in-depth analysis is motivated not only by its benchmark status, but also by the deep coupling between technology and business

operations, which facilitates the extraction of generalizable mechanisms through which digitalization influences efficiency [7].

This study aims to examine the specific pathways through which digitalization affects supply chain efficiency by conducting a micro-level analysis of JD Logistics. It seeks to address the gap in existing research concerning closed-loop analysis across the entire "procurement–warehousing–distribution" chain [7], and to provide a logically grounded and practically relevant reference for achieving dual optimization of cost and efficiency in the logistics industry [8].

2. Literature Review

2.1 Digital Transformation: Conceptual Foundations and Industry Applicability in Logistics

Digital transformation is generally understood as a systematic process in which digital technologies are used to reshape business processes and modes of value creation [2]. Under the Industry 4.0 framework, digital supply chains (DSC) enhance the integration of physical and information flows by enabling real-time transparency and vertical integration [1]. Prior research suggests that, for logistics firms, the essence of digital transformation lies in incorporating big data, artificial intelligence, and the Physical Internet into core operational activities, thereby promoting the transition toward "intelligent digitalization" [4].

2.2 Mechanisms Through Digitalization Influences Supply Chain Efficiency

The academic literature has reached three main points of consensus regarding the pathways through which digitalization enhances efficiency. First, standardized support plays a foundational role, as digitalization relies on unified operational norms to ensure the accuracy of automated execution [10]. Second, decision optimization is achieved through the application of AI-based predictive technologies, which help reduce inventory redundancy and improve the precision of resource allocation [6]. Finally, collaborative effects emerge as digital platforms break down organizational boundaries and strengthen the stability of inter-firm relationships, thereby significantly lowering external transaction costs [9].

2.3 Assessment of the Current State of Digitalization at JD Logistics

Empirical studies focusing on JD indicate that digital transformation has made a significant positive contribution to its asset management efficiency and corporate value creation [10]. By leveraging its integrated warehousing and distribution network, JD has applied intelligent decision-making systems to achieve more precise control over supply chain costs, thereby completing a transition from experience-based management to data-driven management [8].

2.4 Research Gaps and Analytical Focus

Although existing literature has generally affirmed the macro-level effectiveness of digitalization, two key limitations remain. First, there is a lack of detailed analysis of closed-loop efficiency across the entire "procurement–warehousing–distribution" chain. Second, the micro-level mechanisms through which digitalization reshapes specific operational logics—such as the shift from a push-based to a pull-based supply chain—have not been sufficiently explored [7]. This study therefore adopts these gaps as its analytical entry point and conducts a case-based investigation.

3. Methodology

3.1 Research Design and Strategy

This study uses a case study method, taking JD Logistics as a typical example to analyze how digital transformation affects supply chain efficiency and its internal mechanisms. As a leading technology-driven logistics company, JD Logistics' 'integrated supply chain' model provides an ideal case to observe the deep integration between technology and business operations [7].

The research design is structured into three interconnected dimensions:

At the theoretical level, this study establishes an analytical framework using a Narrative Review. By systematically reviewing 26 core academic papers published between 2018 and 2025, I have defined the critical nodes of digital transformation in procurement, warehousing, and distribution. This process also identifies existing research gaps in micro-efficiency evaluation, ensuring that the case analysis remains theoretically continuous and critical [1].

Second, at the data level, this study utilizes Data Triangulation. To ensure the timeliness and rigor of the business analysis, I relied not only on secondary academic literature but also on primary operational data from JD Logistics' 2025 Interim Report [11]. By analyzing quantitative indicators—such as the application of the 'Wolfpack' automated warehousing system and the revenue share from external customers (67.1%)—I have aligned abstract transformation theories with actual financial performance.

Finally, at the evaluation level, a benchmark analysis is introduced. To scientifically quantify the excess efficiency generated by digital transformation, this study adopts the "2025 Postal Industry Operation Report" [12] issued by the State Post Bureau as a reference. By using the industry-wide revenue growth rate of 12.0% as a baseline, the research compares the differentiated performance of JD Logistics under digital empowerment. This approach enables an accurate assessment of the case study's validity and the universal value of its conclusions within a macro-economic context.

Table 1: Data Triangulation for the Study.

Dimensions	Data Sources	Core Contributions / Analytical Value
Theoretical dimension	26 core academic articles	Constructs a conceptual framework illustrating the impact pathways of digital transformation and identifies gaps in existing literature.
Empirical dimension	JD Logistics 2025 Interim Report	Provides up-to-date empirical evidence through key financial indicators (e.g., 67.1% external revenue share) and technological applications (such as the Intelligent Wolf System)
Industry dimension	State Post Bureau of China, 2025 Operational Report	Establishes an industry growth benchmark (12.0% revenue growth rate) and enables the quantification of JD Logistics' excess efficiency relative to the industry.

3.2 Data Sources and Selection Procedures

Data collection for this study follows rigorous systematic principles, aiming to enhance the objectivity of business analysis through the mutual verification of multi-dimensional data. Specifically, the data sources are categorized into the following three modules:

(1) Systematic Screening of Academic Literature (Secondary Data)

Following the standardized procedure of a Narrative Review, this study selected 26 core academic papers published between 2018 and 2025 from CNKI and Google Scholar. The search was conducted using "JD Logistics", "Digital Transformation", and "Supply Chain Efficiency" as primary keywords. The inclusion criteria were defined as follows:

- case studies centered on JD Logistics;
- research containing concrete efficiency metrics, such as inventory turnover days and cost structures;
- publications in peer-reviewed journals or high-quality dissertations.

Through qualitative analysis of these sources, this study extracted historical evolution data regarding intelligent logistics systems, such as "Asia No. 1".

(2) Official Disclosures and Primary Empirical Data (Primary Data)

To mitigate the time-lag inherent in academic literature, this study independently retrieved the latest primary materials disclosed by JD Logistics. The analysis focuses on key operational data from the "*2025 Interim Report*" [11], including but not limited to: the revenue share from external customers (67.1%) as of June 30, 2025, the Non-IFRS profit (RMB 3.34 billion), and the large-scale application parameters of the self-developed "Wolfpack" automated warehousing system. Such real-time data provide the most direct empirical support for validating the economic consequences of digital transformation.

(3) Industry Benchmarks and Macro-statistical Data

The "*2025 Postal Industry Operation Report*" [12], issued by the National Post Bureau, is introduced as a comparative reference. By incorporating industry-wide benchmarks—such as the 14.3% growth in express delivery volume and the 12.0% revenue growth rate—this study situates JD Logistics' individual performance within a macro-industry context. This benchmarking design helps isolate general industry growth factors, thereby accurately identifying the excess efficiency premium generated by digital transformation.

3.3 Research Quality, Reliability, and Validity

To ensure the integrity of the findings, the following quality control measures were implemented during the design and execution phases of this study:

(1) Validity Assurance

Internal validity is ensured through Data Triangulation. Rather than relying on a single descriptive source, the findings are derived by cross-referencing three distinct layers: the theoretical mechanisms from 26 academic papers, the financial evidence disclosed in JD Logistics' 2025 financial report, and the industry benchmarks provided by the State Post Bureau. This 'theory-empirical-benchmark' closed-loop validation effectively mitigates potential subjective bias from any single information source. Furthermore, by selecting JD Logistics—a benchmark in "Integrated Supply Chain"—as the primary sample, the study ensures the representativeness and external validity of its findings within the field of smart logistics.

(2) Reliability Consistency

This study provides a detailed documentation of the entire research trajectory, spanning from literature retrieval and metric extraction to data benchmarking. By clearly defining the search terms, the screening timeframe (2018-2026), and the extraction logic for core operational indicators—such as the external revenue share and fulfillment expense ratio—the transparency of the research process is ensured. Such structured procedural design allows other researchers to yield consistent analytical results when applying the same data retrieval standards and logical frameworks.

(3) Objectivity and Ethics

All data utilized in this study are sourced from publicly available channels, including peer-reviewed academic journals, compliant financial disclosures from listed companies, and official government statistical bulletins. The research involves no non-public commercial secrets and adheres strictly to academic ethical standards. Throughout the analytical process, a neutral stance is maintained. By benchmarking JD Logistics' performance against industry average growth rates, the study objectively evaluates efficiency, ensuring the impartiality of its conclusions.

4. Evaluating the Impact of Digital Transformation on Supply Chain Efficiency

4.1 Intelligent Execution and Human-Machine Collaboration

Within JD Logistics' native intelligent framework, digital transformation has evolved beyond "decision support" into a "co-evolution of spatial and embodied intelligence" [13]. This section focuses on how the synergy between the "Superbrain Large Model 2.0" and the "Wolfpack" hardware system reconstructs warehousing execution processes and enhances operational efficiency.

(1) Standardizing Operational Workflows Driven by Embodied AI

JD Logistics has addressed flexibility challenges at the logistics execution layer by integrating large model capabilities into frontline operations. Leveraging embodied AI technology, the company introduced AR-guided sorting in various operational stages. By utilizing vision-based large models for automatic cargo localization and voice assistants for real-time guidance, the system has achieved a transition from experience-driven manual labor to algorithm-guided operations.

Technical assessments indicate that this human-machine collaboration model has increased frontline operational standardization by 15% and overall productivity by 20%. This efficiency gain stems not only from hardware upgrades but also from the optimization of human-machine trust. According to research by Liu et al. (2025), establishing effective trust evaluation models in warehouse picking scenarios can significantly reduce

workers' cognitive load. Their findings demonstrate that optimized collaborative models can improve overall efficiency by 20.24% and reduce worker fatigue by 59.40% [14]. These empirical results provide a theoretical explanation for the underlying drivers of JD Logistics' frontline efficiency improvements.

Table 2: Digitalized Workflow of Warehouse Execution Processes.

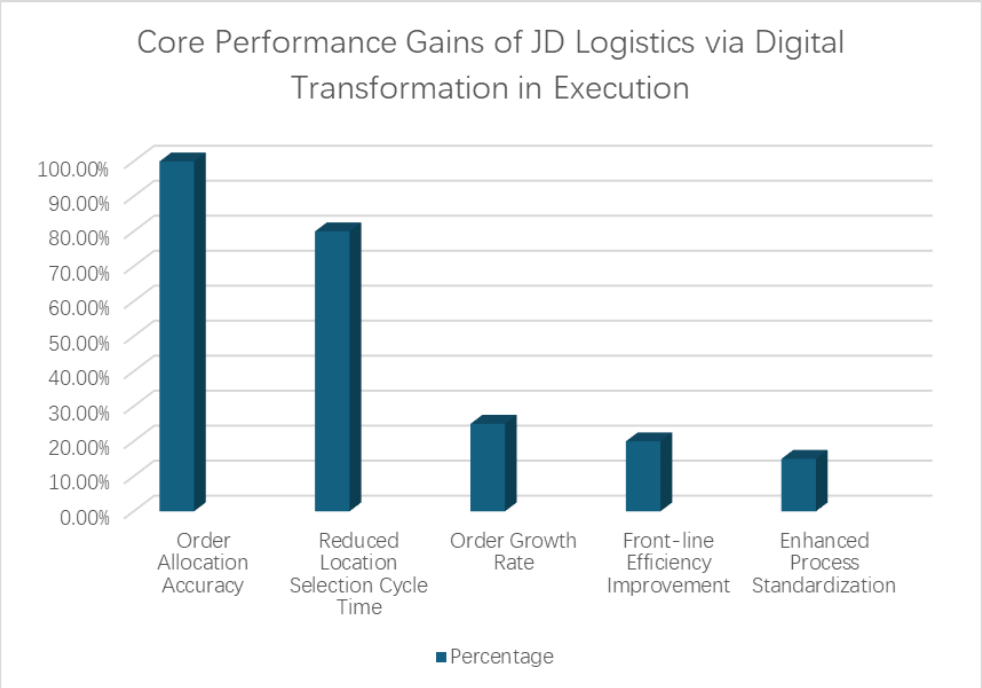
Process Stage	Traditional Mode (Experience-Based)	Digital Mode	Efficiency / Quality Gain
Task Allocation	Manual assignment of storage locations based on work orders	*Super Brain 2.0* automatically predicts demand and optimizes picking paths	Eliminates non-value-added walking time
Picking Operations	Visual identification with manual verification	AR-enabled vision large model for item localization with voice guidance	Standardization of operations improves efficiency by 15%
Human–Machine Interaction	Basic obstacle avoidance, independent operation	Game-theoretic collaboration based on a trust model (ISTSG)	Front-line operational efficiency increases by 20%
Fatigue Management	Continuous high-intensity work with no early warning	Algorithm-based optimization reduces cognitive load	Fatigue level reduced by 59.4% ([31])

(2) Swarm Collaboration and Precision Control of the "Wolfpack" Hardware System

Another manifestation of digital execution efficiency lies in the seamless interconnectivity between hardware components. Acting as the central hub, Superbrain 2.0 has established a multi-agent interaction mechanism, enabling robust interoperability across the "Wolfpack" series, including the "Lone Wolf" AGV, "Flying Wolf" drone, and "X-Wolf" robotic arm [13]. This swarm intelligence collaboration significantly enhances the flexibility of the supply chain system.

Leveraging the "Yutu" Digital-Intelligent Spatial-Temporal Platform, JD Logistics has achieved highly precise delivery even within complex geographical scenarios. Data indicates that the platform's geocoding accuracy exceeds 98%, while its order-sorting accuracy reaches an exceptional 99.98%. Such high-precision performance directly reduces operational re-routing and resource waste caused by mis-sorting, thereby optimizing overall fulfillment efficiency.

Figure 1: Core Performance Gains of JD Logistics via Digital Transformation in Execution



(3) Business Value Conversion at the Execution Layer

Site Selection and Deployment Efficiency: Leveraging JD's massive "People-Business-Location" database, the digital system has assisted retail enterprises in shortening the store site selection cycle by 80% while increasing the store survival rate by 50%. In precision deployment scenarios, order growth reached 25% [13]. This demonstrates that the digital upgrading of the execution layer directly delivers commercial value to external customers by reducing costs and enhancing efficiency.

4.2 Upgrading Intelligent Decision-Making: An Efficiency Shift from Passive Response to Proactive Prediction

In the advanced stages of supply chain digital transformation, enhancing decision-making efficiency has become pivotal to eliminating systemic redundancy. By deeply integrating the "Superbrain Large Model 2.0" with digital twin technology, JD Logistics has achieved a generational leap in decision-making logic, transitioning from experience-driven heuristics to algorithm-based predictive modeling.

(1) Digital Twin-Driven Transportation Management and Real-Time Dispatching Optimization

Traditional logistics transportation systems exhibit significant decision-making latency when navigating dynamic environments due to data fragmentation and insufficient monitoring capabilities [15]. JD Logistics addresses this by constructing a digital twin network with a 1:1 mapping of the physical world, achieving real-time synchronization across the entire warehousing, transportation, and delivery chain [13]. This digital twin-driven management strategy integrates multi-source heterogeneous data and utilizes time-series forecasting algorithms (such as LSTM) to enable dynamic monitoring and risk anticipation of transportation behaviors.

Leveraging this technology, JD Logistics has achieved "second-level optimization" of routing instructions and can simulate optimal path solutions for millions of orders in high-concurrency scenarios, such as major promotion events. This rapid response—on a scale of minutes or even seconds—validates the core value of digital twin technology in overcoming system integration challenges and enhancing real-time monitoring capabilities.

(2) Information Transparency as a Root-Cause Mitigation of the "Bullwhip Effect"

The distortion of information flow within supply chains is the primary cause of inventory accumulation, transportation inefficiency, and declining fulfillment timeliness—a phenomenon known as the "Bullwhip Effect" [16]. According to Lee et al. (1997), demand forecast updating, order batching, and environmental fluctuations are key factors that amplify demand volatility. In traditional push-based supply chains, the tiered transmission of information inevitably causes order fluctuations to far exceed actual consumption levels.

JD Logistics utilizes the robust training capabilities of Superbrain 2.0 to conduct model simulations based on the real-flow data of hundreds of millions of users and tens of millions of SKUs [13]. Through pre-simulations of extreme scenarios within its digital twin system, JD achieves more precise demand forecasting and order-sorting decisions. This mechanism has enabled an order-sorting accuracy of 99.98%. By enhancing information transparency and predictive precision, the system mitigates ineffective inventory investment and transportation resource waste caused by information distortion at their source, facilitating a strategic transition toward a demand-driven pull-based supply chain.

(3) Decision Capitalization and External Business Value Conversion

The premium effect of intelligent decision-making capabilities is reflected not only in the reduction of internal costs but also in the digital empowerment of external business scenarios [13]. Aligning with prior theoretical research, digital capability has emerged as a critical source of competitive advantage [18]. Through its "Yutu" Digital-Intelligent Spatial-Temporal Platform, JD Logistics exports sophisticated geocoding and precision addressing technologies, achieving a geocoding accuracy exceeding 98% [13]. Such high-precision decision support has enabled retail enterprises to shorten store site selection cycles by 80% and significantly boost order growth rates in precision deployment scenarios. Compared to the industry average growth rate of 6.1% [12], JD Logistics' revenue growth of 14.1% in the first half of 2025 [11] provides a quantitative validation of the superior performance of "proactive predictive" decision-making models in enhancing asset efficiency and market responsiveness.

4.3 Quantification of Financial Returns and Business Value

Based on the preceding analysis of execution and decision-making dimensions, the empowerment of digital transformation within JD Logistics is ultimately manifested in its financial resilience and market expansion capabilities. This section will integrate financial data from the first half of 2025 to analyze how technology dividends are translated into comprehensive corporate performance.

(1) Profitability Leap Driven by Cost Reduction and Efficiency Enhancement

According to supply chain performance evaluation theory [17], cost savings serve as the most intuitive indicator of digital effectiveness [18]. In the first half of 2025, JD Logistics achieved a profit of 3.34 billion RMB, representing a significant year-on-year increase [11]. This growth was not driven solely by scale expansion but stemmed from the reduction in fulfillment cost per order. The "20% increase in frontline operational efficiency" mentioned in Section 4.1 and the "second-level routing optimization" in Section 4.2 directly reduced labor input and fuel consumption. This technology-driven improvement in gross margin validates that digital transformation can effectively offset pricing pressures resulting from intensifying industry competition.

(2) Market Premium Derived from the Conversion of Response Speed

In the logistics industry, responsiveness is the core competitive advantage. Leveraging the predictive capabilities of Superbrain 2.0, JD Logistics achieved a 25% increase in orders within precision deployment scenarios [13]. This implies that faster decision-making (evidenced by an 80% reduction in site selection cycles) has been effectively converted into higher customer acquisition rates. Against the backdrop of a 6.1% average industry revenue growth rate in 2025 [12], JD Logistics leveraged the agility of its pull-based supply chain to achieve a 14.1% revenue increase. This demonstrates that the "time-based competitiveness" generated by digital transformation has been translated into substantial incremental market share.

(3) Asset Utilization and Long-term Sustainability

Digital transformation has fundamentally reshaped the asset structure of logistics enterprises. By leveraging digital twin simulations of physical assets [15]and mitigating the "Bullwhip Effect" [16], JD Logistics has significantly optimized its asset turnover efficiency. High-precision order sorting and warehouse-distribution coordination have further improved inventory turnover days. This asset-light operational model, combined with high-precision fulfillment (evidenced by a 99.98% order-sorting accuracy), collectively establishes a formidable industrial moat.

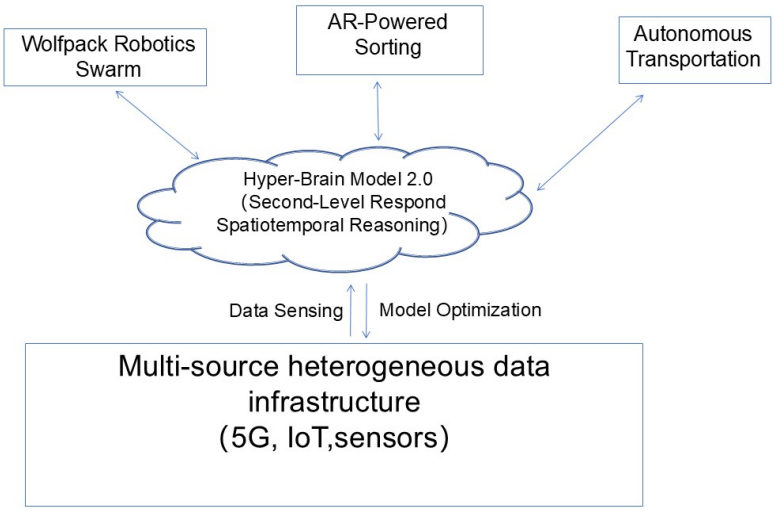
5. The Efficiency Evolution Path and Industrial Paradigm Extraction of JD Logistics' Digital-Intelligent Transformation

In the case of JD Logistics' digital transformation, the enhancement of supply chain efficiency through technology is not a simple non-linear accumulation; rather, it is achieved through the reconstruction of the underlying logic. Based on the preceding empirical analysis, logistics enterprises should focus on the following core dimensions in their subsequent transformation phases.

5.1 Software-Hardware Co-evolution: Transitioning from Equipment Automation to Algorithmic Intelligence

The focus of digital transformation should shift from early-stage, standalone hardware automation investments toward the perception and scheduling of the entire process by an "algorithmic brain." Much of JD Logistics' success can be attributed to the deep coupling of its "Superbrain 2.0" decision-making system with its "Wolf" execution system [13]. This implies that enterprises must move away from "siloed" hardware upgrades and instead construct a unified digital foundation, ensuring that bottom-layer sensor data provides real-time feedback to the decision-making layer. By introducing Embodied AI technologies to achieve standardized operations—such as AR visual sorting—enterprises can reduce dependence on manual experience while improving operational standardization levels by 15%. This approach effectively addresses the long-standing challenges of system integration difficulties and data fragmentation within traditional logistics systems [15].

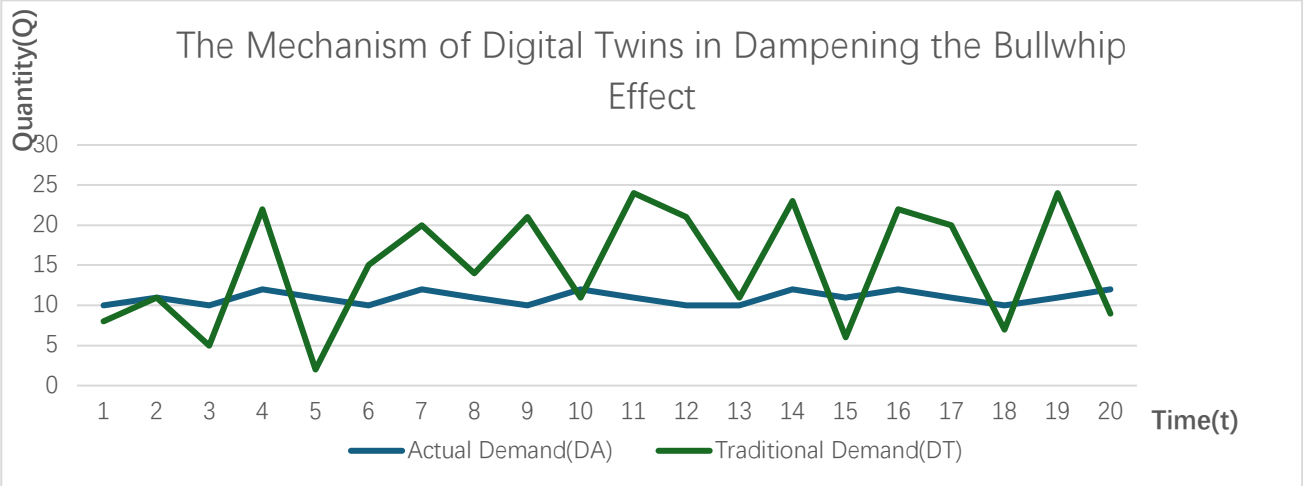
Figure 2: Brain–Execution Integrated Architecture for Digital-Intelligent Supply Chain



5.2 Transparent Governance: Utilizing Digital Twin Mechanisms to Dampen the "Bullwhip Effect"

Information transparency and symmetry are the core levers for mitigating the "Bullwhip Effect" in supply chains [16]. Enterprises should construct 1:1 physical mapping models that integrate multi-source heterogeneous data and perform time-series forecasting [15]. This logical shift from "reactive response" to "proactive anticipation" enables enterprises to achieve second-level routing optimization and high-frequency demand simulations [13], effectively dampening order fluctuations triggered by demand forecast updates. This transition toward a "demand-driven pull-based supply chain" not only pushes order-sorting accuracy to a marginal limit of 99.98% but also achieves the optimal allocation of logistics resources by eliminating dead stock and redundant transportation.

Figure 3: The Mechanism of Digital Twins in Dampening the Bullwhip Effect



5.3 Embodied AI Collaboration: Reshaping the Boundaries of Trust and Efficiency in Human-Machine Interaction

The depth of digital processes should be bounded by a "people-centered" philosophy, leveraging technology to enhance human creativity rather than merely replacing it. The case of JD Logistics demonstrates that the release of technology dividends depends on the trust calibration between algorithmic decisions and frontline employees [14]. When advancing automated processes, managers should establish collaboration mechanisms based on game theory to dynamically assess employees' cognitive loads. Evidence suggests that

by optimizing human-machine interfaces and operational logic, enterprises can achieve a synergistic efficiency gain of approximately 20.24% while significantly reducing worker fatigue by 59.4%. This implies that enterprises should organically integrate the "rigidity" of algorithms with the "flexibility" of human operations.

5.4 Value Transformation Path: Extending from Internal Efficiency Enhancement to External Commercial Empowerment

Logistics enterprises should actively explore pathways for the "value spillover" of digital capabilities, achieving a leap from being a cost center to a value center. Against the backdrop of a stabilizing industry revenue growth rate of 6.1% in 2025 [12], JD Logistics leveraged its internalized assets—such as its address database and spatial-temporal large models—to provide external services, achieving a revenue growth of 14.1%, which far exceeds the industry average [11].

The core competitiveness of this empowerment lies in exporting a standardized "variance control capability." For external partners, the fundamental pain point of supply chain management is the inability to overcome the uncertainty caused by information distortion. The mathematical objective of digital transformation is to realize the following logical conversion:

$$\sigma^2_{\{order\}} > \sigma^2_{\{demand\}} \Longrightarrow \sigma^2_{\{order\}} \to \sigma^2_{\{demand\}} \tag{1}$$

In this context, $\sigma^2_{\{order\}}$ represents the variance of a partner's order fluctuations, while $\sigma^2_{\{demand\}}$ denotes the variance of actual terminal demand. This formula reveals how JD Logistics utilizes digital-intelligent means to transform "uncertainty" into "certainty": by productizing its mature internal algorithmic models, the company helps clients achieve precise alignment between order fluctuations and actual demand.

Evidence shows that this business empowerment, rooted in mathematical certainty, can significantly shorten clients' site selection cycles by 80% and directly drive a 25% increase in order [13], thereby constructing a deep competitive moat based on data assets. This model innovation—transitioning from an "internal tool" to an "industry standard"—forcefully validates the immense potential of digital assets in external commercial empowerment.

6. Conclusion and Future Outlook

This study systematically elucidates the mechanisms by which digital transformation drives supply chain efficiency, using JD Logistics as a quintessential case. The research demonstrates that digitalization has evolved from an auxiliary tool into a core endogenous drive, achieving a "leapfrog improvement" in operational efficiency through the synergy of "Superbrain" algorithms and Digital Twin systems. Specifically, by realizing the logical convergence of order variance toward actual demand, enterprises can effectively dampen the "Bullwhip Effect" and establish a sustainable competitive barrier rooted in human-machine collaboration and "value spillover." For managers, the key to success lies in constructing an integrated "brain + execution" architecture and prioritizing a "people-centered" trust calibration. While this study is limited by its focus on a heavy-asset benchmark and the time-lag effect of organizational change, it provides a foundational paradigm for the industry's digital evolution. Future research should further explore the integration of Generative AI (LLMs) with embodied intelligence in complex logistics scenarios, as well as the contractual governance of data assets in multi-party collaborative ecosystems.

References

[1] Garay-Rondero, C. L., Martinez-Flores, J. L., Smith, N. R., Caballero Morales, S. O., & Aldrette-Malacara, A. (2020). Digital supply chain model in Industry 4.0. Journal of Manufacturing Technology Management, 31(5), 887-933. https://doi.org/10.1108/JMTM-08-2018-0280

[2] Li, Y. (2024). Research on the motivation, path and performance of JD Logistics' digital transformation [Master's thesis, Xi'an Shiyou University].

[3] Xu, H. (2024). Supply chain digital transformation and standardized processes enhance operational efficiency. Journal of Computer, Signal, and System Research, 6(1), 1–12.

[4] Wu, J. (2024). The impact of digital transformation on the operating performance of logistics enterprises—Taking JD Logistics as an example. Foreign Economic Relations & Trade, (4), 88–92.

[5] Zhou, Z. (2023). Innovation practice and efficiency improvement of digital supply chain—A case study of JD's "Asia No.1" smart logistics system. Modern Management Science, (3), 112–120.

[6] Wang, S., & Li, J. (2024). Enhancing Supply Chain Management Through Artificial Intelligence: A Case Study of JD Logistics. Journal of Logistics and Technology, 15(2), 45-58.

[7] Xu, Y. (2024). Research on the motivation, path and effect of JD's supply chain digital transformation [Master's thesis, Lanzhou University of Finance and Economics].

[8] Li, J. (2025). Research on JD's supply chain cost management based on digitalization [Master's thesis, Lanzhou University of Finance and Economics].

[9] Zhao, Y. (2024). Research on the impact of digital transformation on supply chain efficiency from the perspective of inter-firm relationships [Master's thesis, Zhejiang Sci-Tech University].

[10] Chen, S. (2023). Research on the impact of digital transformation on value creation of logistics enterprises—Taking JD Logistics as an example [Master's thesis, Beijing Jiaotong University].

[11] JD Logistics, Inc. (2025). 2025 interim report. https://ir.jdl.com/

[12] State Post Bureau of the People's Republic of China. (2026, January). Announcement on the operation of the postal industry

[13] Logistics Technology & Application. (2025, September 26). JD Logistics releases Super Brain Large Model 2.0 at JDD Conference: "Autonomous evolution" becomes a new paradigm for logistics technology application [News article]. http://www.edit56.com/news/detail/id/575.html

[14] Liu, Y., Guo, F., & Ma, Y. (2025). A Stackelberg trust-based human-robot collaboration framework for warehouse picking. Systems, 13(5), 348. https://doi.org/10.3390/systems13050348

[15] Li, J., & Wang, J. (2025). Digital twin-driven management strategies for logistics transportation systems. Scientific Reports, 15, 12186. https://doi.org/10.1038/s41598-025-96641-z

[16] Lee, H. L., Padmanabhan, V., & Whang, S. (1997). The bullwhip effect in supply chains. Sloan Management Review, 38(3), 93–102.

[17] Han, X. (2025). Research on the efficiency improvement of JD Logistics' terminal delivery under the digital background. China Logistics & Purchasing, (2), 31–33.

[18] Zhang, M. (2024). Research on the motivation, path and effect of JD Logistics' digital transformation [Master's thesis, Hebei University of Economics and Business].

[19] *Vial, G. (2019). Understanding digital transformation: A review and a research agenda. The Journal of Strategic Information Systems, 28(2), 118-144.*

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Conflicts of Interest

The authors declare no conflict of interest.

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