

# ***Development Dilemma and Solutions of Digital Supply Chain Management***

**Yihao Sun**

*School of Management, Shandong University of Technology, Zibo, China  
sunyihao225@gmail.com*

**Abstract.** Against the context of further expansion of digital economy plus industrial restructuring and upgrade, digital supply chains serve as a core pillar to raise the overall development standard of industrial networks and strengthen supply chains' ability to withstand market shocks. This paper takes China's digital supply chain as its research object, deeply analyzing the practical difficulties faced by enterprises, technologies, collaboration, and industries, and proposing targeted solutions. The study finds that China's current digital supply chain is characterized by policy-driven growth, leading enterprises, and the practical application of technologies, with significant achievements in large-scale applications. However, it still faces problems such as insufficient transformation momentum, fragmented technology application, prominent information barriers between upstream and downstream sectors, and lagging standards and regulatory systems. For digital supply chains to achieve robust and sustainable progress, businesses ought to lay out long-term strategies, upgrade internal capabilities, speed up technological integration and data interoperability, create mutually beneficial industrial cooperation ecosystems, and perfect industry norms and relevant regulations. The conclusions drawn from this research can offer actionable guidance for domestic firms and industrial clusters to carry out digital upgrades across their supply networks.

**Keywords:** Development Dilemma, digital supply chain management, commerce

## **1. Introduction**

The global industrial division of labor continues to adjust, and how smoothly and reliably industrial and supply chains operate has turned into a core metric to judge industrial competitiveness. Meanwhile, widespread adoption of digital tools including big data, artificial intelligence and the Internet of Things has reshaped production organization, logistics distribution and resource allocation models from the ground up, making supply chain digitization an irreversible trend amid industrial upgrading. Digital technologies can tear down information silos, better align supply capacity with market demand, raise full-process data transparency and shorten response cycles. These technologies cut operational expenses, mitigate business risks and boost cross-party cooperation. As China pushes forward its new development framework and pursues high-quality economic growth, advancing digital upgrades for supply chains is not merely a practical way for

businesses to lift operational efficiency, but also a vital measure to stabilize industrial chains and guarantee industrial security.

In recent years, driven by both policy initiatives and market demand, the digitalization of China's supply chain has accelerated significantly. More and more companies are introducing digital tools into procurement, production, warehousing, and distribution. Scenarios such as intelligent scheduling, inventory forecasting, and route optimization are gradually maturing, and the construction of smart logistics and smart factories continues to advance. A number of leading enterprises have leveraged their technological and resource advantages to build a digital operation system covering the entire supply chain. They have also driven the upgrading of upstream and downstream enterprises through open platforms, data sharing, and collaborative plans, resulting in an overall improvement in the quality of supply chain operations. However, from an overall perspective, the digitalization of China's supply chain is still in the stage of transitioning from pilot projects to widespread implementation, and the problems of unbalanced and uncoordinated development are quite prominent.

In practice, digital transformation still faces multiple constraints. Many business entities, small and medium-sized firms in particular, lack sufficient understanding of digitalization, have limited investment capacity, weak talent reserves, and unclear motivation and implementation path for transformation. Technology applications often remain at a single stage, which creates barriers to system interconnection, resulting in unified data norms lacking and isolated data pools prevalent across departments. Limited information sharing and an imperfect cooperation mechanism exist among all upstream and downstream participants within supply chains. Issues of trust and profit distribution hinder collaborative efficiency. Furthermore, the development of relevant systems, such as industry standards, data security, privacy protection, and platform responsibility, is relatively lagging behind, so they fail to match the fast-growing demands brought by evolving digital supply chains. These issues collectively affect the full realization of digital value.

Against this backdrop, this paper studies the development trend, current challenges, and optimization paths of China's digital supply chain. This article summarizes the main characteristics and practical achievements of the current digital supply chain, analyzes the prominent problems existing at the enterprise, technology, collaboration, and system levels, and proposes improvement directions based on typical experiences. The study aims to provide a reference for enterprises to promote digital transformation more steadily, offer ideas for improving the industry's collaborative mechanism, and provide a basis for optimizing relevant policies, thereby promoting the development of China's supply chain digitalization towards a deeper and higher quality.

## **2. Overall development trend of digital supply chain management in China**

### **2.1. Overall trend**

Driven by the expansion of digital economy and industrial structural upgrading, the digital transformation of enterprises is showing an accelerated spread. According to relevant statistics, 77.4% of industrial enterprises in China have carried out digital transformation to varying degrees, which indicates that digital technology has gradually moved from early pilot projects to large-scale applications. In terms of industrial support, 80 national-level advanced manufacturing clusters have been formed nationwide, with high-end equipment accounting for 36.25%, providing a relatively complete industrial foundation to advance supply chain digital upgrading.

However, when looking at enterprise groupings, digital adoption gaps remain stark across company scales and industrial sectors. The transformation process of SMEs and traditional

industries is relatively lagging behind, which means the ongoing growth of digital supply networks carries clear traits of rapid expansion paired with uneven development.

According to data from the Fifth National Economic Census, in 2023, among enterprises above a certain size in China, the application rates of cloud computing, the Internet of Things, and artificial intelligence were 37.6%, 26.5%, and 16.4%, respectively. Among them, cloud computing has become the most widely used basic technology due to its low deployment cost and strong scalability. Digital technologies are exhibiting a differentiated penetration pattern in the supply chain sector. Data released by the China Federation of Logistics and Purchasing indicates that the overall penetration rate of artificial intelligence in China's logistics supply chain exceeds 37%, with a penetration rate as high as 78.18% in transportation optimization scenarios, achieving large-scale implementation in areas such as scheduling optimization and route planning. Various technologies are moving from single-point trials to scenario-based implementation, but cross-process and cross-system integrated applications still need further strengthening.

## 2.2. Core characteristics of digital supply chain development

Policy driven and industrial synergy are prominent. The development of China's digital supply chain is highly dependent on policy guidance. Focusing on the modernization of the industrial chain and the improvement of the toughness of the supply chain, the policy reduces the threshold of enterprises' digital transformation and promotes upstream and downstream collaboration through financial support, demonstration projects and other measures. The downstream leading enterprises are the first to complete the digital transformation under the policy incentives, and their information systems and data capabilities are transmitted to the upstream, driving suppliers to adjust production organization and resource allocation, forming a backward spillover effect. At the same time, the construction of advanced manufacturing clusters has consolidated the foundation of regional enterprise collaboration and accelerated the diffusion of digital applications in the industrial chain. The dual drive of "policy guidance + Industrial Agglomeration" has become a key feature of the rapid development of China's digital supply chain.

Led by leading enterprises, the digitalization level of the industry is obviously differentiated. The digital transformation of the industry presents significant structural differences. Large enterprises rely on the advantages of capital, technology and data to realize the digitalization of the whole link of procurement, production and logistics; Small and medium-sized enterprises can only complete partial informatization transformation due to the limitation of investment capacity and technological foundation. This difference is further amplified through the supply chain relationship [1]. Downstream core enterprises manage upstream suppliers through the order system and data platform, which can improve production efficiency, but the lack of docking ability of small and medium-sized enterprises' systems leads to uneven distribution of collaborative benefits and exacerbates the digital stratification within the supply chain [2].

Technology applications have evolved from single-point tools to scenarios and platforms. The application of digital technology in the supply chain is changing from single-point optimization within enterprises to cross-enterprise collaboration. Early focus on inventory management, transportation scheduling and other single links; With the improvement of data capacity, enterprises gradually open up the information links of procurement, production and distribution. However, at present, most enterprise systems are deployed dispersedly, and the data interface and standard are not unified, which restricts the efficiency of information flow in the supply chain, and there is still a gap from the real platform collaboration [3].

### 2.3. Typical case: Jd.com digital supply chain practice

Jd.com, as a benchmark enterprise in the domestic integrated supply chain, has built a digital system covering demand forecasting, intelligent inventory, warehouse network scheduling and intelligent performance. In the demand forecasting process, the production replenishment plan is optimized based on data such as consumption behavior and regional characteristics to reduce inventory fluctuations. In the performance link, with the help of distributed warehousing and intelligent scheduling, the nearest delivery and efficient distribution can be realized. The financial report data of 2024 shows that JD self-operated inventory turnover days are about 30 days, which is better than the industry average; More than 95% of self-operated orders will be delivered within 24 hours, and the core urban agglomeration will achieve half day and day delivery; The picking accuracy of "Asia-1" smart warehouse reached 99.99%, and the operation efficiency was greatly improved. At the same time, jd.com has opened its supply chain capabilities to provide digital services for small and medium-sized businesses and promote industrial chain synergy. Jd.com's practice has proved that the digital supply chain can improve efficiency, reduce costs, and enhance resilience through data penetration and intelligent decision-making, providing a feasible path for enterprise transformation.

## 3. Main difficulties faced by China's digital supply chain management

### 3.1. Enterprise level: lack of transformation power and capability gap

The systematic investment requirements for the transformation of digital supply chain are high, and SMEs are generally faced with financial pressure and resource constraints, which are difficult to support the long-term system construction and technology iteration. Some enterprises' cognition of digital transformation is still at the level of local tool application, lacking top-level strategic design and long-term planning, and lack of transformation initiative and sustainability [4]. At the same time, the shortage of interdisciplinary talents with both supply chain operation experience and digital technology literacy has led to the insufficient ability of enterprises in technology implementation, data governance and process optimization, which restricts the release of digital value [5].

The digital level gap between leading enterprises and small and medium-sized supporting enterprises has further aggravated the collaborative fault within the supply chain. The digital transformation of core enterprises is difficult to extend to downstream supporting enterprises, resulting in inefficient information transmission and lagging response, and it is difficult to form an end-to-end integrated operation system [6].

### 3.2. Technical level: application fragmentation and prominent security risks

At present, digital tools deployed within supply chain operations show obvious fragmented traits. Most enterprises only complete digital upgrades for single segments including warehousing, transportation and order management. The system integration degree of cross-link and cross-enterprise is low, and the problem of data islands is prominent. The data standards and interfaces between different systems are not unified, which makes it difficult to get through, share and analyze data in depth, and cannot support the intelligent decision-making and collaborative optimization of the whole chain [7].

Risks around data safety and private information safeguards have grown more noticeable. While gathering, transferring, storing and exchanging huge volumes of information produced across every

supply chain segment, participants confront various hazards including cyberattacks and data leakage or tampering. Some enterprises lack perfect data security management system and technical protection system, and pay insufficient attention to supply chain network security, which is easy to cause systemic risk [5]. Rolling out new technologies like blockchain and IoT across supply chain networks is still hindered by high deployment expenses, weak cross-system compatibility and limited suitability for real business scenarios, which are difficult to popularize and apply on a large scale [6].

### **3.3. Synergy level: upstream and downstream information barriers and lack of trust**

The degree of information sharing between upstream and downstream enterprises in the supply chain is low, and there is obvious information asymmetry between core enterprises, suppliers and dealers. It is difficult for suppliers to obtain accurate demand forecast data, resulting in the disconnection between production plan and actual market demand, inventory backlog or supply shortage and other problems; Dealers are difficult to grasp the upstream production and logistics information in real time, affecting order delivery and customer service experience [8].

Lack of effective trust mechanism and collaboration platform among enterprises, lack of willingness to share data, and fear of core business data leakage or abuse. The traditional supply chain operation mode of "fighting separately" cannot match the collaborative operation standards required under digital business frameworks. Without consistent cooperation specifications and rational profit-sharing rules connecting upstream and downstream partners, businesses are unable to lift the overall operational performance and risk resistance capacity of the whole supply network [7].

### **3.4. Industry level: inconsistent standards and lagging regulatory system**

At present, there is no unified data standard, interface specification and technical system in the field of digital supply chain in China. Digital systems in different enterprises and industries are difficult to realize interconnection, which increases the difficulty and cost of supply chain coordination. There is a lack of mature digital supply chain evaluation system and best practice guidance in the industry. SMEs lack clear reference standards and paths in the transformation process, and the transformation direction is not clear [4].

At the same time, the relevant laws, regulations and regulatory systems are difficult to keep up with the development speed of digital supply chain. The regulatory rules on cross-border data flow, privacy protection, platform responsibility and other aspects are still not perfect, and the norms and guidance of the new supply chain model are insufficient, affecting the healthy and orderly development of the industry [5].

## **4. Solutions to the dilemma of digital supply chain development**

### **4.1. Enterprise level: strengthening strategic cognition and capacity building**

Enterprises should establish the idea of whole chain digitalization, incorporate supply chain digitalization into long-term development strategies, clarify transformation objectives and Implementation Paths, and avoid localized and fragmented transformation. Small and medium-sized enterprises can invest step by step according to their own scale, reduce short-term capital pressure and improve the sustainability of transformation [4].

Enterprises should improve the internal talent training system and introduce compound talents with both supply chain management and digital technology capabilities to improve data governance, system operation and maintenance and risk prevention and control capabilities. Through internal training, school enterprise cooperation and other ways to supplement the talent shortage, provide support for the digital implementation [5]. Leading enterprises should play a leading role in the chain, drive the collaborative transformation of upstream and downstream SMEs, narrow the digital gap through technology output, standard sharing and resource support, and improve the stability of the overall supply chain [8].

#### **4.2. Technical level: promoting full-link integration and security**

Promoting the coverage of big data, artificial intelligence, Internet of things, cloud computing and other technologies in the whole process of procurement, production, warehousing and distribution, realize end-to-end digital and visual management, and improve the ability of demand forecasting, inventory optimization and intelligent scheduling [9]. Accelerate system integration and data exchange, unify data interfaces and technical standards, eliminate internal information islands, and improve cross-link and cross-system collaboration efficiency. Relying on the cloud platform to realize the flexible deployment of resources and reduce the cost of digital transformation of enterprises [7].

Build comprehensive rules covering data safety and cyber defense frameworks, strengthen data encryption measures, access authorization management, and real-time risk oversight, while standardizing every link of data gathering, storage and exchange. Enterprises should actively deploy blockchain tools to boost data traceability and anti-tampering capacity, so as to guarantee the safety and trustworthiness of all supply chain information [6].

#### **4.3. Collaborative level: breaking information barriers and building collaborative ecology**

Building a supply chain collaboration platform led by core enterprises, promote the secure sharing of upstream and downstream data, keep demand, production, stock and logistics data updated in real time, and ease the imbalance between supply volume and market demand [3].

Establish the trust mechanism and benefit sharing mechanism among enterprises, clarify the data use boundary and responsibility division, and enhance the enthusiasm of enterprises to participate in collaboration. Push supply chains to shift from scattered standalone operations to integrated, networked platform-based management, and boost the overall risk resistance and reaction agility [10].

### **5. Conclusion**

Fueled by the combined push of digital economic growth and industrial upgrade initiatives, China's digital supply chain has stepped into an era of widespread rollout, forming a growth framework featuring robust policy support, core leading firms, and faster tech adoption across business scenarios. This emerging model delivers tangible gains in lifting coordinated operational performance across industrial networks, cutting corporate running expenses, and strengthening supply chains' ability to withstand market shocks. Real-world cases from brands including JD.com prove that end-to-end digital upgrades can greatly speed up stock turnover, streamline operational output, and push joint development between upstream and downstream partners, laying out a viable roadmap for industrial digital overhaul. However, on the whole, China's digital supply chain

development still encounters various constraints, such as the lack of transformation power of small and medium-sized businesses, fragmentation of technology applications, prominent data islands, lack of upstream and downstream trust and coordination mechanisms, and lagging industry standards and regulatory system, which restrict the value release of the whole chain.

To advance sound, sustainable growth for digital supply chains, people need multi-party cooperation. Enterprises should strengthen top-level design and capacity building and make up for talent and technology weaknesses. At the industry level, technology integration and standard unification should be accelerated to promote data security sharing. At the policy level, people should improve the supervision and system guarantee and create a good transformation environment. By building an integrated, networked and platform-based supply chain ecosystem, people can effectively solve the transformation dilemma and further lift operational efficiency, risk resistance and market competitiveness across supply networks. This study can provide practical reference for Chinese enterprises carrying out digital overhaul and upgrade the modernization level of the industrial chain and has certain practical significance for advancing in-depth fusion between digital and real economy.

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