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# Optimization of Cross-Border E-Commerce Supply Chain through Digital Transformation: A Case Study of the Textile and Apparel Industry

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## Article

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## ABSTRACT

*This study investigates the optimization of the cross-border e-commerce supply chain specifically within the global textile and apparel industry, a sector defined by high demand uncertainty and short product lifecycles. Traditional textile supply chains are burdened by challenges such as long lead times in fabric sourcing and garment manufacturing, high inventory costs of seasonal apparel, and a lack of transparency. Through a detailed case study of an ultra-fast fashion apparel enterprise (e.g., Shein), this paper constructs and examines a "digital technology–capability reshaping–supply chain performance" framework to explain how digital transformation addresses these endemic textile industry issues. The findings reveal that digital transformation reengineers the fashion supply chain by reshaping three core capabilities. First, digital platforms establish end-to-end visualization from raw material and fabric tracking to real-time monitoring of garment production, enabling immediate adjustments. Second, a digital ecosystem of textile and apparel suppliers fosters networked collaboration, enabling a flexible "small order, quick response" garment production model. Third, intelligent decision-making, powered by AI and big data, allows for demand-driven production based on real-time fashion trend analysis, minimizing apparel overstock risk. The study concludes that these reconfigured capabilities are the primary drivers for improving agility, cost efficiency, and resilience in the modern fashion supply chain, offering a practical reference for traditional textile and apparel enterprises.*

## KEYWORDS

*textile industry, apparel industry, supply chain management, cross-border e-commerce, fast fashion*

## LITERATURE REVIEW AND THEORETICAL FRAMEWORK

### Literature Review

#### *Research on Digital Transformation and Supply Chain Management*

Digital transformation has become a focus of attention in the global business and academic communities. It is defined as the process of fundamentally changing the way enterprises create value for customers, their operational models, and even their business ecosystems by leveraging digital technologies such as big data, cloud computing, the Internet of Things (IoT), artificial intelligence (AI), and blockchain [1]. Existing research generally holds that digital transformation is a key driver for enterprises to gain and maintain a competitive advantage.

In the field of supply chain management, the influence of digital transformation is particularly profound. The IoT and blockchain technology can enable full tracking and traceability from raw materials to end consumers, significantly enhancing the transparency of the supply chain and reducing information asymmetry [2–4]. Big data analytics and AI can handle massive supply and demand data, enabling more accurate demand forecasting, intelligent inventory replenishment, and dynamic optimization of logistics routes, thereby effectively addressing the “bullwhip effect” [5,6]. By establishing a digital collaborative platform, enterprises along the supply chain can achieve real-time sharing of information and rapid response, thereby enhancing the agility and resilience of the entire chain in dealing with market fluctuations and sudden disruptions [7,8]. However, the existing research also has some limitations. First, many studies have focused on the effect of a single technology (e.g., AI or blockchain) on a specific part of the supply chain (e.g., warehousing or logistics), lacking a comprehensive perspective that integrates multiple digital technologies and examines their end-to-end effect on the supply chain. Second, the “black box” of how digital transformation specifically affects the supply chain and ultimately improves performance has not been fully opened, and the underlying mechanism of its effect needs to be further revealed.

#### *Research on Cross-Border E-Commerce Supply Chain*

The rapid development of cross-border e-commerce has made supply chain management a research hotspot. Compared with traditional domestic supply chains, cross-border e-commerce supply chains exhibit

characteristics of long chains, numerous links, and high uncertainty [9–11]. Research has mainly focused on the challenges they face and optimization strategies. Studies have generally indicated that high cross-border logistics costs, poor timeliness, complex customs clearance processes, difficulties in reverse logistics, and differences in multiple countries' regulations and taxes are the core pain points [12,13]. The proposed optimization strategies in the existing literature include the layout and management of overseas warehouses, the selection and integration of international logistics service providers, the optimization of customs declaration processes through data technology, and the construction of a flexible global inventory management system.

Although research results are abundant, the existing literature has mostly explored from the macro or operational levels of international trade and logistics management, and the combination with cutting-edge digital technologies is not deep enough. Especially in terms of how to systematically reshape the cross-border e-commerce supply chain through digital transformation to cope with its inherent high uncertainty, significant research opportunities remain.

#### *Supply Chain in the Textile and Clothing Industry and Its Digitalization Exploration*

The supply chain in the textile and clothing industry is renowned for its short product life cycle, significant demand fluctuations, strong seasonality, and a large number of stock keeping units [14]. Fast fashion brands like Zara have achieved rapid responses to market demands through their highly integrated supply chains, and they have always been a model for academic research.

On this basis, the rise of e-commerce and digital technologies has given birth to the “ultra-fast fashion” model, which represents a fundamental evolution from traditional fast fashion. Although fast fashion, exemplified by Zara, excels at rapidly translating designer-led trends into retail collections, ultra-fast fashion leverages “digital-native” strategies to achieve an even higher velocity and a different operational logic. Its core distinctions include the following:

- (1) **Data-driven versus Design-driven Core:** Instead of relying primarily on designers to interpret runway trends, ultra-fast fashion brands use AI and big data algorithms to analyze real-time online and social media trends to guide product development directly.
- (2) **Test-and-Repeat versus Batch Production Model:** It largely abandons large-batch production for a “small

order, quick response” model. This involves producing items in extremely small initial quantities and only scaling up production for items with proven demand, thereby creating a purely demand-driven production system.

- (3) **Online-native vs. Retail-centric Approach:** Unlike traditional fast fashion, which remains heavily rooted in physical retail, ultra-fast fashion operates on a digital-native and direct-to-consumer online model, which eliminates the constraints and lead times of physical distribution channels.

In recent years, with the advent of the digital wave, emerging ultra-fast fashion brands like Shein have taken digital applications to a new level. By using algorithms to capture and analyze global fashion trends in real time, they guide the development of products in small and multiple batches, achieving demand-driven production [15]. By building a digital supplier collaboration platform, they integrate a large number of small and medium-sized factories into a highly flexible production network, achieving the ultimate model of small order, quick response. Currently, case studies of emerging digital-native brands like Shein are increasing, but most of them remain at the description of business models and summaries of successful experiences. At the academic level, a systematic theoretical framework is lacking to deconstruct how its digital strategies specifically map onto the various core capabilities of the supply chain (e.g., agility and cost efficiency). Moreover, the universality and transferability of success experiences for traditional textile and clothing enterprises seeking digital transformation also need in-depth exploration.

### *Research Review and Gaps*

In conclusion, the existing literature provides a solid theoretical foundation for this study, but it also reveals obvious research gaps. Although a general consensus exists in the literature that digital transformation can optimize supply chains, a deeper analysis reveals that much of this research remains at a high level of abstraction. The specific causal pathway from digital investment to performance improvement—particularly the mediating role of organizational capabilities—is often treated as a black box. Therefore, the critical gaps are not about if digital transformation works, but how it works. Specifically, these gaps include:

- (1) **Lack of an Integrated Mechanism Framework:** Few studies have integrated digital transformation, cross-border e-commerce, and the textile and apparel industry into a unified framework that explains the end-to-end optimization mechanism.

- (2) Unclear Core Capability Reshaping Process: The process of how digital technologies are translated into specific, measurable supply chain capabilities (e.g., visualization, collaboration, and prediction) remains undertheorized.
- (3) Lack of a Theoretically-grounded Deconstruction of New Models: For cutting-edge models like ultra-fast fashion, a rigorous theoretical framework is lacking to deconstruct the interplay between its digital strategy, core capabilities, and performance outcomes.

To address these identified gaps, this study develops a theoretical framework grounded in the resource-based view (RBV) and dynamic capability view (DCV). The subsequent sections will detail this framework, followed by an in-depth case analysis to explore and refine its propositions.

### Theoretical Analysis Framework

To deeply explore the optimization mechanism of digital transformation on the cross-border e-commerce supply chain of the textile and apparel industry, this study integrates the core ideas of the RBV and the DCV and constructs a systematic theoretical analysis framework. This framework holds that digital transformation not only provides enterprises with new strategic resources, such as data and algorithms, but more importantly, it shapes the enterprises' dynamic capabilities of perceiving the market, integrating resources, and reconfiguring the supply chain. This dynamic capability enables enterprises to effectively cope with the high market uncertainty.

The theoretical analysis framework of this study is built upon three core elements, which are defined in Table 1. The proposed interrelationships among these variables are depicted in Figure 1.

Table 1. Components of the Theoretical Analysis Framework

Core elements	Core definition	Key dimension
Independent variable: Digital transformation	The systematic and strategic transformation carried out by enterprises to adapt to the digital economy, using emerging	Technical infrastructure: The application levels of IoT, AI, and cloud computing.
	digital	Process digitization: Digital reengineering of core processes such as design, procurement, production, and logistics.
	digital	Data-driven decision making: The extent to which data analysis serves as the

	technologies.	core basis for strategy and operation.
Dependent variable:	The significant improvement in the overall performance of the supply chain brought about by digital transformation.	Agility: The ability to respond quickly to market demands (e.g., the speed of introducing new products). Cost efficiency: The level of control over operating costs (e.g., inventory turnover rate). Resilience: The ability to withstand and recover from external shocks. Customer experience: The level of service provided to end consumers.
Mechanism of action:	Digital transformation does not directly affect supply chain performance; instead, it functions by reshaping the core capabilities of the enterprise.	End-to-end visualization capability; Networked collaboration capability; Intelligent prediction and decision-making capability

The subsequent case analysis will be conducted based on this framework to explore and refine the logical relationships therein.

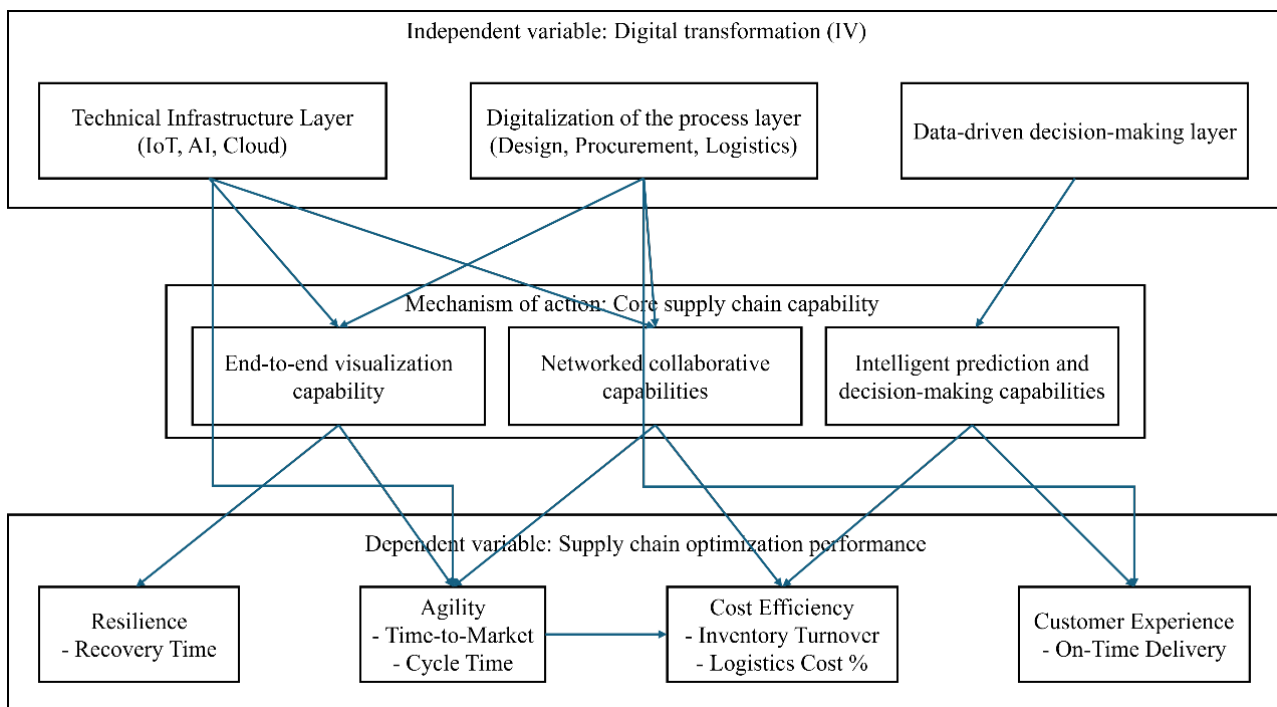


Figure 1. Theoretical Analysis Framework of Digital Transformation for Optimization of Cross-border E-commerce Supply Chain

## **METHOD**

### **Selection of Case Study Methods**

To deeply explore the complex mechanism of how digital transformation systematically optimizes the cross-border e-commerce supply chain, this study adopts the single-case research method. This method is suitable for answering questions of the “how” and “why” types, enabling researchers to conduct in-depth and comprehensive exploration of specific phenomena in real business contexts. Given that this study aims to deconstruct a cutting-edge business model (e.g., the ultra-fast fashion represented by Shein), the case study method helps systematically present the internal logic between its digital strategy, supply chain practices, and final performance, thereby filling the research gaps in the existing literature. This research is not a purely deductive, theory-testing study but rather adopts a theoretical elaboration research strategy. Our starting point is to construct an initial, conceptual analytical framework (initial framework) based on the existing literature (RBV and DCV). Then, we will use this framework as a theoretical lens to guide us in conducting in-depth and systematic analyses of the cases. Finally, we utilize the empirical evidence obtained from the cases to refine, specify, and enrich this initial framework. Therefore, the goal of this research is not to explore or refine a universal theory in a statistical sense but to use a typical and information-rich case to construct a more detailed, more contextualized, and explanatory mechanistic model of how digital transformation works.

### **Case Selection and Data Collection**

This study selected a highly representative ultra-fast fashion enterprise in the cross-border e-commerce sector of the textile and apparel industry (with Shein as a typical example) as the research case. This enterprise is a typical digital-native brand, and its supply chain model is widely regarded as a benchmark for digital transformation, providing an excellent observation sample for this study.

The data for this study were mainly obtained through secondary data collection methods. These include (1) public reports and documents, such as official enterprise reports, industry analysis reports, and research from investment institutions; (2) academic literature and journal articles, specifically existing academic studies analyzing enterprises’ business models and supply chains; and (3) official media coverage, encompassing in-depth interviews and special reports by mainstream financial and technology media. We selected Shein as

the case study because it represents an extreme or paradigmatic example of a digitally-native supply chain. According to case study methodology, examining such a polar type is highly valuable for theory building. It allows for a clear observation of the research phenomenon (digital transformation's optimization mechanism) in its most complete and unobstructed form. Although the findings may not be directly statistically generalizable to all traditional firms, the insights from this idealized case are crucial for establishing a theoretical benchmark and revealing the ultimate potential of such a transformation.

### **Data Analysis**

This study adopted a rigorous and step-by-step pattern matching method for data analysis, ensuring the reliability and validity of the research. The specific analysis protocol is as follows:

**Data Coding and Categorization:** First, we systematically sorted through all the secondary data collected (e.g., industry reports, media coverage, and academic literature). Then, based on the theoretical framework of this study (Figure 1), a detailed coding scheme was established. For instance, any text mentioning "utilizing AI algorithms to predict fashion trends" was coded as "application of technological infrastructure" and "intelligent prediction and decision making." Any evidence describing "allocating small-batch orders to the supplier network through a platform" was coded as an embodiment of "digitalization of processes," "networked collaborative capabilities," and "agility."

**Pattern Matching and Evidence Mapping:** After the coding is completed, we systematically mapped the categorized evidence to each variable and path in the theoretical framework. The matching criterion is that the evidence must clearly and directly illustrate the variables defined in the framework. For instance, to confirm the improvement in cost efficiency, we should find specific evidence such as "inventory turnover rate significantly higher than the industry average" or "substantial reduction in inventory and warehousing costs due to on-demand production" and other explicit statements.

Finally, by examining the matching evidence patterns among various variables, we constructed a clear causal explanation chain. The analysis does not merely refine the existence of variables but also clarifies the transmission logic between them. For instance, we elaborated how the "data-driven decision-making layer" (e.g., small-batch quick-return model) directly reshaped the "intelligent predictive decision-making capability" and ultimately led to two specific performance outcomes: "high inventory turnover rate" (cost efficiency) and

“extremely fast new product launch cycle” (agility).

Through the above rigorous analytical steps, this study aims to ensure the transparency and replicability of the data analysis process, thereby effectively validating or correcting the preset theoretical framework.

Although this method provides rich qualitative insights into enterprises’ operational model, a common limitation of relying on secondary data is the lack of access to proprietary, internal quantitative performance metrics. Therefore, we focused on demonstrating the mechanism of optimization, with performance claims substantiated by publicly available illustrative data and expert analysis rather than specific internal KPIs.

## CASE ANALYSIS

### Digital Transformation Practice (Independent Variable)

In this case, the enterprise achieved its unique competitive advantage through comprehensive digital investment.

- **Technical Infrastructure Layer:** Enterprises widely apply AI and big data algorithms to capture real-time fashion trends on global social media and guide product design. At the same time, through the cloud platform, they connect a vast number of suppliers and build a digital production network.
- **Process Digitalization Layer:** From design, prototyping, and sample testing to production, warehousing, and logistics, enterprises have achieved end-to-end process digitalization. For instance, design tasks are dispatched through the platform, and production progress is tracked in real time online, which is significantly different from the traditional lengthy offline communication mode.
- **Data-driven Decision-making Layer:** The core decisions of enterprises are almost entirely driven by data. The initial production volume of products is extremely small (small orders). By analyzing the initial sales data and user feedback, the system can quickly decide whether to reverse orders (“fast reverse”), thereby precisely matching market demand and avoiding large-scale inventory accumulation.

### Reconfiguration of Core Supply Chain Capabilities (Mechanism of Action)

The aforementioned digitalization practices have transformed the core capabilities of its supply chain:

- **End-to-end Visualization Capability:** By leveraging a central digital platform, enterprises achieve real-time visualization from raw material procurement to final delivery. This is not merely tracking; the data

stream allows managers to see production bottlenecks, monitor quality control at the factory level, and track inventory status in real time. This granular visibility is the foundation for rapid decision making, such as activating the fast reverse order process the moment a product shows high sales velocity.

- **Networked Collaboration Capability:** The digital supplier platform functions as a dynamic, integrated ecosystem rather than a simple order-dispatch tool. It automates the matching of orders to suppliers based on their real-time capacity, quality scores, and speed. This transforms a fragmented network of small factories into a cohesive and highly flexible “virtual super factory.” This mechanism directly enables the small order, quick response model, as the system can seamlessly allocate hundreds of small, experimental orders without the high coordination costs typical of traditional supply chains.
- **Intelligent Prediction and Decision-making Capability:** The AI-driven demand forecasting model is the engine of the supply chain. It analyzes real-time sales data, social media trends, and customer browse patterns to predict which styles will become best-sellers. This predictive power is directly linked to cost efficiency. By guiding firms to place small initial test orders (e.g., 100–200 pieces), it minimizes financial risk. The system then automatically triggers larger fast reverse orders only for proven sellers, directly creating an on-demand production model that dramatically improves inventory turnover and reduces waste.

### **Supply Chain Optimization Performance (Dependent Variable)**

The enhancement of core capabilities brought about by digital transformation ultimately translates into significant supply chain performance:

- **Agility:** The small order, quick response model is achieved. The new product’s design-to-launch-sales cycle has been compressed to 7 days or even shorter, far exceeding that of traditional fast fashion brands. It can quickly respond and lead market trends.
- **Cost Efficiency:** Based on the on-demand production model with precise forecasting, the inventory turnover rate is considerably higher than the industry average, significantly reducing storage costs and losses from unsold products. At the same time, through intelligent algorithms to optimize global logistics routes, it effectively controls the high cost of cross-border logistics.
- **Resilience:** The vast and highly collaborative digital supplier network enables it to quickly reallocate

orders to other factories within the network when facing external shocks, such as the shutdown of a single factory or local epidemic situations, demonstrating strong risk resistance and recovery capabilities.

- **Customer Experience:** Continuously providing trendy new products, along with relatively efficient international logistics delivery, meets the dual pursuit of young global consumers for fashion and speed, thereby enhancing customer satisfaction and loyalty.

## DISCUSSION

### Elaboration of the Theoretical Framework through Case Analysis

The case analysis provides rich empirical detail to elaborate and specify the mechanisms within our initial theoretical framework (Figure 1). The case clearly demonstrates the core transmission path of “digital transformation → core capability reengineering → supply chain performance optimization” (Figure 2). This provides a systematic explanatory model for understanding how digital technologies are transformed from investments into actual competitive advantages, opening up the black box referred to by some scholars. This study moves beyond identifying capabilities by detailing the causal links in practice. For instance, it shows precisely how AI-driven predictive models (a digital tool) enable a small order, quick response system (an intelligent decision-making capability), which, in turn, directly causes a higher inventory turnover rate and lower markdowns (cost efficiency performance).

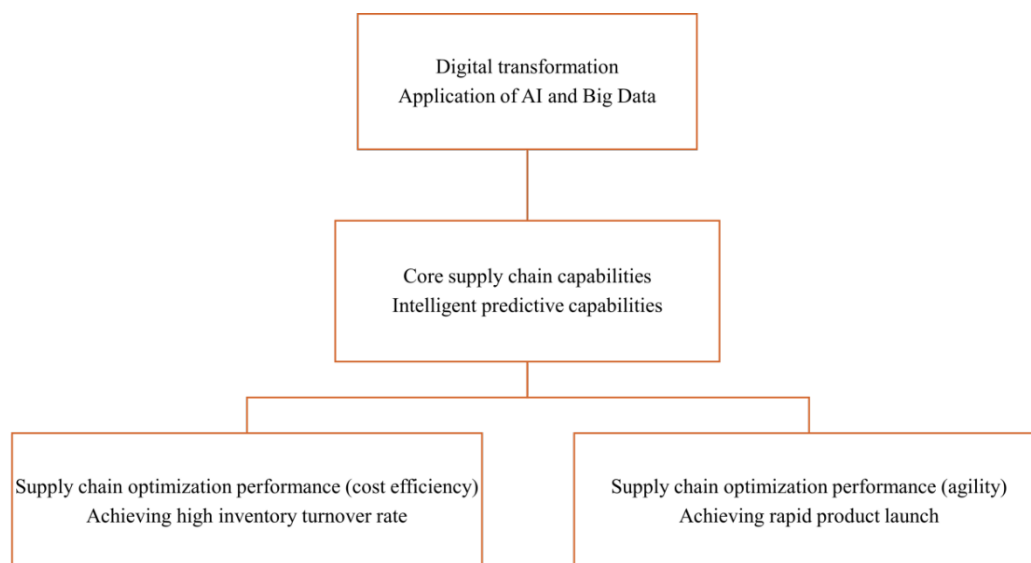


Figure 2. Flowchart

### Theoretical Contribution and Framework Refinement

The theoretical novelty of this study does not lie in restating the established link between digital transformation and supply chain improvement. Instead, its primary contribution is the construction and validation of a nuanced framework that explains the mechanism of this relationship in an extreme-case context. Specifically, this study's contributions are threefold:

This study not only verified its proposed analytical framework but, more importantly, refined it through case analysis. It also offered new insights for applying the RBV and the DCV in the digital era.

**Refinement and Contribution of the Analytical Framework:** Traditional research has often directly associated “digital technology application” with “enterprise performance,” resulting in an unclear mechanism of action. The three-layer framework proposed in this study, “technology application → core capability reshaping → performance optimization,” has its core contribution in identifying and specifying the key intermediary layer of “core capability reshaping.” The research refined that digital investment is not directly equivalent to competitive advantage; it must be transformed into measurable and specific organizational capabilities—namely, end-to-end visualization, networked collaboration, and intelligent predictive decision-making capabilities—before it can ultimately drive performance improvement. The clarification of this intermediary layer is a refinement and deepening of the existing “technology–performance” research framework, providing a more operational analytical path to open the black box of digital transformation.

- **Extension of the RBV:** This study contextualized the classic RBV. The RBV emphasizes that the value, scarcity, and difficulty of imitation of resources are the sources of competitive advantage. This case study shows that in the digital economy, a single digital technology (e.g., AI algorithms or cloud services) is gradually becoming commoditized, and its scarcity and difficulty of imitation are decreasing. On the contrary, this study found that the truly strategic resources are: (1) unique proprietary data accumulated through continuous technological efforts; and (2) a digital ecosystem formed by deeply integrating technology, data, processes, and external partners (suppliers), which is difficult for competitors to replicate. The findings of this study shift the focus of RBV from static technological assets to more dynamic and integrated data and ecosystem resources.

- Visualization of the DCV: This study provides a specific operational example of the DCV in an ultra-high-speed market environment. If the core of the DCV comprises “perception (sensing),” “capture (seizing),” and “reconfiguration (reconfiguring),” then the three core capabilities identified in this study are the specific manifestations of these three fundamental capabilities in a digitalized scenario:
  - Intelligent predictive decision-making capability involves the rapid perception of market opportunities and threats.
  - The end-to-end visualization capability forms the basis for effectively seizing opportunities and conducting management control, ensuring that decisions can be quickly implemented.
  - The networked collaborative capability serves as a powerful tool for rapidly reconfiguring resources and processes to respond to market demands, enabling the immediate mobilization of the entire supply network.

Therefore, the conclusion of this study links the abstract concept of dynamic capabilities with the specific and measurable digital supply chain capabilities of enterprises, enhancing its empirical significance.

### **Alternative Explanations and Boundary Conditions**

Although the framework of this study emphasizes the core role of digitalization, we must also acknowledge that other key factors may have jointly contributed to the success of the case enterprise. These factors constitute the boundary conditions of this study and areas that require further exploration.

**Disruptive nature of the Business Model:** The success of the case enterprise is not only driven by technology, but also represents a complete “consumer-to-manufacturer” business model innovation. Digitalization is a necessary tool for achieving this model, but the forward-looking nature of the business model is equally crucial.

**Digital-native versus Traditional Incumbent Divide:** A critical boundary condition of this study is the digital-native nature of the case enterprise. In contrast to findings from numerous studies on traditional enterprises, which highlight significant challenges like organizational inertia and legacy system constraints, this case study enterprise was built without such historical baggage. This absence was likely a key facilitator of its success. Therefore, the model presented should be interpreted as an idealized benchmark that reveals what is possible, rather than a directly replicable blueprint for traditional firms undergoing “brownfield” transformation.

## Challenges of Scaling and Transferability

Although the digital supply chain model demonstrated in this case is highly efficient, its implementation and transferability to other enterprises, particularly traditional ones, face significant challenges that extend beyond scalability:

- **Organizational Inertia and Resistance to Change:** Traditional enterprises typically have deeply ingrained organizational structures, business processes, and IT systems. Shifting to a highly agile, data-driven model requires not only costly and risky systemic changes to overcome these legacy constraints but also strong cultural resistance. Employees and managers may be reluctant to abandon familiar routines; cede decision-making authority to algorithms; or adopt new, transparent, and collaborative work processes.
- **Supplier Ecosystem Transformation:** The model in this case relies on a supply network consisting of thousands of small, flexible factories located in relatively concentrated geographical areas. Large traditional enterprises, which often sign long-term contracts with global large suppliers to achieve economies of scale, face the monumental task of reconfiguring their entire production base to foster a similar small order, quick response ecosystem. Furthermore, this highly flexible supplier relationship comes with its own costs. Although it provides significant flexibility and bargaining power for the core enterprise (e.g., Shein), it also transfers huge market risks and uncertainties to the small and medium-sized suppliers in the network. Frequent and uncertain small orders make it difficult for the suppliers to plan production, stabilize the workforce, and constantly face the risk of being replaced by lower-priced competitors. This intense “race-to-the-bottom” competition, although temporarily lowering the purchase unit price, may lead to the fragility and instability of the supplier ecosystem in the long run. This competitive relationship is not fully reflected in the collaborative model presented in this article.
- **Data Integration and Security Complexities:** The success of this model is based on the seamless, real-time flow of data across the entire value chain. For traditional companies, integrating disparate legacy systems and “data islands” into a unified digital platform is a massive technical and financial hurdle. Furthermore, this hyperconnected ecosystem, involving extensive data sharing with numerous external suppliers, creates significant data security and governance risks, including threats to

intellectual property (e.g., design specifications) and customer data privacy.

- **Constraints of Infrastructure and the “Digital Divide”:** The analytical model in this paper largely assumes a seamless digital environment. However, the realization of capabilities, such as end-to-end visualization and intelligent prediction is highly dependent on stable and high-speed digital communication networks and mature physical logistics infrastructure. In many textile-producing countries participating in cross-border e-commerce (especially developing countries), these infrastructures may not be complete. Delays in logistics information, instability of factory networks, or the absence of data collection points can all lead to model distortion. Therefore, the universality of this framework is severely limited by the digital divide and infrastructure levels of the target countries. The article fails to fully emphasize this prerequisite in its discussion.
- **Talent and Skill Gaps:** A digitally driven supply chain requires a new breed of talent, including data scientists, AI specialists, and supply chain analysts proficient with digital tools. Many traditional textile and apparel enterprises face a significant talent gap in these areas. Bridging this gap necessitates substantial investment in attracting new talents or extensive retraining of the existing workforce, which can be a slow and costly process.

### **Ethical and Sustainability Counterarguments**

Although the digital supply chain in this research case demonstrated outstanding operational efficiency, we must critically examine the potential significant ethical and sustainability risks underlying it. These risks constitute important boundary conditions for this model.

First, ethical questions exist regarding labor rights. The highly flexible production network relied upon in this case largely relies on integrating a large number of low-cost, labor-intensive small factories. As reported by multiple media and nongovernmental organizations, this model faces continuous external criticism in terms of the labor standards, working hours, and transparency of compensation of suppliers. The analytical framework of this paper focuses on operational efficiency but fails to deeply explore whether this efficiency is partly based on the squeezing of the rights of workers at the bottom of the supply chain. This represents a critical issue that requires urgent attention.

Second, environmental sustainability is affected. The small order, quick response model reduces the inventory

risk of individual items through precise forecasting, but its essence is to greatly stimulate and accelerate the purchase frequency and “disposable culture” of consumers by constantly introducing thousands of new products every day. This is contrary to the global increasingly emphasized concepts of “slow fashion” and “circular economy.” Although the paper acknowledges its efficiency, it does not fully discuss whether this model, on a macro level, exacerbates the excessive production and waste of textiles and the huge carbon footprint brought about by its complex global logistics network. A comprehensive assessment must balance its micro inventory efficiency with the macro environmental cost.

### **Practical Insights: Principles, Not A Blueprint**

Given the full recognition of the aforementioned scale-related challenges, this case provides more thought-provoking practical insights for traditional textile and apparel enterprises seeking digital transformation. These insights should be regarded as a transformation guideline that requires long-term efforts, rather than a simple blueprint that can be easily replicated. The key lies in the fundamental transformation of the thinking mode, specifically through three core shifts:

- **Prioritizing Data-driven Decision Making:** This involves a commitment to establishing the ability to collect, analyze, and apply data, thereby allowing data to truly guide design, production, and inventory decisions.
- **Building a Networked Collaborative Ecosystem:** This entails breaking down barriers within the enterprise and with suppliers, using digital platforms to integrate external resources, and enhancing the flexibility and efficiency of the entire supply chain.
- **Embracing Rapid Iterations from Small-scale Initiatives:** This approach draws inspiration from the small order quick response model, using digital means to conduct small-scale market tests at low cost, reducing the risk of new product development, and gradually moving toward a demand-driven production model.

### **CONCLUSIONS**

This study, through a case analysis of leading enterprises in the ultra-fast fashion industry, systematically reveals the internal mechanism of digital transformation in optimizing the cross-border e-commerce supply

chain of the textile and clothing industry. The core conclusion of the study is that digital transformation does not directly enhance supply chain performance; instead, it achieves comprehensive optimization in agility, cost efficiency, resilience, and customer experience by redefining the three core capabilities of the enterprise, namely, the visualization capability of the entire chain, the networked collaboration capability, and the data-driven intelligent decision-making capability.

The main theoretical contribution of this study lies in that it not only illustrates an analytical framework but also refines it and provides new insights through empirical evidence for existing theories. First, it deepens the understanding of the black box of digital transformation by clarifying the key mediating layer of core capability reshaping, improving the traditional research path of "technology–performance". Second, this study shifts the focus of the RBV in the digital era from easily replicable technologies to more strategic and valuable proprietary data and integrated digital ecosystems. Third, it matches the abstract concepts of perception, capture, and reconstruction in the DCV with the specific and measurable supply chain capabilities of enterprises, providing concrete empirical support for the theory.

Although this study has made the above findings, it still has limitations, which open up new directions for future research. First, this study is a single-case study based on digital-native enterprises, and the applicability of its conclusions in traditional enterprises that need brownfield transformation needs to be verified. Future research can adopt multicase comparative studies to compare and analyze the transformation paths and challenges of different types of enterprises. Second, future research can use quantitative methods, such as large-scale questionnaire surveys, to conduct more extensive empirical tests of the theoretical framework proposed in this study. Third, this study's scope is confined to supply chain operational performance, and it does not address the broader societal and economic effects of the ultra-fast fashion model. Future research should critically examine the model's influence on environmental sustainability, such as increased textile waste resulting from a culture of disposability, and the carbon emissions from its complex global logistics. In addition, the social implications, particularly concerning labor conditions and fair wages within its vast and competitive supplier network, warrant in-depth investigation. A holistic understanding of this digitally enabled model requires balancing its remarkable operational efficiency with these crucial ethical and environmental considerations.

Finally, this study substantiates performance claims primarily through qualitative evidence and illustrative

metrics (e.g., lead times) drawn from public sources. A limitation is the absence of specific, internal quantitative data, such as percentage improvements in inventory costs or precise logistics efficiency figures, to fully quantify the “significant optimization.” Future research could address this through collaborative studies with industry practitioners to gain access to such data. This would allow for a more granular, empirical validation of the performance effects proposed in our framework and could help quantify the specific return on investment of developing each core supply chain capability.

#### *Availability of Data and Materials*

The datasets used and/or analysed during the current study were available from the corresponding author on reasonable request.

#### *Author Contributions*

Tingting Xu designed, collected and analyzed the data, and drafted the manuscript. Tingting Xu conducted the study, critically revised the manuscript for important intellectual content, and gave final approval of the version to be published. Tingting Xu participated fully in the work, take public responsibility for appropriate portions of the content, and agreed to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved.

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#### *Conflict of Interest*

The author declares no conflict of interest.

#### **REFERENCES**

- [1] Vial G. Understanding digital transformation: A review and a research agenda. *Managing Digital transformation*. London, UK: Routledge; 2021. 54 p.
- [2] Rejeb A, Keogh JG, Treiblmaier H. Leveraging the internet of things and blockchain technology in supply chain management. *Future Internet*. 2019; 11(7):161.
- [3] Guo L, Chen J, Li S, Li Y, Lu J. A blockchain and IoT-based lightweight framework for enabling information transparency in supply chain finance. *Digital Communications and Networks*. 2022; 8(4):576-587.
- [4] Hader M, Tchoffa D, El Mhamedi A, Ghodous P, Dolgui A, Abouabdellah A. Applying integrated Blockchain and Big Data technologies to improve supply chain traceability and information sharing in the textile sector. *Journal of Industrial Information Integration*. 2022; 28:100345.
- [5] Thapa A. Demand Forecasting in Logistics: Supply Chain Management Strategies and Trends. Bachelor's Thesis. Helsinki, Finland: Metropolia University of Applied Sciences; 2024. 48 p.
- [6] Yusuf Ali I. The Impact of AI on Enhancing Supply Chain Forecasting and Demand Planning. Bachelor's

- Thesis. Helsinki, Finland: Metropolia University of Applied Sciences; 2025. 45 p.
- [7] Singh RK, Modgil S. Adapting to disruption: The impact of agility, absorptive capacity and ambidexterity on supply chain resilience. *International Journal of Productivity and Performance Management*. 2025; 74(2):637-658.
- [8] Calvo J, Olmo JLD, Berlanga V. Supply chain resilience and agility: A theoretical literature review. *International Journal of Supply Chain and Operations Resilience*. 2020; 4(1):37-69.
- [9] Wang Y, Jia F, Schoenherr T, Gong Y, Chen L. Cross-border e-commerce firms as supply chain integrators: The management of three flows. *Industrial Marketing Management*. 2020; 89:72-88.
- [10] Ye W. E-commerce logistics and supply chain network optimization for cross-border. *Journal of Grid Computing*. 2024; 22(1):22.
- [11] Liu X, Dou Z, Yang W. Research on influencing factors of cross border E-commerce supply chain resilience based on integrated fuzzy DEMATEL-ISM. *IEEE Access*. 2021; 9:36140-36153.
- [12] Jonath A. Determinants of Cross-Border Logistics Performance in East African Community. Moshi, Tanzania: Moshi Co-operative University; 2021.
- [13] Mu D, Ren H, Wang C. A literature review of taxes in cross-border supply chain modeling: Themes, tax types and new trade-offs. *Journal of Theoretical and Applied Electronic Commerce Research*. 2021; 17(1):20-46.
- [14] Brun A, Castelli C. Supply chain strategy in the fashion industry: Developing a portfolio model depending on product, retail channel and brand. *International Journal of Production Economics*. 2008; 116(2):169-181.
- [15] Sharma GK, Sharma SD. Optimizing the Fashion Supply Chain: A Game-Changing Strategy for Reducing Inventory Waste. *Illustrating Digital Innovations Towards Intelligent Fashion: Leveraging Information System Engineering and Digital Twins for Efficient Design of Next-Generation Fashion*. Berlin, Germany, Springer; 2024. pp. 203-229.