Research on Strategies for Enhancing Enterprise Supply Chain Resilience under the "Dual Circulation" Development Paradigm

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Abstract

Under the new development paradigm of "Dual Circulation," enterprises face challenges such as volatility in global supply chains and inefficiencies in domestic circulation. To achieve stable growth, enhancing supply chain resilience is critical. By optimizing supply chain structures, advancing digital transformation, and building diversified supply networks, enterprises can improve flexibility and risk resistance, enabling agile responses and stable operations. The adoption of risk prediction models and collaborative management mechanisms strengthens emergency response capabilities, mitigating disruptions caused by external environmental changes. Through case studies, this research summarizes practical approaches taken by various enterprises to bolster supply chain resilience, proposing actionable strategies for constructing sustainable supply chain systems.

Keywords

Dual Circulation; Supply Chain Resilience; Digital Transformation; Risk Prediction; Collaborative Management

1. Introduction

In the current phase of the "Dual Circulation" development paradigm, corporate supply chains face increasingly complex challenges. Due to evolving international landscapes and regional development disparities, both the stability and flexibility of supply chains are being severely tested. Supply chain resilience has become a critical factor for enterprises to navigate uncertainties and maintain market competitiveness. By enhancing structural agility, accelerating digital transformation, and establishing diversified supply chain networks, enterprises can strengthen their capacity to respond to emergent risks, ensuring stable and efficient production and logistics operations. Research on strategies to improve supply chain resilience not only directly impacts enterprises' long-term development trajectories but also provides viable approaches for building self-sufficient industrial chains with controllable characteristics.

2. Challenges to Enterprise Supply Chain Resilience Under the "Dual Circulation" Paradigm

2.1 Supply Chain Disruption Risks from Constrained External Circulation

Within the "Dual Circulation" framework, geopolitical shifts pose significant challenges to the stability of international supply chains. The resurgence of trade protectionism has led to increasingly complex global market conditions, characterized by frequent tariff barriers, technological embargoes, and non-tariff measures that directly threaten multinational supply chains. Particularly in international logistics, uncertainties stemming from pandemics and geopolitical conflicts have caused recurrent disruptions to transportation corridors in certain regions, resulting in delayed or halted cargo flows that severely impede cross-border supply chain operations.

The growing difficulty in coordinating multinational suppliers has triggered breakdowns in raw material and component supply networks, derailing production schedules. These disruption risks are forcing enterprises to reassess globalized configurations while strengthening autonomous control and adaptive capabilities across their supply chains.

2.2 Supply Chain Coordination Challenges from Inefficient Internal Circulation

As the domestic component of the dual-system, internal circulation aims to mitigate external pressures by revitalizing domestic economic flows. However, regional economic imbalances create persistent coordination difficulties. Within industrial chains, SMEs often struggle to synchronize with production fluctuations of upstream partners due to asymmetrical supply-demand alignment [1,2].

In regional manufacturing clusters particularly, core enterprises frequently lack timely communication regarding material requirements, causing delayed supply chain responses. Divergent local economic policies further complicate cross-regional operations and supply chain integration. Such internal circulation inefficiencies not only hinder operational performance but also amplify latent risks of supply chain fragmentation.

2.3 Increased Demand for Supply Chain Flexibility Due to Market Volatility

The "Dual Circulation" paradigm has accelerated consumption upgrading and demand diversification, requiring higher levels of supply chain flexibility. Rapid changes in consumption patterns have shortened product lifecycles, compelling

enterprises to adjust supply chain configurations swiftly to match market dynamics. In fast-moving consumer goods and electronics industries, where product launches occur with increasing frequency, competitive advantage now hinges on agile inventory management and logistics distribution.

Insufficient supply chain flexibility leaves enterprises vulnerable during market shifts, potentially leading to lost market share. Growing consumer demand for customized and personalized products further necessitates redesigns of production lines and logistics models. How to enhance supply chain flexibility for real-time market responsiveness has consequently become a critical focus in corporate management practices.

2.4 Information Silos Caused by Lagging Digital Transformation

Despite growing adoption of digital technologies in supply chain management, overall progress remains uneven, with persistent information silos. While some enterprises have deployed digital systems internally, the lack of upstream-downstream integration has created isolated digital nodes without systemic coordination. This is particularly evident in order management, logistics tracking, and inventory control, where poor data transmission efficiency prevents information sharing, slowing supply chain responsiveness.

The absence of unified standards across digital platforms has led to incompatible data formats, making system integration prohibitively expensive. During emergencies requiring rapid material redistribution, information delays between supply chain nodes exacerbate decision-making errors and operational failures. These information silos not only impede agile development but also increase systemic vulnerability.

Within the "Dual Circulation" framework, enterprises thus face compound challenges: constrained external circulation, inefficient internal circulation, volatile market demands, and inadequate digital transformation. Only through systematic problem analysis and targeted strategies can enterprises enhance risk resilience and ensure sustainable growth in complex economic environments.

3. Key Elements for Enhancing Enterprise Supply Chain Resilience

3.1 Supply Chain Structural Optimization

Structural optimization forms the foundation of resilience building. Under the "Dual Circulation" paradigm, enterprises must improve upstream-downstream resource integration to create elastic supply networks adaptable to environmental changes. This requires not only redistributing production and logistics nodes but also strengthening collaborative management across industrial chains [3].

Key measures include:

- Establishing stable supplier partnerships and flexible procurement strategies to mitigate single-source disruption risks
- Optimizing factory and warehouse locations during manufacturing stages to reduce transportation costs and improve logistics efficiency
- Implementing dynamic inventory strategies (e.g., flexible stock management) to buffer raw material shortages

This multidimensional approach enhances both the robustness and responsiveness of supply chain architectures.

3.2 Digital Transformation of Supply Chains

The growing adoption of digital technologies in supply chain management has become a pivotal driver for enhancing resilience. Enterprises must accelerate the development of intelligent warehousing systems and real-time logistics tracking to improve information flow across all supply chain nodes. Through IoT, cloud computing, and big data analytics, end-to-end visibility can be achieved for logistics, inventory, and transportation processes.

Specifically:

- **Smart Warehousing**: Automated sorting and intelligent inventory technologies significantly improve operational accuracy and efficiency.
- **Logistics Monitoring**: Real-time cargo tracking ensures secure and controllable transportation.
- **Integrated Platforms**: Digital supply chain platforms consolidate upstream-downstream data, enabling shared visibility that enhances decision-making precision and response timeliness.

During disruptions, these digital systems provide rapid market/supply intelligence, enabling swift contingency adjustments to mitigate production and logistics breakdowns.

3.3 Risk Prediction and Early-Warning Mechanisms

Given the complex and multifaceted nature of supply chain risks, robust prediction and warning systems are essential. Enterprises should:

3.3.1 Develop Multidimensional Risk Assessment Frameworks

- Identify potential disruption points (supplier failures, logistics blockages, demand volatility)
- Conduct quantitative evaluations using risk matrix analysis [4]

3.3.2 Implement Predictive Technologies

- Deploy machine learning algorithms for early risk detection and preemptive intervention
- Extend monitoring to cover material supply, production planning, inventory, and demand shifts

3.3.3 Establish Rapid Response Protocols

- Standardize emergency procedures for immediate risk containment
- Strengthen supply chain stability through proactive risk governance

3.4 Diversified Supply Chain Networks

To mitigate single-source dependencies in the "Dual Circulation" context, enterprises should:

- **Geographical Diversification**: Prioritize suppliers in politically stable regions with efficient logistics, balancing local and global sourcing [5]
- **Production Redundancy**: Adopt multi-site manufacturing layouts to ensure capacity backup
- **Multimodal Logistics**: Integrate air/sea/land transport options to enhance flexibility

This approach minimizes regional disruption impacts while maintaining core material availability.

3.5 Talent Development and Organizational Resilience

Human capital and adaptive structures are equally critical:

3.5.1 Skills Enhancement:

- Train teams in risk identification and crisis response
- Conduct supply chain simulation drills

3.5.2 Organizational Adaptability:

- Break down departmental silos for cross-functional collaboration
- Foster innovative and inclusive corporate cultures
- Implement job rotation and multi-Skilling programs

Such measures reduce single-point failure risks and ensure operational continuity during crises. By systematically advancing these five pillars-structural optimization, digital transformation, risk prediction, network diversification, and talent development-enterprises can construct high-resilience supply chains under the "Dual Circulation" paradigm. This holistic approach strengthens risk mitigation capabilities while enabling sustainable supply chain evolution.

4. Case Study Analysis: Successful Practices in Enhancing Supply Chain Resilience

4.1 Case 1: Digital Transformation of a Manufacturing Enterprise's Supply Chain

Amid the severe disruptions caused by the global pandemic, many manufacturing enterprises faced critical supply chain breakdowns, encountering obstacles in raw material procurement and production scheduling. In this context, one particular manufacturing enterprise experienced acute supply chain disruptions, leading to delayed order deliveries and declining customer satisfaction. To address these challenges, the enterprise opted to enhance its resilience through digital transformation of its supply chain.

The enterprise implemented an intelligent management platform to comprehensively elevate its supply chain's digital capabilities. By deploying IoT technologies and cloud computing platforms, it achieved real-time data collection and sharing of logistics, inventory, and production information. This initiative bridged data flow gaps across upstream and downstream supply chain segments, mitigating information silos.

Specifically, in inventory management, the enterprise utilized big data analytics to forecast market demand accurately, enabling precise control over procurement and production planning. This approach effectively eliminated production halts caused by material shortages.

Results of Digital Transformation: 30% reduction in order processing cycle time, 15% increase in inventory turnover rate through smart warehousing systems, significant decrease in capital occupancy, 20% improvement in production line utilization. These enhancements enabled the enterprise to efficiently navigate the volatile supply chain conditions during the pandemic. (See Table 1 for detailed metrics)

Table 1. Performance Improvement Metrics Before and After Enhancement

Key Performance Indicator (KPI)	Before Improvement	After Improvement	Improvement Rate
Supply Chain Response Speed	100%	130%	+30%
Inventory Turnover Rate	2 times/year	2.3 times/year	+15%
Production Line Utilization	80%	96%	+20%
Customer Satisfaction	70%	85%	+15%

By implementing a digital management platform, the enterprise significantly enhanced its supply chain resilience while simultaneously strengthening market competitiveness and customer satisfaction.

4.2 Case 2: Diversified Supply Chain Strategy of a Retail Enterprise

Amid global logistics disruptions that restricted international merchandise flows—particularly causing shortages of imported goods—a retail enterprise faced severe supply chain challenges. The interruption of imported product supplies led to critical inventory shortages and declining market competitiveness.

4.2.1 The enterprise promptly implemented supply chain restructuring by:

- Developing Local Supply Networks
- Proactively identified domestic alternative suppliers
- Established long-term contracts to ensure stable core material supply
- Maintaining Strategic Global Sourcing
- Retained international procurement as supplementary channels
- Created a hybrid supply chain model balancing localization and globalization

4.2.2 Operational Outcomes:

- 20% improvement in inventory assurance rate
- Local supplier ratio increased from 50% to 70%
- Significant reduction in import dependency

As shown in Table 2, this diversified approach enabled uninterrupted market presence despite global supply chain volatility.

Table 2. Performance Metrics Before and After Supply Chain Restructuring

Metric	Pre-Adjustment	Post-Adjustment	Change
Local Supplier Ratio	50%	70%	**+20%**
Inventory Assurance Rate	60%	80%	**+20%**
Market Share	10%	12%	**+2%**
International Procurement Dependency	50%	30%	**-20%**

By adopting a diversified supply chain arrangement, the company has effectively reduced the risk level of logistics disruptions, improved its ability to cope with supply chain turbulence, and ensured steady progress amid major market fluctuations.

5. Strategies for Enhancing Enterprise Supply Chain Resilience Under the Dual Circulation Framework

5.1 Developing a Dual Circulation-Oriented Supply Chain Ecosystem

Within the new development paradigm of Dual Circulation, establishing a robust supply chain ecosystem serves as the cornerstone for enhancing enterprise resilience. This approach advocates for a balanced development model that

prioritizes domestic circulation while strategically complementing it with international circulation, thereby creating a self-reinforcing supply chain structure. On the domestic front, enterprises should focus on integrating domestic industrial chain resources and strengthening regional production capabilities to reduce reliance on international markets. For international circulation, businesses should expand their global supply chain networks while maintaining operational flexibility and market responsiveness through diversified external market participation.

5.2 Enhancing Supply Chain Flexibility and Responsiveness

Supply chain flexibility represents a critical capability for mitigating uncertainties. Enterprises should implement adaptable production systems incorporating modular designs and flexible manufacturing technologies to improve production line adjustability. Supplier management strategies should emphasize diversification to reduce single-source dependencies and ensure continuous supply of critical materials and components [6]. Proactive contingency planning should include alternative procurement channels and material flow strategies to enable rapid adjustments during disruptions. Implementing multimodal logistics systems combining rail, road, and air transport can further enhance supply chain continuity across various scenarios.

5.3 Accelerating Supply Chain Digital Transformation

Digital transformation emerges as a pivotal strategy for building resilient supply chains under the Dual Circulation model. By leveraging cloud computing, big data analytics, and IoT technologies, enterprises can achieve comprehensive digital control across supply chain operations. Advanced analytics enable real-time monitoring of market dynamics and supply chain performance, facilitating timely production and distribution adjustments. Cloud-based platforms integrate upstream and downstream data flows, eliminating information silos and improving collaboration. IoT implementations support intelligent logistics management through real-time tracking, monitoring, and route optimization, while blockchain technology enhances data traceability and security, effectively addressing fraud and information integrity challenges.

5.4 Strengthening Collaborative Supply Chain Governance

Effective supply chain management requires seamless cross-functional and cross-enterprise coordination. Enterprises should establish integrated management mechanisms that align procurement, production, logistics, and sales operations. Practical implementations may include unified supply chain control towers that centralize scheduling and information flows, significantly improving coordination efficiency. Logistics operations should adopt integrated warehousing-transportation-distribution models supported by digital technologies to enable end-to-end visibility and process optimization.

5.5 Aligning Policy Support with Enterprise Innovation

Enterprises should strategically align with national Dual Circulation policies while developing customized supply chain optimization strategies based on industry-specific characteristics. Active participation in policy-driven digital transformation initiatives and regional industrial cluster development can yield significant benefits. Establishing supply chain service hubs in key development zones can consolidate local logistics resources and enhance regional supply chain resilience. Combining smart manufacturing and green supply chain policies enables optimization of production efficiency and logistics networks while driving sustainable transformation. Concurrently, enterprises should prioritize independent innovation, developing distinctive supply chain management models through technological advancement and managerial innovation to achieve superior resilience and risk mitigation capabilities.

6. Conclusion

In the context of the Dual Circulation development paradigm, enhancing supply chain resilience has become pivotal for achieving sustainable growth. By optimizing supply chain architectures, accelerating digital transformation, establishing diversified networks, and strengthening collaborative governance, enterprises can effectively mitigate risks arising from volatile internal and external environments. Case studies demonstrate that digitalization and supply chain diversification play decisive roles in building resilience, while the synergy between policy support and corporate innovation provides a robust foundation for developing agile yet stable supply chain systems. Enterprises should further advance supply chain management innovation to improve market adaptability and risk resistance, thereby realizing dual enhancement of economic performance and social value. This strategic approach will enable businesses to navigate complex market dynamics while contributing to broader socioeconomic development objectives under the Dual Circulation framework.

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