Research on the Construction Mechanism and Optimization Strategies of Resilient Supply Chain Networks from the Perspective of Fairness Concern Behavior

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Abstract: In the context of accelerated globalization and digitalization, where supply chain networks face increasing uncertainties, building resilient supply chain networks has become crucial for enterprises to enhance competitiveness. Fairness concern behavior, a significant factor influencing supply chain members' decision-making, has often been overlooked in traditional research. This paper focuses on this issue, delving into the theoretical concepts and core elements of fairness concern behavior, and analyzing its specific impacts on decision-making at different levels of the supply chain. It further elucidates the underlying mechanisms of resilient supply chain network construction, exploring both structural optimization and process adjustments. Finally, it proposes optimization strategies based on fairness concern, aiming to provide theoretical support and practical guidance for enterprises to build more resilient and equitable supply chain networks.

Keywords: Fairness Concern Behavior; Resilient Supply Chain Network; Construction Mechanism; Optimization Strategy

1. Introduction

In today's era, globalization and digitalization are advancing at an unprecedented pace, fundamentally reshaping the global economic landscape and operational models. As a critical backbone of global economic activities, supply chain networks have grown increasingly complex and interconnected. However, this intricate system now faces severe challenges from multiple uncertainties. Natural disasters like earthquakes, floods, and hurricanes-characterized by unpredictability and immense destructive power-can abruptly sever critical supply chain links, leading to raw material shortages, production halts, and logistical disruptions. For instance, the Fukushima nuclear accident in Japan not only devastated local production facilities but also sparked global concerns about the availability of related components and raw materials. Many companies dependent on Japan's supply chain have been forced to adjust production schedules and confront rising costs.

Market demand volatility remains a critical uncertainty factor for supply chains. Rapid shifts in consumer preferences, emerging technologies, and intensifying market competition have created highly unstable and unpredictable market demands. These dramatic fluctuations place immense pressure on corporate production planning and inventory management. Failure to promptly adjust supply chain strategies may result in significant financial losses. Additionally, political factors such as geopolitical conflicts and trade disputes pose severe threats to supply chain stability. Geopolitical tensions could lead to increased trade barriers, higher tariffs, and disrupted transportation routes, thereby disrupting the existing global supply chain framework. These interrelated uncertainties collectively present unprecedented challenges to supply chain operations. In this context, building resilient supply chain networks has become crucial for enterprises to enhance competitiveness. Resilient supply chain networks possess capabilities for rapid response, flexible adaptation, and risk mitigation. When facing various uncertainties, they can swiftly recover and maintain efficient operations, ensuring minimal disruption to business activities while preserving market share and profitability [1-6].

Meanwhile, fairness concerns serve as a critical factor in human social preferences, playing a significant role in the decision-making processes of supply chain members. Within supply chains, member enterprises are not isolated economic entities but rather interdependent communities of shared interests. During collaboration, these

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enterprises not only focus on their own economic benefits but also express concerns about the fairness of benefit distribution. Such fairness concerns can influence inter-enterprise cooperation, decision-making processes, and the overall performance of the supply chain.

Traditional supply chain research predominantly relies on the self-interested economic man hypothesis, assuming that all member enterprises are rational actors solely pursuing profit maximization, while overlooking the impact of fairness concerns on supply chain decision-making. However, real-world supply chain operations demonstrate that enterprises consider equitable benefit distribution alongside economic gains. When enterprises perceive unfair benefit distribution within the supply chain, they may adopt behaviors detrimental to collective interests, such as reducing collaborative investments, lowering product quality, or even terminating partnerships. These actions not only damage relationships among supply chain members but also diminish the network's resilience and competitiveness. Therefore, studying the construction mechanisms and optimization strategies of resilient supply chain networks from the perspective of fairness concerns holds significant theoretical and practical implications [7-11].

This study investigates the construction mechanisms and optimization strategies of resilient supply chain networks from the perspective of fairness-conscious behavior [12-14]. First, it analyzes the theoretical concepts and core elements of fairness-conscious behavior to clarify its specific manifestations and influencing factors in supply chain environments. Second, it examines how fairness-conscious behavior affects supply chain members' decision-making processes, including production planning, inventory management, and pricing strategies. Building on this foundation, the study elucidates the underlying mechanisms of resilient supply chain network formation, revealing how fairness-conscious behavior interacts with supply chain resilience to jointly drive the development of such networks. Finally, it proposes optimization strategies grounded in fairness-conscious principles, providing actionable guidance for enterprises to build resilient supply chain networks.

2. Theoretical Concepts and Core Elements of Fairness Concern Behavior

2.1 Theoretical Concepts

The concept of fairness concern originates from social psychology and has since been incorporated into economic and management research. It describes how individuals, when making decisions, consider not only their own economic interests but also the fairness of benefit distribution. When individuals perceive their rewards as disproportionate to their efforts or notice unfair comparisons with other reference points, they develop a sense of fairness concern, which subsequently influences their decision-making. In supply chain contexts, members such as suppliers, manufacturers, and retailers all exhibit fairness concern tendencies. They compare their own benefit situations with those of other members to determine fairness.

2.2 Core Elements

2.2.1 Reference subjects

Internal benchmarking: Supply chain members use their historical performance as a reference. For example, when assessing current profits, retailers compare them with past figures from the same period. If current profits fall below historical levels-even if they are within normal ranges under current market conditions-retailers may feel unfairly disadvantaged, believing their earnings have been compromised.

External reference: Members also compare their own profits with those of other similar members in the supply chain. For instance, manufacturers may compare their profit levels with those of other manufacturers in the same industry. If they find their profits significantly lower than others, they may perceive it as unfair and adjust their production strategies or negotiation tactics with upstream and downstream members.

2.2.2 Fairness perception

Equitable Distribution: This principle evaluates whether profit allocation outcomes are fair. In supply chains, it ensures members receive proportional returns based on their contributions (e.g., capital, technology, labor). For instance, suppliers' raw material quality, quantity, and delivery punctuality directly determine their profit shares. When a supplier perceives disproportionate returns for significant resource investments, it may trigger perceptions of unfair distribution.

Procedural Fairness: This principle emphasizes fairness in decision-making processes and rules. Supply chain members expect transparent,

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impartial, and reasonable decision-making during collaboration. For instance, manufacturers should implement open and fair bidding or negotiation procedures when setting procurement prices, ensuring suppliers perceive procedural fairness. If suppliers suspect opaque practices or unreasonable pricing rules, they may question the fairness of the process.

Interactive Fairness: This principle emphasizes mutual respect, understanding, and effective communication among members during interactions. A positive interactive relationship fosters trust and collaboration. For example, when manufacturers respect retailers' opinions and suggestions while promptly addressing their needs, retailers will perceive this as fair interaction, making them more willing to cooperate with manufacturers.

2.2.3 Behavioral response

Cooperative behavior: When supply chain members perceive fairness or relative fairness, they exhibit positive cooperative behaviors. For instance, suppliers are more willing to invest resources in improving product quality and ensuring timely delivery when they believe their collaboration with manufacturers is fair and reasonable. Similarly, retailers actively promote manufacturers' products to increase sales volume.

Retaliatory behavior: When members perceive unfair treatment, they may engage in retaliatory actions. For instance, retailers may reduce order quantities, delay payments, or even seek alternative suppliers if they deem the wholesale prices offered by manufacturers to be unjust. Suppliers, in turn, may respond by lowering product quality or raising prices as a reaction to perceived unfair treatment.

Exit behavior: Under extreme unfairness, members may choose to exit the supply chain partnership. For instance, when suppliers suffer long-term unfair profit distribution and cannot resolve the issue through communication and negotiation, they may terminate their cooperation with manufacturers and seek new partners.

3. Impact of Fairness Concern Behavior on Supply Chain Members' Decision-Making

3.1 The Connotation of Fairness Concern

Within the intricate ecosystem of supply chains, equitable concern manifests as a pervasive and far-reaching phenomenon. It transcends the narrow pursuit of maximizing economic interests among supply chain members, instead prioritizing fairness in profit distribution. Every participant-be it suppliers, manufacturers, or retailers-strives to achieve a balanced state between their inputs and outputs during collaboration, while ensuring their profit distribution remains fair and reasonable compared to other members.

When members perceive their returns failing to match their efforts and resource investments, or notice significant disparities in benefits compared to peers under similar circumstances, a sense of fairness naturally emerges. This psychological response isn't just a fleeting emotion-it fundamentally shapes their decision-making. For instance, in retailer-manufacturer partnerships, if a retailer discovers the manufacturer offers better wholesale prices to competitors while charging higher prices, they may develop a sense of unfairness. This could drive them to take action: voicing complaints, demanding lower wholesale prices, or in extreme cases, reducing orders from the manufacturer and seeking more equitable suppliers. Conversely, if manufacturers believe retailers are profiting disproportionately from insufficient promotional efforts, they might intervene by requiring increased marketing campaigns or price adjustments to achieve fairer profit distribution.

3.2 Impact on Decision-Making by Members at Different Levels

3.2.1 Supplier decision

In the complex architecture of a three-tier supply chain system, the fair concern behavior of core suppliers significantly influences their pricing decisions. A research project led by Chen Junlin at Central University of Finance and Economics found that when core suppliers exhibit fair concern tendencies, they tend to lower their bid prices. From the suppliers' perspective, they recognize that fair cooperation in supply chain collaboration is crucial for long-term stable development. To demonstrate fairness, they are willing to make certain profit sacrifices and cede a portion of their profit margins. This concessionary behavior results in their bids being significantly lower than the theoretical optimal value. The theoretical optimal value is typically derived from considerations of maximizing only their own costs and profits, while the fair concern factor prompts suppliers

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to transcend such narrow-minded profit considerations. By lowering their bids, they aim to create a more equitable collaborative environment for the entire supply chain, attract more partners, and thereby secure more stable orders and a better reputation in the long run. Although this decision-making approach sacrifices short-term benefits to some extent, it ultimately helps establish closer and more stable supply chain partnerships in the long term.

3.2.2 Intermediary decision

Intermediaries serve as vital bridges connecting suppliers and retailers in supply chains. Their decision-making processes are profoundly influenced by fairness considerations. While economic logic would suggest intermediaries might lower their own prices to maintain competitiveness when suppliers reduce theirs, reality tells a different story. These intermediaries are deeply concerned about equitable profit distribution among all stakeholders. When suppliers offer discounts, intermediaries often view this as a golden opportunity to boost their own profits. They fear that following suppliers' price reductions could squeeze their profit margins, putting them at a disadvantage in profit sharing. Instead of lowering prices, intermediaries may even seize the chance to raise them. While such behavior might initially cause retailer dissatisfaction, it ultimately serves their own interests by ensuring fairer profit distribution and safeguarding their economic standing within the supply chain.

3.2.3 Retailer decision

As the final link in the supply chain, end retailers directly engage with consumers, and their decision-making plays a crucial role in maintaining the stability of the entire supply chain. Retailers strongly react to unfair contracts and implement punitive measures. When they discover manufacturers offering preferential wholesale prices to competitors, they perceive unfair treatment in their collaboration. This sense of injustice drives retailers to take action to protect their interests. Reducing order quantities is a common response-by decreasing orders, retailers signal dissatisfaction to manufacturers, pressuring them to reassess pricing policies. In extreme cases, retailers may even seek alternative suppliers or terminate partnerships entirely. Such actions not only directly impact their own sales performance, leading to short-term declines in revenue and customer attrition, but also disrupt the stability of the entire supply chain. Since the supply chain is an interdependent system, a retailer's order reduction or supplier change can trigger a chain reaction, including production plan adjustments and inventory overstock among upstream suppliers and manufacturers, ultimately affecting the efficiency and competitiveness of the entire supply chain.

4. The Intrinsic Mechanism of Elastic Supply Chain Network Construction

4.1 Supply Chain Structure Optimization Based on Fairness Concern

4.1.1 Adding redundant nodes and edges

In today's complex and volatile business landscape, supply chain disruptions loom like the Sword of Damocles, posing imminent threats to enterprises. To mitigate this risk, companies typically adopt strategies to enhance redundancy at both nodes and edges, with introducing backup suppliers being a key measure. However, fairness considerations must not be overlooked during the process of implementing backup suppliers.

When selecting backup suppliers, companies should not focus solely on traditional factors like credentials and reputation. While these are crucial as they form the foundation for stable product or service delivery, overlooking fairness concerns may lead to issues even with qualified and reputable backup suppliers. For instance, if the profit distribution between the company and backup supplier becomes severely imbalanced during collaboration, or if the company excessively squeezes the supplier's profit margins, the backup supplier might feel unfairly treated and lose motivation. They could cut corners in product quality or, when faced with more lucrative opportunities, decisively end the partnership.

Conversely, if enterprises can establish a fair and cooperative relationship with backup suppliers by clearly defining mutual rights and obligations before collaboration, formulating equitable profit-sharing mechanisms, and ensuring backup suppliers receive proportional returns based on their contributions, their cooperation enthusiasm will significantly increase. Such partnerships will motivate suppliers to invest resources in enhancing their supply capabilities. When supply chain disruptions occur, they can promptly and reliably provide the required products or services, thereby substantially strengthening supply chain

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resilience.

4.1.2 Building a modular topology

The modular topology structure provides robust support for supply chain flexibility and reconfigurability. In a modular supply chain, each module functions as an independent "building block" with relative autonomy. This autonomy enables enterprises to swiftly replace or adjust problematic modules without causing systemic disruption, unlike traditional supply chains where a single node failure would paralyze the entire operation.

The modular structure also offers unique advantages in equitable resource and benefit distribution. Each module within the supply chain performs specific functions and tasks, earning corresponding returns based on their contributions. This fair profit-sharing mechanism effectively motivates collaboration among supply chain members. For instance, in a modular supply chain for electronics manufacturing, modules handling component production, assembly, and sales/after-sales services can all receive fair profit allocations according to their respective value contributions during production and sales processes. This sense of fairness encourages members to work more proactively, continuously improving efficiency and quality. Such efforts ultimately drive supply chain optimization and upgrades, further enhancing its resilience.

4.2 Process Adjustments Based on Fairness Concerns

4.2.1 Establish a dynamic adjustment mechanism

The market and external environment of supply chain are always changing, which requires the process of supply chain to have the ability to flexible adjustment. Considering the concern of fairness, it is very important for enterprises to establish the dynamic adjustment mechanism of fairness.

Take production planning as an example. This process involves multiple production stages within the supply chain, each with its own interests. If a company focuses solely on maximizing its own benefits while neglecting fair profit distribution among these stages, it may easily trigger conflicts. For instance, to cut costs, a company might assign excessive production tasks to a single stage, yet fail to increase its revenue proportionally. This could dampen the stage's production motivation, potentially leading to delays or quality issues. Therefore, when formulating and adjusting production plans, enterprises should maintain timely communication with supply chain members. Through thorough discussions, all parties should understand the rationale and objectives of the adjustments, ensuring mutual comprehension and acceptance of the proposed changes. During the adjustment process, it is essential to balance the interests of all stakeholders. Production tasks and benefits should be allocated rationally based on the actual conditions and capabilities of each production stage, achieving equitable adjustments to ensure the smooth operation of the supply chain process.

4.2.2 Optimizing information sharing process

Information sharing is an important means to improve the supply chain resilience, which can make the members of the supply chain timely understand the market demand, inventory status, production progress and other key information, so as to make more accurate decisions.

To address members' concerns, enterprises must establish a fair information-sharing mechanism. Defining the scope, methods, and profit-sharing principles is crucial. For instance, companies can sign information-sharing agreements to clearly outline the rights and obligations of all parties involved. These agreements should specify what information can be shared, how it is shared, and the benefits and responsibilities each party assumes. This approach ensures fairness and security in information sharing, enabling supply chain members to share information with confidence, thereby enhancing the supply chain's collaborative efficiency and resilience.

5. Elastic Supply Chain Network Optimization Strategy Based on Fairness Concern

5.1 Technology Application Strategy

AI-powered forecasting and planning: Artificial intelligence enables precise prediction and strategic planning of market demands and supply chain risks. When addressing equity concerns, businesses can leverage AI to analyze historical data and behavioral patterns of supply chain members, predicting their decision-making under equity considerations to develop fairer supply chain strategies. For instance, AI algorithms can optimize inventory allocation plans to ensure retailers receive equitable access

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to stock resources.

Blockchain-enhanced transparency: Blockchain technology, with its decentralized, tamper-proof, and traceable features, significantly improves supply chain transparency and trust. In resilient supply chain networks, blockchain enables the recording of transactional and production data among members, ensuring information authenticity and fairness. For instance, blockchain facilitates equitable supply chain finance operations, guaranteeing all stakeholders receive fair funding support during financing processes.

5.2 Risk Management Strategies

Multi-source Procurement and Logistics Route Planning: To mitigate supply chain disruption risks, companies may implement multi-source procurement strategies by partnering with multiple suppliers. When addressing fairness concerns, businesses should treat all suppliers equally, allocating procurement orders based on their qualifications, reputation, pricing, and other factors. Additionally, in logistics route planning, it is essential to ensure equitable benefit distribution across all logistics stages, preventing quality degradation in logistics services caused by uneven cost allocation.

Disaster contingency plan drills: Developing comprehensive emergency response plans is a vital measure to enhance supply chain resilience. During these drills, it is essential to address the equitable concerns of all supply chain stakeholders. For instance, emergency supplies and resources should be allocated based on fair and reasonable principles, ensuring all members receive necessary support. Additionally, strengthening communication and collaboration with supply chain partners is crucial to collectively address disaster challenges.

5.3 Cooperation Mechanism Strategies

Building a cross-enterprise collaboration platform: Establishing such a platform facilitates information sharing and collaborative efforts among supply chain members. On this platform, companies can fairly publish and access information, jointly develop supply chain strategies and make decisions. For instance, it enables synchronized production planning and inventory management among members, thereby enhancing the overall efficiency and resilience of the supply chain.

Building Strategic Alliances: Strategic alliances enable supply chain members to establish long-term, stable partnerships. When forming such alliances, it is essential to consider the interests and equity concerns of all members, and to develop fair and reasonable alliance agreements and profit-sharing mechanisms. For instance, through equity cooperation and profit-sharing arrangements, members can achieve mutual benefit and risk-sharing, thereby enhancing the alliance's stability and competitiveness.

6. Conclusion

This study investigates the construction mechanisms and optimization strategies of resilient supply chain networks through the lens of fairness-conscious behavior. By thoroughly analyzing the theoretical concepts and core elements of fairness-conscious behavior, it examines its impact on supply chain members' decision-making processes, elucidates the underlying mechanisms of resilient supply chain network formation, and proposes optimization strategies grounded in fairness-conscious principles. The research demonstrates that incorporating fairness-conscious behavior can enhance members' collaborative motivation and loyalty, thereby strengthening supply chain resilience and competitiveness. Future research should further explore the application of fairness-conscious behavior across different supply chain types, as well as how emerging technologies can better facilitate the integration of fairness-conscious practices with resilient supply chain systems.

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