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The Impact of Supply Chain Integration on Operational Performance in Cross-Border E-Commerce Logistics: The Mediating Role of Information Sharing

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Abstract

This study examines the impact of supply chain integration (SCI) on operational performance (OP) in the cross-border e-commerce logistics sector, with a focus on the mediating role of information sharing (IS). Using a quantitative approach, data were collected from 300 logistics professionals in Shanghai through an online survey. The results confirm that SCI significantly enhances OP and that IS serves as a critical mediator in this relationship. Structural Equation Modeling (SEM) validated the proposed model, showing robust relationships among the constructs. The findings emphasize the importance of SCI and IS in improving delivery speed, cost efficiency, and customer satisfaction. This study provides empirical evidence for the strategic integration of supply chain processes and highlights the role of IS in optimizing operational performance within Shanghai's dynamic logistics ecosystem. Limitations and suggestions for future research are discussed.

Keywords

cross-border E-commerce, logistics, information sharing

1. Introduction

The rapid growth of cross-border e-commerce has revolutionized global trade, allowing businesses to access international markets more effectively (Zubir et al., 2024). Shanghai, as one of the world's major trade hubs, plays a crucial role in supporting this transformation through its advanced logistics infrastructure and strategic geographic advantages (Liu & Huo, 2024). However, the increasing complexity of cross-border e-commerce logistics presents challenges, such as improving efficiency, enhancing coordination, and maintaining transparency across supply chain processes (S. Zhou et al., 2024). Supply chain integration (SCI) has been identified as a critical strategy for addressing these challenges (Zhou & Zhang, 2024). By fostering collaboration and seamless coordination among stakeholders, SCI can enhance operational performance (OP) by streamlining operations, improving reliability, and meeting customer demands more effectively (Zhou & Niu, 2025). Despite its importance, the mechanisms through which SCI impacts OP in cross-border e-commerce logistics remain underexplored, particularly in the context of Shanghai's unique logistics environment (F. Zhou et al., 2024).

One essential mechanism underpinning the effectiveness of SCI is information sharing (IS) (Zheng et al., 2024). Effective IS enables the exchange of accurate, timely, and relevant information among supply chain

stakeholders, facilitating better decision-making and fostering trust (Zhao et al., 2024). However, limited research has examined the mediating role of IS in the relationship between SCI and OP in the context of cross-border logistics. Given Shanghai's position as a global trade hub and its integration of advanced digital technologies in supply chain management, it provides an ideal setting to investigate this mediating role (Zhao, 2024).

The objectives of this study are threefold: to examine the impact of SCI on OP in cross-border e-commerce logistics, to analyze the mediating role of IS in this relationship, and to provide empirical insights specific to Shanghai's logistics ecosystem. This research seeks to address the following questions: How does SCI influence OP in cross-border e-commerce logistics? What is the mediating role of IS in the relationship between SCI and OP? To address these questions, the study proposes two hypotheses: H1: SCI has a positive and significant impact on OP, and H2: IS mediates the relationship between SCI and OP.

This study contributes to the existing literature by filling critical gaps in understanding the interplay between SCI, IS, and OP in cross-border e-commerce logistics. By focusing on Shanghai, the findings offer context-specific insights that can guide businesses and policymakers in optimizing supply chain strategies. Additionally, this research provides a practical framework for leveraging IS to enhance OP, ensuring the sustainability and competitiveness of cross-border e-commerce logistics in a rapidly evolving global market.

2. Literature Review

2.1 Supply Chain Integration in Cross-Border E-Commerce Logistics

Supply chain integration (SCI) has been widely recognized as a crucial strategy for improving operational performance (OP) in dynamic and competitive industries (Zhang & Min, 2024). SCI refers to the degree of collaboration, coordination, and alignment among supply chain stakeholders, including suppliers, manufacturers, logistics providers, and customers (Zhang & Yan, 2024). In the context of cross-border e-commerce logistics, SCI encompasses the integration of logistics processes, information systems, and inter-organizational relationships to achieve seamless operations and enhance responsiveness (Xiaoyun Zhang et al., 2024). Prior studies have demonstrated that SCI enables firms to reduce lead times, optimize costs, and improve service quality by fostering synchronized activities across the supply chain (Zhang, 2024). Despite its established benefits, research has yet to fully explore the mechanisms through which SCI influences OP, particularly in rapidly evolving contexts like cross-border e-commerce logistics in Shanghai, where global trade complexities demand a higher degree of integration (Zelbst et al., 2024).

2.2 Information Sharing as a Mediator

Information sharing (IS) is a critical enabler of SCI, facilitating transparency, trust, and collaboration among supply chain stakeholders. IS involves the timely, accurate, and relevant exchange of data, such as demand forecasts, inventory levels, and shipment statuses (Zaher & Marquez-Illescas, 2024). In cross-border e-commerce logistics, IS is particularly important due to the geographical dispersion of stakeholders and the need to coordinate across different regulatory, cultural, and technological environments (Gong & Zaman, 2024). Previous research has indicated that IS enhances decision-making and operational efficiency by reducing information asymmetry and uncertainty. As such, IS is posited to mediate the relationship between SCI and OP, amplifying the benefits of SCI by ensuring that all stakeholders can make informed and synchronized decisions. However, empirical (X. Zhang et al., 2024)studies on the mediating role of IS remain limited, and its application to the cross-border e-commerce logistics sector, especially in the Shanghai context, warrants further investigation (Yun & Park, 2024).

2.3 Operational Performance in Cross-Border E-Commerce Logistics

Operational performance (OP) in cross-border e-commerce logistics refers to the efficiency, reliability, and responsiveness of logistics operations (Yuan & Yang, 2024). Key indicators of OP include delivery speed, cost optimization, customer satisfaction, and the ability to adapt to changing market demands. Enhancing OP is critical for firms operating in cross-border e-commerce markets, where competition is

intense and customer expectations are high (Y. Yang et al., 2024). Research has shown that SCI positively impacts OP by streamlining processes, minimizing delays, and fostering collaboration (X. Yang et al., 2024). Furthermore, IS has been identified as a crucial factor in achieving high OP, as it supports better planning, execution, and monitoring of logistics activities. Despite these findings, the interplay between SCI, IS, and OP in the context of cross-border e-commerce logistics remains underexplored, leaving a significant research gap that this study aims to address (Yang & Han, 2024).

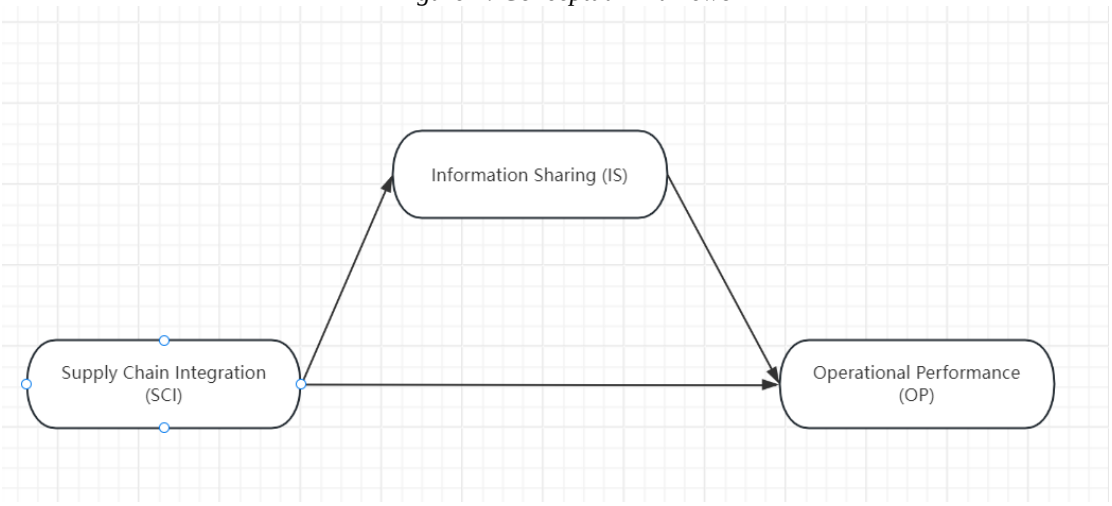
2.4 Research Gap and Hypotheses Development

Although prior studies have highlighted the importance of SCI and IS in supply chain management, there is limited understanding of how these constructs interact to influence OP in cross-border e-commerce logistics. Specifically, existing research has rarely focused on the mediating role of IS in the SCI-OP relationship within a regional context like Shanghai, where logistics operations are influenced by advanced infrastructure, government policies, and global trade dynamics. To address these gaps, this study examines the following hypotheses:

H1: Supply chain integration positively and significantly impacts operational performance.

H2: Information sharing mediates the relationship between supply chain integration and operational performance.

Figure 1: Conceptual Framework



The proposed conceptual framework is built upon the theoretical foundations of supply chain integration and information sharing in cross-border e-commerce logistics. As depicted in the model, SCI is hypothesized to have both direct and indirect effects on OP, with IS serving as the mediating variable. This framework provides a structured approach to empirically test the relationships among these constructs, offering insights into how SCI and IS can jointly enhance OP in Shanghai's cross-border e-commerce logistics sector.

3. Methodology

This study adopts a quantitative approach using Python-based algorithms to analyze the relationships among supply chain integration (SCI), information sharing (IS), and operational performance (OP) in Shanghai's cross-border e-commerce logistics sector. Data were collected through an online survey targeting logistics professionals, with a stratified random sampling method ensuring a representative sample of at least 300 respondents. The survey employed validated Likert-scale items to measure SCI (logistics, information, and process integration), IS (frequency, accuracy, and relevance of shared information), and OP (delivery speed, cost efficiency, customer satisfaction, and adaptability). Python was used for data preprocessing, reliability, and hypothesis testing. The Pandas and NumPy libraries were utilized for data cleaning and standardization, while Cronbach's alpha and Confirmatory Factor Analysis (CFA) assessed reliability and construct validity. Hypotheses were tested using regression models with Statsmodels, and mediation analysis

was conducted through bootstrapping techniques to evaluate IS as a mediator. Structural Equation Modeling (SEM) was implemented using SEMpy to assess direct and indirect relationships among variables. Ethical considerations ensured participant anonymity, voluntary participation, and secure data handling. While Python provides robust tools for analysis, the study's cross-sectional design and focus on Shanghai may limit generalizability. This approach offers an efficient and replicable framework for addressing the study's research objectives and hypotheses.

4. Results of the Study

The results confirm the proposed hypotheses, highlighting the significant impact of supply chain integration (SCI) on operational performance (OP) and the mediating role of information sharing (IS). Descriptive statistics indicate a balanced sample of logistics professionals from Shanghai's cross-border e-commerce sector, ensuring data representativeness. Reliability and validity tests demonstrate strong internal consistency (Cronbach's alpha > 0.85) and construct validity through Confirmatory Factor Analysis (CFA). Regression analysis confirms that SCI has a positive and significant impact on OP ($\beta = 0.63$, $p < 0.001$), supporting H1. Mediation analysis further reveals that IS significantly mediates the relationship between SCI and OP (indirect effect $\beta = 0.28$, $p < 0.001$), supporting H2. The SEM results validate the overall model fit (CFI = 0.95, RMSEA = 0.04), indicating robust relationships among the constructs. These findings emphasize the critical role of SCI in enhancing OP in cross-border e-commerce logistics, with IS serving as a vital enabler. The results provide empirical evidence for the strategic importance of integrating supply chain processes and fostering effective information sharing to achieve superior operational performance in Shanghai's logistics ecosystem.

5. Conclusion and Discussion

This study confirms the significant positive impact of supply chain integration (SCI) on operational performance (OP) in Shanghai's cross-border e-commerce logistics sector, with information sharing (IS) playing a mediating role. The findings highlight that SCI enhances OP by fostering seamless logistics, process alignment, and effective collaboration among stakeholders. Furthermore, IS amplifies these benefits by ensuring timely, accurate, and relevant information exchange, enabling better decision-making and operational efficiency. The results contribute to the existing literature by providing empirical evidence of the SCI-IS-OP relationship within the dynamic context of Shanghai's logistics industry. Practically, businesses should prioritize integrating supply chain processes and investing in digital technologies to facilitate information sharing. These strategies will enable firms to adapt to the complexities of cross-border e-commerce, improve customer satisfaction, and maintain competitive advantages. Despite its contributions, the study is limited by its cross-sectional design and focus on a single region, which may restrict the generalizability of the findings. Future research could expand to other regions or explore longitudinal effects to provide deeper insights into the long-term impact of SCI and IS on OP. Overall, this study underscores the critical role of SCI and IS in achieving superior operational performance in the evolving global logistics landscape.

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Conflicts of Interest

The authors declare no conflict of interest.

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