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A Study on Supply Chain Information Coordination Mechanisms Under Smart Logistics Technologies

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Abstract: Against the backdrop of the deepening development of the digital economy and increasing uncertainty in global supply chains, smart logistics technology has become a key driver for breaking down information barriers in supply chains and enhancing collaborative efficiency. Through literature analysis and theoretical deduction, this paper systematically reviews the current state of research in the field of smart logistics and supply chain information collaboration. Drawing on theories of collaborative management, systems theory, and knowledge management, it constructs a pyramid-shaped framework for supply chain information collaboration mechanisms comprising a technology-driven layer, an information collaboration layer, a value co-creation layer, and a support system. The study clarifies the pathways for collaborative empowerment by technology clusters, proposes a phased implementation strategy, and analyzes the core challenges facing the implementation of this mechanism. This study addresses the gap in existing research regarding systematic investigations into the integration and synergy mechanisms of technology clusters, providing a theoretical reference for supply chain enterprises to achieve information synergy and enhance the resilience and efficiency of the entire supply chain.

Keywords: Smart logistics; Supply chain; Information coordination; Coordination mechanisms; Digital technology.

1. Introduction

Amid profound adjustments in the global economic landscape and the accelerating penetration of the digital economy—coupled with uncertainties such as geopolitical conflicts and sudden public health emergencies—enhancing supply chain resilience and efficiency has become a central priority for high-quality industrial development. As a product of the deep integration of digital technology and modern logistics, smart logistics leverages data as its core driving force and integrates technology clusters such as the Internet of Things, big data, artificial intelligence, and blockchain. It has emerged as a key solution to address the pain points of traditional supply chains—including information silos, insufficient coordination, and system incompatibility—and has become a research focus of shared interest among both academia and industry. Existing research in this field has largely focused on the application outcomes of individual smart logistics technologies or has addressed the value of information sharing in a piecemeal manner; few studies have taken a holistic approach to smart logistics as an integrated system to systematically construct mechanisms for supply chain information coordination. Based on this, this study employs a qualitative research methodology combining literature analysis and theoretical deduction. It systematically reviews relevant academic findings and theoretical foundations to construct a systematic analytical framework for supply chain information coordination under smart logistics technologies. The aim is to deepen the understanding of supply chain operational logic in the context of smart logistics while providing a theoretical reference for supply chain coordination practices.

2. Research Methods

This study employs a qualitative research methodology, primarily utilizing literature analysis and conceptual deduction to systematically review academic findings and industry data in the fields of smart logistics, supply chain management, and information collaboration. Through induction, analysis, and theoretical deduction, the study clarifies core concepts and elucidates the mechanisms linking variables, ultimately constructing a systematic theoretical model of supply chain information collaboration under smart logistics technology. The study draws on collaborative management theory, systems theory, and information sharing and knowledge management theory as its core theoretical foundations, providing the underlying theoretical support for the construction of this mechanism.

3. Research Findings

3.1. Literature Review and Identification of Research Gaps

The system clarifies the functional roles and application effectiveness of core technology clusters in smart logistics: The Internet of Things serves as the sensory foundation of smart logistics; its application can significantly reduce logistics loss rates and improve the real-time tracking rate of logistics elements [1]; Big data and artificial intelligence form the core of decision-making, significantly improving the accuracy of demand forecasting, the efficiency of warehouse scheduling, and the ability to control transportation costs; blockchain, with its decentralized and immutable nature, establishes a foundation of trust for information sharing within the supply chain, thereby substantially reducing the rate of information tampering [2]. The academic community has developed core research findings, including a three-dimensional theoretical framework for smart logistics and a triple-integration model encompassing physical, digital, and value dimensions. Industry data indicates that the global smart logistics market is experiencing robust growth momentum. Existing research confirms that the deep integration of smart logistics technologies with collaborative

governance mechanisms can significantly enhance supply chain coordination efficiency, and has established a stepwise evolutionary model from technology integration to value enhancement. Practical case studies from companies such as JD.com and SF Express further validate the critical role of smart logistics in improving coordination efficiency and creating commercial value [3].

Based on this, three major gaps in existing research have been identified: First, research tends to focus on the application outcomes of individual technologies, with a lack of systematic studies on the integration of technology clusters and the restructuring of collaborative mechanisms; second, research on technology implementation and collaborative management remains fragmented, failing to establish a comprehensive, end-to-end analytical framework; and third, empirical case studies are predominantly concentrated in the e-commerce retail sector, with a scarcity of research on adaptability across different industries.

3.2. Supply Chain Information Collaboration Mechanisms

The pyramid-shaped framework is an organic whole with clear hierarchical logic and functional coupling. The technology-driven layer is the underlying foundation of the whole mechanism, which provides data resources and technical support for the upper-level collaborative activities through the collection, processing, secure storage and sharing of supply chain full-chain data. The information collaboration layer is the core transmission hub of the mechanism, which transforms the underlying data resources into actual collaborative behaviors between supply chain entities, and is the only way to transform technical capabilities into practical collaborative value. The value co-creation layer is the ultimate goal of the mechanism construction, which is the comprehensive embodiment of the effect of information collaboration, and the realization of value will in turn feed back the optimization of technology application and collaborative mode. The support system runs through the above three core layers, providing institutional, organizational and talent guarantees for the stable and long-term operation of the whole mechanism, and is the core prerequisite for the sustainable development of information collaboration. The framework forms a closed-loop logical transmission chain of "technology empowerment - information collaboration - value creation - system guarantee", and the core functions and internal logic of each part are as follows:

Technology-Driven Layer: The foundational layer of the mechanism's operation, comprising four major modules: sensing and data collection, transmission and storage, processing and analysis, and sharing and mutual trust. It integrates technologies such as the Internet of Things, 5G, cloud computing, big data, artificial intelligence and blockchain to achieve end-to-end data connectivity, intelligent processing, and secure sharing across the supply chain, thereby providing data support and technological empowerment for upper-level collaborative activities [4].

Information Collaboration Layer: The core component of the mechanism's operation, which is divided into two main areas—vertical collaboration between upstream and downstream entities and horizontal collaboration among peers—and encompasses five key collaborative elements: information transparency, joint forecasting and planning, collaborative inventory management, shared logistics and warehousing resources, and joint risk management [5].

Value Co-creation Layer: The ultimate goal of mechanism development, which enables the realization of four core values: improved operational efficiency across the entire supply chain, faster response to market demand, enhanced resilience of the supply chain system, and deepened innovation within the industrial ecosystem.

Support System: The core foundation for the long-term operation of the mechanism, comprising four key components: organizational collaboration mechanisms, profit-sharing and incentive mechanisms, standards and safety systems, and talent development and collaborative culture building.

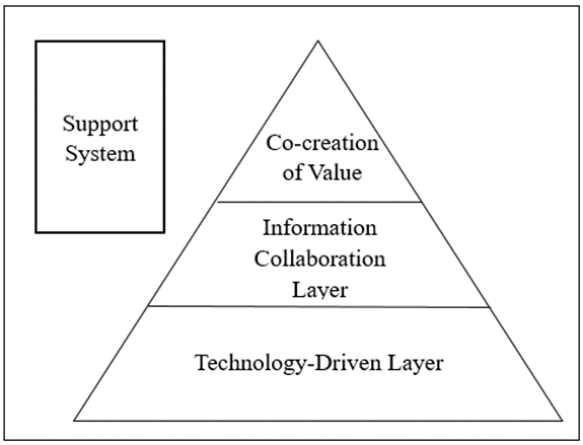


Figure 1. Overall Framework of the Coordination Mechanism

3.3. Implementation Pathway for the Mechanism

Design a four-phase, phased implementation plan to achieve a progression from localized collaboration to ecosystem-wide collaboration: Phase One is the foundational pilot phase, during which consensus on collaboration is reached, partners and pilot scenarios are selected, and responsibilities and quantifiable goals are defined; Phase Two is the technical platform development phase, involving the deployment of data collection infrastructure and the construction of a cloud-based, lightweight information-sharing platform to enable real-time synchronization of core operational data; Phase Three is the process integration and optimization phase, which involves restructuring business processes to align with the collaboration model, establishing standardized collaboration rules, and implementing supporting management systems; Phase Four is the collaboration deepening and expansion phase, which involves promoting replicable collaboration models, upgrading platform service capabilities, and shifting the focus of collaboration from efficiency optimization to strategic innovation and ecosystem co-creation.

4. Discussion

This study overcomes the limitations of existing research—which often adopts a narrow, single-technology perspective and relies on fragmented collaborative analysis—by establishing a comprehensive, closed-loop framework that encompasses technology, processes, value, and safeguards. It clarifies the complementary, synergistic pathways through which smart logistics technology clusters empower one another, and identifies the deep integration of technology and management as the core prerequisite for the sustainable operation of information collaboration. The study thus

provides a holistic solution for addressing information silos in traditional supply chains and mitigating the bullwhip effect.

4.1. Theoretical Contributions and Research Innovations

This study makes three core theoretical contributions to the field:

First, it breaks through the limitation of existing research that mostly focuses on the application effect of individual smart logistics technologies, systematically constructs the collaborative empowerment system of smart logistics technology clusters, and clarifies the complementary and synergistic mechanism between different technologies.

Second, it establishes a comprehensive, closed-loop analytical framework of "technology-driven layer - information collaboration layer - value co-creation layer - support system", which realizes the full coverage from underlying technology empowerment to upper-level value creation, and makes up for the deficiency of fragmented research in existing literature that fails to build an end-to-end systematic framework for supply chain information collaboration.

Third, it expands the application boundary of Collaborative Management Theory, System Theory and Information Sharing Theory in the digital supply chain scenario, reveals the hierarchical coupling logic between technology empowerment and management optimization, and provides a unified theoretical analysis framework for the research on supply chain information collaboration under the background of digitalization.

4.2. Practical Implications

This study also provides clear and targeted practical implications for different participants in the supply chain.

For core leading enterprises in the supply chain, they should give full play to their advantages in resources, technology and channel, take the lead in building a unified information collaboration system, formulate standardized collaborative rules and data specifications, and drive the participation of upstream and downstream enterprises through a reasonable benefit distribution mechanism. They should also pay attention to the construction of a lightweight collaborative platform, reduce the access threshold for small and medium-sized partners, and lay a foundation for the full coverage of the collaboration mechanism.

For small and medium-sized enterprises in the supply chain, they should focus on the improvement of core business digital capabilities according to their own development reality, avoid blind and excessive technology investment, and access the supply chain collaborative system through a low-cost, lightweight access model. They should actively participate in the formulation of collaborative rules, and obtain the dividends of information collaboration through the contribution of core business data and the sharing of their own resource advantages.

For industry associations and relevant regulatory authorities, they should speed up the formulation of unified industry standards for smart logistics and supply chain data exchange, build a public technology service system for small and medium-sized enterprises, improve the regulatory system for data security and privacy protection, and create a good policy and industry environment for the development of supply chain information collaboration.

4.3. Practical Implications

At the same time, the implementation of this mechanism still faces core challenges on multiple fronts, and this study proposes targeted response strategies for each challenge:

On the technical front, the core challenges include the high deployment cost of technical facilities for small and medium-sized enterprises, heterogeneous internal management systems across different companies, and inconsistent data standards, which lead to great difficulties in system integration and data interoperability. The targeted response strategies include: promoting the modular and SaaS-based deployment of smart logistics technology, developing lightweight and low-cost application modules to reduce the one-time investment cost of technology deployment; building a unified data exchange standard and middleware system, realizing the seamless connection between heterogeneous systems through standardized application program interfaces; giving full play to the role of third-party technology service providers, building a public technology service platform to avoid repeated investment in technology research and development.

On the organizational front, the core challenges include the trust barriers between different enterprises, internal resistance to organizational change, imbalanced distribution of collaborative benefits, and disparities in digital maturity among collaborative participants, which directly hinder the deepening of cross-entity collaboration. The targeted response strategies include: building a multi-level trust mechanism through blockchain technology and standardized collaborative contracts, to alleviate the trust barriers between entities; establishing a fair and reasonable profit distribution and incentive mechanism based on the contribution of each participant in the collaboration, to ensure the sustainable participation of all entities; carrying out targeted digital capability training for partners with low digital maturity, to narrow the digital gap between collaborative participants.

On the security and talent fronts, the core challenges include that centralized data sharing exacerbates data privacy concerns and compliance pressures, while the shortage of compound professionals with expertise in both supply chain management and digital technology has slowed the implementation of the collaboration mechanism [6]. The targeted response strategies include: establishing a hierarchical and authorized data sharing mechanism, adopting encryption technology to ensure the security of core business data, and clarifying the data use rights and responsibilities of each participant to meet compliance requirements; building a multi-level talent training system through the cooperation of enterprises, universities and research institutions, to cultivate compound talents that meet the needs of supply chain digital collaboration; strengthening the building of a collaborative culture among enterprises, to form a win-win cooperative atmosphere of mutual trust and resource sharing.

4.4. Boundary Conditions of the Research

This study constructs a universal theoretical framework of supply chain information collaboration mechanism, but there are also certain boundary conditions for the application of the framework. The framework is applicable to the supply chain system with multi-entity participation and clear upstream and downstream links, and the implementation effect of the mechanism will be affected by the industry characteristics, the digital maturity of collaborative entities, the market environment and the institutional environment. In the actual

application process, the framework needs to be adjusted and optimized according to the specific characteristics of the industry and the actual situation of the collaborative entities, to ensure the adaptability and effectiveness of the mechanism.

5. Conclusion

First, this study established a four-tiered framework for supply chain information collaboration comprising the technology-driven layer, the information coordination layer, the value co-creation layer, and the support system. It clarified the functional boundaries and hierarchical relationships among these layers, thereby forming a complete theoretical logic loop.

Second, this study clarifies the collaborative empowerment pathways of smart logistics technology clusters. The Internet of Things, cloud computing, big data, artificial intelligence, and blockchain technologies form a complementary and interconnected technological network, each undertaking core functions in data collection, transmission and storage, value transformation, and trust-building, thereby providing systematic technological support for information collaboration across the entire supply chain.

Third, the core requirement of deep integration between technology and management has been clarified; the four key supporting mechanisms—organizational governance, profit sharing, standards and regulations, and talent culture—are essential for transforming technological empowerment into sustainable collaborative value.

This study established its framework based on literature and theoretical analysis; however, it lacks empirical data to validate the theoretical model. Future research could employ case studies and surveys, taking into account the characteristics of specific sectors such as fast-moving consumer goods and pharmaceutical cold chain logistics, to further investigate the industry-specific applicability of the collaboration mechanisms. Additionally, it should quantify the impact of information collaboration on supply chain performance while exploring the roles of the government and third-party platforms in establishing such collaboration mechanisms.

References

[1] Tang Y, Zha C. Application of internet of things (IoT) and machine learning (ML) in intelligent logistics supply chain [J]. Discover Internet of Things, 2026.

[2] Hariyani D, Hariyani P, Mishra S, et al. A literature review on transformative impacts of blockchain technology on manufacturing management and industrial engineering practices [J]. Green Technologies and Sustainability, 2025, 3 (3): 100169.

[3] Pang X, Tomanek D P. Impact of Digitalization on Ecological Sustainability in Warehousing—Case Study of JD. com and SF Express Warehouses in Shanghai [M]//Digitalisation of the Greening Supply Chain. Cham: Springer Nature Switzerland, 2025: 127-153.

[4] Woschank M, Zsifkovits H E. Smart logistics—conceptualization and empirical evidence [J]. Chiang Mai University Journal of Natural Sciences, 2021, 20 (3): 189-201.

[5] Lu M, Gao Y, Wan Q. Research on evolutionary game of collaborative innovation in supply chain under digitization background [J]. Mathematical Problems in Engineering, 2021, 2021 (1): 3511472.

[6] Albqowr A, Alsharairi M, Alsoussi A. Big data analytics in supply chain management: a systematic literature review [J]. VINE Journal of Information and Knowledge Management Systems, 2024, 54 (3): 657-682.