

The Application of Transaction Cost Theory in Supply Chain Management

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Abstract

In the context of globalization and digitalization, the application of transaction cost theory in supply chain management has become increasingly important. As business environments grow more complex, enterprises face challenges in effectively managing supply chain transaction costs. This paper systematically explores the application of transaction cost theory in supply chain management, covering key areas such as supplier selection, supply chain integration, and risk management. The research finds that supplier evaluation models based on transaction costs can help enterprises make more comprehensive selection decisions. In terms of supply chain integration, transaction cost theory provides important guidance for vertical integration decisions and the design of collaboration mechanisms. The application of digital technologies has both reduced traditional transaction costs and introduced new cost considerations. Faced with emerging risks such as cybersecurity and geopolitical issues, enterprises need to adopt dynamic transaction cost management strategies. In the future, the application of transaction cost theory in supply chain management will likely place greater emphasis on interdisciplinary integration and sustainable development, providing theoretical support for enterprises to achieve efficient, flexible, and sustainable supply chain management in the changing global business environment.

Keywords

Transaction Cost Theory, Supply Chain Management, Digital Transformation, Risk Management, Supplier Selection

1. Introduction

Since its inception, transaction cost theory, an essential economic theory, has been widely applied and developed across numerous fields. In supply chain management,

this theory offers a valuable framework for understanding and optimizing inter-firm transactional relationships. As globalization accelerates and information technology advances, enterprises encounter increasingly intricate supply chain environments, highlighting the growing relevance of transaction cost theory. Scholars have explored the theory's applications in supply chain management extensively, addressing areas like supplier selection, outsourcing decisions, and supply chain integration. For example, Williamson's research illustrates how transaction cost theory assists companies in making optimal choices between market transactions and internal production [1]. Recently, the rise of sustainable development has driven interest in transaction cost theory's application within green supply chain management. The study by Carter and Rogers demonstrates that transaction cost analysis enables firms to better comprehend and manage sustainability challenges in supply chains [2]. Additionally, with digital transformation, emerging technologies like blockchain present novel opportunities for reducing transaction costs in supply chains, an area garnering growing academic interest. This paper aims to systematically review transaction cost theory's application in supply chain management, analyze its recent advancements in today's complex business environment, and provide theoretical insights to help enterprises optimize their supply chain practices.

2. Foundations of Transaction Cost Theory

2.1. Core Concepts of Transaction Cost Theory

Transaction cost theory, introduced by Nobel laureate Ronald Coase in his 1937 work "The Nature of the Firm", centers on the concept that market economies entail costs beyond mere production—specifically, transaction costs. These encompass information search, negotiation, contracting, and enforcement costs. Williamson later expanded on the theory, identifying three primary drivers of transaction costs: asset specificity, uncertainty, and transaction frequency [1]. In supply chain management, transaction cost theory offers a foundation for key decisions, including supplier selection, outsourcing choices, and governance of inter-firm relationships. For instance, when a particular input requires highly specific assets, companies may prefer internal production over market sourcing to mitigate transaction costs tied to opportunistic risks. Grasping these fundamental concepts enables companies to optimize supply chain structures and enhance efficiency.

2.2. Applicability of Transaction Cost Theory in Supply Chain Management

Transaction cost theory is widely applicable in supply chain management, most notably in: supplier selection and evaluation frameworks, where enterprises assess potential transaction costs across suppliers to identify optimal partners; outsourcing decisions, guided by cost comparisons between in-house production and procurement from external vendors (factoring in both production and transaction

costs) [3]; and the design of governance structures, where transaction characteristics (such as asset specificity) inform choices between market transactions, long-term contracts, or vertical integration. Transaction cost theory further enriches supply chain risk management, aiding companies in pinpointing and mitigating risks. Increasingly, firms incorporate transaction cost analysis into supply chain decision-making to bolster competitiveness and efficiency.

2.3. Relationship between Transaction Cost Theory and Other Supply Chain Management Theories

While transaction cost theory is a pivotal lens in supply chain management, it aligns closely with complementary theories. The Resource-Based View, for instance, emphasizes firms' internal resources and capabilities, balancing the transaction efficiency focus of transaction cost theory. Effective supply chain decisions consider both internal strengths and external transaction costs. Relationship management theory, another key framework, underlines the role of long-term partnerships in lowering transaction costs, as shown by Liu *et al.*, who found that robust supplier relationships reduce transaction costs and enhance performance [4]. Additionally, network theory clarifies transaction cost dynamics in complex supply networks. Together, these theories create a dynamic, multifaceted framework for supply chain management, enabling firms to devise informed and comprehensive strategies. Recognizing how transaction cost theory interrelates with other theories helps enterprises apply a holistic approach to supply chain strategy.

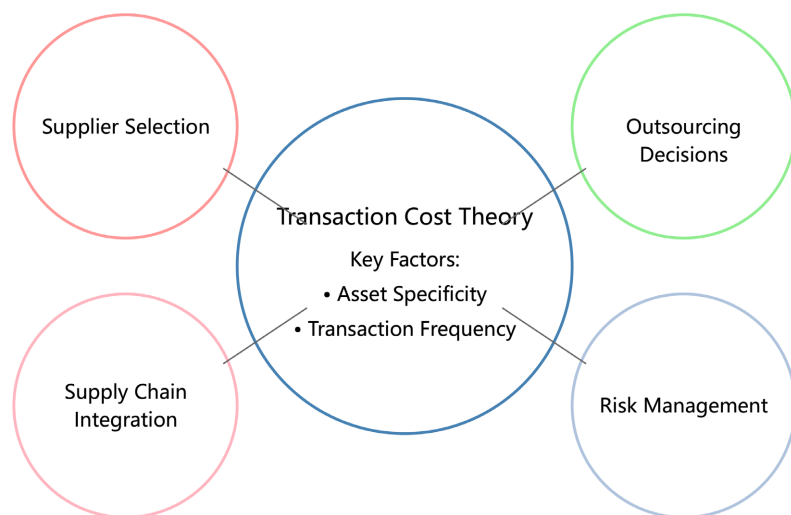


Figure 1. Transaction cost theory in supply chain management.

As shown in **Figure 1**, the application of transaction cost theory in supply chain management mainly involves four key areas: supplier selection, outsourcing decisions, supply chain integration, and risk management. These application areas revolve around the core concepts of transaction cost theory, including key factors such as asset specificity, uncertainty, and transaction frequency. The figure clearly

illustrates the interrelationships between these elements, highlighting the central role of transaction cost theory in supply chain management decisions.

3. Application of Transaction Cost Theory in Supplier Selection

3.1. Transaction Cost-Based Supplier Evaluation Models

In supply chain management, supplier selection is a key decision that directly affects an enterprise's operational efficiency and competitiveness. Transaction cost theory provides a unique perspective for supplier evaluation, emphasizing that in addition to traditional factors such as price and quality, various implicit costs that may arise from transactions with suppliers should also be considered. Supplier evaluation models based on transaction cost theory typically include the following key dimensions: asset specificity, uncertainty, transaction frequency, degree of information asymmetry, and suppliers' opportunistic tendencies. Hwang *et al.* proposed a comprehensive evaluation framework that combines these transaction cost factors with traditional supplier evaluation indicators, providing enterprises with a more comprehensive supplier selection tool [5]. In practical applications, enterprises can quantify and assign weights to these factors based on their own circumstances and industry characteristics, thereby constructing a supplier scoring system suitable for themselves. This transaction cost-based evaluation method helps enterprises better predict and manage various implicit costs and risks that may arise in the process of cooperating with suppliers.

3.2. Supplier Relationship Management Guided by Transaction Cost Theory

Transaction cost theory not only influences the initial selection of suppliers but also provides important guidance for ongoing supplier relationship management. Based on the characteristics of transactions, enterprises can choose different types of supplier relationships and governance mechanisms. For products or services with low asset specificity and low transaction frequency, market governance mechanisms may be more suitable, allowing enterprises to maintain multiple suppliers and reduce costs through competition. For key inputs with high asset specificity and high transaction frequency, enterprises may need to establish closer cooperative relationships, even considering long-term contracts or strategic alliances. Dyer and Singh's research shows that by establishing trust and joint investments, enterprises can reduce transaction costs and create relational rents [6]. In practice, many enterprises adopt a tiered supplier management strategy, applying differentiated management approaches to different types of suppliers based on the principles of transaction cost theory. This strategy helps optimize resource allocation and improve overall supply chain efficiency and flexibility. At the same time, enterprises need to pay attention to the dynamic management of supplier relationships, regularly assess transaction costs, and adjust relationship strategies in a timely manner.

3.3. Role of New Technologies in Reducing Transaction Costs in Supplier Selection

With the rapid development of information technology, new technologies are playing an increasingly important role in reducing transaction costs in supplier selection and management processes. The application of blockchain technology is a typical example. By providing tamper-proof transaction records and smart contract functionality, blockchain can significantly reduce information asymmetry and decrease verification and monitoring costs. Kshetri's research points out that blockchain technology can improve supply chain transparency and traceability, thereby reducing risks and costs associated with supplier transactions [7]. Artificial intelligence and big data analytics technologies also provide new tools for supplier selection and evaluation. These technologies can help enterprises collect and analyze supplier information more quickly and accurately, predicting potential transaction risks. For example, machine learning algorithms can help enterprises identify supplier characteristics most likely to lead to high transaction costs by analyzing historical transaction data. The application of Internet of Things technology enables enterprises to monitor suppliers' production and delivery processes in real-time, further reducing information asymmetry and monitoring costs. The application of these new technologies not only reduces traditional transaction costs but also creates new value-creation opportunities for enterprises. However, when adopting these new technologies, enterprises need to balance implementation costs and expected benefits to ensure that technology investments truly lead to reduced transaction costs and improved supply chain efficiency.

4. Application of Transaction Cost Theory in Supply Chain Integration

4.1. Vertical Integration Decisions and Transaction Cost Analysis

Transaction cost theory provides an important theoretical basis for enterprises' vertical integration decisions. Vertical integration refers to the process by which enterprises incorporate upstream suppliers or downstream distributors into their own organizational structure through mergers and acquisitions or self-construction. According to transaction cost theory, enterprises tend to choose vertical integration when the cost of market transactions is higher than the management cost of internal organizations. This situation typically occurs in the following scenarios: when transactions involve highly specific assets, market transactions may face high negotiation costs and risks of opportunism; when the transaction environment is highly uncertain, making it difficult to fully specify all possible situations through contracts; when transaction frequency is very high, repeated market transactions may lead to accumulated high costs. Geyskens *et al.*'s meta-analysis study shows that asset specificity and uncertainty are indeed significantly related to vertical integration decisions [8]. However, vertical integration may also bring problems such as increased management complexity and reduced flexibility. Therefore, when making vertical integration decisions, enterprises need to

comprehensively assess the trade-off between transaction cost savings and potential increases in organizational costs.

4.2. Supply Chain Collaboration and Transaction Cost Reduction Strategies

In the absence of full vertical integration, enterprises can also reduce transaction costs through various forms of supply chain collaboration. These collaborative forms include strategic alliances, long-term contracts, information-sharing platforms, and more. Transaction cost theory provides important guidance for understanding and designing these collaborative mechanisms. For example, by establishing long-term cooperative relationships, enterprises can reduce the costs of repeated negotiations and the risk of opportunistic behavior. The establishment of information-sharing mechanisms can significantly reduce information search costs and monitoring costs. Cao and Zhang's research finds that supply chain collaboration can improve supply chain performance by reducing transaction costs [9]. In practice, many enterprises adopt supplier development programs, helping suppliers enhance their capabilities through technical support and training, which not only improves supply quality but also builds mutual trust, reducing transaction costs in the long term. The establishment of cross-organizational teams, joint planning, and forecasting are also effective strategies for reducing transaction costs. Enterprises need to choose appropriate forms and intensities of collaboration based on specific transaction characteristics and supply chain environments.

4.3. Digital Supply Chains and Transaction Cost Dynamics

Digital transformation is profoundly changing the way supply chains operate, posing new challenges and opportunities for the application of transaction cost theory. On one hand, the application of digital technologies can significantly reduce transaction costs in the traditional sense. For example, e-procurement platforms lower information search costs, smart contract technology reduces contract execution costs, and blockchain technology improves transaction transparency and traceability. On the other hand, digitalization also brings new transaction cost considerations, such as data security costs and technology compatibility costs. Vendrell-Herrero *et al.*'s research points out that in the digital context, transaction cost theory needs to consider the characteristics of data as a new type of asset [10].

As shown in **Figure 2**, various technologies in digital supply chains, such as blockchain, Internet of Things (IoT), Artificial Intelligence (AI), Machine Learning (ML), and cloud computing, have significant impacts on traditional types of transaction costs. At the same time, the application of these technologies also brings new cost considerations, such as data security costs and system integration costs. In this dynamic environment, enterprises need to constantly evaluate and adjust their supply chain integration strategies to adapt to the opportunities and challenges brought by digitalization. For example, by adopting cloud infrastructure and Platform as a Service (PaaS) solutions, enterprises can reduce the initial

investment and maintenance costs of IT systems, but they also need to consider the risks of data security and vendor lock-in. Overall, digital supply chains provide powerful tools for reducing traditional transaction costs, but they also require enterprises to possess higher technical management capabilities and strategic flexibility.

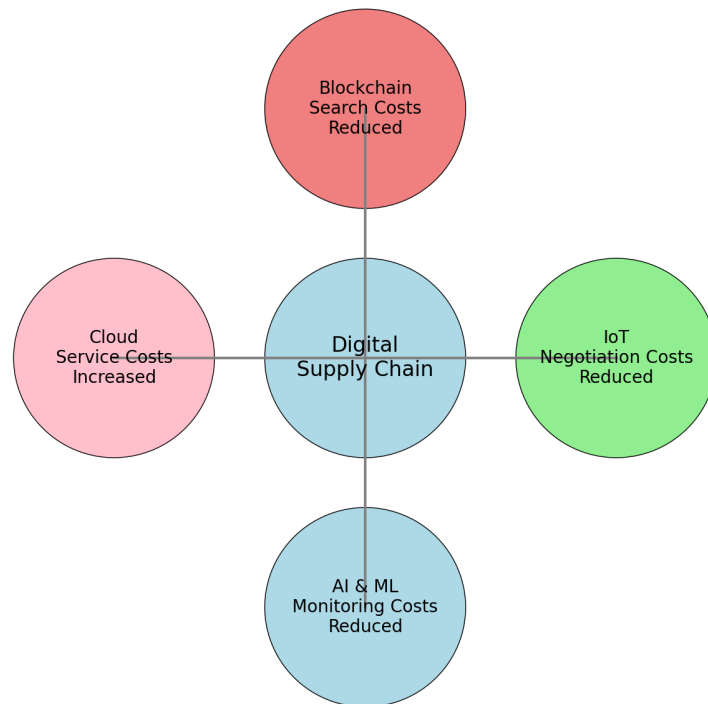


Figure 2. Digital supply chain and transaction costs.

5. Application of Transaction Cost Theory in Supply Chain Risk Management

5.1. Transaction Cost-Based Supply Chain Risk Identification Framework

Transaction cost theory provides a unique perspective for supply chain risk management, helping enterprises more comprehensively identify and assess potential risks. A risk identification framework based on transaction costs mainly focuses on risks arising from transaction characteristics that may lead to unexpectedly high transaction costs. For example, highly specific assets may bring risks of opportunistic behavior by suppliers; environmental uncertainty may lead to contract incompleteness risks; and information asymmetry may trigger adverse selection and moral hazard. The risk identification model proposed by Hoffmann *et al.* combines transaction cost factors with traditional supply chain risk types, providing enterprises with a more comprehensive risk assessment tool. In practice, enterprises can establish systematic risk identification checklists and assessment processes based on this framework, combined with their own industry characteristics and supply chain structures. This method not only helps identify explicit risks but also reveals

potential implicit risks, laying the foundation for comprehensive supply chain risk management.

5.2. Supply Chain Resilience Strategies from a Transaction Cost Perspective

In the face of uncertainty and potential risks, improving supply chain resilience has become a key goal for many enterprises. Transaction cost theory provides important guidance for designing and implementing supply chain resilience strategies. From a transaction cost perspective, supply chain resilience can be viewed as an investment to reduce overall long-term transaction costs. For example, multi-sourcing strategies may increase short-term transaction complexity and costs, but they can reduce supply disruption risks, potentially lowering overall transaction costs in the long run. Similarly, establishing strategic inventory increases holding costs but can reduce the high transaction costs caused by supply disruptions. Wieland and Wallenburg's research shows that relationship management and agility are two key factors in improving supply chain resilience, both closely related to reducing transaction costs. In practice, enterprises need to adopt differentiated resilience strategies based on the characteristics of different types of transactions. For critical, high-risk transactions, higher levels of redundancy and flexibility may be required, while for standardized, low-risk transactions, enterprises can rely more on market mechanisms.

5.3. Emerging Risks and Dynamic Transaction Cost Management

With the rapid changes in the business environment and the continuous emergence of new technologies, supply chains face a series of emerging risks, which also bring new dynamics to transaction costs. For example, cybersecurity risks may not only lead to direct economic losses but also increase future monitoring and protection costs for transactions. Geopolitical risks may suddenly change the feasibility of certain transactions, forcing enterprises to rebuild supply networks and bear high switching costs. Climate change risks may increase the uncertainty of long-term contracts, raising the risk premium for related transactions. Faced with these emerging risks, enterprises need to adopt more dynamic and forward-looking transaction cost management methods. The "Triple-A Supply Chain" concept (Agility, Adaptability, Alignment) proposed by Choi *et al.* provides a useful framework for addressing these challenges. In practice, enterprises can improve their responsiveness to emerging risks by establishing dynamic risk assessment mechanisms, enhancing supply chain visibility, and cultivating cross-functional and cross-organizational collaboration capabilities. Additionally, by utilizing big data analytics and artificial intelligence technologies, enterprises can better predict potential risks and take preventive measures before risks materialize, thereby reducing potential high transaction costs in the future.

As shown in **Figure 3**, emerging risks such as cybersecurity, geopolitics, climate change, and technological disruption have multifaceted impacts on transaction

costs in supply chains. These risks may not only directly increase certain types of transaction costs but also change the structure and operation of the entire supply chain. For example, cybersecurity risks may lead enterprises to increase the protection costs of information systems while also potentially affecting the degree of information sharing with suppliers, indirectly impacting other types of transaction costs. Geopolitical risks may force enterprises to reassess and reconstruct their global supply networks, involving not only direct switching costs but also potentially affecting long-term contract negotiation and execution costs.

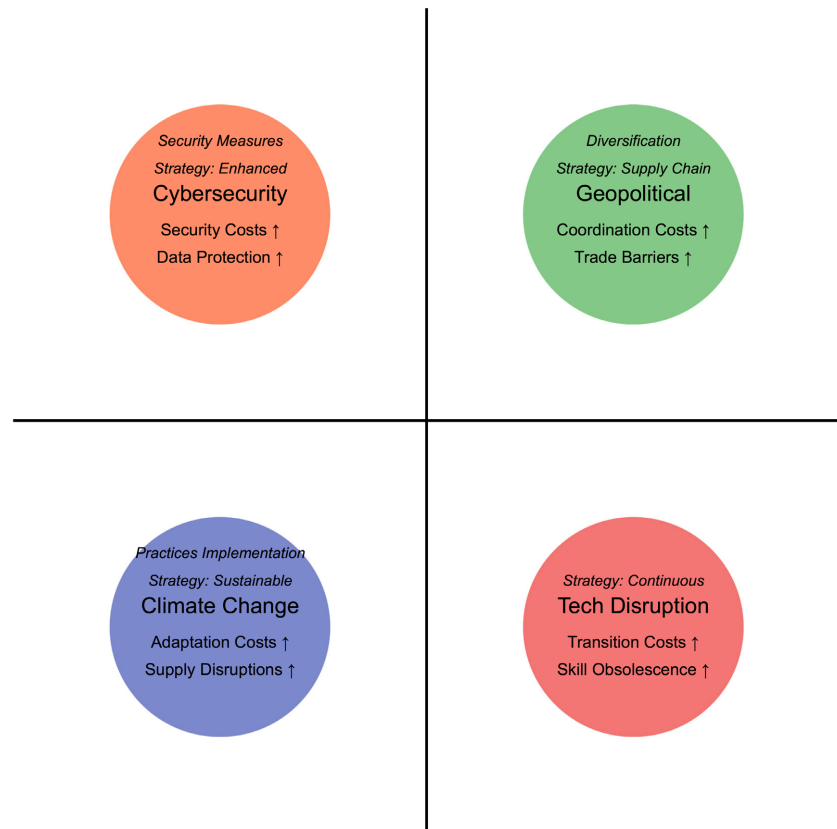


Figure 3. Emerging risks and transaction costs in supply chains.

6. Conclusion

Transaction cost theory provides a powerful and flexible analytical framework for understanding and optimizing supply chain management. Through the discussions in this paper, we can see the widespread application of this theory in key areas, such as supplier selection, supply chain integration, and risk management. As the business environment continues to change and new technologies rapidly develop, the application of transaction cost theory is also continuously evolving. Digital transformation provides new tools and methods for reducing traditional transaction costs while also bringing new cost considerations. The emergence of new risks requires enterprises to adopt more dynamic and forward-looking transaction cost management strategies. In the future, the application of transaction cost theory in supply

chain management will likely place greater emphasis on interdisciplinary integration, such as combining with behavioral economics and complex systems theory, to better explain and predict transaction behaviors in complex supply networks. Furthermore, with the deepening of sustainable development concepts, transaction cost analysis will also need to consider environmental and social factors more, providing theoretical support for establishing sustainable supply chains. Overall, transaction cost theory will continue to serve as an important theoretical foundation for supply chain management research and practice, driving enterprises to achieve more efficient, flexible, and sustainable supply chain management in the constantly changing global business environment.

Conflicts of Interest

The author declares no conflicts of interest regarding the publication of this paper.

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