

# Supply Chain Management: Research Progress, Core Challenges and Future Research Directions

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## ABSTRACT

Against the background of economic globalization and rapid advances in information technology, supply chain management has become a critical strategic approach for firms seeking to enhance competitiveness and achieve sustainable development. By integrating suppliers, manufacturers, distributors, retailers, and end customers, supply chain management aims to coordinate logistics, information flows, and capital flows in order to reduce costs, improve responsiveness, and better meet customer demand. Based on a review of relevant studies, this paper examines the conceptual evolution of supply chain management, its key operational domains, major challenges, and emerging development trends. The review indicates that inventory control, supplier management, logistics optimization, and information sharing remain central to supply chain performance, while e-commerce, green supply chain management, and digital transformation are reshaping supply chain practices. At the same time, enterprises continue to face challenges related to risk prevention, cost control, demand uncertainty, and market competition. Future research should further investigate the deep integration of emerging digital technologies, cross-industry collaboration mechanisms, and global supply chain resilience.

## KEYWORDS

Supply Chain Management; Inventory Control; Supplier Management; Logistics; Green Supply Chain.

## 1. INTRODUCTION

In the context of economic globalization and the rapid development of information technology, supply chain management has become a key strategy through which enterprises enhance competitiveness and pursue sustainable development. By integrating suppliers, manufacturers, distributors, retailers, and other participants, supply chain management seeks to achieve efficient coordination among logistics, information flows, and capital flows. Its ultimate objective is to satisfy customer demand, reduce operating costs, and improve firms' ability to respond to market changes. This paper synthesizes a range of studies on supply chain management and discusses its core domains, major challenges, and innovative strategies, thereby providing a reference for future research and managerial practice.

## 2. CORE CONCEPTS AND DEVELOPMENT BACKGROUND OF SUPPLY CHAIN MANAGEMENT

The concept of supply chain management has evolved substantially over time. In its early stage, supply chain management mainly referred to the integration of internal functions such as procurement, production, and distribution. It has since developed into a complex network-based management

system involving cross-enterprise and cross-industry coordination. Shen et al<sup>[4]</sup> define the supply chain as a value-chain system that includes raw material suppliers, manufacturers, distributors, retailers, and final users, emphasizing the optimization of all related processes through systematic management in order to reduce costs and create value.

This conceptual transformation is closely associated with changes in the market environment, including increasingly personalized and diversified customer demand, intensified market competition, and the enabling role of information technology. Under traditional management models, enterprises often encountered problems such as inventory accumulation and stockout risks caused by the bullwhip effect, poor interdepartmental coordination, and slow responses to market changes. Lan et al.<sup>[2]</sup> analyze the transition from vertical integration to horizontal integration in production organization and argue that supply chain management has become an inevitable response to increasingly complex market conditions. Its core tasks include dynamic alliance management, production resource optimization, demand information sharing, and agile production, particularly in the era of e-commerce.

### **3. KEY LINKS AND STRATEGIES IN SUPPLY CHAIN MANAGEMENT**

#### **3.1. Inventory Control**

Inventory control is a critical component of supply chain management because it directly affects enterprise costs and service levels. Hu<sup>[3]</sup> notes that, as supply chains develop, inventory control faces multiple challenges, including supplier instability, transportation risks, demand uncertainty, information asymmetry, and forecasting errors. These factors may lead to either inventory shortages or excessive inventory, thereby weakening supply chain stability and operational efficiency.

To address these challenges, several inventory management strategies have been proposed. Under vendor-managed inventory (VMI), upstream suppliers assume responsibility for inventory control and formulate replenishment plans based on downstream sales data. The cooperation between Walmart and Procter & Gamble is often cited as an example in which information sharing improved forecasting accuracy and supply chain efficiency. Jointly managed inventory (JMI) emphasizes joint decision-making among supply chain enterprises and shared risk-taking, which can reduce demand amplification and strengthen interfirm cooperation. Collaborative Planning, Forecasting and Replenishment (CPFR) further highlights collaborative forecasting, planning, and replenishment, enabling overall optimization of the supply chain through comprehensive cooperation.

#### **3.2. Supplier Management**

Supplier selection and management are essential to supply chain performance. Zhou<sup>[7]</sup> and Du and Sun<sup>[9]</sup> emphasize the importance of establishing a scientific supplier evaluation system. Such a system should be based on principles of scientific validity, objectivity, suitability, and flexibility, and should comprehensively consider factors such as price, quality, delivery punctuality, and cooperation capability.

In the supplier selection process, firms need to conduct market research, establish evaluation teams, screen potential suppliers, negotiate contractual terms, and build strategic partnerships. Using multiple suppliers can reduce the risk of supply disruption, encourage competition, and improve service quality, although it may also increase management costs. Strengthening supplier relationship management, using modern technologies for information-based supervision, classifying suppliers according to their strategic importance, and increasing supplier participation in projects can further improve supplier management and enhance supply chain coordination.

### **3.3. Logistics and Information Technology Support**

Logistics efficiency is a key indicator of supply chain competitiveness. Tian<sup>[1]</sup> argues that, under the e-commerce environment, technologies such as the Internet of Things, big data, and artificial intelligence have transformed logistics management by enabling real-time monitoring, intelligent decision-making, and route optimization. These technologies improve logistics efficiency and service quality while meeting customers' expectations for fast, punctual, and flexible delivery.

Information technology also plays a fundamental role in supply chain management. Han et al.<sup>[6]</sup> suggest that information sharing can enhance supply chain collaboration and operational efficiency while helping prevent risks. Through internet-based technologies, enterprises can overcome organizational boundaries and achieve real-time information sharing and integration across supply chain links. For example, web-based supply chain information-sharing systems can integrate enterprise resource planning systems and make inventory, order, planning, and transportation information more transparent, thereby supporting more effective supply chain decision-making.

## **4. INNOVATION AND DEVELOPMENT TRENDS IN SUPPLY CHAIN MANAGEMENT**

### **4.1. E-commerce-driven Innovation**

The rise of e-commerce has profoundly changed the structure and operation of supply chain management. Enterprises can use e-commerce platforms to expand markets and optimize sales channels, but these platforms also impose higher requirements on logistics and supply chain management. Tian<sup>[1]</sup> shows that e-commerce encourages enterprises to innovate logistics technologies, including intelligent warehouse management, big-data analysis, and artificial intelligence algorithms for process optimization. Applications such as intelligent route planning and appointment-based delivery systems can satisfy diversified customer needs, improve user experience, and strengthen enterprise competitiveness.

E-commerce also promotes the digital and intelligent transformation of supply chains. By enabling closer coordination and real-time information exchange across supply chain links, e-commerce has contributed to the development of new models such as supply chain finance and virtual supply chains, creating new sources of value for enterprises.

### **4.2. Green Supply Chain Management**

With increasing environmental awareness and stricter regulatory standards, green supply chain management has become an important pathway for sustainable development. Wu et al.<sup>[8]</sup> argue that enterprises should integrate environmental considerations into the entire supply chain management process, including product design, material selection, and supply process optimization. At the product design stage, firms can use life-cycle analysis to assess environmental impact. In material selection, they should avoid hazardous materials and promote recyclable alternatives. During the supply process, firms can evaluate suppliers' environmental performance and optimize logistics to reduce pollution.

Green supply chain management not only helps enterprises reduce environmental risks and comply with regulations but also improves corporate image and market competitiveness. It therefore represents an important direction for future supply chain development, supporting the simultaneous achievement of economic and environmental benefits.

### **4.3. Digital and Intelligent Transformation**

The development of the digital economy has created new opportunities and challenges for supply chain management. Taking agricultural supply chains as an example, Lü<sup>[10]</sup> explains how digital technologies can improve supply chain efficiency, optimize resource allocation, and enhance information transparency. Establishing standardized quality systems, smart logistics systems, information-sharing platforms, and big-data-driven production–marketing matching platforms can promote the digital transformation of agricultural supply chains.

In manufacturing, services, and other sectors, big data, artificial intelligence, blockchain, and related technologies are increasingly used in demand forecasting, inventory management, logistics optimization, and supply chain finance. These applications are pushing supply chains toward intelligent and automated operations, improving resilience and responsiveness in the face of uncertainty and rapid market change.

## **5. CHALLENGES AND COUNTERMEASURES IN SUPPLY CHAIN MANAGEMENT**

### **5.1. Supply Chain Risk Prevention**

Supply chains are exposed to multiple risks related to supply, production, demand, and information. Han et al.<sup>[6]</sup> analyze risk patterns such as shortages and the cascading effects caused by false demand, and they argue that information sharing, the establishment of a leading role for core enterprises, supply chain flexibility, supply chain simplification, and reasonable inventory control can help prevent risk.

Enterprises should establish risk early-warning mechanisms, strengthen supplier evaluation and monitoring, optimize supply chain network structures, and improve their ability to respond to emergencies. Measures such as building strategic partnerships, increasing reserves of key resources, and implementing contingency plans can reduce the impact of disruptions and ensure stable supply chain operations.

### **5.2. Cost Control**

Cost control in supply chain management involves multiple processes and organizational levels. Chen et al.<sup>[5]</sup> suggest that enterprises should adopt a holistic supply chain perspective and consider the total cost of raw material procurement, manufacturing, transportation, distribution, and sales. Strategies such as multi-echelon inventory optimization, shifting cost centers downstream, synchronization strategies, and activity-based costing can reduce the cost of bringing products to market.

In practice, however, cost control remains difficult because of conflicts among cost objectives across different supply chain links, cost increases caused by information asymmetry, and the impact of demand uncertainty. Enterprises therefore need to improve information-based cost management, optimize accounting methods, and reduce costs through supply chain collaboration.

### **5.3. Market Demand and Competitive Pressure**

Personalized, diversified, and rapidly changing consumer demand poses significant challenges to supply chain management. Enterprises must capture market information in a timely manner, adjust production and distribution plans, and respond quickly to customer needs. At the same time, intensified market competition requires firms to improve supply chain efficiency, reduce costs, and enhance service quality in order to obtain competitive advantages.

To meet these challenges, enterprises should strengthen market research and demand analysis, build agile supply chain systems, and collaborate closely with suppliers and partners. Such cooperation can enhance supply chain flexibility and adaptability, enabling firms to satisfy market demand and compete more effectively.

## 6. CONCLUSION

In summary, supply chain management occupies a central position in modern enterprise operations. Its key components—including inventory control, supplier management, logistics support, and information technology—are interrelated and mutually reinforcing. Driven by e-commerce, environmental sustainability, and the digital economy, supply chain management continues to innovate and evolve. At the same time, enterprises face challenges associated with risk, cost, and market competition.

To improve supply chain performance, firms should actively adopt relevant technologies, strengthen management innovation, optimize supply chain structures and processes, and enhance coordination and risk-response capabilities. Future research may further focus on the deep application of emerging technologies in supply chain management, cross-industry collaboration mechanisms, and the resilience of global supply chains, thereby providing stronger theoretical and practical support for supply chain management.

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