

A Comparative Case Study on the Intelligent Supply Chain Transformation Paths of Typical High-tech Enterprises

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Abstract. This paper aims to explore the current status and emerging trends of corporate supply chain management within the context of intelligent supply chains by conducting a comparative analysis of the supply chain systems employed by three typical high-tech enterprises, namely Apple, Xiaomi, and Huawei. Adopting a case analysis method, the study systematically examines the theoretical foundations of intelligent supply chains while providing a detailed analysis of the distinctive features and strategic approaches that characterize the supply chain management practices of these three corporations. The findings indicate that Apple has significantly enhanced production efficiency and reduced inventory by implementing a global outsourcing strategy and building an agile and efficient supply chain network. Huawei has remarkably improved operational efficiency and market competitiveness by focusing on digital and intelligent upgrades and constructing a high-end supply chain system integrating intelligent procurement, manufacturing and logistics. Xiaomi has achieved rapid market response and cost control by adopting a hybrid and agile collaborative supply chain model based on ecological cooperation and digital empowerment. The study concluded that the evolution of intelligent supply chains presents both unprecedented opportunities and challenges for corporate supply chain management.

Keywords: Intelligent Supply Chain, Huawei, Xiaomi, Apple, Digital Transformation

1. Introduction

Against the backdrop of accelerating global economic integration and rapid technological advancement, intelligent supply chains have emerged as a critical focus for both academia and industry, primarily because they are perceived as a pivotal means to enhance corporate competitiveness. This research is situated within this context and aims to conduct an in-depth exploration of the latest progress in intelligent supply chains, which involves the integration of cutting-edge technologies such as the Internet of Things, big data analytics, and artificial intelligence to achieve a high degree of automation and intellectualization across all supply chain stages, thereby improving efficiency, reducing costs, and strengthening market responsiveness.

The study uses comparative case analysis of three leading high-tech enterprises. It aims to explore the systematic comparison of the notable disparities in these three companies' implementation strategies, technological pathways, and ultimate outcomes. The significance of this research lies in its potential to foster a deeper understanding of the current state and underlying

dynamics of intelligent supply chain development, while simultaneously providing practical, actionable guidance for businesses to identify best practices, mitigate potential risks, and promote the healthy development of this critical domain.

2. Literature review

2.1. Theoretical foundations of intelligent supply chains

An intelligent supply chain is a modern supply chain management paradigm that leverages advanced information technologies such as the Internet of Things (IoT), big data analytics, and artificial intelligence to achieve highly efficient coordination and intelligent management across all stages, thereby providing enterprises with a new competitive advantage [1,2]. Its defining characteristics include comprehensive information sharing and connectivity, end-to-end process visibility and transparency, and capabilities for simulation and early-warning that contribute to low operational risk [2]. The construction of such a system emphasizes the integrated application of technology, strategic system design, and the establishment of risk early-warning mechanisms [3].

2.2. Related research on corporate intelligent transformation

Scholars have investigated the intelligent transformation paths of individual enterprises, providing valuable case studies. For instance, research on Xiaomi has explored the digital technology-empowered supply chain finance model, indicating that establishing a corresponding platform can alleviate operational cost pressures for developing enterprises and inject new vitality into their growth [3]. Studies on Huawei have analyzed its successful transformation into a proactive intelligent system integrating smart procurement, manufacturing, factories, logistics, and distribution, summarizing key drivers and challenges in this process [4]. Similarly, Apple's supply chain has been extensively studied, with research highlighting its global layout, outsourcing strategy, and risk management framework as key factors for its efficiency and resilience [5,6].

However, most existing research focuses on the transformation journey of a single enterprise. A comparative analysis that systematically examines the paths, strategies, and outcomes across multiple high-tech enterprises, such as Apple, Xiaomi, and Huawei, remains a gap in the current literature.

3. A comparative analysis of global strategic models for supply chain transformation

3.1. Apple: global integrated outsourcing control model

Apple has built a global integrated outsourcing control model by streamlining its product line, focusing on core high-value links such as R&D and brand marketing, and outsourcing most manufacturing links to professional partners. Its main strategies include optimizing costs through global layout—concentrating over 70% of its manufacturing suppliers in Asia (mainly China, Vietnam, and India) to leverage regional labor and industrial chain advantages, and achieving strong control over the supply chain through massive order volumes. According to the report, Apple's annual order volume for chips and screens supplements often accounts for 30%-50% of the production capacity of key suppliers [5]. It can grasp the priority of supply and pricing initiatives. With a unified global supply chain coordination platform, it realizes real-time information sharing with suppliers. Reports show the path has reduced inventory turnover to approximately 10 days, significantly lower than the industry average of 35 days [5].

3.2. Huawei: global layout with independent control model

Huawei adopts a global layout model centered on independent control. While expanding its supply chain internationally, it insists on mastering core technologies and key links. On the one hand, it has established R&D and production bases in over 170 countries and regions around the world, forming a global supply chain network covering Europe, Asia, and Africa. On the other hand, it has strengthened the independent research and development and supply capacity of core components. The self-developed Kirin chips and the HarmonyOS operating system have assisted in reducing dependence on a single regional supply chain [7].

In terms of supplier management, Huawei has formulated strict global supplier selection standards. It controls the number of global core suppliers at around 500, ensuring the stability and reliability of the supply chain while realizing global resource allocation [7].

3.3. Xiaomi: ecological collaborative agile global model

Xiaomi has built an ecologically collaborative agile global model by relying on a lean internal structure and an extensive cooperative supplier ecosystem. Unlike Apple's strong control and Huawei's heavy investment in independent construction, Xiaomi focuses on strategic cooperation with global suppliers to achieve rapid scale expansion. It has established cooperative relations with more than 200 core suppliers around the world, covering components such as screens, batteries, and chips. Through the digital collaborative platform, it realizes real-time synchronization of market demand and supply chain information, enabling rapid adjustment of production plans according to regional market changes. For example, in emerging markets such as Southeast Asia, Xiaomi cooperates with local suppliers to build localized supply chains, reducing logistics costs by 15%-20% and shortening delivery cycles by 25% [8-9].

4. Comparative implementation paths and risk management in intelligent transformation

4.1. Digital transformation paths

4.1.1. Apple: digital collaborative platform-driven path

Apple's digital transformation focuses on building a global digital collaborative platform to connect upstream and downstream enterprises in the supply chain. The platform integrates functions such as order management, production scheduling, logistics tracking, and quality control, realizing end-to-end digital visualization of the supply chain. For example, through the platform, Apple can monitor the production progress of suppliers in real time, and adjust production plans according to changes in market demand within 24 hours. Meanwhile, it applies big data analysis technology to predict market demand, with a demand prediction accuracy rate of over 90%, which provides a basis for rational allocation of supply chain resources and effectively reduces inventory backlogs [6].

4.1.2. Huawei: systematic digital-intelligent integration path

Huawei's digital transformation is the most thorough and systematic. It has successfully built a proactive intelligent supply chain system integrating intelligent procurement, intelligent manufacturing, intelligent factories, intelligent logistics, and intelligent distribution. It fully applies self-developed IoT technology, with more than 100,000 IoT devices deployed in global factories and logistics nodes. This enables real-time perception and interconnection of supply chain elements. In

intelligent procurement, it uses AI algorithms to automatically match suppliers and optimize procurement plans, reducing procurement costs by 12% and shortening procurement cycles by 30%. In intelligent logistics, it builds an intelligent warehousing and transportation system, realizing automatic sorting and intelligent path planning of goods, with a logistics efficiency improvement of over 40% [4].

4.1.3. Xiaomi: lightweight digital empowerment path

Xiaomi adopts a lightweight digital transformation path, focusing on digital empowerment of the ecosystem. It has built a digital supply chain finance platform and a collaborative operation platform to empower upstream and downstream small and medium-sized suppliers. The supply chain finance platform provides financing services for suppliers based on transaction data, solving the capital turnover problem of more than 80% of small and medium-sized cooperative enterprises. The collaborative operation platform achieves real-time sharing of production, inventory, and sales data between Xiaomi and suppliers, enabling suppliers to adjust production in a timely manner according to sales changes. In addition, Xiaomi applies digital technology to product quality inspection, using machine vision technology to detect product defects, with a detection accuracy of 99.5%, improving product quality while reducing manual inspection costs [9].

4.2. Risk management

4.2.1. Apple: risk control based on strong supplier control and diversification

Apple's risk management focuses on strong control over suppliers and a diversified layout to avoid single-point risks. It signs long-term cooperation agreements with core suppliers and requires suppliers to reserve 20%-30% of spare production capacity to address sudden demand changes. Meanwhile, it adopts a diversified layout for key components, such as screen suppliers covering Samsung, LG, and BOE, and chip suppliers including TSMC and Intel, reducing the impact of supply disruptions caused by regional or enterprise problems. In addition, Apple has established a special supply chain risk early warning team, which monitors global political, economic, and natural disaster risks in real time and develops alternative supply plans [10].

4.2.2. Huawei: risk resistance based on independent innovation and multi-regional layout

Huawei's risk management relies on independent innovation and a multi-regional supply chain layout to enhance risk resistance. By increasing R&D investment (annual R&D investment accounts for more than 15% of annual revenue), it breaks through technical barriers in core components and reduces the risk of technical blockades. In terms of supply chain layout, it has built multiple regional supply chains in Asia, Europe, and the Americas. When a regional supply chain is disrupted, it can quickly switch to other regional supply chains. For example, during regional supply chain tensions, Huawei relied on its European supply chain to ensure the normal supply of key components, maintaining a supply stability rate of over 95% [11].

4.2.3. Xiaomi: risk sharing based on ecological collaboration

Xiaomi's risk management adopts a risk sharing model based on ecological collaboration. It signs risk sharing agreements with core suppliers, clarifying the division of responsibilities and compensation mechanisms for supply chain risks. Through the digital collaborative platform, it

shares market demand and risk early warning information with suppliers, enabling suppliers to make risk preparations in advance. Meanwhile, Xiaomi controls the proportion of orders from a single supplier, with the maximum order volume for a single supplier not exceeding 20% of its total orders, avoiding excessive dependence on individual suppliers. In addition, it has established a flexible logistics network, cooperating with multiple international logistics companies to ensure the smooth transportation of goods under different scenarios [12].

5. Discussion

5.1. Comparative synthesis and theoretical insights

By comparing and analyzing the three core dimensions of the global strategic model, digital transformation path, and risk management, it can be found that they have formed three typical paradigms of intelligent supply chain transformation. The deep driving force behind the differences in their models stems from the synergy of the core strategic positioning of the enterprises, their resource endowments, and the market environment.

Apple employs a globally integrated outsourcing control model. Essentially, it is driven by strategic focus and the leverage effect of resources. By focusing on core high-value links such as research and development and brand, and outsourcing non-core manufacturing links, it achieves cost optimization and efficient supply chain operation. As a technology-intensive company, Huawei emphasizes self-reliance and technological leadership. It sustains substantial R&D investment to master core technologies such as chips and operating systems. This forms its technology-driven autonomous control model. Xiaomi adopts a cost-effectiveness model with a focus on cost-effectiveness and partnership synergy. By empowering upstream and downstream SMEs with lightweight digital technologies, it achieves rapid market response and cost control. Its driving force stems from the adaptation to the rapid iterative characteristics of the consumer electronics market and the insufficient resource integration capabilities of small and medium-sized enterprises.

The research reveals that global layout, risk management, collaborative configuration, digital transformation, and intelligent upgrading are the key dimensions of supply chain management. Although the paths of the three models are different, their transformation practices collectively demonstrated the effectiveness of the core framework of "technology empowerment, strategic adaptation, and risk control".

5.2. Challenges

At present, the transformation of enterprise intelligent supply chains still faces multiple challenges. The integration of technologies such as the Internet of Things and big data with various links of the supply chain is not fully sufficient, resulting in an unmet expected effect on efficiency improvement. Second, the difficulty of ecological collaboration is significant. The digitalization levels of upstream and downstream enterprises vary, and the barriers to information sharing and the contradiction of interest distribution have constrained the overall collaborative efficiency of the supply chain. Thirdly, the risk prevention and control system is not complete. What's more, the transformation difficulties of small and medium-sized enterprises exist. Insufficient funds, insufficient technical reserves, and a lack of professional talents prevent SMEs from replicating leading enterprises' transformation paths.

5.3. Practical implications

To address these challenges, this study proposes the following management insights and policy recommendations. Leading enterprises should continuously promote the deep application of emerging technologies such as blockchain and AI in supply chain visibility, intelligent prediction, risk warning, and other areas. For SMEs, they should focus on developing specialized competencies within specific segments of the chain. Government policy also plays a crucial enabling role. Increasing investment in core technologies for the intelligent supply chain. Providing financial subsidies, tax incentives, talent training, and other measures to lower the barriers for small and medium-sized enterprises.

6. Conclusion

This paper explores three typical high-tech enterprises, Apple, Huawei, and Xiaomi. It systematically explores the differentiated paths of intelligent supply chain transformation from three dimensions: global strategic model, digital transformation path, and risk management. The study finds that Apple prefers a global integrated outsourcing control model. However, Huawei employs a technology-driven autonomous control model. Xiaomi's choice of an ecological collaborative agile model. The study points out that enterprises respectively adapt to the strategic positioning, resource endowment, and market environment of the enterprises. This confirms that the core logic of intelligent supply chain transformation is the combination of technology empowerment, strategic adaptation, and risk prevention. Based on these findings, this paper proposes that enterprises should deepen the integration of technology and supply chain and build an ecological collaborative mechanism.

However, this study focuses on systematically high-tech enterprises, overlooking small and medium-sized enterprises. It also neglects the resource optimization, allocation, and market adaptation strategies in the intelligent supply chain construction of enterprises of different scales.

Future research should therefore focus on the integration path of intelligent supply chains for small and medium-sized enterprises.

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