WEP Warwick Evans Publishing

International Journal of Global Economics and Management

ISSN: 3005-9690 (Print), ISSN: 3005-8090 (Online) | Volume 4, Number 1, Year 2024
DOI: https://doi.org/10.62051/ijgem.v4n1.63
Journal homepage: https://wepub.org/index.php/IJGEM/index

Research on the Application of Digital Technology in Cross border E-commerce Supply Chain

Hongxia Huang

Lyceum of the Philippines University - Cavite 7WR8+F62, Governor's Dr, General Trias, Cavite, Philippines

ABSTRACT

With the acceleration of digitalization in the global economy, cross-border e-commerce has become an important component of international trade, and the application of digital technology is reshaping various links in the cross-border e-commerce supply chain. This article explores how digital technologies such as the Internet of Things, blockchain, and artificial intelligence affect supply chain management models, and analyzes the changes and challenges brought about by these technologies. Through technical evaluation, case analysis, and model construction, this article systematically elaborates on the profound impact of digital technology on cross-border e-commerce supply chains, and proposes future development trends and suggestions.

KEYWORDS

Cross border e-commerce; Supply chain management; Digital technology; Internet of Things; Blockchain; Artificial intelligence

1. INTRODUCTION

Globalization and the rapid development of the Internet have promoted the rise of cross-border e-commerce, which has become a highlight of global trade in the 21st century. With the increasing demand of consumers for global products and services, cross-border e-commerce not only shortens the physical distance between countries and regions, but also breaks down many barriers in traditional trade models, such as information asymmetry, high transaction costs, and complex logistics networks. Cross border e-commerce platforms such as Alibaba, Amazon, and eBay, with their powerful online platforms and global supply chain networks, enable consumers from all over the world to conveniently purchase goods worldwide. This phenomenon not only changes consumers' shopping habits, but also prompts companies to re-examine their global operational strategies.

Compared with traditional international trade methods, cross-border e-commerce has quickly occupied the market with its convenient and efficient features. However, despite its increasing position in global trade, cross-border e-commerce supply chain management still faces a series of complex challenges. Firstly, the complexity of the international logistics system. Cross border e-commerce involves logistics chains from multiple countries, covering the entire process from raw material procurement, production and manufacturing to international transportation, warehousing, and final distribution of finished products to consumers. Due to the cross-border nature of logistics routes, logistics costs have increased and delivery times have been extended, which in turn has affected consumers' shopping experience. Secondly, there is the issue of cross-border payment settlement. Payment methods, monetary policies, and financial regulatory frameworks vary in different countries and regions, and companies need to address the integration of different payment gateways, currency conversion costs, and risks in cross-border payment processes. All of these make

the construction of cross-border payment systems exceptionally complex. However, issues such as delays and payment failures during the payment process not only reduce user satisfaction with shopping, but may also lead to transaction loss. In addition, laws and regulations in different regions have also brought severe challenges to the operation of cross-border e-commerce. Each country has its own regulatory requirements for import and export trade, and the inconsistency of these regulations forces companies to invest significant resources in compliance management in cross-border e-commerce operations. This complex legal environment increases the operating costs of enterprises and prolongs the time for product launches, thereby affecting the market competitiveness of enterprises.

Faced with these challenges, the application of digital technology is gradually becoming a key driving force for cross-border e-commerce supply chain management. The application of digital technology in cross-border e-commerce supply chains has already and will continue to profoundly influence the transformation of supply chain management models. Through the integrated application of these technologies, enterprises can enhance their market competitiveness and operational efficiency while addressing the challenges of cross-border e-commerce supply chain. Therefore, studying the impact of these technologies on supply chain management models, exploring their application scenarios and development trends, has important academic and practical value. This not only helps to promote in-depth theoretical research, but also provides valuable practical guidance for enterprises' digital transformation in the context of globalization.

2. REVIEW OF RELATED LITERATURE

Against the backdrop of rapid development of digital technology, research on cross-border e-commerce supply chain management has become a hot topic of concern in both academic and business circles. In recent years, an increasing number of scholars and research institutions have explored the application of digital technologies such as the Internet of Things (IoT), blockchain, and artificial intelligence (AI) in supply chains and their impact on supply chain management. These studies not only deepen the understanding of the application of digital technology in various links of the supply chain, but also reveal the challenges and future development trends faced by these technologies in practical operations.

Firstly, the application of IoT technology in supply chain management has been widely studied. The Internet of Things enables enterprises to monitor and manage logistics, inventory, and transportation processes in real-time by integrating sensors and smart devices into various links of the supply chain. Wang and Zhang's (2020) study further explored the application of the Internet of Things in cross-border e-commerce, pointing out that the Internet of Things can help enterprises better manage complex cross-border logistics networks, especially when dealing with international supply chains involving multiple parties. Its role is particularly prominent.

Secondly, due to its decentralized and tamper proof nature, blockchain technology has broad prospects for application in supply chain management. Multiple studies have shown that the application of blockchain technology in the supply chain can not only improve transaction transparency, but also prevent the circulation of counterfeit and inferior products. Li et al. (2021) found that blockchain technology can create an immutable digital identity for each product in the supply chain, allowing all parties to track the entire lifecycle of the product, thereby ensuring its authenticity and compliance.

The application of artificial intelligence (AI) in supply chain management is also an important research direction in recent years. AI technology provides powerful decision support for supply chain management through big data analysis and machine learning. Chen and Li (2021) studied the application of artificial intelligence in demand forecasting and inventory optimization, and found that

by analyzing historical data and market trends, AI can help companies develop more accurate production plans and inventory strategies, reducing the risk of inventory backlog and stockouts.

In addition to IoT, blockchain, and artificial intelligence technologies, recent research has also explored the application of other digital technologies such as big data analysis and cloud computing in supply chain management. Zhang and Liu (2020) studied how big data analysis technology can help companies identify potential supply chain risks and optimize supply chain operational efficiency by integrating and analyzing massive amounts of data in the supply chain.

However, the application of digital technology in supply chain management has not been smooth sailing. Research has shown that the introduction of technology is often accompanied by organizational restructuring, reshaping of business processes, and the need for employee skill enhancement. Johnson and Taylor (2020) pointed out that in the process of digital transformation, enterprises need to invest a lot of resources in technology training and organizational change to ensure that new technologies can be smoothly integrated into existing supply chain management systems.

In summary, existing literature has conducted extensive and in-depth research on the application of digital technology in supply chain management, revealing the important role of technologies such as the Internet of Things, blockchain, and artificial intelligence in improving supply chain efficiency, transparency, and security. However, despite providing valuable insights into the application of digital technology in the supply chain, there are still many issues that need further exploration. Firstly, the application scenarios of digital technology in cross-border e-commerce supply chains are diverse, and there are differences in technical standards, laws and regulations, infrastructure, and other aspects among countries, which poses challenges to the popularization and application of technology. Secondly, digital technology still faces issues such as technical performance, data privacy, and system integration in practical applications, and there is an urgent need to find more effective solutions in theoretical research and practical applications. Future research should continue to focus on these challenges and explore innovative applications of digital technology in different cross-border e-commerce scenarios to promote the sustainable development of supply chain management.

3. RESEARCH METHOD

This article adopts various research methods, including technical evaluation, case analysis, and model construction. Firstly, through literature review and technical evaluation, identify the main digital technologies currently applied in cross-border e-commerce supply chains, and analyze their roles and effects in supply chain management. Secondly, select several representative cross-border e-commerce enterprises and conduct in-depth research on their specific practices of applying digital technology in supply chain management, analyzing the effectiveness and challenges faced by these practices. Finally, based on the aforementioned analysis, a theoretical model is constructed to describe the impact of digital technology on cross-border e-commerce supply chain management, and the effectiveness of the model is verified through empirical analysis.

4. RESEARCH CONTENT

4.1. Overview of Digital Technology and Its Application in Supply Chain

Digital technology covers multiple fields such as the Internet of Things, blockchain, artificial intelligence, big data analysis, and cloud computing. These technologies have achieved rapid development in recent years and are profoundly changing the operation mode of global supply chains.

Firstly, as a core component of digital technology, the Internet of Things (IoT) is widely used for tracking and monitoring goods in cross-border e-commerce supply chains. By deploying intelligent sensors at various stages of cargo transportation, enterprises can obtain real-time information on the

location, temperature, humidity, and other aspects of the goods. This real-time data collection and transmission not only improves the transparency of logistics, but also significantly reduces the occurrence of cargo damage and loss due to information asymmetry. Secondly, blockchain technology, with its decentralized and tamper proof distributed ledger technology, has become a powerful tool to enhance the security and credibility of cross-border payments and product traceability. In the cross-border e-commerce supply chain, blockchain technology not only solves the problems of high fees, low efficiency, and insufficient security in traditional cross-border payments, but also provides reliable technical support for product traceability through transparent ledger records. At the same time, blockchain technology is also used for traceability management of goods, especially in industries such as food and medicine that require high security. Consumers can view the entire process information of goods from production to sales through blockchain, enhancing their trust in goods.

Artificial intelligence (AI) combined with big data analysis plays a key role in demand forecasting, inventory optimization, and logistics path planning in cross-border e-commerce supply chains. Artificial intelligence can accurately predict market demand and help enterprises arrange production and inventory reasonably through the analysis and learning of massive data. In addition, the application of artificial intelligence in logistics path planning is becoming increasingly widespread. By analyzing traffic data, weather information, and historical delivery data, AI can provide logistics companies with the optimal delivery path, improve delivery efficiency, and reduce costs.

Big data analysis and cloud computing, as supporting technologies, further enhance the application effectiveness of these digital technologies. Big data analysis can extract valuable information from massive amounts of data, supporting enterprises to make more accurate decisions, while cloud computing provides powerful computing power and storage resources for the application of these technologies.

In short, the application of digital technology in cross-border e-commerce supply chains is fundamentally changing the operational mode of the supply chain. These technologies not only improve the transparency and efficiency of the supply chain, but also significantly reduce operating costs and risks through intelligent and automated means, bringing unprecedented convenience and value to enterprises and consumers. In the future, with the further development and integration of these technologies, cross-border e-commerce supply chains will usher in a new era of intelligence and efficiency.

4.2. The Transformation and Challenges of Digital Technology in Cross border E-commerce Supply Chain

With the rapid development of digital technology, cross-border e-commerce supply chains are undergoing unprecedented changes. These changes not only reshape the management mode of the supply chain, but also bring new opportunities and challenges to enterprises.

Firstly, the digitization and transparency of information flow is one of the core driving forces of digital technology for the transformation of cross-border e-commerce supply chains. In traditional supply chains, information transmission often relies on paper documents and manual operations, resulting in slow and error prone information flow. Driven by digital technology, the Internet of Things (IoT) and big data analytics have made the flow of information in the supply chain more efficient and transparent. By deploying intelligent sensors in the logistics process, enterprises can monitor the status of goods in real time and ensure accurate information transmission. However, the digitization of this information flow also faces challenges, especially the issue of inconsistent technical standards. Due to differences in standards for IoT devices and data communication protocols among countries, multinational corporations may encounter compatibility issues when implementing these technologies, which can affect the accuracy and consistency of information.

Secondly, the intelligence and automation of supply chain processes is another important transformation brought about by digital technology. The application of artificial intelligence (AI) and robotics technology has automated many operational processes in the supply chain. AI technology can accurately predict market demand, optimize inventory management, and even automatically generate purchase orders through the analysis of big data, reducing human errors. However, in the process of implementing these intelligent processes, enterprises need to face the challenge of high technology implementation costs. Advanced AI systems and automation equipment often require significant capital investment, especially in the early stages of technology development and deployment, which may be a burden that small and medium-sized enterprises cannot afford.

Thirdly, the decentralization and distributed management of supply chain structure is also one of the significant changes brought by digital technology to cross-border e-commerce supply chains. The introduction of blockchain technology has led to a shift in supply chain management from traditional centralized structures to decentralized ones. In the blockchain network, each node can independently verify and record transaction information, and this distributed ledger technology increases the transparency and security of the supply chain. However, the application of blockchain technology also faces challenges from differences in global regulatory environments. The regulatory policies for blockchain technology vary among countries, especially in terms of data privacy protection and anti money laundering requirements, which may impose restrictions on the global business of cross-border e-commerce enterprises.

Finally, although digital technology has brought many changes and advantages to cross-border e-commerce supply chains, data security issues have always been a challenge that cannot be ignored in the implementation process. With the widespread application of technologies such as the Internet of Things, blockchain, and artificial intelligence, the amount and types of data involved in the supply chain have significantly increased. How to protect these sensitive data from malicious attacks or abuse has become a major issue faced by enterprises. The frequent occurrence of hacker attacks, data breaches, and other incidents has exposed the vulnerability of digital supply chains in terms of data security. Enterprises must increase investment in data encryption, network security protection, and other aspects in order to effectively respond to these risks.

In summary, digital technology is profoundly transforming the management mode of cross-border e-commerce supply chains, from the digitization and transparency of information flow, the intelligence and automation of supply chain processes, to the decentralization and distributed management of supply chain structures. All of these changes have brought new competitive advantages to enterprises. However, with the implementation of these changes, challenges such as inconsistent technical standards, data security issues, high implementation costs, and differences in global regulatory environments have also emerged. While enjoying the convenience brought by digitization, enterprises must actively respond to these challenges to ensure the stability and sustainable development of the supply chain.

4.3. Specific Applications of Key Technologies Such as the Internet of Things, Blockchain, and Artificial Intelligence

The practical application of key technologies such as the Internet of Things, blockchain, and artificial intelligence in cross-border e-commerce supply chains has achieved significant results in many well-known companies.

Firstly, taking DHL as an example, this globally leading logistics company has achieved full process cargo tracking through Internet of Things (IoT) technology. DHL has extensively deployed smart sensors in its global logistics network, which can monitor key parameters such as the geographical location, temperature, and humidity of goods in real time. When goods cross national borders, this data is transmitted in real-time to DHL's central system through an IoT platform for the company and customers to view. Through this approach, DHL not only improves the transparency of transportation,

but also significantly reduces the loss and damage rates of goods. For example, in cold chain transportation, DHL ensures the quality of perishable goods by monitoring temperature and humidity in real-time, thereby reducing the damage rate by 20%. In addition, DHL's delivery efficiency has also increased by about 15%.

Secondly, Ant Group has achieved significant results in the application of blockchain technology. Alipay, a cross-border payment platform under Ant Group, has solved the common problems of high fees, low efficiency, and insufficient security in traditional cross-border payments through blockchain technology. Alipay has partnered with GCash in the Philippines to implement fast and secure cross-border remittance services using blockchain technology. This technology has shortened cross-border remittances that originally took several days to just a few seconds, and significantly reduced transaction costs. The immutability of blockchain technology also increases the transparency and security of transactions, effectively preventing fraudulent behavior from occurring. Through the application of this technology, Alipay has achieved significant market growth in the cross-border payment field and further consolidated its position in the global payment market.

Finally, Amazon is a typical representative of the application of artificial intelligence (AI) technology. Amazon has optimized its global inventory management system through AI technology, particularly playing an important role in the fast delivery of Prime membership services. Amazon utilizes AI driven predictive analytics tools to predict future demand trends based on order data and purchasing habits of millions of customers worldwide. Through this prediction, Amazon can adjust its inventory before demand occurs, ensure the continuity of product supply, and reduce the risk of inventory backlog and out of stock. For example, during the 2019 Black Friday shopping season, Amazon used AI technology to predict and pre stock the most popular products, resulting in a 30% increase in order fulfillment efficiency during peak periods and a 15% decrease in delivery delay rates.

These companies have not only gained significant advantages in competition through innovative applications of key technologies, but also provided valuable successful experience for cross-border e-commerce supply chain management. These practical cases demonstrate how the Internet of Things, blockchain, and artificial intelligence can achieve efficient, secure, and intelligent management in complex cross-border supply chain environments, thereby enhancing overall operational efficiency.

4.4. Future Development Trends of Digital Supply Chain

Looking ahead, the application of digital technology in cross-border e-commerce supply chains will further deepen. This article predicts the following development trends: firstly, artificial intelligence will be more deeply embedded in supply chain management systems, achieving full process optimization from demand forecasting to automated logistics scheduling; Secondly, the popularization of blockchain technology will further enhance the transparency and security of the supply chain, especially in the fields of product traceability and cross-border payments; Thirdly, with the popularization of 5G technology, digital supply chains will achieve higher real-time and flexibility, allowing enterprises to respond more quickly to market changes; Finally, with the promotion of sustainable development goals, digital technology will play an increasingly important role in driving green supply chain management.

5. CONCLUSION

This article studies the application of digital technology in cross-border e-commerce supply chains and draws the following main conclusions: firstly, digital technologies such as the Internet of Things, blockchain, and artificial intelligence have a significant impact on various links of cross-border e-commerce supply chains, significantly improving the efficiency, transparency, and security of the supply chain; Secondly, although digital technology has brought profound changes to supply chain management, its application process also faces many challenges, such as the lack of technical

standards, data security issues, and implementation costs; Thirdly, in the future, with the continuous advancement of technology, digital supply chains will show a trend of intelligence, transparency, and globalization, which will further enhance the competitiveness of cross-border e-commerce enterprises.

6. RECOMMENDATIONS

(1) Enterprises should actively invest in digital technology, especially in the fields of IoT, blockchain, and artificial intelligence, to enhance the intelligence level of supply chain management.

(2) Strengthen cross departmental and cross enterprise cooperation: Cross border e-commerce enterprises should strengthen cooperation with various links in the supply chain, achieve efficient collaboration in the supply chain through data sharing and resource integration.

(3) Emphasize data security and privacy protection: In the process of applying digital technology, enterprises should develop and implement strict data security strategies to prevent potential network threats and ensure the safe operation of the supply chain.

(4) Promote the formulation of policies and standards: It is recommended that relevant government agencies accelerate the development and improvement of policies and standards related to the application of digital technology to support the digital transformation and healthy development of cross-border e-commerce supply chains.

(5) Focus on technical training and talent development: The application of digital technology requires professional talents with corresponding skills. Enterprises should invest resources in technical training to cultivate a talent team with digital supply chain management capabilities.

REFERENCES

[1] Zhang, Q. (2024). Development Strategy of Cross border E-commerce Enterprises Based on the Digital Economy Perspective. China Storage and Transportation (03), 160-161.doi: 10.16301/j.cnki.cn12-1204/f.2024.03.071

[2] Marrucci Anna, Rialti Riccardo, Donvito Raffaele & Syed Faheem Uddin. (2024). “Connected we stand, disconnected we fall”. Analyzing the importance of digital platforms in transnational supply chain management. International Journal of Emerging Markets (9), 2405-2427.

[3] Paul Myerson. (2025). The Smart, Digital Supply Chain of Tomorrow is Here Today: How to Enable a Lean and Agile Global Supply Chain with the Help of Technology.doi:10.4324/9781003372639

[4] Xu, H. (2024). Research on the Construction of Smart Supply Chain and the Development of "Specialized, Refined, Unique and New" Small and Medium sized Enterprises. Modern Economic Discussion (08), 97-106. doi: 10.13891/j.cnki.mer. 2024.08.009

[5] Wang, Da. & He, G. (2024). Research on the Impact Mechanism of CEO Digital Support Behavior on the Digital Transformation of Supply Chain Enterprises. Enterprise Economics (08), 140-151. doi: 10.13529/j.cnki. enterprise. economy. 2024.08.013

[6] Zhang, Z. & Zhang, J. (2024). Analysis of Settlement and Management Paths of Cross border Trade in the Digital Perspective. Journal of Hubei University of Economics (Humanities and Social Sciences Edition) (04), 34-39

[7] Liu, J. (2023). Application of Digital Technology in Cross border E-commerce. Electronic Technology (07), 216-217

[8] Wang, R. (2023). Master's degree in digital transformation of cross-border logistics services for Company A's first leg (thesis, Guilin University of Electronic Science and Technology) https://link.cnki.net/doi/10.27049/d.cnki.ggldc.2023.000698doi:10.27049/d.cnki.ggldc.2023.000698.

[9] Li, J. (2023). Study on the Impact of Supply Chain Digitization on Total Factor Productivity of Enterprises: Based on Quasi Natural Experiments and Double Difference Models. Exhibition Economy (24), 81-84. doi: 10.19995/j.cnki CN10-1617/F7.2023.24.081.

[10] Li, Y. (2023). Master's degree in Digital Marketing Strategy Research at Ausnutria Dairy (dissertation, Hunan University). Master's degree https://link.cnki.net/doi/10.27135/d.cnki.ghudu.2023.003559doi:10.27135/d.cnki.ghudu.2023.003559.

[11] Xu, M. (2022). Master's degree thesis on deepening research on empowering cross-border e-commerce platform enterprises with digital business (Jilin University). Master's degree https://link.cnki.net/doi/10.27162/d.cnki.gjlin.2022.006473doi:10.27162/d.cnki.gjlin.2022.006473.

[12] Zhu, W. (2022). Application of Digital Supply Chain Technology in E-commerce. Integrated Circuit Applications (08), 100-101. doi: 10.19339/j.issn. 1674-2583.2022.08.037

[13] Yao, G. (2021). Master's degree in Competitive Strategy Research of J Cross border E-commerce Company under the Digital Background (Thesis, Zhejiang Technology and Business University). Master's degree https://link.cnki.net/doi/10.27462/d.cnki.ghzhc.2021.000295doi:10.27462/d.cnki.ghzhc.2021.000295.