XV. The Impact of the Digital Economy on Logistics and Supply Chain Management Under the "Belt and Road" Initiative

Shusen Lang, Enyang Zhu
Dalian Minzu University, Faculty of Economics and Business, Dalian, China
langshusen@126.com, zhuey@dlnu.edu.cn

This paper explores the impact of the digital economy on logistics and supply chain management in countries participating in the Belt and Road Initiative (BRI). It highlights how digital technologies–such as big data, AI, IoT, and blockchain–enhance efficiency, improve risk management, and support sustainable development across international logistics networks. The study also identifies significant challenges, including infrastructure gaps, customs inefficiencies, and digital disparities. Through a comprehensive analysis, it proposes digital strategies to optimise logistics performance and strengthen cooperation among BRI countries. The findings emphasise the transformative role of the digital economy in facilitating cross-border trade, reducing costs, and fostering integration in global supply chains.

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1 Introduction

The Belt and Road Initiative (BRI) is a global cooperation initiative proposed by China to promote connectivity and economic collaboration among countries along the Belt and Road. This initiative aims to foster common development and prosperity by strengthening infrastructure construction and facilitating trade and investment (Li, 2019). In recent years, the rise and development of the digital economy have profoundly changed how global logistics and supply chain management are conducted. As a critical component of the Belt and Road Initiative, logistics and supply chain management are key in enhancing trade cooperation, improving efficiency, and reducing costs. With digital technology's continuous application and innovation, the digital economy has introduced unprecedented opportunities and challenges for logistics and supply chain management (Xing, 2022).

Studying the impact of the digital economy on logistics and supply chain management within the Belt and Road Initiative framework is of great significance. First, this research provides scientific guidance and decision-making support for logistics and supply chain management under the BRI. With the rapid advancement of the digital economy, traditional logistics and supply chain management models are increasingly unable to adapt to emerging challenges and demands. By conducting an in-depth analysis of the digital economy's impact on this field, it is possible to identify and summarise effective innovation models and management strategies, offering practical insights and recommendations for enterprises and organisations involved in the Belt and Road Initiative (Ba & Lv, 2024).

Secondly, this study contributes to fostering international cooperation and exchange. As a global initiative, the Belt and Road requires nations to collaborate, share resources, and exchange experiences. By exploring the influence of the digital economy on logistics and supply chain management, this research can deepen cross-national understanding in this field and facilitate international dialogue and cooperation. Additionally, the study serves as a valuable reference for policymakers in shaping logistics and supply chain management strategies in different countries, promoting coordinated development within this sector (Wang, 2022).

Finally, this study is crucial in advancing economic development and social progress. Logistics and supply chain management are fundamental components of modern economies, and their efficiency is instrumental in improving production output, reducing costs, and optimising resource allocation. By examining the impact of the digital economy, the study aims to promote the modernisation and digital transformation of logistics and supply chain management further, enhancing overall economic performance and global competitiveness (Mi & Lu, 2023). This contributes to sustainable development goals, establishing an open world economy, and fostering mutually beneficial regional partnerships.

The first section of this paper introduces the research, while the second section discusses the theoretical foundations of the digital economy, logistics, and supply chain management. It starts by defining the digital economy and its characteristics before moving on to the fundamental concepts and classical theoretical frameworks of logistics and supply chain management. The third section provides an overview of the current logistics and supply chain management landscape in Belt and Road countries. It explores the challenges and opportunities that arise in this context due to digital economic advancements (Liu, 2023). The fourth section analyses how the digital economy influences supply chain efficiency, risk management, and sustainable development. The fifth section discusses logistics and supply chain management optimisation strategies within the Belt and Road Initiative in the digital economy era. Finally, the sixth section presents prospects for future research on the impact of the digital economy on Belt and Road countries.

2 The concept of digital economy and classic theories of logistics and supply chain management

2.1 Concept and characteristics of digital economy

As a broad concept, the digital economy can be included in any economic form that directly or indirectly uses data to guide resources and promote productivity development. At the technical level, it includes emerging technologies such as big data, cloud computing, the Internet of Things, blockchain, artificial intelligence, and 5G communication. At the application level, "new retail" and "new manufacturing" are typical representatives.

The characteristics of the digital economy are relatively distinct compared to non-digital economies. The summary includes the following characteristics:

Fastness – First, the Internet has broken traditional national and regional boundaries. It is connected by the network, making the whole world closely linked and turning the earth into a "village." Secondly, it breaks through time constraints, allowing people's information transmission and economic exchanges to take place over a smaller period. Once again, the digital economy is speed-driven. Modern information networks can transmit information at the speed of light, and the digital economy collects, processes, and applies information at speeds close to real-time, greatly accelerating the pace (Xiao & Liang, 2023).

High permeability – The rapidly developing information technology and network technology have incredibly high penetration functions, which have led to the rapid expansion of the information service industry towards the primary and secondary sectors, blurring the boundaries between the three major industries and leading to a trend of mutual integration between the primary, secondary, and tertiary sectors (Song, 2024).

Self-inflation – The value of the digital economy is equal to the square of the network nodes, and the benefits generated and brought by the network will grow exponentially with the increase of network users. In the digital economy, due to people's psychological reactions and behavioural inertia, under certain conditions, once advantages or disadvantages appear and reach a certain degree, it will lead to continuous intensification and self-strengthening, resulting in a "winner-takes-all" monopoly situation where the strong become more substantial. The weak become weaker (Mi & Lu, 2023).

Marginal Benefit Incremental Performance – The main manifestations are: firstly, the marginal cost of the digital economy is decreasing; secondly, the digital economy has cumulative value-added effects (Liu, 2023).

External Economics – The externality of the network refers to the utility that each user receives from using a particular product, which is related to the total number of users. The more users there are, the higher the utility each user receives (Wang, 2022).

Sustainability – The digital economy can effectively eliminate the excessive consumption of tangible resources and energy by traditional industrial production, causing environmental pollution, ecological degradation, and other hazards, achieving sustainable development of the social economy (Xing, 2022).

Due to the development of the Internet, the economic organisation structure tends to flatten, allowing the producers and consumers of network endpoints to connect directly, thus reducing the necessity of traditional intermediaries, significantly reducing transaction costs, and improving economic efficiency (Liu & Zhang, 2016).

2.2 Basic concepts and classic theories of logistics and supply chain management

Logistics is the physical flow of goods from the supply location to the receiving area, involving comprehensive management of functions such as transportation, storage, loading and unloading, packaging, circulation processing, distribution, and information processing. The basic concept of logistics revolves around the efficient and low-cost flow of goods, including core activities such as warehousing, transportation, and distribution, aimed at meeting the needs of consumers. In the logistics process, various logistics activities such as storage, loading and unloading, handling, packaging, circulation processing, and information processing need to be organically combined according to the actual situation to ensure that goods can flow smoothly and efficiently from the place of origin to the place of consumption.

Supply chain management refers to the integrated management of product flow, information flow, and capital flow, aiming to maximise customer value and minimise supply chain costs. The supply chain covers the entire process from raw material procurement to final product delivery to consumers. The core of supply chain management lies in integrating and optimising all aspects of this process, including suppliers, manufacturers, distributors, retailers, and end users, to form an efficient functional network. The essence of supply chain management is to comprehensively coordinate and manage the product, information, and fund flow that runs from customers to suppliers. It emphasises the key role of information technology systems in identifying problems, analysing problems, and making decisions, and it states that fund flow is often closely related to information flow.

The classic theories of logistics management mainly include Just In Time (JIT) theory and Lean Logistics theory.

JIT theory is a production method aimed at improving production efficiency by reducing inventory and waste. The JIT theory encourages enterprises to produce and distribute when needed rather than making and storing in advance. The key to this theory lies in establishing close connections with suppliers and customers to ensure the smooth progress of the production process (Qu, 2020).

Lean Logistics is a method of optimising logistics processes to reduce waste and improve efficiency. This theory encourages companies to analyse their logistics processes and eliminate all unnecessary waste, such as excessive transportation and inventory. The key to this theory lies in establishing a flexible, reliable, and sustainable supply chain (Song, 2024).

The classic supply chain management theories include value chain, consumer response, and integration theories.

The core idea of Michael E. Porter's value chain theory is to focus on the big and let go of the small, distinguish priorities, focus on significant output activities on the value chain, and elevate them to a strategic level. Value chain management is a series of strategic management methods formed from the starting point of essential activities that can create and obtain value. Among them, the supply chain is a manifestation of the value chain, and the value chain is the content reflected by the supply chain.

Consumer response, derived from the study of consumer behaviour in marketing, refers to the initial perception that consumers, as the main body, obtain from a company's products, services, behaviour, or culture, the formation of purchase intention, and the psychological and behavioural response state throughout the entire process of generating purchase behaviour. Enterprises need to design, manage, and analyse their supply chain strategies from the perspective of consumer response attitude, willingness, and behaviour. Different supply chain management strategies achieve different results, often requiring a balance between speed, efficiency, and satisfaction.

Since Joseph Harrington first proposed the concept of "integrated manufacturing" in 1973, integrated thinking has attracted widespread attention from scholars both domestically and internationally. Scholars such as Qian and Ma have injected integrated management ideas into the supply chain management system, inheriting the previous views of consumer response and operational schools. Integrated management is not simply about adding up but about forming an excess complementarity result of "1+1>2". The focus of supply chain integration management is that enterprises at each node of the supply chain participate in the integration activities on the "chain" with resources that can generate competitive advantages, achieving the integration effect of "strong alliance + complementary combination."

3 Current situation of logistics and supply chain management under the "the Belt and Road" initiative

Some common problems exist in the logistics and supply chain management of countries along the Belt and Road. The lagging infrastructure construction is a significant challenge. Many countries along the route have inadequate infrastructure, such as roads, railways, and ports, resulting in low logistics transportation efficiency. The problem of traffic congestion and poor road conditions in the land routes between China and Central Asian countries can easily affect the timely delivery of goods.

Secondly, the cumbersome customs clearance procedures are also a common problem. Xiao et al. (2023) pointed out that due to trade barriers and complex customs clearance procedures between countries along the way, the clearance time for goods is longer, which increases logistics costs (Xiao & Liang, 2023). Taking China and ASEAN countries as examples, although they have signed free trade agreements, they still face cumbersome customs clearance procedures and complex document requirements, which limit trade development.

In addition, the low level of supply chain informatisation is also a common problem faced by countries along the Belt and Road. Many countries along the route have low levels of supply chain informationisation and lack efficient logistics information systems, resulting in poor information transmission between various links in the supply chain and making it difficult to achieve transparency and visualisation of the

supply chain. This not only affects logistics efficiency but also increases the risk of the supply chain.

Taking the ten ASEAN countries (Brunei, Cambodia, Indonesia, Laos, Malaysia, Myanmar, the Philippines, Singapore, Thailand, and Vietnam) that play an essential role in the Belt and Road initiative as an example, the three indicators of digital infrastructure, digital economic development, and logistics infrastructure are comprehensively considered, as shown in Table 1.

Table 1: Composition of Cooperation Foundation Index

Primary indicators	Secondary indicators	Third level indicators
	Digital infrastructure	Mobile phone registration rate
		Internet coverage
		Broadband network speed
Fundamentals of Cooperation	The development level of the digital economy	The scale of the digital industry
		The completeness of e-government
		E-commerce activity
	Logistics infrastructure	Logistics Performance Index (LPI)

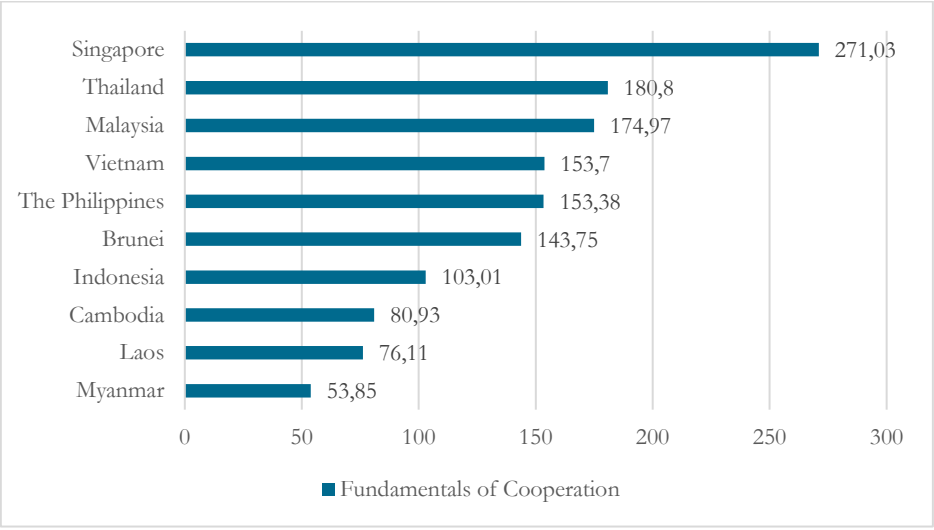

Figure 1: Basic Index of ASEAN Ten Countries Cooperation in 2022
Data source: Hua Xin Research Institute from China

Among the ten ASEAN countries, Singapore has the best cooperation foundation. As one of the few developed countries along the "Belt and Road," Singapore is leading in digital infrastructure, digital economy development, and logistics infrastructure. Compared to Thailand, which ranked second in Figure 1, the cooperation foundation index increased by 89.23. However, the cooperation foundation of the five countries ranked second to sixth is not significantly different. However, it is worth noting that Indonesia, Cambodia, Laos, and Myanmar are considerably lower than the average of 139.15, reflecting that these four countries still have significant disadvantages in digital infrastructure, digital economic development, and logistics infrastructure.

Of course, information asymmetry is also a problem that affects logistics and supply chain management. Due to the lack of effective information-sharing platforms and communication technologies, enterprises find it difficult to promptly obtain market information and supply chain dynamics, affecting decision-making accuracy and flexibility. For example, in the Middle East, due to political instability and information lockdowns, it is difficult for companies to obtain accurate market intelligence and supply chain data, making it challenging to make timely adjustments.

Security issues also need attention. The security situation of countries along the route is unstable, and terrorism, piracy, and other activities threaten the security of logistics transportation. The Strait of Malacca is one of the busiest shipping routes in the world, but due to pirate activities in the region, ships often face the risk of being hijacked.

To solve these problems, Mi et al. (2023) believe that countries along the Belt and Road (including ASEAN countries) can strengthen infrastructure construction and improve logistics transportation efficiency (Mi & Lu, 2023). At the same time, simplifying customs clearance procedures, promoting trade facilitation, and reducing logistics costs are essential measures. In addition, establishing an information-sharing platform and strengthening the application of communication technology can help improve the transparency and accuracy of information. Finally, security cooperation should be strengthened to address security risks in logistics transportation jointly. Through these joint efforts, the logistics and supply chain management of countries along the Belt and Road will improve, thereby promoting the development and prosperity of the regional economy.

The logistics performance level of countries and regions along the Belt and Road is directly related to the success of the initiative's implementation. These countries' logistics performance index (LPI) has generally remained low for an extended period, even below the world average. Central Asia, Mongolia, Russia, and South Asia are the core hinterland regions of the Silk Road Economic Belt and the Maritime Silk Road. Still, they also represent the weakest links in the Belt and Road logistics corridor. Low customs efficiency and poor logistics infrastructure quality are these regions' primary constraints. As a result, the weak logistics performance in these countries hinders the successful implementation of the Belt and Road strategy.

The logistics performance disparities among countries and regions along the Belt and Road directly impact the efficiency of cross-border logistics integration. Significant differences exist in logistics performance among these countries, with a widening gap over time. Consequently, cooperation in logistics remains challenging due to high barriers. Sub-factors contributing to logistics performance disparities include trade and transportation-related infrastructure, quality of information systems, and customs efficiency. Customs clearance efficiency and the effectiveness of other border agencies show the most significant variation, significantly affecting the smooth integration of logistics and supply chains in the Belt and Road region.

The logistics performance base of countries and regions along the Belt and Road remains generally low, with an unpromising growth rate. In the short term, significant improvements in logistics performance appear unlikely. In recent years, the growth rate of logistics performance in top-ranked countries such as China, India, Israel, and Qatar has remained around 2%. Some countries, such as Egypt, Myanmar, Lithuania, and Kazakhstan, have shown significant LPI growth, but their overall LPI base remains relatively low. Meanwhile, other countries have experienced negative LPI growth, including Singapore, which had a higher base, and lower-base countries, such as Syria and Laos.

4 The impact of the digital economy on logistics and supply chain management under the "the Belt and Road" initiative

4.1 Analysis of the impact of the digital economy on logistics and supply chain efficiency of countries along the "Belt and Road."

The digital economy significantly impacts the logistics and supply chain efficiency of countries along the Belt and Road. Liu et al. (2016) argue that with the continuous development and widespread application of digital technology, logistics and supply chain management have entered a new digital and intelligent transformation phase. In the era of the digital economy, logistics and supply chain management place greater emphasis on information sharing and circulation. Improving logistics efficiency and reducing costs through digital means has become a significant trend (Liu & Zhang, 2016).

The digital economy has promoted the informatisation of logistics and supply chain management. In the digital economy, information flow is one of the core elements, and digital technology enhances the real-time sharing and circulation of logistics and supply chain information. For example, by utilising digital technologies such as big data and artificial intelligence, intelligent tracking, distribution, and warehousing of goods can be achieved, thereby improving logistics efficiency and accuracy.

The digital economy has also driven the intelligent upgrading of logistics and supply chain management. In the digital economy, smart devices and technologies—such as automated sorting systems and drone delivery—are widely used in logistics and supply chain operations. The introduction of these devices not only improves work efficiency but also reduces labour costs. At the same time, digital technology enables real-time monitoring and management of goods, allowing for timely detection and resolution of potential issues, thereby ensuring the security and stability of the supply chain.

Moreover, the digital economy fosters cooperation and mutually beneficial outcomes in international logistics and supply chains. In the era of the digital economy, trade between countries is becoming more frequent, and logistics and supply chain management require closer cooperation and coordination. Digital technology makes cross-border logistics and supply chain management more

convenient and efficient while providing countries with new cooperation opportunities and development prospects.

To sum up, the digital economy has profoundly impacted the logistics and supply chain efficiency of the Belt and Road initiative. It promotes the informatisation and intelligent development of logistics and supply chain management, improves logistics efficiency and accuracy, reduces costs, and creates favourable conditions for trade exchanges between countries. In the future, it will be essential to strengthen the application of digital technology in logistics and supply chain management further, contributing to the prosperity and development of the global economy.

4.2 Analysis of the impact of digital economy on logistics and supply chain risk management

The impact of the digital economy on logistics and supply chain risk management is profound and widespread. In the era of the digital economy, with the massive growth of data and the continuous progress of technology, logistics and supply chain risk management are transforming traditional empirical judgment into data-driven decision-making.

Song (2024) pointed out that the digital economy has enhanced risk identification and early warning capabilities. With the help of big data and artificial intelligence technologies, enterprises can collect and analyse real-time data on various aspects of the supply chain, including transportation, warehousing, and sales, to accurately identify potential risks (Song, 2024). For example, by analysing historical weather and traffic flow data, companies can predict the potential impact of natural disasters or traffic congestion on logistics and take proactive response measures.

The digital economy promotes risk diversification and transfer. On digital platforms, enterprises can more conveniently share information with other supply chain participants and jointly respond to risks. Meanwhile, through insurance technology, enterprises can purchase insurance for various links in the supply chain to reduce potential losses. This risk diversification and transfer mechanism helps reduce the risk pressure a single enterprise bears.

The digital economy helps optimise risk management decisions. Through data analysis and simulation techniques, enterprises can quantitatively evaluate various risks before making decisions, thereby selecting the optimal risk management strategy. For example, when choosing a transportation method, enterprises can comprehensively consider cost, time, and safety to choose the most suitable transportation method for the current situation.

The digital economy has driven continuous innovation in risk management. With the constant development of digital technology, new risk management methods and tools are constantly emerging. These innovations improve the efficiency and quality of risk management and bring new development opportunities to enterprises. For example, blockchain technology can be used to establish immutable supply chain records, thereby improving the transparency and traceability of the supply chain and reducing risks of fraud and counterfeiting.

4.3 Analysis of the impact of digital economy on sustainable development of logistics and supply chain

Through its unique advantages, the digital economy provides strong support for the sustainable development of logistics and supply chains. For example, digital technology can help enterprises predict and manage resource usage more accurately, reducing waste and unnecessary consumption. In addition, digital tools can optimise transportation routes and reduce idle rates and carbon emissions, lowering environmental pressure. Big data analysis can precisely track the location and status of goods in real time, ensuring their safety and stability during transportation. This transparency improves customer satisfaction and reduces resource waste caused by damaged or lost goods. At the same time, IoT technology enables devices to report their operational status and maintenance needs in real-time, thereby achieving preventive maintenance of devices, extending their lifespan, and reducing the frequency and cost of device replacement (Wang, 2022).

The digital economy provides unprecedented opportunities for cooperation in globalised logistics and supply chains. The Belt and Road Initiative aims to promote the economic cooperation and development of countries along the Belt and Road, and the digital economy provides strong support for realising this goal. Through digital platforms, countries can share logistics information, coordinate

transportation resources, optimise supply chain structures, and achieve more efficient and green logistics operations (Liu, 2023). This cooperation not only reduces logistics costs but also improves the reliability and resilience of the supply chain.

The openness and inclusiveness of the digital economy also provide more development opportunities for countries along the Belt and Road. Through digital technology, countries can better integrate into the global supply chain system and share the benefits of globalisation. By promoting sustainable development and strengthening international cooperation, the digital economy has injected new vitality into the sustainable development of logistics and the supply chain of the Belt and Road (Ba & Lv, 2024). This vitality contributes to the economic growth and social development of countries along the Belt and Road and positively contributes to the prosperity and stability of the global economy.

5 Problems in logistics and supply chain management under the Belt and Road initiative

5.1 Infrastructure construction

Infrastructure construction and improvement are essential prerequisites for the Belt and Road Initiative's promotion of regional economic integration. However, in practical operation, infrastructure construction faces many challenges. Taking transportation infrastructure as an example, according to a report by the World Bank, land transportation costs in some regions of South Asia and Southeast Asia are four times higher than those in East Asia and the Pacific. The Gwadar Port and its supporting road and railway construction projects, which China invested in in Pakistan, can improve the regional logistics situation in the long run. However, due to insufficient supporting facilities, safety issues, and local political factors in the early stages, project progress was slow, making it difficult to achieve the expected results. In addition, differences in railway gauges between different countries also increase the difficulty and cost of cross-border transportation (Liu, 2023).

5.2 Customs clearance efficiency

Regarding customs clearance efficiency, taking the China-Europe freight train as an example, although it dramatically reduces the transportation time of goods from China to Europe, each country's customs policies and inspection standards differ due to the involvement of multiple border crossings. These differences result in the need for re-inspection and customs clearance of goods at each border station, increasing time and logistics costs. Additionally, some countries enforce strong tariff policies to protect specific commodities, such as imposing high import tariffs or implementing quantity restrictions on sensitive goods like agricultural products and textiles. This threatens supply chain stability (Xiao & Liang, 2023).

5.3 Political risks

The Belt and Road Initiative covers many countries and regions, and political risk is one of its inevitable challenges. For example, political turmoil in the Middle East may lead to fluctuations in oil and gas prices, affecting energy costs and logistics budgets. The Ukrainian crisis has directly impacted the transportation of goods between China and Europe, and some Chinese companies have suffered financial losses due to their investments in the region. In Africa, policy changes resulting from regime shifts or political conflicts in certain countries may disrupt the stability of local logistics projects and supply chain security (Ba & Lv, 2024).

5.4 Financing difficulties

Funding is crucial for driving infrastructure and logistics projects. However, many developing countries participating in the Belt and Road Initiative are experiencing serious financing problems. For example, some infrastructure projects require substantial funding, and local governments and enterprises often struggle to raise sufficient capital. Even with the support of China's Silk Road Fund, the Asian Infrastructure Investment Bank (AIIB), and other financial institutions, negotiating loan terms, interest rate levels, repayment periods, and other economic factors may create obstacles to cooperation. Moreover, the issue of debt sustainability is critical, as ensuring that loans do not lead to debt traps is essential for maintaining long-term partnerships.

5.5 Differences in laws and regulations

The legal systems of countries along the Belt and Road are complex and diverse, requiring enterprises to invest significant time and resources to adapt to different legal environments. For example, regarding trade regulations, countries have different requirements for standards, quality control, and intellectual property protection related to import and export goods. In labour law, regulations on labour contracts, working hours, benefits, and dismissal rules vary across countries. Such differences present significant challenges for enterprise compliance management. For instance, when Chinese companies invest in building factories in Southeast Asian countries, they must thoroughly understand and comply with local labour regulations; failure to do so may result in labour disputes, damaging their reputation and operational efficiency.

6 Optimization strategy of logistics and supply chain management under the "the Belt and Road" initiative

6.1 Give full play to the leading advantages of the Silk Road Fund and the Asian Infrastructure Investment Bank platform

After introducing the Belt and Road strategy, the Chinese government took immediate steps to address the significant infrastructure gaps in countries and regions along the Belt and Road and to accelerate the strategy's implementation. To support and promote infrastructure development, the Chinese government established the Silk Road Fund and the Asian Infrastructure Investment Bank. Li (2019) believes that logistics infrastructure is key in executing this strategy. The Chinese government should continue to build interconnected logistics infrastructure projects with Belt and Road countries, such as Gwadar Port in Pakistan, utilising platforms like the Silk Road Fund and the Asian Infrastructure Investment Bank. This approach will facilitate the transition of high savings in Belt and Road countries into effective logistics infrastructure investment, improving regional logistics and laying a solid foundation for genuine connectivity.

6.2 Establishment of the Belt and Road free trade zone

Ba and Lv (2024) argue that establishing a free trade zone is advantageous for reducing cross-border tariffs, eliminating trade barriers, and ensuring the free movement of goods and services. China has signed 14 free trade agreements with 22 countries and regions worldwide, promoting bilateral and multilateral international trade liberalisation. Customs efficiency remains a weak link in trade among Belt and Road countries. The Chinese government should accelerate negotiations to establish regional free trade agreements, such as the Asia-Pacific Free Trade Area and the Regional Comprehensive Economic Partnership Agreement, and explore new opportunities arising from the Belt and Road strategy. Further studies should be conducted on establishing a Belt and Road free trade zone, which could significantly enhance customs clearance efficiency and improve trade flow among participating nations.

6.3 Jointly build "the Belt and Road" logistics big data information centre

The data generated in the process of economic and trade exchanges between China and countries and regions along the "Belt and Road," commodity production, storage and transportation, and personnel exchanges have new features that traditional databases do not have, such as large-scale, multiple data types, the uncertain relationship between models and data, diversified processing objects, and more advanced and complex processing tools. Therefore, China and the "Belt and Road" Countries and regions along the Belt and Road should be aware of the necessity and urgency of establishing the "Belt and Road" logistics big data information centre. Wang (2022) believes that the information centre can capture, clean, integrate, select, and update the data in all stages and links of the logistics cooperation of countries and regions along the "Belt and Road" and then use data mining technology to mine the potential value of data information, realise data value-added, and present the final results in a visual way, which helps to accurately guide the "the Belt and Road" to improve the quality and capacity of logistics services of countries and regions along the "Belt and Road".

6.4 Building the "the Belt and Road" global supply chain

In 2012, the United States released the National Strategy for Global Supply Chain Security, which aimed to promote efficient and secure transportation of goods, cultivate resilient supply chains, and maintain its continued leading position globally. China is the world's second-largest economy, with the most significant import and export trade volume. It has the ability and conditions to build a Chinese version of the global supply chain. Forming a worldwide supply chain is a systematic project that requires cooperation, multi-link coordination, and a stable development environment. To this end, China can use the "Belt and Road" strategy as a breakthrough to build a global supply chain and achieve the optimal integration and rational allocation of resources in countries and regions along the line, including market, production capacity, enterprises, and logistics, through market-oriented operation, to promote further the free flow of economic factors The advantages of international transportation convenience and logistics performance complement each other.

6.5 Establish "the Belt and Road" logistics planning head office or similar institutions

The "Belt and Road" involves the "Asia, Europe, and Africa" continent and the surrounding sea areas. There are developed countries, developing countries, and underdeveloped countries. For such a vast and complex strategic system, countries or regions along the line will inevitably feel rejection or even resistance. By establishing logistics planning headquarters or similar institutions jointly operated by countries and regions along the "Belt and Road," the interests of all countries will be tied together to eliminate unwarranted suspicion and suspicion. Xing (2022) pointed out that the primary function of the"Belt and Road" logistics planning head office or similar institutions is to coordinate the deployment and operation of railway, maritime, highway, and aviation logistics infrastructure resources in countries and regions along the line, plan and organise cross-border multimodal transport business, guide the standardisation of logistics systems, develop transport routes, carry out rapid and effective cross-border logistics emergency response, properly manage differences and contradictions, and ensure that the "the Belt and Road" cross-border logistics transport is timely and reliable.

6.6 Build the "the Belt and Road" intelligent logistics system

The big data information centre provides a prerequisite for realising intelligent logistics. The "Belt and Road" intelligent logistics system based on the Internet of Things technology enables online information and offline logistics to be integrated to achieve coordinated development. Liu (2023) believes that the accuracy of logistics information recognition can be improved through digital and visualisation technologies. Then, based on the target customers' expected logistics demand conditions, logistics resources should be allocated reasonably, and efficient one-stop logistics solutions should be planned. Qu (2020) thinks that using Global Positioning System (GPS) and Geographic Information System (GIS) to obtain real-time information on the location of goods accurately and using Radio Frequency Identification (RFID) technology to provide real-time feedback on the status of goods in various time points, relevant information is synchronised and shared with customers, and based on this, the optimised logistics implementation plan is adjusted; Finally, deliver the accurate quantity and expected quality of goods to the agreed destination or target customer within the specified time.

7 Research outlook

As a critical international cooperation framework proposed by China, the Belt and Road Initiative aims to promote the common development and prosperity of countries along the Belt and Road by strengthening infrastructure construction and promoting trade and investment. As core components of this initiative, logistics and supply chain management play a crucial role in achieving regional economic integration. However, the current countries along the "Belt and Road" face common problems in logistics and supply chain management, such as lagging infrastructure construction, low customs clearance efficiency, and low supply chain informatisation. These problems have seriously affected the logistics efficiency and stability of the supply chain.

The rapid development of the digital economy has provided new ideas and tools to solve these problems. By utilising technologies such as big data, cloud computing, the Internet of Things, and artificial intelligence, logistics and supply chain management efficiency and transparency can be improved, operating costs can be reduced, and the resilience and sustainability of the supply chain can be enhanced.

At the same time, the digital economy has also promoted international logistics and supply chain cooperation, providing more development opportunities for countries along the route.

A series of measures must be taken to further optimise the logistics and supply chain management under the "Belt and Road" initiative. First, we should fully play the role of platforms such as the Silk Road Fund and the Asian Infrastructure Investment Bank, increase investment in infrastructure construction, and improve logistics efficiency. Secondly, establishing free trade zones and logistics big data centres can promote information sharing and trade facilitation. In addition, building a global supply chain and intelligent logistics system can further enhance the quality and capacity of logistics services.

In a word, by deepening the application of digital technology in logistics and supply chain management, strengthening international cooperation, and jointly building infrastructure, we can effectively solve the problems of logistics and supply chain management in countries along the "Belt and Road" and promote regional economic integration, and achieve common development and prosperity.

In the future, research on the impact of the digital economy on the "Belt and Road" initiative will focus on several key areas. Firstly, the study will focus on the construction and cooperation of digital infrastructure, exploring how to strengthen the connectivity of countries along the route through cross-border fibre optic networks, data centres, and intelligent logistics systems, as well as the role of PPP in financing and operation. Secondly, focus on developing cross-border e-commerce and digital trade and how digitalisation promotes trade facilitation and reduces transaction costs.

In addition, research on digital currencies and payment systems will become a hot topic, especially regarding potential impacts on international trade settlement, financial market stability, and monetary policy. The innovation of intelligent logistics and supply chain management will also be valued, involving the application of technologies such as the Internet of Things, artificial intelligence, and big data. At the same time, the role of digital financial services and financial technology in improving financial inclusivity will be analysed in depth. Data governance and network security, digital skills training and talent mobility, and the construction of

digital innovation and entrepreneurship ecosystems are essential research directions. In addition, the study will explore the impact of the digital economy on social and cultural aspects, including its applications in areas such as educational resource sharing and tourism. Finally, the research will focus on environmental sustainability and green digital practices, such as intelligent energy management and carbon footprint monitoring. These research directions not only help to understand how the digital economy shapes the future of the "Belt and Road" but also provide valuable insights for policymakers, business leaders, and academic researchers in countries along the Belt and Road and jointly promote the successful implementation of this global initiative.

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About the authors

Shusen Lang is a student majoring in International Business at the School of International Business, Dalian University for Nationalities. His research focuses on goods trade, international business policies and practices, changes in export structure, growth factors, and trade potential. In recent years, he has expanded his research scope to the development of the digital economy and its impact on related economies.

Dr. **Enyang Zhu** is an associate professor in the Department of Accounting at the International Business School of Dalian Minzu University. His main research areas are RMB internationalisation, financial risk, accounting informatisation, and internal control.