



Digital transformation in logistics: lessons learned for the Mekong Delta region towards sustainable development

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ABSTRACT

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Digital transformation in logistics has become an inevitable trend in the context of globalization and Industry 4.0. The research aims to analyze lessons learned from various countries and propose lessons for the Mekong Delta region towards sustainable development. Based on the analysis results, the lessons include: Improving the legal framework for digital transformation in logistics; supporting capital for digital transformation activities in the logistics industry; enhancing investment in synchronized and modern infrastructure; applying information technology; supporting enterprises in adopting new technological solutions in the logistics industry; developing high-quality human resources in the logistics sector; promoting green logistics development.

1. INTRODUCTION

Digital transformation is becoming an inevitable trend in the global logistics industry, including Vietnam. The rapid development of the logistics market offers many opportunities for businesses in this sector. To seize these opportunities, logistics businesses need to enhance their competitiveness by effectively applying digital technology. Developing logistics has significantly contributed to GDP, and with the current growth rate of the logistics industry at 12-14% per year, it is estimated that by 2025, the logistics sector will contribute 8-10% of GDP

(Ministry of Industry and Trade, 2021). Decision No. 749/QĐ-TTg dated June 3, 2020, of the Prime Minister, approving the National Digital Transformation Program until 2025, with a vision to 2030, identified logistics as one of eight priority areas for digital transformation. Logistics plays a crucial role in connecting production, processing, and consumption activities. Digital transformation in logistics brings many important benefits such as cost reduction, improved service quality, and enhanced customer experience. At the same time, it strengthens internal connectivity

within organizations and between parties in the supply chain. As a result, operational efficiency is improved, and the competitiveness of logistics enterprises, as well as the entire logistics service industry and the economy, is enhanced. The Mekong Delta (MD) has great potential for logistics service development, with favorable natural conditions for inland waterway transport thanks to a river system spanning 28,000 km, of which 23,000 km are navigable for water transport. There are two main waterway routes connecting Ho Chi Minh City to Kien Giang and Ca Mau, and the Quan Chanh Bo canal (Tra Vinh province) for large cargo ships to enter and exit the Hau River. There are also 5 road corridors connecting the Mekong Delta with the Southeast region and the rest of the country, along with a system of ports stretching along the Hau River and Tien River (Ministry of Industry and Trade, 2023). Currently, the region comprises 13 provinces and cities with an area of about 39,734 km², accounting for 12.2% of the country's area, and a population of approximately 18 million people, accounting for 19% of the country's population. The region has about 150 district-level units, over 1,000 commune-level administrative units, and nearly 10 million farming households (Le Minh Hoan, 2022). For the MD, developing logistics not only helps improve economic efficiency but also contributes to sustainable development by reducing transportation costs, minimizing negative environmental impacts, and creating employment opportunities for local people. This is a socio-economic region that contributes about 50% of

rice production, 95% of exported rice, 65% of aquaculture production, 60% of exported fish products, and 70% of fruits (Nguyen Phu Trong, 2022). Resolution No. 13-NQ/TW dated April 2, 2022, of the Politburo of the 13th term, on the direction for socio-economic development and national defense and security in the MD until 2030, with a vision to 2045, contains many provisions related to logistics development to leverage the region's potential and seize new opportunities in the coming time. Optimizing the benefits of digital transformation will help enhance the competitiveness of the logistics service industry, contributing to the socio-economic development of the MD region. Despite its great potential, the MD still faces many challenges in developing its logistics system. Weak infrastructure, high transportation costs, and a lack of synchronization in logistics management have hindered the development of this region. A report by the Vietnam Logistics Business Association indicates that in the 13 provinces of the MD, there are 1,461 logistics service providers, accounting for about 4.39% nationwide; among them, professional logistics enterprises are very limited, mainly agricultural enterprises. Sustainable development is an important goal for any economy. For the MD, sustainable logistics development not only helps improve economic efficiency but also protects the environment and ensures sustainable livelihoods for local people. This study will provide an overview of the logistics development situation in the MD, analyze lessons learned, and propose

recommendations for the MD to develop sustainable logistics.

2. RESEARCH METHODS

2.1 Theoretical basis

Concept of logistics: To date, there is no unified definition of logistics. According to Article 233 of the Commercial Law 2005, Logistics is the activity of managing the flow of raw materials through storage, production, and delivery to consumers according to customer requirements.

Logistics system: A logistics system is a comprehensive set of components involved in the logistics process, including all relationships and interdependencies between members and factors in this process. The logistics process encompasses from the input stage (material supply) to the output stage (product distribution). A logistics system is the effective management combination of inputs and outputs to save costs and increase efficiency (Dinh Dao Dang & Dinh Hien Nguyen, 2013).

The concept of "digital transformation" is approached from various perspectives. According to Gartner, "Digital transformation is the use of digital technology to change a business model to create new opportunities, revenue, and value" (Ministry of Industry and Trade, 2023). In the field of logistics, digital transformation is the process of applying digital technology to improve logistics processes, models, and operations to enhance efficiency, flexibility, and responsiveness of the supply chain. Digital transformation in logistics can be implemented at various levels, from deploying individual technological solutions to integrating comprehensive systems, or even building entirely new logistics models based on digital technology.

This process not only helps optimize current operations but also creates new value, new opportunities, and new revenue streams for businesses.

Factors affecting digital transformation in Logistics: The implementation of digital transformation in the logistics industry is a complex process, accompanied by many barriers that can limit its success. Many businesses still struggle to realize the potential of digital transformation, and these barriers can hinder or prevent successful implementation. Therefore, businesses need to identify the factors that promote the success of digital transformation in general and in logistics in particular.

Leadership factor: The will and awareness of leaders regarding digital transformation are crucial factors determining the success of this process in any business. Leaders need to believe in the value and benefits of new technologies, support their deployment in the organization's operations, provide necessary resources, and sometimes lead the digital transformation process themselves, especially when facing many difficulties and challenges.

Human factor: People are both the biggest challenge and the main factor affecting the success of digital transformation. Especially in the logistics industry, human resources include various levels of awareness and operate across multiple geographical areas, making it more difficult to change mindsets and equip digital transformation skills.

Process standardization and data integration: A prerequisite for applying software is to standardize processes and input data. However, the complex logistics system with diverse processes and data sources in various standards

creates a major barrier to successful digital transformation in logistics service enterprises.

Data protection and security breaches: To successfully implement digital transformation, strong integration between various business applications and information repositories supporting business processes is required. Cloud solutions allow "anytime, anywhere" access to services demanded by an increasing number of customers, putting significant pressure on data security and preventing breaches or unauthorized access.

2.2 International lessons learned on digital transformation in logistics

Lessons learned from digital transformation in Logistics in the United States: As the world's leading economy, the United States has a highly developed logistics industry. Especially, consumer habits and online shopping have brought the United States to the second position globally in terms of sales and number of online shoppers through e-commerce websites and online shopping platforms. This leads to an increasing demand for information technology (IT) services in the logistics industry, as many companies begin to deploy IT resources into their supply chain operations. Technologies widely applied in the US logistics industry include: Big Data, Blockchain Technology, Automation Solutions, Smart Warehouses, Planning and Management Systems, SaaS Applications and Cloud Services. These technologies are used to modernize old processes, improve performance, and reduce costs.

A typical example of applying Big Data in the logistics industry is in multimodal transport. Small and medium-sized US importers and exporters work with freight forwarders who use

Big Data to manage global cargo transportation. With just a click, they can approve shipment specifications, monitor loading/unloading processes, check cargo status, read internal container temperatures, and track milestones such as customs clearance, arrival dates, and delivery receipts. The widespread application of Big Data and other advanced technologies in logistics has created a major change in the industry. These technologies not only improve efficiency and reduce costs but also enhance transparency and reliability in the supply chain. This helps logistics businesses in the US enhance their competitiveness and better meet the increasing demands of the market. Lessons from the US show that digital transformation in logistics is an important factor to improve operational efficiency and enhance competitiveness. Applying advanced technologies such as Big Data, blockchain, and automation solutions is key to modernizing the logistics industry, meeting market demands, and creating sustainable value for businesses.

Lessons learned from digital transformation in Logistics in China: According to a white paper published by the China Academy of Information and Communications Technology (CAICT), China is one of the countries that has made great strides in digital transformation activities. In 2021, China's digital economy reached a value of 7.1 trillion USD, ranking second after the United States. The proportion of the digital economy in the national GDP, measured by the combined value of technology products and integrated digital inputs, reached 39.8% in 2021. The Chinese government has set digital transformation as one of its development priorities with the view of improving the logistics

network towards being more modern, green, and efficient by 2025. In the 14th Five-Year Plan for Digital Economy Development (2021-2025), China committed to establishing an intelligent logistics system with influential enterprises and international competitive advantages. Technologies encouraged for development in the logistics industry include: Big Data, 5G Technology, Artificial Intelligence (AI). These technologies aim to create a solid technological foundation for logistics operations. In the future, digital transformation in the logistics industry will focus on building data centers, introducing smart ships, unmanned vehicles, and building smart road, rail, port, and airport systems. Blockchain technology will also be used to control the flow of electronic documents.

Specific technology applications: Automated Sea Port System: Applied at ports in Qingdao and Shanghai, this system integrates automation technology to increase operational efficiency and cargo handling without significant human resources. This system significantly improves the speed and efficiency of port operations. Beidou Navigation System (BDS): This is a positioning system similar to GPS but with more advanced features, synchronizing all movement data of vehicles. The BDS system helps optimize national movement and planning, contributing to improved logistics efficiency and cost reduction. Lessons learned from China show that digital transformation in logistics not only improves efficiency and reduces costs but also enhances transparency and safety in the supply chain. Strong government support, along with the application of advanced technologies such as Big Data, 5G, and artificial intelligence, has helped China achieve great strides in this field. Specific

examples such as the Automated Sea Port system and the BDS system demonstrate that investing in technology and digital infrastructure is key to modernizing the logistics industry and enhancing international competitiveness.

2.3 Research methods

This research was conducted using a qualitative research method. It focused on the case study method, specifically the MD. Therefore, the main methods used were document analysis, consultation with experts, and managers in logistics and supply chain. Secondary data collected included legal documents from the Government, the General Statistics Office, research works, statistical data, and other relevant information sources. These data were systematized, analyzed, synthesized, evaluated, and commented upon appropriately to serve as a basis for proposing lessons learned for the region.

3. RESULTS AND DISCUSSION

3.1 Strengths and potential for logistics development in the MD region

Development Orientation: Currently, the Party and the State have issued many economic development strategies and legal documents orienting and promoting logistics development and digital transformation in logistics in Vietnam and the MD region. Decision 749/QD-TTg of 2020, approving the National Digital Transformation Program until 2025, with a vision to 2030, also identified logistics as one of the 8 sectors that need to be prioritized for digital transformation. Decision 942/QD-TTg approved the e-Government strategy, aiming for a digital government 2021-2025. Decision No. 221/QD-TTg dated February 22, 2021, of the Prime Minister, also identified one of the tasks to

enhance the competitiveness and develop Vietnam's logistics services until 2025 as "Researching, applying, transferring technology and technical advances, promoting digital transformation in logistics services".

Resolution No. 13-NQ/TW dated April 2, 2022, of the Politburo of the 13th term, set forth the direction for socio-economic development, ensuring national defense and security in the MD region until 2030, with a vision to 2045. This Resolution emphasizes building and implementing a regional development plan for the period 2021-2030, with a vision to 2045, towards green, sustainable, and comprehensive development. This plan must align with the national master plan, ensuring integration, multi-sectorality, and linkage between agricultural development and industrial and service development, thereby forming value chains for industries and products in the region. Decision 287/QĐ-TTg, approving the MD Regional Planning for the period 2021-2030, with a vision to 2050, also emphasized: Focusing on promoting logistics service development to facilitate production and circulation of goods domestically and for import-export. By 2030, new construction and upgrading of approximately 830 km of expressways, approximately 4,000 km of national roads, 04 airports, 13 seaports, 11 passenger port clusters, and 13 inland waterway cargo port clusters.

The MD holds a special position, located within the coastal economic corridor in the Greater Mekong Subregion, extending from Myanmar through Thailand, Cambodia to Vietnam. The MD is the largest "agricultural and aquatic product hub" in the country, and also has great potential for developing logistics services,

with a river system spanning 28,000 km, of which 23,000 km are navigable for water transport. Currently, there are 2 main waterway routes connecting Ho Chi Minh City with Kien Giang and Ca Mau, and the Quan Chanh Bo canal (Tra Vinh Province) for large cargo ships to enter and exit the Hau River; there are 5 road corridors connecting the MD with the Southeast region and the rest of the country, along with a system of ports stretching along the Hau River and Tien River. The region's agricultural, forestry, and aquatic product sources are abundant and have much potential for continued growth thanks to technological improvements that increase productivity and adapt to climate change.

Notably, in June 2023, the Chau Doc - Can Tho - Soc Trang expressway, over 188 km long, passing through 4 western provinces, with a total investment of nearly 44,700 billion VND, also commenced construction. The starting point of the route connects with National Highway 91 in Chau Doc City, An Giang Province; the ending point is at Tran De port, Soc Trang. Specifically, the section through An Giang is nearly 57 km long, Can Tho is nearly 38 km, Hau Giang about 37 km, and over 56 km through Soc Trang. In the first phase, the project will have 4 lanes, 17 m wide, for cars traveling at 80 km/h. When completed, the road surface will be expanded to over 32 m with 6 lanes. The entire route is expected to be completed in 2027, forming a crucial horizontal transport axis in the MD region. This route will connect the North-South expressway along the vertical axis, reducing the load on National Highway 1, N1 route, National Highway 91, etc. At the same time, the project also contributes to completing the regional transport network, connecting the economy and

society of the western provinces with Cambodia and other Southeast Asian countries.

The MD is the largest agricultural and aquatic product hub in the country, contributing 55.5% of the country's rice production, 65% of aquaculture production, and 70% of various fruits. According to data from the Ministry of Agriculture and Rural Development, the value of agricultural, forestry, and fishery production in 2022 (at constant 2010 prices) in the MD reached 472,972 billion VND, accounting for 33.9% of the total national agricultural, forestry, and fishery production value and increasing by 3.0% compared to 2021. The MD accounts for about 70% of the country's 1 million hectares of aquaculture, being the region with the largest output and value nationwide, contributing about 65%. The two main products are pangasius, contributing about 98%, and shrimp, contributing about 63% of the total national production. Aquaculture is concentrated in Bac Lieu, Ca Mau, and Soc Trang, while Kien Giang leads in wild-caught seafood.

Regarding export goods: the MD contributes up to 90% of the country's exported rice, with main export markets including the Philippines, China, Ivory Coast, Ghana, and Malaysia. With an area of nearly 380,000 hectares for fruit cultivation, the MD accounts for up to 65% of the country's fruit exports, with main destinations being the US, South Korea, Thailand, and Japan.

3.2 Challenges in logistics development in the MD region

Despite the immense potential and demand for logistics services, the current infrastructure (bridges, roads, warehouses, inland waterways, and seaports) and logistics services in the region are still limited. This forces most goods from the

MD to be transported to ports in the Southeast region or to the North for export, incurring high costs, time, and complexity, thereby increasing logistics costs and reducing the competitiveness of goods and businesses in the area.

With its dense network of rivers and canals, the region has potential for waterway transport development but has not been adequately invested in or exploited, and its transport capacity remains low. The waterway network in the MD is dense but not uniformly graded, especially in terms of depth. Although there are many inland waterway ports and terminals, most of the cargo handling equipment has not been modernized or synchronized, resulting in low cargo handling capacity ; many terminals lack road connections. Several bottlenecks, such as low bridge clearances (Mang Thit, Tra On, Nang Hai...), high density (Cho Gao canal), and irrigation sluices blocking small canals, hinder continuous transportation and affect the overall efficiency of the entire system. This "fragmentation" currently allows large vessels to only travel between Ho Chi Minh City and Can Tho via the Hau River, Tien River, and Vam Nao, with a very long waterway route of about 260 km. Although there are shorter alternative waterways between Ho Chi Minh City and Can Tho, these alternative routes only allow small vessels with low cargo capacity to be received. Barges cannot transport their maximum allowed load due to limited bridge clearances, with barge capacities only ranging from 1,500 to 3,500 tons.

Regarding the warehousing system, demand is high but capacity is insufficient and unevenly distributed, mainly concentrated in Can Tho, Long An, and Hau Giang. Empty container yards, port warehouse systems, and standard

agricultural irradiation facilities are projected to be in high demand in the near future, requiring urgent investment for development.

The number of logistics service enterprises in the area is currently not commensurate with the potential, reaching only about over 1,500 enterprises, mainly concentrated in 5 localities: Can Tho City, Kien Giang, Long An, Tien Giang, and An Giang Provinces. The scale of these enterprises is small, operations are dispersed, and they mainly focus on small-scale transport and warehousing services (except for some large frozen seafood warehouses and cold/cool warehouses of Hanh Nguyen Food Co., Ltd. (Hau Giang Agricultural Export Logistics Center).

3.3 Lessons learned for digital transformation in logistics in the MD region

There is a need for comprehensive and synchronized planning for sustainable logistics development in the region. The role of the state in supporting sustainable logistics development needs to be promoted. Based on international lessons learned, the following lessons are proposed for the MD:

Improve the legal framework for digital transformation in logistics: To alleviate concerns of businesses during the digital transformation process and the adoption of new technological solutions in the logistics industry, it is necessary to continue perfecting the legal framework for logistics services and digital transformation. This includes adjusting regulations on e-commerce, security, cooperation in preventing sabotage, and digital governance. The government needs to integrate network monitoring functions, ensuring network safety and security from the design and construction stages. Researching, amending, and issuing new policies and laws regulating logistics

services, multimodal transport, and cross-border transport in e-commerce are extremely necessary.

Support capital for digital transformation activities in the logistics industry: Due to the specific nature of the logistics industry, which is mainly comprised of small and medium-sized enterprises, the Government should issue preferential policies on taxes, land rental, and loan interest rates to support logistics service businesses in investing in warehousing networks, cargo sorting systems, and high-productivity automation equipment. There is a need for policies to encourage digital transformation, support preferential loans and interest rates for technology startup companies, and help logistics service businesses purchase or lease software solutions when they do not have sufficient financial capacity.

Enhance investment in synchronized and modern infrastructure: Investing in logistics infrastructure is a key factor. Projects need to focus on upgrading roads, railways, and seaport systems, completing the multimodal transport network, and effectively connecting regions within the area and other regions nationwide. Prioritize the development of inland waterway transport, maximizing the potential of the river system. Develop modern seaport systems capable of receiving large vessels and meeting increasing import-export demands. Improve cargo handling capacity, shorten vessel turnaround time, and reduce logistics costs. Build standard warehousing systems capable of storing various types of goods, especially agricultural products and food, while applying advanced, environmentally friendly preservation solutions.

Apply information technology: The government needs to invest in developing

telecommunications and IT infrastructure such as Internet networks, telecommunications, and data centers. This is the foundation for applying new technologies and digital transformation in logistics. Apply technology in supply chain management to effectively track and monitor transport, storage, and distribution activities. Develop e-commerce platforms connecting manufacturers, logistics service providers, and consumers. Apply electronic payment solutions and mobile payments to facilitate commercial transactions and blockchain technology for product traceability, ensuring transparency and security. Use IoT devices to monitor the location and status of goods throughout the transportation and storage process.

Support businesses in applying new technological solutions in the logistics industry: Raising awareness of the importance of digital transformation will help logistics businesses better understand and be motivated to implement digital transformation. The government needs to issue policies to support businesses in deploying and applying new technological solutions, such as tax, financial, training, and cooperation policies. These policies need to encourage businesses to invest in new logistics technology solutions, while minimizing risks for businesses on the path of innovation. New technological solutions will promote and enhance the operational efficiency of the logistics industry.

Develop high-quality human resources in the logistics industry: It is necessary to train a team of highly qualified logistics managers and staff who understand the market, operational processes, and technology applications. Raise community awareness about the importance of logistics, encouraging households and businesses

to participate in the logistics industry. Organize training courses and workshops on logistics to share experiences and update new knowledge for the workforce.

Develop green logistics: Developing green logistics helps minimize negative environmental impacts. The government needs to issue policies to encourage green logistics development, supporting businesses in applying clean transport solutions and using renewable energy. Businesses need to apply clean transport solutions, use renewable energy, and optimize transport routes to reduce emissions. Implement environmentally friendly logistics solutions, such as using energy-efficient transport vehicles and efficient waste management. Apply sustainable standards and practices in logistics management to minimize negative environmental impacts.

4. CONCLUSION

This study emphasizes the importance of digital transformation in the logistics sector to enhance the efficiency and competitiveness of the supply chain in the MD region. Learning from advanced countries, along with applying lessons learned such as perfecting the legal framework for digital transformation in logistics; supporting capital for digital transformation activities in the logistics industry; enhancing investment in synchronized and modern infrastructure; applying information technology; supporting enterprises in adopting new technological solutions in the logistics industry; developing high-quality human resources in the logistics sector. Furthermore, the application of information technology and the development of green logistics not only help minimize environmental impact but also bring long-term economic benefits. To achieve sustainable

development goals, close coordination among stakeholders, including government, businesses, and organizations, is needed to promote digital transformation and enhance the competitiveness of the logistics supply chain in the MD.

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