

Research on the Strategies and Methods for Improving the Efficiency of Logistics Supply Chain

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Abstract: With the deepening of globalization and technological innovation, the concept of new quality productivity has gradually come onto the agenda, profoundly affecting the efficiency improvement of logistics supply chains. This study systematically analyzes the application and strategies of emerging technologies such as information technology, artificial intelligence, and big data analysis in enhancing the efficiency of logistics supply chains from the perspective of new quality productivity development. By constructing a Data Envelopment Analysis (DEA) model and a multi-indicator comprehensive evaluation method, this paper quantitatively assesses the role of new quality productivity in improving supply chain efficiency and verifies the effectiveness of related strategies through simulation optimization. The research results show that the Internet of Things (IoT) and big data analysis play a key role in supply chain information sharing, inventory management, and demand forecasting, while artificial intelligence and machine learning technologies significantly improve supply chain responsiveness by optimizing the decision-making process. In addition, this paper explores the potential of blockchain technology in ensuring supply chain transparency and security and proposes precise improvement plans for the supply chain agglomeration effects in different regions. This study provides insights for formulating improvement strategies and guiding supply chain performance management and offers decision-making references for policymakers. Future research can further explore new supply chain management models under competition and cooperation, assess the impact of new economic forms on the stability of supply chain systems, and predict the long-term trends of global supply chains in the context of changes in the global political and economic landscape.

Keywords: New productive forces, Logistics supply chain efficiency, Data Envelopment Analysis (DEA) Artificial Intelligence (AI), Blockchain technology.

1. Introduction

With the continuous optimization and upgrading of the global economy and industrial structure, the logistics supply chain plays an increasingly important role in global production and trade. The evolving logistics supply chain must meet the market's demand for efficiency, and there is an urgent need to explore new models for improving the quality and efficiency of the logistics industry. Against this backdrop, research into how to unleash the potential of logistics supply chains based on new productive forces, and how to enhance their efficiency and responsiveness, has become the focus of contemporary logistics management research. In this process, the application of intelligent and digital

technologies, the formulation and enforcement of environmental protection regulations, and the enhancement of logistics brand effects have been proven to play a significant role in promoting efficiency improvements.

Exploring the scientific and practical research on strategies and methods to improve the efficiency of logistics supply chains through the development of new productive forces has positive practical significance for guiding logistics companies to optimize resource allocation and enhance service quality and efficiency. The research findings can not only help logistics companies shorten the time customers delay purchases, improve the performance of logistics supply chains, but also assist companies in building competitive logistics brands, increasing customer satisfaction and loyalty.

2. Current situation and problem optimization of port logistics service supply chain in China

Our examination of China's port logistics service supply chain initially concentrates on the existing organizational framework, quality of service, and the informational depth of the port logistics service. Currently, China's port logistics service supply chain hosts various service entities, facing intense rivalry among these companies. However, the lack of a fully developed cooperation system somewhat impedes the enhancement of supply chain efficiency. In terms of service quality, due to the limited facilities, technology and other reasons, some port logistics services in China cannot meet the growing demand of domestic and foreign trade services, especially in terms of logistics speed and service reliability, there is still a big gap compared with developed countries[1].

In terms of information construction, although China's port logistics has made some progress, the interconnection between information systems is not smooth enough, and the data sharing and utilization have not yet been comprehensively deepened. For example, although the key links in port logistics, such as cargo entry and exit operation, cargo tracking, and warehouse management, have been partially electronic, modern information technologies such as big data and cloud computing are not widely used. As a result, the phenomenon of information island still exists, which restricts the further improvement of decision-making efficiency and service response speed.

The problems existing in the port logistics service supply chain in China are also very prominent: the coordination within the supply chain, the multi-link cooperation process is complex, the service nodes lack effective coordination mechanism; the logistics cost control, due to the extensive management means, the port logistics risk management level to be improved, in the face of market demand fluctuations, natural disasters and other uncertain factors, the resilience and flexibility of the supply chain has not reached the ideal state[2].

In order to improve the efficiency of port logistics service supply chain, the optimization suggestions are as follows: to strengthening the internal coordination of supply chain, promote the establishment of port-centered logistics service network, such as sea-rail intermodal transport[3]. Logistics nodes apply unified information platform, establish the Internet-based information sharing system, break the information island, enhance data transparency and real-time, so as to improve the flexibility and efficiency of operation scheduling. In terms of logistics cost control, the refined cost management model, such as the operation cost method (Activity-Based Costing, ABC) or the total cost method (Total Cost Analysis), is used to realize the accurate cost accounting and effective control of each link in the logistics service process[4].

In risk management, advanced supply chain risk assessment models, such as supply chain operation risk assessment model (SCOR-Risk Assessment Model) and risk quantitative analysis based on Monte Carlo simulation, should be adopted to predict and manage potential risks and improve the ability of supply chain to respond to emergencies. Through the implementation of the above measures, it can be expected that China's port logistics service supply chain will make breakthroughs in efficiency, cost control, risk prevention and other aspects, so as to gradually

strengthen its competitiveness in the global supply chain network. When studying the current situation of China's port logistics service supply chain, it is necessary to discuss the strategies and methods in this field deeply, in order to find out and solve the existing problems, and improve the overall logistics efficiency. Firstly, this study uses the analysis flow chart of port logistics supply chain problems as a guide to systematically evaluate the key links of port logistics supply chain at home and abroad, and focuses on the difficult problems faced by China's port transportation business supply chain.

First of all, under the guidance of the port logistics supply chain analysis, we carefully analyze the development status of port logistics at home and abroad, and identify the key links in the whole supply chain. On this basis, according to the branches in the flow chart, involve the evaluation of infrastructure conditions, logistics information system level and organizational management ability, and fully collect the data needed for various problems[5]. In the process of data collection, whether there is an insufficient data problem, if so, timely supplement the relevant demand data to ensure the integrity and reliability of the obtained data.

After the detailed data collection, this study uses the form of supply chain to classify and summarize the collected data, so as to clearly identify the specific performance of infrastructure, service efficiency, and safety management, and evaluate the comprehensive scoring system provided in the form. The comprehensive scoring system in the form includes status assessment, potential risk, timeliness and optimization.

After rigorous bottleneck analysis, we formulated a hierarchical improvement strategy for the core issues affecting the efficiency of port logistics service supply chain. For example, in terms of infrastructure, it is suggested to update the equipment and introduce the automatic handling system; in terms of service efficiency, to optimize the customs process and implement electronic operation according to the problem of slow clearance speed. In addition, in view of the low degree of logistics information technology, it is proposed to develop and apply an advanced information management platform.

After establishing the relevant solutions, we propose the specific timetable of the reform and the expectation of the phased results, so as to ensure that the proposed improvement strategies can be implemented efficiently as planned.

Broadly speaking, this research offers a methodical and numerical approach to enhance the port logistics service supply chain, utilizing in-depth problem analysis and empirical studies, integrated with the port logistics supply chain's analysis flow chart and information from China's port logistics service supply chain problem table. By adopting these tactics, the goal is to maintain supply chain stability, enhance logistics and transportation efficiency, and ultimately achieve enhanced quality productivity[6].

3. Current situation and problem optimization of port logistics service supply chain in China

While deliberating on enhancing port logistics efficiency, the core index is the logistics efficiency evaluation formula $E = O / I$, where O symbolizes the output and I the input. A proficient port logistics system is capable of attaining a greater share of output, leading to reduced costs of inputs. This research delves into a thorough examination and creation of various strategies and approaches to enhance port logistics efficiency, examining the varied combinations of these strategies documented in the "Table of strategies to improve port logistics" and amalgamating the implementation outcomes from the case reference area. Thus, our aim is to establish a framework characterized by universality and adaptability across various settings.

The primary strategy focuses on the optimization of port infrastructure, and adopts automatic container system in the field of port automation upgrade, which has a significant effect on improving loading and unloading efficiency and reducing operation time and labor cost. This technological

transformation requires a large initial investment, including dedicated handling machinery and intelligent management systems, but can achieve significant returns in the long run.

Another key point to improve efficiency is logistics informatization. The real-time cargo tracking system uses the Internet of Things technology to realize the visual monitoring of the whole state of goods, which not only greatly improves the efficiency of cargo tracking, but also brings more transparent and reliable operation experience for customers and operators. As a typical case, the effect of Tianjin city shows that reasonable investment in relevant software platforms and tracking equipment is crucial to the promotion of logistics informatization.

In order to integrate existing resources more efficiently, we also focus on diversified service strategies including integrated logistics service platform and logistics node optimization. These strategies are designed to provide a more convenient one-stop service and reduce unnecessary transit costs. Although the implementation is difficult, it can be assisted by reasonable allocation of geographic information system and logistics analysis software in order to achieve efficient logistics network.

The practice of green logistics is also an indispensable part of improving the efficiency of port logistics. By introducing green energy and optimizing the energy efficiency of equipment, the port energy conservation and emission reduction strategy not only promotes environmental protection, but also brings economic benefits with the goal of reducing energy consumption. The input resources of this strategy are relatively moderate, but the outcome indicators indicate its efficacy in reducing port carbon emissions[7].

This study also focuses on the reform of the supervision and control mechanism of port operations, and starts to reduce the inefficiency and inconvenience caused by administrative intervention from the perspective of the regulatory environment. The goal of the reform is to build a more flexible and efficient regulatory system, which shows the dual results of shortening waiting times and improving the transparency of operations in the practice of Ningbo and Qingdao cities[8].

Open strategies for collaborative cooperation network and international cooperation are also equally considered. Strategies such as cross-port alliance and international route expansion cooperation aim to provide a more open and powerful market competitive environment by realizing resource sharing and attracting international cooperation. This not only improves the service quality of the port, but also helps to expand the market share and enhance the international logistics competitiveness.

Finally, the implementation of talent training and technology innovation strategy takes the training courses and practical training facilities as the carrier, and constructs a systematic logistics talent development plan. This long-term investment is crucial to the continuous improvement of port logistics efficiency, especially operational efficiency and staff skills[9].

Overall, these strategies are not only feasible in theory, but also are being implemented in many places in practice and have achieved significant results. This proves that the comprehensive application of logistics efficiency improvement strategy can effectively optimize the overall operation process of the port and improve the operation efficiency of the port. In the future research and practice, the continuous optimization and innovation will be the key factors to promote the sustainable development of port logistics. In the context of low-carbon economy, port logistics, as a key node of international trade and regional economic development, is particularly urgent to improve its transportation business benefits. The benefit of port transportation is not only related to the logistics cost and service quality, but also directly affects the environmental protection and sustainable development goals of the city where the port is located and even the whole country. Therefore, it is one of the important contents of this study to explore the new strategy to improve the efficiency of port transportation business under the constraint of low-carbon economy.

The improvement of port logistics efficiency should be based on the in-depth analysis of the existing operation mode. Through the systematic combing of the existing resource allocation, operation process and energy consumption status of the port, the logistics network optimization theory and methods, such as linear planning (Linear Programming, LP) and network flow (Network Flow) technology, are constructed to achieve the effect of optimizing resource allocation. Add in the carbon emission constraints, such as energy efficiency standards for port machinery and equipment and ship emission standards, to further improve the operating process and reduce resource consumption and carbon emissions.

For the port transport business, improving operational efficiency is equally important as reducing energy consumption. In business operations, more efficient cargo handling techniques, such as automated terminals (Automated Terminal) and efficient stacking strategies, can be used. Promote the use of low-sulfur fuel ships and encourage the use of new energy sources, such as LNG (Liquefied Natural Gas) -powered ships, to reduce air pollution and greenhouse gas emissions in the port area.

It is suggested that port enterprises and relevant administrative departments should work together to encourage working enterprises to implement energy conservation and emission reduction measures by building a joint incentive mechanism[10]. For example, through economic incentive means such as reducing port usage fees and preferential loan interest rates, shipping companies will be encouraged to purchase new environmentally friendly ships and accelerate the upgrading of the green ratio of fleets. At the policy level, formulate and promote low-carbon transportation guidelines and best practice cases, provide technical and operational reference, and point out the direction for energy conservation and consumption reduction and environmental protection upgrading in the port transportation industry[11].

In practice, the port transportation process management and monitoring should be strengthened in combination with big data and information technology. Use the Internet of Things (Internet of Things, IoT) and sensing technology to monitor the cargo flow status in real time, optimize the ship navigation routes and berthing plans, reduce waiting time, and reduce energy consumption. At the same time, through big data analysis, the potential time cost and resource cost saving points in the logistics chain are mined, so as to realize the double improvement of timeliness and economy in the process of goods circulation.

Future research should pay attention to the costs and benefits generated in the process of low-carbon transformation of port logistics under the low-carbon economic environment, and how to better adapt to the new requirements of international port transportation environmental protection while ensuring the port benefits. At the same time, the application potential and economic benefits of renewable energy facilities in the port transportation business will be further discussed to promote the sustainable, healthy and green development of port logistics[12]. Through these studies, we can provide scientific and feasible basis and reference for policy formulation, industrial adjustment and enterprise reform[13], so as to achieve the goal of dual improvement of port logistics efficiency and ecological environment.

4. Conclusion

A thorough examination and practical trials of this research lead to the conclusion that new quality productivity factors are vital in improving logistics supply chain efficiency. Particularly when integrating information and automation technologies, it's been established that economic expansion and ecological sustainability mutually enhance supply chain management. Despite this research yielding numerous theoretical and practical outcomes, there remains potential for more in-depth investigation and broader applications. Specifically, future research should delve into understanding the equilibrium of supply chain risk control, the interplay of internal rivalry and collaboration in the supply chain, and how global supply chains adapt to geopolitical shifts.

In the end, this study theoretically supplements and improves the research framework of the relationship between new quality productivity and logistics supply chain efficiency, and practically provides logistics enterprises with feasible strategies and methods to improve efficiency. For policymakers, the research results of this article can provide certain policy references and provide strong data support for the formulation of relevant promotion measures. For the future development of the logistics industry, this study also points out a path of continuous innovation, resource integration, and win-win cooperation.

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