

Research on the Countermeasures for the Low-Carbon Transformation of China's Logistics Industry under the Goals of Carbon Peaking and Carbon Neutrality

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Abstract: As a result of the massive emission of greenhouse gases, global warming has become the increasingly severe problem. Carbon emission reduction and low-carbon transformation are the general trends. How to make China's logistics industry move toward a low-carbon and low-energy consumption model has become a major challenge for the logistics industry. Based on the existing research and the actual situation, this paper takes the low-carbon transformation and carbon emission management of China's logistics industry under goals of carbon peaking and carbon neutrality as the starting point, and conducts analysis on four aspects deeply: lax policy constraints, imperfect carbon emission verification system of the logistics industry, unreasonable transportation structure of the logistics industry, and weak carbon emission management capabilities of logistics enterprises. And put forward feasible suggestions and improvement strategies to facilitate the low-carbon transformation of China's logistics industry from the four levels.

Keywords: China's Logistics Industry, Goals of Carbon Peaking and Carbon Neutrality, Low-Carbon Transformation.

1. Introduction

As a result of the massive emission of greenhouse gases, global warming has become the increasingly severe problem. China has also proposed the goals of carbon peaking and carbon neutrality. Carbon emission reduction and low-carbon transformation are the general trend. As a leading industry to promote economic development, the logistics industry is crucial to realize its low-carbon transformation and development. China has the largest logistics market in the world, but the traditional logistics industry is a typical energy consumption and environmental pollution industry. The data shows that the transportation, postal and warehousing industries closely related to the logistics industry account for 46.5% of the total consumption of gasoline, and the diesel consumption accounts for 68% of the total consumption. The total annual energy consumption of China's logistics industry has remained at a high level and is in continuous growth with large increases, and the transportation sector accounts for 23% of global greenhouse gas emissions[1].

With the release of policy relating to the goals of carbon peaking and carbon neutrality, China's manufacturing, industry and other industries have gradually established a carbon emission verification management system, but the logistics industry currently lacks a unified and credible carbon emission verification management system. If the logistics industry continues to develop in a high energy consumption and high emission mode, the overall realization of the goals of carbon peaking and carbon neutrality will be a huge challenge.

Therefore, this paper focuses on the insufficiency of low-carbon transformation and carbon emission management in China's logistics industry. In-depth analysis is made from four aspects: lax policy constraints, imperfect carbon emission verification system of the logistics industry, unreasonable transportation structure of the logistics industry, and weak carbon emission management capabilities of logistics enterprises, and targeted to put forward countermeasures to

promote logistics low carbon transformation. It aims to achieve the purpose of energy saving and emission reduction, compliant development, and environmental protection, and promote the transformation of the traditional logistics industry to a sustainable low-carbon logistics.

2. Literature Review

In recent years, the high carbon emissions and high energy consumption of the traditional logistics industry have attracted widespread attention from scholars all over the world, and many scholars have begun to conduct research on low-carbon logistics. The existing research on low carbon logistics is mainly conducted from three aspects: the first is the measurement of the efficiency of low-carbon logistics. Liang et al.[2](2022), combined with the three-stage SBM model and the Malmquist index model, the static efficiency and dynamic efficiency of low-carbon logistics are measured, and it is believed that there are regional differences in the efficiency of low-carbon logistics between regions. Gao et al. [3](2021) adopted the unexpected output SBM model to statically analyze the efficiency of low-carbon logistics in Shaanxi Province and believes that there is still room for improving the efficiency of low-carbon logistics in this region. Shi [4](2018) used the DEA-BCC model to measure the efficiency of low-carbon logistics in 30 provinces in China. The study found that China's overall low-carbon logistics efficiency is still not high.

The second is the research on the path optimization of low-carbon logistics. On the one hand, Lukman et al. [5](2018), Wang et al. [6](2019), Leng L [7](2020) and other scholars constructed and analyzed the low-carbon logistics path problems based on the construction of low-carbon logistics path planning model and optimized the transportation path through the model to energy conservation and emission reduction. On the other hand, Fang et al. [8](2020) conducted a literature review of logistics network optimization under low carbon constraints, and discussed the basic problems of logistics network optimization and the composite

optimization problem of logistics network. Ying [9](2021) constructed a model based on low-carbon logistics and green supply chain and verified the feasibility of applying low-carbon compensation to the logistics network model, thereby realizing low-carbon logistics management.

Finally, the research on the development of low-carbon logistics. Quan et al. [10](2020) used the IPCC method to calculate the total carbon emissions of China's logistics industry and used the LMDI decomposition model to decompose the influencing factors of carbon emissions, and found that economic growth is the main factor in promoting carbon emissions of the logistics industry. Kang H [11](2021) took into account the correlation between the factors affecting the development of low-carbon logistics, it measured the development level of low-carbon logistics in regions and found that there are significant differences in the development level of low-carbon logistics between regions. Guo et al. [12](2021) established an evaluation model for the development of regional logistics decarbonization and found that the development of logistics decarbonization between regions is unbalanced, and there are still significant differences.

At the same time, many scholars have conducted in-depth research on the issue of carbon emissions of the logistics industry, but the research conclusions are inconsistent. For example, in the impact of logistics and transportation structure adjustment on carbon emissions, Shao H [13](2021), Lin, et al. [14](2022) investigated the impact of logistics and transportation structure adjustment on carbon emissions from the regional level. Their studies all show that the optimization of logistics and transportation structure can achieve carbon emission reduction, and the emission reduction effect is the best in the western region, followed by the eastern and central regions. However, the research results of Zhao X et al. [15](2021) show that the carbon emission reduction effect of logistics and transportation structure is not significant.

By reorganizing and systematically summarizing relevant research results, it can be found that:

First, in terms of low carbon logistics efficiency measurement and low carbon logistics path optimization, the existing research mainly adopts the method of constructing empirical model and mathematical model. Based on the characteristics and status quo of low-carbon logistics efficiency, the efficiency of low-carbon logistics in different regions is calculated. The study has found that the efficiency of low-carbon logistics and the carbon emission reduction capacity are constantly improving, but the overall efficiency of low-carbon logistics in China is still not high, and there are still differences between regions. The low-carbon logistics route optimization model reduces resource usage and carbon emissions by reducing transportation routes and integrating logistics distribution networks.

Secondly, in terms of low-carbon logistics development, the current development level of low-carbon logistics and regional logistics decarbonization level in China are not high, so it is still necessary to further improve the evaluation system, optimize the evaluation model, and deeply explore the relevant influencing factors.

Finally, in terms of the impact of logistics transportation structure adjustment on carbon emissions, the existing research mainly uses a relatively single logistics transportation structure adjustment index for analysis. Since road transportation is the main contributor to carbon emissions in the logistics transportation, the implementation

of total carbon emission control under the "dual-carbon" goal and the specific requirements of carbon peaking is a major challenge facing the current logistics and transportation industry.

To sum up, it is urgent to conduct research on the current situation and countermeasures of low-carbon transformation of China's logistics industry under the "dual-carbon" goal, which has certain reference value for promoting the low-carbon transformation of China's logistics industry.

3. Inadequacies of Low-Carbon Transformation of China's Logistics Industry under the "Dual-Carbon" Goal

3.1. Lax Policy Constraints

First, in terms of policy formulation and policy implementation, China currently lacks a unified and feasible management system and policy guidelines on carbon emissions. Compared with foreign developed countries, China's development of carbon emission reduction started relatively late, so relevant laws and regulations still remain imperfect. In addition, the logistics industry involves many links, which makes it more difficult to implement and implement the policies and programs. The second is the lack of an effective punishment mechanism to regulate and restrain the high carbon emissions of the logistics industry and enterprises. The logistics industry is developing rapidly, with extremely high levels of carbon emissions and energy consumption. The choice of logistics enterprise strategy is related to the government's research and development, construction and punishment. However, there is currently no effective punishment mechanism to regulate and restrain the high carbon emissions of the logistics industry and enterprises. The existing schemes also have problems such as lack of strict constraints, unclear standards, and imperfect systems. Third, industry associations and leading enterprises have not taken the lead, resulting in an unreasonable logistics management system, which will affect the efficiency of packaging, warehousing, loading, unloading and transportation, It also leads to a great increase in carbon emissions and limits the speed and progress of low-carbon transformation, and making the logistics industry move towards a vicious circle of high carbon emissions.

3.2. Imperfect Carbon Emission Verification System of the Logistics Industry

First of all, there is a lack of a comprehensive carbon emission verification system for the logistics industry, let alone a standard system for reference. China has not developed a unified greenhouse gas accounting template, and the emission factor accounting method is defective in the actual accounting, which makes it difficult to verify carbon emissions. Second, the verification of carbon emissions data is inaccurate. As China's carbon emission verification technology has not been fully developed, and the logistics industry lacks technical guidance on carbon emissions, the collection and accounting of carbon emissions data relies on artificial. In addition, the quality of data collection instruments is relatively low, resulting in non-standard and inconsistent collection of basic carbon emission data, there are risks such as verification errors and data tampering. Finally, the existing carbon emission verification guidelines

are not practical. The carbon emission verification guidelines used by existing institutions are not clear enough to guide all aspects of the verification work. In addition, the scope of logistics activities involved is large and the collection link is complex, resulting in abstract regulations that are less practicable in actual verification.

3.3. Unreasonable Transportation Structure of the Logistics Industry

Transportation is one of the central links of logistics, and the carbon emissions of the transportation link account for 70% of the logistics industry. The high total carbon emission caused by the unreasonable logistics and transportation structure is a major challenge for China's logistics and transportation industry to achieve carbon emission reduction and green development. From the perspective of logistics transportation structure, there are four main modes of transportation in China's logistics transportation industry, namely highway, railway, waterway and air transportation. China's logistics and transportation structure is mainly based on road transportation, which accounts for 71% and 74% of passenger traffic and freight traffic respectively. Railway transport is obviously low in energy consumption and is generally easier to achieve electrification. However, the proportion of road transportation is relatively large, and the proportion of railway transportation is relatively small. Road transportation is mainly characterized by high energy consumption and high carbon emissions, which makes road transportation become the main source of carbon emissions of the logistics and transportation industry.

3.4. Weak Carbon Emission Management Capacity of Logistics Enterprises

First, logistics enterprises lack the corresponding policy guidelines. The guidelines for carbon emission management are often start from the perspective of the industry, but the carbon emission accounting methods and reporting guidelines of the logistics industry still lack construction and improvement. Moreover, there is also a lack of guidelines that can be implemented at the specific implementation level of enterprises. Second, the basis for verification of carbon emission data of logistics enterprises is weak. On the one hand, the verification proportion of logistics enterprises is relatively low, and the carbon information disclosure is relatively small. On the other hand, the coverage of carbon emission verification and disclosure of logistics enterprises is not comprehensive at the present stage. In the transportation link, a few enterprises may carry out carbon emission management, but the management of packaging, storage and other aspects is relatively lacking. Third, due to the lack of correct policy guidance, logistics enterprises will focus on temporary short-term interests and ignore the attention and verification of carbon emissions, and even ignore the management of carbon emissions for the sake of high efficiency in logistics.

4. Countermeasures for Low-Carbon Transformation of China's Logistics Industry under the "Dual-Carbon" Goal

4.1. Strengthen Policy Constraints

First, promulgate and improve the relevant laws and

security systems for the low-carbon transformation of the logistics industry. Including the improvement of the technical system, the management system of the linkage development of each link and the construction of the government's supervision system, so as to provide timely supervision and guidance to the industry and enterprises. Second, strengthen the constraints of policy to ensure that the implementation of commitments under the supervision of law and public opinion. It can start from the reward and punishment mechanism of strengthening carbon emission management, not only to increase the subsidies for the research and development of carbon emission-related technology, so that logistics enterprises can have more mature technology to carry out low-carbon logistics. At the same time, corresponding incentives will be given to enterprises and behaviors that actively carry out low-carbon transformation, and high-level penalties will be imposed on enterprises and behaviors that are not compliant and deviate from low-carbon transformation, so as to encourage and standardize the low-carbon transformation of the logistics industry. Finally, give full play to the leading role of logistics industry associations and leading enterprises, fully adjust the logistics management system, improve the level of logistics management, and improve efficiency in terms of packaging, warehousing, loading, unloading and transportation, thereby reducing carbon emissions.

4.2. Improve the Carbon Emission Verification System of the Logistics Industry

First, establish a comprehensive logistics industry carbon emission verification system. Different aspects of the logistics industry have different accounting methods, and a comprehensive logistics industry carbon emission verification system is conducive to ensuring the standardization and accuracy of the verification results. Second, increase policy operability. Make full use of the existing policies and guidelines, constantly improve the operability of the policies, and play a guiding role in the practical operation. Third, it is necessary to give full play to the leading role of logistics industry associations and leading logistics enterprises to lead the entire logistics industry to achieve low-carbon transformation. Finally, it is necessary to learn from foreign advanced technology and management experience, use the intellectual resources of universities, strengthen the carbon emission monitoring and verification technology of the logistics industry, increase independent research and development, and fully research and use carbon emission detection and verification equipment and related technology as soon as possible.

4.3. Adjust the Transportation Structure of the Logistics Industry

First, accelerate the adjustment and optimization of the logistics and transportation structure. To ensure that carbon emissions remain within a reasonable range, the logistics industry needs to achieve deep carbon emission reduction. The key way is to optimize and adjust the logistics and transportation structure, mainly by reducing the proportion of road transportation. Second, accelerate the formation of green and low-carbon transportation modes, so that the total carbon emissions can be effectively controlled. The logistics and transportation industry will increase the purchase of green transportation equipment due to the constraints of carbon emissions. The optimization of logistics transportation tools

means reducing the high-emission transportation tools and transportation modes and increasing the proportion of green and new energy transportation methods, which will lead to the internal transportation structure of the logistics transportation industry, and ultimately achieve carbon reduction. In addition, continuously optimizing the public transportation system and increasing the proportion of public transportation trips is also one of the important ways to realize the adjustment of logistics transportation structure and promote carbon emission reduction.

4.4. Improve the Carbon Emission Management Capacity of Logistics Enterprises

First, logistics enterprises should strengthen the awareness and experience of carbon emission data management and integrate carbon data management with production and operation. Logistics enterprises should also allocate professionals to support the carbon emission quantification process to ensure data reliability and avoid problems such as unclear identification of emission sources and incorrect data processing, which will greatly reduce the difficulty of carbon information regulation and statistics. Second, the carbon emission data disclosed by logistics companies should be more complete. It needs to cover all logistics activities, rather than only focusing on one aspect of transportation, but also should comprehensively and linked to cover the carbon emission data of all aspects of logistics. Third, link the long-term benefit returns after low-carbon logistics transformation with the development of logistics enterprises, and take the initiative to save energy and reduce emissions, which can not only respond to the call of national policies, but also achieve the “dual-carbon” goal after the low-carbon transformation, which is conducive to the competitiveness and long-term development of enterprises.

5. Conclusion

At present, China has a large demand for social logistics and transportation, and the rapid expansion of the logistics industry will also generate large carbon emissions. Faced with the task deployment of national carbon emission peaking and deep emission reduction, under the requirements of carbon emission intensity and total carbon value control, this paper explores the shortcomings of low-carbon transformation of China's logistics industry, and proposes measures such as strengthening policy constraints, improving the carbon emission verification system of the logistics industry, adjusting the transportation structure of the logistics industry, and improving the carbon emission management capabilities of logistics enterprises. It is of great practical significance to effectively promote the realization of the "dual carbon" goals of carbon peaking and carbon neutrality in the whole society of China.

References

- [1] Xu W. Research on Carbon Emission Efficiency of Provincial Logistics Industry in Low Carbon Background [D]. Jiangnan University, 2021.
- [2] Liang Z, Chiu Y, Guo Q, et al. Low-carbon logistics efficiency: Analysis on the statistical data of the logistics industry of 13 cities in Jiangsu Province, China [J]. *Research in Transportation Business & Management*, 2022, 43: 100740.
- [3] Gao J, Li T, Ma Z. A Longitudinal Empirical Study on Low Carbon Logistics Efficiency in Shaanxi Province [C]//2021 3rd International Academic Exchange Conference on Science and Technology Innovation (IAECST). IEEE, 2021: 1308-1311.
- [4] Shi M. Environmental Pollution and Measurement of Low-Carbon Logistics Efficiency in China's Logistics Industry [J]. *Nature Environment & Pollution Technology*, 2018, 17(4).
- [5] Lukman R K, Cerinšek M, Virtič P, et al. Improving efficient resource usage and reducing carbon dioxide emissions by optimizing fleet management for winter services [J]. *Journal of cleaner production*, 2018, 177: 1-11.
- [6] Wang J, Lim M K, Tseng M L, et al. Promoting low carbon agenda in the urban logistics network distribution system [J]. *Journal of cleaner production*, 2019, 211: 146-160.
- [7] Leng L. Research on the location path and hyperinspired algorithm of Low-carbon Logistics [D]. Zhejiang University of Technology, 2020.
- [8] Fang X, Nie L, Mu H. Research progress on logistics network optimization under low carbon constraints [C]//IOP Conference Series: Earth and Environmental Science. IOP Publishing, 2020, 615(1): 012060.
- [9] Ying Z. Low carbon logistics network planning based on green supply chain [C]//2021 13th International Conference on Measuring Technology and Mechatronics Automation (ICMTMA). IEEE, 2021: 86-89.
- [10] Quan C, Cheng X, Yu S, et al. Analysis on the influencing factors of carbon emission in China's logistics industry based on LMDI method [J]. *Science of The Total Environment*, 2020, 734: 138473.
- [11] Kang H. Evaluation of Regional Low Carbon Logistics [D]. Hebei University, 2021.
- [12] Guo Z, Tian Y, Guo X, et al. Research on Measurement and Application of China's Regional Logistics Development Level under Low Carbon Environment [J]. *Processes*, 2021, 9(12): 2273.
- [13] Shao H, Wang Z. The Spatial Association Network Structure and Its Impact Factors of Traffic Carbon Emission Efficiency in China [J]. *China's Population-Resources and Environment*, 2021, 31 (04): 32-41.
- [14] Lin S, Wang J. Carbon emission reduction effect of transportation structure adjustment in China: an approach on multi-objective optimization model [J]. *Environmental Science and Pollution Research*, 2022, 29(4): 6166-6183.
- [15] Zhao X, Zhang S, Yuan C. Spatial Measurement Test of Kuznets Curve for Transportation Carbon Emission Environment in China [J]. *Statistics and Decision-making*, 2021, 37 (04): 23-26.