Overview of Low Carbon Logistics Development in China and Foreign Countries

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Abstract. High energy consumption is a major feature of the logistics industry. Under the current low-carbon development requirements, the low carbon development of logistics is bound to be a new direction, and more scholars will turn their attention to low-carbon logistics. This paper presents a detailed introduction to low-carbon logistics from four aspects: the definition of low-carbon logistics, the influencing factors and Countermeasures of development, and the evaluation of carbon emission efficiency.

1. Introduction

In January 2017, the state council issued the "13th five-year plan for energy conservation and emission reduction", and made clear the goal of energy conservation and emission reduction during the 13th five-year plan period. The document points out that by 2020, the energy consumption of China's 10,000 yuan of GDP will decrease by 15% compared with 2015, and the total energy consumption will be controlled within 5 billion tons of standard coal, and the total emissions of major pollutants decreased by 10%-15%. With the rapid development of the logistics industry in recent years, its basic and strategic role in the national economic development has become increasingly prominent, but we should also see the energy and environmental problems it brings. To realize the commitment of "national contribution" and the goal of energy conservation and emission reduction during the 13th five-year plan period, the low-carbon development of logistics is bound to be a new direction, and more scholars need to make a thorough study of low-carbon logistics.

2. Definition of low-carbon logistics

The definition of low-carbon logistics has not yet clearly defined. China and foreign scholars have their own opinions on the definition of low-carbon logistics. Sbihi thinks that green logistics refer to the production and distribution of materials in a sustainable manner on the premise of considering environmental and social factors[1]. Rodrigue believes that green logistics can be used as a supply chain management method, which can reduce the environmental risk of logistics and distribution activities[2]. Katarzyna argues that the operation of low-carbon logistics must be scientifically sustainable and can be carried out from three dimensions: environment, society and economy[3]. Dai is the first to put the concept of low-carbon economy into the logistics. He points out that the problem of low-carbon logistics has three aspects: technical level, planning level and policy level[4]. Huang thinks that low-carbon logistics is the use of scientific management concepts and methods, which combines with advanced logistics technology and information technology to realize the unified coordination of ecological benefits and economic benefits[5].

By comparing the definitions of low-carbon logistics between domestic and foreign scholars, it is found that domestic scholars are integrating low-carbon ideas into logistics activities and supply chains, and foreign scholars usually equate low-carbon logistics with green logistics. But scholars hold the same view on the difference between low carbon logistics and traditional logistics, which is the unification of economic benefits and environmental benefits. The main contents of low-carbon logistics include low carbonization of all aspects of logistics activities and low carbonization of management processes. In a broad sense, it is the low carbonization of logistics activities forward and reverse in the whole supply chain. In the narrow sense, it is the low carbonization of logistics specific activities, namely, the low carbonization of warehousing, transportation, packaging and circulation processing.

3. Influencing factors and countermeasures of low carbon logistics development

3.1 Influencing factors

At present, mainstream scholars are studying the influence factors of low carbon logistics mainly from the micro level, the mesoscopic level and the macro level, involving government, industry and enterprises.

At the macro level, Li Donghui believes that the logistics industry has developed rapidly, but policies, regulations and publicity have not kept up with the pace, which causes the present situation of high energy consumption, pollution and low efficiency. These obstruct the low carbonization process of logistics industry[6]. Ding yiping thinks that the government should play the role of guidance and encouragement. The absence of relevant laws and regulations at the macro level leads to the lack of enthusiasm for low-carbon logistics in related enterprises[7]. According to the current situation of low-carbon logistics development in China, Zhao Songling thinks that the lack of government guiding, the non-standard of carbon emission statistics and the backward development of low-carbon transportation technology have led to the slow progress of low-carbon logistics[8].

At the meso level, Peng yanli argues that the current market for common goods logistics is chaotic and inefficient. The backwardness of fresh goods and cold chain logistics equipment cannot meet the market demands. Dangerous goods logistics is in disorder and there is a big public security risk. The whole logistics industry is inefficient and costly[9]. Fan Lu believes that the current logistics industry should start from its own reality, through scientific and rational planning, to achieve rationalization of transportation routes and methods and to improve the application of logistics information technology[10].

At the micro level, Zwetsloot has studied 61 industrial enterprises from 42 countries. He concludes that the technological innovation ability of enterprises plays a very good role in promoting energy conservation and emission reduction[11]. Kim, through a comparative study of carbon emissions from various modes of transport, finds that the use of multimodal transport can significantly reduce transportation costs and carbon emissions. This method has very good economic and environmental benefits[12].

3.2 Countermeasures

At present, there are two aspects of the research on the implementation mechanism and countermeasure of low carbon logistics development. One is the macroscopic mechanism level and the other is the micro enterprise level.

At the macro level, carbon trading and carbon tax policies are well done now. However, with the deepening of the research on carbon emission theory and the development of "carbon identification" technology, the above two methods will play a great role in promoting the development of logistics industry in the near future. Carbon trading has made certain progress, and carbon emission rights have gradually developed into financial products with circulation and investment value. "Carbon finance" has become a new research hotspot. By studying the case of Industrial Bank, Li Shuxiang establishs the support model of low-carbon logistics, and concludes that the combination of low-carbon logistics and financial services can be as a new model of economic growth[13]. Li Li points out that the development of low carbon logistics cannot realize without financial support as the basis. She sets out a framework for financial support from the two dimensions of the market and government, and provides measures to address the financial shortfalls that exist in logistics activities[14].

At the micro level, the research on the implementation of low-carbon logistics is mainly from the specific aspects of logistics, logistics technology, information technology, logistics management and so on. Mc Kinnon finds that the number of warehousing facilities in the logistics enterprises is related to the amount of carbon emissions through the on-site investigation method. The resulting cost difference curve can serve as a reference to the decision-making of warehousing facilities in logistics enterprises[15]. Li Jiansheng proposes that the connection between the supply and demand bodies of logistics could be realized through the rational planning of the various aspects of logistics operations and the introduction of advanced low-carbon logistics technology[16].

4. Study on carbon emission efficiency evaluation of low-carbon Logistics

4.1 Research status

Although the logistics industry is a strategic industry related to the national economy, it also produces a great deal of carbon dioxide, which harms the environment. It has a practical significance to study the carbon emission efficiency of regional logistics industry. At present, scholars have studied the definition of carbon emission efficiency from two perspectives: single factor perspective and total factor perspective.

The single factor perspective only needs to calculate the ratio of the output of the factor to the input. The relationship between carbon emissions and economic development is inseparable. In order to study the relationship between carbon emissions and economic development, some scholars have used economic indicators GDP to define the efficiency of carbon emissions. Kaya thinks that the concept of carbon productivity refers to the ratio of GDP to carbon emissions in that region within a given period of time[17]. Sinton takes energy intensity as an indicator of energy efficiency[18]. Ang B W takes the energy consumption per unit GDP as a carbon index and studies the climate change through the index[19]. Sun J W believes that carbon emission intensity (unit GDP carbon dioxide emissions) is an ideal indicator to evaluate the effect of carbon emission reduction in a country or region[20].

It is more concise and clear to study the carbon emission efficiency index from the perspective of single factor, but the single factor perspective is only from a single point of view to study the carbon emission efficiency, which has a certain one-sidedness. In order to avoid the limitation of single factor perspective, scholars have made a new study on carbon efficiency from the perspective of total factor. Bing thinks that the total factor efficiency of carbon emissions needs to take into account the role of elements such as politics, economy, culture and technology in carbon emissions[21]. Ramanathan thinks that the definition of carbon efficiency should take into account the relationship between carbon emissions and economic development, energy consumption, which can highlight the overall and rationality of carbon emission efficiency indicators[22]. Zaim believes that the concept of comprehensive performance index of carbon emission is put forward for the first time and carbon emission is defined as non ideal output variable[23]. Zhang agrees with the carbon productivity index, which gives a more adequate consideration of the demographic and economic effects[24].

4.2 Calculation method

At present, most scholars adopt the method of total factor energy efficiency to calculate carbon emission efficiency. This approach maximizes carbon efficiency by keeping energy, capital, and human factors constant. At present, the two methods commonly used by scholars are data envelopment analysis (DEA) and Stochastic Frontier Approach (SFA). The data envelope analysis method does not require a constructor to estimate the energy efficiency which can avoid some of the constraints of the parametric method. Many scholars in China have applied this method to the energy field to study the efficiency of carbon emissions. Yang Hongjuan has studied the concept of low carbon supply chain, and established the index system based on it[25]. In order to solve the problem of inefficiency of carbon dioxide emissions from rural areas in some parts of China, Yao Guanxin uses the three-stage DEA method to evaluate the performance of logistics carbon emissions in rural areas from 2004 to 2014[26].

The stochastic frontier analysis method uses the linear regression model of the parametric equationto to estimate. The model takes the random error into account and is more suitable for the calculation of economic efficiency. Herrala calculates the carbon efficiency of 170 countries in the world through the SFA model, where China is the last bit of emissions efficiency[27]. Liimatainen studies the carbon efficiency of the Finnish freight sector and predicts the carbon efficiency of the freight sector in 2016 accurately[28]. Using the Malmquist index and SFA model, Zhang Lifeng obtains the total factor productivity under the constraint of carbon emission in china. The result shows that technology has a positive effect on the improvement of total factor productivity[29].

5. Conclusion

In recent years, the domestic logistics and distribution industry has developed rapidly. It plays a key role in optimizing the distribution of resources and promoting the comprehensive competitiveness of cities. However, in the development of low carbon economy mode, the external diseconomy of logistics is also getting more and more scale diseases, including large consumption of urban resources, energy and emission of pollutants. With the increasing attention and research of low carbon logistics in recent years, low carbon logistics has formed a more systematic theory. Through the research on the definition, influencing factors and carbon emission efficiency of low-carbon logistics, scholars have grasped some theoretical foundations and methods, but there are still some shortcomings, which need further study. The optimization of all aspects of logistics is a systematic project, and it is a process that involves all stakeholders and involves the integration of global planning and operation optimization. Taking into account the important impact of low-carbon policy on the development of urban economy and logistics industry, the optimization of logistics re-design is also an important issue, such as carbon tax, carbon emissions limit policy, logistics vehicles according to the scale of the right to arrange the policy and Road limited time driving policy.

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