
| RESEARCH ARTICLE

Research on the Problems and Countermeasures of Agricultural Products Distribution in China Under "Double Carbon" Goal

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| ABSTRACT

At the 75th session of the United Nations General Assembly in 2020, China proposed that carbon dioxide emissions should peak before 2030 and strive to achieve carbon neutrality before 2060. The 2022 "Government Work Report" pointed out the orderly promotion of carbon peak and carbon neutrality. This paper analyzes the impact of the "double carbon" target on the logistics distribution of agricultural products, including energy consumption and carbon emissions, and then discusses the existing problems from the aspects of picking, packaging, transportation and storage of agricultural products, such as low logistics distribution efficiency and unreasonable storage methods for waste agricultural products during transportation. As an important link between agricultural production and consumption, agricultural products logistics distribution must adapt to the requirements of dual-carbon goals, optimize logistics distribution mode, improve logistics efficiency, and reduce logistics carbon emissions so as to achieve sustainable development. Therefore, this study selected the problems and countermeasures of agricultural product logistics distribution in our country under the dual carbon goal as the research object in order to provide a reference for promoting green development of agriculture and realizing the dual carbon goal.

| KEYWORDS

A "two-carbon" target; Agricultural products; Logistics distribution

| ARTICLE INFORMATION

ACCEPTED: 1 January 2024

PUBLISHED: 30 January 2024

DOI: 10.32996/jhsss.2024.6.1.9

1. Introduction

The report of the 20th National Congress of the Communist Party of China pointed out that we must firmly establish and practice the development concept that green water and green mountains are gold hills and silver mountains, and promote green and low-carbon economic and social development is a key link to achieve high-quality development. The goal of "dual carbon" (carbon peaking and carbon neutrality) is of strategic significance to the green transformation of China's industrial structure and the realization of high-quality economic development, among which agriculture is one of the important fields. In recent years, global climate change has become more and more serious, and governments around the world have put forward targets and measures to deal with climate change. Among them, the two-carbon target refers to achieving a carbon peak by 2050 and carbon neutrality by 2060. As one of the world's largest producers of agricultural products, China has a large energy consumption and carbon emissions in the logistics distribution of agricultural products, which is of great significance for realizing the double carbon goal. Logistics distribution of agricultural products refers to the logistics process from the production place to the sales place, including picking, packaging, transportation, storage, distribution and other links. With the continuous improvement of the scale, intensification and modernization of agricultural production in our country, the scale and complexity of agricultural product logistics distribution are also increasing. However, there are many problems in the distribution of agricultural products, such as high energy consumption, large carbon emissions, low transportation efficiency and high distribution costs, which not only affect the quality and safety of agricultural products but also cause no small pressure on the environment. Distribution of agricultural products has always been an important support for agricultural development and economic growth. However, with the rapid development of our economy a

nd the acceleration of urbanization, the distribution of agricultural products is facing more and more challenges and problems. First of all, energy consumption and carbon emissions are large. In the logistics distribution of agricultural products, the energy consumption and carbon emissions of transport vehicles and storage equipment are large, which causes a great burden on the environment. Secondly, the transportation efficiency is low. Due to the vast territory of China, the logistics distribution span of agricultural products is large, and the distribution channel is not smooth enough, resulting in low transportation efficiency and affecting the quality and safety of agricultural products. Finally, distribution costs are high. Due to the complexity and unpredictability of the logistics of the distribution of agricultural products, the distribution cost is high, which puts great economic pressure on farmers and consumers. Optimizing the logistics distribution of agricultural products in China, improving distribution efficiency, and reducing energy consumption and carbon emissions under the background of dual carbon targets have important practical significance and theoretical value.

2. Literature review

Domestic scholars have carried out a more in-depth study of agricultural product logistics distribution. Tian Xiaoping pointed out that at present, China has made rapid development in the field of fresh agricultural product logistics, but logistics personnel are still relatively short, and there is a serious waste of resources in the distribution link. In this regard, he gave a series of suggestions for improvement, such as innovating the distribution model, increasing logistics distribution vehicles, and strengthening the training and introduction of logistics talents so as to solve the problems in development. Zhang Runzhuo [2022] believes that agricultural cold chain logistics companies and industries should continue to improve their own concepts and, on this basis, continue to carry out new model innovation and a summary of successful practices. Only in this way can we promote the sustainable development of China's refrigerated logistics industry. Zhu Zhenfeng [2022] concluded that under the low-carbon environment, the agricultural product logistics mode of Shanxi Province needs to be changed from the traditional farmers' market mode to the low-carbon logistics mode to promote the development of a low-carbon agricultural industry in Shanxi Province and to help achieve China's carbon emission goals. Li Jianjun et al. [2022] found that smart agriculture is not only the future development direction of China's agriculture but also an important trend in world agricultural development. The global market value brought by smart agriculture is gradually increasing, and the market potential is huge. [Li et al 2023]

Based on this, this paper firstly analyzes the current situation of agricultural product logistics distribution in China, combined with the proposal of China's double carbon goal, deeply analyzes the existing problems in the development of agricultural product logistics in China and puts forward corresponding solutions. It provides some reasonable suggestions for solving the shortcomings of agricultural product logistics distribution, reducing energy consumption in the distribution process, and achieving the reduction of carbon emissions.

3. The concept definition of "double carbon" target and its requirements for logistics distribution enterprises

3.1 The meaning of the "two-carbon" target

On a global scale, the "dual carbon" goal is an important part of the strategies and targets formulated by countries to address climate change, and it is also the direction of joint efforts of the international community to achieve the goal of sustainable development and shared prosperity. The report of the 20th National Congress of the Communist Party of China once again emphasized the new development concept of green sharing, which pointed out the direction for future efforts to cope with climate change and achieve carbon peak and carbon neutrality. [People's Daily 2023] To control the balance between total emissions and net absorption of greenhouse gases in order to curb global climate change and mitigate global warming. Specifically, the "two-carbon" goal includes two aspects: first, carbon emission control. By reducing carbon dioxide and other greenhouse gas emissions, reduce the total carbon emissions in order to achieve the purpose of mitigating global climate change. Second, carbon absorption control: By increasing the vegetation coverage area, protecting forests, developing ecological agriculture and other ways, increase the absorption of carbon dioxide by plants and increase the total absorption of carbon so as to achieve the purpose of reducing global warming.

3.2 The requirements of the "double carbon" target for the distribution of agricultural products

Under the background of "double carbon" economic development, the green development thought of sustainable development has become the guiding ideology of the development of various industries in society. [Sun 2023] The goal of "double carbon" requires development not only to ensure the effective use of social resources but also to create a new social and economic development ecology. The "Double carbon" economy is a new economic model, and its application to the field of agricultural product distribution is not only conducive to the optimal allocation of resources and promotes the transformation of industrial development but also conducive to improving the quality of agricultural product distribution service and improve the competitiveness of logistics companies. Logistics enterprises should be based on the current market economy development and the basic concept of cold chain logistics, and in view of the problems existing in reality, put forward a standardized and feasible agricultural product logistics distribution mode.

4. Current situation of distribution of agricultural products logistics in China

China has the largest population in the world and is also one of the largest agricultural countries in the world, with abundant agricultural output. Moreover, China also has complex and diverse geographical characteristics, which determines that the crops planted in different regions have significant characteristics, and the distribution of agricultural products varies greatly, so the cross-regional distribution needs are obvious. With the development of China's agriculture, the production and sales of agricultural products are facing more and more challenges, of which logistics distribution is an important link. This section will analyze the current situation of agricultural product logistics distribution in China from the aspects of new energy logistics distribution vehicles, the development of cold chain transport enterprises, and the status quo of logistics employees.

4.1 New energy logistics vehicles are increasing year by year

In 2013, the national new energy logistics vehicle market grew fastest, reaching 14%. In 2017, China's new energy logistics distribution vehicle output was 152,000, the highest in recent years. Over the next few years, capacity declined as the market became saturated. In 2020, the total production of new energy logistics distribution vehicles reached 58,000. With careful analysis of the factors affecting the sales of new energy logistics vehicles, it is not difficult to find that the policy impact is greater. In addition, the unreasonable layout of charging piles, inadequate after-sales, and difficulty in estimating the residual value of new energy logistics distribution vehicles have also had a certain impact on the sales of new energy logistics distribution vehicles. With the introduction of the "dual carbon" policy in 2021, the official implementation of the "National Six", and the call of the central and local governments to accelerate the electrification of public transport vehicles, the cumulative sales of new energy vehicles have reached 130,000, an increase of 126.21% over the same period last year. The sales of new energy logistics vehicles in 2020 are the lowest, which is affected by uncontrollable factors. So, after 2021, there was a strong rebound in market demand. The development of new energy logistics vehicles has the following reasons: First, the policy dividend and the state's policy support for new energy vehicles are great. Logistics transport vehicles are the most important part of the transportation process. Although the current transport vehicles are still mainly used by traditional fuel vehicles, under the continuous release of the national policy dividend, the production of new energy logistics vehicles, vehicle sales will continue to grow in the future for a period of time, new energy vehicles are expected to replace the traditional fuel vehicles, occupy the main position.

4.2 Cold chain logistics is developing rapidly

With the continuous growth of urban and rural income levels in China, people have put forward higher requirements in terms of food diversity, nutrition and taste. Coupled with the rapid rise of the fresh e-commerce market, the refrigerated logistics industry has been pushed to the track of rapid development. According to the data released by the relevant departments, from 2015 to 2019, the scale of China's cold chain logistics market was constantly expanding, and the annual average compound growth rate was about 17%, which is a greater growth compared with the same period last year. In 2020, the overall scale of the entire market will reach the largest development rate in recent years, and its output value will exceed 400 billion yuan. It is expected that before 2025, China's cold chain logistics market will have a greater leap forward, and eventually, there will be an increase of about 897 billion yuan. As can be seen from Figure 3, in 2021, China's cold chain logistics market grew at a rate of 9.2%, and its market size was 418.4 billion yuan. On the whole, the scale of China's cold chain logistics market has a strong momentum of development, but there is also an imbalance in regional development. [Ding et al 2023]

4.3 Logistics big data development momentum is strong

The rapid development of big data applications in China has spawned a number of economic models in the form of "big data +", among which "smart logistics" has grown most rapidly, showing a continuous leapfrog development trend.[Che 2023]The performance of big data logistics guided by the concept of smart logistics is particularly outstanding, with an annual growth rate of more than 50% and more than 2 million employees. It seems that big data has become an indispensable helper for logistics enterprises. "Big data" as new technology brings opportunities for logistics enterprises to reasonably use big data technology, and logistics enterprises will play a positive role in management and decision-making, resource allocation, and other aspects. In 2014, the application scale of China's logistics big data application market was 292 million yuan, and it will reach 18.823 billion yuan by 2020. China's logistics big data industry is still in its infancy, among which the e-commerce logistics big data is beginning to take shape. The analysis of big data can effectively help improve the efficiency of enterprise operation and management, reduce the logistics inventory rate, and help enterprises improve the efficiency of commodity processing, transportation efficiency, delivery accuracy, and other aspects.

5. The bottleneck of logistics distribution of agricultural products in China under "double carbon" goal

5.1 The current distribution model is inefficient

From the perspective of the development of China's agricultural product market, there are four development modes: self-production and self-marketing, agricultural product wholesale market, and agricultural product logistics park. At present, China's agricultural products trading is still wholesale as the main way. After farmers harvest crops and agricultural products, they are purchased by specialized buyers from scattered farmers and then transferred through layers to the wholesale market, then to the consumer

market, and finally to the hands of consumers. This approach involves too many chains, which leads to low efficiency and high costs in the supply chain. The remaining three models each have their shortcomings. Due to the limitations of individual farmers' production, their sales in the market are small, and their concentration in the market is poor, which restricts the production efficiency of transforming the traditional production and management mode into agricultural production and management mode. In addition, due to the wide distribution of farmers, it is difficult to effectively improve the distribution efficiency of agricultural products, which leads to the rise of distribution costs. In addition, there are still some shortcomings, such as the logistics business in the agricultural park not being carried out effectively and insufficient experience in tripartite cooperation. In addition, the use of third-party logistics distribution may also increase operational risks for the company.

5.2 Traditional fuel car deliveries increase carbon emission

In the process of distribution of agricultural products, carbon emissions are affected by many factors. One of the most important is the fuel consumption of transport vehicles. In addition to the fuel consumption from transport vehicle braking, which is also limited by the current domestic refrigerator refrigeration equipment, it is mostly the consumption of diesel, gasoline, and other energy operations. In addition to the fuel consumption mentioned above, there are other factors that affect fuel consumption, such as cargo load and traffic conditions. The quality of road conditions has a certain impact on the speed of the car. In the city, the number of traffic lights is more, the traffic is frequent, the road loss rate is relatively large, and in the city, the internal road is extended in all directions, twists and turns, and the energy consumption is more. Transport conditions can also have an impact on fuel consumption. Urban road traffic is good, vehicles run smoothly, relatively speaking, will reduce fuel consumption. When the vehicle runs on the road with poor traffic conditions, the vehicle runs unsmoothly due to the need for frequent vehicle control, which will cause an increase in vehicle fuel consumption. In addition, road congestion also affects fuel consumption, which in turn affects carbon emissions. In the process of transportation, unreasonable storage will lead to the loss of agricultural products, resulting in an increase in carbon emissions. On the other hand, the fuel consumption of distribution tools is also one of the important reasons for carbon emissions.

5.3 Cold chain transport facilities are not perfect

Due to the imperfect facilities at the front and back end of the domestic cold chain logistics, most of the fresh agricultural products are not provided with standard heat preservation, moisture and cold treatment during transportation, which not only increases the loss rate of agricultural products but also increases the uncertainty of agricultural prices and quality. There may be two reasons for the unsound facilities: first, the number of freezers and other auxiliary equipment is low. As one of the most important modes of transport for cold chain logistics, refrigerated trucks in China had about 214,700 units in 2019, compared with the previous year, although its number has increased by 34,700 units but in the face of China's huge demand market, the number of refrigerated trucks is still far from enough. Second, low temperature storage and transportation efficiency is not high. Compared with developed countries, the cold chain transport rate of primary agricultural products has always been relatively low. In developed countries, its average content has been between 80% and 90%. In addition, due to the imbalance between local supply and demand, as well as the lack of cold chain transport capacity, the company's storage capacity is not used to the maximum extent and is not compatible with population and economic development. This also means that there is still a lot of room for the development of cold chain logistics in the future.

5.4 The labor quality of employees in the industry is low

China's logistics industry already has a large gap between the supply and demand of talent, coupled with the relatively backward domestic talent training system, resulting in a serious shortage of logistics talent. The overall quality of internal personnel is low, especially in the supply chain, where professionals are seriously insufficient. In addition, the age structure of the employees is between 31 and 50 years old, which means that the company lacks a young backbone. In addition, the proportion of people with education level of high school or below is close to 70%. Their education level is relatively low, and they are also relatively lacking in relevant professional knowledge, especially in the logistics of fresh agricultural products. An important factor in the high loss rate of fresh agricultural products in the company is the lack of professional fresh agricultural products logistics personnel, and they have not been able to avoid this in time. The shortage of cold chain logistics talents will, to some extent, have an impact on the management standards of agricultural products, which will adversely affect the service level and quality of distribution and also hinder the development of the entire industry.

6. Optimization path of logistics distribution of agricultural products in China under "double carbon"

6.1 Innovative agricultural product distribution models

First of all, digital technology should be applied to the planning of distribution routes, connecting the Internet and the distribution of agricultural products, making full use of relevant advanced technologies such as cloud computing and big data, using intelligent equipment such as drones and unmanned vehicles, and constantly upgrading logistics activities such as operation and distribution. The traditional logistics system should be upgraded in a planned way, the traditional inefficient work should be replaced by innovation, the distribution efficiency should be improved, and smart logistics should be built. In addition, under the develop

ment idea of a green economy, how to successfully transform the traditional logistics model and how to informationize and digitize the logistics industry has become an urgent problem to be solved, which requires relevant enterprises to use relevant technologies to improve their core competitiveness. In the future, intelligent logistics will be replaced by many automated equipment and high-tech products, and the fastest distribution speed, the highest distribution efficiency, and the lowest distribution cost will be achieved. With the expansion of the distribution volume of agricultural products and the market size of all agricultural products, relying only on a self-operated distribution mode is far from meeting the market demand. Considering the long-term development of agricultural product distribution, third-party distribution and joint distribution models can be adopted to increase distribution volume and meet market demand. The third party distribution mode refers to the third party except for the supplier and the demander to carry out the distribution. The adoption of this model will not only reduce investment in dedicated facilities for agricultural products but also increase the volume of distribution. Of course, when choosing a third-party logistics company, it is also necessary to investigate whether the company's agricultural product logistics distribution ability can meet the requirements.

6.2 Accelerate the promotion and application of new energy logistics vehicles

The government needs to introduce relevant policies to guide and demonstrate the promotion of new energy vehicles for key enterprises and promote large vehicle groups and logistics operation platform enterprises to quickly replace traditional logistics vehicles with new energy vehicles. In this process, we should give full play to the leading role of large enterprises, and relevant departments should also study and formulate the advantages and disadvantages of new energy vehicles in the urban right of way. Formulate the priority policy for new energy trucks as soon as possible, such as liberalizing the right of way, allowing an unlimited tail number, providing parking concessions, and other related policies. It is also necessary to introduce corresponding preferential policies to encourage enterprises to purchase new energy vehicles. In order to accelerate the application of new energy logistics vehicles and formulate a sound operation subsidy policy based on the running mileage, the method of "total control and annual allocation" is adopted to encourage the use of new energy logistics vehicles by logistics express companies. To promote the popularization of new energy vehicles in China, the integrated design of new energy vehicles should be promoted as soon as possible, and the corresponding support policies should be introduced. Promote automobiles, batteries, and other manufacturers to accelerate the development of advanced technology and research and development of advanced products. Carry out scientific research on automobile manufacturing and power battery manufacturing, and encourage the automobile manufacturing industry to accelerate the development of new, efficient and energy-saving vehicles. It is also necessary to solve the charging problem of new energy vehicles, improve the layout of charging stations and hydrogen filling stations, and accelerate the design and layout of fast charging stations and charging facilities for medium and large commercial vehicles.

6.3 Strengthen the construction of logistics professionals

Enterprises should strengthen the cultivation and introduction of talents. First, it is necessary to do a good job in personnel training, especially the training of professional personnel, such as logistics management personnel and cold chain technical personnel. Through the formulation of talent training objectives, the formulation of talent training standards, the use of various means of talent training, talent evaluation and other work. The second is to increase the introduction of talents, especially the introduction of professional talents. For the introduction of technical talents, it is necessary to consider whether the basic knowledge system and professional skills of the cold chain are solid, whether they have the ability to solve the problems of cold chain logistics and distribution, and professional knowledge such as finance, law and computer. It is also necessary to increase educational input, increase educational resources in rural areas, and improve farmers' cultural quality and vocational skills. Establish a training mechanism, conduct professional skills training for existing practitioners, and establish a sound vocational qualification certification system. Support innovation and entrepreneurship, encourage farmers and entrepreneurs to innovate and start businesses in the field of agricultural product distribution, and improve the competitiveness and development level of the entire industry.

6.4 Strengthen the construction of basic cold chain logistics facilities

First of all, we must lay out the backbone base of cold chain logistics. Focusing on the major national strategic needs, the company mainly serves the needs of large-scale refrigeration, emergency materials storage and transportation, international and domestic distribution, and wholesale trading, and focuses on areas with good transportation conditions such as national comprehensive transportation hubs, national logistics hubs, and multimodal transportation centers. Focus on the construction of a certain scale of cold chain logistics base (cold storage capacity $\geq 250,000$ cubic meters), equipped with sorting, grading packaging and other facilities and equipment, with partition storage or temperature conversion storage function, with the whole temperature and humidity monitoring and automatic adjustment of visual information management system. Secondly, it is necessary to lay out cold chain logistics parks. Around key industrial platforms and functional areas, it mainly serves cold chain logistics related industries such as agriculture, forestry, animal husbandry and fishery, food and medicine circulation and processing, warehousing and distribution, and focuses on the surrounding areas of cities and important agriculture, forestry, animal husbandry and fishery producing areas, slaughter areas and manufacturing agglomeration areas. Focus on the construction of a certain number of cold chain logistics parks (storage capacity $\geq 80,000$ cubic meters), with partition storage or temperature conversion storage functions, with a visual information management system. Finally, the distribution center of cold chain logistics should be laid out. Around the cold chain p

reduction and sales of the whole chain circulation network, the main service areas of picking and fishing, livestock and poultry slaughter, milk and egg supply of commercial pre-treatment, packaging, distribution and transport, as well as frozen food, medicine and other temperature control requirements of the temporary storage and distribution of products, focus on the distribution between the production and sales. Focus on the construction of a certain proportion of distribution centers, with post-natal cleaning and pre-cooling infrastructure and warehousing, transport, distribution and other equipment. There is a visual information management system for collecting product pre-cooling and other whole process data.

7. Peroration

By analyzing the meaning and requirements of the "double carbon" goal and exploring the problems in the current distribution process of agricultural products in China, the paper found many problems in the current distribution mode, including low distribution efficiency, high loss rate in the distribution process, and high storage loss of some fresh agricultural products. At the same time, this paper also gives a series of optimization suggestions, including adopting innovative agricultural product distribution modes, accelerating the promotion and application of new energy logistics vehicles, strengthening the construction of logistics professionals, improving cold chain transportation, etc. These suggestions have certain practical significance for improving the efficiency of agricultural product distribution, reducing carbon emissions, and building green logistics.

Funding: This research received no external funding.

Conflicts of Interest: The authors declare no conflict of interest.

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