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Discussion and Analysis of Agricultural Cold Chain Logistics Issues

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Abstract: With the advancement of socialist marketisation, the demand for cold chain logistics for agricultural products is expanding. This not only accelerates the development of cold chain logistics system, but also brings a lot of convenience to the residents' life. This paper takes the current situation of supply and demand of cold chain logistics of agricultural products in China as the starting point, analyses the current problems in the development of cold chain logistics of agricultural products, and puts forward corresponding countermeasures in this regard, with a view to improving the efficiency of cold chain logistics transport in China to meet the daily needs of the people.

Keywords: Agricultural products, agricultural cold chain logistics, cold chain.

1. Introduction

As agricultural products are the necessities of daily life, people's demands for their timeliness and high quality are gradually increasing, so cold chain logistics is more and more widely used in the transport of agricultural products. The relationship between the transport of agricultural products and cold chain logistics is mainly reflected in the fact that the growth of the demand for the circulation of agricultural products promotes the development of the cold chain logistics system, while cold chain logistics guarantees the quality and timeliness of agricultural products and reduces the cost of wastage. Both of them stimulate and promote each other in the context of rural revitalisation.

In such a context, fresh food e-commerce and chain restaurants and other fresh agricultural products sales channels have been broadened, and the public's demand for agricultural products has also shifted. Green, organic and fresh agricultural products have replaced the low price-driven consumption demand for agricultural products. Cold chain logistics, as an effective means to guarantee the quality of agricultural products, not only reduces the loss of agricultural products, but also promotes the deep integration of rural industries and modern markets. However, in the process of the development of cold chain logistics for agricultural products, we need to pay attention to the existing problems, such as the poor flow of supply chain and logistics information, insufficient infrastructure construction and imperfect logistics standard system. Therefore, it is necessary to accelerate the construction of rural intelligence, improve the supporting facilities and equipment in the cold chain logistics area, as well as improve the logistics standards, so as to provide a strong guarantee for the development of the agricultural market.

2. Definition of Relevant Concepts

2.1. Chain logistics for agricultural products

Cold chain logistics, also known as low-temperature logistics, is a goods circulation system based on freezing and refrigeration technology and adopting constant low-temperature keeping means, which can keep the temperature of goods from the place of production to the place of sale according to the requirements, and realise the goal of preventing goods from rotting and keeping them fresh. Among them, cold chain logistics for agricultural products is an important branch of the cold chain logistics system, mainly serving primary agricultural products.

With the development of the economy and the increasing consumption capacity of Chinese consumers, the importance of cold chain logistics for agricultural products in social production has become increasingly prominent. Its wide range of services covers the entire process from the production of agricultural products to the hands of consumers, including temperature control and other links according to the types and properties of agricultural products. This new logistics model, which organically combines agricultural product logistics and cold chain logistics, is adapting to the development needs of society and has been widely used in real life.

2.2. Demand for agricultural products logistics

Logistics demand, in order to meet the needs of social consumption and production, covers all aspects of material flow activities such as transport, inventory, packaging, loading and unloading, distribution and processing, as well as related information needs. This kind of demand is a typical derived demand, which is mainly manifested in two aspects. One is the functional demand for physical flow, including the demand for transport, storage, packaging, loading and unloading, distribution, processing and related information processing. The second is the demand for logistics services, such as the demand for logistics efficiency, time and cost, as well as the requirements for organisational efficiency and technological innovation in logistics process management.

The demand for agricultural logistics is the demand for cold chain logistics services for agricultural products and the demand for logistics links for fresh agricultural products transported in a low-temperature controlled environment in the process of consumers' demand for fresh agricultural products. This demand includes the demand for fresh and perishable agricultural products and their related logistics service activities such as low-temperature warehousing and transport, which is an important part of the cold chain logistics demand.

3. Research Overview

Researchers Li Juntao et al. explored the cold chain logistics vehicle path optimisation problem under traffic congestion conditions. Liu Yan et al. constructed a cold chain logistics and distribution system for agricultural products based on the Internet of Things (IoT), and they believe that the application of IoT technology can monitor the whole process of agricultural products in real time, strengthen the information communication of each link, and ensure the rapid and efficient circulation of agricultural products. However, at present, the logistics efficiency of agricultural products in more than half of the regions in China is still lower than the national average level, which indicates that there is still a lot of space for us to improve the logistics efficiency of agricultural products.

The study by Sumire Weiping et al. found that the level of economic development, location advantages and price fluctuations of agricultural products all have a significant impact on the efficiency of agricultural product logistics. However, due to the shortage of agricultural product logistics professionals and insufficient optimisation of industrial structure, these two factors have not been able to give full play to their roles in enhancing the efficiency of agricultural product logistics. Li Hubing and Song Ying applied the Internet of Things (IoT) technology to the real-time monitoring system of cold chain logistics of fresh agricultural products and fresh fruits in order to enhance the informatisation and transparency of the cold chain logistics so as to improve the product quality. The study by Yanqi Kang, on the other hand, points out the main problems in the ecological development of the international logistics supply chain of agricultural products in the 5G era and proposes relevant optimisation strategies.

In general, improving the efficiency of agricultural product logistics is a systematic project, and a popular and difficult issue that academics and governments at home and abroad are currently endeavouring to study and solve. Although there have been some literature on the evaluation of agricultural logistics efficiency and influencing factors, there is no unified view on the evaluation method and the selection of influencing factor indicators. At the same time, there is a relative lack of research literature on the detailed analysis of China's overall agricultural logistics efficiency. Therefore, this paper summarises the development of cold chain logistics of agricultural products on the basis of existing studies, with a view to having important theoretical and practical significance for safeguarding food security, promoting the sustainable growth of farmers' income and improving the research theory of agricultural product logistics.

3.1. Demand for cold chain logistics for agricultural products

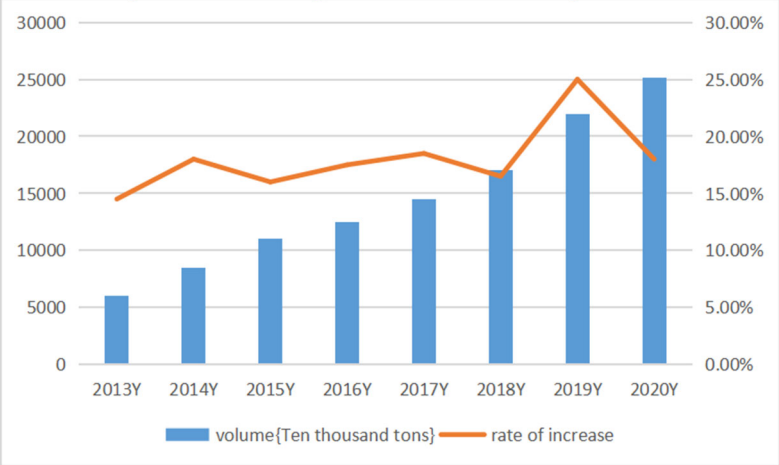
In recent years, China's production and sales of fresh agricultural products have grown significantly. in 2020, national production of fresh agricultural products remained stable, despite the impact of the New Crown Epidemic. The output of pigs, cattle, sheep and poultry meat was 76.39 million tonnes, which was a decline, but only by 0.1%. Meanwhile, the output of meat products such as beef, mutton and poultry meat all rose. And the output of milk and poultry eggs reached 34.4 million tonnes and 34.68 million tonnes respectively, with year-on-year increases of 7.5% and 4.8% respectively. The output of aquatic products even exceeded 65 million tonnes. All these data illustrate the continuous expansion of the production of fresh and live agricultural products in China, which undoubtedly puts forward a greater demand for cold chain logistics of agricultural products.

As per the statistics, the compound growth rate of the demand for cold chain logistics of agricultural products in China from 2013 to 2020 has reached about 19.5 per cent. When we observe the market sales, the scale of the fresh produce market is also expanding. At present, the total annual retail sales of the fresh produce market has exceeded 5 trillion yuan, of which the scale of the fresh produce e-commerce market is as high as about 300 billion yuan, and the average annual growth rate in the past five years has reached more than 30%. This fully proves the strong demand for China's agricultural cold chain logistics market. With the promotion of urban-rural integration, we can foresee that the production and sales of fresh agricultural products in China will continue to rise in the future. This also foretells that the development space of cold chain logistics will be very huge.

3.2. Supply of agricultural products cold chain logistics

Strong support at the policy level has led to the significant development of cold chain logistics for agricultural products in China. In the past decade, policies such as the Development Plan for Cold Chain Logistics of Agricultural Products, Opinions on Accelerating the Development of Cold Chain Logistics to Safeguard Food Safety and Promote Consumption Enhancement, and the Implementing Opinions on Accelerating the Construction of Agricultural Products Warehousing and Freshness Preservation Cold Chain Facilities, etc. have been introduced. At present, the products involved in cold chain logistics of agricultural products in China mainly include fruits, vegetables, meat, poultry, eggs and aquatic products. We have collated relevant statistics from the Cold Chain Committee of CFLP and the Foresight Research Institute, as shown in Figure 1, the total volume of China's agricultural products cold chain logistics has been growing rapidly from 2013 to 2020. the total volume of China's agricultural products cold chain logistics in 2020 will be about 25,000,000 tonnes, with a basically stable year-on-year growth. However, despite the rapid development of China's agricultural cold chain logistics, the shortage of supply capacity is still very obvious relative to the demand increase. According to the demand trend of agricultural cold chain logistics, it is expected that by 2025, the demand for agricultural cold chain logistics will reach 65,000 million tonnes, therefore, the contradiction between supply and demand faced by cold chain logistics cannot be ignored. Again, from the perspective of cold storage capacity increase, the total cold chain volume has been increasing over the years, with the cold storage capacity reaching 60,530,000 tonnes by 2019, a year-on-year increase of 15.6%. However, according to a study by the Cold Chain Committee of China Logistics, the current situation of cold storage still has a lot of room for capacity expansion compared to the huge demand for fresh food logistics.

Table 1. Total volume and growth trend of agricultural cold chain logistics in China from 2013 to 2020



4. Problems in the Development of Cold Chain Logistics of Agricultural Products in China

Although the cold chain logistics of agricultural products in China has achieved obvious development results and rapid growth in scale, the contradiction between market demand and actual supply remains prominent. From the endogenous development of agricultural cold chain logistics, we can see that there are mainly the following problems.

4.1. Insufficient smoothness of agricultural cold chain logistics supply chain

In the context of rural revitalisation and urban-rural integration, the inadequacy of the whole chain system of "one cold to the end", especially the problem of the "first kilometre", has become a major problem that restricts the smooth flow of agricultural cold chain logistics. This is especially prominent in the rapid development of urban-rural integration in China. For the cold chain logistics of agricultural products, the "first kilometre" is more important than the "last kilometre", however, it is also the link that is more likely to be neglected. 2020 data show that China's top 100 cold chain logistics enterprises are mainly integrated and transport-oriented logistics enterprises, accounting for 25% and 44% respectively. In contrast, warehousing or supply chain logistics enterprises, especially those that need to be equipped with pre-cooling and processing equipment, account for less than 20 per cent.

There are two main reasons for this problem. Firstly, rural logistics sites are scattered, the cost of collecting goods is high, coupled with the perishability of cold-chain agricultural products, small-scale logistics cannot meet the demand. Secondly, in cold chain logistics, a series of operations from quality inspection, picking to packaging need to be completed in the "first kilometre", but there are still shortcomings in these aspects in rural areas. For example, China's cold storage is expanding its scale, but the geographical layout is uneven, East China cold storage accounted for 50 per cent, while the cold storage capacity of inland provinces and cities as the main production areas of fruits and vegetables is low, less than 10 per cent. This undoubtedly brings greater challenges to the "first kilometre" of agricultural cold chain logistics.

4.2. Insufficient information flow of agricultural cold chain logistics

The effective operation of agricultural cold chain logistics cannot be separated from the timely acquisition and accurate transmission of information. With effective logistics information, we can adjust supply and demand in real time, reduce the risk of each link in the supply chain and improve the efficiency of resource utilisation. However, the cold chain logistics of fresh agricultural products in China involves a number of subjects such as farmers, sales enterprises and logistics companies. This multiplicity leads to the difficulty of information communication on the one hand, and the lack of a unified information platform on the other, resulting in information not being able to be transmitted in a timely manner in the supply chain. If cold chain logistics information cannot be shared and transmitted in a timely manner, unnecessary logistics links will be generated in the circulation of agricultural products, such as the increase in logistics costs due to long storage time. This is not only unfavourable to energy conservation and emission reduction, but also pushes up the prices of agricultural products. Although some large companies have now established their own internal information systems, resource sharing is still not possible due to information communication barriers with the outside. Therefore, how to break the information barriers and realise the effective transmission of information and sharing of resources is an important issue facing the current cold chain logistics of agricultural products.

4.3. Incomplete cold chain logistics infrastructure for agricultural products

There is a certain lag in the infrastructure construction of cold chain logistics for agricultural products in China, which is mainly reflected in two aspects: firstly, the preservation technology is not advanced enough, and secondly, the aging of facilities and equipment is serious. At present, the cold chain logistics of agricultural products in China mainly relies on primary preservation, while the technology in processing preservation and low temperature storage is relatively backward. This is mainly due to the fact that China's cold product processing mainly stays at the primary stage, with small-scale enterprises, backward technology and equipment, and imperfect supporting facilities. Although cold storage and preservation technologies are relatively mature, most of them are introduced from abroad or imitated, and there are

relatively few technologies with independent intellectual property rights. In addition, the standards of China's cold chain transport system have not yet been unified, especially in the circulation of agricultural products in the temperature requirements, transport equipment and other aspects of the lack of uniform standards, which led to the poor convergence of the links, distribution time and other frequent problems.

Another problem lies in the fact that the number of cold chain logistics enterprises for agricultural products in China is small, the scale is small, and there is a lack of systematic planning. In terms of capital, the imperfect financial system makes it difficult for domestic enterprises to obtain loan support. In terms of technology, technicians engaged in cold chain logistics lack professional knowledge and experience, and their knowledge level is low, which makes cold chain logistics lack systematic planning and integrated management.

In terms of infrastructure, most of the cold chain logistics enterprises in China's agricultural products logistics system operate independently and are mainly responsible for transport and loading and unloading, and genuine third-party cold chain logistics enterprises have not yet emerged. At present, the cold chain facilities built mainly for large wholesale markets in China are mainly cold storage and transport vehicles, etc. Meanwhile, there is a lack of relevant laws, regulations and institutional safeguards.

4.4. Inadequate standard system of cold chain logistics for agricultural products

The current status of China's agricultural cold chain logistics standard system mainly consists of four national standards, namely, the Technical Specification for Quick-Frozen Foods, the General Technical Conditions for Frozen and Chilled Foods, the Technical Conditions for the Storage and Transportation of Fruits and Vegetables, and the Technical Specification for Quality and Safety Control of Frozen and Chilled Foods. These standards are highly targeted and applicable to different types of food respectively. However, the degree of perfection of China's cold chain logistics system still fails to keep pace with the development of the market, in which the following constraints mainly exist.

Firstly, China's cold chain logistics laws and regulations are insufficiently supported. Although relevant laws and regulations such as the Standardisation Law and the Regulations for the Implementation of the Standardisation Law play an important role in the cold chain logistics activities of agricultural products, their role in practice is limited due to the low and mandatory level of legislation and the imperfect supporting regulations. In addition, cold chain logistics is a highly professional activity, and China's cold chain logistics started late, the market mechanism is not yet fully mature, and a complete legal system for cold chain logistics has not yet been formed, and there is a lack of clear legal constraints in the operation process.

Secondly, the technical standards related to cold chain logistics are seriously lagging behind. The construction of China's technical standard system on cold chain logistics for agricultural products is seriously out of step with the speed of development of the industry. For example, Japan, the United States and other countries already have hundreds or even thousands of standards, specifications or guidelines on the preservation of chilled and frozen food, fruits and vegetables, while there are only 28 of them in China. Due to the lack of necessary technical support, the cold chain logistics of agricultural products in China has not yet been able to form a standardisation system, which not only affects the level of modernisation and development and market competitiveness of the cold chain logistics of agricultural products, but also its socio-economic benefits.

5. China's Agricultural Cold Chain Logistics Existing Problems to Solve Countermeasures

5.1. Integration of urban and rural cold chain logistics resources

Achieving economies of scale is the key to the development of the cold-chain logistics market for agricultural products, so we need to accelerate the integration of urban and rural cold-chain logistics resources on an urban basis in order to open up cold-chain logistics supply chain market channels between urban and rural areas. At present, China's cold chain logistics enterprises in the field of agricultural products generally exist in a small, dispersed and disorderly form, which requires us to take advantage of cities to continuously open up the cold chain logistics market in order to realise the scale of operational benefits. In this process, we need to promote horizontal integration. That is to say, under the premise of ensuring that each link of cold chain logistics has its own role, we can support urban enterprises to carry out strategic merger or restructuring with rural enterprises with conditions through supply chain co-operation, or directly merge and acquire rural intentional enterprises by urban enterprises, so as to achieve a high degree of integration of cold chain resources. This kind of integration is conducive to agricultural cold chain logistics enterprises to strengthen specialised investment, develop professional capabilities, reduce product loss and improve the efficiency of cold chain logistics. At the same time, we also need to promote vertical penetration. In particular, we need to rely on the fast-developing e-commerce business model for agricultural products, and make use of e-commerce enterprises' real-time mastery of market information to integrate and optimally dispatch resources in all aspects of cold chain logistics, thereby reducing the cost of cold chain operations.

5.2. Building a Cold Chain Logistics Information Network

Building a cold chain logistics information network platform is the key to reducing information asymmetry and enhancing the efficiency of agricultural product circulation. Achieving this goal requires the joint efforts of suppliers, producers, logistics enterprises and relevant governments in the agricultural products industry chain to provide information support and guarantee for the development of cold chain logistics of agricultural products.

First, the government can play a guiding role in organising third-party enterprises to build a unified information platform for cold chain logistics of agricultural products using big data. Through the establishment of a standardised information system, it can provide information security for all participants in agricultural products. At the same time, the government can also promote the application of advanced information technologies such as GIS, RFID and GPS.

Secondly, logistics enterprises should strengthen information communication and cooperation with enterprises upstream and downstream of the agricultural supply chain to achieve the sharing of information resources. Logistics

enterprises can explore the establishment of an agricultural supply and marketing development model integrating agricultural production bases, cold chain logistics enterprises and fresh agricultural products sellers.

Once again, producers and suppliers should provide timely and comprehensive information feedback for the agricultural supply chain so as to improve the effectiveness of information communication between the various links of the industry chain.

Finally, through the addition of a cold-chain logistics information publicity platform, information related to cold-chain logistics of agricultural products, such as freezing and refrigeration technology, cold-chain logistics resources, and production of agricultural products, etc., can be released and accessed more broadly, thus improving the utilisation rate of all resources.

5.3. Accelerate the improvement of logistics infrastructure

Cold chain logistics for fresh produce has stringent requirements for cold storage and freezing technology and equipment to ensure the best quality of produce. First of all, we can set up additional transit stations and distribution service nodes in low-temperature environments at the receiving and dispatching places of fresh agricultural products, which will help to realise the centralised sorting, splitting, packaging and pre-cooling of agricultural products and other commercialisation processes. At the same time, technical processes such as refrigeration and freezing should also be standardised, so that the cold chain logistics system for fresh agricultural products can realise the integration of production and marketing, thereby reducing logistics and transport costs. Next, the level of cold storage and warehousing construction needs to be improved. When selecting the location of cold storage, we need to consider economic factors, traffic convenience, the surrounding environment and terrain conditions, and give priority to selecting the origin of agricultural products, the centralised transshipment of goods and the place of consumption, so as to facilitate the transfer of agricultural products into and out of the country. Finally, we also need to introduce newer equipment and technology or upgrade existing cold chain equipment to eliminate equipment with unsatisfactory refrigeration effect and improve the efficiency of cold chain logistics.

Infrastructure development is also key to the construction of an all-chain system of "one cold to the end" for agricultural products between urban and rural areas. A sound cold-chain logistics infrastructure for agricultural products can help establish a layered and integrated cold-chain logistics network for agricultural products in urban and rural areas, ensuring that fresh agricultural products can be transported from urban and rural areas to the end of the cold chain. We need to mobilise social forces in cities and towns, and make use of the capital advantages of urban areas to fill the capital gap in rural areas. The government can guide and assist social forces to participate in the construction of cold-chain logistics infrastructure for agricultural products, including the collection of goods, primary picking, pre-cooling, and other cold-chain operations, so as to form a cold-chain logistics network system with a clear division of labour and integration. At the same time, we also need to speed up the construction of high-standard cold storage, improve pre-cooling and distribution, low-temperature processing and other facilities, and promote "one storage with multiple temperatures" and "one storage with multiple uses", so as to ensure that fresh and live agricultural products can be pre-cooled in a timely manner after picking, and realise constant-temperature transport between urban and rural areas.

5.4. Refine cold chain policy standards and unify regulatory norms

China's cold chain market is still in the development stage, and the regulatory system has not yet been perfected, especially the formulation of standards for the cold chain of agricultural products needs to be more specific and unified. Firstly, we need to build a unified standard system for cold chain logistics. Authoritative organisations should carry out unified planning and guidance for cold chain logistics, coordinate the relationship between various departments, improve laws and regulations, and carry out detailed specifications for cold chain logistics operation standards to support the development of cold chain logistics enterprises. Secondly, national government departments should play a macro-control role and strengthen the supervision and management of the cold chain logistics industry. In the process of formulating laws and regulations, it is necessary to fully listen to the opinions of experts and enterprises, and make unified planning and regulation on major issues such as the construction of cold chain logistics facilities, the quality of employees, market access, development planning and subsidies. Finally, the government needs to increase the financial support for the development of cold chain logistics for agricultural products and formulate preferential policies in finance, taxation and finance to promote the development of cold chain logistics industry.

6. Conclusion

In order to meet the increased demand for fresh food as the quality of life improves, it is necessary to carry out technological transformation of cold chain logistics. In this regard, it is indispensable to formulate laws, regulations and technical specifications covering various aspects such as government, enterprises, market and supervision, and at the same time, market supervision should be strengthened. In order to promote the development of the logistics industry in the direction of information technology, intelligence, high efficiency and green health, the state should support the domestic cold chain logistics industry more strongly, especially focusing on improving the technical level of domestic cold chain logistics.

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