Effective Cold Chain Supply of Agricultural Products Logistics in China Based on Internet of Things

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Abstract—China is a big agricultural country, as well as a big country in the production, supply and consumption of agricultural products. With the increasing demand for agricultural products, the effective supply of agricultural products logistics needs to be improved, or thinks it is necessary to explore the rapid development of agricultural product logistics and Internet of things technology in China, so as to achieve the goal of maximizing the profit of agricultural product logistics. In this regard, based on the Internet of things technology, this paper discusses the problems and shortcomings of agricultural products logistics cold chain supply, and puts forward optimization suggestions, to provide theoretical reference for the improvement of effective supply mode, so as to promote the development of cold chain, and promote the development of China's agricultural products logistics supply.

1. INTRODUCTION
With the rapid progress of China's society and the sustainable development of economy, the level of science and technology has been significantly improved, especially in recent years, the technology of Internet of things is gradually mature, and the systematic development of supply chain makes the logistics of agricultural products develop rapidly. However, from the point of view of characteristics, the two ends of agricultural logistics supply chain, the production and sales of agricultural products in China, present two different specificities, namely strong aggregation and dispersion. Therefore, in view of the current problems between the production and consumption of agricultural products in China, it is urgent to establish an effective agricultural logistics system to solve the problems in time and space. However, from the actual situation of our country, the agricultural product market is impacted by the high logistics cost, which has a great impact on the competitiveness of the market. Therefore, combined with the conditions of the Internet of things, it is of great significance to further improve the supply chain system to study the effective logistics supply mode of agricultural products. Through the combination of Internet of things technology and cold chain logistics, it is of great significance to further improve the construction of agricultural products logistics supply chain system and promote the development of agricultural products logistics management towards the direction of science and information, which is conducive to the scientific management of agricultural logistics and the supply and promotion of information.

2. DEVELOPMENT CHARACTERISTIC AND CURRENT SITUATION
First of all, the related concepts of Internet of things, agricultural products logistics and supply chain will be introduced in turn, and then on this basis, the characteristics and development status of
agricultural products logistics supply in China will be analyzed, as follows.

2.1. Related concepts
The concept of Internet of things: originated in the field of media, any object is connected with the network through information sensing equipment, and objects exchange and communicate with each other through information media to realize intelligent identification, positioning, tracking, supervision and other functions.

The concept of agricultural products logistics refers to that producers and consumers of agricultural products meet the needs of consumers and the value of agricultural products through tangible economic activities, with agricultural entities and relevant information. A variety of agricultural products are part of the value-added goal of agricultural logistics.

Supply chain concept: since the concept of supply chain was introduced, many experts believe that supply chain is mainly composed of two parts: basic enterprise and certification node enterprise, which can be divided into a complete supply chain structure. That is product supplier, consumer capital flow, information flow and logistics. In this supply chain, the idea is that the advantages of the supply chain are not only reflected in the purchase, production and sales of raw materials, but also in the reduction and maximization of costs. The managed supply chain based on agricultural products logistics is a functional network closely connected with agricultural products producers, traders and retailers. Optimize the allocation of agricultural logistics from the whole supply chain to improve the efficiency of agricultural logistics management.

2.2. Characteristics of Agricultural Products Logistics Supply in China
From the perspective of agricultural supply chain, there are many participants in each link of agricultural products, which leads to the gradual increase of costs, which is not conducive to the overall efficiency of the supply chain [1]. This is a huge challenge. The challenge of agricultural logistics cost. In addition, agricultural products are fresh and easily expired, so the demand for cold chain is particularly urgent. Moreover, agricultural products have obvious seasonality. Therefore, the theme and mobility of logistics require technology and equipment to ensure logistics safety. Advanced agricultural logistics cold chain and equipment have an important impact on the whole supply chain.

From the perspective of agricultural supply chain, there are many participants in every link of agricultural products, which leads to the gradual increase of the cost of the whole agricultural supply chain and damages the efficiency of the whole agricultural supply chain. In addition, the scale and degree of supply chain improvement vary with the supply chain. There are hysteresis and asymmetry in information transmission, and the upstream and downstream links are not smooth. In addition, agricultural products transportation to ensure quality and safety, so we should pay special attention to the cold chain link.

2.3. The Development of Agricultural Products Logistics in China
In recent years, the total amount of China's agricultural products logistics has been increasing year by year. According to the statistics of the prospective industry research institute, the total amount of China's agricultural products logistics has reached 3.45 trillion yuan in 2015. By the end of 2019, the total amount of China's agricultural products logistics has increased to 3.86 trillion yuan, with a year-on-year increase of 11.9%. From 2015 to 2019, the percentage of China's agricultural products logistics in GDP decreased year by year, from 5.03% in 2015 to 3.90% in 2019. It is predicted that the total amount of agricultural products logistics in China will exceed 4 trillion yuan in 2020, and the percentage of total agricultural products logistics in GDP will continue to decline. In order to improve the performance of agricultural product quality management, at present, the agricultural product industry in China mostly uses the process quality integration system, which integrates the quality management of all links in the agricultural product supply chain, regards each link as a process to form the final quality of agricultural products, and integrates all processes to create synergy effect[2].
TABLE 1. 2015-2019 STATISTICS OF TOTAL LOGISTICS COST OF AGRICULTURAL PRODUCTS IN CHINA.

| Year | Total logistics cost (RMB) | GDP (RMB)      | Proportion of GDP |
|------|---------------------------|----------------|-------------------|
| 2015 | 3.45 Trillion             | 68.60 Trillion | 5.03%             |
| 2016 | 3.62 Trillion             | 74.01 Trillion | 4.89%             |
| 2017 | 3.71 Trillion             | 82.08 Trillion | 4.52%             |
| 2018 | 3.90 Trillion             | 91.93 Trillion | 4.24%             |
| 2019 | 3.86 Trillion             | 99.09 Trillion | 3.90%             |

3. EXISTING PROBLEMS
At present, with people's new demand for agricultural products and agricultural products logistics cold chain supply, there are obvious deficiencies in these aspects in China, and there is a great development space. Especially now we have entered the rapid development period of the Internet of things, the development of agricultural products cold chain logistics under the Internet of things will become a new development point of agriculture. The following will put forward the problems of agricultural products logistics cold chain supply under the condition of Internet of things.

3.1. Unreasonable allocation of logistics resources
First of all, the development of China's agricultural products logistics needs to be improved and gradually optimized, and the path is long, while the logistics subject is scattered and the coverage is limited, which leads to the need for multiple logistics relay in the circulation process, which requires effective cold chain technology, so it is difficult to achieve the most effective cold chain supply. This is a technical issue based on the Internet of things. Second, in the overall composition of agricultural products logistics supply chain, the speed of production, storage, transportation, sales and other links is not fast enough, and the docking is not accurate enough, leading to the agricultural logistics participants need to put their own full resources into the circulation. However, due to the lack of unified guidance and coordination, it can not play a systematic management role, and it is easy to cause waste of resources. Third, to sum up, in view of the current situation of cold chain supply of agricultural products logistics, there are obvious deficiencies in the circulation management and resource allocation of various links, which is relatively backward compared with some developed countries.

3.2. Cold chain circulation and transportation situation is not optimistic
In recent years, with the development trend of scale, quality and brand of agricultural products in China, and the continuous prosperity of Internet economy, the specialization level of agricultural products logistics has been greatly improved. Therefore, improving the quantity and quality of agricultural products is one of the keys to enhance the connotation of agriculture. At present, due to the increasing demand of consumers for the quantity and quality of agricultural products, the logistics in the supply chain of agricultural products is more time-consuming, resulting in a longer logistics cycle. In addition, agricultural products have the characteristics of short season, easy to be damaged and difficult to store, which leads to the strong dependence of agricultural products logistics on cold chain supply. In view of this problem, the state calls for the construction of cold chain logistics to reduce losses, but its cost will increase rapidly, and the profit of agricultural products will be greatly reduced. At present, the logistics cost of agricultural products in China accounts for more than 40% of the total cost, which is far higher than that in developed countries. If the equipment is updated and the technology is upgraded, the proportion will continue to rise. Through data analysis, China's cold storage circulation and transportation is far behind some developed countries. The low circulation rate and transportation rate are the main reasons for the sharp decline in the profits of agricultural products.
Figure 1. Analysis chart of China's cold chain

3.3. Information construction is not perfect
At present, China lacks an effective information release system, and there are few channels for information supply and demand. The optimal effect of agricultural product supply chain is to achieve the deep integration of the whole process from production to transportation through the optimal coordination and combination of all links, so as to obtain the highest profit at the lowest cost. In the horizontal chain of agricultural enterprises, it is impossible for operators to realize mutual sharing of resources and timely and effective communication of information [3]. In addition, the lack of deep-seated information sharing in the cold chain supply of agricultural products logistics makes each link lack of key information, which makes the supply and demand sides have less access to information and is prone to information asymmetry and other problems, resulting in the low efficiency of the whole cold chain supply chain. Among them, farmers belong to the weak side of information asymmetry and bear more risks. Therefore, the agricultural products logistics also needs to combine the Internet of things environment and cold chain technology to form the real agricultural products logistics cold chain information.

4. SOLUTIONS
According to the analysis of the previous chapter, it is not difficult to see that there is no perfect agricultural logistics standardization system in China. At present, there are still some problems in China's logistics industry, such as the unreasonable allocation of agricultural products logistics resources, the situation of cold chain circulation and transportation is not optimistic, and the information construction is not perfect. These problems affect the production and sales logistics supply
chain of agricultural products, making the logistics cost of agricultural products too high, the management system is not appropriate, so that the profit of agricultural products can not reach the expected standard. After the analysis of the above problems, the measures to optimize the effective cold chain supply mode of agricultural products logistics are put forward as follows.

4.1. Integration of logistics resources and construction management system
First of all, promote agricultural producers from decentralized management to large-scale development, and promote the rapid development of centralized management mode. Secondly, it is necessary to strengthen the control of the length of the important links such as lean logistics, information and so on. Finally, the government should play a regulatory role, actively introduce corresponding policies and regulations, standardize the cold chain process of agricultural products logistics, and provide institutional guarantee for agricultural products logistics management. Through the establishment of scientific agricultural products logistics cold chain supply system, the integration and optimization of resources can be realized.

4.2. Optimizing transportation mode and equipping technical equipment
The choice and upgrading of agricultural products transportation mode is helpful to the optimization of agricultural products logistics cold chain. According to the properties and characteristics of agricultural products, the transportation means and transportation mode are selected, and the transportation route and related costs are predicted and referenced to realize the effective cold chain supply. It's better to choose direct transportation mode to reduce the number of transfer. In the development of cold chain logistics, in view of its high construction cost, we can need the support of national policies and funds. Of course, we should also actively cultivate professionals, learn from the mature cold chain circulation and transportation experience of developed countries, improve the technical content of agricultural products cold chain, and strive to maximize the interests.

4.3. Promote the integration of big data and agricultural products logistics
With the advent of the era of big data, it can not only help logistics enterprises and farmers to obtain all kinds of information in time, but also can intelligently analyze and predict the logistics supply, so as to reduce the contradiction caused by information asymmetry. Through the Internet of things technology, it can real-time monitor the agricultural product transportation link, and ensure the relative stability of the whole process [4]. It not only makes logistics management more scientific, but also improves the efficiency of information sharing. With the power of big data, agricultural products logistics will promote an effective cold chain supply mode.

5. CONCLUSION
With the development of socialist market economy, agricultural products are also facing more fierce international competition. Through the above analysis, under the new normal, China's agricultural products logistics transportation develops rapidly. At present, there is no perfect agricultural products logistics standardization system in China. At present, there are still some problems in China's logistics industry, such as the unreasonable allocation of agricultural products logistics resources, the situation of cold chain circulation and transportation is not optimistic, and the information construction is not perfect. These problems affect the production and sales of agricultural products logistics supply chain, forming a strong aggregation and dispersion. In view of the existing problems between the production and consumption of agricultural products in China, we should improve the system as soon as possible to form an effective supply of agricultural products logistics cold chain. After discussion and analysis, the main measures include integrating resources, improving technical equipment, speeding up data development, and establishing a scientific agricultural products logistics management system. Through the combination of Internet of things technology and cold chain logistics, it is conducive to the scientific management of agricultural logistics and the supply and promotion of information, and ultimately maximize the overall benefit of the agricultural product supply chain.
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