Research on Cold Chain Logistics Operation Mode Under Internet Technology

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Abstract—This article first introduces the theoretical basis and concepts related to cold chain logistics of agricultural products, analyzes the cold chain logistics market of agricultural products and the necessity of developing cold chain logistics, and then finds that there is a lack of overall planning for cold chain logistics of agricultural products. Subsequently, it carried out the "Internet +"-based agricultural product cold chain logistics system planning and based on agricultural product development logistics' actual situation, and it gave cold chain system optimization suggestions. Finally, a cold chain logistics enterprise for agricultural products is used to construct a cold chain logistics system for agricultural products, including business models, information platforms, and system functions.

1. Introduction
Through in-depth problems and understanding of the problems, we can find many phenomena in the cold chain of fresh agricultural products in China: high logistics costs, low cold chain rates, high corruption rates, unbalanced profits, and many other phenomena. The response is the loose relationship between the central bodies of the new cold chain in China, the low degree of informatization, inadequate facilities and equipment, multiple circulation links, inadequate facilities and equipment, and weak supervision. To promote the further development of the logistics industry, the national and local governments have continuously issued relevant policy documents, emphasizing the importance of the coordinated development of agricultural products and logistics and using agricultural cold chain logistics to solve the problems of agricultural products in storage and transportation and establish a complete operation mechanism and cold chain logistics system with sound facilities and standardized management [1]. At the same time, the Country has also continued to focus more on food safety and government supervision, and under the general trend of "Internet + agriculture," cold chain logistics of agricultural products have obtained a broader development space. Market demand continues the increase in logistics has made the logistics standards for fresh food more stringent and promoted cold chain logistics service levels. However, in most China areas, due to factors such as the level of economic development, and overall cold chain logistics system has not yet been formed, and there is a clear gap with developed countries: fruits, vegetables, and other agricultural products in developed countries are in circulation. The cold chain rate in the process has reached more than 95%, and the loss rate of fresh agricultural products is controlled below 5%.

Therefore, the author will build a complete and targeted supply chain framework for green fresh
agricultural products based on previous literature research and the current status of China’s new cold chain development to solve the above problems and meet customer needs [2].

2. The operating status and causes of cold chain logistics of fresh food e-commerce

2.1. The primary mode of cold chain operation of fresh food e-commerce

2.1.1. The third-party cold chain logistics model
The third-party cold chain logistics model refers to how new food e-commerce companies use professional third-party cold chain logistics companies to distribute fresh products. This model can integrate social resources, exert economies of scale, provide specialized services, and save cold chain logistics costs for enterprises. However, refrigeration equipment requires more excellent capital investment and lacks industry standards and related cold chain logistics talents. For a fresh order of 100 yuan, the cost of third-party cold chain logistics is about 40-50 yuan, and the cost remains high.

2.1.2. The self-operated cold chain logistics model
The self-operated cold chain logistics model of new food e-commerce refers to companies building their cold storage, distribution center, purchasing refrigerated trucks, etc., and having professional cold chain logistics talents. Since it is difficult for China's third-party cold chain logistics companies to complete the new product business with scattered locations and unstable delivery times, some powerful fresh food e-commerce companies will build their cold chain logistics systems. Although this model has improved customer satisfaction, it has regional limitations and high costs that many fresh food e-commerce companies cannot afford [3]. For example, Tuotuo's self-operated cold chain costs as much as 50 yuan per order for delivery; SF Logistics calculates based on the average number of orders per day and delivery costs within Beijing Sixth Ring Road, and the average logistics delivery cost per order is about 47 yuan. The industry average is more than 40 yuan and does not include infrastructure construction, warehousing, IT, and customer service systems.

2.1.3. Self-operated and third-party cold chain logistics integration model
The self-operated cold chain logistics system has limited coverage. The integration with third-party cold chain logistics can jointly bear the large costs of refrigerated and refrigerated trucks, manpower, etc., and improve logistics enterprises' efficiency in distributing fresh products. For example, merchants on the JD platform currently use "foam box + low-temperature ice bag" thermal insulation packaging delivered by a third-party express company, and JD is responsible for the delivery method of full supervision.

2.2. The current status and shortcomings of cold chain transportation of fresh agricultural products

2.2.1. Status analysis
With the rapid development of China's social economy, consumers' scale continues to expand, and the importance of food safety is increasing. The expansion of consumer demand has promoted the further growth of the agricultural cold chain logistics market, and the scale of cold chain logistics equipment and facilities construction also continues to rise. Although China's cold chain logistics' overall development level is lower than the world average standard, it still shows a steady and rising development trend and shows rational stability characteristics. Diversified development, providing stable and favorable conditions for agricultural cold chain logistics Development conditions and space [4]. As of the end of 2017, the total amount of cold chain logistics for agricultural products in China has exceeded 40 billion yuan, an increase of nearly 15% compared with the previous year, accounting for about 2% of the total national logistics, and the total annual revenue of cold chain logistics has also achieved a substantial increase. The growth rate is about 1,000. As shown in Table 1.
TABLE 1. LOGISTICS STATUS OF AGRICULTURAL PRODUCTS

| years | Agricultural product logistics (100 million yuan) | Total social logistics (100 million yuan) | The proportion of agricultural product logistics (%) | Year-on-year growth (%) |
|-------|-----------------------------------------------|------------------------------------------|-------------------------------------------|-------------------------|
| 2013  | 25388.48                                      | 1978000                                  | 1.28                                      | 0.4                     |
| 2014  | 26000.00                                      | 210000                                  | 1.2                                       | 2.3                     |
| 2015  | 34524.00                                      | 220000                                  | 1.5                                       | 3.9                     |
| 2016  | 35000.00                                      | 230000                                  | 1.52                                      | 13.79                   |
| 2017  | 40000.00                                      | 252800                                  | 1.58                                      | 14.29                   |

Nationwide, the storage space of cold chain logistics has reached more than 100 million cubic meters, an increase of about 13% year-on-year. At the same time, the number of domestic refrigerated trucks has also been significantly increased. As shown in Figure 1.

![Fig.1. China's cold chain logistics warehousing scale](image)

From the change in the scale of warehousing in the above figure and the change in the scale of fresh products this year shown in the figure below, it can be seen that China’s demand for agricultural cold chain logistics has continued to rise. According to relevant official information, China is During 2017, the scale of the fresh food market is continuously expanding, and the same market transaction volume is also on the rise, reaching more than 470 billion yuan, as shown in picture 2.

![Fig.2. The scale of China's fresh products](image)

2.2.2. Analysis of shortcomings of cold chain logistics

There are four critical risks for cold chain logistics of perishable products, namely temperature failure, unqualified packaging, natural disasters, and product quality deterioration due to delivery delays. To prevent these risks, it is necessary to establish a platform system with a high degree of informatization and relatively unified norms and management standards. The five systems of the public service platform are independent and connected. Each system has its function, division of labor, and cooperation between each other, and at the same time, the data collected by each system can be shared, with a high level of informatization and transparency [5]. The cold chain logistics information management system is a system with analysis and decision-making functions, and it is also the most complex system. It is mainly complicated to analyze the information collected by other systems, and
according to the analysis results, the product vehicles in the railway transportation process are dispatched, and route decisions are made; The electronic transaction system is not only responsible for the transaction between the manufacturer and the seller, but also the transaction between the seller and the consumer. By constructing an O2O platform, the retailer’s store information and product quality and inventory information are displayed on the platform. Consumers can browse and purchase online or go to nearby stores to select by themselves; they can choose to provide merchants' delivery services, or You can choose to buy online first and then pick it up at a convenient time. Convenient services can reduce the time cost of consumers and reduce sellers' operating costs, avoiding the situation of poor consumer experience due to massive passenger flow during peak hours and poor sellers during low peak hours.

3. Cold chain operation model based on Internet technology

3.1. The cold chain logistics model based on category

3.1.1. Fruits and vegetables
Most agricultural products, such as fruits and vegetables, are produced far away from the urban area. It is complicated for farmers to complete the cold chain logistics process alone. It needs to be completed with external professional third-party logistics, and as the starting point of the supply chain, farmers participate. The primary purpose of the transaction is to sell agricultural products and obtain a personal profit. The degree of concern about cold chain logistics is not high. Outsourcing cold chain logistics to a third-party logistics company is a reasonable choice for farmers. Third-party logistics can provide Specialized cold chain logistics services that guarantee the quality of agricultural products to a great extent [6]. Besides, you can also choose the way of docking with the supermarket to rely on the supermarket's logistics system to complete the cold chain logistics transportation and distribution process. Then consumers can purchase fruits and vegetables and other agricultural products by themselves. Besides, with the help of "Internet +" tools, consumers can upload consumer demand on product categories, product quantities, product packaging (gift box packaging or ordinary packaging), etc. According to consumer needs, the fruit and vegetable planting base perform the order's agricultural products' requirements. Packaging, delivery to home, and other services. Open upstream and downstream of the supply chain of agricultural products such as fruits and vegetables, form Internet-based B2B2C and B2C businesses, use the Internet to analyze orders to make smart choices, and complete the process from the distribution center or planting base directly to the final consumer. As shown in Figure 3.

![Fig.3.Cold chain logistics model of fruit and vegetable agricultural products](image)

3.1.2. Meat products
Regarding the choice of meat products in the cold chain logistics model, judgments can be made according to the actual situation, which are generally divided into the following situations: 1) Self-operated cold chain logistics model, which is suitable for a particular scale in the industry and
conforms to the self-Enterprises with the necessary conditions for operating logistics can rely on their own cold chain logistics system to complete a series of production, circulation and processing processes for meat products; 2) relying on the third-party logistics model, which is suitable for small scales that do not have the ability to complete cold chain logistics independently. The meat production enterprises with the necessary conditions need to use third-party logistics professional logistics services to achieve the improvement of logistics efficiency and the guarantee of meat quality; 3) Internet-based B2C business model, in order to achieve a multi-channel sales model, fully implement the Internet. After the meat products have completed the slaughtering, processing, freezing and refrigeration processes, the meat product distribution center will use external cold chain logistics services to complete the distribution and transportation of consumer orders and other logistics services. As shown in Figure 4.

![Fig.4.Cold chain logistics model of meat products](image)

3.2. **Omni-channel cold chain logistics model of agricultural products**

Under the Internet's effect, consumers can obtain more product information through the Internet to meet individual needs and avoid the time misalignment between the production of agricultural products and market demand. Internet technology can also help compress space-time distance and reduce. At the level of the agricultural product supply chain, it breaks the traditional transaction model and builds a direct transaction channel between producers and consumers. Under the joint support of the Internet and cold chain logistics systems, a bond that strengthens the connection between consumers and farmers has been created, breaking through the time and space and geographical restrictions of traditional business organizations, forming a borderless supply chain organization, and allowing more consumers to be online. Realize transactions with farmers, and then use the agricultural cold chain logistics system to complete the offline implementation of online transactions. In addition, the realization of omni-channels does not only rely on the integration of online transactions and offline logistics. While developing online transactions, it must also focus on the coordinated development of offline markets, and then use cold chain logistics tools to complete agricultural products from farmers to consumers [7].

4. **Construction of agricultural product cold chain logistics information system**

4.1. **Overall structure**

The terminal intelligent distribution information platform based on Internet+: It is mainly composed of two parts: the "Yousong APP" of the mobile terminal and the "Intelligent Distribution Information Management System" in the background, which serves as an information platform for business interaction between customers and cold chain logistics enterprises. Visualized management system for in-transit distribution at the end of cold chain logistics: The primary function of the system is to monitor the data information of mobile devices such as GPRS temperature and humidity display and control terminals in each refrigerated transport vehicle, and to visualize the last mile of cold chain logistics dynamically. Figure 5 shows the intelligent distribution system at the end of cold chain logistics.
4.2. Function module
The cold chain logistics terminal in-transit distribution visual management system comprises seven modules: a business database module, a database system module, a data mining module, an online analysis module, a decision support module, a logistics information sharing module, and a visualization module. As shown in Figure 6.

5. Conclusion
With the popularization of the "Internet +" concept, more and more traditional industries have transformed, and new operating models have been established. Cold chain logistics will face new challenges. This article builds a new cold chain operation model with the idea of Internet + cold chain. Through the offline cold chain operation model, combined with the online Internet e-commerce platform, and use information technology and Internet of Things technology to improve the current temperature control of the cold chain. Insufficient supervision and high cargo damage rate are in order to promote continuous improvement of cold chain operations and continuous improvement of service levels.
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