

Research on the Construction of Cold Chain Logistics Operation Mode of Fresh Agricultural Products

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ABSTRACT

With the gradual improvement of people's living standards, food safety issues have received more and more attention. Establish a sound cold chain logistics model for fresh agricultural products, strengthen the operation management of cold chain logistics, improve the cold chain logistics system of agricultural products, and make fresh agricultural products always in a low temperature environment during the logistics process.

In this paper, from the perspective of supply and demand two analyzes the basic situation of Chinese agricultural cold chain logistics, pointed out the necessity of fresh agricultural products cold chain logistics development, compares the dominated by "farmers+cooperative", dominated by "wholesale market, dominated by" processing "of three kinds of cold chain logistics operation mode of traditional development present situation and the insufficiency, constructed on the basis of fresh agricultural products cold chain logistics mode based on supply chain management.

Keywords: cold chain logistics; supply chain; fresh agricultural products; operating model

INTRODUCTION

1.1 Research background and significance

1.1.1 Research background

In recent years, with the continuous development of the social economy and the increasing living standards of people, people's purchasing power is constantly increasing, while the consumption structure is also changing. The focus of people's consumer demand has gradually shifted from clothing and food to value and safety. Especially after the exposure of a series of food safety incidents, people are paying more and more attention to food quality issues, and put forward new requirements on the preservation level, quality and safety of agricultural products and market prices. On the one hand, changes in food consumption habits have brought a broad market for fresh food, and also brought new development opportunities to related industries such as food preservation, processing and distribution; on the other hand, the emergence of agricultural product quality problems, On the other hand, the appearance of quality problems of agricultural products is not only caused by itself, but also deteriorated during transportation, which is closely related to China's backward cold chain logistics system.

Lagging agricultural product cold chain logistics system. Due to the lack of standardized management, scientific cooperation, and systematic supply chain cold chain logistics system, most of the fresh agricultural products in the transportation, processing, storage, distribution and other logistics processes, cold chain equipment can not be suitable temperature, suitable Time arrives at the destination, causing the product to deteriorate during transportation. This not only increases the logistics cost of enterprises, reduces the income of farmers, but also poses a great threat to the food safety of residents.

1.1.2 Research significance

Compared with the cold chain logistics and distribution modes of agricultural products in developed countries such as the United States, which is dominated by supermarkets, and Japan, which is dominated by farmers' associations, China's cold chain logistics operation mode is still in the primary stage and in a backward position. It has not really formed an advanced and mature management mode and an efficient and integrated logistics operation mode.

It can be seen that there are still many problems to be solved urgently in the construction of cold chain

logistics in China, and it is very necessary and important to study the cold chain logistics mode of agricultural products. Based on the logistics operation mode of developed countries and China's national conditions, this paper constructs a cold chain logistics operation mode with large chain supermarkets as the core. For consumers, this is conducive to ensuring food safety; For producers, it is beneficial to increase the income of agricultural products; For enterprises, logistics costs can be reduced; For China, it is more conducive to the transformation from an agricultural power to an agricultural power.

1.2 The summary of research

1.2.1 Status of research

In the past five years (2012-2017), foreign countries focused on logistics systems, cold chain logistics, agricultural product safety and logistics distribution modes, etc .

Table 1 Research Fields of Fresh Agricultural Products Logistics

Representative	year	achievement
Vanany	2012	proposes a new logistics system model for the agricultural wholesale market ^[2] (logistics system)
PHTing	2013	proposes a cold chain logistics (cold chain logistics) that ensures efficient and low-temperature food safety through a system of RFID and sensor networks ^[3] .
Preziosi	2014	proposes the main drivers of the implementation of trace ability systems in the food supply chain, and analyzes the scientific literature on the trace ability of companies' investment in food ^[4] (agricultural safety)
BSalinas-Roca	2016	proposes a combination of pulsed light, edible coatings and malic acid impregnation to improve the safety and quality of cut mangoes ^[5] (safety of agricultural products)

1.2.2 Research status in China

In the past three years (2015-2017), China has focused on the following two theoretical aspects of research on the logistics model of fresh agricultural products:

Table 2 Problems in the logistics model of fresh agricultural products or solutions

Representative	year	theoretical point of view
Zhang Weihua	2015	Insufficient agricultural product cold chain logistics model: 1. The source is mostly farmers, showing the characteristics of small, chaotic and scattered production. 2. There are many circulation links and low logistics efficiency ^[6]
Xu Daoyun	2016	Development Status of Agricultural Products Cold Chain Logistics: 1. The production and sales are too scattered and cannot be obtained in time. 2. High logistics costs and many circulation links Countermeasures: Propose the cold chain logistics mode of agricultural products based on e-commerce platform ^[7]
Ren Qinglin	2017	In response to the shortcomings of agricultural product cold chain logistics distribution model, propose corresponding solutions ^[8]

(2) Learn from and compare foreign logistics model experience

Zhou lu (2015) made a comparative analysis of the cold

In terms of logistics and distribution, developed countries have two representative modes of operation.

(1) Logistics distribution model with farmers association as the core (Japan)

The model is characterized by the standardization of agricultural production, the commonalization of transportation, the organization of farmers' cooperation, and the improvement of the wholesale market system. For example, in 2013, Kato Honggui proposed a logistics operation model for agricultural products that is oriented toward reform and innovation.

(2) Logistics distribution model with supermarket as the core (USA)

The model is characterized by wholesaler dominance, scale of production and direct sales of origin. For example, in 2011, Omar Ahumadal proposed a fresh agricultural product logistics operation model based on planning and sales^[1].

(1) Research on fresh agricultural products logistics

Research on fresh agricultural products logistics focuses on the theory of logistics models, as shown in Table 2.

chain logistics modes of agricultural products in Canada and China respectively to build a systematic, standardized and advanced cold chain logistics system of agricultural

products in order to guarantee food safety and improve farmers' income^[9]. Zhou haixia (2016), by analyzing the integrated operation mode of cold chain logistics of agricultural products in the United States and Japan and combining the current development status of China's cold chain logistics, draws on the advanced integrated logistics operation mode^[10].

Zheng tongtong(2017) respectively summarized and summarized the operation modes of cold chain logistics in Singapore, the Netherlands and other countries, and further promoted the innovative development of China's cold chain logistics of agricultural products on the basis of learning from the mature experience of these countries in cold chain logistics of agricultural products^[11].

2 THE BASIC STATUS OF COLD CHAIN LOGISTICS OF AGRICULTURAL PRODUCTS IN CHINA

2.1 Demand for cold chain logistics of agricultural products

With the rapid improvement of people's living standards, the consumption pattern has also undergone tremendous changes. From the previous pursuit of the "quantity" of agricultural products and the current demand for the "quality" of agricultural products.

It can be seen that the preferences of consumers have changed and there are higher requirements for the quality of agricultural products. The fresh-keeping measures of fresh agricultural products can meet the high-quality needs of consumers, so it is necessary to improve the traditional cold-chain transportation equipment (refrigerated vehicles, refrigerated and insulated vehicles), so as to configure rich and efficient storage and transportation equipment. There will be huge demand for cold chain logistics^[12]. Through the study of the changes in the total output of fresh agricultural products, the demand situation of cold chain logistics can be inferred.

The total output of fresh agricultural products (meat, eggs, aquatic products and vegetables) increased from 1.198 billion tons to 13.05 billion tons in 2013-2016. The total meat production increased from 84.1 million tons to 86.1 million tons, the total output of aquatic products increased from 59.08 million tons to 71.8 million tons, and the output of meat, eggs, aquatic products, fruits and vegetables in China has ranked the world for many years^[13].

(Source: National Bureau of Statistics and China Industry Information Network)

In 2013-2017, the turnover of fresh agricultural products increased from 787.13 billion yuan to 963.42 billion yuan. It can be seen that the consumption of fresh agricultural products by residents has increased significantly, which indicates that China needs to vigorously develop cold chain logistics and widely apply cold chain technology. To ensure that fresh agricultural products are transported from the place of production to the place of sale under the premise of high quality, they can meet the growing market share of the agricultural product market^[13].

(Source: National Bureau of Statistics and China Industry Information Network)

2.2 Supply of cold chain logistics of agricultural products

(1) Cold chain equipment

In the middle of the 20th century, China began to transport road refrigerated trucks, refrigerated and insulated cars, and has a history of more than 60 years. Its early period (1950-1990) has been slow to develop. Until the market economic system changed in 1992, the refrigerated trucks were converted from all imports to partial imports, and China's refrigerated transport vehicles have been further developed^[14].

According to the statistics of China Logistics Purchasing Association and China Industrial Information Network, compared with the same period in 2016, the number of refrigerated vehicles in 2017 was 134,000, an increase of 19,000 units year-on-year. It is in a period of stable development and the number of refrigerated vehicles in 2013-2017.

(2) Cold storage

With the continuous introduction of China's cold chain standard policy in 2017, international standards have been widely used. In cold storage, the production of cold storage increased. Meanwhile, the volume of cold storage, fresh storage and air conditioning storage will be increased.

According to the statistics of China Logistics Purchasing Association and China Industrial Information Network, compared with 2016, the total cold storage in 2017 was 119.37 million cubic meters, an increase of 25.85 million cubic meters of storage capacity over the

previous year. It can be seen that the size of the cold storage is getting larger and larger, and it is maintaining a rising trend^[15].

3 FRESH AGRICULTURAL PRODUCTS COLD CHAIN LOGISTICS OPERATION MODE

3.1 Traditional Cold Chain Logistics Operation Mode

3.1.1 Logistics operation mode led by “farmers + cooperatives”

Farmer associations or farmer cooperatives are a collective organization and the source of the supply chain. On the one hand, farmers as a whole, negotiating with middlemen (processing enterprises, wholesale markets, logistics centers) can fully protect the interests of individuals; on the other hand, farmers can increase the bargaining power while reducing transaction costs and can increase Personal income.

With the operation mode of cold chain logistics led by “farmers + cooperatives”, farmers are not only highly motivated but also highly organized^[16]. However, it belongs to a relatively scattered small-scale production operation mode, which has the disadvantages of low management level and backward technology .As shown in Figure 1.

wholesale market, which is in line with the small-scale production and mass circulation in China. Wholesalers form a logistics model for the integration of farmer cooperatives, farmers’ associations and distribution companies to form an integrated production, packaging, processing, transportation and distribution of agricultural products ^[16].

operation mode of cold chain logistics, which is dominated by “wholesale market”, is generally centered on the trading market in which multiple parties participate together. However, the number of target customers and the large difference in demand make it easy for the logistics business to be in an unstable and fragmented state. As shown in Figure 2.

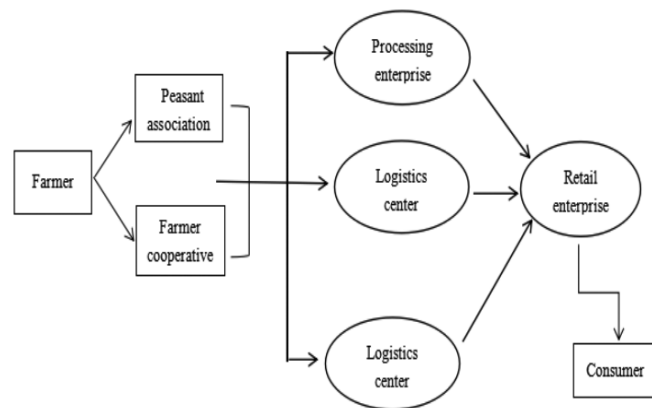


Figure 1 Logistics operation mode led by "FARMERS + COOPERATIVES"

3.1.2 Logistics operation mode led by “wholesale market”

Most primary agricultural products such as fruits and seasonal vegetables in China are still sold in the traditional

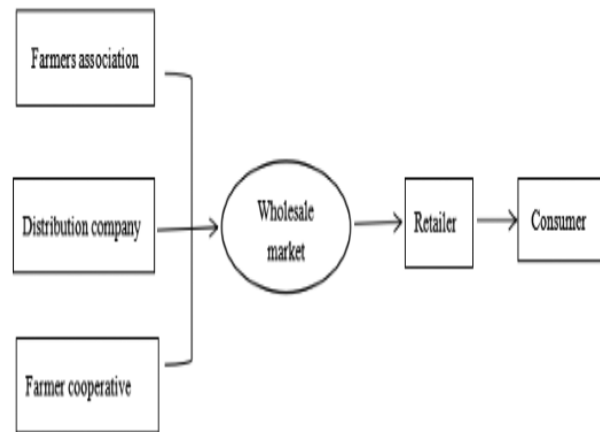


Figure 2 Logistics operation mode led by "wholesale market"

3.1.3 Logistics operation mode led by “processing enterprise”

The cold chain logistics of fresh agricultural products does not enter the consumer market directly from farmers or other suppliers, but needs to be processed, that is, the enterprises will initially process these fresh agricultural products before they enter the market. Then, carry out cold chain logistics activities, distribute or transport them to designated destinations.

Taking “processing enterprises” as the leading cold chain logistics operation mode, with the advantages of less logistics links, high market sensitivity and timely information feedback, it can obtain effective information in time and improve the added value of fresh agricultural products. However, this model belongs to “integration of production, supply and sales”, and the radiation and scope of application are small^[17], as shown in Figure 3.

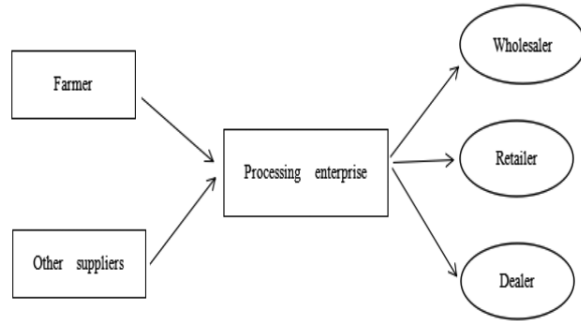


Figure 3 Logistics operation mode led by "processing enterprise"

3.2 Comparison of traditional cold farm logistics operation modes of fresh agricultural products

Table 3 shows the pros and cons of the three cold-chain

Table 3 Advantages and Disadvantages of Cold Chain Logistics Operation Mode of Fresh Agricultural Products

Operation mode	advantage	disadvantage
Farmers+ cooperatives	1.Strong organization 2. High enthusiasm	1.Small-scale distributed production 2. Low technical level 3. Low management level
Wholesale market	1.Many participants 2. In line with the status quo of agricultural	1.A large number of target customers, large differences in demand 2. The logistics business is in a state of scattered instability
Processing enterprise	1. Information feedback in time 2. High market sensitivity	1. It belongs to the "production, supply and marketing integration" logistics mode, and the scope of application is small. 2. The radiation radius of the logistics is small, and the fresh food is easy to deteriorate.

logistics operation modes of fresh produce:

- (1) The cold chain logistics model led by "farmers + cooperatives" is generally a small-scale decentralized production, and its cold chain technology level and management level are low.
- (2) The cold chain logistics model dominated by "wholesale market", due to the large number of target customer groups and large differences in demand, the logistics business is in a state of fragmentation and instability.
- (3) The cold chain logistics mode led by "processing enterprises" belongs to "integration of production, supply and marketing", which not only has a small scope of application, but also fresh foods are prone to deterioration during circulation processing.

3.3 Deficiencies in the traditional cold chain logistics operation mode

3.3.1 Core enterprises lacking supply chain

In the traditional cold chain logistics operation mode, most of the main players in the upstream of the supply chain are farmers, and most of the downstream entities are retailers. However, they belong to individual small traders, and "small, multi, scattered, chaotic" is a typical feature. Because they can not get the market demand information in time, have advanced technical capabilities, it is difficult to achieve scale operation, increase the difficulty of integration of core enterprises, and reduce the competitiveness of core enterprises.

Fresh agricultural products have the characteristics of perish ability. Due to the backward preservation technology, the quality of agricultural products cannot be guaranteed, and some agricultural products are deteriorated during transportation. After the degraded agricultural products are difficult to sell, not only can not meet the needs of consumers, but also reduce the income of farmers and sellers [18].

3.3.2 Too many intermediate links in circulation

Traditional cold chain logistics has too many intermediate links, including procurement, loading and unloading, transportation, processing, packaging, storage and other logistics links, which will inevitably affect the circulation efficiency of fresh agricultural products. The low circulation efficiency is the main reason for the deterioration of fresh agricultural products.

From the point of view of logistics cost, there will be costs between the first node (purchasing) and the final node (sales), resulting in forced price increases at the agricultural product layer, and the final product is expensive. However, consumers want to obtain high-quality and low-cost products, rather than low-quality, high-priced products, so this can not meet the consumer demand for products [18].

3.3.3 The quality of agricultural products is difficult to guarantee

Food safety has always been a livelihood issue that has been the focus of the National People's Congress in the past two years. It

is also a life issue that people usually focus on. In recent years, the government has repeatedly stressed in its work report that it “resolutely puts every pass on the food safety of the people.” However, there have been many food safety incidents in China, such as the sulphur-smelling “poisonous ginger” in 2013 and the smuggling of “zombie meat” into the table in 2015.

China’s fresh agricultural products from the cultivation to the sale of the process, there may be safety risks at all stages. For example, the selection of seeds and seedlings (pre-production), the use of fertilizers and pesticides (in-production), packaging and transportation links cause pollution, deterioration (post-production) and other problems. It can be seen that China’s food safety supervision is insufficient and the process of agricultural products from production to sales needs to be vigorously supervised.

3.3.4 The upstream and downstream information flow is not smooth

Since there is no information sharing platform, the upstream and downstream of the supply chain cannot communicate market information in time and establish an effective communication mechanism. Problems such as information lag and market imbalance will cause conflicts between supply and demand sides.

On the one hand, farmers in the upstream of the supply chain are difficult to obtain accurate market demand information in time due to high cost and narrow channels. Most of the farmers are following the wind planting and blind production. Information circulation and market integration are hindered, which will cause losses to suppliers. On the other hand, when downstream sellers purchase agricultural products, they often appear out of stock and out of stock. Under such circumstances, sellers can only use “high price”. Buying agricultural products, and most farmers will lose the opportunity to sell^[19].

4 CONSTRUCTION OF COLD CHAIN LOGISTICS MODE OF FRESH AGRICULTURAL PRODUCTS BASED ON SUPPLY CHAIN MANAGEMENT

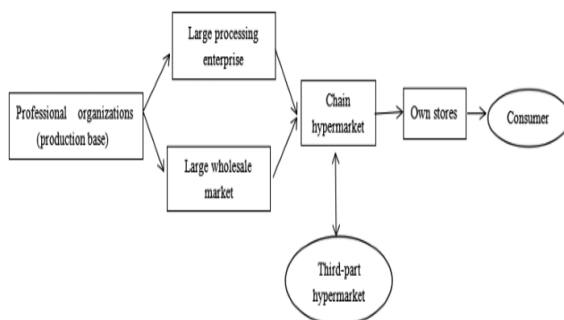


Figure 4 Supply chain model with large supermarket chains as the core

4.1 Construction ideas of agricultural product cold chain logistics operation mode

4.1.1 Build a vendor

The suppliers of agricultural products, traced back to the source of the supply chain are farmers, and the farmers are distributed in rural areas across the country, more dispersed, difficult to scale operations. And because of the lag in rural market information, farmers often blindly produce large-scale agricultural products.

Therefore, building a supplier is very necessary and important. The construction of suppliers, that is, the integration of farmers, can be carried out in two ways: First, the establishment of professional cooperatives for farmers, integration of their own land and existing labor for scale production; Second, the establishment of production bases, the recruitment of large numbers of farmers Production and management of agricultural products^[20].

4.1.2 Building an intermediary

The middlemen of the agricultural product supply chain mainly include processors, wholesalers, and transporters. The small scale of production, the large number of merchants and the large loss of circulation are their typical characteristics. Therefore, in the process of constructing the middlemen, it is necessary to streamline the logistics subject as much as possible and reduce the circulation.

Intermediaries can be constructed from the following two aspects: on the one hand, it is necessary to rebuild the main body of logistics, and it can be used in large-scale wholesale markets and processing enterprises that have been optimized and modified; on the other hand, it is necessary to build procurement, processing, transportation, sales and Distribution of integrated third-party logistics^[21].

4.1.3 Building a vendor

The sellers of agricultural products are mainly retailers. Because retailers have the disadvantages of small scale, large quantity, relatively scattered and incomplete cold chain equipment. it is difficult to maintain the freshness of fresh agricultural products, it is difficult to meet the needs of customers. The sales profit of agricultural products is difficult to be guaranteed, and the loss of businesses often occurs.

To build a sales terminal with a large chain supermarket as its core. On the one hand, it will use its own large-scale stores to form a scale advantage, so that fresh agricultural products can reduce costs in the process of circulation; on the other hand, large supermarket chains have brand advantages and are equipped with refrigeration equipment.

The ability to maintain the freshness of agricultural products to meet the needs of consumers has greatly increased the profits of sellers [22]. As shown in Figure 4.

4.2 Basic framework for the operation mode of agricultural cold chain logistics

4.2.1 Internal supply chain

In the internal supply chain, a modern logistics supply chain management mechanism is formed, which involves logistics, information flow and capital flow. The use of advanced logistics technology to build a modern information platform has gradually formed a benign competition between the supply chain and the supply chain. Actively create a sharing mechanism that is conducive to the supply chain, and improve operational efficiency by enhancing the reliability of related processes.

4.2.2 External supply chain

In terms of external supply chain, the development of cold chain logistics of agricultural products in China can be promoted by strengthening macro-control and focusing on the cultivation of market system. An international agricultural products logistics center with high degree of modernization, strong radiating power and complete functions will be gradually formed, and an information sharing platform with flexible and quick response will be built to build an operation mode of agricultural products cold chain logistics.

4.2.3 Core Enterprise

Large supermarket chains dominate the market. Therefore, large supermarket chains and upstream professional cooperatives, production bases, and downstream distributors and retailers form a network system structure, and each link maintains a consistent cooperative relationship [23].

Such a supply chain can become a chain of value growth, so that agricultural products can continuously improve operational efficiency and reduce logistics costs in the process of circulation. With the large supermarket as the core, through the network function, the members of each node are coordinated to form an integrated supply chain, and can quickly adapt to the market, effectively meet the needs of customers, and achieve effective cooperation between enterprises [24].

4.3 Operation of agricultural product cold chain logistics operation mode

4.3.1 Focusing on “large supermarket chains”

Because fresh agricultural products have the advantages of processing and packaging, high-quality fresh agricultural products are more and more popular among consumers, and they are more inclined to purchase fresh agricultural products in large supermarket chains. In view of the perishable and vulnerable characteristics of fresh agricultural products, higher requirements are put forward for the operation mode of cold chain logistics [25].

4.3.2 Operation mode of the supply chain

Due to the large-scale supermarket chain, on the one hand, it has strong financial strength, strong market development capability, good reputation and brand advantage; on the other hand, it has the advantages of high informationization and perfect logistics distribution system. Practice has proved that large supermarket chains are the most advanced and effective mode in modern supply chain management. In the cold chain logistics of fresh agricultural products, supermarkets, as the core of their operations, are able to grasp market information in a timely manner and respond quickly to the market. At the same time, according to user feedback, fresh agricultural products are dispatched. Establish a “mutual benefit” win-win mechanism in the cold chain logistics system [25].

The agricultural product logistics supply chain model integrates the internal supply chain and the external supply chain. Focusing on the market demand of large-scale supermarket chains, extending to suppliers of fresh agricultural products (pre-production), establishing stable intermediaries in large-scale processing enterprises and wholesale markets, and establishing long-term cooperative relationships (in production), through large

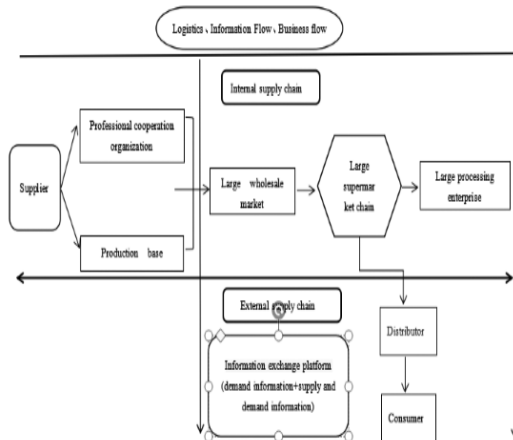


Figure 5 Basic framework of cold chain logistics model for fresh produce based on supply chain management

supermarket chains Self-built logistics distribution center or service by third-party logistics companies, store distribution of fresh agricultural products (post-production). As shown in Figure 5.

4.3.3 Advantage analysis of the operation mode of the supply chain

The supply chain model with large supermarket chains as the core, through the integration of upstream and downstream of the supply chain, the reconstruction of agricultural product circulation nodes and standardized inventory management^[26].

The advantage of this mode of operation is that it is beneficial to effectively reduce redundant intermediate links and improve the circulation efficiency of fresh agricultural products; it is conducive to keeping the products in a low temperature state during the circulation process, and delivering the quality and quantity of agricultural products to consumers; It is conducive to the efficient operation of inventory and reduce inventory losses. Therefore, it will become the mainstream model for the long-term operation of cold chain logistics of fresh produce^[26].

CONCLUSION

The efficient integration of the cold chain logistics system of fresh agricultural products is one of the important measures to promote the cold chain logistics industry of fresh agricultural products in China, and also an important part of the construction and development of the socialist market economy in China. China's traditional fresh agricultural products logistics mode is dominated by farmers+ cooperatives, processing enterprises and wholesale markets. From the perspective of supply chain, the shortcomings of these traditional cold chain logistics modes are caused by the lack of core enterprises, too many intermediate links, the inability to guarantee safety and quality, and the backward construction of information system.

The operation mode of cold chain logistics based on supply chain management can solve the problems in China's agricultural supply chain. This paper constructs a mode of operation with large supermarket chains as the core enterprises. On the one hand, it improves the comprehensive ability and organization of logistics by constructing suppliers, middlemen and sellers on the optimized supply chain system; on the other hand, In the

internal supply chain, we will build a modern information platform by using advanced logistics technology, construction quality and safety system. In the external supply chain, we will focus on the cultivation of the market system by increasing macroeconomic regulation and control. This mode of operation can effectively reduce redundant links, deliver the quality and quantity of agricultural products to consumers, and also play a positive role in promoting the standardized management of products. Therefore, the cold chain logistics model of graduate fresh produce is very necessary.

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