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Quality Control of Agricultural Products Cold Chain Logistics under Internet of Things Technology

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Abstract: *China's agricultural production has achieved fruitful results in recent years, but on the whole, problems such as scattered production, low degree of modernization and lack of integrated organization and operation of production, supply and marketing are still outstanding. However, the achievement of the synergy benefits of cold chain logistics systems cannot be achieved overnight. Relevant entities should consciously and gradually adopt organized strategies and means to promote the evolution of self-organized collaboration to a higher stage. It is of great practical significance to explore the collaborative path and realization mechanism of cold chain logistics of agricultural products in China under the technology of IOT (Internet of Things), to promote relevant enterprises to solve the "bottleneck" of industrial development in interactive coordination, and to realize seamless connection of cold chain logistics nodes and effective integration of resources. To a certain extent, the wholesale market can more accurately control the types and quantities of products demanded by the market, and also has the ability to schedule all links. Build a backbone network of agricultural products cold chain connecting the main producing areas and consumption areas of agricultural products, and improve the security level of large-scale agricultural products logistics.*

Keywords: *Internet of Things technology; Cold chain of agricultural products; Logistics quality control*

1. Introduction

The cold chain technology first appeared in the late 19th century and gradually improved with people's specific practice. Regarding the cold chain, we can describe it as: in order to ensure the freshness of some easily perishable agricultural products and avoid product contamination and loss. From product production to intermediate processing, storage, transportation, and sales, all processes are carried out in a certain temperature environment, forming a unique supply system. China's agricultural production has achieved fruitful results in recent years, but overall, problems such as decentralized production, low modernization, and lack of integrated organizational operation of production, supply, and sales are still quite prominent. The diversity and freshness of residents' agricultural product varieties have put forward higher requirements, and the continuous exposure of agricultural product safety and quality incidents in recent years has already left people with lingering fear. In addition, various regions in China have repeatedly experienced phenomena such as "difficult to sell and expensive to buy" agricultural products, increasing production without increasing income, but also severely impacts the production enthusiasm of farmers [1]. Therefore, developing cold chain logistics is necessary to reduce agricultural product losses and improve quality. Enterprises can choose appropriate cold chain logistics models based on the local situation, optimize logistics processes, reduce costs, and provide consumers with more high-quality and low-priced agricultural products while increasing the revenue of backup links as a "reservoir" between supply and demand, it can effectively regulate the supply and demand balance of agricultural products[2-3]. Cold chain logistics has received high attention from both inside and outside the industry. However, the overall development level of problems such as poor node connection and "chain breakage" emerging one after another. Although the scale and development speed of the agricultural cold chain industry are far inferior to market demand, due to the asymmetry of market supply and demand information, the utilization rate of cold chain logistics equipment and facilities is not high [4]. Therefore, exploring the collaborative path and implementation mechanism under the IOT technology, promoting relevant enterprises to solve the "bottleneck" of industrial development in interactive coordination, achieving seamless connection nodes and effective integration of resources, has very important practical significance.

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2. Cold chain logistics mode of agricultural products

2.1. Cold chain logistics mode of agricultural products in the region

There are three main levels of agricultural products logistics in the region: production, distribution and sales. Logistics operation is mainly based on traditional self-sufficient logistics. The operation efficiency is low, and the logistics circulation channels are more complicated, such as the local sales of farmers' products and the origin procurement of supermarket purchasers. Because the farmers who produce agricultural products are scattered and the production scale is small, information technology will not be introduced to improve their production efficiency and quality control, and the operators of farmers' markets have the same situation [5]. Although large supermarket chains use information technology, the overall information level of agricultural product supply chain is still at a low level. The production base of agricultural products has the widest sales range, except for some local wholesale markets and supermarkets, most of them are transported to wholesale markets in different places for further distribution. Wholesale market is the main channel of urban circulation, while local farmers' market is the main place for farmers to buy. Its mode is shown in Figure 1.

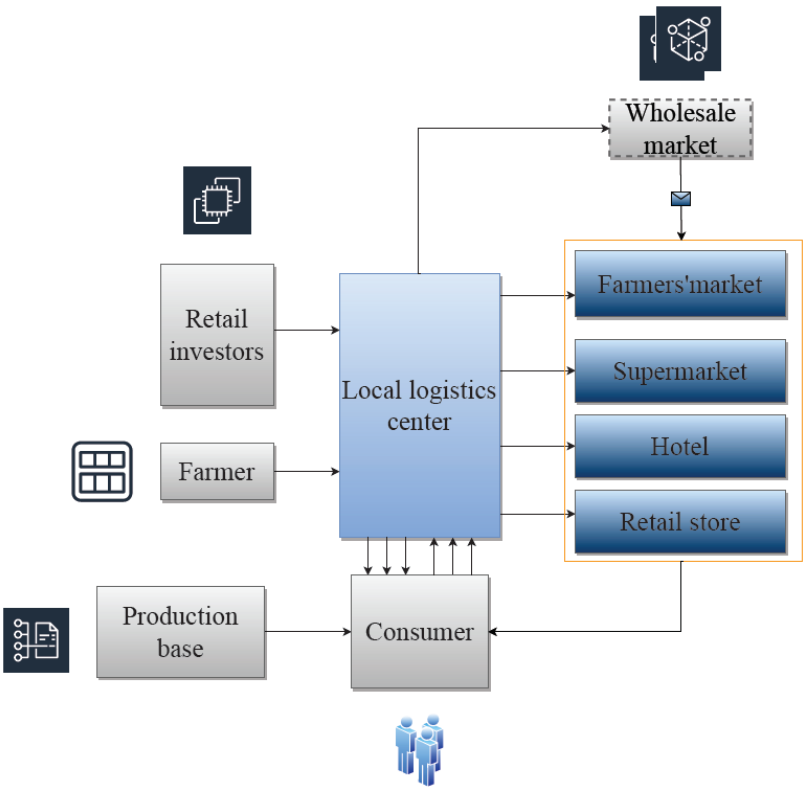

Figure 1: Logistics Mode within Agricultural Product Regions

Agricultural products leave the production and processing site and enter warehouses, distribution centers, or logistics centers to achieve low-temperature storage. This link consists of an information reading and writing module composed of refrigerated warehouses, temperature and humidity monitoring equipment, information collection and transmission equipment, and temperature and humidity control touch management [6]. When agricultural products enter the refrigerated warehouse, all product information carried by agricultural product labels is collected by the antenna and displayed in the backend system to monitor the storage environment of agricultural products. The sales range of agricultural product production bases is the widest, with most of them being further distributed through long-distance transportation to remote wholesale markets, in addition to supplying local wholesale markets and retailers such as supermarkets.

2.2. Cross-regional cold chain logistics model of agricultural products

According to the consumption needs, agricultural products leave the refrigerated warehouse and enter the sales process. Wholesalers and retailers ensure the freshness of products in the sales process. Some trans-regional agricultural products logistics have the following characteristics: there are too

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many logistics links; There are many ways to transport products across regions [7-8]. The refrigerated transport rate is low; There are too few modern professional logistics centers, and most of them are built and operated by large group companies: refrigerated transportation and storage only cover a few operation links, and the cold chain system is not perfect. Complex and diverse circulation channels are difficult to achieve effective supervision of agricultural products.

According to the temperature and humidity; According to product information, temperature and humidity change records and the shelf life of products, sales personnel make timely decisions on promotion or removal[9]. Enterprises often start from their own local interests and short-term interests, and cannot take into account the cooperative provide consumers with more high-quality and low-priced agricultural products while increasing the revenue of backup links as a "reservoir" between supply and demand, it can effectively regulate the supply and demand balance of agricultural products. Cold chain logistics has received high attention from both inside and outside the industry. The primary fresh agricultural products of all kinds of producers can be effectively concentrated, distributed and distributed, and the whole logistics channel has been effectively standardized, which is conducive to the effective coordination between adjacent nodes [10].

3. Application of Internet of Things Technology in Quality Control of Cold Chain Logistics of Agricultural Products

3.1. Design of Cold Chain Logistics System for Agricultural Products

The IOT refers to an information system established on the basis of item coding, RFl D technology, and the Internet. The collaboration of cold chain logistics systems for agricultural products can effectively solve the logistics "bottleneck" that urgently needs to be overcome in the development of the agricultural product industry. However, the achievement of the synergy benefits of cold chain logistics systems cannot be achieved overnight. Relevant entities should consciously and gradually adopt organized strategies and means to promote the evolution of self-organized collaboration to a higher stage. Enterprises can choose appropriate cold chain logistics models based on the local situation, optimize logistics processes, reduce costs, and However, the overall development level of problems such as poor node connection and "chain breakage" emerging one after another[11]. Although the scale and development speed of the agricultural cold chain industry are far inferior to market demand, due to the asymmetry of market supply and demand information, the utilization rate of cold chain logistics equipment and facilities is not high. The architecture diagram of the agricultural product cold chain logistics system based on IOT technology is shown in Figure 2.

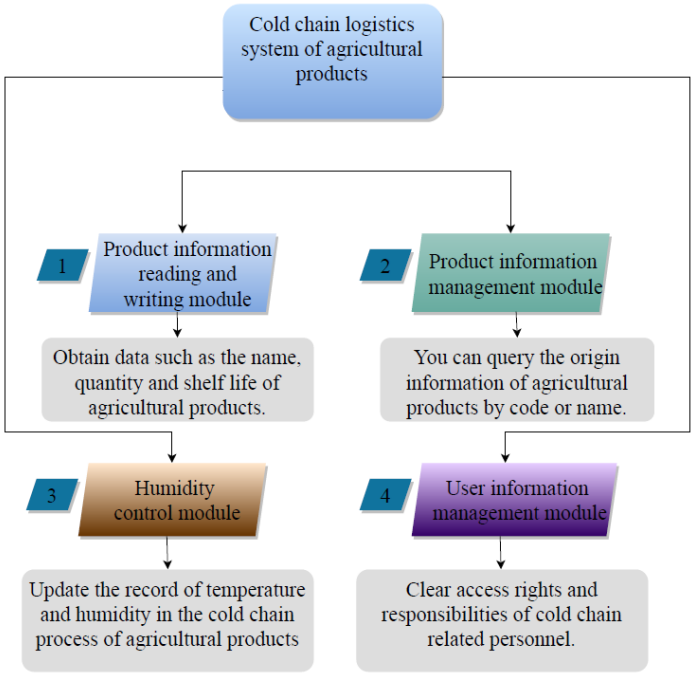

Figure 2: Cold Chain Logistics System of Agricultural Products

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The system not only has a certain structure, but also operates according to certain rules, showing "order" [12]. Moreover, the self-organization mode of the system is far more complicated than that of the natural system. To a certain extent, the wholesale market can more accurately control the types and quantities of products required by the market, and also have the ability to schedule all links to ensure that products can arrive at a certain time and deliver products to all sales points, so as to better promote the connection in each link, reduce the occurrence of product shortage and backlog, and control the cost and loss of cold chain logistics to a minimum [13].

3.2. Countermeasures for Developing Cold Chain Logistics of Agricultural Products

In response to the current cold chain logistics mode and status of agricultural products, the system obtains real-time humidity of the area where the products are located are within the set range. Therefore, exploring the collaborative path and implementation mechanism under the IOT technology, promoting relevant enterprises to solve the "bottleneck" of industrial development in interactive coordination, achieving seamless connection nodes and effective integration of resources, has very important practical significance. In response, this article proposes the following two strategies for developing agricultural cold chain logistics, mainly describing the overall planning of strengthening the cold chain logistics system and establishing various forms of agricultural cold chain logistics.

3.2.1. Strengthen the overall planning of the cold chain logistics system

In the cold chain logistics process of agricultural products, refrigerated transportation runs through the entire process. During transportation, the temperature and humidity control module is used to control the temperature and humidity of the carriage, ensuring that agricultural products do not deteriorate or become contaminated. The cold chain logistics of agricultural products involves a wide range of aspects. It is difficult to effectively promote by relying solely on either party, as it requires the full cooperation of the government, industry organizations, enterprises, and farmers. China should combine its national conditions, draw on the experience of developed countries and regions, and improve its technical management methods and regulatory measures. Starting from reality, formulate policy environment and incentive measures for the development of agricultural cold chain. Realize real-time tracking and positioning of refrigerated vehicles, plan the optimal transportation and distribution route, and improve transportation efficiency.

3.2.2. Establish various forms of cold chain logistics of agricultural products

According to the development status of cold chain of agricultural products in China, we should promote the development of various cold chain logistics modes. Relying on leading agricultural enterprises and large food processing enterprises, we will develop a cold chain system of agricultural products with core enterprises as the axis. Large-scale cold chain logistics centers and cold chain logistics enterprises, are taken as pilots, and the system is used first, and then extended to upstream and downstream enterprises, so as to gradually complete the connection and implementation of the cold chain information system. On the basis of building a green channel for agricultural products. Build a backbone network of agricultural products cold chain connecting the main producing areas and consumption areas of agricultural products, and improve the security level of large-scale agricultural products logistics.

4. Conclusions

The IOT technology is a necessity for future agricultural development, and its application in agricultural production will greatly promote the level of agricultural informatization and ensure the quality and safety of agricultural products. The collaboration of cold chain logistics systems for agricultural products can effectively solve the logistics "bottleneck" that urgently needs to be overcome in the development of the agricultural product industry. However, the achievement of the synergy benefits of cold chain logistics systems cannot be achieved overnight. Relevant entities should consciously and gradually adopt organized strategies and means to promote the evolution of self-organized collaboration to a higher stage. Enterprises can choose appropriate cold chain logistics models based on the local situation, optimize logistics processes, reduce costs, and provide consumers with more high-quality and low-priced agricultural products while increasing the revenue of backup links.

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