### Review on the Application of Intelligent Logistics Technology in Cold Chain Logistics

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Abstract: The development of intelligent logistics technology has greatly promoted the development of intelligent logistics. The special environmental requirements of cold chain logistics make smart logistics technology play a huge role in the field of cold chain logistics. Starting from the construction of cold chain logistics system, this paper reviews the relevant literature on the application of smart logistics technology, including artificial intelligence technology, **RFID** technology and Internet of Things technology, in the field of cold chain logistics, and summarizes the application research of smart logistics technology in cold chain logistics. In addition, combined the promotion of prefabricated with vegetables to the development of cold chain gifts, the research of cold chain logistics of prefabricated vegetables was reviewed.

Keywords: Cold Chain Logistics; Internet of Things Technology; Premade Dish; Artificial Intelligence Technology; RFID Technology

#### 1. Introduction

The continuous development and maturity of intelligent technologies such as artificial intelligence, Internet of Things, and big data have brought infinite possibilities to the development of the logistics industry, especially the cold chain logistics industry with special requirements for temperature and humidity and other environments, whether it is warehousing, transportation, distribution and other operations, or the traceability of the whole life cycle of cold chain logistics products. The application of intelligent technology guarantees the quality and safety of cold chain logistics and increases consumer satisfaction. In recent years, with the development and progress of information

technology, communication technology and other technologies, the continuous application of high-tech in the logistics industry has made the level of modern logistics continue to improve. In particular, the informatization level of cold chain logistics with special requirements for the environment has been better developed. Scholars have also studied the application of traditional bar code technology in the cold chain logistics industry, to RFID technology and Internet of Things technology, and now artificial intelligence and other technologies in the cold chain logistics industry. The development of cold chain logistics has also promoted the development of the food industry, especially the prepared dishes industry, which has developed rapidly in recent years.

### 2. Cold Chain Logistics System Construction

For the construction of cold chain logistics system, scholars mainly believe that there is a lack of complete and standardized cold chain logistics system, high input cost of cold chain logistics, long return on investment cycle, insufficient construction of cold chain logistics infrastructure and backward technology <sup>[1]</sup>. Therefore, many scholars have studied how to build a cold chain logistics system and the development direction of cold chain logistics in the future, and mainly believe that it can be carried out by giving full play to the government's overall planning and supervision functions, strengthening the construction of cold chain logistics system and platform, investment cold increasing in chain infrastructure construction, improving cold chain logistics standards, and strengthening the training of professional cold chain logistics talents.

### 3. Application of Smart Technology in Cold

### **Chain Logistics**

## **3.1** Overview of the Application of Artificial Intelligence Technology in the Field of Cold Chain Logistics

3.1.1 Application scenario of artificial intelligence in cold chain logistics field

As for the application of artificial intelligence technology in the field of logistics, scholars believe that artificial intelligence can be applied to the intelligent management of suppliers, warehousing, transportation, distribution and customers, as well as the intelligent management of logistics information, logistics organization, logistics employees and logistics costing <sup>[2-3]</sup>. For the of artificial intelligence application in warehousing, scholars believe that artificial intelligence can play a role in intelligent warehouse management, intelligent warehouse management and intelligent traceability system, warehouse location and distribution, while reducing storage costs and ensuring the safety of inventory management. Huang et al. studied the construction of artificial intelligence intelligent cold chain logistics system for fresh agricultural products in Hunan<sup>[4]</sup>. Wu studied the monitoring system of ship cold chain logistics based on artificial intelligence technology<sup>[5]</sup>.

3.1.2 Problems of artificial intelligence in intelligent cold chain logistics system

As for the existing problems of artificial intelligence in supply chain logistics, Li Nan believes that the application of artificial intelligence in the field of cold chain logistics is unbalanced between the southeast coast and the central and western regions, and the artificial intelligence level in the central and western regions is generally slower than that in the southeast coast <sup>[6]</sup>. Zhao et al. believe that relevant departments in China have not taken effective measures to improve the information management system in the field of supply chain logistics, and there are problems such as information asymmetry and resource sharing <sup>[7]</sup>. Wu and Qi believe that the construction of intelligent cold chain logistics system of fresh agricultural products based on artificial intelligence technology mainly has the problems of high technical cost, data security and lack of professional talents [8].

3.1.3 Suggestions for the development of artificial intelligence in cold chain logistics

Regarding the future development of artificial intelligence in the field of cold chain logistics and supply chain, Wu believes that the management of intelligent logistics vehicles can be realized through the combination of artificial intelligence technology and Internet of Things technology, and the application of intelligent logistics equipment can be realized through the automation and intelligent control of logistics equipment by artificial intelligence technology <sup>[9]</sup>. Huang and Guo proposed to build a cold chain logistics system of fresh agricultural products with low temperature in all aspects through the application of AI technology, so as to build a public information platform of intelligent cold chain logistics <sup>[4]</sup>. Wu and Qi believe that the strategy of building a smart cold chain logistics system for fresh agricultural products based on artificial intelligence technology includes five aspects: clarifying the construction objectives of the logistics system, strengthening technological innovation, promoting intelligent management, and optimizing personnel training strengthening infrastructure construction<sup>[8]</sup>.

## **3.2** Overview of the Application of RFID Technology in Cold Chain Logistics

3.2.1 Application scenarios of RFID in cold chain logistics

In China, Jiaying first proposed in 2008 to use RFID technology and temperature sensors in cold chain logistics to conduct wireless perception of cold chain temperature <sup>[10]</sup>. Based on her work, Xu et al. further proposed the modular application of RFID temperature sensing system to refrigerated trucks <sup>[11]</sup>. Song believes that RFID can play a role in all business links of cold chain logistics such as procurement, production and processing, warehousing, transportation and distribution, and sales <sup>[12]</sup>.

3.2.2 Problems of RFID in cold chain logistics As for the research on the problems existing in the application of RFID in cold chain logistics, Wan first pointed out that RFID has problems such as different standards, cost bottleneck restricting market development, imperfect technology, restricting application development, privacy risks, identification accuracy and the impact of the operating environment <sup>[13]</sup>. Yang and Yin further pointed out that there are still problems in the

complexity of RFID technology implementation and the problem of bar code technology seizing the market <sup>[14]</sup>. Chen et al. believe that RFID technology has low application rate and low popularity in cold chain warehousing, and there are also problems such as lack of technical personnel and low level of business personnel. They also study the application of radio frequency technology in the storage link of cold chain logistics, and analyze the different reactions of RFID technology with different temperature Real-time monitoring changes. of the temperature of all links in the warehouse<sup>[15]</sup>.

# **3.3** Overview of the Application of Internet of Things Technology in the Field of Cold Chain Logistics

3.3.1 Needs of the Internet of Things in cold chain logistics

Zhang and Shi proposed that from the perspective of technology and industry, the Internet of Things can apply technical means to solve the needs of balanced production in the processing link of the food cold chain, intelligent scheduling in the transportation link, collaborative management in the distribution link and low inventory cost management in the warehousing link <sup>[16]</sup>. Lin further proposed that intelligent mobilization of cold chain logistics also needs the integration of Internet of Things technology to achieve functions such as multiple route planning and unified scheduling <sup>[17]</sup>.

3.3.2 Application advantages of the Internet of Things in cold chain logistics

Zhang and Shi first proposed that the Internet of Things technology can help improve the standardization and feedback efficiency of food cold chain logistics information and the service level and quality of food cold chain logistics <sup>[16]</sup>. Starting from the technical advantages of the Internet of Things itself, Zhu Xuefang believes that real-time supervision and management, accurate and efficient work efficiency, and optimized algorithms are the advantages of the Internet of Things technology, and the application of different cold chain logistics links can achieve different results <sup>[18]</sup>. Chen believes that the application of Internet of Things technology in food cold chain logistics solves the problem of "the first kilometer" and "the last kilometer" and helps to ensure the service quality and food quality

of cold chain logistics <sup>[19]</sup>.

3.3.3 Application scenarios of Internet of Things in cold chain logistics

In view of the application of the Internet of Things in cold chain logistics, Ma et al. further proposed to combine RFID technology and WSN technology to realize data monitoring, and use positioning technology to realize the positioning of transport vehicles to design an intelligent tracking and traceability system for food cold chain logistics <sup>[20]</sup>. Wang et al. applied the Internet of Things technology to carry out intelligent management of cold chain logistics and temperature control management in the cold chain transportation process <sup>[21]</sup>. Ren studied the monitoring system of cold chain logistics and designed a real-time monitoring system of cold chain logistics with four layers, namely perception layer, network layer, platform layer and application layer, by applying the Internet of Things technology <sup>[22-</sup> 23]

### 4. Cold Chain Logistics in Prepared Dishes

## 4.1 Requirements of Cold Chain Logistics for Prepared Dishes

As for the requirements of prepared dishes for cold chain logistics. Wang first pointed out that the core element of prepared dishes is to establish an efficient supply chain system, which is the key to the success of prepared dishes <sup>[24]</sup>. Liu further pointed out in detail that the demand for cold chain logistics of prepared dishes is reflected in strict temperature control requirements, fast distribution, cold chain traceability, high packaging requirements, fast and accurate distribution, and traceability, including temperature monitoring and logistics information recording, etc.<sup>[25]</sup>. At the same time, Wang pointed out that high quality and high price is the demand basis of cold chain logistics, and transparent supply chain is the realization basis of high quality and high price [26]

### 4.2 Summary of Suggestions for Future Development of Cold Chain Logistics for Prepared Vegetables

Regarding the future development prospects of cold chain logistics for prepared dishes, it is generally believed that the prepared dishes industry is highly dependent on the infrastructure construction of cold chain logistics, which is a strong guarantee to ensure the quality and safety of prepared dishes, and the hot development of prepared dishes will help the cold chain logistics system to be more perfect. Wang also believes that the production of China's food manufacturing industry is expected to rebound, imported food is rapidly distributed to the Chinese market, the export of prepared vegetables to foreign countries shows a rising trend, and the cold chain logistics infrastructure and food processing are gradually realizing the integration of business planning and construction [26], and the cold chain logistics of China's prepared vegetables will usher in new opportunities. For the future development direction of cold chain logistics. Liu believes that new formats and new models such as "cold chain city distribution + fresh ecommerce + cold chain house distribution" and "central kitchen + food cold chain distribution" can be explored <sup>[25]</sup>.

In view of the various problems in the cold chain logistics of prefabricated vegetables, Xu et al. proposed that the construction of the cold chain logistics network of prefabricated vegetables should be improved, the distribution route and cost management should be optimized, the logistics and express distribution costs should be reduced, the investment in facilities and equipment should be increased, and the temporary freezer storage space should be used in different areas. Strengthen the whole-process quality control, promote the integrated development of the industrial chain, and build a new ecology of the prefabricated vegetable supply chain <sup>[27-28]</sup>.

### 5. Conclusion

By combing the literature related to the application of smart technology in the field of cold chain logistics, it is found that many previous studies pay attention to the application of smart logistics technology such as artificial intelligence, RFID and Internet of Things. Compared with the research on RFID and Internet of Things technology in the field of cold chain logistics, the research on cold chain logistics based on artificial intelligence technology is relatively few, and the literature is relatively new. On this basis, combined with the rise of prefabricated vegetable industry, the study of cold chain logistics of prefabricated vegetable was reviewed.

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