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Analysis of the Prospect of China's Cold-Chain Logistics Development

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Abstract. With the rising of China's fresh food e-commerce industry, the steady-state growth of the market scale, the improvement of the consuming ability, the reinforcement of the country's management of food safety, the increase of the requirement of the downstream application of cold chain logistics, traditional refrigerated transport can't meet the requirement of the market in various aspects such as organization, management, equipment, facilities, information services, etc. and the cold-chain transportation industry requires upgrade, which promotes China's cold-chain logistics transportation industry to enter a period of rapid development. This paper applies the PESTE model to analyze the differences of cold-chain logistics in China and in developed countries and the development status of China's cold-chain logistics, and uses the literature review to analyze the development prospect of China's cold-chain logistics in the future.

Keywords. Cold-chain logistics, PESTE analysis, contrastive analysis

Introduction

The cold-chain logistics industry in China mainly concentrate in the field of food cold-chain logistics, and it originates from the foreign trade export of meat ware in the 1950s. Since the socioeconomic level at that time was backward, only relying on refitting can refrigerated warehouse and refrigerator car maintain a low temperature. After the foundation of China Federation of Logistics & Purchasing, the infrastructure construction of cold-chain logistics was fully carried out, including the standardized construction of cold-chain logistics, the informatization construction of cold-chain logistics, the scientific and standardized construction of cold-chain logistics, the theoretical research of cold-chain logistics, and the overall planning of cold-chain logistics.

Cold-chain logistics is a complicated system engineering in the logistics system, and a high-end logistics industry that integrates high and new technologies, high investment and advanced management. In regard of the development of cold-chain logistics, China introduced a series of policies and regulations in recent years. After the promulgation of the Development Plan of Agricultural Product Cold-chain Logistics formulated by National Development and Reform Commission in 2010, the "12th Five-Year Plan" about cold-chain logistics is also successively introduced by various provinces and cities in China. In 2022, important laws and regulations such as Logistics Industry Adjustment and Revitalization Plan, Development Plan of Agricultural Product Cold-chain Logistics, and Food Safety Law were promulgated and

implemented, which shows that the country attaches great importance to cold chain logistics. At present, a relatively complete agricultural product cold-chain logistics system has been formed in western developed countries, cold-chain system circulation of fresh products accounts for over 90% of the total circulation amount. Through cold-chain logistics, losses of agricultural products can be effectively reduced, thus indirectly increasing the output and output value of agricultural products. According to incomplete statistics, in China, vegetables transported by the cold-chain system only account for 10% of the total, aquatic products only for 30%, and meat only for 25%. Although some agricultural products are transported by the cold-chain system, the system may also be interrupted from time to time in the process of transporting the products from the place of origin to the market fair for retail. Moreover, cold-chain transportation consumes a lot, with poor safety of delivery. In recent years, domestic refrigerated transport rates of meat, fruits and vegetables are respectively about 70%, 50%, and 85%, and the spoilage rates are respectively about 5%, 10%, and 7%, which are still relatively high when comparing with that of developed countries, which is only 3%. The way to guarantee the quality of food in cold-chain logistics is the biggest obstacle for cold-chain logistics in market competition.

Literature review

Lu Chao (2016) indicates that with the diversified development of the market economy, the food industry also develops in a gradual way, and the food cold-chain logistics industry is facing a larger market for its development. In this situation, the demand market develops fast, which can be presented in the following aspects: The first one is the demand in the meat product market. The domestic processing industry of meat products is in a period of development, with sufficient demand and increasing consumption and output, which provides adequate space for cold-chain logistics' development. The second one is the demand in the quick-frozen food market. The development of quick-frozen technology promotes the development of this industry. The market of modern society has a great demand for quick-frozen food, which is also a factor that promotes the development of cold-chain logistics. The third one is the demand in the dairy product market. Dairy products have a high requirement for the temperature control of logistics, which can be fully satisfied by cold-chain logistics. The above three aspects are all important factors that promote the development of the cold-chain logistics industry.

According to Lei Guo (2015), China's cold chain and cold-chain logistics are in the stage of explosive growth. The cold-chain transportation rate of food in the United States, Japan and Western European countries reaches 80%-90%, and is about 50% in Eastern European countries, but only about 10% in China. Currently, existing refrigerated capacity in China only accounts for 20%-30% of the demand for goods. There is a huge business opportunity in the cold-chain industry, which attracts the attention and investment enthusiasm of foreign investors. Swire, the largest cold-chain logistics supplier in Australia, enters the market in Southern China. PFS as one of the biggest American cold-chain logistics operators lays the foundation in the modern cold-chain storage facility in Shanghai. It is necessary for domestic enterprises to seize the precious opportunity in China's huge cold-chain market.

Zhang Hong (2016) proposes that China's enterprises of the cold-chain logistics industry are mainly small and medium-sized enterprises, with small scale, weak strength and single service. A large number of enterprises engaging in the agricultural product cold-chain logistics industry can only carry out single business of refrigerated transport and refrigeration storage, with a low service level, lacking of the ability of controlling the whole process of cold-

chain logistics, while larger cold-chain logistics enterprises with the abilities of resources integration and industry promotion just start their business, which can hardly meet the demand of the market.

Through studying the development status and existing problems of China's cold-chain logistics industry, Liu Hao (2016) puts forward the development mode and innovative countermeasures of China's cold-chain logistics industry from two perspectives of government and enterprise. Fan Jiang (2015) states that the innovative logistics mode requires the guidance of policies, the exploration of innovative thinking patterns of cold-chain logistics, and the adjustment of the demand system. Through the contrastive analysis of cold-chain logistics research conducted by scholars at home and abroad, Xie Sixin and Xue Linlin (2018) discuss the risk control measures of specific links of China's cold-chain logistics for fresh food and agricultural products, as well as the overall operation process and development strategy. Different from traditional research that focuses on food safety and inventory of the supply chain, Huang Chunhui (2012) combines "food cold chain" and "transportation network optimization" and discusses the application of transportation network optimization theory in food cold chain from a new perspective.

Research method

This paper adopts the way that combines qualitative analysis, PESTE analysis, theoretical research and empirical research, which mainly has the following points:

(1) Qualitative analysis

Qualitative analysis of relevant concepts and characteristics of cold-chain logistics. The PESTE analysis method is adopted to compare the internal advantage and external opportunity and show the difference of the development of cold-chain logistics in China and other developed countries, find the shortcomings of development and potential threats, thus to provide countermeasures and suggestions for the development of cold-chain logistics in China.

(2) Combination of theoretical research and empirical research

In terms of theoretical research, this study consults and arranges a mass of materials and documents, and summarizes the latest theories and data to support the empirical analysis of the paper. In terms of empirical research, the study collects the information such as the current development status, transportation scale, and category distribution of China's cold-chain logistics, the opinions and problems of cold-chain transportation development presented by practitioners. Investigation and demonstration are adopted to analyze the development prospect of China's cold-chain logistics in the future.

Research conclusions

1. China's systematic transportation system of cold-chain logistics is still in the preliminary stage of development, with insufficient refrigeration equipment and a low refrigerated transportation rate, and the transportation and circulation rate of cold-chain logistics is far lower than that of developed countries, whose transportation and circulation rate reaches over 95%, while more than 60% of domestic fruits, vegetables, meat and aquatic products still rely on traditional refrigerated transportation, whose refrigerated storage temperature can hardly meet the requirement for storage. Professional refrigerator cars are also in a severe shortage. China's refrigerator cars only account for 2% of the total number of freight vehicles. In terms of highway transportation, the refrigerated transport amount of fresh food, fruits and vegetables only account for 15%-25% of the total account of transportation. Besides, there is also a huge

gap between China and developed countries in the aspects of hardware facilities and transport efficiency of cold-chain logistics transportation.

2. China's third-party cold-chain logistics are lagging. At present, only a few suppliers can provide integrated services in domestic cold-chain logistics industry, and most of them still take services such as goods agency, inventory management, carrying, oriented transportation as the main business. Therefore, logistics enterprises can't provide all-round, comprehensive, integrated and efficient cold-chain logistics transportation. General enterprises can only provide one or several basic functions, such as cold storage, refrigerator cars, etc. The comprehensive coverage rate of cold-chain logistics is limited, without unified and complete platform for transportation information sharing of cold-chain logistics, and the quality, accuracy and timeliness of cold-chain logistics can hardly be ensured. In addition, the cost of cold-chain logistics construction is relatively high, and the high loss rate of commodities can't be avoided. There is no complete supply chain system, and the information sharing mechanism is also imperfect, which leads to that enterprises can only rely on a third party, which may further cause food safety problems after the outsourcing of cold-chain logistics business. Therefore, enterprises either rely on their own operation to meet their demands of cold-chain logistics, or outsource parts of business or regional business. However, self-support cold-chain logistics transportation accounts for two thirds of the total amount of this industry, and only one third of cold-chain logistics transportation is supported by third-party enterprises of cold-chain logistics transportation. It impedes the development of the third-party cold-chain logistics transportation industry to a certain extent.

3. The lagging hardware equipment of China's cold-chain logistics industry is the main reason for the slow development of the cold-chain logistics industry. There is a severe shortage of standard and intelligent freezing and refrigeration transport vehicles. Backward refrigeration technologies and processes, lagging food refrigeration hardware equipment, rare cold-chain logistics transportation temperature control equipment with a high standard performance, disable to provide a standard guarantee of low temperature for perishable food circulation, all of which result in the huge loss in the process of transportation, and the loss caused by cold-chain logistics reaches tens of billions of yuan every year. There are hundreds of kinds of goods that need to be transported by cold-chain logistics, especially biochemical and pharmaceutical products that require a guaranteed temperature control standard of the cold-chain transportation car. In terms of cold-chain transportation of food, there are also different required standards. The perishable degree of food in different temperature may vary, and every product also has their own requirements on storage temperature. Therefore, there is a relatively high requirement for cold-chain transportation cars, which should be professional and standardized.

4. Complete system of laws and regulations on behaviors of the cold-chain logistics industry hasn't been established in China, and related management methods and operation specifications generally adopted in developed countries is applied in current stage. Compared with developed countries' policies, China's policies are looser. There is no unified standard for facilities, equipment, temperature control, operation specifications, and other aspects of various links of cold-chain transportation, while complete industrial standards for supervision, regulation, monitoring of cold-chain transportation, and laws and regulations for various behaviors carried out in the process of production, operation and circulation are established in developed countries. There is no uniform industrial standard for reference and implementation in China's cold-chain logistics transportation industry. At present, some large-scale enterprises of the cold-chain logistics transportation industry can only refer to the industrial standard made by some developed countries and formulate their own cold-chain transportation standards. As

for the supervision of cold-chain logistics transportation, relatively simple and suited supervision methods are developed according to the requirements of local areas and enterprises. Due to the particularity of cold-chain logistics transportation, a standard tracking and monitoring system should be set to realize 24-hour, all-around and safe monitoring and supervision in the process of circulation. Nevertheless, such kind of tracking and monitoring system of cold-chain logistics transportation is only applied in large-scale cold-chain transportation enterprises for the application in a small range in current China, where there is also no unified standard for the tracking system of the cold-chain logistics industry, which remains void in some places. However, there is also no consolidated standard for various executive standards such as specific and systematic technical standards, loss and efficiency standards for cold-chain transportation, operation standards for the cold-chain transportation industry, safety standards for cold-chain transported food hygiene, environmental temperature control standards for cold storage, temperature control standards for cold-chain transportation, configuration standards for perishable food transportation vehicles and the management systems of the cold-chain logistics industry. It is necessary to determine a unified industrial standard as the core of system construction for the development of the cold-chain logistics industry, and form a strict and complete industrial standard for implementation. Only in this way, can this industry develop healthily and rapidly, while there is just a lack of construction of this core system (industrial standard, supervision standard, access standard) in China. What required in China is just the rapid establishment of related standard system to promote the rapid development of the cold-chain logistics industry, and the establishment of the system is an effective way to develop modern cold-chain logistics industry. It is urgent to formulate and implement the industrial standard.

Strategies and recommendations

1. It is available to develop large-scale cold-chain logistics transportation enterprises, form a group of comprehensive cold-chain logistics enterprises with strong economic strength, advanced management concepts and strong core competitiveness, promote the integration of cold-chain logistics service network through scale operation, break the limit of industry, region, ownership and other aspects, form an integrated supply chain system to achieve the integrity, industrialization, intelligence, informatization and modernization of cold-chain logistics, realize seamless handover in the process of cold-chain logistics transportation and circulation, and participate in the competition of the international market.

2. It is advisable to improve the infrastructure of cold-chain transportation, build a batch of infrastructure systems of cold-chain logistics, which are adaptive to modern requirements of development and consumption, reform the infrastructure, update current refrigerated transportation equipment, introduce advanced management technologies, adopt high-end and professional refrigerated transportation equipment, set up the industrial standard for temperature monitoring and tracking system, trace the source of goods through checking the information of cold-chain commodities, establish an all-round supervision and control mode, ensure the controllability and safety of the quality in the link of circulation, gain advantages of enterprises in the cold-chain logistics industry and enhance their social competitiveness.

3. It is recommendable to establish an integrated cold-chain logistics standard system, learn from the advanced experience of cold-chain logistics enterprises at abroad, combine with domestic development status of cold-chain logistics, gradually build a cold-chain logistics standard system that adapts to the current situation, promote the standard of the supply chain of

the complete cold-chain transportation system to conform to the international standard of cold-chain logistics.

4. It is required to complete the information sharing system of cold-chain logistics, optimize the resource allocation of information, improve the efficiency of cold-chain transportation, reasonably allocate resources, achieve integrated network operation, realize whole-course monitoring and information sharing of goods and cold-chain transportation cars through the application of some new information technologies, such as the Internet and cloud computing, in the field of cold-chain transportation, change the extensive and decentralized operation mode of China's cold-chain transportation in the past, make it develop towards the direction of collaboration, intensification and informatization, and realize the globalization and interconnection and intercommunication with the world.

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