

Experience of and Enlightenment from Cold Chain Logistics Development in Foreign Countries

Bo Wei

Hunan Modern Logistics College
Changsha, China

Abstract—In China, cold chain logistics has always been a bottleneck restricting the further development of logistics industry and has many problems such as high logistic cost, lacking relevant standards, many circulation links, low efficiency and high loss. This paper sorts out and analyzes the development experience of cold chain logistics in developed countries such as the United States, Canada, Japan, etc., and draws enlightenment for the development of China's cold chain logistics to promote the development of cold chain logistics in China.

Keywords—cold chain logistics; development experience; enlightenment

I. INTRODUCTION

The early cold chain logistics in China was emerged in 1960s in form of chill store. After entering the 21st Century, the "small quantity and multiple batches" characteristics of commodities in e-commerce mode and people's higher requirement for eating and drinking quality and safety have driven the rapid development of cold chain logistics and increasing demand in the market. According to the data sourced from China Federation of Logistics & Purchasing (CFLP), in 2017, the total value of cold chain logistics reached 4 trillion Yuan, at a year-on-year increase rate of 17.6%, accounting for 1.58% of the total value of logistics in China (252.8 trillion Yuan); and the total revenue of cold chain logistics reached 240 billion Yuan at an increase rate of 10%, and is expected to grow at an average annual growth rate of 25% in future cold chain logistics industry. However, compared with the development level of cold chain logistics in developed countries, the cold chain development in China is obviously lagged due to the short development period. Therefore, analyzing the development experience of foreign cold chain logistics has important strategic significance for promoting the development of cold chain logistics in China.

II. EXPERIENCE OF COLD CHAIN LOGISTICS DEVELOPMENT IN FOREIGN DEVELOPED COUNTRIES

A. Experience of Cold Chain Logistics Development in the United States

1) *The government of the United States attaches highly attention to development of cold chain logistics:* In 2002, the United States had established the "Cold Chain Logistics Association" and issued the "Cold Chain Quality Index"

which imposed mandatory regulations on product packaging materials and specifications, refrigeration temperature, quality inspection and transportation operations. It also continuously improved the cold chain logistics professional certification system and market access system. With the rise of green and low-carbon logistics concepts, the means of transportation of more US goods have been transferred from long-distance vehicle to railway, and the requirements for cost control are getting higher and higher. Shippers are increasingly making innovation in packaging and transfer rates. For example, Wal-Mart has achieved the goal of reducing transportation mileage by 28 million miles and reducing carbon dioxide emissions by 41,000 t by continuously improving vehicle's transfer rate, unit packing volume ratio and smarter route management.

2) *Integrated application of electronic information technology:* Cold chain logistic companies in US have equipped each vehicle with a GPS, network tracking equipment and network billing function, so that goods can be delivered to the destination and in the exact time specified by the customer. In this way, the company can avoid the risk of compensation for delay and become a trustworthy transportation company. At the same time, cold chain logistics companies in US also have advanced auxiliary equipment: electronic data exchange, truck satellite positioning system, on-board computer and remote control platform, project management software and a large number of self-developed software. This greatly improves the company's operational efficiency and avoids product deterioration.

3) *Strict qualification inspection in the processing and packaging links:* To ensure that import and export goods fully comply with current import and export regulations, many cold chain logistics companies in US maintain close ties with relevant government agencies, and need to be inspected by the US Department of Agriculture and the agricultural departments of each State and provide complete information about the shipper and producer to the Food and Drug Administration. Customs clearance services can be provided on if the said information meet the relevant regulations. The US government may irregularly dispatch FDA commissioner to conduct on-site inspection on the

commodities in the warehouse of distribution center by using relevant security inspection equipment authorized by the US Customs. The double insurances have ensured the safety of fresh food. Foods that have been inspected in such logistics distribution centers can be exempted from inspection in being imported. For export, the US government arranges FDA monitoring points in cold chain logistics companies for making monitoring and analysis from time to time. This design not only reduces the workload of the customs, but also avoids deterioration of food in the queuing test in customs. At the same time, it increases the speed of food circulation, reduces the logistic cost, and brings benefits to the enterprise.

B. Experience of Cold Chain Logistics Development in Canada

The refrigerated transport rate in Canada reaches 90%; the cold chain logistics loss rate is only 5%; and the cold chain transportation cost accounts for less than 30% of the logistic cost. The mature development of cold chain logistics in Canada is inseparable from the government's strong support. In terms of macro management of cold chain logistics, the government of Canada has issued relevant laws and regulations such as the "Navigation Law", "Maritime Law" and "Environmental Impact Assessment Law". With respect to construction of cold chain logistics standards and certification systems, the government has established a GMP production specification and standard, ISO international standardization organization and HACCP hazard critical control point analysis system. In the process of producing and processing meat, poultry, eggs, dairy products, fruits and vegetables, the government has applied strict control on the residues, operating procedures, sanitary environment, temperature control and transportation in order to promote the development of cold chain logistics towards standardization and intensification. In terms of cold chain logistics mode, the government has form a diversified logistics model such as processing enterprises, distribution centers, and third-party logistics. In terms of transportation, the government has formed a multimodal transport logistics network system including maritime transport, highway, railway, river transport and civil aviation. In addition, Canada has established three large cold chain logistics and transportation corridors, including the West Coast Transport Corridor centered on Vancouver mainly responsible for economic and trade exchanges with Asia-Pacific countries, the East Coast Transport Corridor centered on Montreal and Halifax ports mainly responsible for the maritime trade with the Atlantic countries, and the North-South transport corridor centered on the Great Lakes region mainly responsible for trade with the United States.

Canada's cold chain logistics information system is integrated with information, automation and intelligent technologies, and can comprehensively realize comprehensive warehouse management, including information data exchange, whole-process transportation management, whole-process temperature monitoring and quality and safety traceability. In addition, the Canadian Cold Chain Logistics Association has established a standard

and unified data management and exchange system by using information technologies such as POS and EDI. This system can be used to conduct real-time all-round dynamic monitoring on cold chain logistics, fully grasp the cargo flow information, and is of great significance to improve the efficiency of cold chain logistics and reduce the cost and risks of cold chain logistics.

As the federal government's food safety authority, Canadian Food Inspection Agency (CFIA) has developed the Food Safety Oversight Program (FSEP) based on the internationally recognized Hazard Analysis and Critical Control Point (HACCP) principles. The program is widely used not only in meat and poultry processing plants, but also in the dairy products, honey, egg, vegetable and fruit processing industries. Since implementation of the program, 664 food companies (among 2003 food companies in total) registered in Canadian federal government (2003) have applied for certification, of which 327 food companies have received HACCP certification. In addition, CFIA also provides scientific and technical support to the Canadian On-Farm Food Production Safety Planning (COFFSP) program managed by the Canadian Agricultural Federation. The program covers food safety issues from the field (animal house) to the portal of slaughtering and processing companies. Through the cooperation between the federal government and industries, the program encourages domestic primary product associations to develop development strategies and necessary tools to enable producers to take the same food safety measures as HACCP principles in food production on farms. CFIA's participation in the FSEP and COFFSP programs reflects its commitment to continuous improvement of food safety, namely to realize multi-sectorial and cross-industry food safety collaborations from primary product production to final product retail, and ultimately achieve food safety control and management on the whole process of cold-chain logistics process from farm to table.

C. Experience of Cold Chain Logistics Development in Japan

Japan's cold chain logistics has a complete set of independently-developed temperature standard control system to strictly control the temperature during storage and transportation of goods. The temperature control system is divided into three categories: freezing, refrigerating and normal temperature, which is referred to as "three temperature zones". In the actual distribution process of goods, on the basis of characteristics of products, the temperature is precisely divided into more than ten levels such as heated temperature, normal temperature, fixed temperature, C3 to C1, F1 to F4 so as to meet different products' requirements for temperature control. Taking the cold chain logistics of agricultural products as an example, Hokkaido's "Yubari Melon" must be preserved and transported at normal temperature, and Tokyo's cockfighting must be stored and transported at 0 to 4 °C in a refrigerated state. The Japanese government has provided great financial support for infrastructures of cold chain logistics, with a total of more than 200,000 refrigerated trucks, and established a complete product traceability system. At present, Japan has

realized a whole-process temperature and environmental data collection from warehousing to logistic center, warehouse inventory management, delivery, distribution of goods. Logistic enterprises in Japan are equipped with automatic temperature recorder to record the interior temperature of the cabin from pre-cooling to unloading. In addition, Japanese logistics companies have extensively used automated tiered warehouse and realized automatic access to goods. By using cold insulation box and refrigerants, the cost of refrigeration is greatly reduced, and the cost of cold chain logistics is effectively reduced.

From central government to local governments, Japan attaches great importance to the planning and construction of logistics industry and provides certain preferential policies. In 1997, the Japanese government formulated the "Integrated Logistics Administration Outline", and provided strong financial support for major logistics infrastructures.

III. ENLIGHTENMENT TO COLD CHAIN LOGISTICS DEVELOPMENT IN CHINA

A. *Emphasizing That Quality and Safety Are the Core of Cold Chain Logistics*

It is needed to establish a complete system "from the field to dining table". Cold chain logistics is a complex low-temperature system composed of multiple links, involving the whole process from raw material planting and purchasing, processing, delivery, distribution, retail and consumption of food. Ensuring the quality and safety at each link is the core of cold chain logistics. The governments of Canada, the United States, and Japan have attached great importance to the construction of a quality and safety system for cold chain logistics, and developed a series of standards and regulations involving the production, processing, sales, packaging, transportation, storage, labeling, quality grades, containers and packaging, food additives and pollutants, maximum allowable contents of veterinary drug residues and pesticide residues in agricultural products.

B. *Needing a Large Amount of Fund Investment by Government*

Countries with developed cold chain logistics have promoted the development of cold chain logistics of agricultural products by inputting large amount of fund from the government. From central government to local governments, Japan attaches great importance to the planning and construction of logistics industry and provides certain preferential policies. In 1997, the Japanese government formulated the "Integrated Logistics Administration Outline", and provided strong financial support for major logistics infrastructures. The government has also established a special fund to fund professional logistics companies and reduce personal and corporate income taxes for companies developing new logistics technologies. The financial department may also provide governmental subsidies for members of peasant association to purchase standard pallets and logistics-related equipment, and for transportation companies to purchase standard container transport trucks. In order to reduce the loss of

agricultural products in the circulation process, according to corresponding laws of agricultural product packaging, the government contributes 80% fund and farmers contribute 20% to get the pre-sale agricultural products packaged, stored and transported in low temperature and then entered the process of cold chain logistics. The US government also provides guidance for the location selection, planning and business orientation of companies that are going to build up distribution centers facing North America market, and gives certain percentage of financial support or loan interest subsidies to such companies.

C. *Improving the Construction of Cold Chain Logistics Infrastructure*

The development of US cold chain logistics mostly depends on its developed transportation network. Therefore, the government should first increase investment in infrastructure construction such as rural transportation, to ensure smooth traffic in agricultural production areas. Furthermore, in view of the shortage and obsolescence of agricultural products cold chain logistics transportation infrastructure, it is necessary to improve the credit guarantee system, provide low-interest loans guaranteed by relevant guarantee institutions and corresponding tax preferences to logistics enterprises engaging in cold chain transportation to encourage them developing third-party cold chain logistics, increase the investment in cold chain logistics of agricultural products, and timely update the old cold chain logistics transport equipment. Finally, cold storage is a key node of cold chain logistics of agricultural products. Therefore, it is needed to further enhance the construction and layout planning of cold storage and improve the construction of storage and distribution facilities to prevent the phenomenon of "broken chain" in the cold chain logistics transportation of agricultural products.

D. *Using New Technology to Promote the Development of Cold Chain Logistics*

Encouraging technological innovation and promoting advanced technologies and management tools. Cold chain logistics enterprises in various countries rely on technological innovation to improve the overall level of cold chain logistics industry, and technological innovation is reflected in all aspects of cold chain logistics. First of all, in the construction of standardized raw material bases, they actively adopt advanced management norms such as GAP and GVP, and use environment-friendly cultivation (breeding) management technology and advanced and rapid analysis and detection technology against harmful substances to ensure the quality and safety of cold chain logistics from the source. Second, they use advanced production technology to improve product quality and extend shelf life. Many developed countries regard pre-cooling and preservation as the first process in the production and processing of cold collections. The key to pre-cooling is a "quick" manner including advanced technologies for rapid cooling down without compromising products' quality. For example, Melvin Farms, a Canadian cauliflower processing company in local place, uses vacuum pre-cooling technology and freezing-point pre-cooling technology to effectively

eliminate heat in field, reduce the respiration rate of vegetables, and extend the shelf life.

IV. CONCLUSION

In recent years, China has seen rapid development in economy; people's living standards have been increasing; the consumption power of urban and rural residents has been continuously improved, followed by residents' higher and higher demand for quality and differentiation of food and medicine. The quality of goods can be guaranteed only after undergoing frozen processing, frozen storage, refrigerated transportation and distribution, frozen sales and other cold chain logistics links. Major foreign countries developed in economy have accumulated a lot of valuable experience in the development of cold chain logistics. They have promoted the development of cold chain logistics in the country by formulating strict technical and management standards, using advanced cold chain and information technologies, and providing guiding policies and financial support. Those valuable experiences provide a good enlightenment and reference for the development of cold chain logistics in China.

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