Problems and Countermeasures of Fruit and Vegetable Logistics Distribution Development in Guangxi Zhuang Autonomous Region

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Abstract The logistics transportation and distribution of fruits and vegetables has become one of the important links for people to obtain food, and it is also an important direction and emerging challenge in the logistics industry. As the social economy and transportation develop, the consumption ability of residents has been improved, and the high demand for fruits and vegetables has promoted the transportation of fruits and vegetables to meet the development conditions of the future fruit and vegetable industry. The study of fruit and vegetable logistics distribution can improve the efficiency of fruit and vegetable distribution, improve the construction of fruit and vegetable distribution system, and also meet the needs of people for different kinds of fruits and vegetables. Taking Guangxi fruit and vegetable distribution as an example, through empirical investigation, this paper studies the existing problems in the development of logistics distribution in the fruit and vegetable distribution industry, and puts forward corresponding measures and countermeasures according to the problems, so as to innovate the fruit and vegetable distribution mode in Guangxi Zhuang Autonomous Region.

Key words Fruit and vegetable distribution, Fruit and vegetable logistics, Development

1 Introduction

As the primary industry, agriculture has important economic significance and social status in China. The intake of fresh fruits and vegetables has become a necessary means for people to absorb nutrition. In other words, fruit and vegetable products have become people's "basic necessity" food. As a large agricultural country, the distribution logistics of vegetables and fruits is an inevitable important part of daily consumption in China. With the development of economy and the improvement in people's living standards, the demand of residents is no longer satisfied with the fruits and vegetables produced in the surrounding areas. Therefore, the scope of fruit and vegetable distribution logistics has been expanding, and the fruit and vegetable distribution industry has been growing. Besides, many distribution problems and loopholes are more likely to appear, which brings more and more challenges.

Logistics industry has been listed as one of the top ten revitalization industries in China, and all industries are inseparable with the basic support of logistics industry. China pays more and more attention to the development of logistics industry. In recent years, the *Medium and Long-term Plan for the Development of the Logistics Industry (2014 -2020)* issued by the State Council mentions "strengthening the construction of cold chain logistics facilities for fresh agricultural products, forming logistics distribution centers for key varieties of agricultural products, and improving the cold chain logistics network". At the same time, Guangxi has also issued the *14th Five-Year Plan for the Development of Logistics Industry in Guangxi*, pointing out that the professional service capabilities of cold chain logistics and aviation logistics are not strong. The State Council issued the *14th Five-Year" Cold Chain Logistics Development Plan*, pointing out that the problem of unbalanced and insufficient development of China's cold chain logistics is prominent, and the cold chain distribution and distribution system of sales is improved. Guangxi has also issued the *Action Plan for Promoting the High-quality Development of Rural Logistics in Guangxi (2022 -2025)*, which sets forth vigorously developing cold chain distribution and supporting the standardization of cold chain technology and equipment for agricultural products and the construction of traceability management information system for frozen and refrigerated food. The problem of logistics distribution in China needs to be solved urgently.

2 Concept and characteristics of fruit and vegetable distribution and transportation

2.1 Concept of fruit and vegetable logistics distribution Distribution refers to the behavior composed of a series of procedures including warehousing, storage, sorting, packaging, loading, delivery and signing. Compared with the distribution of general commodities, the logistics distribution of fruits and vegetables has more requirements, such as temperature, humidity control and placement without oppression. The distribution system of fresh fruits and vegetables reasonably uses cold chain logistics to assist in optimizing the quality of distribution. The fruit and vegetable distributor shall sort and pack the fruits and vegetables according to the customer's order requirements, transport them to the designated place according to the specified time, and the customer shall check and accept the goods or reject the return.

2.2 Distribution characteristics of fruits and vegetables Fruits and vegetables and other agricultural products occupy an important

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position in the agricultural industrial structure, and are also the necessary agricultural products in the people's "vegetable basket".

(i) Short shelf-life: fresh foods such as fruits and vegetables have short shelf-life[1] and belong to products with short life cycle, so the timeliness of fruit and vegetable logistics distribution is limited by certain conditions.

(ii) Perishable: Fruits and vegetables also have the characteristics of perishable and prone to consume. After being picked, water is easily consumed, or the skin is damaged due to improper transportation and oxidized and rotten due to contact with the air. The process of logistics transportation of fruits and vegetables has different requirements for temperature and humidity control.

(iii) Regional and seasonal[2]: The variety of fruits and vegetables also comes from the change of seasons and the difference of natural conditions in different regions. Therefore, the production and sales of fruits and vegetables have a certain degree of separation, and the distribution and demand sides are also very extensive.

In view of these characteristics, the distribution link of fruits and vegetables needs to pay attention to the management of fruits and vegetables in the process of distribution and transportation, so as to avoid the accelerated decay of fruits and vegetables caused by collision. It is necessary to deliver them to consumers as soon as possible. If conditions permit, the whole process of cold chain low-temperature distribution should be used to achieve the maximum quality assurance effect. The best storage temperature of most fruits and vegetables is 0 – 4 ℃. If the low but suitable temperature can be guaranteed from field picking to transportation and distribution, the efficiency and quality of distribution and the feedback of consumers can be guaranteed.

3 Current situation of fruit and vegetable logistics distribution

3.1 Supply and demand of fruits and vegetables in Guangxi In 2020, Guangxi, Henan, Shandong, Heilongjiang and Hebei are the top five main producing areas of agricultural products in China, with 11 691.4 of million t, 10 104.3 of million t, 8 702.7 of million t, 7 752.1 of million t and 5 424.6 of million t, respectively, and Guangxi ranked first[3], among which the fruit output of Guangxi accounted for a relatively high proportion. In 2021, the total output of fruits in Guangxi will reach 3 121.13 million t, ranking first in all regions of the country; the total output of vegetables will reach 4 047.46 million t, known as China's "winter vegetable basket". The high production of fruits and vegetables in Guangxi is a source of supply for other provinces and regions. Because the main producing areas of all kinds of fruits and vegetables are not the same, the circulation of fruits and vegetables in the region is the most important, so it is bound to be inseparable from the means of fruit and vegetable logistics distribution. In 2020, Guangxi launched the "Eco-Guangxi Agricultural Assistance Festival" online, with sales of 291 million yuan. Fruit and vegetable logistics distribution is a necessary part of online sales of fruit and vegetable agricultural products, which shows that the demand for logistics distribution of fruit and vegetable agricultural products produced in Guangxi is high.

3.2 Distribution cost of fruits and vegetables in Guangxi Accor-ding to the field survey, distribution costs include fixed costs, labor costs, transportation costs, vehicle maintenance costs and cargo damage costs. Fixed costs include the cost of warehousing, the cost of purchasing transportation, and the cost of leasing or purchasing sorting equipment. Costs that fluctuate with the market economy include the cost of automobile fuel or electricity, the cost of human labor in transportation, and sometimes the cost of warehouse rental. The survey shows that the logistics cost of fruits and vegetables in China accounts for more than 60% of the total cost[4]. When the distribution service is not properly managed, the damage rate of fruits and vegetables increases, and the cost of damage borne by distribution enterprises also increases. If the distribution cost increases, the final price of fruits and vegetables increases, and the distribution cost accounts for a larger proportion of the price of fruits and vegetables, consumers will choose local fruit and vegetable products with higher cost performance[5].

3.3 Fruit and vegetable cold chain logistics in Guangxi Most of the distribution logistics of vegetables and fruits in Guangxi are transported at room temperature, and only some imported fruits and vegetables that must be stored at low temperature will be transported at low temperature by cold chain logistics. In 2021, there were only about 959 refrigerated vehicles in the whole region, and in 2021, there were 192 field refrigerators in the whole region, which was often neglected, resulting in poor preservation of fruits and vegetables. According to the *Development Plan of Cold Chain Logistics Industry in Guangxi Zhuang Autonomous Region (2018 – 2020)*, the circulation rate of fruit and vegetable cold chain in Guangxi is not greater than 25%, while the damage rate of fruit and vegetable in the process of normal temperature logistics is about 20% – 30%. The low temperature processing rate of fruits and vegetables in China is about 20%, while the total amount of refrigeration and fresh-keeping facilities in Guangxi agricultural products producing areas is insufficient, the geographical distribution is uneven, the commercial processing capacity is weak, and the backbone cold chain logistics distribution network lacks effective connection.

3.4 Informatization degree in rural areas of Guangxi Fruit and vegetable logistics information includes production information, picking information, warehousing information, transportation information, warehousing information, status information, warehouse information, order information and other information data obtained and transmitted by different operation departments[6]. In 2021, the Internet penetration rate in China's rural areas was only 59.2%, and in 2022, the number of end-users of the Internet of Things in smart agriculture in Guangxi reached only 3.39 million. The information level of fruit and vegetable producing areas in Guangxi is low, and the information data received by both the

main producers and the main distributors are very missing, so it is impossible to adjust the supply and demand and distribution of fruits and vegetables in time. According to the field survey, most of the fruit and vegetable distribution system in Guangxi is still extensive work management mode, most employees work according to paper orders, and there are few links involving information and data. In Guangxi, only a small number of large enterprises have applied RFID technology, M2M technology, CRM technology, GPS technology and other Internet of Things (IoT) data systems in fruit and vegetable distribution. Most of the small and micro enterprises and consumers in Guangxi are unable to obtain the live information of goods orders in the distribution process, and it is theoretical to control the conditions of fruits and vegetables in real time according to their conditions.

3.5 Composition of fruit and vegetable distribution staff in Guangxi According to a field survey of several fruit and vegetable distribution companies in Nanning City of Guangxi, all companies did not employ logistics and distribution professionals as employees, 90% of the distribution enterprises employed ordinary workers or their relatives as distribution staff, and after employment, no regular distribution training was conducted to standardize the distribution operation links. About 50% of the distribution companies employed rural women and other labor to carry out sorting and cleaning work, and employed young people with lower education to carry out warehousing, transportation and other work. Most employees, including distribution and transportation drivers, have poor professional knowledge and mainly rely on experience to lead the distribution work. The professional level and cultural level of distribution staff are low, and the distribution operation of most distribution enterprises is still dominated by manual labor.

3.6 Distribution mode of fruits and vegetables in Guangxi According to the investigation and study of the distribution system of fruit and vegetable distribution enterprises in Nanning, such as distribution links, distribution cost composition, distribution timeliness, cost composition and unexpected loss scheme of distribution work, we found that there are the following modes of fruit and vegetable logistics distribution in Guangxi. (i) Farming-supermarket docking mode: agricultural cooperatives or farmers purchase fruit and vegetable agricultural products, with large supermarkets as the end. (ii) Fresh product platform trading mode: consumers place orders for fruit and vegetable products through the app platform, the platform purchases orders from the fruit and vegetable agricultural products trading company, and finally the platform distributor delivers them to the designated location. (iii) Farmer wholesale market mode: the township and county wholesale markets purchase foreign or imported agricultural products through agricultural products trading companies, and the agricultural products trading companies use logistics to distribute fruit and vegetable agricultural products to the township and county wholesale markets.

Table 1 Comparison of fruit and vegetable logistics distribution modes in Guangxi

Fruit and vegetable logistics distribution modes	Characteristics	Advantages
Farming-supermarket docking	Farmers or agricultural cooperatives are the starting point and large supermarkets are the end, circulation links are few.	The logistics mode is point-to-point, the loss rate of goods is low, and the distribution efficiency is high.
Fresh product platform trading	Farmers or agricultural cooperatives are the starting point and individual consumers as the end, and orders are scattered.	The order is personalized, and the logistics circulation time of fruit and vegetable agricultural products is short, so it can be directly distributed to the home.
Farmer wholesale market	Farmers or agricultural cooperatives are the starting point, wholesalers are the terminal, and most of them are third-party distribution.	Logistics mainly adopts professional fruit and vegetable logistics companies, thus having a high level of standardization and systematization.

4 Problems in fruit and vegetable logistics distribution

4.1 High distribution cost and poor fresh-keeping condition In order to save money, most micro-distribution enterprises in Guangxi are reluctant to purchase high-cost refrigerated trucks or rent refrigeration warehouses. The fuel consumption or power consumption of refrigerated vehicles is larger than that of ordinary freight vehicles. If the number of orders is small or the no-load phenomenon is normalized, and the carrying capacity is less than a certain value, the cold chain logistics transportation operation will be in a loss state, and the economic profits of enterprises will be negatively affected. Environmental factors such as temperature and humidity have a great impact on fresh products such as fruits and vegetables. Too high or too low temperature and humidity will accelerate the decay of fruits and vegetables. Fruits and vegetables with shorter shelf life should be refrigerated at -1 to 3 ℃, while fruits and vegetables with longer shelf life should be refrigerated at 8 – 10 ℃. However, due to the poor transportation conditions, the loss of agricultural products after delivery is large, and the loss is serious in the distribution process. In the process of transportation and storage, controlling low temperature and ensuring humidity is an important guarantee for the quality of fruits and vegetables. Through good quality management, fresh fruits and vegetables products can reach the maximum level of freshness and be delivered to consumers. The existing "first kilometer" can not guarantee the low temperature conditions, and the low temperature conditions in the subsequent transportation and storage are sometimes absent, resulting in chain breakage. Most enterprises in Guangxi lack the awareness of cold chain, and the low circulation rate of cold chain leads to high damage rate of fruits and vegetables and poor fresh-keeping ability, which not only increases the loss cost of

enterprises, but also reduces the shopping experience of consumers. Moreover, the "last kilometer" cold chain terminal facilities of distribution are not perfect, which reduces the guidance of consumer demand. If the cold chain logistics can be popularized in the distribution of fruits and vegetables and improve the completion rate of the cold chain of fruit and vegetable logistics, the circulation of fruits and vegetables in the most fresh-keeping way can directly improve the economic benefits from reducing the damage rate of goods.

4.2 Insufficient infrastructure and equipment to take advantage of modern science and technology In terms of public infrastructure, most of the traffic roads in Guangxi are built around the mountains, and the integrity of the national roads is uneven. The more remote the villages are, the more dilapidated the roads are. When facing extreme weather such as rainstorms, they are often subject to landslides, road stones or muddy water and road blockade. Due to uneven traffic roads and bumpy road conditions, fruits and vegetables are damaged and rotten, accounting for a certain proportion. In the construction of cold chain logistics, the construction of refrigerated trucks and cold storage is not enough to supply the demand for agricultural products; the construction of pre-cooling facilities is not perfect, and field cold storage is not widely used. In terms of warehousing and freight transportation, the establishment of large-scale cold chain distribution center is the main way to reduce the loss of fruits and vegetables and improve the efficiency of cold chain distribution of fruits and vegetables[7]. The infrastructure equipment of most fruit and vegetable distribution enterprises in Guangxi is not intelligent and information equipment, which consumes more manpower and has a higher error rate than automation, which reduces the efficiency of fruit and vegetable distribution, and also affects the retention time of fruit and vegetable to a certain extent, and the quality of fruit and vegetable is reduced due to low efficiency. The hardware of infrastructure equipment is backward, and the distribution information can not be monitored and queried in real time, which can not meet the market demand.

4.3 Information technology not popularized and perfected, and impossible to adjust the distribution management in time China's fruit and vegetable logistics has not yet been fully informationized[8], and the use of the Internet has not been popularized in a certain range of rural areas, which is a manifestation of information lag and inefficiency for the logistics industry. The opening of the Internet in rural areas is essential for the sale and circulation of crops in traffic-clogged areas. The output of crop information and the input of market price information can better adjust the information symmetry, and it can also improve farmers' income and the prediction level of the next crop. In addition, the opening and popularization of Internet information can also get relevant information and data in time in the distribution logistics, so as to adjust the distribution conditions of fruits and vegetables or adjust the distribution plan in the shortest time, and make adequate plans for special emergencies to ensure the quality of fruit and vegetable distribution logistics. If information technology can be added to the process of fruit and vegetable logistics, then we can understand the products before purchasing, master and control the state and location of fruits and vegetables during distribution, use machines to ensure accuracy in sorting, packaging and shipping of fruits and vegetables, and timely remedy and stop losses in case of accidents, so as to greatly improve the efficiency of logistics. At the same time, it can also reduce distribution logistics costs such as labor costs.

4.4 Lack of professional logistics and distribution personnel and unable to improve the professionalism of distribution links The survey and interview found that the distribution workers recruited by enterprises are almost not composed of logistics graduates or professional training technicians with logistics management and other related professional knowledge, most of them are ordinary workers with low educational background. They do not have the professional knowledge related to logistics distribution before they enter the post, and their ability to understand, learn and use semi-automatic high-tech products is relatively low. Without the support of basic professional knowledge, it will be difficult to quickly integrate new technologies into the distribution work. The promotion cycle and application cycle of new technologies are relatively longer, and it is difficult to innovate the distribution mode and put forward more reasonable updating suggestions. For the management of the whole distribution logistics work, there is also a lack of professionalism, mainly based on the business process of the industry leader to imitate learning and the subjective understanding and judgment of non-professional managers. If enterprises can employ high-quality logistics talents, command and co-ordinate the distribution work with professional vision and management ability, analyze and put forward guiding opinions to optimize the distribution work at different stages according to the current situation and cost of enterprises, the efficiency of distribution logistics operation can be improved more directly.

5 Measures for optimizing fruit and vegetable logistics distribution

5.1 Increasing subsidies for fruit and vegetable logistics to reduce the cost of preservation The development of fresh logistics such as fruits and vegetables in China is still in the initial stage and is not mature yet, and the logistics mode of fruits and vegetables that can meet the domestic demand is still being explored. For enterprises, the cost risk of early investment is high, most of the local potential logistics companies are small and micro enterprises, because of the lack of investment funds and can not maintain operation. The circulation of fruits and vegetables in the whole country is not only an irreplaceable demand, but also a consumption trend of fresh fruits and vegetables under the economic development. The government should support and help the development and growth of the fruit and vegetable logistics industry, and increase policy support and financial subsidies for the construction of local refrigerated trucks and cold storage, including electricity subsidies for cold storage, preferential subsidies for the purchase of refrigerated vehicles by logistics enterprises and oil subsidies for refrigerated vehicles. Government departments can also organize research on corresponding fruit and vegetable logistics projects,

and allocate an appropriate amount of fund funds as incentives for fruit and vegetable logistics enterprises, so as to promote the operation and development of the fruit and vegetable logistics industry and find fruit and vegetable logistics distribution behavior models that are adapted to local conditions and compatible with China's development.

5.2 Increasing investment in infrastructure and equipment and accurately simplifying circulation links Fruits and vegetables belong to fresh agricultural products, which require more storage, which means that the investment cost of fixed assets is also larger. It is necessary to strengthen and improve the logistics infrastructure and traffic road facilities, which will help to increase the convenience and diversification of fruit and vegetable logistics distribution. In the first place, it is necessary to improve the construction of traffic facilities such as road conditions and roads. Government departments should actively repair damaged roads and land, and open up a number of roads in villages and towns. Traffic facilitation not only promotes the circulation of rural economic commodities and tourism, but also helps to improve the stability of fruit and vegetable distribution and transportation and the efficiency of distribution logistics. In the second place, in the "first kilometer", it is recommended to invest in the construction of precooling facilities and processing and packaging equipment, extend the "shelf life" of fruits and vegetables by means of low-temperature preservation from the first step of picking fruits and vegetables, and do a good job of low-temperature management can reduce the decay rate and improve the success rate of fruit and vegetable logistics transportation. Finally, it is necessary to improve the level of hardware facilities in the configuration of distribution centers, including modernization and automation, to reduce the manual error rate and shorten the operation time, so as to improve the efficiency of fruit and vegetable outflow.

5.3 Establishing and improving the fruit and vegetable logistics information database to achieve sustainable development of logistics Relevant government departments and industry associations should cooperate with fruit and vegetable logistics enterprises to establish a fruit and vegetable logistics and distribution information database on the basis of existing information technology, and realize functional applications such as information sharing, real-time monitoring and order co-creation in this database. Fruits and vegetables logistics is a kind of work which is composed of many links and processes and may be completed in different working places. It is recommended to promote the wide application of big data, IoT, 5G, block chain, artificial intelligence and other technologies in the field of cold chain logistics, integrate the known logistics information, establish and use the fruit and vegetable distribution information system database for data analysis and comprehensive collation to formulate an optimized and convenient logistics distribution plan, and receive the arrival feedback in time to deal with problems or update the logistics model. Under the multi-party connection of supply chain, it is the trend of the times for fruit and vegetable logistics to enter the informationization, which can not only solve the problem of information asymmetry, but also reduce the loss of goods through information technology monitoring.

5.4 Attaching great importance to the training of professionals and attracting them to enter fruit and vegetable logistics It is recommended to vigorously train professionals in the direction of agricultural logistics, build and improve the training system of agricultural talents, improve the technical specialization of personnel in the agricultural logistics and distribution industry, develop with modern scientific and technological intelligent equipment, and improve the overall application level of the industry. The government should work with leading enterprises to set up relevant fruit and vegetable logistics and distribution projects and reserve funds, and undertake joint training and practical training with students of corresponding majors in colleges and universities. It is necessary to encourage colleges and universities and trade associations to set up cold chain logistics training courses at different levels, so that practitioners can get knowledge updating and skills upgrading, and jointly promote fruit and vegetable logistics distribution projects. In addition, enterprises should cooperate with the government to provide professional fruit and vegetable logistics positions for students of similar majors, increase the employment confidence of logistics students and reduce their employment pressure, and also encourage talents to carry out and achieve deeper academic achievements. On this basis, it is also necessary to increase the threshold and base salary of professional posts, enhance the core value of the posts, and gradually form the talent organization and industry standard operation system of fruit and vegetable logistics distribution industry. Finally, the fruit and vegetable logistics distribution work can be simplified, and the fruit and vegetable logistics distribution industry can be systematized and matured, so as to enter a new journey of fruit and vegetable logistics.

6 Conclusions

It has gradually become the norm to deliver essential agricultural products such as fruits, vegetables, grain and oil to people's homes through logistics distribution. Stimulated by the COVID-19 pandemic, the importance of fruit and vegetable logistics has taken the stage and become the focus of attention. Based on the current situation of fruit and vegetable logistics distribution, we analyzed the existing problems and influencing factors in this direction, and puts forward corresponding countermeasures from a macro perspective to improve the efficiency of fruit and vegetable logistics distribution in China. Fruit and vegetable logistics in China is still in the initial stage, in the process of constantly exploring the mode of fruit and vegetable logistics to adapt to China, there will be different challenges, but also need each main body to cope with, innovate, and create a new era of fruit and vegetable logistics.

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2021. According to the general layout plan of the temporary facilities of the project, the effective collection area was about 1 000 m^2, and the total annual catchment was about 1 471.5 m^3. Through the further research and development of the composite water storage and drainage environmental protection ground and the realization of a series of derivative systems in the project, such as the temporary fire fighting system based on the rainwater recycling system, the main structure and tower crane spray dust suppression system, the construction site green space spray irrigation system. These systems have become a favorable guarantee for the company's project to create a safe and civilized model site in the province, promote green construction in the ten new technologies of the construction industry, and establish a good corporate image in the local and owners.

6 Conclusions

The construction of urban flood control and drainage system with the function of combining storage and drainage is the requirement of China's "14th Five-Year Plan" to solve the problem of urban drainage and waterlogging prevention. The prevention and control of urban waterlogging should be carried out on the basis of system integration and improvement of drainage system, so as to eliminate the hazards caused by rainwater and flood as far as possible, and turn them into resources for human use. The ecological outdoor ground designed in this study can not only promote urban drainage, but also effectively store rainwater for road green space irrigation. It has the functions of promoting urban waterlogging management, saving water and energy, alleviating urban heat island effect and green irrigation, and has high economic and social effects.

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