

Factors Influencing on the Evaluation System of Cold Chain Logistics Services for Agricultural Products in Guangxi Province, The People's Republic of China

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Abstract:- The objectives of this study were: (1) To study the factors that affect the evaluation system of cold chain logistics services for agricultural products in Guangxi Province, the People's Republic of China. (2) To study the relationships between influence factors and the evaluation system of cold chain logistics services for agricultural products in Guangxi Province, the People's Republic of China. (3) To build a model of relationship between quality management and the evaluation system of cold chain logistics services and propose suggestion for improving the evaluation system of cold chain logistics services for agricultural products in Guangxi Province, the People's Republic of China. The study employed a mixed research methodology. In the quantitative analysis section, a questionnaire survey was conducted using simple random sampling. In the qualitative part of the analysis, in-depth interviews were conducted with eight senior managers from agricultural production departments, logistics management companies, fresh agricultural product sales companies, hotels, and government departments. The data analysis utilized statistics including frequency, percentage, mean, standard deviation, and structural equation model.

Major Findings: the factors influencing the evaluation system of cold chain logistics services for agricultural products in Guangxi Province were examined. The identified influencing factors included agricultural product cold chain logistics quality management, logistics environment, and transportation efficiency. It was found that agricultural product cold chain logistics quality management has a significant positive impact on the logistics environment, transportation efficiency, and agricultural product cold chain logistics service evaluation system. At the same time, the logistics environment and transportation efficiency have a significant positive impact on the agricultural product cold chain logistics service evaluation system. This study presents the issues with the development of the cold chain logistics service evaluation system for agricultural products in Guangxi, along with countermeasures and suggestions for improvement. (1) Full utilization of existing resources to promote industrialization and modernization of fresh agricultural product logistics; (2) Development of a systematic agricultural product cold chain logistics system to support the agricultural product industry; (3) Strengthening the construction of cold chain supply

chains for urban and rural agricultural products; (4) Expediting the introduction of energy-efficient and environmentally sustainable long- and short-distance cold chain transport vehicles; (5) The application of information technology is to be encouraged with a view to enhancing the efficiency and transparency of cold chain logistics.

Keywords:- Factors; Cold Chain Logistics; Agricultural Products.

I. INTRODUCTION

Agricultural products are a key industry in the development of China's national economy, and under the new rural construction system. Agricultural product logistics has become a key support project in China, it has the characteristics of large output and diverse types, covering a wide range of agriculture, including forestry, animal husbandry, planting, fishing, and so on. Grain, animal husbandry products, and aquatic products are gradually transformed into commodities circulating in the market. The increase in commodity rates can provide production materials for the food and chemical industries, and commercial exchanges between agricultural products and various industries are becoming increasingly close. The main goal of cold chain logistics services for agricultural products is to increase product added value, reduce cost inputs in the logistics process, and ensure the efficiency of commodity circulation.

With the rapid development of social economy and agricultural product trade, the cold chain logistics industry has been widely developed nationwide. As a major agricultural province, Guangxi is also actively developing the cold chain logistics industry to meet market demand and the added value of agricultural products. Quality management is one of the important factors involves overseeing all of the tasks that must be completed in order to deliver the level of excellence the customer expect. However, the development of cold chain logistics for agricultural products in Guangxi Province is still in its early stages, and a modern cold chain logistics system has not yet formed. There is still a gap compared to Guangxi's Provinces (regions) with large agricultural product resources, consumption, and output.

The outstanding performance is: firstly, the overall quality of agricultural cold chain logistics infrastructure needs to be improved. Most cold technologies are aging, facilities are outdated, functions are relatively single, and utilization rates are

low. Secondly, the organizational mode of cold chain logistics is backward, and the development of third-party cold chain logistics enterprises is slow. Most of the existing cold chain logistics enterprises in Guangxi Province are mainly small and medium-sized enterprises, with small distribution scales and inconsistent service standards. They have not formed a regional, chained, and large-scale service network, and are unable to provide comprehensive cold chain logistics services that meet market demand. Thirdly, the proportion of cold chain transportation of fresh agricultural products is relatively low. The refrigerated transportation volume of fresh agricultural products by road is relatively low, with about 80% of fresh agricultural products still circulating at room temperature in the area, and the decay rate reaching over 25%; (China Quality News Network) The refrigerated transportation rate is only about 10%, and there is a phenomenon of "chain breakage" in cold chain storage, transportation, sales, and other links. The organizational level of third-party cold chain logistics companies is low, and the development of third-party cold chain logistics enterprises is also significantly lagging behind, resulting in a low degree of socialized satisfaction for cold chain development. The service system of cold chain logistics has not yet been fully established, and the service level needs to be further improved. Large cold chain logistics enterprises with resource integration and industry promotion capabilities have just started. Therefore, improving the quality management level of agricultural cold chain logistics and enhancing its influence on the evaluation system of agricultural cold chain logistics services is of great significance. At the same time, the evaluation results can provide improvement directions and optimization decisions for enterprises, promoting the sustainable development of the agricultural cold chain logistics industry.

At present, Chinese scholars' research on cold chain logistics mainly focuses on related concepts, development status, performance evaluation of cold chain logistics enterprises, optimization of cold chain logistics distribution paths, and the application of mature quality management theories to the cold chain logistics industry. There is relatively little research on the evaluation of cold chain logistics services. In response to the relevant research on the evaluation of cold chain logistics services, Sun Jing and Huang Shixiang (2007) established an indicator evaluation system for third-party cold chain logistics enterprises based on five aspects, and determined the weights using Analytic Hierarchy Process (AHP). Then, fuzzy comprehensive evaluation method was used for practical verification. Luo Yongping (2009) established an evaluation index system for fresh agricultural product logistics from three perspectives and determined the weights of each index. Liu Guanghai and Xie Ruhe (2009) pointed out that China should standardize the operation process of cold chain logistics, improve the cold chain management system, and establish a standardized food cold chain logistics system that meets its own needs. He Yaoyu and Lv Yongwei (2012) established a structural equation model for the relationship between logistics service quality influencing factors and customer loyalty through five factors that affect logistics service quality, and conducted empirical research. Yu Weiyang and Peng Fan (2012) established a logistics service quality evaluation index system for fresh agricultural products. Chen Hongli and Lu Hua (2013) discussed in detail the principles for establishing a quality

evaluation system for cold chain logistics services of fresh food in China, the content that should be included in the index system, and the selection of evaluation methods. They established a quality evaluation index system for cold chain logistics services of fresh food.

Delivery is an important link in the process of cold chain logistics services, and the study of logistics distribution routes is also a hot topic in the theoretical community. Some foreign researchers have summarized the related problems of vehicle optimization scheduling in the logistics distribution process as the "Vehicle Routine Problem or Vehicle Scheduling Problem". Dantzig and Ramser (1959) first proposed this problem, and subsequently established a corresponding mathematical model and provided an algorithm for solving it. Subsequently, Clarke & Wright (1964) proposed a modified heuristic algorithm called Clarke-Wright savings algorithm based on Dantzig & Ramser's research. Afterwards, research on the optimization and scheduling of logistics delivery vehicles quickly became the focus of attention for experts and scholars in fields such as applied mathematics and computer applications, and has also become a hot and cutting-edge issue in the fields of operations research and combinatorial optimization since then. The definition of this problem can be summarized as: planning reasonable vehicle driving routes for specific loading and unloading destinations, so that delivery vehicles can orderly pass through these designated routes under the premise of meeting established constraints, and ultimately achieve the predetermined delivery task or goal. According to this definition, some scholars have classified this proposition based on the priority of spatial and temporal elements into: (1) arranging driving routes without considering time constraints, only considering the requirements of spatial location, known as the Vehicle Routing Problem (VRP). (2) Arranging routes without considering spatial constraints and only considering delivery time requirements is called the Vehicle Scheduling Problem (VSP). (3) Considering the dual requirements of space and time simultaneously, it is called the Routing and Scheduling mixed problem. In addition, vehicle routing problems with time constraints are sometimes referred to as Vehicle Routing Problem with Time Windows (VRPTW).

The existing literature reveals a noticeable dearth in research concerning the theoretical underpinnings of cold chain logistics services, particularly within the context of evaluating such services for agricultural products in Guangxi. Both domestic and international scholars commonly address factors like quality management, logistics environment, and transportation efficiency when delving into the complexities of cold chain logistics service systems. These factors wield substantial influence over the evaluation framework for cold chain logistics services catering to agricultural products. While experts and scholars have extensively explored the standardization of cold chain logistics for agricultural products, there remains a notable gap in terms of standardization and integration efforts. Presently, the interplay between local, national, and industry standards in the realm of cold chain logistics is intricate, resulting in a landscape marked by confusion and overlap in standards. Consequently, there is an urgent need to enhance the efficacy and integration of cold chain logistics standards for agricultural products nationwide. Thus, the

primary objective of this study is to conduct a comprehensive investigation into the effects of quality management, logistics environment, and transportation efficiency on the evaluation system for agricultural product cold chain logistics services in Guangxi Province. Through meticulous analysis and research into these key factors, this study seeks to furnish valuable guidance and recommendations on how to proficiently develop the evaluation system for cold chain logistics services catering to agricultural products across the nation. Such research endeavors hold profound significance in augmenting the quality of agricultural product cold chain logistics services in Guangxi Province, fostering enhancements in agricultural product circulation efficiency, and catalyzing advancements within the agricultural product cold chain logistics sector as a whole.

➤ *Research Objective*

- To study the factors that affect the evaluation system of cold chain logistics services for agricultural products in Guangxi Province, the People’s Republic of China.
- To study the relationships between influence factors and the evaluation system of cold chain logistics services for agricultural products in Guangxi Province, the People’s Republic of China.

- To build a model of relationship between quality management and the evaluation system of cold chain logistics services and propose suggestion for improving the evaluation system of cold chain logistics services for agricultural products in Guangxi Province, the People’s Republic of China.

➤ *Research Hypothesis*

- Hypothesis 1: Quality management positively influences logistics environment.
- Hypothesis 2: Quality management positively influences transport efficiency.
- Hypothesis 3: Quality management positively influences evaluation system of cold chain logistics services for agricultural products.
- Hypothesis 4: Logistics environment positively influences evaluation system of cold chain logistics services for agricultural products.
- Hypothesis 5: Transport efficiency positively influences evaluation system of cold chain logistics services for agricultural products .

➤ *Research Framework*

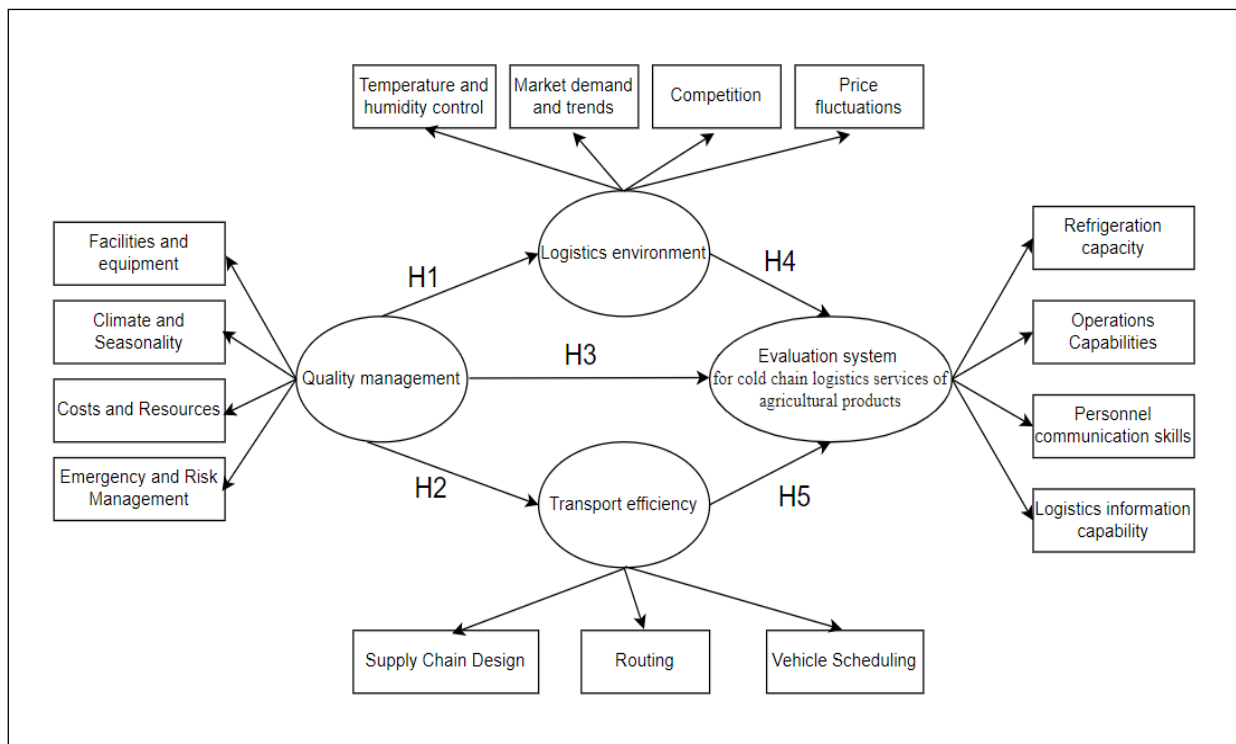


Fig. 1 Research Framework

II. LITERATURE REVIEW

China entered the agricultural product cold chain logistics sector relatively late, resulting in a lag in the development of this industry. As the economy rapidly advances, consumers' perceptions of fresh agricultural products have significantly transformed, leading to heightened expectations for the cold chain logistics associated with these products. Unfortunately, China's fresh agricultural products encounter a range of significant

challenges within the cold chain logistics system, including high costs, low efficiency, and substantial losses. Consequently, there is a pressing need for domestic researchers to shift their focus toward this emerging field, expediting the establishment of a robust agricultural product cold chain logistics system. This entails integrating fundamental theories from the broader logistics industry into the agricultural product cold chain logistics circulation system and conducting thorough research on the industry's development. In essence, domestic researchers have explored

the nascent field of agricultural product cold chain logistics, but a cohesive consensus has yet to be reached. Summarily, these explorations primarily encompass the following three aspects.

A. Commencing with an Exploration of the Significance and Research Implications of Agricultural Product Cold Chain Logistics

Sun Chunhua (2013) pointed out in the article "Analysis of the Current Situation and Development Countermeasures of Cold Chain Logistics of Fresh Agricultural Products in my country": The constraints to the development of cold chain logistics in my country are: less cold chain infrastructure, lagging technology and informatization construction, and a still-undeveloped market environment. Immature, the scale and operation level of the company need to be improved, and there is a lack of talent. Countermeasures to develop cold chain logistics include: the government strengthens coordination and improves relevant policies; strengthens infrastructure construction and encourages technological innovation of enterprises; improves industry standards and accelerates the cultivation of cold chain logistics enterprises; strengthens brand building and promotes high-quality and low-price market mechanisms; Learn from the experience of developed countries to improve operational management levels; innovate talent training models and increase talent training efforts.

Building upon an examination of the cold chain logistics sector for fresh agricultural products, Zhao Mei (2020) delved into issues encompassing inadequate systematic construction, suboptimal technical proficiency, and elevated operational costs within fresh cold chain logistics. She presented remedies directed toward industrial standardization, advocating for strategies such as enhanced infrastructure development, elevated warehousing management practices, and the advancement of technology within fresh cold chain logistics.

In a related study, Sun Jie (2020) employed the SWOT analysis method as a strategic framework to systematically investigate and analyze the transformative processes within cold chain logistics enterprises. Sun proposed pragmatic countermeasures, specifically leveraging policy advantages to enhance the industrial chain of cold chain logistics. This involves increased investments in cold chain logistics enterprises, elevating the level of informatization, fostering innovation in the operational models of cold chain logistics enterprises, augmenting infrastructure development, and intensifying the training initiatives for professional talents within cold chain logistics enterprises.

Guo Ruiwei and Li Xin (2020) identified the burgeoning developments in rural logistics and rural e-commerce against the backdrop of the strategic integration of "Internet +". They highlighted the interactive relationship between the value systems of rural e-commerce and rural cold chain logistics, emphasizing a rapid synergy. Positioned within the broader strategy of rural revitalization, the authors advocated for a collaborative approach, with farmers as the primary stakeholders and government entities leading in

parallel. They underscored the crucial role of introducing technologies such as the Internet and artificial intelligence into the application and implementation of rural e-commerce and rural cold chain logistics. The goal is to establish a standardized rural e-commerce logistics system, fostering the interdependent progress of rural e-commerce and rural logistics.

B. In Terms of Expanding the Research Field of Cold Chain Logistics of Agricultural Products

The integrated development of cross-border e-commerce of agricultural products and cold chain logistics is an inevitable trend and requirement for future economic development. The development of cross-border e-commerce of agricultural products and cold chain logistics are complementary and mutually reinforcing. Dou Xin (2017) analyzed the problems existing in the common development of my country's cross-border agricultural product e-commerce and cold chain logistics service providers, and provided cross-border agricultural product e-commerce from several aspects: government support, technological innovation, industry improvement, and platform construction. Provide suggestions for the integrated development of logistics companies and cold chain logistics service providers.

From the perspective of urban-rural integrated development, Huang Yingqiu (2021) combined with the current characteristics of the development of cold chain logistics of agricultural products in my country, focused on analyzing the current supply and demand status of cold chain logistics of agricultural products and the important problems and bottlenecks faced in the development process, from the perspective of supply and demand. From a relationship perspective, the huge demand in the future will place high demands on cold chain logistics supply. From the shortcomings of the problem, the key points can be summarized as the obstruction of urban and rural logistics supply chain channels and the lack of vitality of cold chain logistics entities. Then focusing on the perspective of urban-rural integrated development, we innovatively propose two concepts that need to be followed. The first is to unblock the supply chain market channels of cold chain logistics between urban and rural areas and realize the "cold to the end" of fresh agricultural products; the second is to comprehensively promote the main body of cold chain logistics. The scale, quality and efficiency have both increased.

Zhao Lu and Zhu Yufei (2020) underscored the rapid development of cold chain logistics within the agricultural product domain in China, yet concurrently identified persisting challenges such as high operational costs and suboptimal efficiency. The imperative to establish an intelligent, specialized, and innovative model for agricultural product cold chain logistics is emphasized as pivotal within the contemporary landscape of agricultural logistics. Addressing this exigency, the authors, leveraging the evolving landscape of blockchain technology, introduced three novel models for agricultural product cold chain logistics in China: a decentralized model, an embedded cold chain logistics supply chain link contract transaction system

model, and a virtual artificial intelligence model coupled with the establishment of an artificial intelligence-based information integration platform. These models are strategically aligned to deeply integrate the cold chain logistics of agricultural products with blockchain technology. Building upon this foundation, the paper delineates countermeasures and strategies for the development of agricultural product cold chain logistics in China within the framework of blockchain technology. The proposal advocates for the widespread utilization of blockchain technology in the implementation standard system of agricultural product cold chain logistics, calls for national policies promoting the profound integration of agricultural product cold chain logistics and blockchain technology, and introduces the concept of a talent training linkage model under the rubric of "agricultural product cold chain logistics + blockchain technology."

C. In Terms of the Development and Operation of Cold Chain Logistics for Agricultural Products

Zhang Zhihong's (2013) investigation delved into the current landscape and prospective trajectory of the cold chain logistics network for agricultural products in Hebei Province. The primary focus was an in-depth analysis of the agricultural product cold chain logistics market in Hebei Province, aimed at identifying prevailing challenges and discerning developmental patterns within the cold chain circulation of agricultural products. The overarching objective was to contribute theoretical insights and serve as a reference for the enhancement of the cold chain logistics network specifically tailored to agricultural products in Hebei Province.

Similarly, Zhu Shixiong (2012) provided a comprehensive exposition on the existing state of cold chain logistics for fresh agricultural products in China. Highlighting significant shortcomings in the connectivity between upstream, midstream, and downstream segments of fresh agricultural product cold chain logistics, Zhu identified issues such as outdated cold chain logistics equipment and a lag in the advancement of technology. Additional challenges included disorganized production entities, insufficient marketization of cold chain logistics, and a deficient legal and regulatory framework for cold chain logistics. To address these concerns, Zhu proposed governmental initiatives encompassing the refinement and enforcement of an overarching plan for fresh agricultural product cold chain logistics. These measures involved increased investment in infrastructure, widespread adoption of cold chain logistics technology, comprehensive attention to the overall construction of the cold chain logistics chain, expedited development of third-party cold chain logistics enterprises, and the formulation and enhancement of legal and standard systems governing cold chain logistics.

Liu Hao's (2016) examination commenced by delineating the concept and distinctive features characterizing agricultural product cold chain logistics. A critical analysis ensued, revealing pervasive challenges within the sector, including a sluggish overall development process, deficient road infrastructure, antiquated hardware facilities—

specifically cold chain vehicles—limited standardization, and a dearth of technical services. In response to these identified issues, Liu proffered strategic countermeasures and recommendations, emphasizing the imperative to fortify infrastructure development, enhance standardization efforts, facilitate industrial integration, and augment capital investment, all of which should be bolstered by comprehensive policy support.

The inherent biochemical characteristics of fresh agricultural products render logistics and distribution at ambient temperatures exceptionally perishable, exerting deleterious effects on product freshness and jeopardizing consumer health and safety. Consequently, the domain of e-commerce for fresh agricultural products imposes inherently heightened prerequisites for logistics and distribution. The ascendancy of e-commerce in fresh agricultural products has propelled a commensurate surge in attention directed towards cold chain logistics. Chen Jingyu et al. (2015) undertook an investigation encompassing 111 fresh agricultural products e-commerce websites from a pool of 648 such websites. This research scrutinized various facets, including the overview of cold chain logistics services, utilization of cold chain logistics facilities and equipment, geographical coverage of cold chain logistics, regional logistics models, and the outsourcing landscape of cold chain logistics services. The study culminated in the articulation of recommendations and countermeasures targeting extant issues, spanning policy, standards, information technology, equipment, and other pertinent dimensions.

In a parallel scholarly effort, Chen Yuying and Zhang Bing (2020) contend that the evolving consumer perceptions of fresh agricultural products, concomitant with the amelioration of living standards, necessitate a critical examination of the current state of cold chain logistics in China. Through the lens of the Internet of Things (IoT) technology, they discerned notable inadequacies in the extant framework, notably the inadequacy of the refrigerated transportation rate to meet market demands, the relative backwardness of infrastructure development, the insufficient degree of informatization, and the overarching deficiency in comprehensive planning. To address these shortcomings, the authors advocated for the judicious application of IoT technology across the entire spectrum of fresh agricultural product logistics—from procurement and harvest planting to warehousing, transportation, and sales. This approach, they argued, not only ensures the preservation of fresh agricultural product quality but also augments logistical efficiency.

In a parallel perspective, Huang Xing (2020) posits that the intensive, networked, and diversified developmental paradigm of cold chain logistics has not only enhanced the core competitiveness of the entire logistics industry but has also catalyzed the transformation and elevation of the agricultural product circulation sector. However, despite these advancements, certain constraints persist in China's cold chain logistics technology, encompassing imperfect systems, elevated costs, diminished efficiency, and low industry concentration. As a remedy, Huang advocates the innovation of cold chain logistics business models,

envisioning a transformative leap in the development of China's agricultural product circulation industry. This entails initiatives such as expanding and integrating logistics industry infrastructure, among other strategic measures, aimed at augmenting the core competitiveness of the logistics industry vis-à-vis agricultural products.

III. RESEARCH METHODOLOGY

This research study is a mixed method between qualitative research and quantitative research. (Quantitative Research) which can be explained as follows.

A. Quantitative Research

The population of this research is business representatives of the cold storage logistics industry in Guangxi. As of the end of January 2023, there were a total of 525 cold storage logistics companies in Nanning, Beihai, Qinzhou, Guangzhou. Ya Lin and Fang Chenggang and the size of the company is generally small (Qichamao Bureau of Statistics (2023)) The researcher uses structural equation modeling to randomly select an appropriate sample size from the appropriate population identified and recommended by stratified sampling. floor

The researcher used structural equation modeling and AMOS data analysis and used empirical rules to determine the sampling method to select the sample size (Schumacker and Lomax, 1996; Hair et al., 1998, cited in Nonglak. Wiratchai, 1999) has 15 variables in the model. The appropriate and sufficient sample size is $15 \times 15 = 225$ to $15 \times 20 = 300$. Therefore, in order to better use the statistical tools of structural equation modeling in data analysis. The sample used in this study consisted of 422 entrepreneurs using a simple random sampling technique. The researchers used a total sample of 422 enterprises in the cold chain logistics industry in China in this study.

The instrument used in this study was a questionnaire which the researcher determined. The questionnaire was supported by a meticulous synthesis of relevant literature. logistics management theory and a thorough assessment of the development landscape characterizing the cold chain logistics industry for agricultural products. Design a questionnaire The main body of this research attempts to determine the determining factors affecting China's evaluation system for cold chain logistics services for agricultural products. Using a random sampling method, respondents are selected in a random manner to take part in the investigation. The questionnaire was systematically divided into five sections. The researcher then tested the validity of the questionnaire by handing it to experts and analyzing the validity of the discussion content. The researcher tested reliability by trying out the questionnaire on groups outside the sample before collecting the data.

Data collection The researcher will distribute the questionnaire to the specified target group. This is based on a predetermined sample size for each region. The data collection period runs from 1 April 2023 to 31 October 2023, covering the distribution of 400 questionnaires within the designated target areas. During questionnaire administration The researcher will explain the purpose of the research to the respondents. After this, the completed questionnaire will be carefully checked to ensure its completeness. If the questionnaire is still incomplete or returns

defective answers. The researcher systematically filters out questionnaires and continues the distribution process until a predetermined quota is reached.

Statistics used to analyze data The analyzes used in this study included descriptive statistical analysis and structural equation modeling. The analytical framework involves the use of various statistical techniques. Including frequency analysis Calculating the average Calculating standard deviation Hypothesis testing and application of structural equation modeling by

- Descriptive statistical analysis Descriptive statistical analysis is the method used after data collection. It covers various activities such as tabulation, classification. Graphic display and summary calculations to describe the inherent characteristics of the data collected.
- Statistical analysis of the relationship between variables is the Pearson Product Moment Correlation Coefficient (PPMCC or PCC) analysis used to moderate the relationship between variables. It provides insights into the existence of linear relationships, the direction and magnitude of such relationships.
- analyze statistical models of structural equations A linear regression analysis will study the relationship of influence. Basically Regression analysis includes linear regression model of quality management in cold storage logistics service evaluation. Linear regression model of logistics environment to evaluate cold chain logistics services. Linear regression model of transportation efficiency in evaluating cold storage logistics services. Linear regression models of quality management in logistics environments. and linear regression model of quality management on transportation efficiency.

B. Qualitative Research

Population and sample From this interview questions were developed and in-depth telephone interviews were conducted with eight senior managers from agricultural production. Logistics management Distribution of fresh fruits and vegetables, hotels and government agencies All of them had more than 10 years of experience. All of the participants had more than 10 years of experience. The main target of the investigation was the head of a cold chain logistics company.

C. Research Tools

- Literary research: Literary research is considered a methodological approach to collecting and organizing relevant literature within a specific research area. With a comprehensive review of both domestic and international literature.
- In-depth interviews are in-depth interviews which are characterized by their unstructured nature and direct personal participation. It serves as a methodological guide designed to reveal the underlying behavioral motivations of cold storage logistics operators and professionals dealing with specific issues.

Quality testing of tools is carried out by experts. The questions were checked and adjusted before the interview according to the recommendations of the actual sample.

How to collect data, After identifying the target population Data collection will follow the following steps:

- Step 1: Initiate contact with 8 key informants to request participation in the interview, then schedule the interview. By considering the preferences and readiness of the interviewee.
- Step 2: Call the interviewee to request permission from the researcher to conduct the interview according to the prescribed questions.
- Step 3: Conduct in-depth interviews with the target group at an agreed upon time to gather the required information. The interview is conducted with the consent of the other party. The interviews were semi-open. And the researcher will ask each interviewee a set of pre-set questions.

Gather information from the interviews according to the specified questions. according to the objectives of this study Data will be compared and analyzed.

D. Statistics Used To Analyze Data

To analyze the content and purpose of the interviews. The researcher extracted information from all 8 key informants.

Analysis and processing of the organization's relevant personnel is as follows.

- Group the information received in the interview notes. in the concept and variables, The data is grouped according to four modules: logistics environment; Logistics quality management transportation efficiency and strategies for creating an evaluation system for cold chain logistics services for agricultural products.
- Collect and enter respondents' answers.
- After collecting the main points of all respondents' answers. Analyze and summarize according to the conceptual framework.

IV. RESULTS

Combined with the previous content, the main research of this paper is summarized, and the direction of future research is proposed, as follows:

This study focuses on the development of the cold chain logistics service evaluation system for agricultural products in Guangxi. Based on the review of relevant literature, a mixed research method combining quantitative and qualitative methods was used to study the impact of quality management, logistics environment and transportation efficiency on the agricultural product cold chain logistics service evaluation system in Guangxi Province, in order to build and improve the agricultural product cold chain logistics evaluation system in Guangxi Province. The agricultural product cold chain logistics service evaluation system provides suggestions and strategies.

To investigate the effect of quality management, logistics environment, and transportation efficiency on the evaluation system of cold chain logistics services for Guangxi agricultural products, this article focuses on three main research areas: (1)What are the factors that affect the evaluation system of cold chain logistics services for

agricultural products in Guangxi Province, the People's Republic of China? (2)How do the quality management, logistics environment, and transport efficiency affect the evaluation system of cold chain logistics services for agricultural products in Guangxi Province, the People's Republic of China? (3)What is the model of factors influencing the evaluation system of cold chain logistics services for agricultural products and the path to improve the evaluation system of cold chain logistics services for agricultural products in Guangxi Province, the People's Republic of China?

Based on literature review, questionnaire survey and in-depth interviews, this paper examines the model of influencing factors for the evaluation system of cold chain logistics services for agricultural products in Guangxi through a literature review, questionnaire survey, and in-depth interviews. The article presents the issues with the development of the cold chain logistics service evaluation system for agricultural products in Guangxi, along with countermeasures and suggestions for improvement. The main conclusions are as follows:

The results answered the first goal: To study the factors that affect the evaluation system of cold chain logistics services for agricultural products in Guangxi Province, the People's Republic of China.

A. According to Statistics

China circulates an average of about 400 million tons of fresh agricultural products every year, of which the cold chain circulation rates of fruits, vegetables, meat, and aquatic products only account for 6%, 17%, and 25%. It can be seen that there are still gaps in my country's cold chain market, especially in the process of transportation and sales. In addition, the development of cold chain logistics enterprises is also lagging behind, and most areas of the service network and information system are still blank and difficult to cover. In addition, the supply of fresh agricultural products in Guangxi Province is difficult to meet market demand and there are large market risks. The main reason is that it has a low penetration rate of modern planting technology, weak scale effect, low degree of integrated operation of production, supply and marketing in the industrial chain, and the fruit and vegetable The low level of cold chain logistics management of fresh agricultural products will result in huge logistics losses and low profits. By analyzing relevant literature, this article learns and summarizes the concepts of fresh agricultural products, logistics, cold chain logistics, as well as transaction cost theory, supply chain management theory and production frontier theory, and summarizes three influencing factors on the logistics service evaluation system, cold chain logistics Quality management, transportation efficiency and supply chain environment. This article distributed questionnaires to 450 industry personnel in Guangxi Province and recovered 422 valid questionnaires. According to the research results, it was proved. Agricultural product cold chain logistics quality management has a significant positive impact on the logistics environment, transportation efficiency, and agricultural product cold chain logistics service evaluation system. At the same time, the logistics

environment and transportation efficiency have a significant positive impact on the agricultural product cold chain logistics service evaluation system.

The results answered the second goal: To study the relationships between influence factors and the evaluation system of cold chain logistics services for agricultural products in Guangxi Province, the People's Republic of China.

B. Examine the Correlation Between the Factors that Influence the Evaluation System and the Cold Chain Logistics Services for Agricultural Products in Guangxi Province, China.

The evaluation of cold chain logistics services for agricultural products in Guangxi Province is influenced by quality management, supply chain environment, and transportation efficiency. Quality management has a positive impact on logistics service evaluation, with a path coefficient of 0.828. Additionally, quality management has a positive impact on the supply chain environment, with a path coefficient of 0.824. Quality management has a positive impact on transportation efficiency, and its path coefficient is 0.617. The supply chain environment has a positive impact on logistics service evaluation, with a path coefficient of 0.607, and transportation efficiency has a positive impact on logistics service evaluation, with a path coefficient of 0.862. Quality management has an indirect impact on competitive advantage through the supply chain environment and transportation efficiency. The mediation effect's P value is 0.000, which is less than 0.01. The supply chain environment has a partial intermediary effect, accounting for 60.384% of the total effect. Similarly, the transportation environment plays a partial intermediary role, accounting for 64.281% of the total effect.

The results answered the third goal: To build a model of relationship between quality management and the evaluation system of cold chain logistics services and propose suggestion for improving the evaluation system of cold chain logistics services for agricultural products in Guangxi Province, the People's Republic of China.

C. Measures and Suggestions for the Development of the Cold Chain Logistics Service Evaluation System for Agricultural Products in Guangxi Province:

The current situation of fresh agricultural product companies and cold chain logistics enterprises in Guangxi Province reveals that the cold chain logistics of agricultural products in the region suffers from several issues. These include insufficient storage equipment for fresh agricultural products, a lack of professional technicians for loading and unloading, and problems with information processing during storage and loading and unloading processes, as well as information processing. However, there is still room for development in the cold chain logistics of agricultural product companies. It is important to make full use of the country's existing resources to promote the industrialization and modernization of fresh agricultural product logistics. This can be achieved by building a systematic agricultural

product cold chain logistics system and promoting the agricultural product industry. The logistics industry has efficiently transformed, upgraded, and developed, contributing to rural revitalization.

V. DISCUSSION

A. Conceptual Framework

Dr. William Edwards Deming, a renowned authority on quality management, has made significant contributions to the field's advancement worldwide. In his Deming Fourteen Points of 1950, he asserted that "Quality is the most cost-effective method for producing marketable items of the highest usefulness." In his Deming Fourteen Points of 1950, he asserted that "Quality is the most cost-effective method for producing marketable items of the highest usefulness." Enhancing product quality leads to automatic increases in productivity. To investigate the current issues in total quality management in my country, Yao Dan (2006) suggested that the primary variance between quality management principles and other concepts is the emphasis on starting with identifying customer quality requirements to achieve genuine economic benefits, leading to customer satisfaction with the final product. Total quality management aims to guide the coordinated activities of people, machines and information to achieve customer satisfaction. The term "comprehensive" highlights the need to begin with the close integration of quality management theories, methods and outcomes to produce products that meet customer requirements. This requires a series of organizational coordination efforts to comprehensively solve quality problems. Duan Yuangang (2017) proposed in "Application Research on Strategic Quality Cost Management in Enterprises" that quality cost denotes the costs incurred in ensuring that products or services meet specified quality standards as well as the internal and external quality losses from failing to satisfy the said standards. Strategic cost management for quality is a fundamental aspect in creating competitive advantages for businesses. It requires the dynamic reflection of various quality activities, founded on analyses of quality positioning and value chain, and utilisation of innovative quality management tools. Optimising quality management, dynamic quality and cost controls, strategic performance evaluations, and improved quality management levels also contribute to this approach. It must be noted that product quality plays a vital role in determining a business's success in the competitive market. Since the 1990s, supply chain management has received widespread attention from theoretical and industrial circles, and logistics management is an important part of supply chain management. However, during this period, people's understanding of the supply chain was still based on the supply and demand of physical products. In the network chain stage, the industry and academia generally have not included logistics service providers into the scope of supply chain management. Therefore, research on logistics quality management is still basically carried out from the perspective of industrial and commercial enterprises' own logistics and supply chain management. The representative research result is the logistics competitiveness study conducted by the global logistics research team of Michigan State University in 1995

on 3,700 production, wholesale and retail enterprises in 11 countries in North America, Europe and the Pacific Rim. A world-class logistics model for industrial and commercial enterprises with 18 dimensions in 4 aspects including, response and performance evaluation.

The research outlined in this article adopts a multifaceted approach, examining quality management, logistics environment, and transportation efficiency. Quality management constitutes a comprehensive methodology aimed at ensuring consistent fulfillment or surpassing of customer expectations by the products or services provided by an organization. It entails a systematic methodology involving planning, monitoring, and enhancing all organizational activities and processes to attain and sustain a high standard of quality. Quality management integrates various principles, methodologies, and tools to realize its objectives. The logistics environment encompasses a complex array of interconnected factors, conditions, and elements that influence the planning, execution, and oversight of goods, information, and resource transportation within supply chains. It encompasses a broad spectrum of both internal and external influences impacting logistical operations. The logistics domain encompasses diverse factors and scenarios influencing the planning, execution, and management of logistics and supply chain activities. Transportation efficiency, often denoted as transport efficiency, quantifies the effectiveness with which resources such as time, energy, and infrastructure are utilized during the movement of goods or individuals from one location to another. It involves the optimization of all facets of transportation to attain desired objectives while minimizing waste, costs, and environmental ramifications.

In contrast to prior research endeavors, the examination of determinants influencing the cold chain logistics service evaluation system for agricultural products in Guangxi exhibits a wider scope and a more profound depth of analysis.

B. Research Methods

Ronald D Anderson et al. (1998) proposed that the significance of enforcing quality management measures in attaining operational outcomes and customer contentment in logistics has been confirmed in numerous studies. Nevertheless, despite being extensively employed, quality management lacks a universally agreed framework for evaluating improvement endeavours. This exploration devises quality management constructs and a casual model built on the standards utilised in the Malcolm Baldrige National Quality Award. Causal connections between quality management factors and logistics outcomes, particularly logistics operational performance and customer service, have been established. The management implications of these findings are discussed. Foreign research on the perception and evaluation of logistics service quality is represented by Mentzer and Bienstock. Mentzer (1989) and others believed that logistics service quality (Delivery Service Quality) includes two aspects: customer service quality and physical distribution service quality, and proposed that the understanding of logistics service quality should be combined

with the perspective of customer marketing. They believe that time, item availability and item status are the most important aspects of customers' perception of logistics service quality, while service contact personnel and error handling processes will affect customers' perception of the entire logistics service quality. On this basis, they constructed a physical distribution model Measurement of service quality (PDSQ).

Anderson et al. (1998) conducted a questionnaire survey on shipper members (industrial and commercial enterprises) of the American Society of Transportation and Logistics (ASTL) based on the evaluation indicators of the "Baldrige National Quality Award". A causal relationship model between industrial and commercial enterprise quality management factors and logistics output was constructed and empirically tested. The above analysis shows that research on logistics management as part of the operational functions of industrial and commercial enterprises has achieved rich results.

Miu Miao (2006) paid attention to the fact that at the end of the 20th century, my country's logistics industry began to develop vigorously, and the express delivery industry, which is a component of the logistics industry, also emerged in response to the needs of social development. Nevertheless, private express delivery firms have been unable to expand significantly due to policies, internal constraints and other factors. On the basis of theories of customer loyalty and logistics quality management, this study addresses three key problems by examining how the service quality of express delivery enterprises impacts customer system stability. The analysis includes a case study, which explores the practical implications of this research. By prioritising customer needs, enterprises can fulfil their own objectives, and it is crucial that all businesses remain customer-focused.

The study outlined in this article initiates by gathering data via questionnaire surveys, employing quantitative analysis methodologies. Utilizing the social science statistical package alongside structural equation modeling, the study aims to validate the proposed hypotheses. Additionally, it integrates in-depth interviews, employing a mixed-method approach combining both quantitative and qualitative techniques. This comprehensive methodological framework aims to elucidate the multifaceted impact of quality management, logistics environment, and transportation efficiency on the assessment framework of cold chain logistics services for agricultural products in Guangxi.

C. Research Hypothesis

In the realm of cold chain logistics standardization development, Cai Nanshan et al. (2011) examined the state of affairs and issues pertaining to cold chain logistics standardization construction in the UK and presented proposals to bolster its standardization efforts. Meanwhile, in a separate study, Chang Lina et al. (2014) put forward a systematic blueprint for the creation of cold chain logistics standardization measures for agricultural goods. The fundamental structure of standardizing chain logistics is crucial. Liu Dan (2013) suggested optimization measures to

tackle the issue of inadequate standard construction during the advancement of cold chain logistics in the country. Meanwhile, An Jiuyi (2010) assessed current complications in the standardization construction of cold chain logistics and proposed plans for future standard construction. Furthermore, Huang Ying et al. (2013) broadened the ways and methodologies of standardized management by utilizing existing standards related to cold chain logistics of agricultural products. The quality management positively influences logistics environment of cold chain logistics services for agricultural products in Guangxi Province, the People's Republic of China.

With regard to the harmonization and integration of standards, Chen Zhihe (2009) examined the inherent connection between quality management systems, environmental management systems, and occupational health and safety management systems, and suggested fundamental concepts to merge the three standards. Similarly, Zhou Junxing (2014) analyzed mandatory standards for the stone industry and foreign stone regulations, and formulated a plan for attaining uniformity and coordination in national standards. Moreover, Zhang Hong et al. also contributed to this field. In 2015, relevant standards regarding food contact coatings were collected and analyzed, resulting in proposed methods to enhance the safety of my country's food contact coatings. Safety standards recommendations were provided subsequently. The quality management positively influences transport efficiency of cold chain logistics services for agricultural products in Guangxi Province, the People's Republic of China.

Xia Wenhui (2003) suggests abandoning the traditional logistics development model and promoting the third-party logistics model of agency-based customer-customized agricultural product cold chain logistics services in order to vigorously develop agricultural product cold chain logistics. Zhang Qian (2004) advocates for efforts to upgrade and optimize the established cold chain logistics system of the Jiangnan Plain agricultural product logistics development model. Under the supply chain management model, the future trend will be the vigorous development of sustainable green logistics models. Zheng Yingjie, Liu Yanni (2008) and others analyzed the existing agricultural product logistics models in our country and suggested that the cost-efficiency principle is crucial for the successful operation of modern logistics. The agricultural product logistics model must adhere to its core principles. Adherence to market demands necessitates a high-efficiency, cost-effective logistics system that not only addresses environmental concerns, but also supports environmental progress. Gao Zhenjuan (2010) proposed integrating economic activities to improve agricultural product logistics models. This integration can leverage valuable resources, expand circulation channels, and facilitate processing of fresh agricultural goods, thereby boosting the supply chain's overall value. The quality management positively influences evaluation system of cold chain logistics services for agricultural products in Guangxi Province, the People's Republic of China.

Qin Hong et al. (2003) conducted a comprehensive analysis of the different elements of logistics demand and concluded that the level of logistics service is a crucial factor impacting potential logistics demand. The authors explicitly proposed regional logistics demand analysis indicators. Xiao Dan (2003) and colleagues focused on the distinctive characteristics of cold chain logistics demand for agricultural products. They scrutinized the terminal market's requirement for agricultural products, after which they introduced techniques and principals to quantify logistics demand. Wang Xiaoyuan and colleagues (2004) developed a regional logistics demand forecasting model, which utilises set pair analysis, to predict the logistics demand in Shandong Province. Meanwhile, Liu Bingqian (2004) analysed and researched the logistics analysis and forecasting method of the value chain based on input and output. From the perspective of constructing an agricultural product logistics center, a study was conducted. The logistics environment positively influences evaluation system of cold chain logistics services for agricultural products in Guangxi Province, the People's Republic of China.

Castle and Lee (1996) introduced a novel method to research supply chain management, merging the most efficacious aspects of supply chain models and system simulations to refine supply chain management. In his research, Singer (Singh, 2006) highlighted the dual nature of the supply chain as both a product and information flow process. Zuurbier and Den Ouden (1996) originally established Food Supply Chain as a concept, explaining that it encompasses the various entities involved in the production, processing, transportation, sales, and distribution of food and agricultural products. The goal of implementing an integrated operation model is to decrease the costs of food logistics while enhancing quality, service levels, and food safety.

Martijn F.L. Rademakers and Phillip J. McKnight (1998) conducted a thorough analysis of the ongoing decline of the Dutch potato industry. Martijn F.L. Rademakers and Phillip J. McKnight (1998) conducted a thorough analysis of the ongoing decline of the Dutch potato industry. They concluded that strategic alliances between upstream and downstream enterprises are not only necessary but also unavoidable due to the current state of modern enterprises. Ian Robson and Vikkey Rawnsley (2001) undertook a comprehensive investigation of the connections between suppliers and purchasers of British food, focused on the two aspects of British food manufacturing and regulation. The transport efficiency positively influences evaluation system of cold chain logistics services for agricultural products.

SUGGESTIONS FOR FURTHER RESEARCH

❖ *Suggestions*

➤ *Quality Management*

- Enhancing a company's competitive advantage involves meeting consumers' individual needs and effectively differentiating itself from competitors. Agricultural product companies should segment the market based on

consumers' actual needs and adopt corresponding strategies for different segments.

- A price strategy should be implemented to guarantee customer satisfaction.
- Channel strategy guarantee. In a complete marketing system, channel strategy is a key component, which can effectively reduce the company's production and operation costs and ensure the company's competitive advantage.
- Promotional policy. Business promotion strategy. Differentiated preferential policies are adopted for different periods and types of consumers, such as providing gifts to important customers during promotional periods or holidays to stabilize customer relationships. In addition, customers should be led to visit the company from time to time to ensure that customers can systematically understand logistics standards and their development in a timely manner.

➤ *Logistics Environment*

To stimulate the development of Guangxi's cold chain logistics industry, an academic approach involves firstly focusing on attracting investment and fostering industrial clusters. This can be achieved through the implementation of targeted policies by the local government to incentivize domestic and international professional cold chain logistics firms to establish operations and invest in the region. Such policies may encompass tax exemptions, land lease concessions, and utility bill subsidies, aimed at reducing operational costs and enhancing the profitability of enterprises. Concurrently, efforts should be made to encourage major industry leaders to establish regional headquarters or branches in Guangxi, leveraging their expertise and resources to provide technical support and strategic guidance to local players.

➤ *Transport Efficiency*

The promotion of standardisation and informatisation is crucial to the development of cold chain logistics. In the current stage, the widespread use of information technology makes it essential to establish a unified logistics information platform and a complete logistics system to enhance the quality of cold chain logistics. To enhance compatibility and coherence, Guangxi should develop technical plans and operating guidelines that are localized, easy to operate, and based on the characteristics of resources and the actual situation of the industry. This will ensure that cold chain equipment can be monitored and tracked throughout the process, promoting high standards and close-to-reality practices. To improve the capabilities of cold chain logistics in terms of scale, intensification, organization, and networking, Guangxi should further enhance the use of information technology. For instance, create a public information platform for the ASEAN cold chain. This platform should integrate data from large-scale cold storage, cold storage on farmland floors, cold chain storage centers, distribution centers, pre-cooling distribution centers at origin, cold chain transportation, and multinational cold chain companies. The platform should allow for comprehensive and full-process monitoring of the cold chain, with no breaks in the entire process. The achievement of this objective will significantly enhance the efficiency and transparency of cold chain logistics, while also reducing the associated risks and costs.

❖ *Suggestions for Next Research*

- Based on the findings of this study, the focus has been on developing a cold chain logistics service evaluation system for agricultural products in Guangxi Province. Future research endeavors could encompass extending this investigation to other regions across China, such as Guangdong Province, Zhejiang Province, Shandong Province, among others. Furthermore, exploring the factors influencing the competitive advantages of the agricultural product cold chain logistics service evaluation system is warranted. Considering the variances among the eastern, central, and western regions, it would be beneficial to analyze and propose strategies aimed at enhancing the competitive advantage of agricultural product cold chain logistics services in each respective region.
- There is a need to expand research efforts to include dimensional evaluation indicators for cold chain logistics services catering to a diverse range of agricultural products. Additionally, the expansion of cold chain logistics service operations for agricultural products in Guangxi Province to other Asian nations could be explored to foster high-quality collaboration within the framework of the "Belt and Road" initiative. This expansion would facilitate the enhancement of service trade cooperation, the establishment of a comprehensive cold chain logistics infrastructure for agricultural products, and ultimately contribute to the transformation, advancement, and efficient development of the agricultural product industry's logistics sector, thereby aiding in rural revitalization efforts.

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