

# Study on the Service Quality Evaluation of Fresh Agricultural Products Cold Chain Logistics under the Background of E-commerce: Based on the Perspective of Customer Satisfaction

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**Abstract**-The economic development and the improvement of quality consumption consciousness have promoted the development of the cold chain logistics industry, and exposed the problems of backward infrastructure, low degree of specialization and low service level in the cold chain logistics service industry. Based on the SERVQUAL model (Service quality) and LSQ model (Logistics Service Quality), cold-chain logistics service quality evaluation system is constructed, which contains the reliability, timeliness and economy, informativeness and service flexibility five dimensions and service 24 specific indicators. The structural equation model is used to analyze the impact of economy on cold chain logistics service quality. Timeliness and informativeness have the same impact on cold chain logistics service quality. Compared with service flexibility, reliability indicators such as goods intact and correct can better affect customers' perception of cold chain logistics service quality, and cold chain logistics service quality can predict customer satisfaction to a greater extent. By integrating logistics resources, building cold-chain logistics information platform, optimizing the return process, improving the comprehensive quality of employees, and improving the quality of fresh agricultural products cold-chain logistics service.

**Keywords**-Fresh Cold Chain, Service Quality, LSQ, Customer Satisfaction, Structural Equation Model

## I. INTRODUCTION

At the present stage, China's fresh agricultural products logistics is mainly based on normal temperature logistics, and the concept of cold chain logistics is backward. Problems such as imperfect cold chain logistics system and inconsistent industrial standards lead to the loss rate of vegetables and fruits of more than 10%. Ensuring the preservation and appreciation of perishable and fresh food in the process of processing, transportation and sales [1] is the key to the development of fresh agricultural products e-commerce. Scholars in China and abroad have extensively studied the service quality of cold chain logistics from the perspective of customer satisfaction.

Perreault and Russ (1974) put forward the 7Rs theory based on the utility of time and place in the study of logistics service quality: cargo accuracy, cargo completion rate, accurate commodity information, punctuality of delivery, accuracy of delivery, timeliness and price. Research conducted by Ekonora Bottanl (2006) shows that the improvement of logistics service quality plays a very important role in expanding the market and enhancing the competitiveness of enterprises involved in logistics services. It is proposed that the improvement of logistics service quality can improve customer satisfaction. Sun Jun [2] (2011), referring to SERVQUAL service quality model, constructs an evaluation system of China's logistics service quality with 24 specific indicators, and summarizes three dimensions (quality of the process, quality of the result and corporate image) that affect China's logistics service quality. Groorus (1982) proposed that the core of customer perception of service quality is that quality is evaluated by customers, and the process of customer evaluation of service quality is actually the result of comparing their actual feelings in the process of receiving service with their psychological expectations before receiving service. ZhengBing [3] (2008) took B2C e-commerce platform consumers as survey objects and summarized five major aspects that affected their service quality, and further empirically analyzed the influence of these five factors on customer loyalty with customer satisfaction and customer trust as mediating variables. Liu Ye [4] (2011) established a logistics service quality index system based on customer satisfaction, and conducted an empirical analysis by using the fuzzy comprehensive evaluation method. He Wangbing [5] (2012) established a pyramid model of influencing factors of brand equity of B2C e-commerce websites with brand loyalty as the apex of pyramid from the perspective of customers. JiaTengfei [6] (2014) used the theory of service quality to summarize customer demand items and quality control elements of cold chain delivery of fresh products. Traditional service industry is process-oriented, while logistics service itself is results-oriented. [7] Most existing researches focus on improving the service quality of traditional service industry, such as hotel, banking and other industries, while ignoring the results-oriented cold chain logistics service quality. In addition, most existing studies focus on the benefits of cold chain

logistics enterprises to study the quality of cold chain logistics service, which to some extent damages the shopping experience of customers, thus making it difficult to improve customer satisfaction with shopping. Therefore, the market segment –fresh agricultural products– is chosen as the research object, based on the SERVQUAL model (Service quality) and LSQ model (Logistics Service Quality) building in line with the Chinese characteristics of fresh agricultural products cold chain logistics service quality evaluation index system. It evaluates and analyzes cold-chain logistics service quality according to the customers’ “perception–expectation” data, and does empirical research taking the consumer as the research object. Countermeasures and suggestions are put forward to improve the quality of cold chain logistics service.

## II. THEORETICAL BASIS AND RESEARCH HYPOTHESIS

### A. Theoretical Basis

Based on SERVQUAL Service Quality evaluation model and LSQ evaluation index dimension in the model, and the electronic commerce in the context of fresh agricultural products cold chain Logistics Service Quality connotation of set, this paper qualitatively analyzes the cold-chain logistics customer requirements, to formulate the cold-chain Logistics Service Quality dimensions, and then through preliminary investigation each dimension correction, finally to attribute the influencing factors on the quality of the cold chain logistics services to individual characteristics, the reliability of the cold chain logistics services, timeliness, economy, informativeness and service flexibility.

Reliability refers to whether the service personnel involved in the whole process of cold chain logistics service can bring good consumption experience to customers by relying on advanced equipment. This paper reflects the reliability of cold chain logistics service by the advanced refrigeration equipment, the soundness of goods and the correctness of goods.

Timeliness refers to that the links of cold-chain logistics, such as delivery and return, can meet consumers’ expectations and quickly respond to customers’ needs, which is the essential requirement of logistics service [8]. This paper reflects the timeliness of cold chain logistics service by order response time, delivery delay time and return and replacement error processing time.

Economy refers to customers’ perception of cost performance when they enjoy cold chain logistics services, that is, whether the service price they pay attention to matches the service quality of cold chain logistics. The complete cold chain logistics service process includes the return process, so the return cost is also one of the important indicators affecting consumer satisfaction. Therefore, this paper summarizes the factor reflecting economic indicators as: logistics price and return cost.

Informativeness means that consumers can obtain all the information of products in the process of logistics in a timely and accurate way. Considering the characteristics of cold chain

logistics service of fresh agricultural products in B2C e-commerce, this paper reflects the information nature of cold chain logistics service with the completeness of information system, the updating speed of goods tracking information and the feedback ability of error information.

Service flexibility refers to whether the cold-chain logistics enterprises can provide more diversified and personalized value-added services according to the personalized logistics needs of consumers. This paper reflects the flexibility of cold-chain logistics services by means of flexible payment method, dressing attitude of delivery personnel, flexible distribution mode and flexible delivery form.

The definition of customer satisfaction from the Angle of the consumption process includes a full set of consumption experience, pointed out the important processes of customer satisfaction. This definition leads people to pay attention to the perception of customer satisfaction. Judgment and mental process, has more practical value, based on this definition, this article will customer satisfaction due to customer expectations, quality perception and value perception.

Customer expectation is defined as customers’ judgment and prediction of the quality of products or services based on past empirical or non-empirical information. This paper makes use of the expectation of cold chain logistics service to manifest the customers’ expectation.

Quality perception is the customers’ judgment of the overall excellence of a product. Parasuraman and other experts point out that quality perception is composed of five dimensions: reliability, assurance, reactivity, empathy and tangible. Based on this, this paper manifests quality perception through three dimensions: the quality perception of cold chain logistics equipment, the perception of cold chain logistics information sharing and the perception of cold chain logistics service flexibility.

Value perception refers to customers’ experience of the expenses paid and the actual benefits achieved in the process of purchasing and consuming products or services. In this paper, the indicators reflecting the value perception are summarized as the perception of the total cost and the perception of the total value.

### B. Research Hypothesis

The cold chain logistics service process is a low-temperature logistics process with refrigeration technology as the means. The advanced cold chain logistics equipment to ensure the complete rate and accuracy of goods is the fundamental guarantee to win the trust of consumers and win the satisfaction of consumers. Service quality is the fundamental driving force for the long-term development of the logistics industry. In order for customers to have a “sense of quality acquisition”, it is necessary to strengthen the timeliness of service and meet customers’ demands for quick response. Economy, namely cost performance, is the most intuitive judgment of whether the service price and service quality match. Customers tend to choose cheaper alternatives. Unreasonable distribution of distribution outlets and delayed update of express delivery information may reduce consumers’

satisfaction with express service quality. Employees are the main body of enterprise services, and their comprehensive quality is related to enterprise service level to some extent: the higher the quality of employees, the higher the service quality, the higher the customer satisfaction.

There is a positive correlation between customer expectation, perceived quality and perceived value, that is, the higher the expectation, the higher the future perception, and vice versa. The perceived quality of customers affects the perceived value, that is, the higher the service quality, the higher the perceived value of customers, which indicates that there is a positive correlation between the perceived quality of customers and the perceived value. Based on the above discussion and the data collected from the survey, the following assumptions are made:

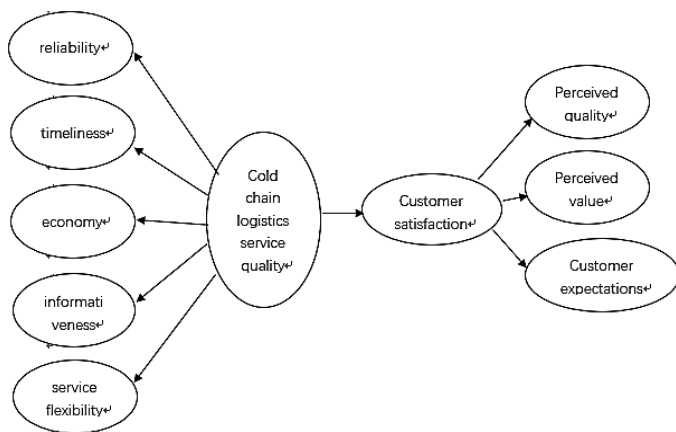


Figure 1. Theoretical hypothesis model of influencing factors on service quality of cold chain logistics

### III. VARIABLE SETTING AND MEASUREMENT

The variables related to consumer attitudes in this paper refer to the practices of Ortega [9] and other scholars and are measured by 7-level Likert scale. The specific description of the variables is shown in Table I.

### IV. EMPIRICAL MODEL AND ANALYSIS RESULTS

This paper selects Qingdao, Rizhao, Ji'nan and other cities in Shandong province to carry out a series of surveys. Shandong province is located in the east coast of China, with relatively developed economy, high consumption level of residents and rapid development of cold chain logistics industry. This not only guarantees that the survey objects have great representative significance, but also, in order to ensure the randomness of the survey sample selection, the consumers who come into the investigator's sight in the interview are appointed as the interview objects [10].

TABLE I. VARIABLE SETTING AND DESCRIPTION

	Gradually variable	Observation variable	The mean	The standard deviation
Customer satisfaction with cold chain logistics service quality	Customer expectations	Overall expectations for cold chain logistics services	3.24	1.08
		Expectations that cold chain logistics services meet their needs	2.86	1.21
	Perceived quality	Perception of cold chain logistics equipment quality	3.19	1.22
		Perception of cold chain logistics information sharing	3.22	1.28
		Perception of the flexibility of cold chain logistics service	3.21	1.33
	Perceived value	Perception of total cost	3.34	1.36
Perception of total value		3.53	1.17	
Cold chain logistics service quality	reliability	Advanced refrigeration equipment	3.27	1.21
		The goods in good condition	3.24	1.05
		The goods properly	2.94	1.65
	timeliness	Order response time	3.04	1.52
		Delivery delay time	3.18	1.25
		Return response time	3.49	1.26
	economy	Logistics price	3.59	1.22
		Return of the cost	3.52	1.28
	Informativeness	Information system completeness	3.22	1.14
		Cargo tracking information update speed	3.23	1.64
		Error feedback	3.29	1.46
	Service flexibility	Payment flexibility	2.68	1.89
		Distribution staff attitude	3.27	1.28
		Dressing of delivery personnel	3.16	1.57
		Flexibility of distribution mode	3.35	1.18
Flexible pick-up mode		3.34	1.29	
		Flexible pick-up time	3.43	1.12

In this survey, a total of 200 questionnaires were issued, 188 of which were effective, with an effective recovery rate of 94%. The male-female ratio of the sample is about 3:17, which is in line with the reality that Chinese families are mainly female buyers. The age ranges from 18 to 50 years old (96.28%). The annual income mainly focuses on 50,000 to 100,000 Yuan and the specific statistical characteristics of the survey samples.

### A. Reliability and Validity Test

In this paper, exploratory factor analysis and confirmatory factor analysis are used to test and analyze the collected data and the scale of cold chain logistics service quality and customer satisfaction are revised. The revised cold chain logistics service quality scale contains 17 items, and the revised

customer satisfaction measurement scale contains 7 items. The revised scale has good reliability and validity, common factors exist among variables. It is suitable for the use of factor analysis, and each indicator can effectively reflect its corresponding factors.

TABLE II. RELIABILITY TEST RESULTS OF EACH INDICATOR

	reliability	timeliness	Service quality	Informativeness	economy	Service flexibility	Perceived quality	Perceived value	Perceived expectation	Customer Satisfaction
A coefficient	0.193	0.822	0.842	0.787	0.653	0.932	0.753	0.678	0.651	0.726

SPSS20.0 was run to conduct descriptive statistical analysis, and the correlation coefficient between cold chain logistics service quality, customer satisfaction and each dimension variable was obtained (see Table III). The hypothesis test results of the correlation coefficient show that at the significance level of 0.01, any two groups of variables

have passed the significance test, and there is a high level of correlation between the two variables. Based on this, a structural equation model can be built to explore the mechanism of each index on the service quality and customer satisfaction of cold chain logistics.

TABLE III. CORRELATION ANALYSIS OF EACH VARIABLE

	reliability	timeliness	economy	Informativeness	Service flexibility	Perceived quality	Customer Satisfaction	Perceived value
Reliability	1							
Timeliness	570	1						
Economy	458	551	1					
Informativeness	583	493	505	1				
Service flexibility	573	463	330	547	1			
Perceived quality	482	340	445	366	251	1		
Customer satisfaction	503	358	274	319	372	615	1	
Perceived value	657	475	421	410	377	437	355	1

### B. Inspection and discussion of structural model

It can be seen from table III that there is correlation between perceived quality, customer expectation and perceived value, which indicates that there may be higher-order factors with more explanatory power. Therefore, three factors of customer satisfaction are taken as first-order endogenous latent variables and customer satisfaction as second-order endogenous latent variables. Since the five factors of cold chain logistics service quality are also correlated with each other, five factors of cold chain logistics service quality are taken as the first-order exogenous latent variables and cold chain logistics service quality as the second-order exogenous latent variables to construct the relationship model of cold chain logistics service quality and customer satisfaction.

The Amos Output value of the initial measurement model of the relationship between service quality and customer satisfaction shows that the absolute fitness indexes, MRR value and RMSEA value, are all greater than 0.05, which are not within the scope of the fitness index inspection standard. Therefore, the model needs to be revised. Through the

correction index, all the fitting indexes of the modified model meet the excellent standard, and the data fit well with the model. By running AMOS2.0, the standardized path coefficient of the model is 0.95 and the significance level is more than 0.001, indicating that the service quality of cold chain logistics can predict customer satisfaction to a large extent.

### V. STRATEGY TO IMPROVE THE SERVICE QUALITY OF FRESH AGRICULTURAL PRODUCTS COLD CHAIN LOGISTICS

Consumers in Shandong province in this paper, based on the sample survey data, using SPSS and SEM affecting the cold chain logistics service quality and its influencing factors of customer satisfaction analysis, draw the following conclusion: the economic impact on the quality of cold chain logistics service are the most significant, customers tend to through the cold chain logistics price to directly evaluate the quality of service; From the perspective of customers, timeliness and informality have the same path coefficient for cold chain logistics service quality, and that is, they have the

same impact on cold chain logistics service quality. Compared with service flexibility, reliability indexes such as goods soundness and correctness can affect customers' perception of cold chain logistics service quality. The path coefficient of cold chain logistics service quality to customer satisfaction is 0.95. Therefore, cold chain logistics service quality can predict customer satisfaction to a large extent.

Considering the above conclusions, we give the following Suggestions to improve the service quality of fresh agricultural products cold chain logistics.

*Firstly, to integrate logistics resources, and to improve the economy of cold chain logistics:*

The economy of cold chain logistics service is an intuitive means for customers to evaluate the quality of cold chain logistics service, which determines the level and scope of service and determines the choice of customers. To provide cost-effective logistics services is the key to enterprise competitiveness. Fresh produce producers' core business is to provide quality products, and it is difficult to do both cold chain logistics. Therefore, they need to rely on third-party cold chain enterprises that can provide complete low-temperature services to achieve the purpose of integrating logistics resources [11].

*Secondly, to build a cold chain logistics information platform, and to improve the level of cold chain logistics information:*

The timely and accurate logistics information system can make customers inquire the transportation status of fresh agricultural products in real time, meet the customers' perception expectation of cold chain logistics information sharing, and improve customer satisfaction. Therefore, enterprises should pay attention to the construction of cold chain logistics information platform, timely introduce new information equipment and technology, strengthen the daily maintenance of information system, speed up the information processing speed of order processing, delivery process and return process, improve the error information feedback mechanism, and improve the after-sales service level.

*Thirdly, to optimize the return process and enhance the timeliness of cold chain logistics:*

On the one hand, the core of cold chain logistics should be to improve the advanced cold chain logistics equipment, ensure the quality of fresh agricultural products transportation, and reduce the rate of return. On the other hand, when returning goods, enterprises should add a variety of ways to meet the personalized needs of customers. In addition to optimizing the return process, cold chain logistics enterprises should also pay attention to order response time, return delay time and other timeliness indicators. Strengthen the development and innovation of information technology, so that it can process order information in a timely manner, update logistics information in a real-time manner, and provide refund information to customers quickly after the return of goods, so as to avoid the decline of customer satisfaction caused by asymmetric information [12].

*Fourthly, to strengthen personnel training, to ensure product transportation, and to improve the reliability of cold chain logistics and service flexibility:*

The reliability of cold chain logistics is the basic requirement of logistics service. The reliable refrigeration equipment and the correct and non-destructive demand of fresh agricultural products are the key to win customer satisfaction and enhance customer purchasing desire. The reliability of cold chain logistics determines the delivery time and mode, which is the important premise of flexible service of cold chain logistics, and also the core of the whole logistics system. In order to improve the level of super cold chain logistics, it is necessary to transform or replace the old cold chain logistics equipment on a large scale. At the same time, an equipment monitoring team should be set up to establish files for cold chain logistics facilities and equipment, so as to use the equipment scientifically and improve its use efficiency. Market competition requires that the cold chain logistics services provided by enterprises must be all-directional, whole-process and diversified, so enterprises should pay attention to the cultivation of personnel quality and the improvement of technical ability.

## VI. SUMMARY

In this paper, through a structural equation model of cold chain logistics service quality evaluation system of each index is analyzed, the structure shows economic impact on the quality of cold chain logistics service is most significant, timeliness and informative for cold chain logistics service quality with the same strength, the influence of relative to the flexible service, such as the goods in good condition right reliability index can affect customer perception of cold chain logistics service quality. These conclusions can not only provide a scientific basis for customers to choose cold chain logistics companies, but also provide a certain reference for the direction of improving cold chain logistics service, so it has a certain practical guiding significance for both customers and cold chain logistics enterprises.

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