



Multi-Criteria Decision Making for Affecting the Logistics Service Quality of JD Fresh Cold Chain

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Abstract. Fresh cold chain logistics plays a unique role in effectively ensuring the freshness and safety of food. However, the service quality of fresh cold chain logistics is often criticized by consumers. Especially for well-known logistics enterprises such as JD Group in mainland China, the quality of logistics services has a very important impact on the competitiveness of their industries. This study proposes a service quality improvement scheme. The service quality of JD Fresh Cold Chain Logistics is evaluated by combining the multi-criteria decision-making models of DELPHI, DEMATEL and IPA, while improving shortcomings to meet customer needs. The DELPHI method can establish a standard framework, and the DEMATEL method can establish an impact network relationship diagram to analyse the interrelationship between the guidelines, and then obtain a much-needed service quality pointer according to the IPA. From the perspective of consumers, empirical results show that “freshness of products”, “convenience of returns and exchanges”, “convenience of payment methods”, and “convenience of pickup” are key criteria. Among them, “freshness of products” plays the role of the source, indicating that JD Group should prioritize management based on this criterion, develop optimization plans in a timely manner, and improve quality. The research results aim to provide reference for similar enterprises to improve the overall logistics service quality, in order to seek to enhance competitive advantages, thereby better enhancing consumer satisfaction and serving society.

Keywords: Fresh cold chain logistics, Service quality, DELPHI, DEMATEL, IPA.

1 Introduction

With the improvement of people’s living standards, the demand for fresh goods is increasing, and due to the particularity of their own storage, the importance of quality assurance is self-evident. The “Internet + New Retail” model has promoted the rapid development of fresh e-commerce, and consumers have higher and higher requirements for product quality and logistics service quality. The average complaint rate of domestic logistics service quality in 2022 was 3.08%, while the complaint rate of logistics service quality of JD Logistics in 2022 was 3.49%. So far, the logistics ser-

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vice problem of fresh cold chain has become more and more important, and the quality improvement of all links of logistics services has attracted more and more attention from fresh e-commerce enterprises.

This study takes JD Logistics Group as the research object and adopts a multi-criteria decision-making method to build a JD fresh cold chain logistics service quality evaluation pointer system. Use the DEMATEL method to establish an impact network relationship diagram, explore the interrelationship between the quality pointers of fresh cold chain logistics services, and then combine it with IPA to obtain the key criteria of “extremely needed improvement” and propose corresponding ways to improve.

Based on the above research background and motivation, this study hopes to achieve the following objectives through the research:

(1) Establish a multi-criteria evaluation framework for the quality quota of JD fresh cold chain logistics services. (2) Analyse the key factors of JD fresh cold chain logistics service quality, and put forward optimization suggestions through importance and performance value. (3) The analysis results and optimization suggestions of this study are provided to the same type of enterprises to improve the quality of logistics services.

2 Evaluation attributions of the logistics service quality

In the logistics industry, logistics services play a crucial role, and the defects of service quality factors will affect the performance and customer satisfaction of enterprises [1]. Zheng Ting-ting [2] believes that logistics service quality refers to the ability of enterprises to provide a series of logistics services, including transportation, distribution, storage, and inventory, to meet customer requirements, which can ensure that the correct quality of goods is delivered at the right time and in the right state, so as to improve customer satisfaction and loyalty [3].

The advantages and disadvantages of logistics services can often be reflected from the perceived feedback of customers. In today's huge competitive pressure in the logistics industry, the higher the customer's satisfaction with logistics services, the more beneficial it is to the development of the enterprise. How can enterprises provide better logistics services? The first thing to do is to understand the customer's experience of enterprise logistics services. On the basis of customer perception, understand the advantages and disadvantages of your existing logistics services, and make adjustments accordingly. Therefore, this study focuses on the relevant indicators of logistics service quality, refers to the discussions of scholars, and develops and constructs a preliminary research framework for the service quality of JD fresh cold chain logistics, as shown in Table 1.

Table 1. Research on the Related Factors of Fresh Cold Chain Logistics Service Quality

Dimension	Criterion	Source
Tangibles	Equipment specialization	[4]; [5]; [6]
	Packaging specialization	[5]; [7]; [8]
	Product freshness	[7]
	product consistency	[6]
Convenience	Convenient payment method	[8]
	Convenient return and exchange	[8]
	Reasonable delivery fee	[6]
	Convenient pickup	[9]
Economy	Reasonable return and exchange fees	[8]
	Cost performance	[8]
Responsiveness	Timeliness of order processing	[6]; [9]
	After-sales service response	[4]; [6]
	Customer service response	[6]; [9]
	Convenient communication	[4]
Reliability	Personnel reliability	[4]; [6]
	Timeliness rationality	[6]
	Delivery specifications	[4]
	Accurate logistics information	[4]

3 Research methods

Delphi, also known as expert investigation, is a research method for group decision-making. Deng Zhen-yuan [10] points out that Delphi’s method is based on the experience, intuition and value of experts, and conducts research on a specific problem through a group of 10-15 experts.

Decision Making Trial and Evaluation Laboratory (DEMATEL) is the main factor in identifying complex systems, simplifying the system structure analysis process and proposing methods. The flow chart of this study is shown in Figure 1.

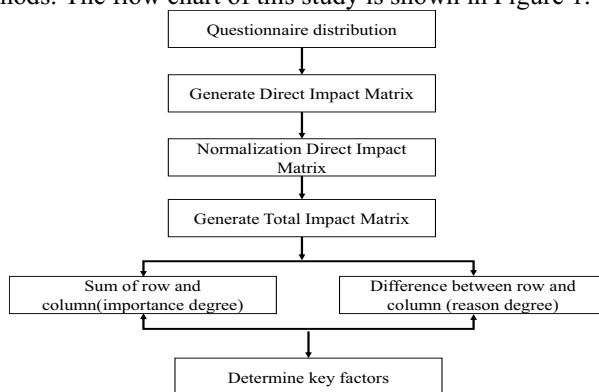


Fig. 1. Formal research architecture diagram

Through the analysis of each criterion factor, the method transforms the complex impact relationship between factors into an easy-to-understand structural relationship, and then classifies each factor as a cause class and a result class, and calculates the degree of influence between the factors [11].

The Importance-Performance Analysis (IPA) Model is an important performance analysis, which is measured by technologies such as importance, performance and location to evaluate the relevant attributes of the selected commodity. In 1977, this model was analyzed by Martilla and James [12] on the performance of dealers. This model can evaluate the advantages and disadvantages of products or services and propose improvement measures by comparing the gap between users' perceived importance of products or services and their actual performance, ultimately helping enterprises achieve optimal resource allocation. Figure 2 shows the importance performance analysis model diagram.

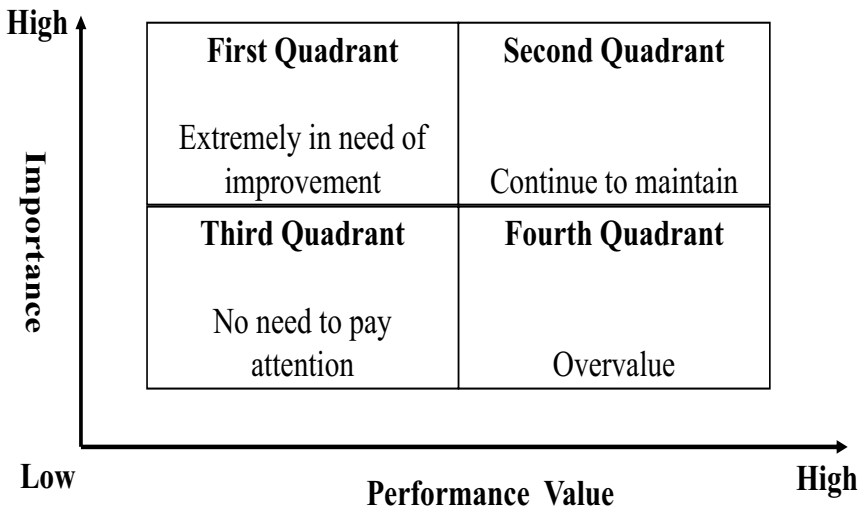


Fig. 2. Importance Performance Analysis Model.

4 An empirical case analysis for improving the logistics service quality

According to the above-mentioned reference expert group interview, it is recommended to add, subtract, delete and modify the prototype structure of the structure and guidelines given by the expert group. This study finally formed a total of 4 frames and 10 criteria of the formal structure, as shown in the figure 3.

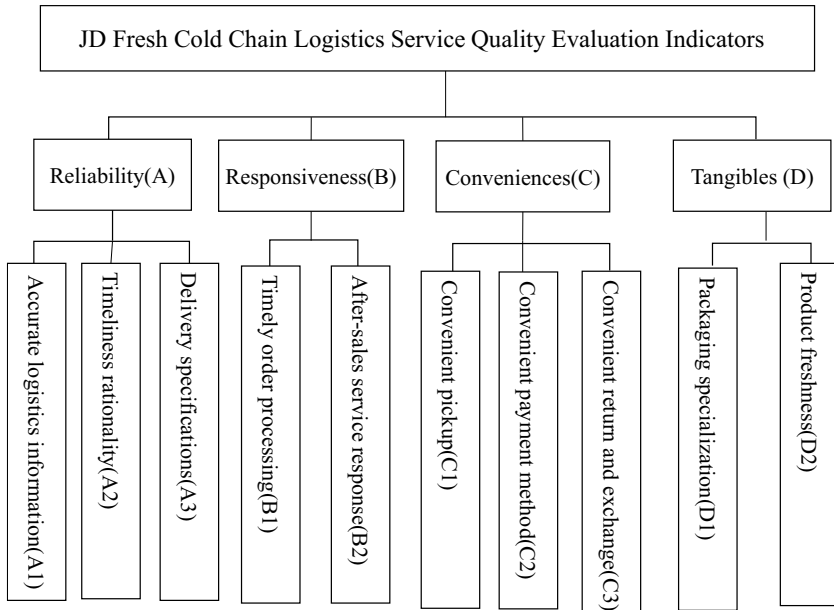


Fig. 3. Formal research architecture diagram.

The questionnaire design of this study refers to the decision-making laboratory method. The correlation of the degree of interaction between the questionnaire design survey criteria is given, and the scoring scale refers to the three-point scale, so the degree of interaction between the three scores of 0, 1 and 2 is used to distinguish the degree of interaction between the factors. A total of 70 valid questionnaires were finally recovered. After calculation, the total impact relationship matrix can be obtained. According to the total impact matrix, the importance D+R and the cause degree D-R can be obtained, as shown in Table 2.

Table 2. Importance and Causality of Criteria.

Z	Impact degree	Affected degree	Importance degree	Ranking	Reason degree
D2	16.945	5.059	11.673	1	11.886
D1	11.681	5.643	11.495	2	6.038
C3	8.825	6.82	12.14	3	2.005
C2	7.145	7.599	12.574	4	-0.454
C1	6.002	7.989	13.382	5	-1.987
B2	5.485	7.897	13.991	6	-2.412
B1	4.501	8.073	14.747	7	-3.572
A3	4.072	8.068	15.645	8	-3.996
A1	3.826	7.847	17.324	9	-4.021
A2	4.004	7.491	22.004	10	-3.487

The greater the importance indicates that the more important the criterion is. For example, the importance of the freshness of the product is 22.004, and the importance of the rationality of timeliness is 11.495. Therefore, this study believes that the freshness of the product is more important than the rationality of the timeliness for consumers. According to Table 2, the criterion on the whole is the classification characteristics of “cause” or “result”, which is usually determined according to the degree of cause D-R. If D-R is positive, it tends to be “cause” (causing factor), indicating that this criterion tends to “influencing other criteria”. The larger the value is, the more likely Make improvements. If D-R is negative, it tends to be a “result” (result factor), indicating that this criterion tends to be “affected by other criteria”. The larger the negative value, the greater the impact of other criteria. The causal characteristics of the summary criteria are classified as shown in Table 3.

Table 3. Importance and Causality of Criteria.

Characteristic	Criteria
Cause (Tendency influences other criteria)	Accurate logistics information(A1)、 Delivery specifications(A3)、 Timely order processing(B1)
Result (Tendency to be influenced by other criteria)	Product freshness(D2)、 Packaging specialization(D1)、 Convenient return and exchange(C3)

The focus of this study is to optimize the quality of cold chain logistics services through key factors and source management analysis. Therefore, in order to better clarify the relationship between key factors, we only need to retain the key factors for analysis [13]. Draw a causal diagram according to the interrelationship of the criteria in the total impact matrix Z, as shown in Figure 4. According to the causal chart, because the D-R difference of “Product Freshness D2” is 11.886, indicating that it highly affects other criteria, which is an impact factor, which is more suitable as the source of improving the performance of all key factors, and is reasonable in practice. Therefore, it is finally confirmed that “Product Freshness D2” is the source of improvement.

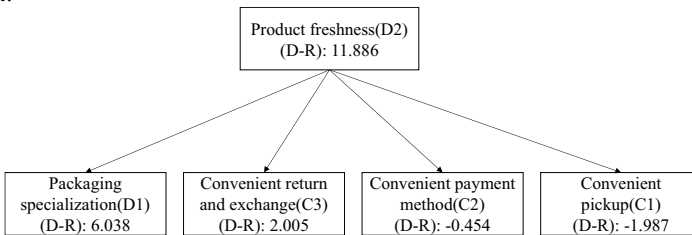


Fig. 4. Causality diagram between key criteria

This study draws an importance-performance analysis chart based on the importance of the criterion and the performance value, as shown in Figure 5. It can be seen from the figure that “Packaging Professional D1” is a criterion with high importance and good performance. Consumers recognize it, and JD.com should continue to maintain it. “After-sales service response B2”, “Distribution specification A3” and

“Logistics consultation accuracy A1” are the criteria for good performance but low importance. Consumers recognize that JD may pay too much attention to these factors, it is necessary to consider whether to adjust the allocation of resources; “Order processing timeliness B1” and “delivery time reasonableness A2” are the criteria with high importance and poor performance. At present, JD does not need to pay too much attention to the improvement of such guidelines; and “product freshness D”, “Convenience for return and exchange C3”, “Convenient payment method C2” and “Convenience for pick-up C1” are the criteria with high importance but poor performance, JD should improve it as soon as possible to improve consumer satisfaction, so as to obtain consumers’ recognition and willingness to repurchase.

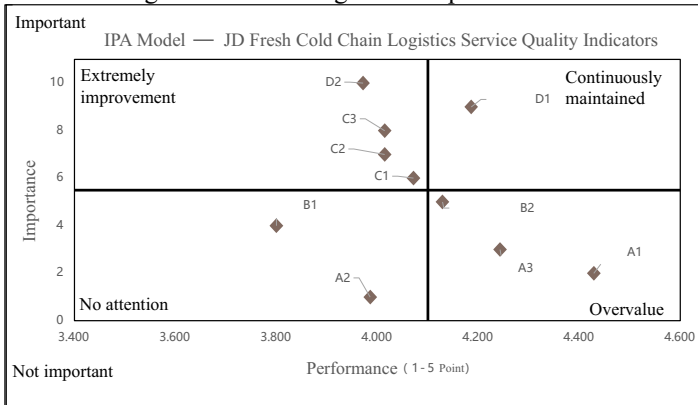


Fig. 5. Importance-Performance Matrix.

5 Conclusion

The 21st century is a service-oriented era, and the role of service quality in attracting and retaining customers should not be underestimated. The quality of fresh cold chain logistics service plays a vital role for fresh cold chain enterprises to maintain their competitive advantage and improve their performance. “Product freshness” is the source index. Based on this source analysis, we can clarify the subordinate relationship of many factors, so as to find the root cause of the problem, and then take this as the starting point to seek improvement strategies to help effectively solve the problem and better promote the sustainable development of the enterprise. Therefore, this study puts forward the following optimization suggestions:

- (1) Update and establish a system that can identify the freshness of products through microorganisms, screen the fresh products flowing into the market, and disclose the data on the product label.
- (2) Improve the cold chain equipment and system rules, manufacture products to adapt to the refrigeration environment, and cooperate with other cold chain logistics merchants to form a relatively complete and controllable supply chain system.
- (3) Select the display equipment according to the temperature requirements of fresh products. Changeable items should be stored and distributed at medium and low

temperatures in a fresh-keeping cabinet, for example, refrigerated products stored at about 0°C, and freeze-dried products stored at about -18°C.

The quality of logistics services has an important impact on customer satisfaction, customer loyalty, market share, and corporate profits. Therefore, improving the quality of logistics services is the core element for enterprises to establish brand image and enhance competitiveness. They should never avoid actively meeting customer needs by providing better and better logistics services.

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