Research on service quality evaluation method of cold chain logistics of agricultural products based on key control points

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Abstract. Based on the idea of key control points, the evaluation model of cold chain logistics service quality of fresh agricultural products is constructed. Based on the analysis of the characteristics of cold chain logistics of fresh agricultural products, combined with SERVQUAL model and LSQ model, four key control points of service quality of cold chain logistics of fresh agricultural products are selected, and the fuzzy comprehensive evaluation method is used to analyze the evaluation examples. The results show that the method is effective.

1. Introduction
In recent years, e-commerce of fresh agricultural products has developed rapidly. Because fresh agricultural products are perishable and vulnerable, they need to be stored or transported at a certain temperature to ensure their quality. The key to the development of e-commerce of fresh agricultural products lies in cold chain logistics, which is also an important node to ensure food safety. In the increasingly competitive e-commerce market of fresh agricultural products, the service quality of cold chain logistics is an important factor to improve consumer satisfaction and competitiveness of e-commerce enterprises[1-6]. Therefore, this paper chooses the cold chain logistics service quality of fresh agricultural products as the research object, and tries to build a set of evaluation methods suitable for the cold chain logistics service quality of fresh agricultural products under the background of e-commerce.

2. Concept of key control points
Key control points (CCP) originated from management. For simple business activities, management personnel can control through personal observation of work. However, for complex business activities, it is usually impossible for executives to observe everything in person. Instead, they must select some key control points and pay special attention to them. With all kinds of information given by these key control points, managers at all levels can ensure the implementation of the whole organization plan without knowing every detail of the plan in detail. The "key control points" in management are set to facilitate the effective control of business activities by managers.

It is necessary to set up "key control points" for the complex work of cold chain logistics service quality evaluation of fresh agricultural products, which is helpful for the implementation of logistics service quality evaluation. According to the characteristics of cold chain logistics of fresh agricultural products, the "key control points" are defined as the activities that play a key role in the whole cold chain logistics service process and ensure the effective operation of the whole logistics work. The so-called "play a key role" means that these work nodes are not only related to the success or failure of a
certain link of logistics service, but also to the success or failure of the whole logistics work; there are guidelines to realize the specific logistics process, which means that these work nodes must be controllable, and there are objective procedural standards to guide the logistics service evaluation work.

3. Selection of key control points for service quality evaluation

3.1. Selection principle
Cold chain logistics activities of fresh agricultural products usually need to meet the following conditions to be selected as the key control points: ① It must first ensure the quality and safety of fresh agricultural products; ② It must reflect the timeliness of product distribution; ③ It must take into account the high requirements of fresh agricultural products for logistics facilities, equipment and cold chain technology; ④ The selected indicators must be representative and operable, and it should be easy to measure and evaluate.

3.2. Selection method
When analyzing the key control points of cold chain logistics of fresh agricultural products, it mainly uses the elements of SERVQUAL model and LSQ model for reference. Based on the key requirements of cold chain logistics of fresh agricultural products for quality, the logistics service quality in LSQ model is retained; based on the high requirements of cold chain logistics of fresh agricultural products for timeliness, the timeliness in LSQ model and the responsiveness of SERVQUAL model are retained and combined into responsiveness; based on the high requirements of cold chain logistics of fresh agricultural products for product reliability and information operation correctness, the reliability and assurance in SERVQUAL model are combined into reliability; the empathy and tangibility in SERVQUAL model refer to the feelings of customers in the process of logistics service, which are combined into customer perception. The availability in LSQ model has little relation with cold chain logistics, so it is deleted. Therefore, four key control points can be determined for cold chain logistics service quality evaluation of fresh agricultural products: key control point A is service quality, key control point B is responsiveness, key control point C is reliability, and key control point D is customer perception.

4. Service quality evaluation model of cold chain logistics of agricultural products based on key control points
Starting from the service quality of cold chain logistics of fresh agricultural products, taking the characteristics of cold chain logistics of agricultural products, SERVQUAL model and LSQ model as reference points, selecting quality, responsiveness, reliability and customer perception as the key control points to measure the service quality, and then using the expert judgment method and the experience of experts, comprehensively considering the characteristics of cold chain logistics of fresh agricultural products and the principle of index selection, 13 evaluation indexes are selected, including commodity operation quality, commodity integrity, order response time, distribution punctuality, return and exchange processing time, complaint processing time, special case delay time, temperature control, distribution accuracy, distribution flexibility, information level, distribution personnel status and personalized service. Therefore, the evaluation index system is as shown in Figure 1.

4.1. Quality evaluation index system of key control point A
According to the requirements of cold chain logistics service quality of fresh agricultural products, we select the secondary indicators of quality as: Commodity Operation Quality and commodity integrity.

① Commodity operation quality
The operation quality of goods is to measure whether the delivered goods are consistent with the goods purchased by customers in terms of quantity and type.

② Goods intactness
The intactness of the goods is a measure of whether the goods received by the customer and the outer packaging are intact.

4.2. Quality evaluation index system of key control point B
According to the requirements for responsiveness of cold chain logistics of fresh agricultural products, we select the secondary indicators of responsiveness as: order response time, delivery punctuality, return and exchange processing time, complaint processing time and special case delay time.

① Order response time
Order response time refers to the time from the customer's order to the merchant's delivery.

② Delivery punctuality
Delivery punctuality is an important indicator to measure whether the business can deliver the goods to the customers according to the promised time.

③ Return and exchange processing time
Return and exchange processing time is to measure the processing time of return, exchange or damage.

④ Complaint handling time
Complaint handling time refers to the handling time after the merchant receives the customer complaint.

⑤ Special case delay time
Special circumstances refer to the delay time of delivery by merchants in important holidays, severe weather or emergency.

4.3. Quality evaluation index system of key control point C
According to the reliability requirements of cold chain logistics of fresh agricultural products, we select the secondary indicators of reliability as: temperature control, distribution accuracy, distribution flexibility, and information level.

① Temperature control
The research object of this paper is cold chain fresh agricultural products, so the strict control of temperature plays an important role in ensuring the quality of products.

② Distribution accuracy
Distribution accuracy refers to whether the location and goods of logistics distribution are consistent with the customer's reservation. Distribution accuracy will directly affect customer satisfaction.

③ Distribution flexibility
The flexibility of delivery includes the flexibility of delivery mode, delivery time and delivery form. The flexibility of distribution mode refers to whether businesses can provide customers with multiple distribution modes to meet the needs of different customers. Delivery time flexibility refers to whether customers can flexibly choose the delivery time of goods according to their own needs, such as delivery on the same day, delivery on the next day, etc. The diversity of picking up forms refers to the diversity of picking up forms provided by merchants, such as store self delivery, door-to-door delivery, delivery to designated outlets, etc.

④ Information level
The degree of informatization includes information adequacy, information accuracy, information timeliness and error information feedback. Among them, information sufficiency refers to whether the logistics information provided by the business is sufficient, such as price, delivery time and delivery mode; information accuracy refers to whether the logistics tracking information provided by the business is accurate; information timeliness refers to whether the business can update the logistics information of the order in time, so that the customer can track the logistics status change of the order in real time; error information feedback refers to whether the business can feedback error information to customers in time.
4.4. Quality evaluation index system of key control point D

According to the requirements of cold chain logistics for fresh agricultural products on customer perception, the second level indicators are selected as: distribution personnel status and personalized service.

① Distribution personnel status
The status of distribution personnel includes clothing, service attitude and service standardization. Among them, the clothing of the distribution personnel refers to whether the clothing of the distribution personnel is clean and tidy; the service attitude of the distribution personnel refers to whether the service of the distribution personnel is polite; the service standardization refers to whether the distribution personnel can complete the service according to the operating procedures.

② Personalized service
Personalized service refers to whether businesses can provide personalized logistics services according to the special requirements of customers.

5. Case study

5.1. Quality evaluation value of key control points
For the three logistics companies a, B and C, based on the quality evaluation index system of the above key control points a, B, C and D, the quality evaluation values of the four key control points of the three logistics companies are obtained by comprehensive use of statistical methods, evidence theory methods, fuzzy methods and expert evaluation methods, which may be assumed as shown in Table 1.

| Logistics company | Key control point A | Key control point B | Key control point C | Key control point D |
|-------------------|---------------------|---------------------|---------------------|---------------------|
| A Logistics company | 0.80                | 0.90                | 0.70                | 0.70                |
| B Logistics company | 0.70                | 0.70                | 0.75                | 0.60                |
| C Logistics company | 0.92                | 0.85                | 0.95                | 0.85                |

5.2. Synthesis of quality evaluation value
It may be assumed that the weights of key control points of logistics activities given by experts are shown in Table 2.

| Index | Key control point A | Key control point B | Key control point C | Key control point D |
|-------|---------------------|---------------------|---------------------|---------------------|
| weight | 0.3 | 0.3 | 0.2 | 0.2 |

Therefore, the comprehensive service quality of three logistics companies can be easily obtained by using the above model:

Logistics company 1 \( Q_1 = 0.80^{0.3} \times 0.90^{0.3} \times 0.70^{0.2} \times 0.70^{0.2} = 0.77 \)

Logistics company 2 \( Q_2 = 0.70^{0.3} \times 0.70^{0.3} \times 0.75^{0.2} \times 0.60^{0.2} = 0.69 \)

Logistics company 3 \( Q_3 = 0.92^{0.3} \times 0.85^{0.3} \times 0.95^{0.2} \times 0.85^{0.2} = 0.89 \)

5.3. Result analysis
If the Q value of cold chain logistics service of fresh agricultural products is greater than 0.85, the service results meet the requirements. According to the above example analysis, logistics company 1 and logistics company 2 do not meet the requirements, only logistics company 3 meets the requirements.
6. Conclusions
Reasonable and good cold chain logistics service quality evaluation of fresh agricultural products is helpful to improve consumer satisfaction and competitiveness of e-commerce enterprises. Starting from the idea of key control points, several important activities in the process of logistics service quality evaluation are selected as the evaluation benchmark. On this basis, a comprehensive application of a variety of evaluation methods provides a way for service quality evaluation.

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