An Empirical Study on the Exploration of Factors Influencing Customer Satisfaction in Logistics Distribution Service

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Abstract. In order to solve the problem of lacking quantitative description method for customer satisfaction of logistics distribution service, based on the China Customer Satisfaction Index model, the three core influencing factors named perceived service quality, expected service quality and brand image were respectively set up with second-level measurement indicators, to explore its impact on customer satisfaction and loyalty, and then construct a customer satisfaction evaluation model for logistics distribution service. The second-order structural equation model is used to analyze the quantitative relationship among the influencing factors, between satisfaction and loyalty, and the effect of each influencing factor on the customer satisfaction of logistics distribution service. Finally, the model is applied to the case analysis of residents in the main urban area of Chongqing. The results show that the perceived service quality (0.63***), and perceived service cost (-0.40***), have the most significant impact on the customer satisfaction of logistics distribution service. Customer satisfaction plays a decisive role in customer loyalty (0.78***).

1. Introduction
With the rapid development of Internet information technology, the number of Chinese netizens and online shopping users continues to grow, and the scale of e-commerce continues to expand. The volume of express delivery business across the country in 2019 exceeded 60 billion pieces, and the cumulative revenue of express delivery business exceeded 750 billion yuan. The express logistics companies handle an average of 170 million packages per day, and 540 million packages per day during the peak period. The logistics distribution industry has shown a blowout development.

In the early days of e-commerce logistics development, logistics companies often adopted a price competition model dominated by low-end service, and this has led to inaccurate logistics information, loss of express mail, and improper service attitude of staff. Such problems have become a key obstacle for major logistics companies to improve service quality. In recent years, many logistics companies have gradually changed to adopt a quality competition model that pays more attention to customer service experience, but it has been accompanied by the increase in freight rates. Carrying out customer satisfaction research on logistics distribution service can improve the level of logistics distribution service in a targeted manner, and improve the customer's actual feelings of service.

2. Literature Review
In recent years, domestic and foreign research on the satisfaction of logistics distribution service is mainly to explore the conception of the influencing factors of satisfaction, but there is a lack of analysis on the quantitative relationship between influencing factors. Tontini et al. have found that security, reliability, flexibility and other factors have a non-linear effect on customer satisfaction and loyalty of...
third-party logistics distribution service\cite{1}. Rabinovich et al. believe that the quality of express logistics service is a key factor affecting B2C customer satisfaction\cite{2}. Shashank et al. found that logistics distribution costs and service quality are the key factors that affect customer satisfaction and loyalty\cite{3}. For the logistics distribution service satisfaction evaluation, the fuzzy comprehensive evaluation method and the entropy weight method are mainly used. The method of assigning the weight of each factor is open to discussion, and it can't accurately quantify the relationship between the influencing factors and the satisfaction. Vlachos established a conceptual model of third-party logistics (3PL) enterprise customer satisfaction\cite{4}. Wang Xin combined the entropy weight method and the fuzzy comprehensive evaluation method to build an evaluation index system for the service quality of express delivery enterprises\cite{5}. The theoretical models built by existing research institutes at home and abroad lack corresponding empirical analysis. Based on the Chinese Customer Satisfaction Index model, this paper builds a evaluation model of logistics distribution service customer satisfaction. The quantitative relationship among the influencing factors is verified by structural equation model, which provided theoretical support for improving the quality of logistics distribution service from the perspective of improving the actual customer experience.

3. Methods

3.1. Research hypothesis

The Chinese Customer Satisfaction Index (CCSI) was jointly proposed by the China Institute of Standardization and Tsinghua University in 2002\cite{6}, which pointed that customer satisfaction depends on the comparison of the expected quality and perceived quality of products or service and the joint effect of corporate brand image. It has been widely used in various research fields such as sociology and management\cite{7}. This paper combines Grönroos's Perceived Service Quality Theory\cite{8} and the service characteristics of the logistics distribution system, and further extended the perceived quality and expected quality in the CCSI model to perceived service quality and expected service quality. Based on the existing path relationship of the CCSI model, this paper proposes research hypotheses H1~H6. Considering that the customer satisfaction of logistics distribution service is more concerned with exploring whether the effect of its influencing factors is quality wins or price lead, this paper replaces perceived value which in the CCSI model with perceived service quality and perceived service cost. It directly explores the impact of quality and price on customer satisfaction, and proposes research hypotheses H7. The research hypothesis path relationship is shown in Figure 1.

![Figure 1. Research hypothesis](image)

3.2. Variable measurement

In order to quantitatively describe the latent variables in the model, first-level measurement indicators and second-level measurement items were established for perceived service quality, expected service quality, and brand image, respectively. The 5-point Likert scale was adopted in this study to measure the latent variables that cannot be directly observed in the model. The specific variable measurement items are detailed in Table 1.
### Table 1. Variable measurement items

| Latent variable | First-level measurement index | Item No. | Second-level measurement item |
|-----------------|-------------------------------|---------|------------------------------|
| Expected Service Quality (EQ) | Public Reputation (EQ1) | E1 | Evaluation of logistics distribution service by the surrounding people |
|                  |                                | E2 | Evaluation of logistics delivery service by internet |
|                  |                                | E3 | Evaluation of Logistics Distribution Service by the traditional media |
|                  | Personal Needs (EQ2)           | E4 | Demand for the speed of logistics service |
|                  |                                | E5 | Demand for the integrity of the goods |
|                  | Past Experience (EQ3)          | E6 | Demand for accuracy (time, location) of logistics service |
|                  |                                | E7 | The experience of self-operated logistics such as Jingdong and Suning |
|                  |                                | E8 | The experience of third-party logistics companies such as SF Express and YTO Express |
| Perceived Service Quality (PQ) | Information Service Quality (PQ1) | P1 | The convenience of logistics information query |
|                  |                                | P2 | Accuracy of logistics information update |
|                  |                                | P3 | Timeliness of delivery information prompt |
|                  | After-sales Service Quality (PQ2) | P4 | Processing of order errors |
|                  |                                | P5 | After-sales service situation of cargo damage |
|                  | Delivery Service Quality (PQ3)  | P6 | Service situation of returned goods (secondary delivery) |
|                  |                                | P7 | Speed of goods delivery |
|                  |                                | P8 | Goodness of delivery |
|                  |                                | P9 | Accuracy of cargo delivery location |
| Brand Image (BI) | Cognitive Image (BI1)          | B1 | Public awareness |
|                  |                                | B2 | Consumer trust |
|                  |                                | B3 | The degree of influence on the choice of logistics company |
|                  | Service Image (BI2)            | B4 | Image of cargo delivery personnel |
|                  |                                | B5 | Image of goods distribution packaging |
|                  |                                | B6 | Image of goods collection outlets |
|                  | Social Image (BI3)             | B7 | Contributions in providing current logistics service |
|                  |                                | B8 | Contribution in improving the future logistics service |
|                  |                                | B9 | Contributions in dealing with contamination of express packaging |
| Perceived Service Cust (PC) | PC1 | PC1 | Cost-effectiveness of logistics service |
|                  |                                | PC2 | Service cost for second delivery of goods (returns and exchanges) |
|                  |                                | PC3 | In the case of rising prices, the perception of current service prices |
| Customer satisfaction (CS) | CS1 | CS1 | Satisfaction with information service |
|                  |                                | CS2 | Satisfaction with after-sales service |
|                  |                                | CS3 | Satisfaction with delivery service |
|                  |                                | CS4 | Satisfaction with overall service level |
| Customer loyalty (CL) | CL1 | Customer's willingness to continue using next time |
|                  |                                | CL2 | Customer's willingness to recommend others to use |
|                  |                                | CL3 | Customer's emotional investment in logistics enterprises |

#### 3.3. Model solution and quality test

The structural equation model was used to quantitatively describe the causality and the impact of variables on the satisfaction of logistics distribution service and the Mplus software was used to estimate the parameters of the model, and to check the closeness (fitness) of the measured variable covariance matrix generated by the model and the sample covariance matrix. The better fitness the model got, the more accurate the parameter estimation results are.

The fitting test indexes include: Chi-square degree of freedom ratio ($\chi^2$/df, also known as standard chi-square), Root Mean Square Error of Approximation (RMSEA), Comparative Fit Index (CFI), Non-standardized adaptation index (TLI, Tacker-Lewis Index), Standardized Root Mean Square Residual (SRMR). Among them, good model adaptation degree requires $\chi^2$/df to be in the range of (1, 3), RMSEA
and SRMR are less than 0.08, and CFI and TLI are greater than 0.90.

4. Empirical analysis

4.1. Descriptive statistical analysis

Taking the urban residents of Chongqing as the survey object, it conducts a research on the satisfaction of logistics distribution service. In August 2019, the survey issued 600 formal questionnaires in the main urban area of Chongqing. Excluding samples that were not filled in carefully, a total of 508 valid questionnaires were recovered finally, and the effectively recovered rate is 84.67%. For detailed statistical information, see Table 2.

| Characterization | Classification | Sample size (N) | Percentage |
|------------------|----------------|----------------|------------|
| Gender           | Male           | 266            | 52.36%     |
|                  | Female         | 242            | 47.64%     |
| Age              | <18            | 32             | 6.28%      |
|                  | 18-25          | 175            | 34.43%     |
|                  | 26-40          | 204            | 40.06%     |
|                  | 41-60          | 67             | 13.22%     |
|                  | >60            | 31             | 6.01%      |
| Education Level  | High school and below | 103 | 20.35% |
|                  | College degree | 122            | 23.96%     |
|                  | Bachelor’s degree | 193  | 38.09% |
|                  | Master’s degree and above | 89  | 17.60% |
| Average monthly use of logistics distribution service | 0 times | 13 | 2.64% |
|                  | 1-2 times      | 266            | 52.45%     |
|                  | 3-4 times      | 136            | 26.79%     |
|                  | 5 times and above | 92  | 18.11% |

4.2. Reliability and validity analysis

The first-order and the second-order measurement model were respectively verified by factor analysis to obtain the corresponding chi-square value $\chi^2_1$ and $\chi^2_2$, then calculate the target coefficient $T$, $T=\frac{\chi^2_1}{\chi^2_2}=0.97$ (Close to 1.0). This indicates that it is suitable to use the second-order measurement model to simplify the conception, so as to enhance the explanatory ability of the model.

The calculation results of factor loading coefficient of the second-order formal measurement questionnaire are shown in Table 3. The Composite Reliability (CR) value of each latent variable is greater than 0.8, indicating that the internal consistency between the measurement indicators of the same latent variable in the model is good. The factor loading of the first-level measurement index and the second-level measurement item are both greater than 0.7, the Average Variance Extracted (AVE) of each variable is greater than 0.5. So, the model's validity is better. In summary, the model has good reliability and validity, and the calculation results can be accepted.

| Latent variable | First-level measurement index | Factor loading | Second-level measurement item | Factor loading | CR   | AVE   |
|-----------------|-------------------------------|----------------|-------------------------------|----------------|------|------|
| Expected quality of service (EQ) | Public Reputation (EQ1) | 0.842 | E1 | 0.825 |     | 0.859 | 0.670 |
|                  |                               |                | E2 | 0.899 |     |      |      |
|                  |                               |                | E3 | 0.800 |     |      |      |
|                  | Personal Needs (EQ2)          | 0.737          | E4 | 0.785 |     | 0.859 | 0.670 |
|                  |                               |                | E5 | 0.818 |     |      |      |
|                  | Past Experience               | 0.871          | E6 | 0.894 |     |      |      |
|                  |                               |                | E7 | 0.821 |     |      |      |
4.3. Path analysis and hypothesis testing

The calculation results of test indexes about goodness of fit are shown in Table 4. The test indexes are all within the acceptable range, and the model fit degree meets the test standards. The standardized path coefficients reflect the magnitude of the influence between the variables (the negative sign indicates the negative influence). The results of the standardized path analysis of the structural equation model are shown in Figure 2. The impact of each latent variable on customer satisfaction is ranked from the highest to lowest as follows: PQ (0.63***), PC (-0.40 ***), EQ (0.39***), and BI (0.35***). It can be seen that the effect of each influencing factor on customer satisfaction of logistics distribution service is quality win and price second. The effect of brand image and expected service quality on perceived service quality is 0.56(***) and -0.31(***). The most significant effect is customer satisfaction on customer loyalty, and its path coefficient is 0.78(***). The calculation results of the standardized path coefficients between the latent variables are shown in Table 5. It can be seen that the influence relationship between the variables reaches 95% confidence significance (P <0.05), so the seven hypotheses about the latent variables are all established.

| Latent variable | First-level measurement index | Factor loading | Second-level measurement item | Factor loading | CR | AVE |
|-----------------|-------------------------------|----------------|------------------------------|----------------|----|-----|
| Perceived Quality of Service (PQ) | (EQ3) | E8 0.753 | E9 0.840 |
| Information Service Quality (PQ1) | 0.810 | P1 0.830 |
| After-sales Service Quality (PQ2) | 0.827 | P4 0.867 |
| Delivery Service Quality (PQ3) | 0.798 | P7 0.798 |
| Brand Image (BI) | 0.901 | B1 0.746 |
| Service Image (BI2) | 0.879 | B4 0.817 |
| Social Image (BI3) | 0.892 | B7 0.822 |
| Perceived Cust of Service (PC) | | | | | | |
| PC1 0.799 | | | | | | |
| PC2 0.634 | | | | | | |
| PC3 0.848 | | | | | | |
| Customer satisfaction (CS) | | | | | | |
| CS1 0.837 | | | | | | |
| CS2 0.836 | | | | | | |
| CS3 0.854 | | | | | | |
| CS4 0.812 | | | | | | |
| Customer loyalty (CL) | | | | | | |
| CL1 0.862 | | | | | | |
| CL2 0.873 | | | | | | |
| CL3 0.905 | | | | | | |

Table 4. Test results of goodness of fit

| Evaluation Index | χ²/df | RMSEA | CFI | TLI | SRMR |
|------------------|-------|-------|-----|-----|------|
| Criterion        | (1, 3)| <0.08 | >0.90 | >0.90 | <0.08 |
| Test value       | 1.94  | 0.06  | 0.93 | 0.93 | 0.04 |
### Table 5. Path coefficient of structural equation standardized and hypothesis test results

| Hypotheses | Standardized path coefficients | C.R. | P   | Significance | Hypothesis test result |
|------------|--------------------------------|------|-----|--------------|------------------------|
| H1: PQ→CS  | 0.63                           | 8.107| **   | Significant  | H1 Valid               |
| H2: EQ→CS  | -0.39                          | -5.841| **   | Significant  | H2 Valid               |
| H3: BI→CS  | 0.35                           | 4.850| **   | Significant  | H3 Valid               |
| H4: EQ→PQ  | -0.31                          | -4.905| **   | Significant  | H4 Valid               |
| H5: BI→EQ  | 0.56                           | 7.236| **   | Significant  | H5 Valid               |
| H6: CS→CL  | 0.78                           | 10.547| **   | Significant  | H6 Valid               |
| H7: PC→CS  | -0.40                          | -6.210| **   | Significant  | H7 Valid               |

Note: C.R. is the critical ratio, and a C.R. value greater than 1.96 indicates a significance level of 0.05 has been reached; *** denotes P<0.001.

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5. Conclusion

Based on the CCSI model, this paper directly explored the impact of quality and price on satisfaction with perceived service quality and perceived service cost instead of perceived value, constructed a customer satisfaction evaluation model of logistics satisfaction service, and used structural equation model to evaluate the relationship between the measured variables and the latent variables concretely, and then the model was applied to the empirical analysis of residents in the main urban area of Chongqing, the mutual influence relationship in the model was quantitatively verified. It indicates that this model has good applicability to the research field of customer satisfaction in logistics distribution service.

This research has enriched the theoretical analysis methods in the field of customer satisfaction, and has explored the influencing factors of logistics distribution service, which is conducive to the analysis of the e-commerce logistics market environment. It will point out the direction of improving the quality of logistics distribution service for the logistics distribution industry and provide objective reference opinions to issue management policies for the government. However, whether there are significant differences in customer satisfaction of logistics distribution service with different demographic attributes such as age, gender, and education level remain to be further studied.
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