

# *Construction of the "Last Mile" Service Quality Evaluation Index System for E-commerce Logistics*

—Analysis of Questionnaire Based on Consumer Perception

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**Abstract**—The “last mile” of logistics is in the terminal link of the logistics supply chain, which restricts the development of the logistics industry. Studying this link is of great significance for improving the logistics operation level and logistics service level. The “last mile” is also the only part of logistics distribution that can face consumers. Consumers play decisive roles in it, and consumer satisfaction is closely related to consumer’s perception. Using Kaizhou District of Chongqing for empirical research, the paper summarized many indicators that influence the consumer’s perception in the “last mile” of e-commerce logistics based on an in-depth interview and literature review. Employing the exploratory factor analysis, the main indicators of service quality evaluation were obtained. After testing the reliability and validity of the survey data, the 5-dimensional logistics service quality thus, order quality, delivery quality, reliability, personnel quality and product quality evaluation index system which conformed to the Chinese situation is finally revised and constructed. The corresponding suggestions for logistics enterprises were put forward based on the findings.

**Keywords**—Last mile; consumer perception; e-commerce logistics; service quality evaluation

## I. INTRODUCTION

Logistics distribution constitutes an indispensable part of e-commerce, and the “last mile” problem in logistics distribution has received several more attention. In the entire logistics distribution cost, about 30% is spent in the “last mile” link. Many problems such as low distribution efficiency, high distribution cost, and difficulty in distribution still exist. Improving distribution efficiency and service level of the “last mile” link, as well as consumer evaluation to gain competitive advantage for logistics enterprises have become a hot issue that require an urgent solution in the entire logistics industry.

Consumer evaluation is determined by the consumer’s perception. Perceived service quality is a comprehensive judgment or opinion made by the consumer subjective to the quality of the service. The “last mile” is the terminal link of the logistics supply chain. Consumers are the service subjects and play decisive roles in this link. Consumer perception of logistics service quality (LSQ) is mainly based on the service perception of the “last mile” link. Therefore, the service quality of the “last mile” of logistics directly affects

consumers’ judgment and evaluation of the overall service quality. This study explored the components of LSQ from the perspective of consumers’ perception, and constructed 5-dimensions of LSQ evaluation index system using the Chinese situation as a baseline to provide a basis for logistics enterprises to better improve the quality of logistics service.

## II. LITERATURE REVIEW

Mentzer, Gomes & Krapfe as pioneers of the LSQ theory, summarized a proposed three-dimensional measure for quality of service, and pointed out that the process of logistics distribution service should include two aspects thus, physical distribution service and customer marketing service [1]. Parasuraman, Zeithaml & Berry put forward the classic service quality evaluation scale-SERVQUAL model based on the view that, the service quality is the cognitive gap between the customer’s expectations and the actual perceived service [2]. This was considered as an important turning point to measure the quality of service. Based on the previous research and SERVQUAL model, Mentzer, Flint & Kent summarized the influencing components of physical distribution service and the influence components of customer service, and established a customer-oriented logistics service quality LSQ model [3].

Researchers domestically has also contributed to the literature of this field. Peng Runhua, Lin Xiaoxiao & Yang Zhenqing built a terminal logistics service quality evaluation index model based on the SERVQUAL model, and used the analysis hierarchical process (AHP) method to verify the indicator system of the model and provided a logistic service improvement as well as quality locus [4]. Zheng Bing, Jin Yufang, Dong Dahai & Liu Ruiming used the “direct measurement of perceived expectation difference” method to measure and construct a local LSQ evaluation index system. Seven dimensions of LSQ which includes time quality, personnel communication quality, order completion quality, error processing quality, delivery quality, flexibility and convenience were formed to assess and evaluate logistics service quality in the clothing industry [5]. Mei Hu, Lin Lingxia & Ma Zicheng, however, summarized the e-commerce LSQ evaluation index system into five dimensions as availability, responsiveness, error handling, reliability and speed through factor analysis, and obtained key

indicators sorted by the importance degree through regression analysis and proposed a matching management strategy to improving the e-commerce logistics service [6]. Wei Hua, Wang Yong & Deng Zhonghua, on the other hand, explored the evaluation indicators of online shopping service quality based on the perspective of consumer perception, and summarized seven dimensions such as delivery quality, personnel quality, error processing quality, order quality, communication quality, convenience and flexibility through empirical analysis which covered the entire process of online shopping customers' perception of logistic service hence providing guidance for improvement of sellers' logistic service quality [7].

Most LSQ indicators focus on the entire logistics distribution process whereas the "last mile" of logistics, is concerned with the existence of problems and solutions. There are few studies on consumer perceived LSQ indicators for the "last mile" of logistics. With the rapid development of Chinese logistics and the changing demand of consumer, the past logistics quality evaluation indicators may not be suitable for the status quo. Therefore, it is necessary to construct a new LSQ evaluation index system from the perspective of consumer perception based on the existing theoretical results and the actual situation of e-commerce logistics.

### III. INDICATOR CONSTRUCTION

#### A. Construction of Logistics Terminal Distribution Service Quality Evaluation Indicators

Twenty-two (22) e-commerce LSQ evaluation indicators were initially formed through the review of literature and interview method based on the consumer perception perspective, combined with the actual situation of e-commerce logistics industry and the characteristics of the "last mile" of logistics. This is shown in the Table I below.

TABLE I. E-COMMERCE LSQ EVALUATION INDICATORS

No.	Evaluation indicator	No.	Evaluation indicator
Q01	Service attitude of employees	Q12	Delivery time after arrival at the destination
Q02	Communication ability of employees	Q13	Advance notice of delivery time
Q03	Appearance of employees	Q14	Whether to complete the delivery service as promised
Q04	Professional quality of employees	Q15	Whether to deliver at the right time
Q05	Meeting personalized needs of consumers	Q16	Special holiday delay
Q06	Integrity of goods	Q17	Availability of logistics information
Q07	Express packaging quality	Q18	Accuracy and timeliness of logistics information
Q08	Delivery correctness	Q19	Security of personal information
Q09	Diversity of delivery modes	Q20	Convenient delivery process
Q10	Distribution business scope	Q21	Freight rate
Q11	Pick up time	Q22	Compensation for damaged goods

#### B. Pre-research and Indicator Adjustment

Before the formal investigation, the evaluation indicators were pre-investigated in the form of survey. The questionnaire used the measurement method of "consumer perception minus consumer expectation" to judge the importance of each indicator to the LSQ. The scoring standard adopted the Likert's 7-point scale. The respondents were mainly experts and scholars in the field of logistics, logistics personnel and logistics consumers. A total of 50 questionnaires were issued. According to the feedback results, four indicators which include Q3 "appearance of employees", Q17 "availability of logistics information", Q18 "accuracy and timeliness of logistics information" and Q20 "convenient delivery process" were eliminated. Finally, a formal questionnaire of 18 indicators was obtained.

#### C. Data Collection

This study selected Kaizhou District of Chongqing as a case study for the research. This district was selected based on two reasons that includes: the problematic state of the "last mile" of logistics express delivery from a distribution point to customers in both rural and urban areas within a day due to the relatively developed economy and large number of online shoppers; and Kaizhou was in 2016 upgraded from a county into a district meaning its population has increased hence the online shoppers has gradually increased as well. the selection of district as a case study will reflect the existence of the problems in the logistic industry because of the rapid development of the industry in the district.

The questionnaires were distributed in person to respondents at selected advantageous populated points such as driving schools, transport stations, shopping malls, etc., for which different groups were collected at different times and different places. A total of 300 questionnaires were randomly distributed and 289 completed questionnaires were returned. Out of the 289 completed questionnaires, 36 were adjudged to be invalid hence the effective questionnaire recovery rate was 84% (thus 253). Out of the total 253 effective questionnaires, 121 representing 48% were males while 132 representing 52% were females. 71% of the respondents value the quality of service in the logistics distribution however, 64% believed their choice of a logistic enterprise will be based on the strength and weakness of logistics and distribution service.

### IV. DATA ANALYSIS

#### A. Project Analysis

The t-test was used to analyze the result to establish the significance of the study on the 18 evaluation indicators. The first 27% and the last 27% of the total score of the scale were divided into high group and low group. Find the high group and low group in each item's average difference significance, the resulting value was called the Critical Ratio (CR) value. When the CR value of the item reached a significant level ( $P < 0.05$ ), the item can distinguish and identify the difference in mental level of different subjects, and the greater the CR value, the stronger the identification ability of the item. The results are shown in Table II. The CR value of item Q4 "professional quality of employees" and Q5 "meeting personalized needs of consumers" were not significant at

( $P > 0.05$ ) level and so were eliminated and kept the remaining 16 items.

TABLE II. CR VALUE OF EACH ITEM

Item.	CR value	Remarks	Item	CR value	Remarks
Q1	3.525***		Q11	6.478***	
Q2	6.083***		Q12	9.816***	
Q4	2.314	eliminated	Q13	4.150***	
Q5	0.476	eliminated	Q14	6.567***	
Q6	4.328***		Q15	7.083***	
Q7	4.472***		Q16	6.170***	
Q8	5.895***		Q19	4.850***	
Q9	5.340***		Q21	5.336***	
Q10	6.319***		Q22	6.840***	

<sup>a</sup>. \*\*\* means  $p < 0.001$

### B. Factor Analysis

Before doing factor analysis, samples were performed to KMO suitability test and Bartlett sphericity test. The test results showed that the KMO value was 0.786, Bartlett's sphericity test had a  $\chi^2$  value of 13770.75 (degree of freedom of 210), and the significance level value of 0.000. The null hypothesis of no correlation between the indicators was rejected making it suitable for the usage of the factor analysis. The exploratory factor analysis was then carried out on the 16 indicators. The factor analysis used principal component analysis and orthogonal rotation method. With the eigenvalue greater than 1.0 as the extraction factor, five common factors were extracted from the 16 measurement indicators of LSQ, and the cumulative interpretation variance ratio was 65.058%. The composition index of each common factor was taken as the initial factor by the component with a factor load greater than 0.5. The rotated factor matrix is shown in Table III.

TABLE III. FACTOR ANALYSIS RESULTS AFTER ORTHOGONAL ROTATION

New serial number	Content	Ingredients				
		1	2	3	4	5
L1	Pick up time	.792				
L2	Advance notice of delivery time	.678				
L3	Distribution business scope	.660				
L4	Delivery time after arrival at the destination	.648				
L5	Freight rate	.554				
L6	Whether to deliver at the right time		.800			
L7	Special holiday delay		.659			
L8	Diversity of delivery modes		.629			
L9	Whether to complete the delivery service as promised		.601			
L10	Delivery correctness		.587			
L11	Security of personal information			.885		
L12	Compensation for damaged goods			.825		
L13	Service attitude of employees				.837	
L14	Communication ability of employees				.696	

Cont.to TABLE III					
L15	Integrity of goods				.846
L16	Express packaging quality				.788

Extraction method: main component.

Rotation method: An orthogonal rotation method standardized by Kaiser.

The rotation converges after 6 iterations.

The common factors were named according to the contents of the indicators contained in the common factors. The first factor included five items: pick up time, advance notice of delivery time, distribution business scope, delivery time after arrival at the destination, and freight rate. These indicators were all consumers' requirements for the quality of logistics orders, so they were grouped as order quality. The second factor included whether delivery is made at the right time, special holiday delay, diversity of delivery modes, whether the delivery service is completed as promised and delivery effectiveness, these were customers perceived service quality in the delivery process, hence grouped as the delivery quality. The third factor included the security of personal information of customers and compensation for damaged goods, which are the rights of customers the reliability of good service delivery of that logistics companies to their prospective customers; therefore, it is grouped as reliability. The fourth factor had two indicators: service attitude of employees and communication ability of employees, so they were grouped as personnel quality. The fifth factor also had two indicators as the integrity of goods and express packaging quality. They were about the quality of the goods, so they were grouped as the product quality.

Based on the above analysis, the LSQ evaluation index was divided into five dimensions: order quality, delivery quality, reliability, personnel quality, and product quality.

### C. Reliability Analysis

In order to further know the reliability and validity of the questionnaire, it is necessary to continue to test the reliability and validity of the data. At this stage, the variable reliability was measured by Cronbach's  $\alpha$  coefficient. The closer the Cronbach's  $\alpha$  of the variable is to 1, the higher the reliability of the variable, and the more reliable the measurement. The results were shown in Table IV. Even though personnel quality and product quality are lower  $\alpha$  coefficients among the 5-dimensions, the other three dimensions have  $\alpha$  coefficients above 0.70 indicating that the reliability of the indicators meets the standard, and the measurement results are highly reliable.

TABLE IV. RELIABILITY TEST RESULTS

	Order quality	Delivery quality	Reliability	Personnel quality	Product quality
Cronbach's $\alpha$	0.770	0.750	0.766	0.670	0.691

### D. Validity Analysis

1) *Content validity*: On the basis of reviewing the previous literatures, this paper drew on the empirically tested indicators from domestic and foreign scholars. After summarizing the initial measurement indicators, the opinions of experts and relevant field staff were sought through interviews, questionnaires, etc., and the rationality of the scale indicators

and the clarity of language expressions were carefully scrutinized. According to the feedback, the scale indicators have been modified to achieve good content validity.

2) *Construct validity*: According to the results of principal component factor analysis above, the cumulative interpretation variance of the five factors was 65.058%, indicating that the results of this study have good construct validity.

After the reliability and validity test, the final 5-dimension based on the 16-index e-commerce LSQ evaluation index system is obtained, as shown in Table V.

TABLE V. OFFICIAL E-COMMERCE LOGISTICS SERVICE QUALITY EVALUATION INDEX SYSTEM

Dimension	Serial number	Indicator
Order quality	L1	Pick up time
	L2	Advance notice of delivery time
	L3	Distribution business scope
	L4	Delivery time after arrival at the destination
	L5	Freight rate
Delivery quality	L6	Whether to deliver at the right time
	L7	Special holiday delay
	L8	Diversity of delivery modes
	L9	Whether to complete the delivery service as promised
	L10	Delivery correctness
Reliability	L11	Security of personal information
	L12	Compensation for damaged goods
Personnel quality	L13	Service attitude of employees
	L14	Communication ability of employees
Product quality	L15	Integrity of goods
	L16	Express packaging quality

## V. CONCLUSION AND RECOMMENDATIONS

This paper focused on the “last mile” of logistics. Through reviewing the e-commerce LSQ evaluation indicators based on the perspective of consumer perception, and used the measurement method of “consumer perception minus consumer expectation”, the exploratory factor analysis was carried out on many indicators that affect the service quality of the “last mile” of e-commerce logistics. Five (5) of dimensions and 16 indicators e-commerce LSQ evaluation index system based on the conformity of Chinese situation is constructed, namely the order quality, delivery quality, reliability, personnel quality and product quality to help reduce the problems confronting the “last mile” in the logistics industry. It was therefore observed that the indicator system has good reliability and validity, and on this basis, this paper puts forward suggestions for logistics enterprises to strengthen service quality construction. At the same time, this paper also provides theoretical basis and index reference for logistics enterprises to carry out consumer logistics service quality evaluation and service quality improvement work in the future.

The concept of consumers is changed from the focus of time and location to the flexibility of logistics distribution and

the value of logistics service. This brings new requirements for logistics service to meet the expectations of their customers. While strengthening the logistics basic services, such as delivery time, express packaging quality, distribution business scope, and delivery correctness, logistics enterprises should pay more attention to the improvement of the utility of logistics service to consumers, and attach importance to the creation of flexibility.

As the window of the “last mile” link between consumers and logistics companies, the attitude and communication ability of employees will greatly influence consumers' evaluation of the LSQ, and even affect the impression to logistics enterprises. Therefore, logistics enterprises should strengthen the screening and training of personnel, to further improve the incentive and restraint mechanism for employees, and improve the quality of personnel service.

The low compensation for damaged goods in express delivery service does not fully protect consumer rights, hence a major issue in the logistics industry today. Strengthening the security of personal information and the compensation for damaged goods, which guarantees the reliability creation of consumer rights, can help logistics enterprises to leave a good corporate image in the hearts of consumers, and will positively affect the quality evaluation and re-selection.

But this paper also has limitations. First of all, the scope of research is too small, and the external utility needs to be tested. Also, it pays attention to the construction of logistics service quality index system, and lacks the practical application of the index system in logistics enterprises. Follow-up research can be considered to expand the scope of research, select representative logistics enterprises to carry out follow-up service quality evaluation empirical work.

## REFERENCES

- [1] Mentzer J. T., Gomes R. and Krapfel R. E., “Physical distribution service: A fundamental marketing concept,” *Journal of the Academy of Marketing Science*, vol. 17(4), pp. 53-62, 1989.
- [2] Parasuraman A, Zeithaml V. A. and Berry L. L., “Servqual: a multiple-item scale for measuring consumer perceptions of service quality,” *Journal of Retailing*, vol. 64(1), pp. 12-40, 1988.
- [3] Mentzer J. T., Flint D. J. and Kent J. L., “Developing a logistics service quality scale,” *Journal of Business Logistics*, vol. 20 (1), pp. 9-32, 1999.
- [4] Peng Runhua, Lin Xiaoxiao and Yang Zhenqing, “Construction and testing of end-logistics service quality evaluation index system,” *Journal of Business Economics*, vol. 20, pp. 83-86, 2018. (In Chinese)
- [5] Zheng Bing, Jin Yufang, Dong Dahai and Liu Ruiming, “Creation and verification of China's local logistics service quality assessment indicators,” *Management Review*, vol. 4, pp. 49-55, 2007. (In Chinese)
- [6] Mei Hu, Lin Lingxia and Ma Zicheng, “Construction and analysis of key indicators for e-commerce logistics service quality evaluation,” *Logistics Technology*, vol. 11, pp. 85-88, 2015. (In Chinese)
- [7] Wei Hua, Wang Yong and Deng Zhonghua, “Service quality assessment of online shopping stream based on consumer perception,” *China Circulation Economy*, vol. 1, pp. 88-94, 2016. (In Chinese)