

A Study on Customer Satisfaction of Postal Express Service Based on Structural Equation Modeling

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Abstract: Based on the questionnaire survey data and empirical research of 600 postal express users, the structural equation model is to evaluate and analyze customer satisfaction with postal express service from four aspects: acceptance service, delivery service, post-sales service and service quality. The results show that acceptance service and post-sales service have a direct positive impact on customer satisfaction, and delivery service has an indirect impact on customer satisfaction through post-sales service and acceptance service, and there is a two-way relationship between acceptance service and delivery service. This indicates that each customer satisfaction evaluation index is correlated with each other, and the improvement of a single ability index may not directly improve the customer satisfaction of postal express service. According to the results of the empirical study, it is suggested to strengthen the management of receiving and sending services, improve the quality and efficiency of receiving and sending services, strengthen the management of delivery services, improve the quality and efficiency of delivery services, strengthen the post-sales service management, optimize the customer service acceptance process and response speed, continuous improvement and innovation, and continuously improve the service.

Keywords: Structural Equation Model, Express Service, Customer Satisfaction.

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Introduction

In order to further promote the “Express Delivery to Villages” program, the State Post Bureau issued the “3-year Action Plan for Express Delivery to Villages (2020-2022)” in April 2020. In July, the State Post Bureau played an important role in carrying out the pilot test of “Express Delivery to Villages” program and constructing a three-level logistics system in the counties and villages, according to the “the Notice of Carrying Out the Pilot Test of ‘Express Delivery to Villages’ program in the Postal Express Industry”. Referring to the previous researches, this paper makes a comprehensive survey on customer satisfaction with postal express service, and then uses structural equation model to conduct empirical analysis on the questionnaire data, hoping to figure out the users’ satisfaction degree with postal express service, to promote its high-quality development, and to smoothen the economic cycle connecting urban and rural areas.

1. Literature Review

With the continuous expansion of the express delivery market and the increasingly fierce competition, the users’ satisfaction has grown to be a significant factor for the express delivery enterprises’ market competitiveness. It has also aroused academic interests and attention. The paper will review the previous researches on express service satisfaction, summarize the research results, and predict the academic research.

In terms of influencing factors of customer satisfaction, scholars have come to the conclusion that customer satisfaction and perceived service quality are the main factors affecting customer loyalty through different research methods. Papassapa (2007) analyzed the relationship quality theory and believed that customer satisfaction and perceived service quality were the main factors affecting customer loyalty^[1]. He Liu (2013) built an SEM model and confirmed that perceived service quality is a factor affecting customer satisfaction, and that time value, item value, employee value and convenience value as intermediary variables also affect customer satisfaction^[2]. Meng Qingliang et al. (2014) integrated Kano model and IPA analysis method, and believed that express delivery service quality and service performance affected customer satisfaction, among which the safety, timeliness of express delivery and the communication ability of service staff were the main factors affecting service quality^[3].

In the research on satisfaction, fuzzy comprehensive evaluation method is widely used. Zhao Jiana (2014), Fan Xin (2014) and Yang Jieyu et al. (2019) adopted the fuzzy comprehensive evaluation method to evaluate the service quality of Dalian Post Express Logistics Company^[4], the customer satisfaction of YTO Express company^[5] and the satisfaction of rural residents in Tongwei County, Gansu Province on the express service industry^[6]. These studies evaluated the satisfaction of express delivery service by quantitative method, and drew

corresponding conclusions.

In addition, some scholars have conducted research for specific markets. Among them, Yuan Qinghui (2015) obtained the customer satisfaction of Yunda Express service through customer ratings, and proposed improvement suggestions based on the analysis conclusion^[7]. Liang Jinping put forward the methods to improve the service quality by rebuilding new image, cultivating culture, promoting efficiency and carry out supervision system and so on^[8]. Based on the empirical test of structural equation model, Wu Gang et al. (2022) believe that the influence of perceived service quality, perceived price and customer expectation on customer satisfaction decreases successively, and commodity contact is the key link to improve perceived service quality^[9].

Moreover, some scholars put the research perspective on campus express service. Yu Ming et al. (2015) adopted the regression analysis method and concluded that the service attitude of staff, delivery time and logistics speed have a significant impact on college students' satisfaction^[10]. Zhang Xiaohua et al. (2016) adopted the method of combination of step-by-step regression, principal component regression and grey correlation analysis to argue that Guangzhou college students have a high degree of satisfaction with SF Express, and the convenience of transportation is a key index factor affecting the satisfaction of express service^[11]. Gao Yaping et al. (2017) verify several hypotheses on college express service satisfaction and they believe that nine factors are effective, including intact commodity, flexibility, time, error handling, communication, psychological expectation, price, order fulfillment quality and convenience^[12]. Based on structural equation theory, Wang Lianzhen et al. (2021) show that service quality, corporate image and expected quality have a significant positive and direct impact on satisfaction, and their effects are decreasing in turn. Remediation not only has a significant positive direct impact on service quality, but also is the most critical factor^[13].

To sum up, the researches mainly focus on the influencing factors of users' satisfaction, on the evaluation methods of satisfaction and on the specific markets. These studies provide theoretical support and practical guidance for improving the

service quality and management level of express delivery enterprises. However, the in-depth study of different regions and groups is scarce, and research method is monotonous. Future research is predicted to expand the scope of research, carry out in-depth researches from multi-level and multi-angle, explore the variation analysis on express service satisfaction and influencing factors in different regions and groups, and strengthen researches pertinence. Based on the background of establishing a pilot city of "Express Delivery to Villages" and constructing a three-level logistics system of counties and villages, this paper analyzes customer satisfaction degree of postal express service, and suggests how to improve service level from the perspective of users, by employing the empirical analysis method of structural equation model. It sticks to the Concept of People-centered and contribution to local economy and society, forming an evaluation index system to interpret the connotation and extension of high-quality development in the new era.

2. Overview of Model

2.1 Research Methods

Structural equation modeling is a statistical analysis method that deals with abstract concepts by studying the relationships between variables. In structural equation models, latent variables are things that cannot be directly observed or measured and need to be estimated by specific and measurable observed variables, so structural equation models include measurement and structural models. Among them, the measurement model describes the relationship between latent variables and their observed variables, and the structural model describes the relationship between each latent variable^[14]. The model contains three variables: latent, observed and error variable. There are four potential variables in this paper: acceptance service, delivery service, post-purchase service and customer satisfaction. Observation variables can be measured to reflect potential variables, and there are eight of them (see Table 1). Error variable refers to the deviation caused by the measurement of the observed variable or by ignoring the secondary observed variable.

Table 1. Latent Variables & Observe Variables

Latent Variables		Observe Variables	
Reception Services	Customer Service	Reception & Delivery Services	
Delivery Service	Delivery Time	Delivery Staff Service	
Post-Purchase Service	Inquiries	Complaints	
Customer Satisfaction	Delivery Quality	Problem Handling	

2.2 Structural Model

ξ represents external potential variables, η for internal potential variables, e for interference variables, and λ for path coefficient. The regression equation of the latent variable in Figure 1 is shown below.

Formula (1)

$$\eta = \lambda_{11}\xi_1 + \lambda_{12}\xi_2 + \lambda_{13}\xi_3 + e$$



Figure 1. Structural model

2.3 Measurement Model

This paper takes the measurement of reception service as an example to introduce the measurement model, as shown in Figure 2. ξ represents the potential variable, X represents the observed variable, e represents the error, λ represents the path coefficient, and the regression equation between the observed variable and the potential variable is as follows.

Formula (2)

$$X_1 = \lambda_{11}\xi_1 + e_1$$

$$X_2 = \lambda_{12}\xi_1 + e_2$$

The matrix equation of the regression equation is as follows.

Formula (3)

$$X = \Lambda_x \xi + \delta$$

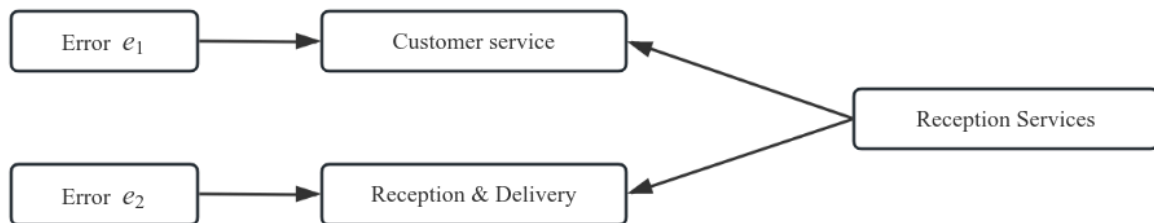


Figure 2. Measurement model

3. Empirical Research

3.1 Questionnaire Design & Collection

The questionnaire items used in this study are all multiple-choice questions and measured by Likert scale, including four first-level indicators and eight second-level indicators related to customer satisfaction. The total score of all questions is set up with four answers: "very satisfied, satisfied, no comments, not satisfied", with four scores: "4,3,2,1".

Among the main indicators of the survey, the stratified variance of relevant empirical evaluation is carried out on the main views of the current consumer status. The degree of certainty of the survey indicators is 95%($t=1.96$), and the sample design effect (deff) is estimated to be 1.11.

Overall estimation: Based on public opinion surveys on the security and urban planning of the same population in the sample city of Yuxi in recent years, the overall variance is estimated. The results of the survey evaluation indicators are highly correlated with the age, occupation and residence of the respondents. The total population of Yuxi is estimated at 350,000. Total variance estimate (σ^2) = 1279.5.

Since the results of the survey are mainly to estimate various proportion data and compare among data, the sample size is determined by estimate of the overall proportion P of simple random sampling. With 95% confidence, t is 1.96, and the sampling absolute error $d \leq 3\%$ is required for calculation. Sample size to be extracted is as follows:

$$n = \frac{Nt^2\sigma^2}{Nd^2 + t^2\sigma^2} = 541$$

The design effect deff is set at 1.11, so the required sample size is 600, which can meet the estimation of each subpopulation and has a high representativeness for the population, so it is a relatively appropriate sample size.

3.2 Analysis of Survey Results

This questionnaire focuses on the four first-level indicators related to customer satisfaction of express service, and sets a total of 8 questions, namely 8 second-level indicators, which are unified customer service acceptance, receiving and mailing service quality, delivery time limit, delivery quality, delivery staff service, inquiry, problem handling, and complaints. According to the principle of random equidistant sampling, the survey households were selected from the postal express users in 6 counties, 1 city and 2 districts f Yuxi City. In the selected households, the real user of the express business is asked to answer the questionnaire. A total of 600 valid questionnaires were collected, and the comprehensive scores of each index are shown in Table 2.

Table 2. Analysis of Survey Data								
Second-level indicators	unified customer service	Receive and mail service	time	Quality	Staff service	Inquire	Defective parcels	Handling complaints
Weight	0.01	0.05	0.32	0.2	0.15	0.05	0.11	0.11
Scores	81.79	82.88	77.85	82.70	82.25	81.18	78.67	75.11

According to the judgment by weight factor, the weights of 8 secondary indexes are determined according to the importance degree of influencing customer satisfaction of express service. Among them, the delivery time limit of is the most concerned aspect, and the weight is the highest 0.32. Secondly, customers are also very concerned about the integrity and quality of express delivery, and the weight of "delivery quality" is determined to be 0.2; Thirdly, the weight of “staffs’ service” is determined to be 0.15; The remaining six indicators are also weighted according to their importance.

As Table 2, according to the scores of 600 customers on 8 aspects of express service satisfaction, the comprehensive score of postal express service customer satisfaction is obtained by weighted average. The top three satisfaction are: receiving service quality, delivery quality and delivery staff service; The next three are: delivery time, problem handling and complaints. The slow delivery of State Post Bureau has been complained frequently. The survey results shows that the the State Post Bureau should shorten delivery time, improve delivery efficiency, and promote the service quality of handling defective parcels and complaints, so as to improve customer satisfaction furtherly.

3.3 Empirical Analysis

3.3.1 Reliability Analysis

Reliability refers to the consistency or stability of the measurement results, that is, whether the questionnaire can stably measure the object it is going to measure. Reliability can analyze the reliability of the questionnaire and reflect the reliability of the questionnaire data, which is mainly represented by the reliability, consistency and stability of the data test results. Cronbach's α reliability coefficient method was used for internal reliability analysis of the obtained data. The closer the coefficient is to 1, the higher the reliability and the better the stability of the scale. The reliability analysis results of the original data obtained by SPSS statistical analysis software are shown in Table 3.

Table 3. Reliability Analysis of Survey Data			
Measurement dimension	Question Number	Cronbach's Alpha	Cronbach's Alpha (based on the normalized term)
Processing service	2	0.720	0.721
Delivery service	2	0.727	0.729
Post-purchase	2	0.707	0.708
Customer satisfaction	2	0.756	0.757

Shown as Table 1, the Cronbach's Alpha value of each cause variable of the entire questionnaire is greater than 0.70, indicating that the reliability and stability of the entire questionnaire are good, the questionnaire design is more appropriate, the measurement content of the research variables is relatively consistent, and the survey data is relatively reliable.

3.3.2 Validity Analysis

The validity analysis of model variables is used to test the accuracy of the data of each variable, that is, the degree to which the questionnaire can correctly measure the characteristics it is intended to measure. The higher the validity, the more accurate the measurement results and the higher the validity. The higher the validity, the more the measurement results can show the real characteristics of the object to be measured. Validity can be divided into content validity, structure validity and criterion validity. Structure validity is used to evaluate the

correspondence between a certain structure reflected in the investigation results and the theoretical structure. Factor analysis is usually used to test the structure validity. Similarly, SPSS software is used to test the validity of the questionnaire data, and the validity test results were shown in Table 4.

Table 4. Validity Test Results

Test statistic for sample adequacy (Kaiser-Meyer-Olkin,KMO)		0.907
Bartlett's sphericity test	approximates Chi-square	1838.242
	degree of freedom,(df)	28
	(Significance,Sig)	0.000

KMO (Kaiser-Meyer-Olkin) measures the appropriateness of sampling. The larger the KMO value, the more common factors between variables (items), the more suitable for factor analysis. According to Kaiser(1974), factor analysis is not appropriate when KMO value is <0.5 . KMO value in Table 4 is $0.907 > 0.70$ and Sig value is $0.000 < 0.05$, indicating strong data reliability and good validity of the questionnaire, which is suitable for factor analysis.

Table 5. Component Matrix of Evaluation Index System

First-level indicators	Second-level indicators	Composition matrix
Acceptance service	Unified customer service acceptance	0.706
	Delivery service	0.740
Delivery service	delivery time	0.677
	Staff service	0.765
Post-purchase service	Inquire	0.741
	Complaints handling	0.674
Customer satisfaction	Delivery quality	0.756
	Defective parcels handling	0.750

In Table 5, component matrix values of all indicators are greater than 0.05, showing good validity of the questionnaire. The following conclusions can be drawn:

Acceptance service includes two second-level indicators: unified customer service acceptance and receiving services. The weights of unified customer service acceptance and receiving services are 0.706 and 0.740, respectively, indicating that unified customer service acceptance and receipt services have a greater impact on first-level indicators in terms of acceptance services.

Delivery service is with two secondary indicators: delivery time and delivery personnel service. The weights of delivery time is 0.677 and delivery time is 0.765, indicating that delivery service and delivery time have a greater impact on the first-level index.

Post-purchase service also contains two second-level indicators: inquiries and complaints. The weights of inquiries and complaints are 0.741 and 0.674 respectively, illustrating that the influence of inquiries and complaints on the first-level indicators is relatively balanced in terms of post-purchase service.

Finally, customer satisfaction includes two second-level indicators: delivery quality and problem handling. The weights of two items are both 0.750, representing the impact of delivery quality and problem handling on the first-level index is relatively balanced in terms of customer satisfaction.

3.3.3 Path Analysis

According to the exogenous potential and observed variables identified in Table 1, the measurement and structural equations of customer satisfaction of postal express service are established, and the path coefficient of the structural equation model of customer satisfaction is obtained by software AMOS17.0 for calculation and analysis (Table 6) and various fitting indexes (Table 7).

Table 6. Model path coefficients and verification results

X	→	Y	path coefficient	verification results
Reception Service	→	Customer satisfaction	0.056	Passed
Delivery service	→	Post-purchase service	0.972	Passed
Post-purchase service	→	Customer satisfaction	0.953	Passed
Reception Service	→	Receiving Service	0.777	Passed

Acceptance Service	→	Unified customer service	0.725	Passed
Delivery Service	→	Delivery Staff service	0.744	Passed
Delivery Service	→	Delivery time	0.627	Passed
Post-purchase service	→	Complaints handling	0.627	Passed
Post-purchase service	→	Inquire	0.711	Passed
Customer Satisfaction	→	Defective- parcels handling	0.718	Passed
Customer Satisfaction	→	Delivery quality	0.716	Passed

In Table 6, it's known that the path coefficient between acceptance service and customer satisfaction is 0.056, indicating that there is a certain positive correlation between these two, but the correlation is weak. The path coefficient of delivery service and post-purchase service is as high as 0.972, showing a high positive correlation. The path coefficient of post-purchase service and customer satisfaction is 0.953 also with a high positive correlation.

In addition, the path coefficients between acceptance service and receiving service, unified customer service acceptance, delivery service and delivery staff service, delivery time, post-purchase service and complaints, inquiries, customer satisfaction and defective parcels handling, delivery quality are all higher than 0.6, indicating a significant positive correlation between observed variables and latent variables. The conclusion is drawn that a strong correlation between these factors is existed.

Table 7. Fitting Index of Structural Equation Model

Fit index	NFI	CFI	NNFI	RMSEA	RMR
Judging criteria	>0.9	>0.9	>0.9	<0.10	<0.05
The fitting value	0.965	0.973	0.952	0.072	0.027

As shown in Table 7, the judgment criteria of NIF, CFI and NNFI are all >0.9, and the actual fitting values are all higher than 0.9. In addition, RMSEA=0.072<0.7, RMR=0.027<0.05, indicating that the structural equation model has a good fitting effect.

The standardized path model diagram is drawn by AMOS17.0 software, as shown in Figure 3. The numbers on the arrow represent the path coefficients of external variables and internal variables (standardized regression coefficients).

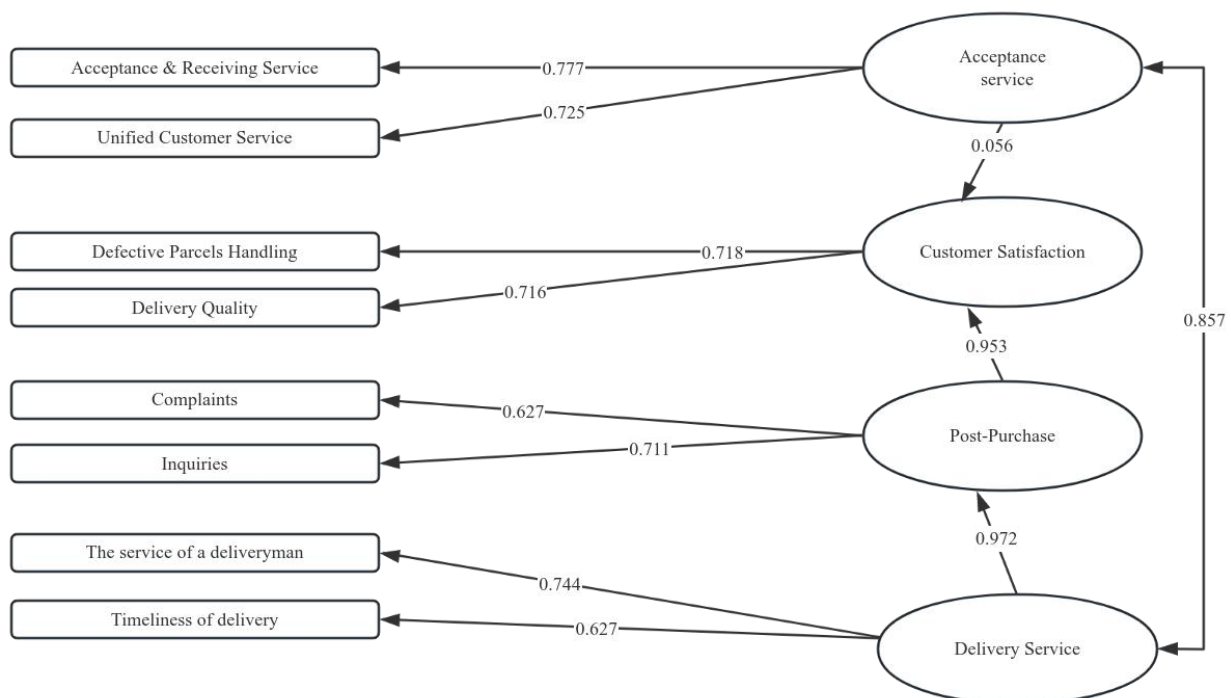


Figure 3. Path Model

Seen from the potential variables in Figure 3, acceptance service and post-purchase service is directly related to customer satisfaction. Delivery service firstly affects post-purchase service or acceptance service, and then affects customer satisfaction. There is a two-way relationship between acceptance service and delivery service, and each observed variable has a significant positive correlation with the potential

variable. The main factor affecting the reception service is the receiving service level, and the path coefficient is as high as 0.777; The key factor affecting delivery service is the delivery staff's service attitude, and the path coefficient is 0.744. Delivery quality and defective parcels handling influence great on customer satisfaction. The convenience of package inquiry has a great impact on post-purchase service.

Through the path analysis, it concludes that the quality of receiving and sending service, delivery staff attitude, the response efficiency of customer service acceptance, the defective parcels handling way, the delivery quality of express delivery should be given more priority to shortly improve the customer satisfaction of postal express service in Yuxi City.

3.4 Research Conclusion

Based on principles of the index system, this paper constructs a structural equation model of customer satisfaction of postal express service. The index system includes 4 latent variables: acceptance service, delivery service, post-purchase service and customer satisfaction, and then 8 observation variables: receipt and delivery service and unified customer service acceptance, and then obtains relevant data through questionnaire survey. The structural equation model is employed to analyze the customer satisfaction of postal express service, and the main influencing factors, specific influencing ways and influencing paths are obtained. Finally, the reliability and validity of the model are analyzed, and the results showed that the Cronbach's coefficients of the four latent variables are all above 0.7, and the KMO value is >0.70, indicating that the measurement terms of each research variable have high internal consistency and the survey data is relatively reliable.

Table 8. Research Conclusions & Test Results

Research Conclusion	Test Results
Acceptance Services Positively Impact on Customer Satisfaction Directly	Supported
Post-purchase Service Positively Impact on Customer Satisfaction Directly	Supported
Delivery Services Indirectly Impact on Customer Satisfaction Through Post-purchase Services	Supported
Delivery Services Indirectly Impact on Customer Satisfaction Through Acceptance Services	Supported
Two-Way Influence Relationship Between Acceptance Service & Delivery Service	Supported

The empirical research shows in Table 8 that the evaluation indicators of customer satisfaction of postal express services influence and correlate with each other. Trying to change single one of the indicators does not necessarily directly improve the customer satisfaction. On the contrary, it is a key point to locate the key influencing factors and indicators and to understand the internal relationship and mutual influence between them effectively and accurately in order to improve the customer satisfaction of postal express service

4. Suggestions for Increasing Express Satisfaction

According to Figure 3 and Table 8, receiving service and reception response speed have a significant positive impact on reception service, while reception service has a direct positive impact on customer satisfaction. Improving the quality and efficiency of reception service, and increasing the response speed of customer service reception are important means to improve customer satisfaction. Delivery service has an indirect impact on customer satisfaction through after-sales service and acceptance service. Delivery staffs' good service attitude can help to improve customer satisfaction with delivery service, and furtherly affect the entire postal express service satisfaction. Some suggestions are coming as follows.

4.1 Strengthen the management of receiving and mailing services to improve their quality and efficiency

In terms of staff training, service wording, service time and standard are main training content, as well as service process, quality standardization projects, service attitude and professional skills, to ensure the receiving and sending quality of mail and parcels, optimize the process, improve the efficiency, and reduce

the waiting time caused by downloading enterprise client programs and scanning documents. Meanwhile, in order to meet the different needs, it's suggestive to provide a variety of delivery methods, such as self-pickup, appointment, adjust the delivery service time catering to the customers' schedule. Different customer service strategies are formulated to meet the urban and rural receiving service needs. In the city centers, supermarkets, convenience stores and shops are to be added as delivery service outlets with standardizing the service processes. In rural areas, the role of State Post Bureau continues to fully play on the cooperation of "postal express" and "postal transportation". Relying on the "Express delivery to the village" project, it's to strengthen the coordination with other express delivery enterprises in rural areas, such as passenger transport companies, supply and selling system, and other enterprises. The aim is to increase the express service channels and extend the service network to the villages with a population of 100. The above-mentioned measures are to improve the customer's perception of postal express service quality.

4.2 Strengthen Delivery Service Management to Improve Delivery Quality & Efficiency

Firstly, to ensure their good service attitude, professional skills and the quality of express delivery, staffs are to be strictly selected and trained. Secondly, linking the customer satisfaction with the staffs' working performance by the service evaluation system to improve the service quality. Thirdly, staffs' good communication with their customers is encouraged to promote the customers' satisfaction. Fourthly, it's significant to improve the express delivery quality and timeliness, to optimize delivery routes and frequency, to ensure safely and to set up post-purchase service. Fifthly, the advanced logistics technology, real-time tracking

system, intelligent express cabinets are recommended to improve delivery efficiency and customer satisfaction.

4.3 Strengthen Post-Purchase Service Management To Optimize Customer Service Acceptance Process And Response Speed

First, an efficient customer service acceptance platform is to be set up to make customers easily contact customer service in a timely and convenient manner. At the same time, staff training is necessary to improve their professional skills and service attitude, in order that customer problems can be solved timely and effectively. customer service acceptance process is to optimized to reduce customer waiting time and to improve response speed.

The second is to focus on improving the problem handling method and efficiency, establish a perfect problem handling mechanism to ensure that customers' problems can be solved in time, that handling process and waiting time can be shortened. It's a key point to help rural customers solve troubles, such as return and refund, goods exchange.

The third is to optimize the problem handling method, conduct professional staff training on problem handling attitude and ability, to enhance customer satisfaction with delivery service and post-purchase service, so as to improve customer satisfaction with the entire postal express service.

The fourth is to optimize the convenience of package query by establishing and facilitating a perfect package query system, by providing diversified query methods to meet the needs of different customers, such as express tracking number, mobile phone number, etc. Package information is to be updated timely to help customers get the new delivery. A fast and accurate package inquiry service is provided as post-purchase service, so as to improve customer satisfaction in the entire postal express

industry.

4.4 Continuous Improvement and Innovation to Enhance Services

The first point is to encourage customers to evaluate postal express services, to share good comments through social media, and actively publicize the advantages and characteristics of postal express services through various channels so as to improve brand popularity and good reputation.

The second is to deal with negative comments and complaints timely, to collect and analyze customer feedback regularly, to understand customer needs and expectations, to explore unique and differentiated services, to better each service process, to make the charges open and transparent, to implement whole-chain quality protection for logistics express service chain, and to constantly improve service quality and process.

The third is to actively employ innovative ideas and advanced technologies, to increase the support of network information technology for the logistics and express industry, to improve the level of smart logistics, to improve the construction of logistics and express operation network, to build a smart cloud logistics platform, to strengthen the information management of logistics and express service outlets and customer characteristics, to optimize the service model and process, and to improve the core competitiveness of postal express services.

The fourth is to strengthen the management of logistics express services at special occasions, to formulate measures in advance at peak online shopping, such as the Spring Festival, "6.18" and "Double Eleven" to avoid inadequate express quality such as extrusion, damage, and loss of packages caused by increasing delivery.

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