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Evaluation theory and application of logistics enterprise customer satisfaction

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ABSTRACT

The satisfaction of customer is the power source of sustainable development of logistics enterprises. To implement customer satisfaction evaluation is one of the effective ways to promote the competitiveness of the logistics enterprises. Establish the logistics enterprise level analysis model and build the evaluation index system of logistics enterprise customer satisfaction By Delphi and AHP. Using the weighted average method to quantify the indicators of evaluation factors, then you will obtain logistics enterprise customer satisfaction comprehensive evaluation result. Finally, Ningbo Sea-land Logistics Company has carried on the analysis and evaluation, the evaluation results agree with the enterprise actual situation, it provides theory basis for further development and improvement of the logistics enterprise.

Key words: Logistics enterprises; FCE-AHP; Customer satisfaction; Effect evaluation

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INTRODUCTION

Customer satisfaction is a measure of how products and services supplied by a company meet or surpass customer expectation the evaluation for Customer satisfaction is a kind of customer-oriented evaluation in order to measure and enhance the performance. During the customer satisfaction evaluation, the overall evaluation is undergone with the reality and expectancy of all purchases and consumer groups in the market. This is aimed to measure management quality, and it also reflects the state of the emotions of customers about the products or services.

LOGISTICS ENTERPRISE CUSTOMER SATISFACTION EVALUATION INDEX SYSTEM

The design of customer satisfaction evaluation index system has a direct impact on the authenticity and validity of the evaluation results. This article was based on the 1994 U.S .University of Michigan Business School model of customer satisfaction index (ACSI) framework, and analysis the key factor of customer satisfaction which depends on customer complaints and customer loyalty caused by the customers' quality awareness of products or services, value-conscious and customer expectation. The indexes of customer satisfaction have been constructed based on consumers' concern, integrity, system rapidity, service respond in time, guarantee service, performance of system, reliability and product strategy.

These five elements are the hidden variables of customer satisfaction, and all can not be directly measured. We need to start step by step until the formation of a series of direct evaluation of the indicators of latent variables. According to the summary of the long-term practice, the evaluation index system can be divided into three levels, each level of evaluation is commenced by up one layer of evaluation , on a level of evaluation results of the evaluation is reflected by the next level of evaluation indicators .Customer satisfaction is the first indicator, that is the first level; The image of the logistics enterprises in the customer satisfaction evaluation model, enterprise logistics service quality, evaluation of the cost of logistics enterprises, the Persistent logistics services, enterprise infrastructure, take the five elements as the second indicators , namely the second level ;according to the characteristics of different products, services , enterprise or industry , the five elements can be expanded into the third indicators , namely, the third level.

The specific content of the index system can be summarized as shown in Table2-1, a total of 18 evaluations.

Table2-1 logistics customer satisfaction evaluation index system

	First grade indicator	Second grade indicator
Y Customer satisfaction	$\mathbf{Y_1}$ Logistics enterprise image	$\mathbf{Y_{11}}$ Enterprise asset capability
		$\mathbf{Y_{12}}$The public image of enterprise
		$\mathbf{Y_{13}}$ Enterprise affinity
		$\mathbf{Y_{14}}$ Brand benefit
	$\mathbf{Y_2}$ Logistics enterprise service quality	$\mathbf{Y_{21}}$ Time quality
		$\mathbf{Y_{22}}$ Communication ability
		$\mathbf{Y_{23}}$ Order completion quality
		$\mathbf{Y_{24}}$ Error processing quality
		$\mathbf{Y_{25}}$ Good quality goods
		$\mathbf{Y_{26}}$ Flexibility
		$\mathbf{Y_{27}}$ Convenience
	$\mathbf{Y_3}$ Logistics enterprise cost evaluation	$\mathbf{Y_{31}}$ Operation cost
		$\mathbf{Y_{32}}$ System cost
		$\mathbf{Y_{33}}$ Clearing way
	$\mathbf{Y_4}$ Logistics enterprise service persistence	$\mathbf{Y_{41}}$ Logistics service creativity
		$\mathbf{Y_{42}}$ Accidental disaster treatment
	$\mathbf{Y_5}$ Logistics enterprise infrastructure	$\mathbf{Y_{51}}$ Completeness
		$\mathbf{Y_{52}}$ Progressiveness

THE MODEL FOR LOGISTICS CUSTOMER SATISFACTION EVALUATION

Quantization of evaluation indexes

In the evaluation of customer satisfaction, we often encounter many quantitative evaluation indexes, and these indicators can not be directly used for the Li Ke scale. For the convenience of collection of data information and statistical analysis, we must change these indexes into evaluation index required by Li Ke scale. The conversion method is to properly divide index value into 5 sections; each section corresponds to 5 assignment of Li Ke scale, so as to realize transformation of the indicators. This paper use 5 Li Ke scales to evaluate the customer satisfaction degree. 5 levels of attitudes are: very satisfaction, satisfaction, generally satisfaction, less satisfaction and dissatisfaction, the corresponding assignment is 5, 4, 3, 2, 1 (or in the reverse order). The respondents should tick in the corresponding position of the table. Though understanding can calculate customer satisfaction evaluation value of each index so as to understand the attitude of respondents to different means of measure object, and also can calculate the scores given by each respondent in order to understand different attitudes from different respondents to measure object.

Determining the weights of evaluation index

The importance of Logistics enterprise customer satisfaction evaluation index is different, so we can not do simple addition to the investigated scores of, but must carry out the weighted average. Determining the weight of each index is the key to the weighted average, and this work is relatively complicated and controversially. Usually we have expert evaluation method, substitution method, 04 score method, distribution method, analytic hierarchy process and so on, other methods either from the qualitative point of view, or from the quantitative angle. As to combine qualitative and quantitative analysis, and make the process of thinking hierarchical and quantification, this paper adopts the analytic hierarchy process, transferring the complex and comprehensive multi factor comparison problem into a simple problem compared between two factors , and specific process is as following:

① Do multiple comparison among the first level indicators, and to quantitative the results.

According to psychology research, doing the qualitative comparison, people usually have 5 distinct levels: the same, little strong, strong, obviously strong, and absolutely strong. In this paper, we according to table 3-1 scale to quantify.

Table 3-1 Dimension table for index quantitative

Qualitative results	Quantitative result
Y_i and Y_j has the same importance	$Y_i:Y_j=1:1$
Y_i is little important than Y_j	$Y_i:Y_j=3:1$
Y_i is important than Y_j	$Y_i:Y_j=5:1$
Y_i is more important than Y_j	$Y_i:Y_j=7:1$
Y_i is absolutely important than Y_j	$Y_i:Y_j=9:1$
The influence of Y_i to Y_j is between the two scales	$Y_i:Y_j=2,4,6,8:1$
The influence of Y_i to Y_j contrasts with the above situation	$Y_i:Y_j=1:1,2,\ldots,9$

After the investigation and the analysis of experts, according to various indicators' degree of influence we get matrix

as follows:

First grade indexes:

$$Y=\begin{pmatrix} 1 & 1/3 & 2 & 3 & 3 \\ 3 & 1 & 4 & 5 & 5 \\ 1/2 & 1/4 & 1 & 2 & 1 \\ 1/3 & 1/5 & 1/2 & 1 & 1/2 \\ 1/3 & 1/5 & 1 & 2 & 1 \end{pmatrix} \tag{3-1}$$

Second grade indexes:

$$Y_1=\begin{pmatrix} 1 & 2 & 4 & 2 \\ 1/2 & 1 & 2 & 1 \\ 1/4 & 1/2 & 1 & 1/2 \\ 1/2 & 1 & 2 & 1 \end{pmatrix} \tag{3-2}$$

$$Y_2=\begin{pmatrix} 1 & 2 & 3/2 & 3/2 & 3/4 & 3 & 6 \\ 1/2 & 1 & 3/4 & 3/4 & 3/8 & 3/2 & 3 \\ 2/3 & 4/3 & 1 & 1 & 1/2 & 2 & 4 \\ 2/3 & 4/3 & 1 & 1 & 1/2 & 2 & 4 \\ 4/3 & 8/3 & 2 & 2 & 1 & 4 & 8 \\ 1/3 & 2/3 & 1/2 & 1/2 & 1/4 & 1 & 2 \\ 1/6 & 1/3 & 1/4 & 1/4 & 1/8 & 1/2 & 1 \end{pmatrix} \tag{3-3}$$

$$Y_3=\begin{pmatrix} 1 & 2 & 4 \\ 1/2 & 1 & 2 \\ 1/4 & 1/2 & 1 \end{pmatrix} \tag{3-4}$$

$$Y_4=\begin{pmatrix} 1 & 1/2 \\ 2 & 1 \end{pmatrix} \tag{3-5}$$

$$Y_5=\begin{pmatrix} 1 & 3 \\ 1/3 & 3 \end{pmatrix} \tag{3-6}$$

②In determining the weights of indexes at all levels, and doing the Consistency check.

Through programming in Mat lab software, we gets weights of first grade indexes is W=(0.223,0.487,0.118,0.069, 0.104), the largest Characteristic Root λ max is 5.09; the weights of second grade indexes of logistics enterprise image is W_1= (0.444,0.222,0.111,0.222), the largest Characteristic Root λ max is 4.003; the weights of second grade indexes of logistics enterprise service quality is W_2= (0.214,0.107,0.143,0.143,0.286,0.071,0.036), the largest Characteristic Root λ max is 7; the weights of second grade indexes of logistics cost evaluation is W_3= (0.571, 0.286, 0.143), the largest Characteristic Root λ max is 3.004; the weights of second grade indexes of service persistence of logistics enterprise is W_4= (0.333, 0.667), the largest Characteristic Root λ max is 2; the weights of second grade indexes of infrastructure of logistics enterprise is W_5= (0.750, 0.250), the largest Characteristic Root λ max is max=2.

Because we can not get the exactly same importance ratio of complex things using multiple comparison method, since the existence of error, it is necessary to know exactly how big the error is. In this paper n' represents the largest Characteristic Root with deviation and the difference in size between n' and n reflects the degree of inconsistency. Considering this factor, we reference Saaty consistency index:

$$CI=\frac{n'-n}{n-1} \tag{3-7}$$

Consistency ratio:

$$CR = CI / RI < 0.1 \tag{3-8}$$

Testing largest Characteristic Root λ max=5.09 of first grade indictor in this paper as follows:

$$CI = \frac{n' - n}{n-1} = \frac{5.09-5}{5-1} = 0.0225 \tag{3-9}$$

$$CR = CI / RI = 0.0225/1.12 = 0.020089285 < 0.1 \tag{3-10}$$

The first indictor RI in (3-10) has the results of RI=1.12 according to table 3-3. First grade indicator's Characteristic Root λ max is 5.09, and pass the consistency test, and the degree may not in the allowable range. Similarly, the maximum Characteristic Root of second grade pass consistency test.

Table RI reference table of first grade indictors

n	1	2	3	4	5	6	7	8	9	10
RI	0	0	0.58	0.96	1.12	1.24	1.32	1.41	1.45	1.49

FUZZY COMPREHENSIVE EVALUATION OF SATISFACTION DEGREE OF LOGISTICS ENTERPRISES

①To construct matrix of assessment samples.

We have the results of customer satisfaction degree of Ningbo logistics enterprise according to the index in table 3-1. The factors of this comprehensive evaluation is U={Y_{11}, Y_{12}, Y_{13}, Y_{14}, Y_{21}, Y_{22}, Y_{23}, Y_{24}, Y_{25}, Y_{26}, Y_{27}, Y_{31}, Y_{32}, Y_{33}, Y_{41}, Y_{42}, Y_{51}, Y_{52}}, comment set V={ satisfaction, less satisfaction, generally satisfaction ,not satisfaction, deeply dissatisfaction }, weight sets W={0.099, 0.049, 0.025, 0.049, 0.104, 0.052, 0.070, 0.070, 0.139, 0.035, 0.017, 0.067, 0.034, 0.017, 0.051, 0.017, 0.035, 0.069}.

②Single factors evaluation.

According to the questionnaire, we have the result of U= {Y_1 (logistics enterprise image), Y_2 (logistics enterprise service quality), Y_3 (Logistics enterprise cost evaluation), Y_4 (Logistics enterprise service persistence), Y_5 (logistics enterprise infrastructure)}. The five aspects of satisfaction degree matrix were: R1, R2, R3, R4, and R5. According to each index satisfaction degree matrix and the corresponding second grade indictor's weights, we get the fuzzy evaluation vector V:

V1=W1 ⊗ R1

V2=W2 ⊗ R2

V3=W3 ⊗ R3

V4=W4 ⊗ R4

V5=W5 ⊗ R5

③Fuzzy comprehensive evaluation

We get a single factor evaluation matrix V through the single factor evaluation, using the weight vector W of each first grade indicator and single factor evaluation matrix V get the comprehensive evaluation results μ of logistics company:

μ=W ⊗ V

Combining the evaluation level of customer satisfaction and the maximum membership degree principle, we can judge the customer's satisfaction degree about logistics enterprises.

CASE STUDIES

The date of this passage is mainly from part customers of Ningbo Hail logistics enterprise. Investigators will answer satisfaction degree of each two grade index, using 5 ranking scale. The total number of questionnaire is 120, and 100 is valid. Questionnaire recovery rate is about 83%. After collecting statistics, I obtain a membership matrix R.

According to membership matrix R, I evaluate the index of all levels.

1) Second index evaluation

$$R_1 = \begin{pmatrix} 60/500 & 110/500 & 240/500 & 90/500 \\ 20/400 & 124/400 & 208/400 & 48/400 \\ 33/300 & 63/300 & 192/300 & 12/300 \\ 42/200 & 58/200 & 26/200 & 74/200 \\ 26/100 & 31/100 & 33/100 & 10/100 \end{pmatrix} \tag{4-1}$$

$$V_1 = W_1 \otimes R_1$$

$$= \begin{pmatrix} 0.444 & 0.222 & 0.111 & 0.222 \end{pmatrix}^{\mathrm{T}} \otimes \begin{pmatrix} 0.12 & 0.22 & 0.48 & 0.18 \\ 0.05 & 0.31 & 0.52 & 0.12 \\ 0.11 & 0.21 & 0.64 & 0.04 \\ 0.21 & 0.29 & 0.13 & 0.37 \\ 0.26 & 0.31 & 0.33 & 0.10 \end{pmatrix} \tag{4-2}$$

$$= \begin{pmatrix} 0.195 & 0.175 & 0.173 & 0.254 & 0.243 \end{pmatrix}^{\mathrm{T}}$$

Similarly:

$$V_2 = \begin{pmatrix} 0.013 & 0.201 & 0.326 & 0.312 & 0.007 \end{pmatrix}^{\mathrm{T}} \tag{4-3}$$

$$V_3 = \begin{pmatrix} 0.147 & 0.263 & 0.197 & 0.402 & 0.114 \end{pmatrix}^{\mathrm{T}} \tag{4-4}$$

$$V_4 = \begin{pmatrix} 0.032 & 0.108 & 0.384 & 0.532 & 0.034 \end{pmatrix}^{\mathrm{T}} \tag{4-5}$$

$$V_5 = \begin{pmatrix} 0.079 & 0.198 & 0.202 & 0.409 & 0.227 \end{pmatrix}^{\mathrm{T}} \tag{4-6}$$

Table4-1 satisfaction degree

Grade	Very satisfactory	Satisfactory	Basically satisfaction	No satisfaction	Deeply no satisfaction
Numerical segment	(0.9,1]	(0.7,0.9]	(0.5,0.7]	(0.3,0.5]	(0,0.3]
median	0.95	0.8	0.6	0.4	0.15

According to table4-1, using maximum membership principle, the V1 maximum membership degree is 0.254, the result of second index evaluation of logistics enterprise is" deeply no satisfaction". Similarly, I figure out other first grade index satisfaction degree. Show in table 4-2.

Table4-2 first grade index satisfaction degree

evaluation result / first grade index	evaluation score	satisfaction degree
Logistics enterprise image	0.254	Deeply no satisfaction
Logistics enterprise service quality	0.326	No satisfaction
Logistics enterprise cost evaluation	0.402	No satisfaction
Logistics enterprise service persistence	0.532	Basically satisfaction
Logistics enterprise infrastructure	0.409	No satisfaction

After evaluation and analysis: enterprise image of Ningbo HaiLu logistics is the least satisfied one. The things influence logistics enterprise image main indexes are the enterprise assets ability, public enterprise image, enterprise affinity and brand benefit. According to (4-2) data, the enterprise assets ability must be improved, the next are the updating of public corporate image and brand benefit

2)First grade indexes evaluation

$$V = \begin{pmatrix} V_1 & V_2 & V_3 & V_4 & V_5 \end{pmatrix}^{\mathrm{T}} = \begin{pmatrix} 0.195 & 0.175 & 0.173 & 0.254 & 0.243 \\ 0.113 & 0.201 & 0.326 & 0.312 & 0.107 \\ 0.147 & 0.263 & 0.197 & 0.402 & 0.114 \\ 0.332 & 0.318 & 0.384 & 0.490 & 0.134 \\ 0.079 & 0.008 & 0.102 & 0.509 & 0.107 \end{pmatrix} \tag{4-7}$$

$$\mu = W \otimes V = \begin{pmatrix} 0.223 & 0.487 & 0.118 & 0.069 & 0.104 \end{pmatrix}^{\mathrm{T}} \otimes \begin{pmatrix} 0.195 & 0.175 & 0.173 & 0.254 & 0.243 \\ 0.013 & 0.201 & 0.326 & 0.312 & 0.007 \\ 0.147 & 0.263 & 0.197 & 0.402 & 0.114 \\ 0.332 & 0.318 & 0.384 & 0.490 & 0.134 \\ 0.079 & 0.008 & 0.102 & 0.509 & 0.107 \end{pmatrix}$$

$$=(0.192 \quad 0.183 \quad 0.224 \quad 0.322 \quad 0.079)^T \tag{4-8}$$

According to table4-1, using maximum membership principle, the maximum membership degree is 0.322,the result is“ no satisfaction”. As a result overall customer satisfaction of Ningbo HaiLu logistic enterprise is “no satisfaction”. Connecting with Table 4-2, if Ningbo Ningbo HaiLu logistic enterprise wants to improve customer satisfaction, enhancing corporate image is the key, and then the service quality, cost control, infrastructure construction.

CONCLUSION

According to the satisfaction evaluation results calculated by this model, we can not only find the weak link of customer management in the enterprise, defining the potential risk, but also achieve the optimal allocation of resources though sequencing from the overall system. But it must be pointed out that, the current evaluation methods in the evaluation of the reliability and validity have some problems such as imperfection of indicators, inaccurate of standard, deviation of execution, imprecise of grade, this method is no exception. According to the method and process described in this paper, in the future ,we will try to work out some corresponding technical software .Another weakness is due to the various factors influence logistics enterprise customer satisfaction, and each factors may exist mutual influence and restrict. Therefore, the researches of perfected correlation-type evaluation indicator model are needed.

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