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The Establishment of the E-commerce Logistics Service Evaluation System Based on Regression-AHP[1]

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Abstract

With the development of economy and the progress of science and technology, E-commerce is rapidly penetrating into all fields of people's life. On the one hand, e-commerce plays a more and more prominent role in the consumption of the circulation. On the other hand, E-commerce distribution has become an important force pulling the express service increasing. But, express logistics service level in China is poor and it constrains the development problem. Therefore, establishing a scientific evaluation system is very necessary. In this paper, we propose Regression-AHP (RAHP) method. This new method can reduce the influence of subjectivity on the assessment result. The instance analysis shows that this method can evaluate the target equitable, objective and effective.

Keywords: *E-commerce, RAHP, Evaluate*

1. Introduction

The electronic commerce industry in our country starts late. However, it develops rapidly. The electronic commerce enterprises have gained a great success, such as Alibaba. The development of the e-commerce increases the express demand. But it also brings a lot of problems. These problems are the low express personnel quality, the low express service efficiency, the single service function and the slow speed. These problems seriously affect the shopping experience of consumers. Therefore, the express service problem becomes the most concerned problem for the electronic commerce, the consumers and even the service providers. For example, Alibaba made an investigation about more than ten thousand network operations in 2010 years. The investigation showed that the network operations had researched a considerable importance of the logistics service. More than 90% network operations considered that the logistics service of the express company could affect the satisfaction level of their own shops. There are many factors which can affect the consumer shopping experience. They include the distribution time, the parcel level, delaying or not on special holidays and the logistics information update etc. Therefore, we need to establish a scientific evaluation system. This evaluation system can regulate the service quality of the electronic commerce and enhance the shopping experience of the consumers.

In foreign countries, many scholars studied the evaluation system of the electronic commerce. Wen-Yau Liang, Tzu-Liang Tseng developed a methodology to appraise performance of the IA and demonstrated the use in the B2C e-commerce negotiation process [1]. An experiment was conducted to acquire empirical data and a survey was implemented to confirm advantage of the use of the IA. The computational results indicated that the proposed approach successfully evaluated IA performance and significantly distinguishes groups of using (vs. not using) the negotiation mechanism in B2C e-commerce. Farid Aulia Tanjung and Wawan Dhewanto proposed a multidimensional Approach to evaluate E-Commerce website development plan [2]. Fan Wu, Hsiao-Hui Liand and Yo-Hsin Kuo proposed several new metrics for online auctions as social networks [3]. They used simulation methods in

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order to show that malicious participants who had been difficult to identify at other auction websites can be easily identified with our proposed metrics.

In China, Zeng Tao and Liu Xin combined the critical incident technique (CIT) with the fuzzy comprehensive evaluation method to design the service quality evaluation questionnaire [4]. Ding Jianyong and Xu Xin analyzed the factors which affected the quality of the service delivery based on the characteristics of the electronic commerce website. And they established the service quality evaluation system of the express industry for the electronic commerce website [5]. Liu Yue and Guo Fan adopted the foreign e-trust electronic commerce trust scale to measure the intention of using the express companies when the customers shopped online. In addition, they got that the distribution quality, the customer service quality and the information quality can affect consumers to use the express company positively [6].

AHP is a kind of quantitative analysis method. After 70"s of twentieth, it developed rapidly. The present AHP methods have DEA-AHP [7-10], TOPSIS-AHP [11-14], Fuzzy-AHP and SWOT-AHP [15-18] etc. Now, AHP adopts the Delphy method to score. It can increase subjective influence on the evaluation results. In order to solve the above problem, we propose a new method-RAHP. This method adopts the analysis method to get the weight of each weight. This paper reduces greatly the influence of the subjective assessment results. The structure of this paper is as follows. The first part is the introduction. The second part is the improved AHP-RAHP. The third is the instance analysis and the last part is the conclusion.

2. The Improved AHP-RAHP

RAHP is an improved AHP method. Firstly, we establish the index system and the comment set. Then, we use the regression analysis to get the weights of the indexes. At last, we combine the comprehensive weight with the comment sets and get the finial evaluated scores. RAHP not only retain the advantages of the traditional AHP, but also get the weights of the indexes with regression analysis. This method reduces the subjective influence on the assessment results greatly.

The steps of the RAHP are as follows.

(1)We establish the index system $L=\{L_1,L_2,\cdots,L_i\};(i=1,2,\cdots,n)$. L_i is the evaluation indicator. (2)We set up the comment sets $V=\{V_1,V_2,\cdots,V_i\};(j=1,2,\cdots,m)$. And we assign different values for the remarking grade in the remarking sets.

(3) We get the index weights according to the regression analysis.

(4) According to the comment sets, we obtain the second index evaluation matrix $L=(L_{ij})$ which is normalized. We multiply the evaluation matrix and the comprehensive weight of the second index. Then we get the evaluated results of the first index $T=w''\cdot L_{ij}$. We make the results as the input of the indexes in order to make the evaluation score. We get the evaluated results of the index $S=w'\cdot B_{ij}$. w'' is the comprehensive weight of the second index. w' Is the comprehensive weight of the first index.

(5)We use $E=S\cdot V$ to get the final score of the e-commerce evaluation score.

3. Instance Analysis

This paper uses SPSS16.0 to do the regression analysis. The results are shown in the following table. There exists difference between the six dimensions and the service quality of the electronic commerce logistics in B2C. The value Sig. of the associated probability is 0.000. The dimension regression analysis results are listed in Table 1

Table 1. The Dimension Regression Analysis Results

Model		Non standardized coefficient		Standard coefficient	t	Sig
		B	Standard error	Trial version		
Variables	Constant term	2.037	0.17		0.007	0.000
	Convenience	0.108	0.17	0.194	3.011	0.000
	Time	0.211	0.17	0.253	7.144	0.000
	Reliability	0.258	0.17	0.202	8.480	0.000
	Economy	0.158	0.17	0.156	6.889	0.000
	Empathy	0.111	0.17	0.249	5.480	0.000
	Reactivity	0.095	0.17	0.258	3.153	0.000

The dependent variable is the service quality of the electronic commerce logistics in B2C.

(1) To determine the regression mode.

We use FWZL to express the service quality of the electronic commerce logistics in B2C. The reliability is KK. The time is SJ. The economic is JG. The empathy is YQ. The convenience is FB. The reactivity is FY. We can get the regression coefficient of the convenient dimension is 0.103. In addition, the regression coefficient of time dimension is 0.208. The regression coefficient of reliability dimension is 0.273. The regression coefficient of economic dimension is 0.149. The regression coefficient of empathy dimension is 0.132. The regression coefficient of reactive dimension is 0.099. Therefore, the regression equation for the service quality of the e-commerce logistics in B2C is as follows.

$$FWZL = 0.273 * KK + 0.208 * SJ + 0.149 * JG + 0.132 * YQ + 0.103 * FB + 0.099 * FY$$

(2)To make the regression coefficients normalized

The regression coefficient of each dimension needs to be normalized. Then they can be as the weight coefficients.

The weight of the convent dimension is as follows.

$$X_1 = \frac{0.103}{0.103 + 0.208 + 0.273 + 0.149 + 0.132 + 0.099} = 0.107 \quad (1)$$

The weight of the time dimension is as follows.

$$X_2 = \frac{0.208}{0.103 + 0.208 + 0.273 + 0.149 + 0.132 + 0.099} = 0.216 \quad (2)$$

The weight of the reliability dimension is as follows.

$$X_3 = \frac{0.273}{0.103 + 0.208 + 0.273 + 0.149 + 0.132 + 0.099} = 0.283 \quad (3)$$

The weight of the economic dimension is as follows.

$$X_4 = \frac{0.149}{0.103 + 0.208 + 0.273 + 0.149 + 0.132 + 0.099} = 0.154 \quad (4)$$

The weight of the reactivity dimension is as follows.

$$X_5 = \frac{0.099}{0.103 + 0.208 + 0.273 + 0.149 + 0.132 + 0.099} = 0.103 \quad (5)$$

The weight of the empathy dimension is as follows.

$$X_6 = \frac{0.132}{0.103 + 0.208 + 0.273 + 0.149 + 0.132 + 0.099} = 0.137 \quad (6)$$

The dimension weight coefficients are in Table 2

Table 2. The Dimension Weight Coefficients

Dimension	Regression coefficients	Weights
Convenience	2.037	0.107
Time	0.108	0.216
Reliability	0.211	0.283
Economy	0.258	0.154
Reactivity	0.111	0.103
Empathy	0.158	0.137

Similarly, we make each index do the regression analysis. Then we can get the weight of each index in its dimension. For example, to convenience, the regression analysis results of each index are listed in table 3.

Table 3. The Regression Analysis Results of Each Index

Model		Non standardized parameters		Standard coefficient	t	Sig.
		B	Standard error	Trial version		
Variables	Constant term	-0.020	0.012		-1.637	0.103
	Network coverage	0.371	0.006	0.416	53.100	0.000
	Distribution patterns	0.342	0.007	0.417	51.599	0.000
	Send receive procedure	0.278	0.006	0.468	58.380	0.000

The dependent variable is convenience.

(1)To determine the regression equation

We use FB to express the convenience. The following indexes are expressed by FB1, FB2 and FB3. Then the regression equation is as follows.

$$FB = 0.368 * FB1 + 0.345 * FB2 + 0.335 * FB3 - 0.2$$

(2)To make the regression coefficients normalized

The weight of the network coverage is as follows.

$$X_{11} = \frac{0.368}{0.368 + 0.345 + 0.335} = 0.351 \quad (7)$$

The weight of the distribution patterns is as follows.

$$X_{12} = \frac{0.345}{0.368 + 0.345 + 0.335} = 0.329 \quad (8)$$

The weight of the sanding and receiving is as follows.

$$X_{13} = \frac{0.335}{0.368 + 0.345 + 0.335} = 0.320 \quad (9)$$

Using the regression analysis method, we can get the regression equation of each dimension about time, economy, empathy, reactivity. Then we make the regression coefficients normalized. Therefore, we get the weight of each index. The weight of each index is in Table 4

Table 4. The Weight of Each Index

First class indicator	Second class indicator	weights
Convenience	Network coverage	0.351
	Distribution pattern	0.329
	Send receive procedure	0.320
Time	Delay in special holiday	0.231
	Updated speed of logistics information	0.247
	Order and delivery cycle	0.323
	Parcel waiting time	0.199
Reliability	Wrapped package and perfect goods	0.323
	Accurate delivery package	0.564
	The parcel information online display should be no missing	0.113
Economy	The conform between the logistics service and the payed cost	0.474
	Freight and price elasticity	0.526
Empathy	Providing personalized service	0.239
	Implementation of the delivery	0.221
	Staff service attitude	0.256
	Staff operating proficiency	0.284
Reactivity	Response time of telephone or the call online	0.341
	The processing speed for the lost or damaged	0.447
	The processing speed for the emergencies	0.212

We normalize the scores of the index. The scores are as follows.

Table 5. The Index Data of the Convenience for Tmall

The first layer	The second layer	Comment		
			Grade	Normalize
Convenience	Network coverage	Excellent	1	0.2
		Fine	4	0.8
		Good	0	0
		Qualified	0	0
		Poor	0	0
	Distribution pattern	Excellent	0	0
		Fine	5	1
		Good	0	0
		Qualified	0	0
		Poor	0	0
	Send receive procedure	Excellent	1	0.2
		Fine	4	0.8
		Good	0	0
		Qualified	0	0
		Poor	0	0

Table 6. The Index Data of The Time For Tmall

The first layer	The second layer	Comment	Grade	Normalize
Time	Delay in special holiday	Excellent	0	0
		Fine	5	1
		Good	0	0
		Qualified	0	0
		Poor	0	0
	Updated speed of logistics information	Excellent	2	0.4
		Fine	3	0.6
		Good	0	0
		Qualified	0	0
		Poor	0	0
	Order and delivery cycle	Excellent	1	0.2
		Fine	4	0.8
		Good	0	0
		Qualified	0	0
		Poor	0	0
	Parcel waiting time	Excellent	0	0
		Fine	5	1
		Good	0	0
		Qualified	0	0
		Poor	0	0

Table 7. The Index Data of the Reliability for Tmall

The second layer	The third layer	Comment	Grade	Normalize
Reliability	Wrapped package and perfect goods	Excellent	1	0.2
		Fine	3	0.6
		Good	1	0.2
		Qualified	0	0
		Poor	0	0
	Accurate delivery package	Excellent	1	0.2
		Fine	4	0.8
		Good	0	0
		Qualified	0	0
		Poor	0	0
	The parcel information online display should be no missing	Excellent	0	0
		Fine	5	1
		Good	0	0
		Qualified	0	0
		Poor	0	0

Table 8. The Index Data of the Economy for Tmall

The first layer	The second layer	Comment	Grade	Normalize
Economy	The conform between the logistics service and the payed cost	Excellent	1	0.2
		Fine	4	0.8
		Good	0	0
		Qualified	0	0
		Poor	0	0
	Freight and price elasticity	Excellent	1	0.2
		Fine	3	0.6
		Good	1	0.2

		Qualified	0	0
		Poor	0	0

Table 9. The Index Data of the Empathy for Tmall

The first layer	The second layer	Comment		
			Grade	Normalize
Empathy	Providing personalized service	Excellent	1	0.2
		Fine	4	0.8
		Good	0	0
		Qualified	0	0
		Poor	0	0
	Implementation of the delivery	Excellent	0	0
		Fine	5	1
		Good	0	0
		Qualified	0	0
		Poor	0	0
	Staff service attitude	Excellent	0	0
		Fine	5	1
		Good	0	0
		Qualified	0	0
		Poor	0	0
	Providing personalized service	Excellent	2	0.4
		Fine	3	0.6
		Good	0	0
		Qualified	0	0
		Poor	0	0

Table 10. The Index Data of the Ereactivity for tmall

The first layer	The second layer	Comment		
			Grade	Normalize
Reactivity	Response time of telephone or the call online	Excellent	1	0.2
		Fine	4	0.8
		Good	0	0
		Qualified	0	0
		Poor	0	0
	The processing speed for the lost or damaged	Excellent	0	0
		Fine	5	1
		Good	0	0
		Qualified	0	0
		Poor	0	0
	The processing speed for the emergencies	Excellent	1	0.2
		Fine	3	0.6
		Good	1	0.2
		Qualified	0	0
		Poor	0	0

According to the normalized evaluation matrix, we assess the evaluation index for the Tmall. We calculate the evaluation results for the Tmall. The results are as follows.

$$T_a = w_a'' \cdot L_{ij} = (0.351, 0.329, 0.320) \cdot \begin{bmatrix} 0.2 & 0.8 & 0 & 0 & 0 \\ 0 & 1 & 0 & 0 & 0 \\ 0.2 & 0.8 & 0 & 0 & 0 \end{bmatrix}$$

$$= (0.1342, 0.8658, 0, 0, 0)$$

$$T_b = w_b'' \cdot L_{ij} = (0.231, 0.247, 0.323, 0.199) \cdot \begin{bmatrix} 0 & 1 & 0 & 0 & 0 \\ 0.4 & 0.6 & 0 & 0 & 0 \\ 0.2 & 0.8 & 0 & 0 & 0 \\ 0 & 1 & 0 & 0 & 0 \end{bmatrix}$$

$$= (0.1634, 0.8366, 0, 0, 0)$$

$$T_c = w_c'' \cdot L_{ij} = (0.323, 0.564, 0.113) \cdot \begin{bmatrix} 0.2 & 0.6 & 0.2 & 0 & 0 \\ 0.2 & 0.8 & 0 & 0 & 0 \\ 0 & 1 & 0 & 0 & 0 \end{bmatrix}$$

$$= (0.1174, 0.7580, 0.0646, 0, 0)$$

$$T_d = w_d'' \cdot L_{ij} = (0.474, 0.526) \cdot \begin{bmatrix} 0.2 & 0.8 & 0 & 0 & 0 \\ 0.2 & 0.6 & 0.2 & 0 & 0 \end{bmatrix}$$

$$= (0.200, 0.6948, 0.1052, 0, 0)$$

$$T_e = w_e'' \cdot L_{ij} = (0.239, 0.221, 0.256, 0.284) \cdot \begin{bmatrix} 0.2 & 0.8 & 0 & 0 & 0 \\ 0 & 1 & 0 & 0 & 0 \\ 0 & 1 & 0 & 0 & 0 \\ 0.4 & 0.6 & 0 & 0 & 0 \end{bmatrix}$$

$$= (0.1641, 0.8386, 0, 0, 0)$$

$$T_f = w_f'' \cdot L_{ij} = (0.341, 0.447, 0.212) \cdot \begin{bmatrix} 0.2 & 0.8 & 0 & 0 & 0 \\ 0 & 1 & 0 & 0 & 0 \\ 0.2 & 0.6 & 0.2 & 0 & 0 \end{bmatrix}$$

$$= (0.1106, 0.8469, 0.0424, 0, 0)$$

$$S = w''' \cdot B_{ij} = (0.107, 0.216, 0.283, 0.154, 0.103, 0.137) \cdot \begin{bmatrix} 0.1342 & 0.8658 & 0 & 0 & 0 \\ 0.1634 & 0.8366 & 0 & 0 & 0 \\ 0.1174 & 0.7580 & 0.0646 & 0 & 0 \\ 0.200 & 0.6948 & 0.1052 & 0 & 0 \\ 0.1641 & 0.8386 & 0 & 0 & 0 \\ 0.1106 & 0.8469 & 0.0424 & 0 & 0 \end{bmatrix}$$

$$= (0.1457, 0.7973, 0.0403, 0, 0)$$

Then, we define the comment sets

$$V = \{V_1, V_2, V_3, V_4, V_5\} = \{Excellent, Fine, Good, Qualified, Poor\} = \{90, 80, 70, 60, 50\}$$

The final evaluation index

$$E = S \cdot V = [0.1457, 0.7973, 0.0403, 0, 0] \cdot (90, 80, 70, 60, 50)^T$$

$$= 79.718$$

So, the assessment scores of Tmall are 79.718.

4. Conclusion

With the development of the electronic commerce, the logistics enterprises appear which likes the bamboo shoots after a spring rain. When the number of the express companies is increasing, a series of quality problems begin to expose. In order to regulate the electronic commerce market express, improve the core competitiveness of logistics enterprises and strengthen the online shopping chain management, we must establish a set of scientific evaluation system. This evaluation system can help the logistics enterprises to understand their own deficiencies. And it also can be used as the evaluation standard of selecting the express logistics service provider for the e-commerce online shopping mall.

In this paper, we complete the below work: (1) we construct the express logistics service quality evaluation system of the B2C e-commerce. (2) We propose an improved AHP-RAHP.

This method pays more attention to the objectivity. And it can reduce the influence of the subjectivity on the evaluation results at the maximum extent. (3) We apply this method to evaluate the express logistics service quality of Tmall. The result shows that this method can evaluate the target equitable, objective and effective.

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