Manufacturing and Service Operations Management (2023)
Clausius Scientific Press, Canada

DOI: 10.23977/msom.2023.040103
ISSN 2616-3349 Vol. 4 Num. 1

Research on Service Quality Evaluation of College Express Collection Point Based on AHP Matter Element Analysis

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Keywords: Online shopping, Colleges and universities, Matter element analysis, Service quality

Abstract: Online shopping has become a major part of the purchasing power of college teachers and students, so it is particularly important to study the service quality evaluation of college express collection points. Therefore, this paper based on AHP matter element analysis to evaluate the service quality of college express collection points. Through an example of the service quality of a college express collection point in Tibet, it shows that the AHP matter element analysis method is feasible and operable in the evaluation of the service quality of college express collection points.

1. Introduction

In recent years, with the rapid development of the Internet, online shopping has gradually become the main shopping method for college students. According to incomplete statistics, among Chinese college students, online shopping accounts for 95.4% of their own shopping level. Due to the universality of college students' online shopping and the particularity of students' time arrangement, college express collection points have developed rapidly. Postal, Cainiao Post, Shunfeng, Jingdong, Jitu Express, etc. have matching express collection points. Therefore, in order to improve the service quality of teachers and students for college express collection points, it is particularly important to study the current service quality of college express collection points.

Yu Qun and others studied the use of college students' express collection points in the form of questionnaires, made statistical analysis of the effectively recovered samples, and put forward corresponding suggestions[0.] Yao Zhiqiang takes Jingdong Express as the research object, and combines SERVQUAL model to build the university express service quality evaluation index system; The weighted college express service quality model is established to provide decision-making reference for improving the business service quality of JD Express colleges and universities and improving the overall competitiveness of enterprises[0]. Luo Yishan et al. used AHP to determine the weight of service quality evaluation indicators, and used fuzzy comprehensive evaluation method to evaluate the service quality of Cainiao Post Station[0].

To sum up, the mathematical model used in the study of college express service quality can only

evaluate high-level indicators, and the analysis of the weight of low-level indicators is insufficient. Therefore, on the premise of using the analytic hierarchy process to determine the indicators, this paper combines the matter element analysis method to obtain the subordination degree of low-level indicators, and then obtains more detailed analysis results, so as to provide some reference for the improvement of the service quality of college express collection points.

2. Index System

The service quality rating system of college express collection points is an indicator system composed of specific indicators. In this paper, according to the basic rules of reference and index establishment, from the perspective of college teachers and students, the evaluation index system is established in five aspects: service, security, timeliness, economy and convenience of college express collection points. The established index system is shown in Figure 1.

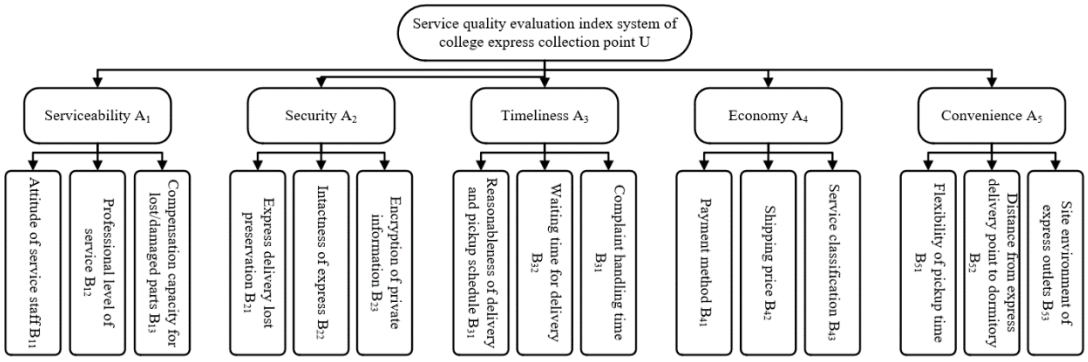

Figure 1 Service Quality Evaluation Index System of College Express Collection Point

3. Model Establishment

3.1 Hierarchical Analysis

Analytic Hierarchy Process (AHP) is a hierarchical weight analysis method proposed by Saaty, which is widely used in multi-objective decision-making problems. Its solution steps are shown in Figure 2^0.

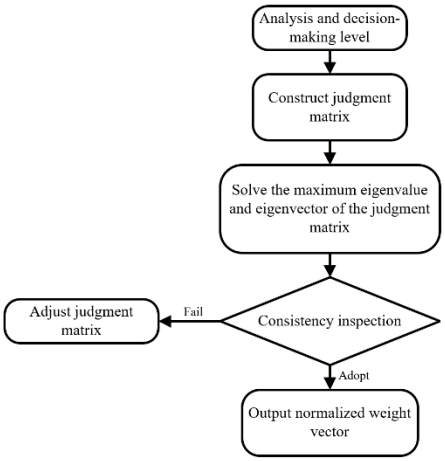

Figure 2 Analytical Hierarchy Process Solution Steps

The 1-9 evaluation scale system proposed by Saaty is not consistent with the actual scale system

in people's minds, and this inconsistency may destroy the final scheme ranking and optimization. Therefore, it is necessary to improve the scaling method on the basis of previous scaling research results. This paper adopts the 10/10-18/2 scale of Zhang Chenguang et al., as shown in Table 1 [0].

Table 1 Types of Evaluation Indicators

Importance	10/10-18/2 Scale	1-9 Scale
Identical	10/10(1)	1
Slightly important	12/8(1.50)	3
Obviously important	14/6(2.33)	5
Strongly important	16/4(4.00)	7
Extremely important	18/2(9.00)	9
General formula	(9+K)/(11-K)	
Value range of K	1~9	

3.2 Matter Element Analysis

3.2.1 Determination of Basic Matter-Element

In this paper, the university express service quality N, n evaluation indicators c_i and the corresponding n quantities $v_i(i = 1,2,\dots,n)$, called ordered triplet. Service quality evaluation of college express collection point:

$$R = (N, c, v)\begin{bmatrix} R_1 \\ R_2 \\ \vdots \\ R_n \end{bmatrix} = \begin{bmatrix} N & c_1 & v_1 \\ & c_2 & v_2 \\ & \vdots & \vdots \\ & c_n & v_n \end{bmatrix}$$

N is the service quality of college express delivery, c is the satisfaction evaluation index, and v is the characteristic value of N with respect to c.

3.2.2 Determining the Classical Domain

The classic domain is the quantitative value range corresponding to each evaluation index of each satisfaction evaluation grade. The classic domain is:

$$R_{0j} = (N_{0j}, c_i, v_{0ji})\begin{bmatrix} R_1 \\ R_2 \\ \vdots \\ R_n \end{bmatrix} = \begin{bmatrix} N_{0j} & c_1 & v_{0j1} \\ & c_2 & v_{0j2} \\ & \vdots & \vdots \\ & c_n & v_{0jn} \end{bmatrix} = \begin{bmatrix} N_{0j} & c_1 & [a_{0j1}, b_{0j1}] \\ & c_2 & [a_{0j2}, b_{0j2}] \\ & \vdots & \vdots \\ & c_n & [a_{0jn}, b_{0jn}] \end{bmatrix}$$

N_{0j} is the jth evaluation grade of college express service quality; v_{0j} is satisfaction evaluation index c The value range of i, that is, the classical field R_{0j}.

3.2.3 Determining the Section Area

The section area is the range that each indicator C_i of the express service quality evaluation grade of each university can take, then:

$$R_p = (P, C_i, v_{pi})\begin{bmatrix} R_1 \\ R_2 \\ \vdots \\ R_n \end{bmatrix} = \begin{bmatrix} P & c_1 & v_{p1} \\ & c_2 & v_{p2} \\ & \vdots & \vdots \\ & c_n & v_{pn} \end{bmatrix} = \begin{bmatrix} P & c_1 & [a_{p1}, b_{p1}] \\ & c_2 & [a_{p2}, b_{p2}] \\ & \vdots & \vdots \\ & c_n & [a_{pn}, b_{pn}] \end{bmatrix}$$

P refers to all college express service quality evaluation grades; v_{pi} is the value range of C_i, that is, section v_{pi}.

3.2.4 Determination of Matter Element Matrix

For the university express service quality N to be evaluated, the matter element matrix is constructed, then:

$$R_0 = (N, c_i, v_i) = \begin{bmatrix} N & c_1 & v_1 \\ & c_2 & v_2 \\ & \vdots & \vdots \\ & c_n & v_n \end{bmatrix}$$

v_1 is N about c_i The range of values that can be taken is the specific value of the evaluation index of the college express service quality to be evaluated.

3.2.5 Determination of Correlation Function

The correlation function is a function that represents the degree of membership of the evaluated object and a certain evaluation grade. Its numerical value represents the degree to which the matter element meets the required value range when the value of the matter element is a certain point on the axis, which can quantize the incompatibility problem. Then the correlation function can be expressed as:

$$k_j(v_i) = \begin{cases} \dfrac{\rho(v_i, v_{0ji})}{\rho(v_i, v_{pi}) - \rho(v_j, v_{ji})} & (v_i \notin v_{0ji}) \\ -\dfrac{\rho(v_i, v_{ji})}{|a_{0j} - b_{01}|} & (v_i \in v_{0ji}) \end{cases}$$

$$\rho(v_i, v_{0ji}) = \left| v_i - \frac{(a_{ij} - b_{ij})}{2} \right| - \frac{b_{ij} - a_{ij}}{2}$$

$$\rho(v_i, v_{pi}) = \left| v_i - \frac{(a_{pi} + b_{pi})}{2} \right| - \frac{b_{pi} - a_{pi}}{2}$$

3.2.6 Determination of Comprehensive Correlation Coefficient

The comprehensive correlation degree of matter element N_i of college express service quality is:

$$K_i(N_i) = \sum_{i=1}^{m} \omega_i K_j(v_i)$$

According to Formula (8), the comprehensive correlation coefficient of the evaluation index is an n-dimensional line vector. According to the principle of maximum correlation degree identification, the grade corresponding to the maximum correlation coefficient is the evaluation result of the item to be evaluated. Namely:

$$K_{it0} = \max\{K_{ij}(N_i)\}, j = 1,2,\cdots,n$$

4. Case Analysis

4.1 Data Acquisition

In this paper, teachers and students of a university in Tibet are selected as the survey objects. According to the principle of random sampling, 150 online test papers will be sent in December 2022, and 137 valid questionnaires will be collected. The effective rate is 91.3%. There were 72 female students, accounting for 52.6% of the total number; There are 65 male students, accounting for 47.4% of the total number, which is consistent with the fact that female students shop more. The

survey data in this paper basically conforms to the shopping characteristics of college teachers and students today.

4.2 Data Processing and Analysis

4.2.1 Index Weight

SPSS software was used to analyze the weight of AHP two-level indicators, and the weight of 15 two-level indicators was obtained as shown in Table 2.

Table 2 Calculation Results Of Secondary Index Weights

Secondary evaluation index	Secondary index weight	Standardization
B_{11}	1.864	0.0305
B_{12}	1.547	0.0135
B_{13}	3.113	0.0973
B_{21}	4.629	0.1785
B_{22}	9.274	0.4272
B_{23}	19.972	1.0000
B_{31}	5.899	0.2465
B_{32}	5.131	0.2054
B_{33}	4.034	0.1467
B_{41}	1.295	0.0000
B_{42}	17.509	0.8681
B_{43}	6.492	0.2783
B_{51}	7.464	0.3303
B_{52}	8.494	0.3854
B_{53}	3.283	0.1064

The calculation result of the analytic hierarchy process shows that the maximum characteristic root is 17.789 and the CI value is 0.139. According to the RI table, the corresponding RI value is 1.584, so CR=CI/RI=0.088<0.1, passing the one-time test.

4.2.2 Determine the Classical Domain and Node Domain Matter Elements of Each Indicator

According to the actual situation of college students and teachers for online shopping, and after consulting experts, this paper divides the evaluation indicators of the service quality of college express collection points into four grades: poor, average, good and good, and determines the classic domain matter-element and section domain matter-element of each evaluation indicator.

(1) Matter element of classical domain

$$R_{10} = \begin{bmatrix} N_{01} & N_{02} & N_{03} & N_{04} \\ [0,0.5) & [0.5,0.6) & [0.6,0.7) & [0.7,1] \\ [0,0.4) & [0.4,0.6) & [0.6,0.8) & [0.8,1] \\ [0,0.4) & [0.4,0.6) & [0.6,0.7) & [0.7,1] \end{bmatrix}$$

$$R_{20} = \begin{bmatrix} [0,0.5) & [0.5,0.6) & [0.6,0.7) & [0.7,1] \\ [0,0.3) & [0.3,0.7) & [0.7,0.8) & [0.8,1] \\ [0,0.4) & [0.4,0.5) & [0.5,0.7) & [0.7,1] \end{bmatrix}$$

$$R_{30} = \begin{bmatrix} [0,0.2) & [0.2,0.4) & [0.4,0.6) & [0.6,1] \\ [0,0.4) & [0.4,0.5) & [0.5,0.7) & [0.7,1] \\ [0,0.3) & [0.3,0.6) & [0.6,0.8) & [0.8,1] \end{bmatrix}$$

$$R_{40} = \begin{bmatrix} [0,0.4) & [0.4,0.6) & [0.6,0.8) & [0.8,1] \\ [0,0.3) & [0.3,0.7) & [0.7,0.9) & [0.9,1] \\ [0,0.4) & [0.4,0.5) & [0.5,0.8) & [0.8,1] \end{bmatrix}$$

$$R_{50} = \begin{bmatrix} [0,0.2) & [0.2,0.4) & [0.4,0.7) & [0.7,1] \\ [0,0.4) & [0.4,0.6) & [0.6,0.9) & [0.9,1] \\ [0,0.5) & [0.5,0.7) & [0.5,0.9) & [0.9,1] \end{bmatrix}$$

(2) Nodal matter element

$$R_{1p} = \begin{bmatrix} \mathrm{P} & \mathrm{c}_1 & [0,1] \\ & \mathrm{c}_2 & [0,1] \\ & \mathrm{c}_3 & [0,1] \end{bmatrix} R_{2p} = \begin{bmatrix} \mathrm{P} & \mathrm{c}_1 & [0,1] \\ & \mathrm{c}_2 & [0,1] \\ & \mathrm{c}_3 & [0,1] \end{bmatrix} R_{3p} = \begin{bmatrix} \mathrm{P} & \mathrm{c}_1 & [0,1] \\ & \mathrm{c}_2 & [0,1] \\ & \mathrm{c}_3 & [0,1] \end{bmatrix}$$

$$R_{4p} = \begin{bmatrix} \mathrm{P} & \mathrm{c}_1 & [0,1] \\ & \mathrm{c}_2 & [0,1] \\ & \mathrm{c}_3 & [0,1] \end{bmatrix} R_{5p} = \begin{bmatrix} \mathrm{P} & \mathrm{c}_1 & [0,1] \\ & \mathrm{c}_2 & [0,1] \\ & \mathrm{c}_3 & [0,1] \end{bmatrix}$$

4.2.3 Matter Element Results to Be Evaluated

According to the standardized data in Table 2, the matter elements to be evaluated for the service quality of college express collection points are:

$$R_1 = \begin{bmatrix} 0.0305 \\ 0.0135 \\ 0.0973 \end{bmatrix}, R_2 = \begin{bmatrix} 0.1785 \\ 0.4272 \\ 1.0000 \end{bmatrix}, R_3 = \begin{bmatrix} 0.2465 \\ 0.2054 \\ 0.1467 \end{bmatrix}, R_4 = \begin{bmatrix} 0.0000 \\ 0.8681 \\ 0.2783 \end{bmatrix}, R_5 = \begin{bmatrix} 0.3303 \\ 0.3854 \\ 0.1064 \end{bmatrix}$$

4.2.4 Correlation Result

Use formula (5-7) to calculate the grade correlation degree of service quality evaluation indicators of college express collection points. See Table 3 for the results.

Table 3 Grade Correlation Results of College Express Collection Point Service Quality Evaluation Indicators

Secondary evaluation index	Difference	Commonly	Good	Excellent	Grade
B_{11}	-0.5700	-0.4625	-0.2833	0.2833	Excellent
B_{12}	-0.5898	-0.3848	0.2305	-0.1578	Good
B_{13}	-0.8292	-0.7438	-0.6583	0.3417	Excellent
B_{21}	-0.6924	-0.6155	-0.4873	0.4873	Excellent
B_{22}	-0.8916	-0.7470	-0.6205	0.3795	Excellent
B_{23}	-0.8272	-0.7926	-0.6543	0.3457	Excellent
B_{31}	-0.4779	-0.3038	0.0885	-0.0407	Good
B_{32}	-0.4894	-0.3873	0.0318	-0.0203	Good
B_{33}	-0.6903	-0.4580	0.0840	-0.0719	Good
B_{41}	-0.9109	-0.8663	-0.7327	0.2674	Excellent
B_{42}	-0.8490	-0.6477	0.0285	-0.0512	Good
B_{43}	-0.9043	-0.8852	-0.7130	0.2870	Excellent
B_{51}	-0.6169	-0.4892	0.0217	-0.0208	Good
B_{52}	-0.7377	-0.6066	0.1912	-0.2672	Good
B_{53}	-0.7286	-0.5477	0.1785	-0.2083	Good

It can be seen from Table 3 that in the evaluation results of service quality U of college express collection points, there are 7 excellent indicators, 8 good indicators, 0 general indicators and 0 poor indicators.

Use Formula (9) to calculate the comprehensive correlation degree of the five first level indicators in the university express collection point service quality U evaluation system, as shown in Table 4.

Table 4 Service Quality Evaluation Results of College Express Collection Point

Level I indicators	Weight	Difference	Commonly	Good	Excellent	Grade
A_1	0.03275	-0.09368	-0.07494	-0.03350	0.02201	Excellent
A_2	0.37220	-1.29052	-1.15348	-0.94317	0.64897	Excellent
A_3	0.13875	-0.22999	-0.15944	0.02835	-0.01844	Good
A_4	0.26573	-0.70796	-0.63754	-0.37658	0.13371	Excellent
A_5	0.19056	-0.39697	-0.31317	0.07459	-0.09456	Good
Comprehensive correlation degree		-0.09368	-0.07494	0.07459	0.64897	Excellent

It can be seen from Table 3 and Table 4 that timeliness and convenience are at the "good" evaluation level, so these two aspects need to be improved; In the secondary evaluation indicators, the professional level of service, the rationality of the time arrangement for sending and picking up, the waiting time for sending and picking up, the complaint handling time, the sending price, the flexibility of the picking up time, the distance between the express delivery point and the dormitory, and the site environment of the express delivery network are all at the "good" evaluation level. Therefore, these aspects need to be improved in order to improve the satisfaction of college teachers and students with the service of the express delivery collection point.

5. Conclusion

In this paper, the service quality of college express collection points is comprehensively evaluated by multiple indicators and multi-level. The matter-element analysis model is introduced for comprehensive evaluation to get a better and accurate evaluation result, which is convenient for relevant enterprises to do a good job with the corresponding indicators. Through an example of the service quality of a college express collection point in Tibet, it shows that the AHP matter element analysis method is feasible and operable to apply to the service quality evaluation of college express collection points.

This paper can evaluate the service quality of express collection points and rank the service quality, so as to obtain more accurate service improvement methods. The team will continue to carry out relevant research.

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