ISSN : 0974 - 7435 Volume 10 Issue 14

2014

BioTechnology

An Indian Journal

FULL PAPER

BTAIJ, 10(14), 2014 [7886-7895]

# Research of extension evaluation on logistics service quality in B2C electronic commerce

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## ABSTRACT

With popularization of computers and smart phones and the fast development of Internet technologies, Electronic Commerce (E-Commerce) has swept people's lives. More and more people are involved in E-Commerce, especially when B2C E-Commerce has taken up half the market shares in E-Commerce due to its outstanding advantages. As the influence of E-Commerce on people's lives grows, enterprises are paying more attentions to their service quality, especially logistics service quality which is of vital importance, and therefore, it has become an important and effective strategy for E-Commerce operators to maintain advantageous position in the competition by improving their logistics service quality. However, there is not any currently prevailing evaluation standard on logistics service quality in E-Commerce. This paper focuses on such evaluation standard and proposes an evaluation indicator system and establishes an evaluation model on basis of extenics, aiming to realize accurate evaluations on basis of data acquired through investigations. In addition, this paper takes Tmall as a typical E-Commerce operator for multi-dimensional verification of such evaluation standards. The paper gives a general clue to the currently logistics service quality in current B2C E-Commerce and the prospects of B2C E-Commerce operators. As such, the researches are of practical values.

## KEYWORDS

Extenics; B2C e-commerce; Logistics service quality; Evaluation model.



## INTRODUCTION

The past ten years, with fast development of Internet, industries on basis of the Internet were growing at extraordinary rate, among which E-Commerce was the most eye-catching industry, especially the on-line shopping has become a most important shopping mode popular among the young generation. For many consumers, on-line shopping has taken up more than a half of their total shopping expenditures[1]. Attracted by these opportunities, operators increased their investment in related facilities as well as promotion and advertising. The B2C (Business to Consumer) mode has become the core of E-Commerce due to its outstanding advantages. Along with the development of B2C E-Commerce, logistics service quality is a great driving power, however E-Commerce operators are at a loss to identify the areas where logistics service quality can be improved. The reason for this is that all existing researches are focused on measurement of service quality. For instance, Zhang Yanyan (2013) proposed a quantitative measuring method on B2C E-Commerce service quality[2], and few people were working on uniform evaluation researches on various measuring models. Since the measuring models differ from one another, the research findings were incomparable. Therefore, it is of great significance to establish a unified evaluation indicator system and to build a universally applicable evaluation model. This paper makes innovative attempts to establish and verify such a universally applicable evaluation model.

## INDICATOR SYSTEM FOR B2C E-COMMERCE LOGISTICS SERVICE QUALITY EVALUATION

The basic research approaches of extension and summarization are applied throughout this paper. In addition, the elementary theory and association analysis are used to identify the factors having influence on logistics service quality from several aspects and tiers, and then such factors are classified by a certain standard to finally form the B2C E-Commerce logistics service quality evaluation indicators system[3].

(1) Replace the logistics service quality of a B2C E-Commerce in question by M.

(2) During the extension stage, the association analysis is used to deduce, from B2C E-Commerce logistics service quality element M, a subordinate element Mi which covers various aspects in B2C E-Commerce logistics service quality and reflects the influencing factors on B2C E-Commerce logistics service quality.

The list of basic factors of B2C E-Commerce logistics service quality is shown as TABLE 1.

(3) During the summarization stage, the subordinate elements are sorted in accordance with certain requirements and by using related analysis methods, and finally six major groups of factors having influences on the B2C E-Commerce logistics service quality. The inclusion relations are as shown below Figure 1:

As shown in Figure 1 above, there are 28 subordinate elements under element M of B2C E-Commerce logistics service quality, which are summarized into six major groups. In such a way, the influencing factors on B2C E-Commerce logistics service can be obtained to figure out an indicator system shown as TABLE 2.

## B2C E-COMMERCE LOGISTICS SERVICE QUALITY EVALUATION MODEL

### Nonlinear extenics based comprehensive evaluation method

The comprehensive evaluation involves many evaluation strategies, of which only the nonlinear extenics based comprehensive evaluation method is a method established on basis of the extenics and can be used to carry out comprehensive evaluation on a matter, process and method. The evaluation process is described as Figure 2.

**TABLE 1 : List of basic factors of B2C E-Commerce logistics service quality**

| Basic element | Description | Basic element | Description | Basic element | Description |
|---|---|---|---|---|---|
| M | | M1 | Quantity ordered | M11 | Details of guidance and instructions |
| | | | | M12 | Easy operating process |
| | | | | M13 | Precise order processing |
| | | | | M14 | Timely order response |
| | | | | M15 | Order release cycle |
| | | | | M16 | Complete commodity information |
| | | M2 | Customization quality | M21 | Diversified payment methods |
| | | | | M22 | Diversified acceptance methods |
| | | | | M23 | Diversified refunding and replacement methods |
| | | | | M24 | Reasonable delivery cost |
| | | | | M241 | Logistics cost |
| | | | | M242 | Service cost efficiency |
| | | | | M243 | Refunding and replacement cost |
| | | | | M25 | No transaction information is disclosed |
| | | | | M26 | Personal information is transferred in a safe manner |
| | | | | M27 | Customized value added services |
| | | M3 | Response quality | M31 | Ordering and delivery progress |
| | | | | M32 | Question response timeliness |
| | | | | M33 | Inquiry satisfaction |
| | | | | M34 | Service attitude in communication |
| | | M4 | Delivery quality | M41 | Agreed delivery time |
| | | | | M42 | Accuracy of commodity |
| | | | | M43 | Intactness of commodity |
| | | | | M44 | Proper packing |
| | | | | M45 | Professional logistics |
| | | M5 | Deviation response | M51 | Complete measures |
| | | | | M52 | Satisfactory measures |
| | | | | M53 | Deviation response timeliness |
| | | | | M54 | Result satisfaction |

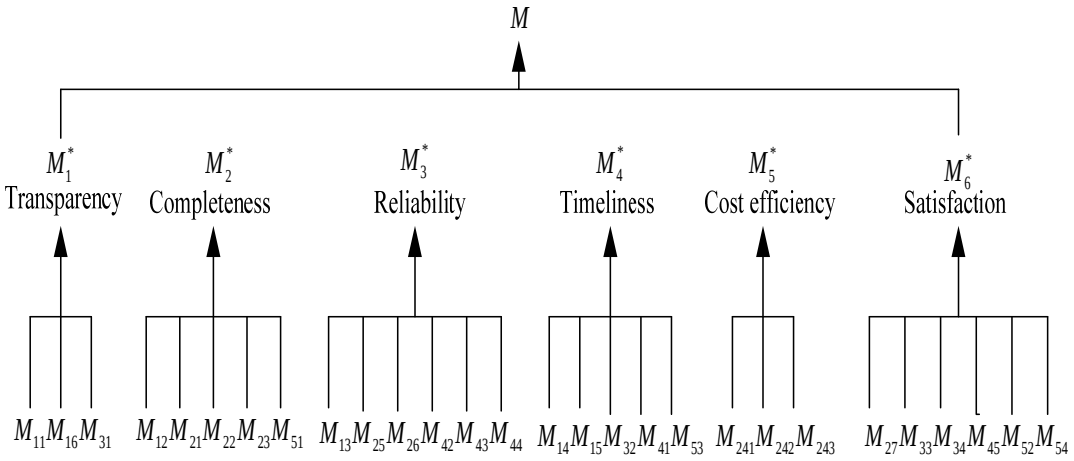


**Figure 1 : Influencing factors on B2C E-Commerce logistics service quality**

**TABLE 2 : Indicator system for B2C E-Commerce logistics service quality evaluation**

| | | |
|---|---|---|
| B2C E-Commerce Logistics Service Quality | Transparency | Details of guidance and instructions |
| | | Complete commodity information |
| | | Ordering and delivery progress |
| | | Easy operating process |
| | Completeness | Diversified payment methods |
| | | Diversified acceptance methods |
| | | Diversified refunding and replacement methods |
| | | Complete measures |
| | Reliability | Precise order processing |
| | | No transaction information is disclosed |
| | | Personal information is transferred in a safe manner |
| | | Accuracy of commodity |
| | | Intactness of commodity |
| | | Proper packing |
| | Timeliness | Logistics cost |
| | | Service cost efficiency |
| | | Refunding and replacement cost |
| | | Timely order response |
| | Cost efficiency | Order release cycle |
| | | Question response timeliness |
| | | Agreed delivery time |
| | | Deviation response timeliness |
| | Satisfaction | Customized value added services |
| | | Inquiry satisfaction |
| | | Service attitude in communication |
| | | Professional logistics |
| | | Satisfactory measures |
| | | Result satisfaction |

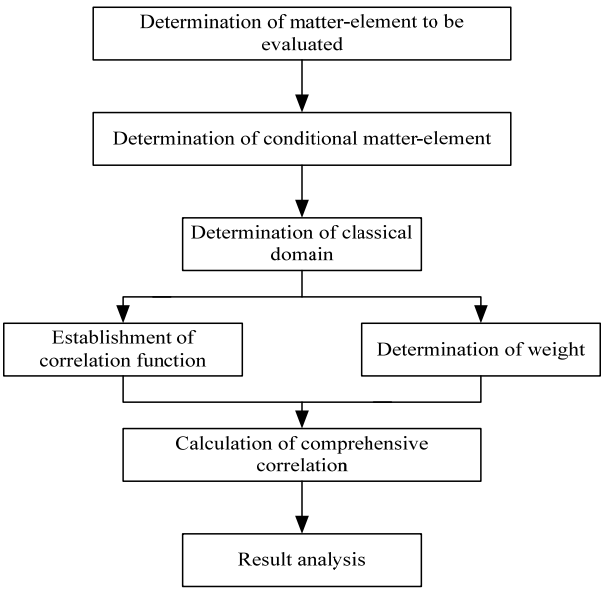


**Figure 2 : Evaluation process by using nonlinear extenics based comprehensive evaluation method**

The nonlinear extenics based comprehensive evaluation method has many peculiar advantages in comparison with other comprehensive evaluation methods. For instance, the calculation results by using this method can accurately evaluate the quality of such matter-element and change the rank based evaluation into accurate quantitative evaluation, by which a clear quality boundary can be identified. Besides, this method may be used in dynamic analysis on the matter-element to obtain real-time evaluation results.

**Extenics based B2C e-commerce logistics service quality evaluation model**

Since the B2C E-Commerce logistics service quality involves many aspects, when a correlation function is established on basis of its core content and the nonlinear extenics based comprehensive evaluation method is used in analysis, the logistics service quality of any B2C E-Commerce operator can be worked out and it is also possible to make comparisons and ranking on basis of the logistics service quality of several operators[4]. The establishment of an extenics based evaluation model for B2C E-Commerce logistics services should follow the procedures as described below:

(1) Matter-element to Be Evaluated

In the first step, n related factors to the B2C E-Commerce logistics service quality are identified and there are m operators to be evaluated, then the evaluation matter-element Ri can be described as follows:

$$R_i = (N_i, C, V) = (N_i, c_j, v_{ij}) = \begin{bmatrix} N_i & c_1 & v_{i1} \\ & c_2 & v_{i2} \\ & \cdots & \cdots \\ & c_n & v_{in} \end{bmatrix}, (i = 1, 2, ..., m;\ j = 1, 2, ..., n) \quad \textbf{(1)}$$

Wherein, $N_i$ represents the operator to be evaluated, $c_j$ represents related factors and $v_{ij}$ represents the value of such influencing factor.

(2) Determination of classical domain and joint domain

If logistics service quality of all operators is ranked in1 grade, then the evaluation matter-element may be described as:

$$R_{ot} = (N_{ot}, c, v_{ot}) = \begin{bmatrix} N_{ot} & c_1 & v_{ot1} \\ & c_2 & v_{ot2} \\ & \cdots & \cdots \\ & c_n & v_{otn} \end{bmatrix} = \begin{bmatrix} N_{ot} & c_1 & < a_{ot1}, b_{ot1} > \\ & c_2 & < a_{ot2}, b_{ot2} > \\ & \cdots & \cdots \\ & c_n & < a_{otn}, b_{otn} > \end{bmatrix}, (t = 1, 2, ..., l) \quad \textbf{(2)}$$

Wherein, $v_{otj} =< a_{otj}, b_{otj} >$ indicates the value rang of related influencing factors $c_j$ to $N_{ot}$ when the evaluation grade is *t*, which is known as the classical domain. In the above-mentioned example, the classical matter-element and its similar matter-element form an extended value range, known as joint domain. Classical domain and joint domain may be described as:

$$R_p = (N_p, c, v_p) = \begin{bmatrix} N_p & c_1 & v_{p1} \\ & c_2 & v_{p2} \\ & \cdots & \cdots \\ & c_n & v_{pn} \end{bmatrix} = \begin{bmatrix} N_p & c_1 & < a_{p1}, b_{p1} > \\ & c_2 & < a_{p2}, b_{p2} > \\ & \cdots & \cdots \\ & c_n & < a_{pn}, b_{pn} > \end{bmatrix} \quad \textbf{(3)}$$

Wherein, $N_p$ indicates joint domain, $v_{pj} =< a_{pj}, b_{pj} >$ indicates the value range of related influencing factors $c_j$ to $N_p$ which is known as joint domain.

(3) Determination of matter-element to be evaluated

In accordance with the classical domain and joint domain above determined and data acquired through investigation and statistics, the matter-element to be evaluated may be expressed as:

$$R = (P, c, v) = \begin{bmatrix} P & c_1 & v_1 \\ & c_2 & v_2 \\ & \cdots & \cdots \\ & c_n & v_n \end{bmatrix} \quad \textbf{(4)}$$

The matter-element of *P* to be evaluated is indicated by *R*; $v_j$ indicates the value range of related influencing factors $c_j$ to *P*, which may be in dot arrangement or in the form of an interval.

(4) Weight Determination

Most comprehensive analysis in the past adopted subject weights[5], and since the personal factors had greater influence, in some cases the value obtained through calculation deviated from actual situations. But in this paper, the nonlinear extenics based comprehensive analysis adopted makes use of correlation functions to determine such weights, eliminating the interference from personal factors, so it can objectively reflect the actual situation. Besides, the objective weights may be able to change the weight of various indicators as such indicators change[6]. The main procedures are described as follows:

$$r_{it}(v_i, V_{it}) = \begin{cases} \dfrac{2(v_i - a_{it})}{b_{it} - a_{it}}, v_i \le \dfrac{a_{it} + b_{it}}{2} \\ \dfrac{2(b_{it} - v_i)}{b_{it} - a_{it}}, v_i \ge \dfrac{a_{it} + b_{it}}{2} \end{cases}, i = 1, 2, ..., n, t = 1, 2, ..., l \quad \textbf{(5)}$$

And $v_i \in V_{ip}$ (joint domain), then:

$$r_{\text{itmax}}(v_i, V_{it}) = \max_t \{r_{it}(v_i, V_{it})\} \quad \textbf{(6)}$$

One of the following formulas should be selected, as cases may be:

In the first case, a greater weight is given in accordance with the grade of indicator $C_i$:

$$r_i = \begin{cases} t_{\max} \times (1 + r_{it\max}(v_i, V_{it})), r_{it\max}(v_i, V_{it}) \ge -0.5 \\ t_{\max} \times 0.5, \qquad\qquad r_{it\max}(v_i, V_{it}) < -0.5 \end{cases} \quad \textbf{(7)}$$

In the second case, a smaller weight is given in accordance with the grade of indicator $C_i$:

$$r_i = \begin{cases} (l - t_{\max} + 1) \times (1 + r_{it\max}(v_i, V_{it})), r_{it\max}(v_i, V_{it}) \ge -0.5 \\ (l - t_{\max} + 1) \times 0.5, \qquad\qquad r_{it\max}(v_i, V_{it}) < -0.5 \end{cases} \quad \textbf{(8)}$$

In comprehensive considerations of the two cases, the weight of indicator $C_i$ is determined as:

$$\lambda_i = \frac{r_i}{\sum_{i=1}^{n} r_i} \quad \textbf{(9)}$$

(5) Determination of Correlation Function

A correlation function can objectively reflect certain property of the matter-element, so it is of great importance to establish a correct correlation function.

When $X_0=(a,b)$, $X=(c,d)$, $X_0\in(a,b)$, $X_0\subset X$, the correlation function without common endpoint is as follows:

$$k(x)=\begin{cases}\dfrac{\rho(x,x_0,X_0)}{\rho(x.X)-\rho(x,X_0)}, & x\notin X_0\\ \dfrac{\rho(x,x_0,X_0)}{\rho(x.X)-\rho(x,X_0)+a-b}, & x\in X_0\end{cases} \tag{10}$$

When $X_0=(a,b)$, $X=(c,d)$, $X_0\in(a,b)$, $X_0\subset X$, the correlation function with common endpoint is as follows:

$$k(x)=\begin{cases}\dfrac{\rho(x,x_0,X_0)}{\rho(x.X)-\rho(x,X_0)}, & \rho(x,X)\neq\rho(x,X_0)\text{ and }x\notin X_0\\ \dfrac{\rho(x,x_0,X_0)}{\rho(x.X)-\rho(x,X_0)+a-b}, & x\in X_0\\ \dfrac{\rho(x,x_0,X_0)}{a-b}-1 & \rho(x,X)=\rho(x,X_0)\text{ and }x\notin X_0\end{cases} \tag{11}$$

Wherein, $\rho(x,X)=\left|x-\dfrac{c+d}{2}\right|-\dfrac{d-c}{2}$, $\rho(x,X0)=\left|x-\dfrac{a+b}{2}\right|-\dfrac{b-a}{2}$, $\rho(x,x_0,X_0)$

The lies in the given interval, and the left and right distance of optimal point $X_0$ is:

In the given interval, $X_0=(a,b)$, $X_0\in(a,\dfrac{a+b}{2})$, and the left distance is

$$\rho(x,x_0,X_0)=\begin{cases}a-x, x\le a\\ \dfrac{b-x_0}{a-x_0}(x-a), x\in<a,x_0>\\ x-b, x\ge x_0\end{cases} \tag{12}$$

When $X_0=a$,

$$\rho(x,a,X_0)=\begin{cases}a-x, x<a\\ a_z, x=a\\ x-b, x>a\end{cases} \tag{13}$$

Wherein,

$$a_z=\rho(a,a,X_0)=\begin{cases}0, a\notin X_0\\ a-b, a\in X_0\\ 0\otimes(a-b), a\notin X_0\text{ and }a\in X_0\end{cases} \tag{14}$$

In the given interval, $X_0=(a,b)$, $X_0\in(\dfrac{a+b}{2},b)$, the right distance is

$$\rho(x, x_0, X_0) = \begin{cases} a - x, x \le x_0 \\ \dfrac{a - x_0}{b - x_0}(b - x), x \in < x_0, b > \\ x - b, x \ge b \end{cases} \quad \textbf{(15)}$$

When $X_0 = b$,

$$pr(x, b, X_0) = \begin{cases} a - x, x < b \\ b_z, x = b \\ x - b, x > b \end{cases} \quad \textbf{(16)}$$

Wherein,

$$b_z = \rho r(b, b, X_0) = \begin{cases} 0, b \notin X_0 \\ a - b, b \in X_0 \\ 0 \otimes (a - b), b \notin X_0 \text{ and } b \in X_0 \end{cases} \quad \textbf{(17)}$$

(6) Calculation of overall correlation

The overall correlation of quality grade t of B2C E-Commerce logistics service is:

$$K_t(P) = \sum_{i=1}^{n} \lambda_i K_t(v_i) \quad \textbf{(18)}$$

(7) Determination of evaluation grades

According to the following formula, the value of quality grade t of B2C E-Commerce logistics service is:

$$\overline{K_t}(P) = \frac{K_t(P) - \min K_t(P)}{\max K_t(P) - \min K_t(P)} \quad \textbf{(19)}$$

$$t^* = \frac{\sum_{t=1}^{l} t\overline{K_t}(P)}{\sum_{t=1}^{l} \overline{K_t}(P)} \quad \textbf{(20)}$$

Wherein, $t^*$ indicates the evaluation grade of measured data, if $\max K_t(P) \ge 0 (t = 1, 2, \ldots, l)$, then B2C E-Commerce logistics service quality is rated as grade t; and if $\max K_t(P) < 0 (t = 1, 2, \ldots, l)$, then the quality grade t is beyond the given range.

## APPLICATION RESEARCH

The linear extenics based comprehensive evaluation analysis is used on logistics service quality of Tmall to delivery addresses in first-and-second-tiered cities and third-and-fourth-tiered cities as well as logistics services during special occasions such as the "November 11th", and consumer rating shows that they are basically satisfied with logistics services of Tmall and the evaluation results by such analysis basically conforms to the actual situations. Although the comprehensive evaluation in the above-mentioned three cases conform to the actual situations that consumers are basically satisfied, it can be found from the data during analysis that the satisfactions of consumers focus on different aspects

in the logistics service[7]. The list of comprehensive correlation to five evaluations rating on target indicators is shown as TABLE 3.

**TABLE 3 : List of comprehensive correlation to five evaluations rating on target indicators**

| Comprehensive correlation of matter-element R | $K_1(N_i)$ | $K_2(N_i)$ | $K_3(N_i)$ | $K_4(N_i)$ | $K_5(N_i)$ |
|---|---|---|---|---|---|
| $K_i(N_1)$ | -0.61 | -0.49 | -0.22 | 0.20 | -0.12 |
| $K_i(N_2)$ | -0.58 | -0.45 | -0.14 | 0.20 | 0.01 |
| $K_i(N_3)$ | -0.48 | -0.31 | 0.02 | 0.06 | -0.28 |

Firstly, it can be found from TABLE 3 that the logistics service quality on special occasions such as "November 11th" and on ordinary days are highly correlated to grade 4. However the correlation coefficient of logistics service quality to special occasions including the "November 11th" us 0.06 which is much smaller than the same correlation of 0.20 on ordinary days. This means that there is significant decline of logistics service quality on the "November 11th" resulting lower consumer satisfaction. According to the analysis on influencing factors in TABLE 3, it can be found that the main reason for such decline is the dramatic increase or order quantity on the "November 11th", resulting in lower service quality in terms of order response timeliness, inquiry satisfaction, order release cycle, cost effective of logistics service and diversity of refunding and replacement as well as the promptness of order processing and satisfaction of order processing. The B2C E-Commerce operators should improve their logistics service in the seven aspects during special occasions including the "November 11th", so as to generally increase their evaluation grades. In terms of logistics service, B2C E-Commerce operators should cooperation more actively with logistics service companies and ensure their service quality through multiple channels and to increase the consumer satisfaction[8].

Secondly, according to TABLE 3, it can be found that the logistics service quality is highly correlated to the fourth evaluation factor both when the delivery address is in first and second tier cities and when such delivery address is third and fourth tier cities and their correlation coefficients are both 0.20. However, there is difference between them on the fifth evaluation item which has the second largest correlation which is -0.12 in first and second tier cities and 0.01 in third and fourth tier cities. This means that the consumer satisfaction is higher in third and fourth tier cities while the logistics service quality is actually better in first and second tier cities, which is obvious by analyzing the correlation of the individual indicator. The changes in comprehensive correlation results is attributed changes of weights of influencing factors. In first and second tier cities, consumers tend to be more demanding on logistics service quality, while in third and fourth tier cities, consumers are actually more sensitive to logistics service costs. The difference of weights of such indicators results in such phenomena. According to analysis on influencing factors in TABLE 3, it can be found that main influencing factors on logistics service quality include costs, diversity of payment methods and progress of ordering and delivery, which has also indicated the aspects to be improved by B2C E-Commerce operators.

Through the analysis on Tmall logistics service quality by using the nonlinear extenics based comprehensive evaluation method, it clearly indicates the current situations of Tmall logistics service quality and points out the directions of future efforts of E-Commerce operations and also verified the advantages and objectiveness of such method in evaluation.

## CONCLUSIONS

This research is based on the extenics theories and establishes a B2C E-Commerce logistics service quality evaluation indicator system and builds an evaluation model. Besides it applies the nonlinear extenics based comprehensive evaluation methods in the analysis and finally demonstrates its practicability by taking Tmall as an example and also provides operators with future directions on

improving their logistics service quality. The weight method mat still need more improvements to make the evaluation more precise.

## REFERENCES

**[1]** Zhang Liyi, Li Fenglin; Brief Introduction to Electronic Commerce, Wuhan: Wuhan University Press, **(2011)**.

**[2]** Zhang Yanyan; B2C E-Commerce Logistics Service Quality Measurement Model and its Application, (Master's Thesis). Jilin: Jilin University, **(2013)**.

**[3]** Ming-Hsiung Hsiao; Shopping Mode Choice: Physical Store Shopping Versus E-Shopping, **(2012)**.

**[4]** Xu Yuan; Comments on Related Researches Inside and Outside China on Logistics Service Quality Evaluation, Logistics Sci-Tech., **8**, 73-74 **(2013)**.

**[5]** Liu Xianfeng, Chen Mei; Researches on Logistics Company Service Quality Evaluation Indication System, Logistics Sci-Tech, **26(2)**, 25-27 **(2012)**.

**[6]** Tao Hua; Nonlinear Extenics based Comprehensive Evaluation Method and its Application to Urban Road Intersection System and Municipal Road Quality Evaluation. (Master's Thesis), Jiangsu: Jiangsu University, **(2011)**.