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Exploratory study of logistics service quality scale based on online shopping malls*

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Abstract: Online shopping has already become the new mode that a lot of customers try to adopt. At the same time, the online shopping could not be successfully completed without logistics service. Logistics service quality (LSQ) has significant impact on revenue and profitability. This paper presents the issue from the perspective of the customer, and explores the initial factors of LSQ based on the online shopping through in-depth interview and the Delphi method. The survey uses a standard 7-point Likert-type scale to measure the LSQ. Empirical research results are shown in detail to confirm seven LSQ dimensions with Chinese characteristics, including timeliness quality, personal contact quality, order quality, order discrepancy handling, order condition and convenience. Statistical analyses of the investigation were conducted to test the reliability and validity of the LSQ evaluation model.

Key words: Online shopping, Logistics service, Logistics service quality (LSQ), Dimensions of LSQ
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INTRODUCTION

Internet technologies provide many competitive advantages such as agility, selectivity, individuality and interactivity (Weiber and Kollmann, 1998). The Internet enables customers to search products and services meeting their needs in less time than before.

As the number of Internet users and Internet usage increase, the way consumers use and will use this interactive tool in or as part of their shopping decisions and practices continues to attract the attention of researchers and practitioners (Rohm and Swaminathan, 2004; Brengman *et al.*, 2005; Farag *et al.*, 2006). When studying online shopping behavior, we should bear in mind that logistics service is one of the fundamental objectives for online shoppers. Online shoppers make their orders at their office or home anticipating quicker delivery than offline purchasing, and timely delivery at his convenience (Soopramanien and Robertson, 2007). Logistics excellence makes users satisfied so that they will keep using the online shopping malls. On the contrary, even though the Web presence has well designed Web pages and powerful Web features, the consumer may turn to other Web sites or traditional brick-and-mortar shops if the delivery is too late or delivered item is different from the product listed at the Web sites.

Logistics excellence has clearly been recognized as an area in which firms can create competitive advantage, in part because of its visible service impact on customers (Sharma *et al.*, 1995; Morash *et al.*, 1996). Anecdotal evidence from firms such as Dell Computer Corporation, Nabisco, and Federal Express suggest that logistics excellence has significant impact on revenue and profitability (Mentzer and Williams, 2001). Some researchers have developed a

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model of what they termed "Logistics service quality", or LSQ, through surveying a broad range of purchasing managers (Mentzer *et al.*, 2001). But the model was developed on the basis of American organizations. As a service offering, logistics is often subject to cultural influences that exist in trade, so it cannot be used to measure Chinese companies' LSQ (Mentzer *et al.*, 2004). Generally, the researches of logistics service concentrate their attention almost entirely on B2B marketing in the traditional environment, but rarely examine the online B2C environment (Bienstock *et al.*, 1996; Mentzer *et al.*, 1999; 2001).

This paper aims to develop an LSQ model in the context of online shopping. This research investigates several logistics organizations with multiple market segments to determine whether the general methodology used by Bienstock, Mentzer, and Bird results in a similarly valid, reliable scale of LSQ. By doing so, the work begun by people in broad applications can be focused on the logistics customer service environment faced by multiple logistics organizations.

REVIEW OF LOGISTICS SERVICE QUALITY

The service quality approach is an attempt to understand customer satisfaction from the perspective of the differences between customer perceptions and actual customer service on various attributes (Parasuraman *et al*., 1985). Researchers have begun to examine whether the service quality model can be used to measure logistics service. Modifications have been made to the original service quality model by developing logistics attributes that fit into the previously customer-defined dimensions and by identifying additional gaps that could be applied to the logistics service context (Lambert *et al*., 1990). These views of logistics service provide the building blocks to create a customer-based foundation for better definitions and measures of LSQ.

The use of customer-based definitions of LSQ has brought logistics research, which traditionally focused on more physically observable operational attributes, more in line with marketing, which has devoted more attention to understanding such unobservables as customers' perceived value (Perrault and Russ, 1974; Rinehart *et al*., 1989; Bienstock *et al*., 1996; Mentzer *et al*., 1999).

By recognizing, tapping into, and measuring customer perceptions of LSQ, logistics practitioners and researchers have added to the traditionally measured set of operational service attributes. Building upon (Bienstock *et al.*, 1996), Mentzer *et al.*(1999) conceptualized and tested LSQ as a second-order construct, with two categories of nine dimensions: order placement—personnel contact quality, order release quantities, information quality, ordering procedures, and order receipt—order accuracy, order condition, order quality, order discrepancy handling, timeliness.

Mentzer *et al.*(2001) built upon this research to propose and test a 'process of LSQ' and found that all the nine components were important for at least one of the customer segments tested. This research revealed that LSQ is a complex concept demanding a great deal of attention from supplying firms. They also found that LSQ is a process, rather than merely a single concept or second-order construct.

But the limitation of (Mentzer *et al*., 2001)'s study is that the survey was administered to customer segments of only one organization (Defense Logistics Agencies, or DLA) and this survey was developed on the basis of focus groups and interviews within these same customer segments. All the samples were from segments of the same supplier organization. Therefore, conclusions from this study may not suit for customer segments of other firms. Items used to operationalize constructs in this study were expressed to be relevant to DLA customers. Other suppliers of logistics services will need to modify the wording of some items so that they are relevant to their customers yet still maintain the reliability and validity of the constructs they are designed to measure. More importantly, the research conclusion was developed on the basis of American organizations, but China is a highly risk avoidance country, so it cannot be used to measure Chinese companies' LSQ.

METHODS

Following the precedent literature (e.g. Bienstock *et al.*, 1996; Mentzer *et al.*, 1999; 2001), we conducted qualitative research to develop constructs and item pools related to LSQ from the perspective of

the customer. SERVQUAL is the most popular measure. Performance-to-expectations gaps on attributes that consumers use to evaluate the quality of a service form the theoretical foundation of SERVQUAL (Parasuraman *et al.*, 1985; 1988). But some evidence of convergent validity as reflected by the factor-loading patterns in these studies (Carman, 1990; Babakus and Boller, 1992; Headley and Miller, 1993) is weaker because several of SERVQUAL items had very low loadings on the dimensions they were supposed to represent. The practicable solution is the measurement of expectations and the related issue of computing perception-minus-expectation gap scores. Carman (1990) and Babakus and Boller (1992) discussed this subject and made several useful suggestions that are worthy of additional research. There are theoretical aspects to the pros and cons of measuring expectations and perceptions separately and then computing gap scores. This paper introduced the "direct computing perception-minus-expectation gap scores" LSQ measurement method. All items used a standard 7-point Likert-type scale ranging from "strongly disagree" (1) to "strongly agree" (7).

Scale development

The methodology closely followed that of (Parasuraman *et al.*, 1985; Bienstock *et al.*, 1996) to develop the LSQ scale. The first step was a qualitative effort to understand the LSQ needs of the customers. For this qualitative exploration, 3 managers within the logistics companies and 8 customers who had the experience of online shopping were interviewed one-on-one to develop preliminary concepts. Each in-depth interview lasted approximately one hour and the general topics covered three basic areas: (1) the nature of the participants' work in relation to the online shopping; (2) evaluation of the working relationship with the logistics firm; (3) perceptions of what the logistics firm does well or poorly. Each in-depth interview was recorded on videotape for later analysis, and extensive notes were taken by the first author. The videotapes were reviewed by the entire research team. The researchers individually identified specific LSQ dimensions raised in the reviews, then met to discuss them and resolve any differences. The qualitative research facilitated understanding of the LSQ needs of the logistics service companies' customers. Specifically, we previously discussed the literature and the qualitative research that revealed an LSQ scale of 6 dimensions and 30 items, and we numbered the 30 items from L1 to L30.

The questionnaire was composed of the above 30 items and natural information of logistics customers. According to (Churchill, 1979), we made a quantitative test to identify the face validity and the content validity of the items; the concrete method was as follows:

Five judges who were graduate students majoring in marketing were invited. The researchers explained to participants the meaning of every item and took example for an item. Then asked the judges to answer that every item would show the degree of the content, ranging from "does not explain at all" (1) to "completely explains" (3).

The criterion is that there are at least three judges who think that a certain item could completely explain the content, and nobody thinks it could not explain. The items which comply with the above criterion could be retained; otherwise, be deleted. As a result of the process, 3 items (L1, L2 and L6) were deleted from an initial pool of 30 items, which resulted in 27 items to do the formal survey.

Samples and data collection

We distributed the questionnaire to 200 undergraduate students who had experience in online shopping malls and using logistics express. We sent students for this study a survey through Bulletin Board Service (BBS). The 121 usable questionnaires returned represented a response rate of 60.5%. Table 1 shows the sample characteristics of the research.

Table 1 Sample characteristics

Descriptive index	Percentage (%)
Gender	
Male	46.3
Female	53.4
Age	
18~22	53.7
23~26	37.2
27~30	9.1
Education background	
Undergraduate	59.5
Master	33.8
Doctor	6.7

ANALYSES AND RESULTS

Item analyses

According to (Ruekert and Churchill, 1984)'s opinion, item analyses were used to analyze the tested items to determine their discriminations. There are often two methods to do item analyses, namely, *t*-test and correlation coefficient test. A *t*-test is any of a number of tests based on the *t*-distribution. We used *t*-test to compare the average difference of top-mark group (the top 27% of total responses) and bottom-mark group (the bottom 27% of total responses) of total marks at each item. The value was named Critical Ratio (*CR*). No significant differences were found in L11 (*CR*=1.389, *P*>0.05), L13 (*CR*=1.267, *P*>0.05) and L19 (*CR*=1.787, *P*>0.05), whereas average value of L11, L13 and L19 did not differentiate the different responses, so L11, L13 and L19 were eliminated. There were significant differences for the other 24 items (*P*<0.05), so we retained them.

Table 2 lists means and standard deviations (SD) of the 24 retaining items.

Table 2 Mean and standard deviation (*SD*) of the retaining items*

Item	Mean	*SD*	Item	Mean	*SD*
L3	4.19	1.283	L18	4.23	1.611
L4	4.48	1.566	L20	4.05	1.387
L5	4.09	1.385	L21	4.40	1.591
L7	3.80	1.313	L22	3.98	1.501
L8	4.22	1.139	L23	3.42	1.570
L9	4.20	1.135	L24	4.26	1.577
L10	4.23	1.211	L25	3.99	1.405
L12	4.32	1.145	L26	3.81	1.546
L14	4.79	1.356	L27	4.36	1.548
L15	4.12	1.312	L28	4.13	1.696
L16	4.45	1.542	L29	4.15	1.509
L17	4.17	1.394	L30	3.68	1.490

* 121 samples, *P*<0.05

Factor analyses

SPSS 13.0 software is used to analyze the data. We examined the SPSS output for a Kaiser-Meyer-Olkin (KMO) on 121 samples. As a result, the KMO measure of 0.827 indicated a very high sampling adequacy and good preconditions for factor analyses. In addition, results of Bartlett's Test for Sphericity had significant differences (χ^2=1467.623, *df*=300). According to the above test results, the samples were suitable for factor analyses. The fact Bartlett's Test for Sphericity was refused showed that the 24 variables were not independent.

Factor analysis is at the heart of the development of the scales used as a statistical test for data analysis. Factor analysis is a method which reduces the number of integrated factors found from the observation.

Suppose the original variables to be $x_1, x_2, x_3, \ldots, x_p$, principal components to be $F_1, F_2, \ldots, F_m$. The relations between the factors and the original variables are then expressed as:

$$x_1 = a_{11}F_1 + a_{12}F_2 + a_{13}F_3 + \ldots + a_{1m}F_m + e_1,$$
$$x_2 = a_{21}F_1 + a_{22}F_2 + a_{23}F_3 + \ldots + a_{2m}F_m + e_2,$$
$$\ldots$$
$$x_p = a_{p1}F_1 + a_{p2}F_2 + a_{p3}F_3 + \ldots + a_{pm}F_m + e_p.$$

Use the matrix to express: $\boldsymbol{x}=\boldsymbol{AF}+\boldsymbol{E}$. $\boldsymbol{F}$ is called co-factors, a_{ij} is termed as factor load, which is the load exerted by the *i*th variable to the *j*th principal factor, reflecting the relative importance of the *i*th variable with respect to the *j*th principle factor. $\boldsymbol{E}$ is residual, usually insignificant. Ignoring $\boldsymbol{E}$, the matrix then becomes $\boldsymbol{x}=\boldsymbol{AF}$. If $F_1, F_2, \ldots, F_m$ are irrelative, it forms particular factor analysis, named principal components analysis (PCA).

We used PCA and varimax rotation in the paper. The Kaiser rule is to drop all components with eigenvalues under 1.0. It may overestimate or underestimate the perceived LSQ of customers.

Perform PCA for 24 items, 6 factors proved rational in the scree plot which showed the sorted eigenvalues, from large (6.9) to small (1.3), as a function of the eigenvalue index. The total cumulative variance explained jumped up substantially (from 27.6% to 65.3%) by the varimax rotation of 6 factors (see Table 3). The rotated factors pattern that isolated the 6 factors showed that each factor loading was above 0.5.

Table 3 Total variance explained

Factor	1	2	3	4	5	6
Eigenvalues	6.9	2.7	2.3	1.7	1.4	1.3
Cumulative variance (%)	27.6	38.6	47.7	54.6	60.0	65.3

Factor 1 refers to whether orders arrive at the customer location when promised. More broadly, timeliness also refers to the length of time between order placement and receipt. For example, the efficiency and effectiveness of procedures are followed

by the supplier. So it is named "timeliness". Factor 2 is named "personnel contact quality" which refers to the customer orientation of the supplier's logistics contact people. Specifically, customers care about whether customer service personnel is knowledgeable, emphasizes with their situation, and helps resolve their problems. Factor 3 refers to how well the products work. This includes how well they conform to product specifications and customers' needs, which is named "order quality". Factor 4 is named "order discrepancy handling" which refers to how well logistics companies address any discrepancies in orders after the orders arrive. If customers receive orders that are not accurate, in poor condition, or of poor quality, they would seek corrections from the logistics company. Factor 5 is named "order condition" which refers to barbarized loading and unloading that did not exist and the orders must be scientifically sorted. In addition damages rarely occur. Factor 6 refers to whether orders arrive at door to door and convenient packs, including how to deal with when applied to customs procedure, specifically, when applied to customs, price and transportation means. So it is named "convenience".

Reliability analyses

In order to examine the reliability of a scale, we must compute Cronbach's α after factor analysis. Cronbach's α is important as a measure of the scale reliability (Churchill, 1979; Peter, 1979; Gerbing and Anderson, 1988). As a result of Table 4, all the items' α values were above 0.6, showing that the scale reliability was acceptable for an exploratory study (Fornell and Larcker, 1981).

Validity analyses

Construct validity is an assessment of how well you translated your ideas or theories into actual programs or measures. It refers to the degree to which inferences can be legitimately made from the operationalizations in your study to the theoretical constructs on which those operationalizations were based. In the study, the total cumulative variance explained 65.3%, which indicated the scale had high construct validity.

According to the above analysis results, we formed the final scale of LSQ, including 6 dimensions and 24 items (see Table 4).

CONCLUSION

This study explores the LSQ features of online shopping malls. The results showed that there were six dimensions of evaluation used by the customers in terms of the LSQ variables structure, including timeliness, personal contact quality, order quality, order discrepancy handling, order condition and convenience.

The dual nature of the online consumer as a traditional shopper and a Web user implies that the LSQ features are very important for retaining customers as online quality factors. Hence, the practitioners seeking to increase the visit of user and purchasing through their Web sites should emphasize not only the online presence of online shopping mall but also the back office operations such as logistics service.

The contributions of this study are that online retailers can use LSQ scale to better understand the service expectations and perceptions of consumers and, as a result, improve the LSQ. LSQ scale is most valuable when it is used periodically to track the LSQ trend, and when it is used in conjunction with other forms of service quality measurement. An online retailer, for example, would learn a great deal about its LSQ and what needs to be done to improve it by

Table 4 Final scale of logistics service quality

Factor	Factor name	Item content (example)	Number of item	Cronbach's α
1	Timeliness	Deliveries arrive on …	4	0.88
2	Personal contact quality	The experience of the staffer …	4	0.89
3	Order quality	Goods meet requirements …	4	0.79
4	Order discrepancy handling	The report of discrepancy …	3	0.85
5	Order condition	Scientifically sorted goods …	4	0.65
6	Convenience	Convenient package …	5	0.70

administering LSQ. The online shopping mall should have higher benchmarks so that the high online and offline quality will have competitive edge in the online shopping market.

Although this study provides meaningful implications for online shopping malls, it has some limitations and thus has further research issues. First, all external variables are based on the perceived quality of users, which are subjective and may be influenced by each user's individual characteristics such as Web skills, sensitiveness to price, and level of demand for delivery time. Different results may be obtained if we measured LSQ from the independent Web survey companies. Second, this study focuses on the online shopping mall domain. Future research can consider other intrinsic measures of user beliefs to better understand the user behaviors for various Web domains.

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