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Validating the Logistics Service Quality (LSQ) Scale in Indian Logistics Industry

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Abstract — This study aims at validating a construct and measurement instrument for logistics service quality (LSQ) in Indian logistics industry. A second order model for LSQ was tested for its validity. The various dimensions leading to LSQ included; information quality, ordering procedures, order release quantities, timeliness, order accuracy, order quality, order condition, order discrepancy handling and personal contact quality. The data was collected from the logistics managers representing 154 manufacturing companies in Mumbai, India by using a 25 item instrument developed by Mentzer, Flint and Kent (1999). The findings of the study support the model evaluating the LSQ.

Keywords-: logistics, service quality, logistics service quality, structural equation modeling, confirmatory factor analysis

I. INTRODUCTION

All Outsourcing of Third party logistics business(3PL) in India is all set to acquire a size of US$90million by 2012 as the concept introduced in US and Europe is fast catching up the pace to increase the efficient domestic corporate through efficient logistics function (ASSOCHAM, 2009). The report further says that presently, 3PL outsourcing among Indian companies is estimated at US$ 60 million with around 55% of Indian companies outsourcing logistic services like supply chain management and warehousing, which used to be 10-15%, 10 years ago.

There is also a good indicator that logistics industry is in the brink of exciting growth for the coming years as the manufacturing, retail and real estate have started recovering and will return their buoyancy for striking expansion of logistics (Commodity online, 2009). Indian firms are demanding new logistics capabilities and more complete solutions from their 3PL partners. Greater acceptance of demand driven logistics practices introduces complexities into the supply chain and the need for contract logistics providers to deliver more expert services. More companies are turning towards 3PL to help them in successful management of supply chain process. 3PL provide their ability to bring down conventional logistics costs and handle many complicated tasks (Mentzer et al.; 1997). Customers continue to give their 3PLs more responsibility and input into their business process. Companies are eager to expand into new markets which are creating more logistics challenges. This is driving the companies to partner with logistics service providers who can give them the best possible support and service. These companies now believe that to remain competitive in the market, they are required to develop strong relationship with the service providers who can understand their needs and respond accordingly.

Service quality becomes the major facilitating factor towards developing the relationships. It is with this importance it has become mandatory for the 3PL service providers to evaluate the quality of services they are offering. Taking this into consideration this paper attempts to test the Logistics Service Quality (LSQ) scale developed by Mentzer, Flint and Kent(1999) in the Indian context.

II. REVIEW OF LITERATURE

Five streams of literature relate to logistics provider models (Sink and Langley; 1997): strategic decision making in organizations, industrial buying behavior, transportation purchasing, supplier selection, and logistics relationships. Among these topics, supplier selection, or how to evaluate 3PL providers and form strategic alliances with them, has been inadequately addressed in the current literature. Strategic alliances allow companies to reduce conflict, reciprocate regarding mutual goal-related matters, increase efficiency and stability, and establish marketplace legitimacy (Cooper and Gardner; 1993). Logistics managers consider perceived performance, perceived capability, and responsiveness as important factors in selecting logistics providers (Menon et.al.,; 1998). In general, it appears that market and firm characteristics influence the choice of logistics providers (Van and Van; 1996), and managers achieve customer service improvement and cost reduction by outsourcing logistics services (Rabinovich et al.; 1996).

Most of the research studies in the past have emphasized the important role played by the logistics services in the success of the shipper. The logistics services play an

important role in fulfilling the strategic objectives of shipper (Manzinin et al., 2007). The influence of including logistics in strategic management, on customer satisfaction and firm performance has been found positive (Tracey, 2006). Logistics has also been playing a tremendous role in providing a competitive advantage for companies in a networked economy and market (Gunasekaran and Ngai, 2004).

Saura et. al (2008) recognized the importance of LSQ and its impact on the customer satisfaction. Supporting his finding a number of empirical studies followed to establish the positive effect of LSQ on the customer satisfaction (Daugherty, Stank, and Ellinger 1998; Innis and La Londe 1994; Mentzer, Flint, and Hult 2001; Stank, Goldsby, and Vickery 1999). Furthermore, LSQ has also been linked to market share through customer satisfaction and loyalty (Daugherty, Stank, and Einger 1998).

Valuable contribution to the area of LSQ came from Mentzer and his colleagues (Bienstock, Mentzer, and Bird 1997; Mentzer, Bienstock, and Kahn 1993; Mentzer, Flint, and Kent 1999; Mentzer, Gomes, and Krapfel 1989; Mentzer, Flint, and Hult 2001). Most of the studies focusing the LSQ were examined using the operational parameters whereas the customer perspective got relatively little recognisation. Mentzers' study placed more importance on the customer perspective rather than the operational dimension of the service. Deriving from the work of Gronross (1984) in the service quality area where technical quality refers to the service outcomes and functional quality refers to the process of service delivery, they aligned the physical distribution aspects as the technical service parameter and customer service aspects as the functional service parameter leading to the development of an instrument to measure the Physical Distribution Service Quality (PDSQ) (Bienstock, Mentzer, and Bird ; 1997). Further studies broadened the scope of physical distribution to a component of logistics leading to the development of LSQ scale LSQ (Mentzer, Flint, and Hult 2001; Mentzer, Flint, and Kent 1999).

MFK's Logistic Service Quality

Mentzer, Flint, and Kent (1999) henceforth refereed as MFK developed and validated their Logistics Service Quality (LSQ) scale using a single large logistics services provider firm in the United States, namely the DLA, which provides logistics services to internal customers. MFK proposed nine constructs for evaluating logistics service quality by expanding the concept of service quality into logistics context. The methodology used by Bienstock, Mentzer, and Bird (1997) to develop PDSQ scale was used by them. The constructs conceptualized as a second order model from the customers' viewpoint are information quality, ordering procedures, order release quantities, timeliness, order accuracy, order quality, order condition, order discrepancy handling, and personnel contact quality. Rigorous scientific approach was used to generate scale items, item purification, and validation using hold-out samples from a large initial dataset which resulted in a robust 25 item scale.

However, MFK's study has a number of limitations, which are listed below;

i. The scale employs a 5-point Likert scale which MFK in his study suggest may have limited the range of responses and therefore recommended the use of a 7-point Likert scale in future research.
ii. The development of the MFK scale is based on one focal organization with an in-house logistics function providing logistics services to internal customers. It is possible that criteria used to assess internal suppliers may differ from those applied to external suppliers.
iii. The DLA customers were purchasing inbound-only logistics services. Hence, the LSQ scale's applicability to outbound-only logistics and both inbound and outbound logistics is untested.

The present study addresses the limitations of the MFK study by conducting a cross-sectional survey of customers' perceptions of services provided by third-party logistics service providers in India. Furthermore, the Indian context helps to assess the robustness of the LSQ scale in an international context and hence its generalizability beyond the original US context.

This paper reports the testing and validation of the MFK LSQ instrument in the context of the third-party logistics industry in India. Due to the increasing trend of outsourcing logistics activities by Indian organizations, 3PL context was considered a more appropriate setting for testing the instrument than the in-house logistics service (in original study). The other reasons being the easy availability of the 3PL service providers and the benefits a logistician will get in presence of a valid scale while evaluating a service provider amongst the available alternatives. This scale can also be used by the 3PL operators for their long term survival and commitment for quality service. The above reasons are particularly important in the Indian context as the concept of 3PL is gaining popularity reflecting the relatively high level of the industry's development.

III. METHODOLOGY

A survey instrument was developed based on the suggestions/limitations of MFK's original study. As the original study focused only on the inbound logistics this study covered various industries as it was expected that the sheer variety of procedures of logistics operations among the different industries and the specific type of services used by customers would also contribute to some problems. Also, as proposed by MFK, the number of scale responses was increased from 5-point Likert "agree/disagree" scale to a 7-point scale to allow wider discrimination of the responses. A larger number of scale points leads to larger variances, resulting in increased reliability. Due to the expected problems of filling in the questionnaire, the scales of "don't know" and "not applicable" used by MFK were not

incorporated into the questionnaire. In addition, there were some minor changes in wording to refiect the changed context. For example, "DLA" was replaced with "3PL provider" and "vendors" changed to "suppliers" to reflect Indian usage. The modifications mentioned above were incorporated into the original LSQ instrument and reliability test using cronbachs alpha was done based on a pilot study of 25 logistics managers. Final survey was conducted consisting of 154 logistics managers of 3PL customer firms drawn from Mumbai, India. Logistics managers were targeted in this survey (rather than purchasing managers as in the MFK study) because it was reasoned that they would be the best people to assess logistics services provided by their 3PL providers. The respondents were approached directly by the researchers. The majority of the respondents were logistics-related managers (78.8%). Most respondents (82%) had more than six years of working experience in the current position as well as more than six years experience working with 3PL providers (52.12 %). This reflects positively on the reliability of the information obtained, given that the respondents had a high level of familiarity with the subject matter. All the respondents represented the manufacturing setup. Out of the total respondents 63% employed 3PL providers for outbound-only services, 34% employed 3PL providers for both inbound and outbound services and just 3% employed 3PL providers for inbound-only logistics services.

The measurement instrument had a total of 25 measurement items: two for information quality, two for ordering procedures, three for order release quantities, three for timeliness, three for order accuracy, three for order quality, three for order condition, three for order discrepancy handling and three for personal contact quality as shown in Table 1. The factor loadings and the p-value for all the measurement items is also presented in the table.

B. Pilot Test

The main purpose of the pilot study was to establish the construct validity of the adopted instrument. The pilot survey was conducted on 25 logistics managers selected randomly from Mumbai. Item-to-total correlation analysis and reliability test was conducted. The results of the pilot study are presented in table 2.

IV. Results

A. Validity and Reliability

As suggested by J€oreskog (1993) and the methodology adopted by Lai et al (2002) in a similar study we performed the reliability test on the items used for measuring the first order constructs viz. information quality, ordering procedures, order release quantities, timeliness, order accuracy, order quality, order condition, order discrepancy handling and personal contact quality. The finding of the Reliability tests were further supported by Confirmatory Factor Analysis (CFA) carried for the above constructs separately. CFA was used to assess

TABLE 1: MEASUREMENT INSTRUMENT USED FOR THE STUDY

Dimension	Dependent Latent Dimensions	Standardized Path Coefficient	P-value
Information Quality	Catalog Information Available (IQ1)	0.862	0.00
	Catalog Information Adequate (IQ2)	0.561	0.00
Ordering Procedures	Requisition Procedures are effective (OP1)	0.807	0.00
	Requisition Procedures are easy to use (OP2)	0.626	0.00
Order Release Quantities	Requisition quantities are not challenged (ORQ1)	0.593	0.008
	Difficulties never occur due to maximum quantities(ORQ2)	0.130	0.155
	Difficulties never occur due to minimum quantities(ORQ3)	0.160	0.152
Timeliness	The lead time for delivery is short (T1)	0.551	0.00
	Deliveries arrive on the dates promised(T2)	0.731	0.00
	The amount of time a requisition is on backorder is short(T3)	0.784	0.00
Order Accuracy	Shipments are rarely filled with obsolete items(OA1)	0.305	0.00
	Shipments rarely contain an incorrect quantity(OA2)	0.319	0.00
	Shipments rarely contain substituted items (OA3)	0.731	0.00
Order Quality	Substituted items sent by 3PL work fine (OQ1)	0.591	0.00
	Products ordered from 3PL meet the technical requirements (OQ2)	0.117	0.185
	Equipments and/or parts are rarely non- confirming(OQ3)	0.688	.008
Order Condition	Material received from 3PL is undamaged (OC1)	0.565	0.00
	Material received direct from vendors is undamaged (OC2)	0.607	0.00
	Damage rarely occurs as a result of the transport mode or carrier(OC3)	00.571	0.00
Order Discrepancy Handling	Correction of delivered quality discrepancies is satisfactory (ODH1)	0.694	0.00
	The report of discrepancy process is adequate(ODH2)	0.695	0.00
	Response to quality discrepancy reports is satisfactory(ODH3)	0.637	0.00
Personnel Contact Quality	The designated 3PL contact person makes an effort to understand my situation(PDC1)	0.569	0.00
	Problems are resolved by the designated 3PL contact person(PDC2)	0.640	0.00
	The product knowledge/experience of 3PL personnel is adequate (PDC3)	0.824	0.00

TABLE 2: RELIABILITY TEST FINDINGS

Factors	No. of item	Mean*	Std D*	Alpha	Range of Item to item correlations
information quality	2	5.01 (4.12)	1.30 (1.60)	0.702	0.437 – 0.487
ordering procedures	3	5.00 (4.51)	1.02 (1.12)	0.730	0.417 – 0.606
order release quantities	3	5.07 (4.08)	1.13 (1.49)	0.829	0.437 – 0.527
timeliness	3	4.89 (4.75)	1.32 (1.37)	0.685	0.401 – 0.428
order accuracy	3	5.01 (4.85)	1.18 (1.26)	0.705	0.45 – 0.531
order quality	3	5.24 (4.89)	1.21 (1.38)	0.715	0.398 – 0.505
order condition	3	5.12 (4.32)	1.18 (1.29)	0.712	0.427 – 0.457
order discrepancy handling	3	5.20 (4.61)	1.08 (1.22)	0.737	0.427 – 0.60
personnel contact quality	3	5.17 (4.89)	1.09 (1.33)	0.789	0.417 – 0.521

**The values in bracket reports the findings from the pilot study*

the fit of these measuring items for describing the behavior of the unobserved latent variables mentioned above.

The reliability test and item to item correlation analysis presented in table 2, suggests a reasonable fit of the latent factors to data. Cronbach alpha values for all six factors are all greater than 0.65 and the item loadings on factors are all acceptable i.e > 0.40. Through the item correlation for one of the item in order quality is marginally below the benchmark.

B. VALIDATION OF THE LOGISTICS SERVICE QUALITY MODEL

The second order model, testing the LSQ model as a higher order latent factor of information quality, ordering procedures, order release quantities, timeliness, order accuracy, order quality, order condition, order discrepancy handling and personal contact quality is 0.819, 0.906, 0.305, 0.6, 0.850, 0.610, 0.763, 0.937 and 0.726 respectively. The test results produced $\chi 2$ statistic of 1480.222 at P = 0.00 df = 816 , with GFI, NFI and CFI well above the 0.90 benchmark and with RMR below 0.05 (see figure 1 for details).

V. DISCUSSION

The study compares the validity of LSQ rating scale Models as proposed by MFK (1999). The LSQ scale proposed by MFK which was tested on the logistics managers in US is found to be valid in India. It may be therefore generalized that the factors of information quality, ordering procedures, order release quantities, timeliness, order accuracy, order quality, order condition, order discrepancy handling and personal contact quality have influence on the LSQ and behave in an identical manner in these two countries.

The managers in logistics industry have to give varying amount of importance based on the factor loadings of the constructs on the LSQ as obtained in the study. The managers are required to measure their performance on information quality, ordering procedures, order release quantities, timeliness, order accuracy, order quality, order condition, order discrepancy handling and personal contact quality by taking into consideration the measurement items used in this study. This will give them insight at the sub-dimension level and will help them to assess their present service quality. The logistics managers may use the measurement instrument details presented in the table 2 for evaluating their service quality and identify areas that require individual attention.

VI. CONCLUSION

The main objective of this research was to measure the logistics service quality dimensions of the 3PL using the Logistics service quality Scale suggested by MFK. A validity check of the scale using cronbach alpha and reliability analysis was carried out which indicated that the number of dimensions of logistics service quality is 7 and that all 25 items of MFK are valid in the Indian situation. The applicability of this scale to the Indian situation leading to service quality was tested using structural equation modeling and was found to be valid.

With the development of the IT field and use of IT services in information gathering and decision making it is felt that the measurement items needs have a relook considering the developments. Hence, identifying the Indian logistics service quality construct based on an exploratory survey can be undertaken by future researchers. Also, this research tried to identify the logistics service quality only for the 3PL services in India mainly focused on availing the outbound logistics services, as little participation was there from the companies using 3PL for their inbound services which implies that researchers can identify logistics service quality for inbound 3PL services as well as inbound and outbound as a combination of services This research was conducted only in the Mumbai city in India and covered the respondents from the manufacturing setup and therefore

future studies can be conducted in other parts of India and other industries to improve the reliability of the study.

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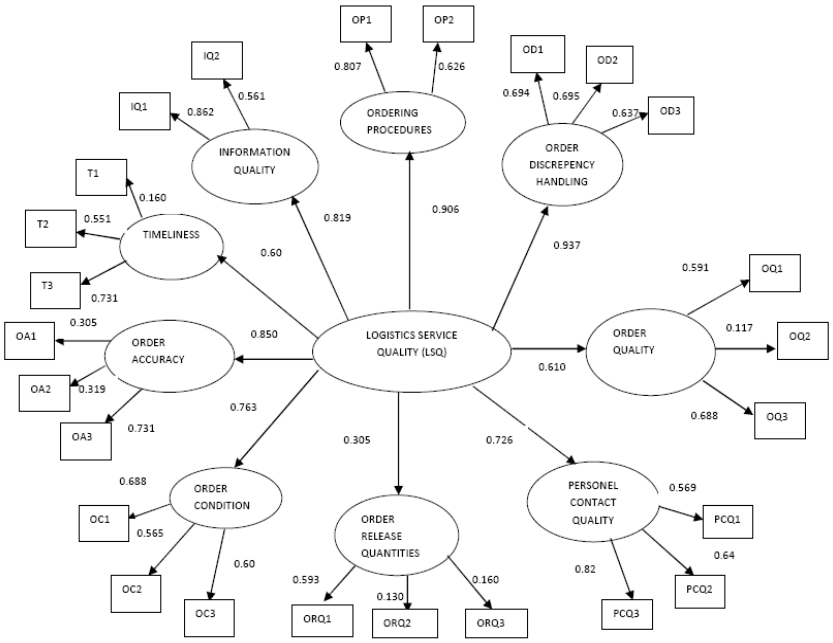

Figure 1. Logistics Service Quality Model