



Research Journal of
**Business
Management**

ISSN 1819-1932



Academic
Journals Inc.

www.academicjournals.com

Applying Fuzzy Zot to Explore the Customer Service Quality to the Ocean Freight Forwarder Industry in Emerging Taiwan Market

¹Wen-Cheng Lin and ²Gin-Shuh Liang

¹Department of Business Administration, National Taipei College of Business, Taipei, Taiwan

²Department of Shipping and Transportation Management, National Taiwan Ocean University, Keelung, Taiwan

Corresponding Author: Wen-Cheng Lin, Department of Business Administration, National Taipei College of Business, Taipei, Taiwan

ABSTRACT

Taiwan is a trade oriented country. Goods must be transported from enterprises to overseas marketing through shipping industry. International shipping industry plays an important role on assisting enterprises for logistics and supply chain management. Taiwanese mid-small enterprises reach more than one million, it is impossible to be effectively in consolidating LCL parcels into containers. Therefore, connecting mid-small enterprises with international carriers through ocean-freight forwarders as intermediary is a must. This study focused on applying Fuzzy Zone of Tolerance (FZOT) to systematically explore the overall service quality of Taiwanese ocean-freight forwarder industry. This study surveyed the shipper's needs and develop the qualify perspective by using factor Analysis. There are four dimensions observed: convenience of operation process, aggregated service, excellent transit handling and rationalization of Freight rate. Based on these factors, the FZOT is utilized to explore shipper's needs on the service quality. The results of study revealed that the five priority improved items are: EDI (Electronic Data Interchange) and cargo tracing service, availability of cargo space, the competency of emergency handling, the ability of claims handling and freight rate.

Key words: Service quality, ocean-freight forwarder, fuzzy zone of tolerance, fuzzy set theory, tolerance zone, service quality dimension

INTRODUCTION

Taiwan is a trade oriented country. The government adopts an export-oriented policy to keep the developmental vitality in international trade. According to the study reports published by the Ministry of Transportation and Communications (2006), on average, over 99% of imported and exported cargos are dependent on sea carriage. Therefore, the efficient shipping transportation is very important. Ocean-freight forwarders are granted with intermediary connection between mid-small enterprises and international carriers. During the service process of shipping transportation, Ocean-freight forwarders assist carriers with forwarding goods, as well as help shippers with handling shipping arrangement. That is, the ocean-freight forwarders play an important role in these economic activities (Liang *et al.*, 2006).

Shippers need better, safer and fast transportation services in order to receive good care of the goods they sold or bought. Ocean-freight forwarders thirst for better entire service to enhance cognitive service for shippers, such as sound inland transportation arrangement and efficient and accurate customs clearance services before the cargo is handed over carrier, selection of best

suitable carrier and safe and efficient delivery of goods to their customers. Ocean-freight forwarders provide a promise between shippers and carriers for improved quality in the overall performance of services.

Parasuraman *et al.* (1985, 1988) addressed “the gaps model of service quality” and SERVQUAL to observe the differences between customers’ expectation and actual perceptions for judging whether or not customers’ satisfaction (is consistent). Service quality is specified from comparing perceived service with expected service. Parasuraman *et al.* (1991) suggested the dual-leveled and dynamic concepts to customer service expectation. They argued that customers’ service expectation had two levels: desired and adequate. Besides, they considered the zone of tolerance (ZOT) as the area separating the desired service level from the adequate service level. The zone of tolerance can help the managers to develop customer franchise. In precision-based ZOT, it is presented by crisp numeric. In real life, fuzziness and vagueness are very common in decision-making problems and good decision-making models should tolerate vagueness or ambiguity (Yu, 2002).

Hjalager (2001) identified and discussed modes of collective consumer pressure that might affect tourism service quality in a comprehensive way. She investigated new ways to understand the role of customers in the gradual improvement of quality. Her study addressed the need for policy interventions and possibly in transnational organizational set-ups. Atilgan *et al.* (2003) suggested a new approach to the exploratory and survey research of service quality dimensions. They employed correspondence analysis for examining the expectations and perceptions of service quality in freight forwarder industry. Prayag (2007) assessed the service quality of Air Mauritius, using the SERVQUAL model and determined the relative importance attributed to service quality dimensions by international tourists. He found that structural service quality dimensions are context and culture-specific. Four factors were perceived as influencing perceptions of service; service efficiency and affect as the most important and service personalization, reliability and tangibles as the least important. Empathy as a service dimension was valued more than assurance. Customer satisfaction and willingness to recommend the airline was primarily dependent on service efficiency and affect.

Tarofder and Haque (2007) aimed to find out what are critical factors that play an important role for selecting right suppliers of telecommunication industry. Results of their study provide a comprehensive analysis of the important factors for suppliers’ selection for this industry. Shahin and Dabestani (2010) assessed the expectations and perceptions of customers based on service quality dimensions in a four-star hotel in Isfahan, Iran. The purpose of their study was to examine the service quality gaps through the correlation analysis in order to identify the most important service quality dimensions. The main findings showed that all the service quality gaps were negative and price as a service quality dimension had the highest negative value. Communication also had the highest correlation with other service quality dimensions. Because decision-makers very naturally provide uncertain answers rather than precise values, the transformation of qualitative preferences to crisp estimates is difficult.

Emari *et al.* (2011) examined the European perspective (i.e., Gronroos’s model) suggesting that service quality consists of three dimensions, technical, functional and image. Their study is an applied research and its strategy is casual strategy. A standard questionnaire was used for collecting the data. Two hundred and eighty seven customers of Pasargad Bank of Northwest were selected through cluster sampling and were studied. The results from a banking service sample revealed that the overall service quality is influenced more by a consumer’s perception of technical quality than functional quality. Hence, combining the concepts of fuzzy set theory and ZOT, this

paper focuses on developing the fuzzy zone of tolerance to help business to understand service quality of operation for improving performance and maintaining high customer, satisfaction.

LITERATURE REVIEW

PZB model: Parasuraman *et al.* (1985) presented the integrated model of service quality which called PZB model. They differentiated between the qualities associated with the process of service delivery from the quality associated with the outcome of the service. The foundation of this model is the set of five gaps in which first four gaps are the main obstacles of service quality offered by business operation. Expected Service (ES)-Perceived Service (PS) (gap 5) is the focus group unambiguously supported the notion that the key to ensuring good service quality is meeting or exceeding what consumers expect from the service. It appears that judgments of high and low service quality depend on how consumers perceive the actual service performance in the context of what they expected. When $ES-PS > 0$, perceived quality is less than satisfactory and will tend toward totally unacceptable quality, when the gap between ES and PS is keep on expanding; when $ES-PS = 0$, perceived quality is satisfied; when $ES-PS < 0$, perceived quality is more than satisfactory and will move toward ideal quality when the gap between ES and PS is keep on expanding. Expected service would be influenced by a marketer's promotion and be shaped by word-of-mouth communications, personal needs and past experience.

Zone of tolerance: Parasuraman *et al.* (1991) suggested that customers' service expectations have two levels: desired and adequate. The desired service level is the service the customer hopes to receive. The adequate service level reflects the minimum performance level expected by customers after they consider a variety of individual and situational factors. The Zone of Tolerance (ZOT) is the area separating the desired service level from the adequate service level. The conceptualization of adequate service level, zone of tolerance and desired service level is useful for helping the managers to build the customer franchise through service. Based on the conceptualization, a firm can operate at a competitive disadvantage, a competitive advantage, or at a customer franchise level in terms of its service. If the customer perceptions of service performance fall below adequate service level, the firm is at a competitive disadvantage. If a firm is performing in ZOT, the firm is competitive advantage. Otherwise, if a firm's service performance exceeds the desired service level, the firm is with high customer loyalty (Customer Franchise). To develop a true customer franchise, firms have to deliver service to not only the adequate service level but also the desired service level.

Service attributes to shippers research: Brooks (1985) proposed the shippers research for the containers route of American market. There are fifteen service attributes affecting the selection model of shippers: the level of freight cost, the goodwill of carrier, the number of voyage, door-to-door transportation, total transit time, scheduling accuracy, willingness of carrier to negotiate service changes, transit flexibility, carrying capacity, salesmanship attitude, the attitude toward freight loss and damage, past record of freight indemnification, the number of berth in a particular port and transit time reliability. APL's report displays the service priority shipper wanted: transit on time, totally responsiveness of shipper's demand, freight cost, pickup and delivery service, transit time, the area of service, the accuracy of documents, equipment availability, well-done service control, the process of freight indemnification and shipment tracing. Risseeuw and Masurel (1994) analyzed the relation between planning behaviour and performance for a large number of small real estate firms in the Netherlands The explanation of performance is dominated by a firm's

size and the nature of its activities. Hardly any effect of planning on a firm's performance is found, though it appears that in an environment perceived as highly dynamic, planning is merely counter-productive. Gooley (1994) pointed the service items shipper expected from carrier surrendering service: high service quality, the quicker voyage, transit on time, the ability of electronic information, the attitude of salesmanship, freight tracing and documents handling. Lu (2003) examined the previous study and conducted personal interviews with 10 shipping executives, 33 service attributes were selected for use in the questionnaire survey. The five most important carrier service attributes according to shippers were availability of cargo space, low damage or loss record, accurate documentation, reliability of advertised sailing schedules and courtesy of inquiry. Liang *et al.* (2006) proposed 24 service attributes to characterize the shippers' service needs: staffs' professional knowledge and service attitude, prompt response to claim, provision of consultant service, willingness to negotiate, computer EDI and cargoes tracing ability, emergency handling ability, document operation processes simple and simple and prompt document operation process, safekeeping ability, ability of sales representatives to handle problems, door-to-door service. Simple procedures of consigning for shipment, provision of intermodal service, provision of diversified service, business reputation, maintaining communication with customers, reasonable charging for agent fees, on time delivery, provide (provision of) complete ship route, short transit time, safe delivery, sufficient provision of shipping space, reasonable damage indemnification, reasonable operations fees and reasonable transportation price. From the previous study, all of them indicate that ocean-freight forwarders need to be especially concerned with shippers' perceptions of these service attributes, for example, the process and results of transit, service context, service items and salesman's attitude when developing a shipper-carrier partnering relationship.

Ding (2009) applied fuzzy Quality Function Deployment (QFD) model to identify solutions of Service Delivery System (SDS) for port of Kaohsiung from the viewpoints of customers. The results of empirical study show that (1) 10 key factors are deemed as to have priority to improve the quality of SDS for Kaohsiung port and (2) eight feasible solutions for improving service quality performance are identified. Moreover, it is suggested that port Authority of Kaohsiung should listen attentively the voice of customers and emphasize on exploiting these customer requirements effectively. And then develop the 'how' issues of profiles of solutions which should continuously strengthen the perspectives of customer, internal business process and learning and growth, respectively. Liu *et al.* (2010) proposed a measure for online auction sites' service quality (OA-SQ). The conceptualization is based on a literature review of service quality research and an analysis of the unique characteristics of online auctions. A pilot study refined the initial scale. A second survey data set tests the final scale. Results of both exploratory and confirmatory factor analysis show high construct validity of the scale. The scale includes 24 items for seven dimensions: efficiency, system availability, privacy/security, compensation, personalization, playfulness and reputation.

RESEARCH DESIGNS AND METHODS

In this section, research designs and methods utilized in this study are briefly introduced.

Service attributes: After a review of previous literature (Brooks, 1985; Gooley, 1994; Lu, 2003; Liang *et al.*, 2006; Sebusang and Moeti, 2005; Jain *et al.*, 2010; Ibeto *et al.*, 2011) and conducting personal interviews with ten shipping executives, twenty-two service attributes were chosen for use in the questionnaire survey. These are listed below: transit on time, the number of freight

forwarding for sailing line, short transit time and reliability, low tariff of pickup, freight rate, the speed of issuing bill of lading, good condition of container, the ability of goods loss claims, the convenience of pickup and delivery, multimodal transport service, the diversification of service items, courtesy and knowledge ability of salesman, prompt response to shipper's complaint, inquiry service, frequency of sales representative's calls to shippers, availability of cargo space, EDI and cargo tracing service, the competency of emergency handling, simple and speed of operation process, rationalization of agency charge, good condition of storage and prompt service and certainty. These service attributes could be categorized into convenience of operation process, complete service, optimization of traffic handling and rationalization of freight and charges.

Questionnaire design and sampling technique: Most studies on service attributes had focused on the level of satisfaction for carriers, not on the importance level of service attributes. While some of the service attributes are regarded as indices of satisfaction by shippers, they are not necessary the attributes important to ocean freight forwarders. In order to improve this shortcoming, questionnaire design of this study was constructed from questionnaire survey, previous literature and personal interviews with shipping practitioners. Questionnaire is consisted of two parts: shipper's background and information and importance-satisfaction level of service attributes based upon questionnaire responses. Hence, this study used the IPA analysis to improve service quality for ocean-freight forwarders. Attitudes to each of the variables in this study were assessed using a 5-point Likert scale anchored by the satisfaction (or importance) level of performance "1 = very poor (or very unimportance)" to "5 = excellent (or very important)".

An initial mailing included a covering letter, a three page questionnaire and a postage-paid return envelope. This study was chosen based on the top 1-1000 firms in the 2007 "List of Leading Firms" published by the Board of Foreign Trade of the Ministry of Economic Affairs in Taiwan. It was sent to 150 shippers, 125 responses were recovered because of the contacts of shippers had either left the companies contacted, or the businesses were no longer in existence. The valid population was further reduced to 102 as 23 of the responses were found completed inadequately and the overall recovering rate for this study is 68%.

Methodology: When the service attributes are designated, research methods are applied which include reliability and validity tests, factor analysis and fuzzy set theory. The factor analysis was conducted to summarize large number of service attributes into a smaller number of underlying dimensions which is call dimensions of service quality. According to ZOT, the perceived service of shippers is categorized into 3 items in this design of questionnaire, they are: The level of adequate service, the level of desired service and the actual perceived services.

Because shipper's attitude provides highly uncertain answers inherently rather than precise values, the transformation of qualitative preferences to point estimates is difficult. To handle efficiently the fuzziness in human judgment and preference, triangular fuzzy numbers are utilized in this paper to describe the fuzzy perception levels of adequate services, actual perceived services and desired services to all responses.

RESULTS OF EMPIRICAL ANALYSES

In this section, we describe firstly reliability and validity tests and the next is factor analysis and importance and satisfaction analysis.

Reliability and validity tests: Cronbach's α values were statistically determined to provide a summary measure of the inter-correlations that existed among a set of items. In this study, Cronbach's α value of all 22 service attributes with respect to satisfaction degree is 0.95 which show that all 22 service attributes achieve a satisfactory level of reliability in research (Nunnally, 1978; Sekaran, 1992; Churchill, 1991; Hosnavi and Ramezan, 2011).

The content of questionnaire was constructed through literature review and discussed with a number of executives and specialists in shipping field. In addition, a pretest was carried out. Therefore, the content validity of this questionnaire is very good.

Results of factor analysis: In this study, principle component factor analysis with VARIMAX rotation technique was used to generate the underlying factors of service satisfaction. Using an eigenvalue greater than 1.0 as the criterion (Churchill, 1991), the factor analysis suggests that a four-factor solution explained 70.52% total variance for service satisfaction. The Cronbach's α values for each factor are greater 0.8. (than 0.8, or of 0.8*) This shows that each factor achieves a satisfactory level of reliability in research (Nunnally, 1978; Sekaran, 1992; Churchill, 1991). Table 1 summarizes the factor analysis results. The four satisfaction factors are named as "convenience of operation process", "aggregated service", "transit handling excellently" and "rationalization of freight rate". The highest Eigenvalue is 8.686 that named convenience of operation process; the lowest Eigenvalue is 1.023 that named Rationalization of freight rate.

Table 1: Factor analysis and reliability analysis of service quality attributes for ocean-freight forwarders

Factor dimensions	Factor loading	Eigenvalue	Importance (Cronbach's α)	Satisfaction (Cronbach's α)	Explaining rate (accumulated)
Convenience of operation process		8.686	0.9318	0.9485	51.07%
-Courtesy and knowledge ability of salesman	0.69238				
-Prompt response to shipper's complaint	0.62664				
-inquiry service	0.67260				
-Availability of cargo space	0.74194				
-EDI and cargo tracing service	0.69049				
-The competency of emergency handling	0.80552				
-Simple and speed of operation process	0.67539				
-Good condition of storage and warehousing	0.63721				
-Prompt service and certainty	0.62755				
Aggregated service		1.418	0.8854	0.9623	54.65%
-The speed in issuing Bill of Lading	0.59843				
-The convenience of pickup and delivery	0.55823				
-Multimodal transport service	0.50513				
-The diversification of service items	0.56254				
-Frequency of sales	0.75583				
-Rationalization of agency charge	0.47755				
Transit handling excellently		1.243	0.8581	0.8759	63.45%
-Transit on time	0.76461				
-The number of freight per shipping line	0.51520				
-Short transit time and reliability	0.69485				
-Good condition of container	0.64721				
-The ability of goods loss claims	0.48298				
Rationalization of freight rate		1.023	0.9338	0.8384	70.52%
-Pickup tariff	0.86129				
-Freight rate	0.89096				

Satisfaction analysis of service attributes: To effectively characterize the perceptions of all shippers to the satisfaction and importance degrees of service attributes provided by ocean-freight forwarders, the fuzzy perception levels to adequate services, actual perceived services, desired services and fuzzy zone of tolerance are proposed.

The generalized means is a typical representation of many well-known averaging operations (Klir and Yuan, 1995), e.g., min, max, geometric mean, arithmetic mean, harmonic mean, etc. The min and max are the lower bound and upper bound of generalized means, respectively. Besides, the geometric mean is more effective in representing the consensus opinions of multiple decision makers (Saaty, 1980). To aggregate all information generated by different averaging operations, we use the grade of membership to demonstrate their strength after considering all approaches. For the above-mentioned reasons, the triangular fuzzy numbers characterized by using the min, max and geometric mean operations is used to convey the satisfactory degrees of all respondents. That is, let a_{jk} , $k = 1, 2, \dots, p$ be the numerical perception levels (e.g., satisfaction degrees) given to service attribute j by respondent k . Then, the fuzzy perception levels of the service attribute to all respondents is defined as:

$$A_j = (c_j, a_j, b_j),$$

Where

$$c_j = \min\{a_{j1}, a_{j2}, \dots, a_{jp}\}$$

$$a_j = \left(\prod_{k=1}^p a_{jk} \right)^{1/p}$$

$$b_j = \max\{a_{j1}, a_{j2}, \dots, a_{jp}\}$$

The fuzzy perception levels of adequate services, actual perceived services and desired services are shown as Table 2. Define that the fuzzy zone of tolerance is a fuzzy area separating the fuzzy desired service level from the fuzzy adequate service level. Based Table 2, the good condition of storage and warehousing attribute has the highest fuzzy desired service (3, 3.9794, 5); the EDI and cargo tracing service attribute has the lowest fuzzy desired service (3, 3.7868, 5). Many fuzzy ranking methods have been proposed by Chen (1985), Kim and Park (1990), Chang and Chen (1994) and Chen and Hsieh (2000). Because of the graded mean integration representation method (Chen and Hsieh, 2000) not only improve some drawbacks of the existing method, but also possess the advantage of easy implementation and powerfulness in problem solving, it will be used to rank the final ratings of all fuzzy satisfactory degrees of adequate, actual perceived and desired services.

Let $A_i = (c_i, a_i, b_i)$ $i = 1, 2, \dots, n$, triangular fuzzy numbers. The graded mean integration representation $P(A)$ of is (of it is):

$$P(A_i) = \frac{c_i + 4a_i + b_i}{6}$$

Let $P(A_i)$ and $P(A_j)$ be the ranking values of triangular fuzzy numbers A_i and A_j , respectively. Define that:

Table 2: The fuzzy perception levels of adequate services, actual perceived services and desired services

Service quality attributes	Adequate services	Actual perceived services	Desired services
Courtesy and knowledge ability of salesman	(1, 3.0914, 4)	(2, 2.9398, 4)	(3, 3.9097, 5)
Prompt response to shipper's complaint	(2, 3.1652, 5)	(1, 2.7814, 5)	(3, 3.9157, 5)
Inquiry service	(1, 3.0633, 4)	(1, 2.0609, 3)	(3, 3.8795, 5)
Availability of cargo space	(1, 2.9227, 4)	(1, 2.6428, 4)	(3, 3.9401, 5)
EDI and cargo tracing service	(1, 3.3598, 5)	(1, 2.4574, 5)	(3, 3.7868, 5)
The competency in emergency handling	(1, 3.0612, 5)	(1, 2.787, 5)	(3, 3.8999, 5)
Simple and speed of operation process	(1, 2.9812, 4)	(1, 2.5057, 4)	(3, 3.7961, 5)
Good condition of storage and warehousing	(1, 2.7534, 5)	(1, 2.7648, 5)	(3, 3.9794, 5)
Prompt service and certainty	(1, 2.6329, 5)	(1, 2.6574, 5)	(3, 3.8974, 5)
The speed of issue bill of lading	(1, 3.103, 4)	(1, 2.9104, 5)	(3, 3.9121, 5)
The convenience of pickup and delivery	(1, 2.7833, 3)	(1, 2.7458, 4)	(3, 3.9338, 5)
Multimodal transport service	(1, 3.0147, 5)	(2, 3.1147, 5)	(3, 3.8939, 5)
The diversification of service items	(2, 3.3478, 5)	(2, 3.2811, 5)	(3, 3.9401, 5)
Frequency of sales representative's calls to shippers	(1, 3.1973, 5)	(1, 2.8763, 5)	(3, 3.7914, 5)
Rationalization of agency charge	(1, 3.3351, 4)	(2, 3.0915, 4)	(3, 3.8603, 5)
Transit on time	(1, 3.0237, 5)	(2, 3.5691, 5)	(3, 3.9658, 5)
The number of freight forwarding for shipping line	(1, 3.0829, 4)	(2, 3.4224, 4)	(3, 3.8746, 5)
Short transit time and reliability	(1, 3.2727, 5)	(2, 3.2438, 5)	(3, 3.8137, 5)
Good condition of container	(1, 3.0657, 4)	(2, 2.5759, 5)	(3, 3.9302, 5)
The ability of goods loss claims	(2, 3.3458, 4)	(2, 3.2352, 4)	(3, 3.8711, 5)
Low tariff of pickup	(2, 3.3327, 5)	(2, 3.2275, 5)	(3, 3.8976, 5)
Freight rate	(2, 3.0749, 5)	(2, 3.2235, 4)	(3, 3.8866, 5)

$$A_i > A_j \Rightarrow P(A_i) > P(A_j)$$

$$A_i = A_j \Rightarrow P(A_i) = P(A_j)$$

$$A_i < A_j \Rightarrow P(A_i) < P(A_j)$$

By using the graded mean integration representation described above, the ranking values of adequate services, actual perceived services and desired services to all service attributes can be easily calculated and related ranking of these items can be effectively determined. The results are shown as Table 3.

Based on Table 3, all perception levels of actual perceived services to all service attributes provided by ocean-freight forwarders are below the desired services. That is, the shippers' satisfaction degrees of all actual perceived services are below desired services. Especially, there are six service quality attributes in the factor dimension of "convenience of operation process" below the FZOT. These are: prompt response to shipper's complaint, inquiry service, availability of cargo space, EDI and cargo tracing service, the competency of emergency handling and simple and speed of operation process. The lowest actual perceived service is inquiry service by scoring 2.0406. In the second factor dimension, there are two items below FZOT. These are: the diversification of service items and frequency of sales representative's calls to shippers from aggregated service dimension, the frequency of sales representative's calls to shippers is the lowest actual perceived service by scoring 2.9175. In the third factor dimension, the ability of goods loss claims is below FZOT with 3.1568 scoring. The factor dimension of "rationalization of freight rate" comprised two items below FZOT. They are low tariff of pickup and freight rate.

Table 3: The ranking values of adequate services, actual perceived services and desired services to all service attributes

Service attributes	Adequate services	Actual perceived services	Desired services	The remarks to actual perceived services
Courtesy and knowledge ability of salesman	2.8943	2.9599	3.9398	In FZOT
Prompt response to shipper's complaint	3.2768	2.8543	3.9438	Below the FZOT
Inquiry service	2.8755	2.0406	3.9197	Below the FZOT
Availability of cargo space	2.7818	2.5952	3.9601	Below the FZOT
EDI and cargo tracing service	3.2399	2.6383	3.8579	Below the FZOT
The competency of in emergency handling	3.0408	2.8580	3.9333	Below the FZOT
Simple and speed of operation process	2.8208	2.5038	3.8641	Below the FZOT
Good condition of storage and warehousing	2.8356	2.8432	3.9863	In FZOT
Prompt service and certainty	2.7553	2.7716	3.9316	In FZOT
The speed of issue bill of lading	2.9020	2.9403	3.9414	In FZOT
The convenience of pickup and delivery	2.5222	2.6639	3.9559	In FZOT
Multimodal transport service	3.0098	3.2431	3.9293	In FZOT
The diversification of service items	3.3985	3.3541	3.9601	Below the FZOT
Frequency of sales representative's calls to shippers	3.1315	2.9175	3.8609	Below the FZOT
Rationalization of agency charge	3.0567	3.0610	3.9069	In FZOT
Transit on time	3.0158	3.5461	3.9772	In FZOT
The number of freight forwarding for shipping line	2.8886	3.2816	3.9164	In FZOT
Short transit time and reliability	3.1818	3.3292	3.8758	In FZOT
Good condition of container	2.8771	2.8839	3.9535	In FZOT
The ability of goods loss claims	3.2305	3.1568	3.9141	Below the FZOT
Low tariff of pickup	3.3885	3.3183	3.9317	Below the FZOT
Freight rate	3.2166	3.1490	3.9244	Below the FZOT

Importance and satisfaction analysis to service quality attributes: Based on the ranking values of all service attributes shown as Table 4, the most important six items for shippers were followed by good condition of the container, transit on time, the competency in emergency handling, EDI and cargo tracing service, courtesy and knowledge ability of salesman and prompt response to shipper's complaint. Besides, the FZOT analysis results showed that there are ten service attributes with service level expectations fall below adequate levels. They are: prompt response to shipper's complaint, inquiry service, availability of cargo space, EDI and cargo tracing service, the competency of emergency handling, simple and speed of operation process, diversification of service items, frequency of sales representative's calls to shippers, the ability of goods loss claims, low tariff of pickup and freight rate.

Generally, service attributes characterized by high importance levels that is their service expectation levels below the adequate levels need to be improved with priority. That is, the priority has a direct relationship with the importance degree and has an inverse relationship with the satisfaction degree. Let P_i and S_i denote the ranking values of the fuzzy importance level and fuzzy perception level of actual perceived services to service attribute A_i , respectively. Based on the concept stated as above, the formula $p_i (5-S_i)$ is utilized to calculate the priority rating of service attribute A_i . By considering the service attributes with importance priority top ten is No. 1 to No. 10, don't see anything higher service quality. The six service attributes need to be improved with priority are: prompt response to shipper's complaint, availability of cargo space, EDI and cargo tracing service, the competency of emergency handling, the ability of goods loss claims and freight

Table 4: Importance and satisfaction analysis to service attributes

Factor dimensions	Service quality indicators	Importance level	Importance order	Actual perceived services	The remarks to actual perceived services
Convenience of operation process	Courtesy and knowledge ability of salesman	4.4348	5	2.9599	In FZOT
	Prompt response to shipper's complaint	4.4348	5	2.8543	Below the FZOT
	Inquiry service	4.0978	15	2.0406	Below the FZOT
	Availability of cargo space	4.3152	9	2.5952	Below the FZOT
	EDI and cargo tracing service	4.4783	4	2.6383	Below the FZOT
	The competency in emergency handling	4.5109	3	2.8580	Below the FZOT
	Simple and speed of operation process	4.2609	12	2.5038	Below the FZOT
	Good condition of storage and warehousing	4.2717	11	2.8432	In FZOT
Aggregated service	Prompt service and certainty	4.4239	6	2.7716	In FZOT
	The speed of issue bill of lading	4.2500	13	2.9403	In FZOT
	The convenience of pickup and delivery	4.2065	14	2.6639	In FZOT
	Multimodal transport service	4.0761	16	3.2431	In FZOT
	The diversification of service items	3.8043	19	3.3541	Below the FZOT
	Frequency of sales representative's calls to shippers	3.9457	17	2.9175	Below the FZOT
	Rationalization of agency charge	4.1630	14	3.1610	In FZOT
Transit handling excellently	Transit on time	4.7174	2	3.5461	In FZOT
	The number of freight forwarding for shipping line	3.8587	18	3.2816	In FZOT
	Short transit time and reliability	4.3152	9	3.3292	In FZOT
	Good condition of container	4.7283	1	2.8839	In FZOT
Rationalization of freight rate	The ability of goods loss claims	4.4022	7	3.1568	Below the FZOT
	Low tariff of pickup	4.2826	10	3.3183	Below the FZOT
	Freight rate	4.3587	8	3.1490	Below the FZOT

rate. The EDI and cargo tracing service attribute has the lowest actual perceived services below the FZOT (2.6383). The ability of goods loss claims attribute has the highest actual perceived services below the FZOT (3.1568).

CONCLUSIONS

In this study, the FZOT was developed to help business in understanding service quality of operation for improving performance and maintaining high customers' satisfaction. This study had also examined the impact of ocean-freight forwarder service attributes on shippers from a shipper's perspective. The six most important service attributes, according questionnaire survey on shippers, were good condition of the container, transit on time, the competency of emergency handling, EDI and cargo tracing service, courtesy and knowledge ability of salesman and prompt response to shipper's complaint.

The FZOT analysis results indicated that ten service attributes are below desired services. They are: prompt response to shipper's complaint, inquiry service, availability of cargo space, EDI and cargo tracing service, the competency of emergency handling, simple and speed of operation process, the diversification of service items, frequency of sales representative's calls to shippers, the ability of goods loss claims, low tariff of pickup and freight rate.

Based on the importance and satisfaction analysis used in this paper, five service attributes need to be improved with priority. They are: EDI and cargo tracing service, availability of cargo space, the competency of emergency handling, the ability of goods loss claims and freight rate. To effectively grip the perceptions of all shippers to the satisfaction and importance degrees of service attributes, the generalized means and triangular fuzzy numbers are combined to convey the

shippers' fuzzy perception levels to all service attributes. Therefore, the proposed FZOT method can be effectively utilized to explore the customer service quality.

ACKNOWLEDGMENTS

This study was supported by National Science Council, Taiwan, ROC under grant NSC 99-2410-H-231-007. The authors would like to thank anonymous reviewers for their helpful comments on this paper.

REFERENCES

- Atilgan, E., S. Akinici and S. Aksoy, 2003. Mapping service quality in tourism industry. *Managing Serv. Qual.*, 13: 412-422.
- Brooks, M.R., 1985. An alternative theoretical approach to the evaluation of liner shipping-part II: Choice criteria. *Marit. Policy Manage.*, 12: 145-155.
- Chang, P.L. and Y.C. Chen, 1994. A fuzzy multi-criteria decision making method for technology transfer strategy selection in biotechnology. *Fuzzy Set Syst.*, 63: 131-139.
- Chen, S.H., 1985. Ranking fuzzy numbers with maximizing set and minimizing set. *Fuzzy Sets Syst.*, 17: 113-129.
- Chen, S.H. and C.H. Hsieh, 2000. Representation, ranking, distance and similarity of LR type fuzzy number and application. *Aust. J. Intell. Process. Syst.*, 6: 217-229.
- Churchill, G.A., 1991. *Marketing Research: Methodological Foundations*. 5th., The Dryden Press, New York.
- Ding, J.F., 2009. Applying fuzzy Quality Function Deployment (QFD) to identify solutions of service delivery system for port of Kaohsiung. *Qual. Quantity*, 43: 553-570.
- Emari, H., S. Iranzadeh and S. Bakhshayesh, 2011. Determining the dimensions of service quality in banking industry: Examining the Gronroos model in Iran. *Trends Applied Sci. Res.*, 6: 57-64.
- Gooley, T.B., 1994. How to choose an ocean carrier. *Traffic Manage.*, 31: 83-83.
- Hjalager, M.A., 2001. Research and concepts quality in tourism through the empowerment of tourists. *Managing Serv. Qual.*, 11: 287-295.
- Hosnavi, R. and M. Ramezan, 2011. Intellectual capital and organizational organic structure how are these concepts related. *Trends Applied Sci. Res.*, 6: 256-268.
- Ibeto, C.N., A.U. Ofoefule and H.C. Ezugwu, 2011. Analytical methods for quality assessment of biodiesel from animal and vegetable oils. *Trends Applied Sci. Res.*, 6: 537-553.
- Jain, R., G. Sinha and S.K. De, 2010. Service quality in higher education: An exploratory study. *Asian J. Market.*, 4: 144-154.
- Kim, K. and K.S. Park, 1990. Ranking fuzzy numbers with index of optimism. *Fuzzy Sets Syst.*, 35: 143-150.
- Klir, G.J. and B. Yuan, 1995. *Fuzzy Sets and Fuzzy Logic Theory and Application*. 1st., Prentice-Hall Inc., Engle-Wood Cliffs, New Jersey, ISBN-13: 978-0131011717.
- Liang, G.S., T.Y. Chou and S.F. Kan, 2006. Applying fuzzy quality function deployment to identify service management requirements for an ocean freight forwarder. *Total Qual. Manage. Bus. Excellence*, 17: 539-554.
- Liu, C.T., Y.M. Guo and T.Y. Hsieh, 2010. Measuring user perceived service quality of online auction sites. *Serv. Ind. J.*, 30: 1177-1197.
- Lu, C.S., 2003. The impact of carrier service attributes on shipper-carrier partnering relationships: A shipper's perspective. *Transp. Res. E: Logist. Transp. Rev.*, 39: 399-415.

- Nunnally, J.C., 1978. *Psychometric Theory*. 2nd Edn., McGraw-Hill, New York, ISBN-10: 007047849X.
- Parasuraman, A., V.A. Zeithaml and L.L. Berry, 1985. A conceptual model of service quality and its implications for future research. *J. Market.*, 49: 41-50.
- Parasuraman, A., V.A. Zeithaml and L.L. Berry, 1988. SERVQUAL: A multiple item scale for measuring consumer perceptions of service quality. *J. Retailing*, 64: 12-40.
- Parasuraman, A., V.A. Zeithaml and L.L. Berry, 1991. Understanding customer expectations of service. *Sloan Manage. Rev.*, 32: 1-25.
- Prayag, G., 2007. Assessing international tourists' perceptions of service quality at Air Mauritius. *Int. J. Qual. Reliab. Manage.*, 24: 492-514.
- Risseuw, P. and E. Masurel, 1994. The role of planning in small firms: Empirical evidence from a service industry. *Small Bus. Econ.*, 6: 313-322.
- Saaty, T.L., 1980. *The Analytic Hierarchy Process: Planning, Priority Setting, Resource Allocation*. 1st Edn., McGraw-Hill, New York, ISBN-13: 9780070543713, pp: 437.
- Sebusang, S.E.M. and N.N. Moeti, 2005. Is the botswana public service customer-centric. *J. Applied Sci.*, 5: 93-98.
- Sekaran, U., 1992. *Research Methods for Business: A Skill Building Approach*. 2nd Edn., John Wiley and Sons, New York.
- Shahin, A. and R. Dabestani, 2010. Service quality improvement based on gap correlation analysis with a case study in a four-star hotel. *Int. Bus. Res.*, 3: 40-46.
- Tarofder, A.K. and A. Haque, 2007. Exploring critical factors for supplier selection in telecommunication industry in Malaysia. *Asian J. Market.*, 1: 1-13.
- Yu, C.S., 2002. A GP-AHP method for solving group decision-making fuzzy AHP problem. *Comput. Oper. Res.*, 29: 1969-2001.