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Evaluating Quality Improvement of Service Recovery for Ocean Freight Forwarders in Taiwan

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Abstract: The main purpose of this study aims to evaluate the quality improvement of service recovery for ocean freight forwarders (F/Fs) in Taiwan. To facilitate the concepts of measuring quality improvement of service recovery, a systematically-integrated method is employed to evaluate the proposed issue. An empirical analysis is conducted to evaluate the quality improvement of service recovery. The first finding shows the freight or cost, compensation for cargo damages and the accuracy of shipping schedule are the most three criteria of service quality needed to be improved. The second finding shows the strengthening of education and training for employees, swift response and establishment of SOP are three best solutions of service recovery to be executed in the future.

Key words: Quality improvement, ocean freight forwarder, service recovery, fuzzy quality function deployment

INTRODUCTION

When the goods are produced to export, the distribution of the consignment using ocean transport is appeared. Today, the traders/shippers are outsourcing their shipping operation activities to the ocean Freight Forwarder (F/F) which in charge of managing goods flow from an exporting country to importing one. The ocean F/F not only can offer value-added services but also can provide cost- and time-effective methods of overall transport for her customers in the shipping logistics chain. The ocean F/F plays an important role of logistics service provider who is considerably important to the entire ocean logistics chain. In addition, it also plays an important of fourth party logistics provider normally to provide total solution and acts as a coordinator to provide efficient supply chain management for consignors. Thus it can see that the ocean F/F indeed plays an important role in the global logistics services (Ding, 2010a).

The low threshold of capital for ocean F/Fs in Taiwan has encouraged more people to engage in this field which has also led to a fierce competition in this industry. As a result, how to provide customers with service of higher quality has become a commitment relationship between organizations and customers (Gronroos, 2000). From the viewpoint of marketing (Kotler, 2000), the service quality of a service provider can decide if customers will return or not and is also an important factor to customer satisfaction and loyalty.

According to the gap analysis model (i.e., the PZB model) presented by Parasuraman *et al.* (1985, 1988), service quality can be defined by the gap between Expected Service (ES) and Perceived Service (PS). Through this model, we can analyze the source of service quality to help operators improve their service qualities. However, as personnel and machines in a service system may sometimes make mistakes or go out of order and result in service failures (Gronroos, 2000) which make the provision of totally satisfactory service a mission impossible. To a customer-oriented service industry, the occurrence of service failures is the very beginning of real tests for the maintenance of customer satisfaction and loyalty. As a result, there are more and more discussions on service remedies.

In the shippers' viewpoints, there are at least three types of perceived quality produced by various service quality offered by the ocean F/Fs, including (i) High quality (i.e., ES>PS), (ii) Acceptable quality (i.e., ES = PS) and (iii) Bad quality (i.e., ES<PS), respectively (Gronroos, 2000). In the case (i) and (ii) are produced as perceived qualities, such service quality should be 'maintained;' however, when the case (iii) of perceived quality is produced, showing that such service quality should be 'improved.' Consequently, how to evaluate if the service provided by ocean F/Fs can satisfy the needs of customers and what kind of technologies can be used to remedy their service qualities were the motives behind this study.

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In short, the service quality affects customers' satisfaction and customers' loyalty due to the fact that the development of service recovery has a fundamental impact on the structures and processes of business systems (Kotler, 2000). When customers are unsatisfied or the service qualities are not meeting the customers' requirements, the issues of service failure and service recovery are emerged (Gronroos, 2000). Besides, discussions of service failure and service recovery to ocean F/Fs remain scanty. Hence, it is worthy to concentrate the issue of service recovery due to the fact that the service failures occur frequently in the service system for ocean F/Fs.

Regarding to the analytical processes, the preliminary criteria of service quality (e.g., freight, transport time, sailing frequency etc.) and the preliminary solutions of service recovery (e.g., discount, replacement, apology etc.) are the basic points in terms of evaluating criteria and solutions. Hence, a systematically-integrated method-Threshold and Importance Analysis (TIA) approach (Ding and Liang, 2005), Importance-performance Analysis (IPA) approach (Martilla and James, 1977) and Fuzzy Quality Function Deployment (FQFD) approach (Ding, 2009a) is utilized to evaluate the proposed applications in this survey. These analytical processes are interlinked with the four stages questionnaires. Finally, the solutions of quality improvement of service recovery for ocean F/Fs in Taiwan can be evaluated by the proposed model.

In the light of this, the main purpose of this paper aims to evaluate the quality improvement of service recovery for ocean F/Fs in Taiwan. The main contribution of this paper with its methodologies developed can be employed as a practical tool for business application in the forwarding service industry. We will describe step-by-step procedures to evaluate this issue in the follows.

MATERIALS AND METHODS

The preliminary criteria of service quality: Since the measured criteria of service quality for ocean F/FS can be directly applied to other similar services or be promoted for studies of service quality of other types of sea transport services. Hence, we combined the measurements of preliminary criteria of service quality via academic literature (Chou and Liang, 2001; Ding, 2009b, c; 2010b; Durvasula *et al*., 2004; Liang *et al*., 2004, 2006; Murphy and Daley, 1995, 1996, 1997) and considered the characteristics of service quality of ocean F/Fs via consultations of managers and experts in Taiwan. As a result, the preliminary five dimensions with 24 criteria of service quality for ocean F/Fs are summarized in this paper; and their codes are shown in parentheses. They are:

- **Freight and shipping schedule (C_1):** This dimension includes four criteria; they are freight (price) or cost (C_{11}), transport time (C_{12}), sailing frequency (C_{13}) and the accuracy of shipping schedule (C_{14}), respectively
- **Factors related to convenience of service (C_2):** This dimension includes five criteria; they are service reliability and completeness (C_{21}), convenience of service (C_{22}), service scope and locations (C_{23}), availability of shipping space (C_{24}) and propriety of delivery place (C_{25}), respectively
- **Supportive transport items (C_3):** This dimension includes four criteria; they are completeness of composite transport service (C_{31}), security (C_{32}), availability of equipment (C_{33}) and completeness of information system (including EDI) and information transfer (C_{34}), respectively
- **Contingency handling ability (C_4):** This dimension includes four criteria; they are familiarity with navigation law and provision of counseling service (C_{41}), cargo-tracking ability (C_{42}), contingency handling ability (including special situations and emergencies) (C_{43}) and compensation for cargo damages (C_{44}), respectively
- **Company reputation and internal management (C_5):** This dimension includes seven criteria; they are staff's attitude (C_{51}), staff's professional knowledge (C_{52}), smooth contact and communication with customers (C_{53}), correctness of shipping documents (C_{54}), rapidity of shipping document (bill of lading) issuance (C_{55}), OP personnel's quality (C_{56}) and reputation (C_{57}), respectively

Acquisition of preliminary solutions of service recovery: The direction of technical specifications involves in the acquisition of preliminary solutions of service recovery which are expressed by academic literature (Chou *et al*., 2009; Davidow, 2003; Ennew and Shoefer, 2004; Hoffman *et al*., 1995; Karande *et al*., 2007; Miller *et al*., 2000; Simon, 2004; Smith *et al*., 1999; Wirtz and Mattila, 2004) and consulted by senior managers and experts in sea-cargo forwarding services. In summary, three dimensions with 14 preliminary technical solutions of service recovery are suggested; and their codes are shown in parentheses. They are:

- **Substantial compensation (A_1):** This dimension includes five solutions; they are discount (A_{11}),

replacement (A_{12}), operators coming forward to solve problems (A_{13}), gifts or discount coupons (A_{14}) and proper and satisfactory compensation (A_{15}), respectively

- **Spiritual compensation (A_2):** This dimension includes five solutions; they are apology (A_{21}), explain the situation and reason for service failures (A_{22}), provision of information during waiting time (A_{23}), swift response (A_{24}) and provision of counseling to customers (A_{25}), respectively
- **Internal management (A_3):** This dimension includes four solutions; they are strengthening of education and training for employees (A_{31}), regular review meetings (A_{32}), a database built based on past experience with complaint handling (A_{33}) and establishment of Standard Operational Procedure (SOP) (A_{34}), respectively

TIA approach: In this study, we use this technique to aggregate all information generated by questionnaires of stage 1 and 2. These steps (Ding, 2009c) can be summarized as follows:

- **Step 1:** Find the importance value of all preliminary criteria and solutions. Let a_{ik}, k = 1, 2,..., q, be the importance value, measured by the Likert's 7-point scale, given to the preliminary criterion or solution i by a DM k
- **Step 2:** Use geometric mean technique (Saaty, 1980) to integrate the opinions of all DMs. Let a_i denote the consensus opinion evaluation value of the preliminary criterion or solution i, then:

$$a_i = \left(\prod_{k=1}^{q} a_{ik}\right)^{1/q}$$

- **Step 3:** Set up the threshold value. Threshold value can be subjectively decided by researchers. In the questionnaires of stage 1 and 2, the very high thresholds of the top 85 and 80% are suggested by Chen (2002)
- **Step 4:** Compare geometric mean a_i with threshold value. For example, if $a_i \geq 5.95$, then retain the item of evaluation criterion; otherwise, delete the one. The retained items are considered as the suitable criteria or suitable solutions in this paper.

IPA approach: In order to determine whether the criteria of service quality are valued by customers or whether they are factors that should be improved by ocean F/Fs, this study used the IPA approach (Martilla and James, 1977). A stepwise description of the IPA approach is briefly introduced in the following:

- **Step 1:** Assess the degrees of importance and satisfaction of the criteria of service quality. Let b_{jp} and c_{jp}, j = 1, 2,..., r; p = 1, 2,..., n, be the importance value and satisfaction value, measured by Likert's 7-points scale, given to the criterion of service quality j by a DM p, respectively. It is obvious that $1 \leq b_{jp}$ and $1 \leq c_{jp} \leq 7$
- **Step 2:** Use the geometric mean technique to integrate the opinions of all DMs. Let b_j and c_j denote the consensus opinion evaluation values of importance and satisfaction of the criteria of service quality, respectively, then we can obtain:

$$b_j = \left(\prod_{p=1}^{n} b_{jp}\right)^{1/n} \text{ and } c_j = \left(\prod_{p=1}^{n} c_{jp}\right)^{1/n}$$

- **Step 3:** Set up the threshold values (TVs). In this paper, the TV of importance (i.e., first TV) and the TV of satisfaction (i.e., second TV) of all questionnaires are calculated by the arithmetic mean of all r criteria of service quality. That is, the first and second TVs are:

$$\bar{y}_b = \sum_{j=1}^{r} b_j \Big/ r \text{ and } \bar{x}_c = \sum_{j=1}^{r} c_j \Big/ r$$

- **Step 4:** Skeletonize the relative position of all criteria of service quality as shown in Fig. 1. The fig. 1 is plotted in a two-dimensional matrix which is composed by 'keep up the good work' (in quadrant 1), 'concentrate here' (in quadrant 2), 'low priority' (in quadrant 3) and 'possible overkill' (in quadrant 4)

The proposed FQFD approach: The FQFD model (Ding, 2009a) can be used to translate customer requirements into product specifications. It is a tool to deploy the Voice of Customer (VOC) into searching for best solutions of product development. In this paper, we used a matrix, also called the "House of Quality (HOQ)," which is used matrices to show multiple relationships

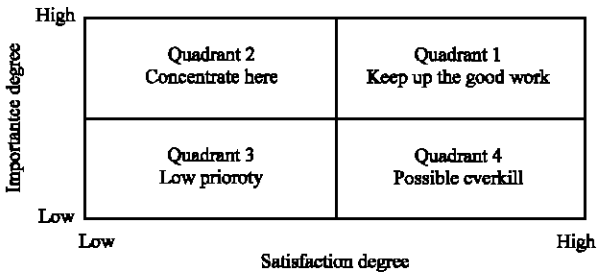

Fig. 1: The importance-performance matrix (Martilla and James, 1977)

between customer's requirements and technical specifications. In this paper, the matrices of HOQ are used for organizing the criteria of service quality and evaluating priorities of solutions of service recovery. The systematic steps of FQFD approach (Ding, 2009a; Liang *et al*., 2006; Liang, 2010) are proposed below:

- **Step 1: Identify customer requirements:** In this study, the preliminary criteria influencing service quality were used to sift the suitable criteria from the TIA approach. Then, we applied the IPA approach to select some criteria of service quality needed to improve to identify as the customer requirements in this study. These selected criteria of service quality are the 'what' issue in the HOQ
- **Step 2: Compare the criteria between the importance and satisfaction degrees:** The criteria of service quality can be measured by Likert's 7-points to evaluate the gaps between importance and satisfaction degrees. If the latter is bigger than the former, it implies the criterion of service quality in ocean F/F is acceptable. On the other hand, if the former is bigger than the latter, it implies that there would be some measures or solutions to be identified and then proceeding with the Step 3. In this paper, the authors will evaluate these gaps for the criteria of service quality of customer requirements via stage 4 questionnaire
- **Step 3: Identify technical solutions:** In this study, the preliminary technical solutions of service recovery were used to sift the suitable technical solutions from the TIA approach. These selected solutions are the 'how' issue in the HOQ
- **Step 4: Calculate the priorities of the criteria of service quality:** As mentioned in the Step 2, the importance and satisfaction degrees for each selected criteria of service quality are compared to obtain the arithmetic averages of all importance and satisfaction levels. The priorities of selected criteria of service quality have to calculate to evaluate the perception of the VOCs. This is because that the higher the importance levels and the lower the satisfaction levels, the higher the selected service quality of customer requirements should be improved

Let I_t and S_t, t = 1, 2,..., u, be the arithmetic averages of importance and satisfaction levels for each selected criterion (C_t, t = 1, 2,..., u) of service quality. Since the priority of each customer requirement has a direct relationship with the importance level, whereas the priority has an inverse relationship with the satisfaction level. Thus, the original priority v_t of C_t can be denoted by $v_t = I_t (6\text{-}S_t)$. For being convenient to compare with the priorities, these crisp weights are normalized and denoted by:

$$w_t = v_t \Big/ \sum_{t=1}^{u} v_t$$

- **Step 5: Construct the fuzzy relationship matrix:** The fuzzy relationship matrix can be constructed to link between the selected criteria of service quality (C_t, t = 1, 2,..., u) and technical solutions (A_S, s = 1, 2,..., z) of service recovery. Let x^h_{ts}, h = 1, 2,..., E, be the linguistic variable (Zadeh, 1975) given to tth selected criterion of service quality corresponding to sth technical solution by hth expert. The linguistic relationship degree in the position (t, s) of the matrix should be transferred into triangular fuzzy numbers firstly and then calculate the integrated fuzzy relationship degree R_{ts} by arithmetic mean method. Therefore, the integrated fuzzy relationship matrix can be constructed as $[R_{ts}]_{u\times z}$. Furthermore, the triangular fuzzy numbers (Zadeh, 1965) are utilized to describe the set of relationship degree as High = {high, Medium, Low, Non}, where the linguistic values are defined as High = (0.5, 0.75, 1), Medium = (0.25, 0.5, 0.75), Low = (0, 0.25, 0.5) and Non = (0, 0, 0), respectively
- **Step 6: Calculate the fuzzy relationship strength (FRS):** Let $R_{ts} = (c_{ts}, a_{ts}, b_{ts})$, t = 1, 2,..., u; s = 1, 2,..., z, be the triangular fuzzy numbers of integrated fuzzy relationship degree in the fuzzy relationship matrix. After integrating the opinions of all E experts, the fuzzy relationship strength corresponding to each technical solution can be denoted by:

$$RS_s = \left(\sum_{t=1}^{u} c_{ts} \Big/ u, \sum_{t=1}^{u} a_{ts} \Big/ u, \sum_{t=1}^{u} b_{ts} \Big/ u \right)$$

- **Step 7: Defuzzify the fuzzy relationship strength to rank the priority:** The Graded Mean Integration Representation (GMIR) method, proposed by Chen and Hsieh (2000), is used to defuzzify the fuzzy relationship strength RS_S. By using the GMIR defuzzify equation, the priorities can be denoted by:

$$P(RS_s) = \left(\sum_{t=1}^{u} c_{ts} + 4\sum_{t=1}^{u} a_{ts} + \sum_{t=1}^{u} b_{ts} \right) \Big/ 6u$$

s = 1, 2,..., z. Then, we can rank the technical solutions of service recovery

EMPIRICAL RESULTS

Obtaining suitable criteria and solutions using TIA approach: The questionnaires of stage 1 and 2 are, respectively based on the 24 preliminary criteria of service quality and 14 preliminary solutions of service recovery. These two valid questionnaires are designed and employed to refine the suitable criteria and suitable solutions. The reliabilities (Hair *et al*., 2010), i.e., Cronbach's α, of the two questionnaires are 0.876 and 0.848 for stage 1 and 2, obtained by using statistical software SAS. The validities (Hair *et al*., 2010), both questionnaires are conformed to content validity and construct validity. A total of 141 respondents (shippers/customers), most are working over 5-10 years, participated in the survey.

The participants were requested to record the importance based on Likert's 7-point scale. After coding these data and using the TIA approach and subjective setting the threshold values as 5.95 and 5.60 for the criteria and solutions, respectively. The authors refine the numbers of suitable criteria from 24 to 18 and suitable solutions from 14 to 12. The results and processes are shown in Table 1 and 2, respectively.

Selecting the criteria of improvement using IPA approach: The 18 suitable criteria are designed at the stage 3 questionnaire. They are identified to be maintained or improved by using the IPA approach. Regarding the reliability analysis of the importance and relative satisfaction in the questionnaire, the Cronbach's α of the stage 3 questionnaire were 0.823 and 0.812, respectively. This indicated good consistency of the questionnaire. As to validity analysis, the items in the questionnaire were based on the academic literature and expert opinions; thus, the questionnaire content had a certain degree of content validity. The total score was subtracted by the score of individual items, the new total-item correlation coefficient was 0.3 which was significant and indicated good construct validity (Hair *et al*., 2010). Since the correlation coefficients of items in this questionnaire were 0.512-0.725, they were significant and indicated good construct validity. A total of 139 effective samples (shippers/customers), most are working over 5-10 years, were returned in the survey.

The participants were requested to record the importance and relative satisfaction based on Likert's 7-point scale. After coding these data and using the IPA approach, we objectively set the values of 6.116 and 4.998 to represent both threshold values of first TV and second TV in this study. According to the steps of the IPA approach and empirical questionnaire surveys, the findings indicate that among the eighteen suitable criteria of service quality, five criteria of service quality were in quadrant 2 (i.e., concentrate here or the first priority of improvement), while five ones were in quadrant 3 (i.e., low priority or the second priority of improvement). As to service quality items, three ones were in quadrant 1 (i.e., keep up the good work) and five ones were in quadrant 4 (i.e., possible overkill). The analytical results and processes are as shown in Table 3.

Prioritizing solutions of service recovery using FQFD approach: In this study, the authors combined the 10 criteria of improvement (the first and second priorities of improvements via IPA approach) and 12 technical solutions of service recovery (via TIA approach) to construct a matrix table to evaluate the relationship strength. Due to the fact that the relationship strength is generated by a group of professional experts (Robbins, 1994); hence, the 19 experts of senior managers in the sea-cargo forwarding services, most are working fifteen to twenty years, were selected to fill in this stage questionnaire in this survey.

The systematic steps of the proposed FQFD approach to obtain the final results are shown in Table 4.

Table 1: The results of suitable criteria using TIA approach

Preliminary criteria	Geometric mean	Process	Preliminary criteria	Geometric mean	Process
C_{11}	6.285	√	C_{34}	5.600	×
C_{12}	6.225	√	C_{41}	5.801	×
C_{13}	5.985	√	C_{42}	6.037	√
C_{14}	6.271	√	C_{43}	6.146	√
C_{21}	6.242	√	C_{44}	6.190	√
C_{22}	5.955	√	C_{51}	6.095	√
C_{23}	5.726	×	C_{52}	6.045	√
C_{24}	6.022	√	C_{53}	6.114	√
C_{25}	5.704	×	C_{54}	6.220	√
C_{31}	5.844	×	C_{55}	6.065	√
C_{32}	6.238	√	C_{56}	6.002	√
C_{33}	5.685	×	C_{57}	5.960	√

√: Retain, ×: Delete

Table 2: The results of suitable solutions using TIA approach

Preliminary solutions	Geometric mean	Process	Preliminary solutions	Geometric mean	Process
A_{11}	5.586	×	A_{23}	5.884	√
A_{12}	5.646	√	A_{24}	6.086	√
A_{13}	5.819	√	A_{25}	6.033	√
A_{14}	5.387	×	A_{31}	5.871	√
A_{15}	5.983	√	A_{32}	5.694	√
A_{21}	5.689	√	A_{33}	5.845	√
A_{22}	6.125	√	A_{34}	5.878	√

√: Retain, ×: Delete

Table 3: The results of criteria of improvement using IPA approach

	Geometric mean				Geometric mean		
Suitable criteria	Imp.	Rel. strength	Quadrant Results	Suitable criteria	Imp.	Rel. strength	Quadrant Results
C_{11}	6.285	4.811	2	C_{43}	6.146	4.990	2
C_{12}	6.225	4.951	2	C_{44}	6.190	4.854	2
C_{13}	5.985	4.958	3	C_{51}	6.095	5.009	4
C_{14}	6.271	4.972	2	C_{52}	6.045	4.977	3
C_{21}	6.242	5.123	1	C_{53}	6.114	4.937	3
C_{22}	5.955	5.030	4	C_{54}	6.220	5.187	1
C_{24}	6.022	5.024	4	C_{55}	6.065	4.996	3
C_{32}	6.238	5.123	1	C_{56}	6.002	4.923	3
C_{42}	6.037	5.012	4	C_{57}	5.960	5.083	4

Imp.: Importance, Rel.: Relative

Table 4: The results of solutions of service recovery

Solutions criteria	A_{12}	A_{13}	A_{15}	A_{21}	A_{22}	A_{23}	A_{24}	A_{25}	A_{31}	A_{32}	A_{33}	A_{34}	I_t	S_t	v_t	w_t
C_{11}																
1	0.039	0.053	0.092	0	0.092	0.013	0.197	0.25	0.039	0.105	0.079	0.053	6.285	4.811	20.0429	0.1067(1)
2	0.079	0.079	0.224	0	0.158	0.026	0.342	0.421	0.066	0.184	0.158	0.092				
3	0.118	0.105	0.355	0	0.224	0.039	0.487	0.592	0.092	0.263	0.237	0.132				
C_{12}																
1	0.039	0	0.026	0.013	0.118	0.118	0.289	0.145	0.013	0.026	0.789	0.105	6.225	4.951	18.98	0.1010(4)
2	0.066	0.026	0.039	0.026	0.197	0.211	0.487	0.289	0.053	0.04	0.145	0.184				
3	0.092	0.053	0.053	0.039	0.276	0.303	0.684	0.434	0.092	0.053	0.211	0.263				
C_{13}																
1	0.092	0	0.013	0	0.039	0.118	0.118	0.25	0.013	0.053	0.079	0.092	5.985	4.958	18.2064	0.0969(10)
2	0.158	0	0.026	0	0.079	0.224	0.237	0.408	0.026	0.105	0.131	0.158				
3	0.224	0	0.039	0	0.118	0.329	0.355	0.566	0.039	0.158	0.184	0.224				
C_{14}																
1	0.132	0	0.039	0.013	0.053	0.118	0.145	0.158	0.013	0.066	0.105	0.132	6.271	4.972	18.9886	0.1011(3)
2	0.224	0.026	0.066	0.066	0.118	0.211	0.263	0.276	0.039	0.132	0.184	0.224				
3	0.316	0.053	0.092	0.118	0.184	0.303	0.382	0.395	0.066	0.197	0.263	0.316				
C_{43}																
1	0.053	0.132	0.171	0.158	0.289	0.066	0.211	0.105	0.276	0.105	0.197	0.184	6.146	4.990	18.4995	0.0985(6)
2	0.105	0.237	0.276	0.263	0.447	0.118	0.368	0.197	0.434	0.197	0.355	0.303				
3	0.158	0.342	0.382	0.368	0.605	0.171	0.526	0.289	0.592	0.289	0.513	0.421				
C_{44}																
1	0	0.145	0.263	0.184	0.171	0	0.092	0.092	0.026	0.145	0.158	0.171	6.190	4.854	19.4737	0.1037(2)
2	0	0.25	0.447	0.329	0.276	0.013	0.171	0.171	0.039	0.25	0.25	0.263				
3	0	0.355	0.632	0.474	0.382	0.026	0.25	0.25	0.053	0.355	0.342	0.355				
C_{52}																
1	0.013	0	0	0.013	0.066	0.079	0.092	0.105	0.395	0.158	0.079	0.158	6.045	4.977	18.274	0.0973(8)
2	0.026	0.013	0	0.026	0.118	0.132	0.171	0.184	0.605	0.276	0.171	0.289				
3	0.039	0.026	0	0.039	0.171	0.184	0.25	0.263	0.816	0.395	0.263	0.421				
C_{53}																
1	0	0	0.026	0.026	0.158	0.092	0.132	0.171	0.303	0.132	0.105	0.118	6.114	4.937	18.7272	0.0997(5)
2	0	0.013	0.105	0.066	0.276	0.184	0.25	0.289	0.5	0.25	0.197	0.211				
3	0	0.026	0.184	0.105	0.395	0.276	0.368	0.408	0.697	0.368	0.289	0.303				
C_{55}																
1	0	0	0	0	0.013	0.053	0.118	0.026	0.237	0.039	0.039	0.263	6.065	4.996	18.2193	0.0970(9)
2	0	0	0	0	0.039	0.092	0.197	0.053	0.382	0.092	0.079	0.434				
3	0	0	0	0	0.066	0.132	0.276	0.079	0.526	0.145	0.118	0.605				
C_{56}																
1	0	0	0	0	0.039	0.039	0.092	0.079	0.421	0.105	0.039	0.234	6.002	4.923	18.4682	0.0983(7)
2	0.013	0.013	0	0.013	0.092	0.066	0.171	0.145	0.671	0.237	0.079	0.421				
3	0.026	0.026	0	0.026	0.145	0.092	0.25	0.211	0.921	0.368	0.118	0.605				
FRS																
1	0.0368	0.0329	0.0632	0.0408	0.1039	0.0697	0.1487	0.1382	0.1737	(0.0934	0.0961	0.1511				
2	0.0671	0.0658	0.1184	0.0789	0.1803	0.1276	0.2658	0.2434	0.2816	0.1763	0.1750	0.2579				
3	0.0974	0.0987	0.1737	0.1171	0.2566	0.1855	0.3829	0.3487	0.3895	0.2593	0.2539	0.3645				
GMIR	0.0671	0.0658	0.1184	0.0789	0.1803	0.1276	0.2658	0.2434	0.2816	0.1763	0.1750	0.2579				
Ranking	11	12	9	10	5	8	2	4	1	6	7	3				

The empirical results show that the top five key criteria of service quality should be improved to have first priority. They are freight (price) or cost (C_{11}), compensation for cargo damages (C_{44}), the accuracy of shipping schedule (C_{14}), transport time (C_{12}), and smooth contact and communication with customers (C_{53}), respectively. Moreover, the top six feasible solutions of service recovery for ocean F/Fs in Taiwan include strengthening of education and training for employees (A_{31}), swift response (A_{24}), establishment of SOP (A_{34}), provision of counseling to customers (A_{25}), explain the situation and reason for service failures (A_{22}), and regular review meetings (A_{32}), respectively.

DISCUSSION

The main purpose of this study aims to investigate the quality improvement of service recovery for ocean F/Fs in Taiwan. At first, the preliminary 24 criteria of service quality and the preliminary 14 solutions of service recovery are conducted by literature review with combination of experts' opinions. Secondly, an evaluation framework integrating three methods (i.e., TIA approach, IPA approach and FQFD approach) and with combination of four stages questionnaires are developed. Continually, an empirical analysis for the evaluation is performed to demonstrate

the computational process of three methods adopted by this paper. Finally, the empirically results show that:

- 18 suitable criteria of service quality and 12 suitable solutions of service recovery are evaluated by shippers via TIA approach
- 10 criteria of service quality of needed improvements are selected to position on the 'concentrate here' in quadrant 2 and 'low priority' in quadrant 3 by using the IPA approach
- The top 6 feasible solutions of service recovery are prioritized by experts via FQFD approach, including strengthening of education and training for employees, swift response, establishment of SOP, provision of counseling to customers, explain the situation and reason for service failures and regular review meetings, respectively
- In addition, to acquire VOCs, the top 5 criteria of service quality are suggested to improve, as well as positioned on the 'concentrate here' in quadrant 2. These include freight (price) or cost, compensation for cargo damages, the accuracy of shipping schedule, transport time and smooth contact and communication with customers, respectively

By using the proposed methods, top six feasible solutions of service recovery are evaluated, whereas the most important strategy of service recovery is strengthening of education and training for employees. In this paper, some discussions were presented for the top six feasible solutions of service recovery for ocean F/Fs in Taiwan. Furthermore, the solutions of service recovery are suggested to be paid more attention by the ocean F/Fs in Taiwan. Those 6 feasible solutions should be prioritized in quality improvement of service recovery.

For strengthening of education and training for employees, the employees' attitude is the most important and for any service failures in service industry. All staff members, including both frontline personnel and high-level executives, should assume their own responsibilities. As a result, employees' education and training are very important because successful education and training can improve their abilities to properly respond to service failures which can increase customer satisfaction.

For the swift response, we see in an age that attaches great importance to efficiency, ocean F/Fs need to be able to swiftly respond to their customers in case of any service failures and demonstrate their greatest sincerity to alleviate customers' worries and make sure that customers' displeasure will not increase with time after they learn about service failures.

For the establishment of SOPs, as most service failures will happen unexpectedly, there should be a set of SOPs in place to ensure that proper response can be made immediately after a service failure and that all details are taken into account and problems can be handled in an organized manner.

For provision of counseling to customers, the ocean F/Fs need to maintain a good interaction with customers to enhance their service qualities as a smooth communication channel not only allows customers to lodge their complaints when they are not satisfied but also enables them to express their positive opinions. The ocean F/Fs should also provide immediate assistance to customers whenever they need to increase interaction between both sides which will be very helpful to ocean F/Fs' operations.

For explain the situation and reason for service failures, consigners entrust their cargoes with ocean F/Fs not only because they are satisfied with ocean F/Fs' terms of transport but also because they trust ocean F/Fs. Therefore, when there is a service failure, the ocean F/Fs should inform consigners of the situation and cause of the failure to give customers a better understanding of the situation and minimize their worries and anxieties. Doing so can reduce the chance of customers' becoming dissatisfied with and losing loyalty for ocean F/Fs.

For regular review meetings, a good interaction between ocean F/Fs and customers and a smooth communication channel between ocean F/F employees and executives are both very important. Review meeting should to be held regularly to make improvement and prevent similar failures from happening again. Opinion exchanges between employees and executives can not only improve their relationship but also facilitate their cooperation which can further lead to ocean F/Fs' continuous progress.

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