



Customer Satisfaction Evaluation of Liner Shipping and Logistics Service by using Quality Function Deployment(QFD)

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Doctoral Dissertation

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QFD による定期船およびロジスティクスサービスの
顧客満足度の評価に関する研究

July 2013

Graduate School of Maritime Sciences
Kobe University

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Biography

Sheng Teng Huang is born in Maoli, Taiwan. He received his bachelor degree from the Department of Shipping and Transportation management (Majoring in Air Transportation) at National Taiwan Ocean University. He became a Christian during this period. While he was studying the Master of Business Administration degree (MBA) in NTOU, he was selected by NTOU to study in Graduate School of Maritime Science of Kobe University as an exchange student in 2006. He graduated from Shipping and Transportation Management of NTOU in 2007. In 2008, he joined Inchcape Shipping Services (ISS) Taipei office. He also received special newcomer's training in Singapore Headquarter (ISS) of Asia Pacific region. In 2010, he proceeded to study the Ph D. course in Graduate School of Maritime Science in Kobe University. During his Ph D. study, he had several chances to join international conferences in North America, Europe and East Asia. His proceeding was also recommended by IAME 2012 Taipei Conferences for publication as a special issue. He has published several journal papers and conference papers during his Ph D. study. His research interests are *Japanese shipping industry, air transportation, logistics business, home delivery service, supply chain management and customer satisfaction evaluation.*

Contents

Chapter 1 Introduction	1
1.1 Background and motivation	1
1.2 Research outline	3
1.3 Summary	8
 Chapter 2 Methodology	 9
2.1 Introduction	9
2.2 The quality function deployment and house of quality	10
2.3 Literature review	13
2.4 Fuzzy analytic hierarchy process	17
2.5 The consistency calculation for the FAHP method	21
2.6 The prioritization of decision makers	22
2.7 Principles of QFD	24
2.8 Summary	24
 Chapter 3 Customer satisfaction assessment on liner shipping service	 26
3.1 Introduction	26
3.2 Background and motivation	26
3.3 The empirical study on Asian liner shipping market	32
3.4 Service quality improvement in LSCs and discussion	38
3.5 Summary	42
 Chapter 4 Customer satisfaction assessment on logistics service	 43
4.1 Introduction	43
4.2 Service attributes of logistics companies	44
4.3 The empirical study on logistics companies in Asian region	48
4.4 Service quality improvement in LLCs and discussion	52
4.5 Summary	54
 Chapter 5 Conclusion and future work	 58
5.1 Interview with practitioners in East Asia	58
5.2 Research originality and application	66
5.3 Research limit	67
5.4 Summary	70
5.5 Future study	70

Chapter 1

Introduction

1.1 Research background and motivation

The world trade is the vital force driving the growth of both regional and global economy. International trade brings a lot of benefits to countries and business units to get the profits from comparative advantages as well as provides consumers a variety of options to purchase their daily needs. Nowadays, trades and business activities rely on transportation which connects cargoes, people and countries to facilitate business growth and regional prosperity. Transportation also provides time utility and place utility from the point of merchandise production to the point of consumption for the business supply chain management. Governments also make efforts to reduce logistics cost by improving infrastructure for overcoming the trade barriers and vitalizing their manufactures to stay competitive in the global market.(Drewry Shipping Consultant, 2012; DP World Annual Report, 2012)

According to the *maritime review* of UNCTAD, around 90% of the global trade is completed by ocean transportation and the average cargo growth rate of maritime shipping is about 6% for the past ten years. About 16% of these trades are belonged to containerized cargoes. Containerized transportation is vital to people's living including food, household products and electrical appliances. Liner shipping transport is characterized by carrying large amount of cargo economically with relatively lower cost but longer delivery time by contrasting with air transportation. To tell the difference

between liner and tramp shipping, liner shipping companies usually serve as common carriers to public people and operate fleets for fixed routes, fixed schedules, containerized cargoes and dedicated berths, while tramp shipping companies generally operate ships in different routes, schedules and designated berths. The shipment condition of tramp shipping is generally based on charter party and the cargo is non-containerized, bulk cargoes. The fixed cost of capital investment is relatively higher than other service industries. (Lin and Chang, 2012)

Liner shipping industry provides the service of transporting merchandises by means of container ships that transit regular routes on fixed schedules with high capacity. It is an important segment of global economy and donates significantly to world economic output. This business has contribution to develop the higher standard of living of world's population in the last 35 years, as the advantage of global commerce obtained by the efficient, reliable and relatively low cost transportation provided by this industry. (OECD, 2002) The liner shipping industry is the part of the maritime industry that comprises all operations and related infrastructure involved in ocean shipping schedule. It generally comprises of container vessels and crew members on board, shipbuilding operations, ports, shipbuilders, stevedoring workers and all other on-shore operation staff. Shippers move most of the high unit-value consuming products and intermediary goods, including ocean containerized cargo, mobile machinery and vehicles. This industry operates on all ocean and many of the navigable inland waterways, benefitting exporters and consumers worldwide.

According to the *annual statistical report 2012* of Drewry Shipping Consultants, the industry carried almost 60% of the total value of the world's seaborne commodities on more than 7000 registered vessels. The industry was directly and indirectly responsible

for over 464 billion in output and 1.4 million jobs with investment in fixed assets of more than 29 billion dollars. Furthermore, the building of liner vessels offered about 280,000 jobs in shipbuilding countries and produced 42 billion of gross output, more than 6 billion of that are labour payment. The estimation of the value of this industry does not comprise related activities such as storage activities at port and cargo handling, nor does it include the inland transportation of liner cargos, unless moved inland by waters. Since the liner shipping and logistics service are so important to world economy, numerous scholars and business practitioners have argued and commented its characteristics from several different perspectives.(Ng, 2012)

1.2 Research outline

Many researchers usually focus on supply and demand relationship which leads liner shipping market; operational performance and customer service are also key elements to sustain the shipping service. Several studies mention the characteristics and new concepts of shipping in terms of operation, finance, network deployment, capacity adjustment, economies of scale, CSR, bunker cost management and environmental shipping. Most of the innovations are to attain operational excellences and improve service quality for enhancing customer satisfaction. Many important attributes regarding customer service such as value added service and logistics solution are listed and identified to evaluate the quality of service in shipping business. However, few studies explores both the key service quality attributes and the appropriate strategies to improve them since decision makers not only needs information about key service attributes but also understands the key technical measures to transform them for redefining company strategies and standards to improve liner shipping and logistics service. A appropriate

strategies are key factors for business success in the competitive market. Thus, this thesis aims to contribute to the research gap and contribute the literature key service quality attributes as well as appropriate measures to improve customer service especially in East Asian region.

On the other hand, global economy and supply chain were hindered due to financial crisis and natural disaster worldwide, along with oversupply of capacity makes the shipping market unclear and major liner carriers suffer tremendous loss up to billion dollars until 2012. In this changing and unpredictable environment, it is necessary to build strong sustainability in shipping and logistics business to satisfy their investors and customers. Many major leading carriers even already propose aggressive strategies for customer service such as NYK's "More than shipping 2013" and Daily Maersk's "Absolute reliability" service. Many business operators face serious challenges for "right" judgement for decision making due to lack of sufficient information collecting and decision support process, as a result, wrong decisions could bring companies millions or billions dollars loss. To avoid this, scientific and reasonable process for defining customer service strategies is essential for decision makers to make correct judgement. (NYK Research Group, 2012; NYK Annual Report, 2012; Yusen Logistics Report, 2012)

The considerations of global trade, market, environment, business cycle, exchange rate, bunker, competitors and customer requirements deeply increase complexity of operating liner and logistics business. NYK group support the liner shipping business by strengthening logistics service to serve their customers and protect their existing market. Sustainability of the industries may depend on continuously improving service quality to attain customer satisfaction. In 2013, our research group in Kobe University

empirically visit the leading companies and consult with the executives in East Asian region. The executives emphasize their strategies for operations by providing customers high quality service to gain trust and good reputation among the manufacture firms and traders since cheaper price is already not enough in the current shipping market. Customer requirement is getting demanding with relatively strong bargaining power since the current market tends to be buyer's market. As the increasing speed of global business and supply chain management, the current customer wants not only good service but great service to meet these needs. According to research report of Maersk Group, only 60% of customers are satisfied with their logistics service providers, and about 50% of containerized cargo is on time delivery.

Based on this, the thesis is motivated by this urgent need of improving customer service in this drastically changing market. Service quality is a key issue of managerial goal of business to pursue customer satisfaction. Therefore, the thesis aims to explore the key customer service strategies for both liner shipping and logistics service to explore the applicable business strategies by using quality function deployment (QFD) method. The selected attributes for research analysis are based on famous shipping publications and previous academic researches as well as consulting with logistics practitioners and experts. The feature of QFD is to find out the important technical measures by combining the computed relative weight of customer requirement obtained by applying fuzzy analytical hierarchical analysis (FAHP). The result will give us important information regarding to the important measures to improve the service quality of liner and logistics business. Finally, author will conclude findings by comparing our empirically interviews with executives in East Asian region to verify if our research results are also meaningful in practical business world.

The brief research flow chart and methodology are shown as Figure 1.1.

The typical framework of this research is defined in stepwise form as follows:

- Step1. Explore customer requirement related to the objective
- Step2. Categorize the technical measures related to the objective
- Step3. Compute the relative weight of customer requirement by using Fuzzy-AHP method
- Step4. Construct the HoQ relationship matrix for QFD assessment
- Step5. Data collection and pair wise investigation
- Step6. Data analysis and alternative evaluation for each requirement
- Step7. Comparative analysis among the liner carriers and logistics operators

This dissertation is consists of five chapters. In Chapter 1, author introduces the brief research background and key issues of current shipping business. Chapter 2, the methodology application of QFD framework and FAHP to explore the key customer requirement and technical measures would be explained. In Chapter 3 and Chapter 4, the empirical study to analyze the quality assessment on liner shipping and logistics service will provide the key research findings and practical meaning for business application. Chapter 5 investigate the practitioner's comments from East Asian regions and conclude the comments with our research findings to compare the result both academically and practically.

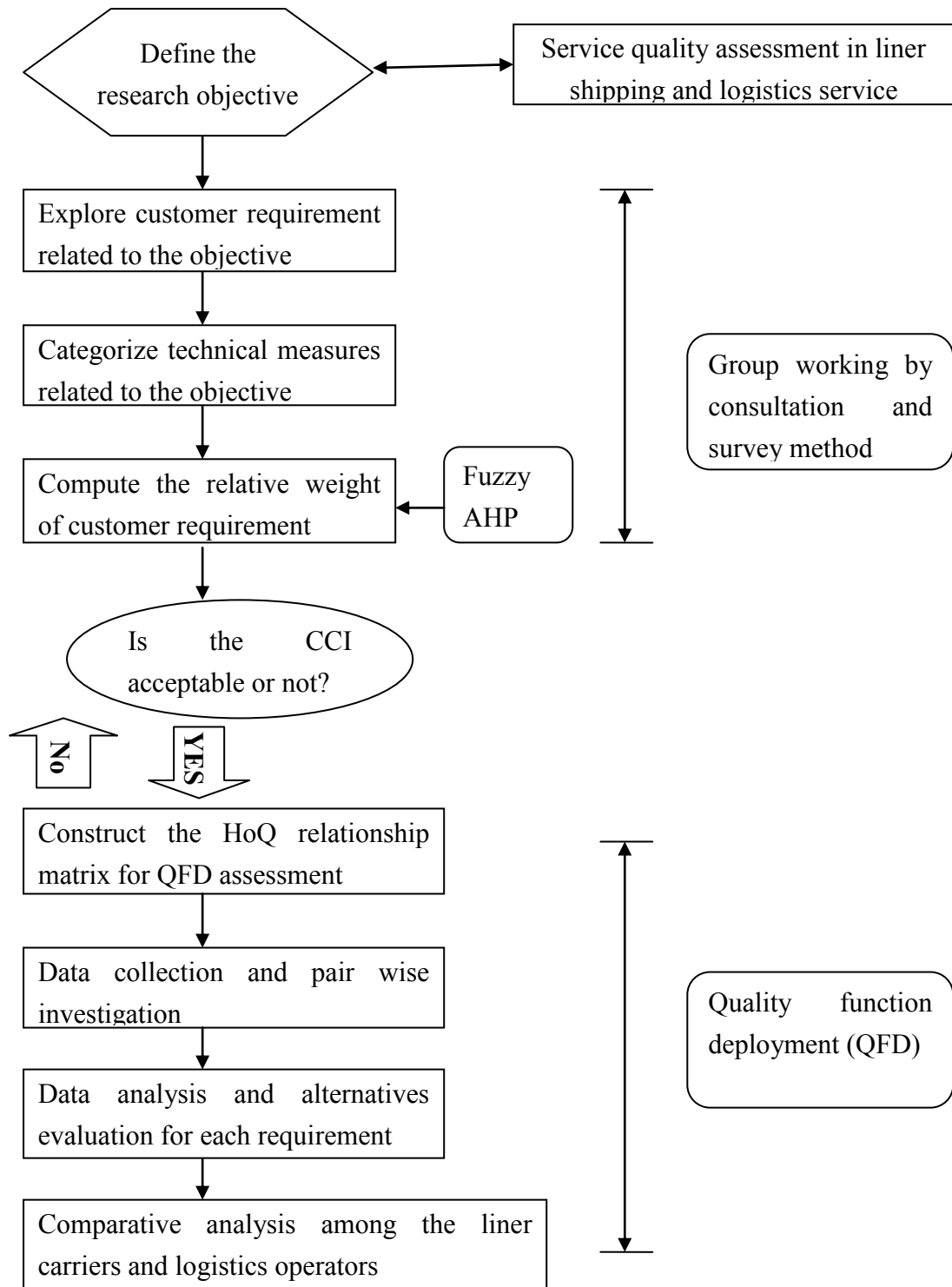


Figure 1.1 Research flow chart and method application design for service quality assessment

1.3 Summary

New service innovation and globalization challenge pattern of customer service. By reviewing the current development of liner and logistics service providers, we could recognize the important operational issues as well as customer service strategies. Through reviewing annual report regarding to the future strategy of major liner and logistics operators, we could understand their individual management style and how these decision makers take action to stay competitive based on their individual management philosophy. This research believes they all propose the most suitable strategies for their organizations with logical decision making procedures.

As we have mentioned that the recent worse world economy situation forces the operators to propose appropriate policy in terms of scales economy, market restructure and differentiation to meet new customer's needs. It is urgently necessary to understand customers and work closely with them to enhance satisfaction since shipping market is not as optimistic as it used to be especially in East Asian region. Practitioners offer their own solutions according to their own experience or intuition to improve service quality to please clients but many issues still have disputation and need further discussion. Therefore, scientific decision making processes based on academic and practical literature to explore the appropriate strategies are proposed to investigate the suitable customer service. This dissertation may not provide the "best" strategy but aim to propose the "appropriate" strategy depend on the actual situation of service providers or decision makers.

Chapter 2

Methodology

2.1. Introduction

The globalization of economy brings regional prosperity and significant development as well as strong competition among logistics service providers. Appropriate strategy of customer service may have positive effect to enhance customer satisfaction. Improving service quality is a key issue of managerial goal of business to pursue customer satisfaction. Through hearing the voice of customers, the service providers could understand what customer wants and have a clear direction of product design or process improvement. Numerous researches explore the gap of service quality and key service quality items. Quality function deployment (QFD) was founded by Yoji Akao in 1966 and applied by shipping industry for Mitsubishi Kobe shipyard of building of a new oil tanker ship. Following many applications in manufacture, service industry and public organization make QFD an important and popular methodology for quality improvement. QFD is a unique methodology to explore the important service quality as well as assessable technical measures for quality improvement.

The House of Quality (HoQ) is the main structure to complete QFD research. In this chapter, firstly the relative weight of customer requirement is defined by using FAHP and applied to calculate the technical measures. This combination with FAHP could improve the classic QFD method by determining the relative weight quantitatively and

assessing the relationship between requirements precisely. Second, the technical measure would be obtained for the priorities of enhancing customer satisfaction.

2.2. The quality function deployment and house of quality

Quality Function Deployment (QFD) was identified as “ a general idea that provides a means of translating customer requirements into the appropriate technical requirements for each stage of product development and production”. The most important tool of QFD is the House of Quality (HoQ) which was first applied in the Kobe Shipyard of Mitsubishi Heavy Industries for advancing a new building project of an oil tanker ship. Around 1986, Ford Motor Company also applied this technique in the US, and Toyota Motor Company in Japan successfully cut their design costs and product development time by one third after using QFD in their process.

The house of quality would be useful to allocate possible contribution of improvements into customer requirements, and the service provider can maximize customer satisfaction through execute the alternatives of improvement. This research investigates the international logistics companies and the customer requirements are discussed under the QFD method.

The procedure for building the house of quality for completion of the QFD can be constructed by the following steps:

1. Customer requirements (WHATs): Customer requirements information can be defined through a survey or consultation with customers. The weight of customer requirements represents the importance of each item.
2. Technical measures (HOWs): Technical measures are defined in accordance with a firm's product or service by an expert consultation.

3. Relationship Matrix : Combining each WHATs and HOWs, the relationship matrix shows the contribution level and the relation of technical measure to each customer requirement. Typically, signs stand for four levels of interaction (Strong relationship, ■; Moderate relationship, ▲; Low relationship, ●; and No relationship, ø) by applying 9-5-1 scale.

4. Correlation Matrix : Correlation matrix relationship is to measure the relationship of each technical measure and how much they effect each other. Correlations are represented with signs that express the degree of relation between technical measures. Signs are translated into a five-step scale (strong positive correlation, “++”; positive correlation, “+”; no correlation “ø”; negative correlation “-”; strong negative correlation, “--”).

5. Relative weight: Relative weight of a technical measure is calculated approximately by the normalization of the sum of products. The sum of products denotes the sum of multiplication of the weight of customer requirements and relationship value.

6. Target values : Targets of the intended project are identified by the expert group by investigation of relative weight of technical measures and the correlation among them. Defining targets is a judgmental process which is figured by the capacity and facilities. The HoQ is composed of the mentioned sections and is an interface between the intended project assessment and the expert. The classical structure of the HOQ is listed in Figure 2.1. (Duru et al, 2013).

Customer satisfaction is the key goal of the quality studies and several methods contribute to improving its efficiency and sustainability. Among the various approaches, QFD is one of the most unique and object-oriented tools in the quality control science. The QFD method is a prior assessment approach which assures customer satisfaction by

improving manufacturing and service processes. Rather than classical quality assessment methods, the QFD approach concentrates on primary analysis of the features of the product. QFD is designed to assess the particulars of products based on customer inputs. (Akao and Ohfuji, 1989).

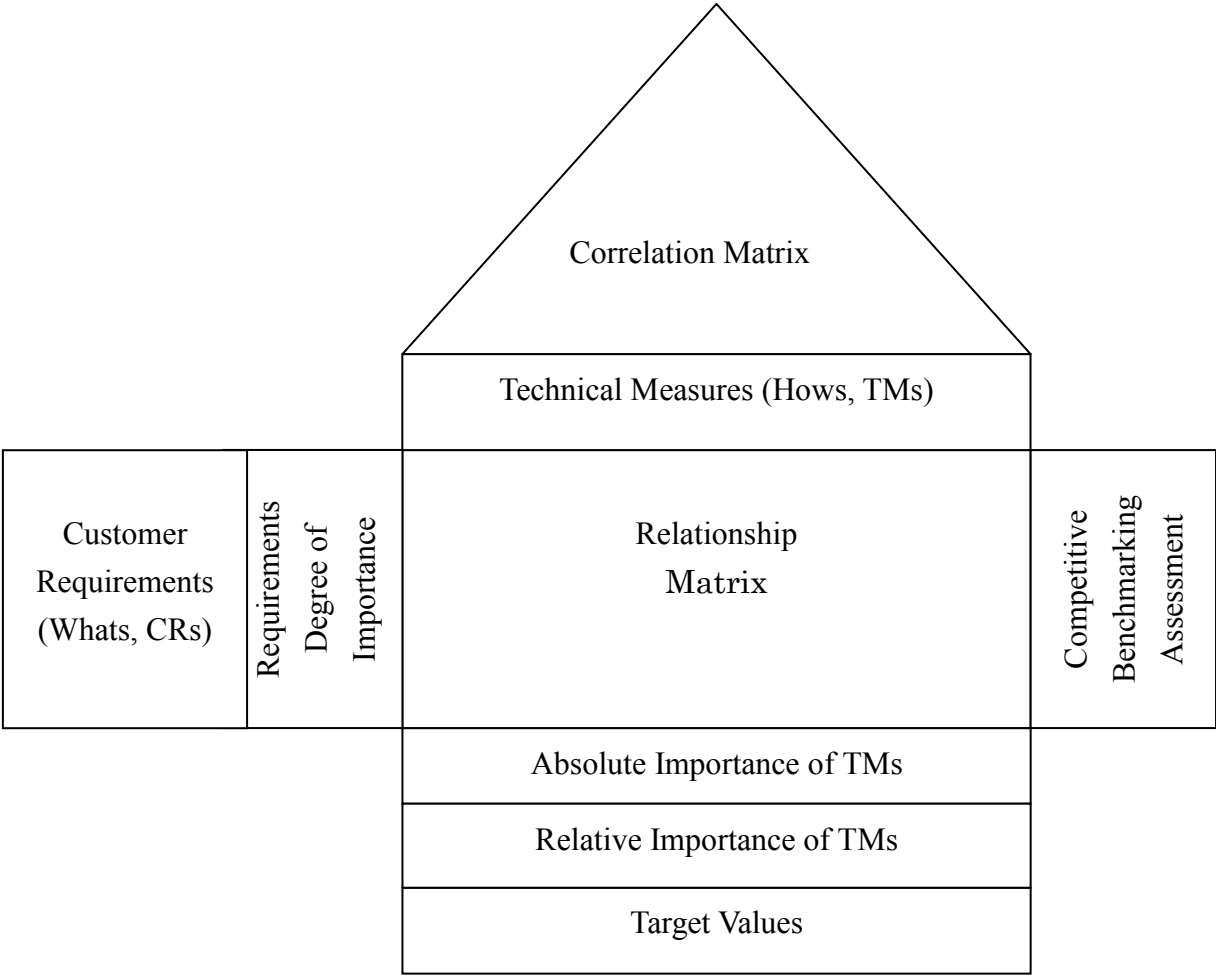


Figure 2.1 House of Quality

After Yoji Akao recommended the use of QFD for the shipbuilding industry, its popularity was enhanced among several industries. In 1975, the Japanese Society for

Quality Control (JSQC) appointed the Computer Research Committee (later named QFD Research Group which is managed by Akao). The report of QFD practice among 80 Japanese firms was published through in a final report by this committee. The major motivation of the QFD method is based on the Japanese business perspective which is formed by the long-term competitiveness and the patient capital. While the short-termism and the impatient capital focus on instant premiums and turnover, the long-term competitiveness endeavors to improve customer satisfaction in the long-run and it contributes to the risk aversion by securing the cash-flows. However, the long-term competitiveness is also constituted by relatively low income and the corporate governance has mental boundaries on the fiscal desire and on the business initiative.

The main practice of QFD is based on the technical classification of the product and on the improvement of the design by utilizing proper technical particulars. The final part of the QFD is the definition of technical objectives for the product by engineers or other related experts. On the other hand, customer satisfaction of the producer is usually ignored or assumed is only taken into consideration by experts on defining technical objectives. This part of the QFD is not figured in setting of the procedure. Therefore, QFD is relying on the customer satisfaction itself and does not consider its practice and feasibility in depth.

2.3 Literature Review of QFD

Several scholars combine QFD with other method to solve problems in terms of service quality, product design, process management and quality management systems. Orgener (2003) stresses the evolution and advantage of QFD for product design and

service management. However, the teamwork concept is key factor to make QFD successful because it will take more time and effort to get the best result. Shahin and Chan (2006) improve QFD methodology by introducing the concept of customer requirement segmentation (CRS) for a four-star hotel. The contribution is to overcome the problems and difficulties such as ambiguities of VOC, handling of larger HoQ, conflict of each CR. Chen (2009) innovatively integrates the concept of QFD and process management techniques to meet customer requirement and company goals in terms of product design, process management in semiconductor industry. Process management is an important concept of Six Sigma implementation and may be significantly improved by applying the QFD method. Ip (2009) creates a model for business succession such as assessment of current situation of business, successor and competencies analysis and planning of necessary tasks for future development by utilizing the QFD method. Dror and Sukenik (2011) combine QFD and mean square error (MSE) criterion to evaluate the bank service. The important service dimensions are service quality, staff attitude, information providing, technology and management feature. Pakdil et al. (2012) apply QFD to analyze the after sales services both qualitatively and quantitatively for a manufacture firms. SERVQUAL and factor analysis are also used to include the house of quality. Munuzuri et al (2013) explore the Spanish small medium sized enterprises to discuss their certified quality management systems and logistics performances. Their current standard is ISO 9001. The authors proposed the more specific logistics management standards may be needed to improve the process.

Wasserman (1993) indicates the cost-benefit trade-offs and recommends the inclusion of the cost factor. Bode and Fung (1998) improve on the contributions of Wasserman by

investigating cost-quality trade-offs. A linear program is developed to optimize trade-offs between economic and technical prioritization. The major contribution of Bode and Fung (1998) was to combine budget constraints with product quality. Dikmen, Birgonul and Kiziltas (2005) investigated the cost-quality trade-off problem under the global limitations of the QFD and recommended several methods to improve its functionality. Although, the cost limitations of the QFD is frequently discussed, the drawbacks of customer-only assessment still exist since the intentions of the manufacturer or service provider is broadly neglected. The shortcomings of a unidirectional analysis disqualify the generality of the results in the QFD assessment. Under these foundations, the QFD method provides a local result rather than a global solution.

The traditional form of QFD is illustrated by a single layer house of quality chart which classifies customer requirements and their interrelations with technical particulars of the product. This paper originally proposes a QFD design which interprets the satisfaction of both producer and user and also investigates how the requirements of producer and user conflict. In practical, the requirements of the producer and user usually differ from each other and while the producer intends to increase profits of the business, the user requires cheaper products and services within required characteristics. Conflict of interests exists between parties which is also named *Agency Problem* (or principal-agent problem) in financial economics. (Eisenhardt, 1989) The basic principle of the agency problem in QFD is portrayed the disparity between a fully satisfying product and its financial boundaries. Since the business is sustained by its monetary strength and secured by the technical condition of its facilities, the producer cannot be perceived as a fully customer oriented agent. Therefore, the QFD method implicitly

assumes that the conditions of rational choice theory just exist for customer satisfaction. Rational choice theory (i.e. rational expectations) classifies agents by their own nature of business and intentions by maximizing benefits of a particular stakeholder which ignores the benefits of other stakeholders. Although the drawbacks of the rational choice theory are noted by various scholars and recognized as a theory of advice, in the practical business (profit making corporations), a private company is regarded more or less as a capital improving enterprise. Therefore, the QFD method is of limited use in a multi-directional business environment. A multi-lateral framework is developed to address these limitations.

The proposed model of QFD is strongly recommended to deal with the resolution of the conflict of interest in the agency problem. The third layer of the QFD is designed for the conflict resolution by revaluation of the relative importance of the requirements. The revaluation is based on assessment of the cross analysis of relationship degree between requirements of the agents. While the traditional QFD method just evaluates relationship between customer requirements and technical responses, the QFD investigates relationships between customer requirements and manufacturer/service provider requirements, customer requirements and technical responses, manufacturer/service provider requirements and technical responses. The QFD satisfies not only the customer, but also considers the manufacturer/service provider.

Duru et al (2013) empirically investigate the shipping asset selection under the long term time domain contract named time charter party. The assessment of shipping assets is investigated from the financial perspective and several papers suggested models for estimating the volatility of spot and future market prices (Kavaussanos, 2004), the spot freight market prices in tanker shipping (Adland and Cullinane, 2006), the price of

second hand shipping assets, the timing of the ship investment and the valuation of the large tankers among others. Also Liang et al. (2008) investigates the ocean freight forwarding business and identifies service management requirements by using the QFD method. This chapter contributes to the literature by combining the financial point of view and the technical assessment and evaluates the conflict of interests between parties. Rather than the mentioned studies, this chapter focuses on the technical measures and their indirect contributions to the satisfaction of both customer and service provider. Therefore, the financial feasibility of the intended purchasing project is assumed to be previously verified. However, the forthcoming performance of the asset is conventionally investigated by the income-expense framework which ignores its technical competence. The proposed method handles such drawbacks and also improves a multi-dimensional perspective to expose financial sensitivity of the technical particulars.

Fuzzy number	Linguistic scales	Membership function	Reciprocal
$\tilde{A}_1$	Equally important	(1,1,1)	(1,1,1)
$\tilde{A}_2$	Slightly important	(1,1,3)	(1/3,1,1)
$\tilde{A}_3$	Moderately important	(1,3,5)	(1/5,1/3,1)
$\tilde{A}_4$	More important	(3,5,7)	(1/7,1/5,1/3)
$\tilde{A}_5$	Strongly important	(5,7,9)	(1/9,1/7,1/5)
$\tilde{A}_6$	Extremely important	(7,9,9)	(1/9,1/9,1/7)

2.4. Fuzzy analytic hierarchy process

The pair wise comparison matrix is computed with the subjective judgments of the decision makers and there might be some uncertainty associated with this judgment that is not taken into account by the analytic hierarchy process (AHP) (Yang, 2004).

Therefore, Buckley (1985) proposed the evolutionary algorithm with the trapezoidal fuzzy numbers to overcome this uncertainty by using fuzzy set theory. The symbols for this study on fuzzy treatment are determined as in Table 2.1 and its fuzzy number is displayed in Figure 2.2. In this study, Chang's (1996) approach for FAHP is used to calculate the weight of customer satisfaction and its definition is as follows:

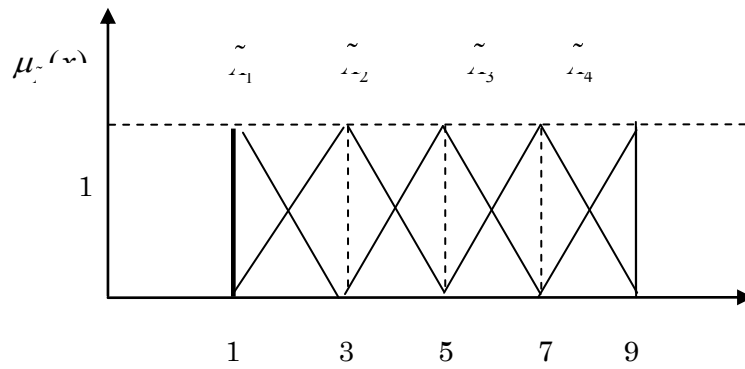


Figure 2.2 Fuzzy Number of Linguistic Variable Set

Definition 1: A fuzzy set $\tilde{A}$ in a universe of discourse R is characterized by a membership function $\mu_{\tilde{A}}(x)$ which associates with each element x in R is a real number in the interval $[0, 1]$. The function value $\mu_{\tilde{A}}(x)$ is termed the grade of membership of x in $\tilde{A}$.

Definition 2: A fuzzy number is a fuzzy subset in the universe of discourse R that is both convex and normal.

Definition 3: A triangular fuzzy number denotes as $\tilde{A} = (l, m, u)$, where $l \leq m \leq u$, has the following triangular type membership function;

$$\mu_{\tilde{A}}(x) = \begin{cases} 0, & x < l, \\ (x-l)/(m-l), & l \leq x < m, \\ 1, & x = m, \\ (u-x)/(u-m), & m < x \leq u, \\ 0, & u < x. \end{cases} \quad (\text{eq. 1})$$

where l and u are the lower and upper bounds of the fuzzy number $\tilde{A}$, respectively, and m is the midpoint as shown in Figure 2.3.

The Chang approach for the FAHP method is stated as follows:

Let $X = \{x_1, x_2, x_3, \dots, x_n\}$ be an object set and $U = \{u_1, u_2, \dots, u_m\}$ be a goal set. The extent analysis for each goal is performed under each object. Therefore, m extent analysis values for each object are indicated with the following parameters:

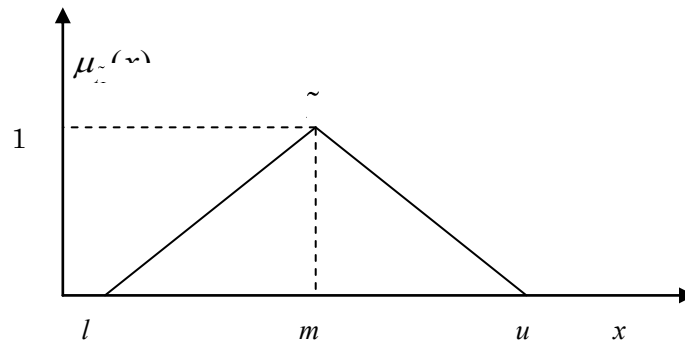


Figure 2.3. A Triangular Fuzzy Number $\tilde{A}$

$$M_{g_i}^1, M_{g_i}^2, \dots, M_{g_i}^m, \quad i=1, 2, \dots, n, \quad (\text{eq. 2})$$

where all the M_g^j ($j=1, 2, \dots, m$) are TFNs.

Step 1: The value of fuzzy synthetic extent with respect to the i th object is defined as

$$S_i = \sum_{j=1}^m M_{g_i}^j \otimes \left[\sum_{i=1}^n \sum_{j=1}^m M_{g_i}^j \right]^{-1} \quad (\text{eq. 3})$$

To obtain $\sum_{j=1}^m M_{g_i}^j$, the fuzzy addition operation of m extent analysis values for a particular matrix is performed such as:

$$\sum_{j=1}^m M_{g_i}^j = \left(\sum_{j=1}^m l_j, \sum_{j=1}^m m_j, \sum_{j=1}^m u_j \right) \quad (\text{eq. 4})$$

And to obtain $\left[\sum_{i=1}^n \sum_{j=1}^m M_{g_i}^j \right]^{-1}$, the fuzzy addition operation of $M_{g_i}^j$ ($j=1, 2, \dots, m$) values is performed such as:

$$\sum_{i=1}^n \sum_{j=1}^m M_{g_i}^j = \left(\sum_{i=1}^m l_j, \sum_{i=1}^m m_j, \sum_{i=1}^m u_j \right) \quad (\text{eq. 5})$$

and then the inverse of the vector in Eq. (9) is computed, such as:

$$\left[\sum_{i=1}^n \sum_{j=1}^m M_{g_i}^j \right]^{-1} = \left(\frac{1}{\sum_{i=1}^n u_i}, \frac{1}{\sum_{i=1}^n m_i}, \frac{1}{\sum_{i=1}^n l_i} \right). \quad (\text{eq. 6})$$

Step 2: The degree of possibility of $M_2 = (l_2, m_2, u_2) \geq M_1 = (l_1, m_1, u_1)$ is defined as

$$V(M_2 \geq M_1) = \sup_{y \geq x} \left[\min(\mu_{M_1}(x), \mu_{M_2}(y)) \right] \quad (\text{eq. 7})$$

and can be expressed as follows:

$$V(M_2 \geq M_1) = \text{hgt}(M_1 \cap M_2) \\ = \mu_{M_2}(d) = \begin{cases} 1, & \text{if } m_2 \geq m_1, \\ 0, & \text{if } l_1 \geq u_2, \\ \frac{l_1 - u_2}{(m_2 - u_2) - (m_1 - l_1)}, & \text{otherwise.} \end{cases} \quad (\text{eq. 8})$$

Figure 2.3 illustrates Eq. 11 where d is the ordinate of the highest intersection point

D between μ_{M_1} and μ_{M_2} . To compare M_1 and M_2 , we need both the values of $V(M_1 \geq M_2)$ and $V(M_2 \geq M_1)$.

Step 3: The degree possibility for a convex fuzzy number to be greater than k convex fuzzy $M_i (i=1,2,\dots,k)$ numbers can be defined by

$$V(M \geq M_1, M_2, \dots, M_k) = V[(M \geq M_1) \text{ and } (M \geq M_2) \text{ and } \dots \text{ and } (M \geq M_k)] \\ = \min V(M \geq M_i), i=1,2,3,\dots,k. \quad (\text{eq. 9})$$

Assume that $d'(A_i) = \min V(S_i \geq S_k)$ for $k=1,2,\dots,n; k \neq i$. Then the weight vector is given by

$$W' = (d'(A_1), d'(A_2), \dots, d'(A_n))^T \quad (\text{eq. 10})$$

where $A_i (i=1, 2, \dots, n)$ are n elements.

Step 4: Via normalization, the normalized weight vectors are

$$W = (d(A_1), d(A_2), \dots, d(A_n))^T, \quad (\text{eq. 11})$$

where W is a non-fuzzy number.

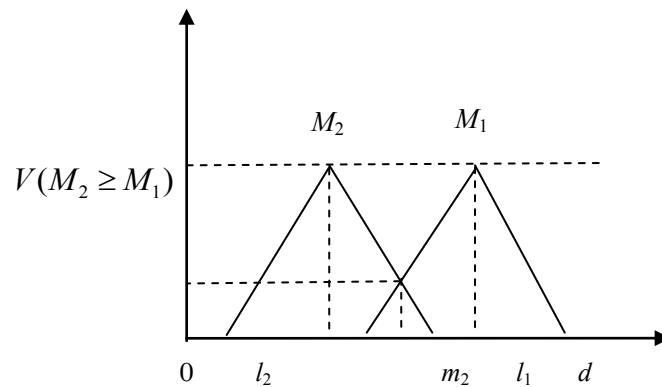


Figure 2.3. The Intersection between M1 and M2

2.5 The consistency calculation for the FAHP method

The consistency calculation for pair wise matrices plays a significant role for the FAHP method and Bulut et al. (2012) proposed the centric consistency index (CCI) which is based on the geometric consistency index (GCI) (Aguarón and Moreno-Jiménez, 2003; Crawford and Williams, 1985) is applied to compute the consistency of each matrix. The calculation of CCI is as follows:

Let $A=(a_{Lij}, a_{Mij}, a_{Uij})_{n \times n}$ be a fuzzy judgment matrix, and let $w=[(w_{L1}, w_{M1}, w_{U1}), (w_{L2}, w_{M2}, w_{U2}), \dots, (w_{Ln}, w_{Mn}, w_{Un})]^T$ be the priority vector derived from A using the RGMM. The centric consistency index (CCI) is computed by

$$CCI(A) = \frac{2}{(n-1)(n-2)} \sum_{i < j} \left(\log\left(\frac{a_{Lij} + a_{Mij} + a_{Uij}}{3}\right) - \log\left(\frac{w_{Li} + w_{Mi} + w_{Ui}}{3}\right) + \log\left(\frac{w_{Lj} + w_{Mj} + w_{Uj}}{3}\right) \right)^2 \quad (\text{eq. 12})$$

where n is the number of elements. When $CCI(A)=0$, author consider A fully consistent.

The thresholds of GCI are used for the CCI and its scale is $\overline{GCI}=0.31$ for $n=3$; $\overline{GCI}=0.35$ for $n=4$ and $\overline{GCI}=0.37$ for $n>4$ (Aguarón et al, 2003).

2.6 The prioritization of decision makers

In the existing literature, the prioritization of each decision maker is assumed same; however, their experience and knowledge are different than each other. Bulut et al. (2012) suggest that the reverse of each decision maker's consistency can be used for the weight of each matrix. The algorithm of proposed method is as follows:

Let $D = \{d_1, d_2, \dots, d_m\}$ be the set of decision makers, and $\lambda_k = \{\lambda_{L1}, \lambda_{L2}, \dots, \lambda_{Ln}\}$ be the weight of decision makers. The weight of decision makers (λ_k) is the normalized I_k for the group of experts which is calculated as follows:

$$I_k = \frac{1}{CCI_k} \quad (\text{eq. 13})$$

where I_k is the inverse of the CCI,

$$\lambda_k = \frac{I_k}{\sum_{k=1}^m I_k} \quad (\text{eq.14})$$

where $\lambda_k > 0$, $k = 1, 2, \dots, m$, and $\sum_{k=1}^m \lambda_k = 1$.

All individual matrices can be aggregated by using the aggregation of individual judgment (AIJ) or the aggregation of individual priorities (AIP) (Cao et al., 2008; Forman and Peniwati, 1998; Ramanathan and Ganesh, 1994). In this study, AIP is applied for the calculation of aggregation matrix because the prioritization of each decision makers is assumed different than each other and its formulation is as follows;

Let $A^{(k)} = (a_{ij}^{(k)})_{n \times n}$ be the judgment matrix provided by the decision maker d_k .

$w_i^{(k)}$ is the priority vector of criteria for each decision maker calculated by

$$w_i^{(k)} = \frac{\left(\prod_{j=1}^n a_{ij} \right)^{1/n}}{\sum_{i=1}^n \left(\prod_{j=1}^n a_{ij} \right)^{1/n}} \quad (\text{eq. 15})$$

The aggregation of individual priorities is defined by

$$w_i^{(w)} = \frac{\prod_{k=1}^m (w_i^{(k)})^{\lambda_k}}{\sum_{i=1}^n \prod_{k=1}^m (w_i^{(k)})^{\lambda_k}} \quad (\text{eq. 16})$$

where $w_i^{(w)}$ is the aggregated weight vector.

2.7 Principles of QFD

The typical framework of the QFD method is defined in stepwise form as follows:

- Step1. Customer needs for service quality must be identified
- Step2. Measure the importance degree of each customer requirement by using Fuzzy-AHP method
- Step3. Measure the degree of satisfaction of each customer requirement
- Step4. Make the assessment of the priorities of customer needs
- Step5. Develop service management requirements to represent the service provider management to reveal customer service quality requirements.
- Step6. Create the central relationship matrix to connect the service management requirements to customer needs
- Step7. Establish the fuzzy relationship strength of each service management requirement and each attribute of customer needs
- Step8. List the service management requirements' ranking to identify the priority that each service management requirement satisfies the overall customer service quality requirements.

The house of quality would be useful to allocate possible contribution of improvements into customer requirements, and the service provider can maximize customer satisfaction through executing the alternatives of improvement. This research investigates the shipping companies and the customer requirements are discussed under the QFD method (Akao, 1989).

2.8 Summary

The QFD is an appropriate methodology to improve customer requirements and

propose suitable technical measures for quality improvement. It is a mature methodology widely applied by manufactures, product design and process management. There are numerous researches which apply statistical application by collecting large number of random sampling surveys to identify key service quality gap for enhance customer satisfaction. Large number of surveys could provide meaningful statistical results but need to be further verified by explaining practical meaning for decision makers. On the other hand, few researches combine QFD and FAHP to explore liner shipping and logistics service in recent year. The feature of this combination is to point out key customer requirements as well as investigation the technical measures with regard to actual business application. The key customer requirements and technical measures calculated by this methodology should be reliable to reflect the voice of customer and define solution to achieve the proposed targets.

Chapter 3

Customer satisfaction assessment on liner shipping service

3.1 Introduction

The aim of this chapter is to investigate the QFD of quality assessment method. Liner shipping is particularly characterized by both the container transportation and the wider organization including other logistics activities. In recent years, liner shipping companies face several challenges such as high fuel prices, changing pattern of strategic alliances, environmental friendly policy and energy efficient shipping. The new trends of liner shipping business may change their pattern to serve their customers. Therefore, liner shipping company should find new strategies or redefine standards to meet their customer requirements and improve customer service. The major customers of the liner shipping services are the industrial clients. The customer satisfaction is a key managerial task since the competitiveness is a growing issue in the liner shipping industry. The QFD is one of the unique procedures to expose the requirements of customer and transform them into managerial tasks by cross-correlation analysis between requirements and technical measures. The empirical study is performed to investigate the service quality of Asian liner shipping industry by focusing on a group of anonymous leading liner shipping companies.

3.2 Back ground and motivation

One of the biggest service industries is the maritime transport since around 90% of world trade is performed by seaborne transport. In Asian countries, maritime transport has particular importance and trading activities are depending on secure and safe shipping business (UNCTAD, 2011). Because of the recent strong economic growth in ASEAN regions, shipping business plays the key role to facilitate the regional trade and prosperity. Both Japan and Taiwan are island countries and also China is an island-like country because of limited land transport geography. Maritime transport is still the most easy and cheaper mode of transport for Chinese import-export trade. According to the statistics report published by Ministry of Land, Infrastructure and Tourism of Japan in 2010, about 99.7% of international trade in Japan is based on sea transportation (MLIT, 2010). From 1980, the annual average percentage of containerized cargo grows to 9.1% and even more since 2000. The shipping industry plays a very significant role in sustaining these economic activities. Also, the shipping industry is very oligopolistic with extremely high entry barriers that it is not easy to enter and exit due to its heavy sunk cost. According to the Clarkson's research publication for 2013, shipping cycles already forced people to adapt to changing environment and plan for a long cold winters. High bunker cost and over capacity make the laying-up vessels visible. Recessions drive shipping companies to change to survive in this environment.

The operation requires intelligences to help management to make the right judgement and decision making. With the global competition in current global economics, the strategy to get competitive advantage in shipping industry turns to be an important issue (Lun and Browne, 2009). Among the whole shipping industry, liner shipping is the key transport service for the finished goods and other manufactures. Fremont (2009) states liner shipping usually engages freight forwarders, shippers, agents, brokers,

non-vessel-owning common carriers (NVOCC), port or terminal operators, customs clearance, stevedore companies, warehouse service, truckers, inland warehouse operators, railway transportation, freight distributors and consignees. It is a business service providing integrated intermodal transportation or marine shipping of freight. Shipper is considered as the ultimate customer but a variety of related party operating on behalf of the shipper also has important mandatory powers to the selection of reliable liner shipping service. Liner shipping industry is very capital-intensive, and large sums of investment on trucks, containers and vessels make the operation more difficult and complex (Ting and Tzeng, 2004). Competition is intensified as shipping company attempt to obtain and retain customers. As a result, the price war begins and represents a loser-loser relationship between carrier and shipper because it not only makes the price unclear but reduces the service quality and shrinks business profit. Porter (1998) points out that in order to survive in the competitive market, organization ought to choose one of the three general strategies, such as cost leadership, differentiation and niche market strategy. These strategies aim to support the organization to gain competitive advantage among the competitors. However, recent studies revealed that shipping organization could not merely depend on these strategies (Sandberg and Abrahamsson, 2011). It is emphasized that the importance of intangible resources for gaining comparative advantage such as knowledgeable human resource and key competence factors in shipping industry (Lai et al., 2007).

Shipping is a service industry and the significance of its quality has increased considerably in recent years. To gain the higher loyalty from customer, business reputation, and market share make it important for shipping company to enhance and deliver a high quality service (Bolton and James, 1991; Lun and Pang, 2010; Lun and

Marlow, 2011). Harmon (1997) states the nature of shipping service is basically different from physical product or manufacturing as it copes with intangible services, depends on human performance and decisions, producing value by location change, to some extent, and the condition of the cargo transported. Although measuring the service quality is difficult, some researchers and practitioner have investigated shipper's perception of service attributes and their weights of carrier selection for evaluating customer service requirements. Author would like to review the important literature and issues regarding to the service performance and operational issues in the following paragraph.

Brooks (1985) classifies the service attributes of liner shipping industry in America for consideration of decision maker such as transit time, directness of sailings, service attitude of staff, price, carrier's reputation for reliability, frequency of sailing and next ship leaving. McGinnis (1990) has developed service quality criteria of shippers' selection about carrier. The service quality criteria includes freight rates, reliability, transit time, OSD (over, short and damaged), SMC (shipper market considerations), carrier considerations. Tengku (1995) explored the promotion of liner shipping services with regards to the East Asia/Europe trade. The key service attributes include cargo handling and care, transit time, and freight rate.

Lu et al. (2006) listed the service attributes and intention such as perceived usefulness, ease of use and security by shippers to use internet in liner shipping business in Taiwan. The result shows perceive tracing is the most important service attributes followed by checking for customs clearance, vessels schedules and electronic document services. Liang et al. (2006) pointed out four critical service items for an ocean freight forwarder. The four service items include operations convenience and response ability, integrated

service, transportation ability, and price. Lu (2007) indentifies seven capability dimensions for liner shipping including purchasing, operation, human resource management, customer service, information integration, pricing, and financial management. Results show four factors are significant differ between shipping companies and agency: marine equipment, information equipment, operation, and information integration.

Alan Platet(2012) managing director of John Good Shipping, analyzes the recent customer service given to shippers from freight forwarders' perspective. He pointed out the problems of service are uncertainty of reliability, service quality, reduces frequency while carriers all allied to deal with the over capacity supply since 2012. Cullinane et al. (2012) explore the service attributes of short sea shipping to attract modal switches from rail and road such as greater reliability, transit time, frequency and cost. These factors would influence shippers to choose transport modes or carriers. Juga et al. (2012) examines the relationships between customer satisfaction, service quality and loyalty in the logistics outsourcing business in Finland. It is revealed that perceived service quality influences the customer's satisfaction which also affects loyalty. Shang (2012) empirically examines customer relationship management (CRM) and its impacts on performance of freight forwarder services in Taiwan. The understanding of relationships among IT, client response, KM application, profit and managerial performance may offer a reference as to how freight forwarders can amend customer relationship to improve their performance.

After reviewing the attributes of evaluating service quality above studies, consulting with the experienced expert, professional academics as well as considering the feature of liner shipping industry, 12 service attributes were chosen to measure the service

quality in Table 3.1.

Table 3.1 Customer requirements in the empirical Work

<i>Customer requirements</i>	<i>Symbol</i>	<i>Description</i>
1. Cheaper service	CS	Price is cheaper than other service providers
2. Less transit time	LTT	Shorten transportation time for delivery
3. Safety of cargo	SC	Reliable cargo handling procedure
4. Less time for customs	LTC	High efficiency of customs clearance
5. Responsive operation	RO	Well information providing
6. Quality staff	QS	Well trained staff for customer service
7. Intermodal service	IS	Ability to combine different mode of transport
8. Prompt response to claim	PRC	Ability to handle complaint immediately
9. Cargo tracking system	CTS	Dynamic cargo condition
10. Simple documentation	SD	Paperless or simple procedure for process
11. Business reputation	BR	Past performance in the industry
12. Less handling time	LHT	Fast delivery to consignee

Among the literature, the QFD is one of the major methods of service quality assessment. The founder of QFD defines it is a tool to integrate customer requirements into product design (Akao and Ohfuiji, 1989; Akao, 2003). The QFD is a method to convert customer needs from the superficial and pure judgmental form into measurable and practical sub-tasks. In the traditional form, customers express their requirements in general titles and the service provider is required to satisfy these requirements by investigating its business process and design particulars. However, the problem exists on setting which improvement satisfies the particular customer requirement. Because

some of the improvements may directly contribute while some of them indirectly. The HoQ matrix is the key tool of the QFD method to allocate possible contribution of improvements into customer requirements. Therefore, service provider can manage the alternatives of improvements for the maximization of customer satisfaction.

3.3 The empirical study on Asian liner shipping market

The liner shipping industry of Asian region is investigated for service quality assessment and a series of technical measures are used to convey customer requirements. A group of leading liner shipping companies (LSC) is compared according to the technical performance and the satisfaction of the customer requirements. These companies are selected from East Asian countries such as China, Japan, South Korea and Taiwan and the name of the companies is kept confidential (alphabetical labels are used). Fifteen practitioners are chosen to participate consultation including professors, senior managers, shipping specialists and experiential experts. The survey was collected through email, interview or personal visit from March 2012 to December 2012. The expert consultation is performed in two steps. In the first step, a preliminary survey is prepared to define customer needs and technical measures in a short group. Then, the fundamental survey is performed to collect responses for an assessment in the second step. The initial expert group considers items existing in the literature and also suggests possible novel contributions to them. At this stage, a number of customer requirements are preferred as presented in Table 3.1. Although, the items of No. 2, 4 and 12 appear similar, the duration of practical transport service (No. 2), the duration of custom clearance and follow-up (No. 4) and the time spent between an electronic order or notification and the practically handling the cargo (No. 12) are classified in different

titles. The motive of this classification is to indicate the profession on seaborne transport (No. 2), port related procedures (No. 4) and the land-based facilities for hinterland connections (No. 12). While this paper evaluates the service quality of frequent maritime transport, it also exposes the quality of additional services such as logistic business and door-to-door process.

Table 3.2 Technical measures in the empirical work.

<i>Technical measures</i>	<i>Description</i>
1. Capacity of transit in one month	Ability to handle the cargo volume in a month
2. No. of office home port	Self office number in major ports or use of agent
3. Membership to an alliance (1/0)	Belong to an alliances or independent operation
4. No. of owned ports	Number of exclusive berth or quay
5. No. of owned-facilities in home port	Priority of stevedoring or terminal service
6. Existence of door-to-door service (1/0)	Deliver cargo to consignee's warehouse or company
7. Existence of logistics framework in company (1/0)	Subsidiaries to provide various logistics service
8. Yard capacity in home port (TEU)	Enough space to accommodate containers
9. Electronic tracking system (1/0)	Real-time tracking system and database
10. Internal training centre (1/0)	Special training for the professional and skilled staff
11. Customer relationship management department	Build strong relationship and mutual trust
12. Human resource management department	Employee caring and performance management
13. Exemption on terminal handling fee (1/0)	Provide competitive prices for customers
14. Specialized computer facility for notification (1/0)	Satellite or superior equipment to inform shippers
15. Bulk service department	Provide shipper the bulk shipping and information
16. ISO 9001 SOP (Standard operation procedure)	Quality manual standard to operation in detail
17 Advertising	Enhance business reputation and corporate image

A number of technical measures are selected to transform customer requirements to measurable and tangible indicators. Table 3.2 presents these technical measures for liner shipping assessment. The technical measures disclose the size of liner shipping company by evaluating the assets (ports, port facilities, service centers etc.) and also expose the availability of professional organizational segments and systems. Although some of the technical measures are directly tangible items, some of them are indirectly tangible by binary selection of existence (1/0).

Table 3.3 Aggregated fuzzy judgement matrix for customer satisfaction

	CS	LTT	SC	LTC	RO	QS	IS	PRC	CTS	SD	BR	LHT	Weight
CS	(1,1,1)	(1,1.72,3.86)	(0.29,0.56,1.13)	(1.80,3.94,5.98)	(3,5,7)	(1.72,3.86,5.91)	(1,1.72,3.86)	(2.25,4.37,6.41)	(3.46,7.48,9)	(3.69,7.71,9)	(1.51,2.08,4.38)	(1.52,2.47,4.74)	(0.21)
LTT	(0.26,0.58,1)	(1,1,1)	(0.18,0.29,0.56)	(1,1.18,3.24)	(1.43,3.59,5.64)	(1.34,1.97,4.22)	(1,1.52,3.65)	(1.69,3.83,5.87)	(3.86,5.91,7.93)	(3.86,5.91,7.93)	(1.29,1.94,3.54)	(1.13,1.60,2.55)	(0.14)
SC	(0.89,1.80,3.49)	(1.80,3.49,5.65)	(1,1,1)	(4.55,6.63,8.23)	(4.92,6.95,8.75)	(5,7,9)	(1.51,3.63,5.67)	(2.58,4.79,6.86)	(3.46,7.48,9)	(7.9,9)	(2.82,4.92,6.95)	(2.15,4.33,6.39)	(0.33)
LTC	(0.17,0.25,0.56)	(0.31,0.85,1)	(0.12,0.15,0.22)	(1,1,1)	(0.85,1.1,6.7)	(0.75,2.25,3.27)	(0.66,1.1,1.13)	(0.85,1.32,2)	(0.89,2.25,3.87)	(3,5,7)	(0.22,0.33,0.89)	(0.43,1.1,1.13)	(0.07)
RO	(0.14,0.20,0.33)	(0.18,0.28,0.70)	(0.11,0.14,0.20)	(0.60,1.1,1.18)	(1,1,1)	(0.3,1.1,1.13)	(0.24,0.38,1.13)	(0.46,0.66,1)	(0.62,1.17,1.53)	(0.89,1.16,1.85)	(0.17,0.29,0.43)	(0.29,0.50,0.86)	(0.04)
QS	(0.17,0.26,0.58)	(0.24,0.51,0.75)	(0.11,0.14,0.20)	(0.31,0.45,1.34)	(0.89,1.2,6.6)	(1,1,1)	(0.24,0.38,1.13)	(0.24,0.49,1)	(0.85,1.51,2.70)	(1.34,3.05,5.17)	(0.21,0.38,1)	(0.30,0.59,1)	(0.05)
IS	(0.26,0.58,1)	(0.27,0.66,1)	(0.18,0.28,0.66)	(0.89,1.1,5.2)	(0.89,2.66,4.18)	(0.89,2.66,4.18)	(1,1,1)	(0.41,0.97,1.77)	(1.48,2.70,4.19)	(2.22,3.70,5.64)	(0.33,0.74,1.13)	(0.74,1.13,2.36)	(0.09)
PRC	(0.16,0.23,0.45)	(0.17,0.26,0.59)	(0.15,0.21,0.39)	(0.50,0.76,1.18)	(1.1,5.1,1.51)	(1.2,0.3,4.17)	(0.56,1.03,2.46)	(1,1,1)	(1.82,2.71,3.42)	(2.06,2.92,3.61)	(0.37,0.58,1.43)	(0.33,0.76,1.04)	(0.07)
CTS	(0.11,0.13,0.18)	(0.13,0.17,0.26)	(0.11,0.13,0.18)	(0.26,0.44,1.13)	(0.65,0.85,1.62)	(0.37,0.66,1.18)	(0.24,0.37,0.68)	(0.29,0.37,0.55)	(1,1,1)	(1.24,1.72,2.63)	(0.22,0.33,0.85)	(0.19,0.27,0.57)	(0.03)
SD	(0.11,0.13,0.18)	(0.13,0.17,0.26)	(0.11,0.11,0.14)	(0.14,0.20,0.33)	(0.54,0.86,1.12)	(0.19,0.33,0.74)	(0.18,0.27,0.45)	(0.28,0.34,0.49)	(0.38,0.58,0.81)	(1,1,1)	(0.20,0.29,0.56)	(0.19,0.31,0.60)	(0.03)
BR	(0.23,0.48,0.66)	(0.28,0.52,0.78)	(0.14,0.20,0.35)	(1.13,3.01,4.57)	(2.33,3.44,5.75)	(1.2,6.6,4.72)	(0.89,1.34,3.05)	(0.70,1.73,2.71)	(1.18,3.04,4.57)	(1.80,3.49,5)	(1,1,1)	(0.89,1.69,3.24)	(0.11)
LHT	(0.21,0.41,0.66)	(0.39,0.63,0.89)	(0.16,0.23,0.47)	(0.89,1.2,3.3)	(1.16,2.01,3.49)	(1,1.69,3.39)	(0.42,0.89,1.34)	(0.96,1.32,3.02)	(1.76,3.66,5.16)	(1.66,3.24,5.16)	(0.31,0.59,1.13)	(1,1,1)	(0.08)

CCI = 0.01

The FAHP process is applied to define the priority weights of the customer requirements. An expert group from manufacturing industry is asked to complete a pairwise comparison survey and the time spent for the business is also noted for the prioritization process. Table 3.3 presents the aggregated fuzzy judgment matrix for the customer requirements. CCI is 0.01 which is far less than the critical value of 0.37. The safety of cargo is the major requirement of the customers. Since the purpose of transport is the transshipment of product in good manner, safety of cargo is crucial. Then, the

second important variable is the cheaper service. The time spent for transport and the business reputation are following indicators among others.

The relationship matrix is the key part of HoQ in QFD assessment. A group of contributors including scholars from shipping research is asked to define correlation degree of each customer requirements with the technical measures. For this purpose, a three-level scale is used which consists of strong relationship (“■” corresponding to 9), medium relationship (“▲” corresponding to 5), low relationship (“●” corresponding to 1) and no relationship (“nil” corresponding to 0).

According to the number of indications through a single row of customer requirements, “Business reputation” is found the most related factor by the technical content (14 of 17 items). The “Responsive operation” (9 of 17), “Less transit time” (7 of 17), “Safety of cargo” (7 of 17) and “Less handling time” (7 of 17) are also substantially oriented by the technical measures.

The relative weights of the technical measures are calculated for rankings. The existence of ISO 9001 standard operating procedure is found the most significant improvement for the customer satisfaction. This means liner shipping companies should have a precise quality manual, clear standards operation procedure, internal audit systems, periodic quality survey response from shippers. These standards will prove that the carrier comply with the international regulation such as ISPS, C-TPAT, Environmental Protection and anti-terrorism code. It would be much better and effective to establish performance indicator for quality procedure to measure the quality management of each business function. More international standard certificate and strict quality management would enhance confidence of customer and have positive impact on business reputation.

The monthly transport capacity is also another major indicator for the customer satisfaction. Increasing capacity contributes to the enhancement of facilities, economy of scale and increase of port calls. Logistic service, exemption on a terminal handling fee and an electronic tracking system are the following technical content which improve customer satisfaction. In the right side of Table 3.4, the comparison of the Leading Shipping Company (LSC) is indicated according to the customer requirements by using ranking orders. For this step of the analysis, authors endeavoured to collect responses from business practitioners of the logistic/ freight forwarding industry of different countries to ensure objectivity and quality of the results.

The comparative analysis indicates that LSC C has superiority in general and LSC A and LSC D have a strong competition for the customer satisfaction. According to the transport fees, LSC B and LSC A have the leading position among the industry. Since the cheaper service is the second important requirement, price advantage is an important parameter. LSC B is not in superior position in the remaining assessment, but its outstanding price advantage is preferable by many medium to small size industries.

On the other hand, the logistic framework of the LSC C and LSC D maintains several superior facilities and services which contribute to the cumulative satisfaction of the customers.

The top of the HoQ table indicates the correlation matrix of technical measures. The correlation matrix is particularly useful for developing corrective actions and policies. While an industry attempts to implement a number of tasks for the improvement of the customer satisfaction according to the QFD assessment, it should be taken into consideration that the technical measures may interact and positively or negatively influence each other. Therefore, one improvement may cause unexpected loss of quality

on another aspect. Although, these indications are based on a limited number of expert considerations, the implications may exist on the practical use of the results.

For example, the capacity of transit in a month is highly correlated with the yard capacity of LSC in home port. While a LSC intends to increase its transport capacity, the size of yard will be critical to ensure proper storage of container traffic. The yard capacity extension should follow such an implementation and these two improvements must be taken into practice simultaneously. Figure 3.1 illustrates an implementation plan diagram for “Capacity of transit in a month” measure. The strong correlated technical measures and the indirect correlation of uncorrelated items are presented in a flow diagram. Although, there are several directly correlated or indirectly correlated measures, figure 3.1 introduces a number of them as an example. The direction of impacts is not directly applicable, since some of them are in opposite direction. For example, the transit capacity may cause the extension of owned facilities (opposite direction) or the yard capacity may support the increase of transit capacity (direction as is). The exemption on terminal handling fee is strongly correlated with the transit capacity. Advertising is not classified as a direct factor, but it is indirectly required for the implementation of the exemption on the terminal handling fee. If the advertisement is poor, such an opportunity may not be noticed well by customers. The correlation matrix plays a significant role on developing business plans and the route of improvements.

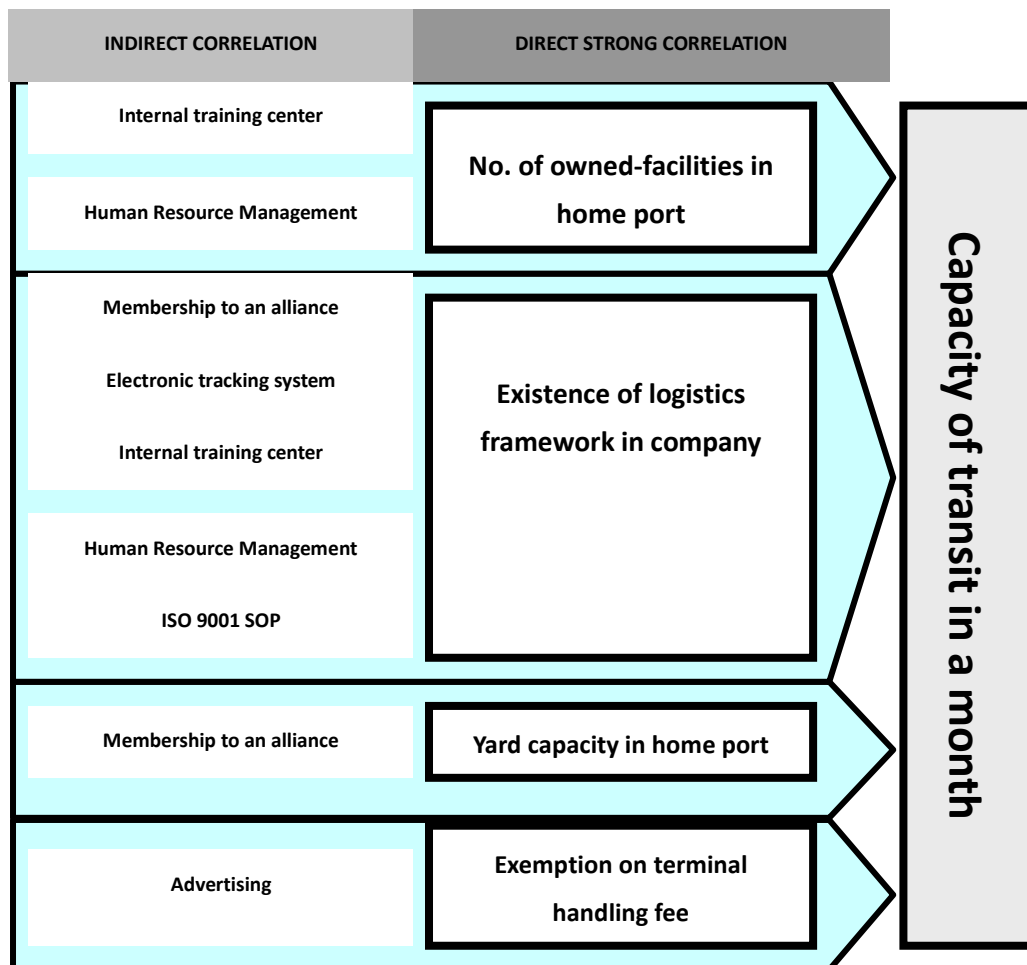


Figure 3.1 Strong correlation diagram for “Capacity of transit in a month”.

3.4 Service quality improvement in LSCs and discussion

According to the present research, a group of improvements are found critical to ensure business sustainability and increasing competitiveness in the liner shipping market. First of all, the customer of liner shipping service tends to purchase a complete transport service including other logistics services. Rather than a single seaborne transport, a liner shipping company is expected to serve additional tasks such as management of the entire transportation business, computer aided follow-up and door-to-door services. In case of lack of intermodal and complete logistic support,

customers need to hire these services separately and transaction costs are rising. Basically, the economies of scale and one-contact-whole-service benefits are required for business development. For example, Maersk line provides daily service to emphasize absolute reliability for delivery. If shipping line's schedule could not meet customer's production plan, customers need to cooperate with more than one shipping lines to transport their cargo. Maersk's innovative product solves this problem and becomes the one-stop-shop to satisfy all the customer's needs. Second, rather than aggressive marketing and advertising processes, the improvement of the existing customers is more effective and long-lasting. The relative weights of the technical content indicated that advertising has minor effect while CRM and ISO 9001 establishments are superior. LSCs with the strong customer care have critical foremost position. Third, another prominent improvement is the capacity and frequent service. With a limited service capacity, customer is required to change shipping schedule and that is increasing the inventory and warehousing facilities which is costly and time consuming. Particularly in market recovery and up-turn of the global economics, shipping schedule and delivery dates are critical for business developing. Therefore, LSCs with high frequency of port calls and larger capacities also contributes to the fulfilment of the emergent needs of the industrial shipments and the improvement of the response duration in case of unusual orders.

Table 3.4 House of quality matrix – Part I

HoQ of Customer Satisfaction				Maximize (▲), Minimize (▼) and Target (x)																					
Relationship Indicators				Legend																					
■ Strong relationship ▲ Moderate relationship ● Low relationship No relationship				++ Strong positive correlation + Positive correlation No correlation - Negative correlation -- Strong negative correlation																					
Direction of improvement				▲	▲	x	▲	▲	x	x	▲	x	x	x	x	x	x	x	▲						
Row No.	Max. value in row	Relative weight		Capacity of transit in a month	No. of office in home port	Membership to an alliance (1/0)	No. of owned ports	No. of owned-facilities in home port	Existence of door-to-door service (1/0)	Existence of logistics framework in company (1/0)	Yard capacity in home port (TEU)	Electronic tracking system (1/0)	Internal training center (1/0)	Customer Relationship Management department (1/0)	Human Resource Management department (1/0)	Exemption on terminal handling fee (1/0)	Specialized computer facility for customer notification (1/0)	Bulk Service department (1/0)	ISO 9001 SOP (1/0)	Advertising	LSC A - Taiwan	LSC B - China	LSC C - Japan	LSC D - South Korea	
1	9	0.21	Cheaper service			●		●		●						■					1	1	2	2	
2	9	0.14	Less transit time	■			●	●	●	▲	●	●										2	3	1	1
3	9	0.33	Safety of cargo					●	●	●		●	●	●					■			2	3	1	2
4	1	0.07	Less time for customs	●	●		●		●	●												1	3	2	1
5	5	0.04	Responsive operation (frequent information transfer)		●			●	●	●		●		●	●		▲		●			2	3	1	2
6	9	0.05	Quality staff		●								■		■				●			3	4	2	1

Table 3.4 House of quality matrix – Part II

HoQ of Customer Satisfaction			Direction of improvement																		
Row No.	Max. value in row	Relative weight		▲	▲	X	▲	▲	X	X	▲	X	X	X	X	X	X	X	X	▲	
				Capacity of transit in a month	No. of office home port	Membership to an alliance (1/0)	No. of owned ports	No. of owned facilities in home port	Existence of door-to-door service (1/0)	Existence of logistics framework in company (1/0)	Yard capacity in home port (TEU)	Electronic tracking system (1/0)	Internal training center (1/0)	Customer Relationship Management department (1/0)	Human Resource Management department (1/0)	Exemption on terminal handling fee (1/0)	Specialized computer facility for customer notification (1/0)	Bulk Service department (1/0)	ISO 9001 SOP (1/0)	Advertising	
7	5	0.09	Intermodal service			●			●	▲								●			LSC A - Taiwan
8	5	0.07	Prompt response to claim	▲							▲		●				●		●		LSC B - China
9	9	0.03	Computer aided cargo tracking system or equivalent									■					▲		●		LSC C - Japan
10	1	0.03	Simple documentation									●		●			●		●		LSC D - South Korea
11	9	0.11	Business reputation	●		■	▲	●	●	●	●	●	●	■	●	■	●		■	■	
12	9	0.08	Less handling time	■				●	●	●	●	▲							●		
Max. value in column				9	5	9	5	1	1	5	1	9	9	9	9	9	5	5	9	9	
Sum product				2.16	0.51	1.29	0.76	0.91	0.86	1.99	0.33	1.67	0.89	1.46	0.6	1.89	0.56	0.45	4.26	0.99	
Relative weight				0.10	0.02	0.06	0.04	0.04	0.04	0.09	0.02	0.06	0.04	0.07	0.03	0.09	0.03	0.02	0.20	0.05	
Target/ Limit																					

This chapter investigated the service quality of liner shipping companies in the East Asian market and the QFD method was implemented to conduct the assessment of the services and facilities for customer satisfaction. The present study indicated the foremost requirements of the customers while transferring this information to practical improvements on technical content. According to the recent condition of the East Asian liner shipping market, a number of leading companies were compared and the key factors of service quality implementation were introduced. Among the several technical measures, the implementation of ISO 9001 framework was found to be very influential factor to ensure customer satisfaction. The ISO 9001 implementation may ensure the confidence of customer on liner shipping services. The quality manual to define standards and targets is essential to promise the operational procedure of company. With these standards, all the overseas offices could follow up in the right direction for

company growth. For example, a shipping executive gives McDonald's operation to emphasize the importance of standards and manual. They have strict procedure and manual to define uniform, manners, time for cooking food and operation in details, so they could expand successfully worldwide. It is more important for shipping line since the operational management is much more complex and uncertain. Other important measures are found in pricing policy. Cheaper service and exemption on terminal handling fee are rated over many other factors by the assessment committee. Since 2011, COSCO Group positively invests their terminal infrastructure to expand their logistics business. By taking advantage of China's strong economy growth and strong containership fleet, they expect to provide their shippers with better prices and terminal handling service. This proves the Porter's cost leadership strategy may be an optional choice for liner carrier to attract more potential customer and expand the market share.

3.5 Summary

We summarize above results in this section. First of all, though many major liner carriers already have systematic standard operating procedure, smaller or regional carriers may not have mature system or global standards to assure customers their service quality. When scale and organization get bigger, standards should be the key measure to assure promising efficiency and coordinated service performance. Second, exemption of terminal handling fee is good measure to offer better prices for shippers. Differentiation service could avoid liner carriers in a price war and provide value-added service to customers. Since shipping is an important part of customer's supply chain and facilitator of economy growth, the further involvement of customer's operation would help liner carrier always have information about their requirements.

Chapter 4

Customer satisfaction assessment on logistics service

4.1 Introduction

The marine transport is one of the largest service industries since around 90% of world trade is performed by seaborne transport, and the other 10% is by air or inland transport. Both Japan and Taiwan are surrounded by sea and China is also a heavily populated country with burgeoning major seaports, and international trade must be accomplished by reliable and experiential international logistics service providers (Lee, 2012). Until 2012, the registered logistics firms are over 1 millions in China. The oversupply of capacity makes the rates and market uncertain.

The globalization of the world economies creates many chances as well as challenges for international logistics companies to expand more business in this changing environment. More and more manufactures outsource their core logistics job to the professional logistics companies, however, a numerous of failure service cases force them to shift to better service providers with diversity of shipper's service requirement in Japan. The national logistics policy report published by Ministry of Land, Infrastructure and Tourism (2011) proposes to establish international logistics strategy teams in 10 different regions around Japan in order to satisfy the increasing demand for advance transportation infrastructure and stay competitive in Asia Pacific. In China, above a million registered logistics companies and around 90% are small or medium in

size but the logistics service and infrastructure should keep pace with the consumer's demands and country's needs (<http://www.lloydslist.com/>).

Logistics is a supply chain channel which adds the value of place and time utility. Logistics generally means a series of operational activities including inputting, packing, warehousing, information changing, transporting and physical distributing goods from point of suppliers to point of customers, and the international logistics companies can offer the firms the proper logistics solution plan and handle complicated transport task with utilizing the best transportation mode to save their logistics budget. The ISO 9001 standard stressed the importance on achieving customer satisfaction, and many studies revealed that customers will change to the service supplier whose service is perceived to have the better service quality (Hung et al., 2003). Moreover, global competition pressure forces the logistics companies to find out the way to create customer value and provide excellent service, while customer requirements are getting demanding and critical to the service providers, as a result, to satisfy the shippers' needs through hearing their voice and wants has become an important strategic and even survival issue for logistics service provider to accomplish (Mollenkopf, 2005).

4.2 Service attributes of logistics companies

To accurately express and quantify the service quality of international logistics company is difficult due to its characteristics such as intangibility, inseparability, ambiguity and heterogeneity. The perceived service quality is the interaction between service provider and customer, so the service attributes of the logistics company are practically assessed by shipper with qualitative and quantitative questionnaires. Nevertheless, author can find many previous researches and related studies investigating

the service quality or performance of logistics industry. Ogura Masao (2000), chairman of Yamato Transport, highlighted his business strategy of operating Yamato home delivery logistics service such as individual service, service differentiation, all employee participation, retailing business partnership, new business developing and financial health management. These strategies and innovation lead Yamato Transport successful among the firms in Japan. For example, the home delivery driver can also respond the companies the reaction of customer needs and provide innovative business solution. That's how the ideas such as golf, reefer, airport and souvenir home delivery service came from. He also explains the key successful secrets how he leads the Yamato Transport as follows: 1. Theoretical and strategic thinking. 2. Understand the trend of logistics. 3. Aggressive management. 4. Not rely on politics or administration. 5. Good relationship with mass communication. 6. Reward the good employee. 7. Good ethics and positive character.

Lai and Cheng (2004) empirically study the freight forwarding industry in terms of demographic profiles, capabilities of providing different type of logistics services, service performance and the perceived prospects in Hong Kong. He explains many forwarders have high capability to provide freight forwarding and traditional logistics service, but they seem to lack the ability to provide other value-added service.

Mikko (2006) investigated the mode selection criteria of Finnish logistics service. According to the research, the products with high price/kg ratio, short life cycles and worldwide market, for example in the hi-tech industries, are typical relying on rapid mode transportation due to their high time utility and worthy of expensive or speedy transport.

Miyashita (2006) explained the evolution and development of logistics with life cycle

theory and flying geese theory. He urged the shipping industry in Japan to combine the software and hardware in both of air and shipping transportation as the combined 3PL or 3PL mega carrier because it will ensure the long term profit stability and enjoy short term low risk.

Bottani (2006) explained companies may enlarge customer satisfaction and expand market shares by improving logistics performances. He applied fuzzy QFD to empirically find out the strategic management of logistics service in an Italian company operating in the mechanical industry in terms of important warehouse functions such as IT, JIT philosophy, forecasting skill, customer relationship management, order picking and warehouse lay-out optimization.

Liang et al. (2008) pointed out four critical service items for an ocean freight forwarder. The four service items include operations convenience and response ability, integrated service, transportation ability, and price. Lu (2007) revealed the shippers' service attributes in logistics industry, such as documentation, storage space, transportation service, tracking system.

Zhao (2007) explored the taxonomy of IT strategies utilized by 105 of 3PL companies in China with a cluster analysis survey. The study revealed the strategies can attain only IT advantages compared with their rivals but not financial or competitive advantages.

Lee (2010) pointed out with the higher value of maritime logistics created, the better customer satisfaction would be attained and the key value is reflected in service effectiveness (e.g. responsiveness, flexibility and service reliability) and operational.

Ministry of land, infrastructure and Transportation (2011) investigates important service quality items for third party logistics providers in Japan, including price, speedy

delivery, schedule reliability, staff ability, trouble handling, logistics solution and information providing. After logistics diagnosis by consultant group, several strategies are proposed such as improving technical support, solution to reduce cost and time, total logistics strategies, customer service support system and web-based information sharing.

Peter (2011) applied a two-stage DEA model to analyze the efficiency of the Brazilian 3PL for 10 years. The results of inputs and outputs analysis for each attribute are discussed to improve the scale efficiency. Fondi and Schiraldi (2012) apply DEA and AHP to select and evaluate the logistics service providers. The most important factor for selecting is the past performance of service suppliers. Chen (2012) emphasized the developing of value-added logistics activities to improve customer satisfaction.

According to the report of Containerization International 2012, the global freight forwarder like DHL still increases its revenue up to 2.8% in spite of the economic depression, nature disasters, and great loss of major ocean carriers. All the division meets the targets and the implemented strategy for future development is all under good progress. The secret of their strength is providing owners/shippers with innovative, strategic cargo handling sector and efficient supply chain solution.

After reviewing the above journals related to measure the service quality, consulting with professor academic, experienced executive as well as shippers, we select 10 customer requirements and 11 technical measures to assess the service quality of international logistics company as shown in Table 4.1 and 4.2.

Table 4.1 Customer requirement in empirical work

<i>Customer requirements</i>	<i>Symbol</i>	<i>Description</i>
1. Cheaper service	CS	Price of service
2. Speedy delivery and quality	SDQ	Time spent for delivery and cargo condition
3. Global service	GS	Worldwide service and local service network
4. Efficient operation and customized ability	EOC	Interaction between customer and staff
5. Strong logistics and intermodal solution	SL	Ability to offer different modes of service
6. Good business reputation	GBR	Public image and records of the company
7. Well information providing	WI	Instant information dynamic market situation
8. Professional sales and staff	PSS	Profession and expertise of company staff
9. Excellent problem solving ability	EPS	Experiential and capable to provide solution
10. Sufficient slot supply	SSS	Enough capacity to large shipment

Table 4.2 Technical measures in empirical work

1. Operation and business developing
2. IT and technical support
3. Existence of ISO 9001 (1/0)
4. Global network (1/0)
5. Customer relationship management
6. Human resource management
7. Performance assessment system (1/0)
8. Multimodal options
9. Strategic alliance and partnership (1/0)
10. Supply chain integration
11. Legal regulation and green logistics

4.3 The empirical study on logistics companies in Asian region

The leading logistics companies of Asian region are investigated for service quality assessment and a series of technical measures are used to convey customer requirements. A group of leading logistics companies (LLC) is compared according to technical measures and customer requirements. These companies are selected from East Asian countries such as Japan, China, South Korea and Taiwan and the name of the companies

is kept confidential (alphabetical labels are used). The expert participants are professors, practitioners and experiential experts from East Asian countries. The surveys were collected by telephone, email, facsimile and personal visits from October 2011 to April 2012. The expert consultation is performed in two steps. In the first step, a preliminary survey is prepared to define customer needs and technical measures in a small group. Then, the fundamental survey is performed to collect responses for an assessment in the second step. The initial expert group considers items existing in the literature and also suggests possible novel contributions to them. At this stage, a number of customer requirements are preferred as presented in Table 4.1.

Several technical measures are selected to transform customer requirements to measurable and tangible indicators. Table 4.2 presents these technical measures for quality assessment of logistics companies. The technical measures disclose the size of logistics companies by evaluating the assets (fleet size, distribution centres, CRM centre etc.) and also expose the availability of professional organizational segments and systems. Although some of the technical measures are directly tangible items, some of them are indirectly tangible by binary selection of existence (1/0).

The fuzzy-AHP process is applied to define the priority weights of the customer requirements. An expert group from manufacturing industry is asked to complete a pair wise comparison survey and the time spent for the business is also noted for the prioritization process. Table 4.3 presents the aggregated fuzzy judgment matrix for the customer requirements. The CCI is 0.01 which is far less than the critical value of 0.37. The “speedy delivery and quality” is the major requirement of the customers with relative weight of 0.26. Since the purpose of transport is the transshipment of product in good manner, safety of cargo condition is crucial. Then, the second important variable is

“cheaper service” with relative weight of 0.23. The time spent for transport and the business reputation are following indicators among others.

The relationship matrix is the key part of HoQ in QFD assessment. A group of contributors including scholars from shipping research is asked to define correlation degree of each customer requirements with the technical measures. For this purpose, a three-level scale is used which consists of strong relationship (“■” corresponding to 9), medium relationship (“▲” corresponding to 5), low relationship (“●” corresponding to 1) and no relationship (“nil” corresponding to 0).

Table 4.3 The aggregated fuzzy judgement matrix for customer’s satisfaction

	CS	SDQ	GS	EOC	SL	GBR	WI	PSS	EPS	SSS	Weight
CS	(1,1,1)	(1,1,1)	(1.62,2.03,2.36)	(1.77,2.69,3.41)	(0.89,1.40,1.88)	(0.99,1.50,1.98)	(1.67,2.57,3.29)	(1.92,2.33,2.66)	(0.94,1.14,1.48)	(2.53,3.01,3.67)	(0.23)
SDQ	(1,1,1)	(1,1,1)	(1.86,2.22,2.52)	(2.03,2.94,3.65)	(1.19,1.61,2.06)	(1.67,2.57,3.29)	(1.54,2.54,3.29)	(2.10,2.49,2.66)	(1.25,1.86,2.28)	(2.03,2.81,3.49)	(0.26)
GS	(0.42,0.49,0.62)	(0.40,0.45,0.54)	(1,1,1)	(1.1,21,1.32)	(0.85,0.99,1.12)	(0.81,1.03,1.48)	(1.1,25,1.38)	(0.76,1.38,2.13)	(0.41,0.58,0.78)	(0.85,1.27,1.62)	(0.06)
EOC	(0.29,0.37,0.56)	(0.27,0.34,0.49)	(0.76,0.83,1)	(1,1,1)	(0.68,0.71,0.76)	(0.81,1.03,1.48)	(0.76,1.38,2.13)	(1.01,1.58,2.33)	(0.41,0.58,0.78)	(0.59,0.81,1.03)	(0.05)
SL	(0.53,0.71,1.12)	(0.49,0.62,0.84)	(0.89,1.01,1.17)	(1.32,1.40,1.47)	(1,1,1)	(0.89,1.01,1.17)	(0.97,1.49,2.22)	(0.97,1.49,2.22)	(0.59,0.65,0.75)	(0.82,1.28,1.73)	(0.09)
GBR	(0.51,0.67,1.01)	(0.30,0.39,0.60)	(0.68,0.97,1.23)	(0.68,0.97,1.23)	(0.85,0.99,1.12)	(1,1,1)	(0.73,1.02,1.68)	(0.73,1.02,1.68)	(0.72,0.80,1)	(1.34,1.92,2.33)	(0.07)
WI	(0.30,0.39,0.60)	(0.30,0.39,0.65)	(0.72,0.80,1)	(0.47,0.72,1.32)	(0.45,0.67,1.03)	(0.59,0.98,1.37)	(1,1,1)	(1,1,1)	(0.31,0.39,0.62)	(0.59,0.98,1.37)	(0.01)
PSS	(0.38,0.43,0.52)	(0.38,0.40,0.48)	(0.47,0.72,1.32)	(0.43,0.63,0.99)	(0.45,0.67,1.03)	(0.59,0.98,1.37)	(1,1,1)	(1,1,1)	(0.30,0.39,0.65)	(1.1,51,1.83)	(0.02)
EPS	(0.68,0.87,1.06)	(0.44,0.54,0.80)	(1.28,1.73,2.46)	(1.28,1.73,2.46)	(1.34,1.54,1.68)	(1.1,25,1.38)	(1.62,2.54,3.26)	(1.54,2.54,3.29)	(1,1,1)	(1.62,2.54,3.26)	(0.19)
SSS	(0.27,0.33,0.45)	(0.29,0.36,0.49)	(0.62,0.79,1.17)	(0.97,1.23,1.68)	(0.58,0.78,1.22)	(0.43,0.52,0.75)	(0.73,1.02,1.68)	(0.55,0.66,1)	(0.31,0.39,0.62)	(1,1,1)	(0.02)
CCI = 0.04											

Table 4.4 shows the final content of the matrix in two parts including the priorities of the customer requirements, the correlation matrix among the technical measures, the direction of improvement and the comparative analysis among the international logistics companies. The relative weights of the technical measures are also indicated in Table 4.4.

According to the number of indications through a single row of customer requirements, “Good business reputation” is found the most dependent factor by the

technical content (11 of 11 items). The “Speedy delivery and quality” (9 of 11), “Cheaper service” (8 of 11), “Excellent problem solving ability” (8 of 11) and “Strong logistics and intermodal solution” (8 of 11) are also substantially oriented by the technical measures.

The relative weights of the technical measures are calculated for rankings. The particulars of operation and business developing are found the most significant improvement for the customer satisfaction. The existence of ISO 9001, particulars of customer relationship management (CRM) and supply chain integrations are considered as important indicators for the enhancement of customer satisfaction. In the right side of Table 4.4, the comparison of the LLC is indicated according to the customer requirements by using ranking orders. For this step of the analysis, authors endeavoured to collect responses from business practitioners of the logistics and freight forwarding industry of different countries to ensure objectivity and quality of the results.

The comparative analysis indicates that LLC C has superiority in general and LLC A and LLC D have a strong competition for the customer satisfaction. According to the logistics fees, LLC B and LLC A have the leading status among the industry. Since the cheaper service is the second important requirement, price advantage is an important parameter. LSC B is not in superior position in the remaining assessment, but its outstanding price advantage is preferable by many medium to small size industries. On the other hand, the logistic framework of the LLC C maintains several superior facilities and sophisticated business solutions which contribute to the cumulative satisfaction of the customers.

The top of the HoQ table indicates the correlation matrix of technical measures as shown in Table 4.5. For this reason, a four-level scale is used which consists of strong

positive correlation (“++”), positive correlation (“+”), negative correlation (“-”), strong negative correlation (“--”) and no correlation (“nil”). The correlation matrix is particularly useful for developing corrective actions and policies. While an industry attempts to implement a number of tasks for the improvement of the customer satisfaction according to the QFD assessment, it should be taken into consideration that the technical measures may interact and positively or negatively influence each other. Therefore, one improvement may cause unexpected loss of quality on another aspect. Although, these indications are based on a limited number of expert considerations, the implications may exist on the practical use of the results.

4.4 Service quality improvement in LLCs and discussion

According to the research literature, a group of improvements are found critical to ensure business sustainability and increasing competitiveness in the logistics business market. A numerous of failure cases of logistics service providers lose their customers because they do not provide the right service or appropriate solutions to attain customer satisfaction in each details of service items. First of all, the customer of international logistics service tends to purchase a complete transport solution and expect long term relationship commitment rather one time transaction or short term cooperation. Customer cares about the transport reliability and service quality more than alliance service or other advertisement slogan stressed by logistics companies (Lee, 2011). LLCs with the strong customer relationship management have critical foremost position. In case of multimodal solution issue, customer requirement may be somehow different in terms of cost saving, delivery speed or other individual requirement. The ability of customized and individual service becomes an important task to handle according to the

shipper's special requirement (Yoshida et al. 2005).

We investigated the service quality of international logistics companies in the Asian market and the QFD method was implemented to conduct the assessment of the services and facilities for customer satisfaction. The present study indicated the foremost requirements of the customers while transferring this information to practical improvements on technical content.

First, since the operation and business developing are found the most significant improvement for the customer satisfaction, enlarging the overall service coverage and analyzing cost performance of specific logistics functions such as order processing, transportation, warehousing will contribute to the diversified service options and decreasing the total operating cost. In February 2012, the Maersk Line CEO Thomas Knudsen identified relative high operational cost as one of Singapore's logistics weakness compared with China, though they have high quality of labour, property and supportive government towards businesses. High operational cost may spoil the profit and competitive advantage, so it is necessary for logistics companies to analyze the costly areas such as fuel or labour to have a big savings to increase total revenue.

Second, the implement of ISO 9001 will ensure the standard operation procedure and capable staff to handle every detail of logistics activity to earn the mutual trust with customers and build stronger business reputation. It is necessary for logistics companies to have more quality certificates to show their services are equal to international standard.

Third, as to the success of CRM, the logistics company should concentrate on the requirements of individual customer and conduct one-to-one marketing to their special needs. Recently, SBS Group CEO Steve Walker stresses the importance for shipper to

have strong relationships and long term cooperation commitment with more than one reliable logistics or shipping service providers in 2012. Therefore, the strengthen functions of CRM will help logistics companies to hear the voice of their customers and build long-term cooperation agreement and commitment with their shippers to gain sustainable competitive advantage in the shipping market. Surprisingly, although the current green logistics and environmental issue catches the attention around the world, the relative weight remains the lowest and has very little contribution to customer satisfaction in this empirical study (Chang, 2006).

Finally, improving supply chain integration will directly affect the efficiency and cost of the logistics systems. The IMC Pan Asia Management's general manager of shipping and logistics reveals that China's immature internal logistics infrastructure invalidate its 60% market share of the iron ore market as world's largest iron importer. He stresses that China needs all the facilities including hardware, software, integrated supply chain systems and government policies to accommodate the increased imported iron and ore. For that reason, logistics companies should provide overall seamless supply chain systems to minimize the transit time and improve customer satisfaction. Though providing quality service is sometimes costly to many logistics companies, the further research to find out the customer's requirement is still necessary to the sustainable business and win-win relationship with customers. The relationship between service quality and performance can be explored for future research issue. (<http://www.fairplay.co.uk>)

4.5 Summary

Four key technical measures proposed for enhancement of customer satisfaction

provide the direction for decision maker to rethink their strategies and allocate their limited budget or resource reasonably. Many major carriers strengthen their liner business through establishing subsidiary of logistics division or large amount of investment for infrastructure. “Yusen Logistics” is a typical example to emphasize the coordination of liner and logistics division with an aim to differentiate their customer service from their competitors. They aim to take advantage of their logistics capabilities to show their customers and investors the high quality delivery service. With the growing Asian market, more trades and business are expected to bring revenue to logistics service industry, so constantly improving quality of logistics service would definitely be the key weapon to gain comparative advantages as well as support liner business for enhancing client’s satisfaction.

Table 4.4 House of quality matrix for customer requirement

HoQ of Customer Satisfaction			Maximize (▲), Minimize (▼) and Target (x)											
Row No.	Max. value in row	Relative weight	Direction of improvement	▲	▲	×	▲	×	▼	×	×	×	×	▼
				Operation and business developing	IT and technical support	Existence of ISO 9001 (1/0)	Global network(1/0)	Customer relationship management	Particulars of Human resource management	Performance assessment system (1/0)	Multimodal options	Strategic alliance and partnership(1/0)	Supply chain integration	Legal regulation and green logistics
1	5	0.23	Cheaper service	▲*		●	●	●		●	●	▲	●	
2	9	0.26	Speedy delivery and quality	▲	●	▲	▲	▲		▲	▲	●	■	
3	9	0.06	Global service	●		●	■			▲	■	■	●	
4	9	0.05	Efficient operation and customized ability	■	■	▲		●	▲	●			●	●
5	9	0.09	Strong logistics and intermodal solution	▲		●	●	●		▲	■	■	■	
6	9	0.07	Good business reputation	▲	●	■	■	■	▲	●	●	▲	●	■
7	9	0.01	Well information providing	●	■	■	●	■	▲	●	●			
8	9	0.02	Professional sales and staff	●	■	■		■	■	●				●
9	9	0.19	Excellent problem solving ability	▲	■	■	●	■	■	▲			●	
10	9	0.02	Sufficient slot supply	●	●	●	●				●	■	▲	
Max. value in column				9	9	9	9	9	9	5	9	9	9	9
Sum product				4.76	2.78	4.56	3.01	4.28	2.54	3.38	2.98	3.29	3.85	0.7
Relative weight				0.13	0.08	0.13	0.08	0.12	0.07	0.09	0.08	0.09	0.11	0.02
Rank				1	9	2	7	3	10	5	8	6	4	11

* “■”, Strong relationship (9), “▲” Moderate relationship (5), “●” Low relationship (1) and “Ø” No relationship.

Table 4.5 Correlation between technical measures

Correlation of Technical Measures	Operation and business developing	IT and technical support	Existence of ISO 9001 (1/0)	Global network (1/0)	Customer relationship management	Human resource management	Performance assessment system (1/0)	Multimodal options	Strategic alliance and partnership (1/0)	Supply chain integration	Legal regulation and green logistics
Operation and business developing		+	+	+			+	++	++	+	+
IT and technical support			++		+			+	+	+	++
Existence of ISO 9001 (1/0)				+	+	+	-	+	+		++
Global network (1/0)						-		++	++	+	
Customer relationship management								+	+	++	
Human resource management	Legend ++ Strong positive correlation + Positive correlation No correlation - Negative correlation -- Strong negative correlation						++		-	-	
Performance assessment system (1/0)									-		
Multimodal solution										++	
Strategic alliance and partnership (1/0)										++	-
Supply chain integration											
Legal regulation and green logistics											

Chapter 5

Conclusion and future study

In this chapter, author would like to verify if our empirical result have practical meaning and suitable business application in liner shipping and logistics business by providing the executive's opinions author obtained by empirical visiting the leading companies in East Asian region. Author empirically visits major liner shipping companies and leading freight forwarder companies to find useful information for our study during 2012. Furthermore, author has the pleasure to meet with CEO to get the latest trend of customer service and suggestions to this study. However, information regarding to these companies and person in charge should be kept confidentially as we promise. In this section, we would like to highlight the valuable comments and viewpoints for quality improvement in shipping and logistics service. The information regarding to company and executive is kept confidential. The comparison of the research findings and consultation will provide us both academic and practical perspectives regarding the improvement of service quality for this industry. Though every firm has their own organizational culture and business style, these comments may be helpful and provide practical meaning to our research. All the interviews give us precious information and business implication for our research.

5.1 Interview with practitioners in East Asia

The interview contents for executive A are as follows:

The transport and logistics industry is a complex industry because many stakeholders' interest could not be neglected such as shipping lines, terminals, governments, security companies, customers, along the whole supply chain. The global shipping business faces serious challenges and competition in this changing environment. As a shipping business, we need to set up appropriate strategy to cope with the coming difficulty and environment. For our company, human resource management plays a key role in our whole corporate operation. We can invest equipment, facility, IT technology immediately but the suitable professional intelligence could not be trained in the short time. Our company needs professional intelligence to redefine our strategy and standard to meet the customer requirement and ensure high customer satisfaction. Also, we have a complete customer relationship management system to make sure every customer have a positive feedback to our company. Generally speaking, we would provide general or no-frill service to common customer. For the profitable or important customers, we will provide VIP or individual consultant service to enhance their loyalty to our company. As the 80/20 rule, our major profit is contributed by minor manufactures and traders. It is not necessary to satisfy all the smaller customers but we are relatively interested and focus on customers who bring major profit and have long term partnership or commitment with our corporate. Every firm needs to make clear and clarify who is the VIP customer. The correct marketing strategy and regular commercial visit would help us to keep these customers and stay competitive. By the way, we must have a clear market segment. The target market of liner carrier is mainly FCL customers while forwarders target more on LCL customers. Every firm must know their niche market to develop their core competency or aggressive measures to take the market.

If you mention about high service quality in terms of reliability, reputation, service

or good prices, we should not say company A is inferior or better than company B, since every company have their own strength and niche market in different routes. As for our company, our core competency is providing our customer the quality service. We strictly trained our staff to make sure they can satisfy their customer in details and educate them the skills to attract new customers. The well-trained staff will help our company considerable value to bring good reputation and brand among industries. For example, it is important to notice the interaction with customers in details such as handshake, good manners, shipping knowledge, emails and problem solving skills. To deeply understand customer's operation and requirements would help us build strong relationship and trust from customers. That is we could win the reputation as a leading logistics service company in our country.

On the other hand, shipping has a considerable environmental impact and liner carrier should work continuously to advance the fuel efficiency for reducing CO₂ emission by using fossil fuels. Economic growth does bring the higher quality of life and income level as well as negative impact such as resource sustainability, climate and environmental impacts. Shipping also faces this challenge to more reduce energy, port and transport impact on the environment. The productivity evaluation of port performance is important for overall efficiency of trade flows. Efficient infrastructure may help decrease storage and fuel cost. Lower transportation cost could increase the nation's business activities. For our company, we also need to take measure to follow the international regulation regarding to green shipping and environmental friendly commitment to satisfy the stakeholders.

As to the current trend of liner shipping, small size shipping lines were tempted to sway their bets onto East-West major strings, crowding into the ventures where some

major liner player already lined up with very large container ship deployment. Unfortunately, over supply led to price war and lower profitability among major carriers. After the global financial crisis in 2008, many major liner shipping companies have collaborated to deal with problems such as the surplus capacity of market supply, fierce competition, drop of cargo demand and low profit through strategic alliances as well as make preparation for the recovery of economy. This collaboration may include weekly or daily service, inland logistics service, good reputation, economies of scale energy efficient, environmental friends, global network service and supply chain management to provide the customers better service with cheaper prices. We will enhance our service quality by associating with shipping business and customer service. We would increase our local subsidiaries globally to build worldwide network for providing logistics and depot service. We would define better key performance indicator benchmarking system to make our improvement of service quality quantified and visible by all stakeholders.

The interview contents of executive B are as follows:

Shipping business carries materials that are crucial to life, natural gas, petroleum, clothing, machinery, automobiles and energy resources to food products. The development of shipping is key issue to facilitate the global trade and economic growth of emerging countries. About 35% of the world's wealth is forecasted to emerging market, with the increasing world population and growing potential market represents the larger demand of cargo need to be transported by liner shipping and related logistics service providers. Cost efficient transportation across the resources and emerging markets facilitate the movement of economic growth and national or even regional prosperity.

In today's shipping market, price is no longer the only factor for shipper to choose their ideal carrier. The importance of service quality becomes an important factor to attract new clients. On the other hand, since the importance of logistics service is considered as core competency to support liner shipping service to complete the door to door service, it is also necessary to discuss the logistics capabilities to evaluate the service providers in terms of inland transport, IT ability, operational efficiency, tracking systems and supply chain solution. In recent year, we can see NYK Group established strong logistics subsidiary to support their liner business. Actually, almost all major liner carriers establish logistics subsidiary or invest large amount of money to strengthen their logistics capabilities. Customer wants more complex logistical service and supply chain solution rather than conventional shipping service. On the other hand, since the importance of logistics service is considered as core competency to support shipping line to complete the door to door service, it is also necessary for shipping line to develop their logistics capabilities to evaluate the service providers in terms of inland transport, IT ability, operational efficiency, tracking systems and supply chain solution. Regarding to the shipping service in East Asia, the shipping firms in Japan provide high quality service but the price is not so competitive due to their higher operation cost. Many shipping firms in China provide competitive prices to shipper but their service quality may not meet customer's needs. Author think they should train their staff the concept of "customer first" and it is not allowed to lose any customers. The performance evaluation for sales staff is extremely important, and the bonus system may be good options in business in China. As author knows, the market competition is getting strict, so many service providers begin to improve their service quality in China. You may say our company provide our customer with middle service in terms of price and service.

The customer service criteria in our company includes E-Business, Green logistics management, time for transit, reliability service, global network and etc. The core competency for our firms is the customer relationship management. Recently, the customer loyalty is not high, and it is very easy for them to switch service providers even if we do not make any mistakes. Constant commercial visit build the strong relationship and commitment is the only way for us to hold existing customers.

IT application is also key approach to improve efficiency in shipping business. As author knows, Hong Kong- based Hutchison Port Holdings' expand the worldwide network of port operation through pursuit of technological innovation and improvement. The new terminal management system improves efficiency of total throughput significantly. As the leading shipping company, we need to make sure our ability to provide our customer seamless supply chain solution and technical support.

In 2011, we encounter large loss due to surplus capacity and high bunker price. Since Lehman Shock, all liner carriers realized that trade amount would not increase even though rates are lower and only price competition could not benefit the operator in the long term perspective. In 2012, many major European shipping operators change their priority from market share to focus on profitability and service differentiation mainly on Asia Europe route. Maersk line's daily service has a great impact on market structure. Daily Maersk emphasizes that shipping must be predictable and on time reliability. Shipping is the integrated part of customer's supply chain. A lot of customers have to adjust their production schedule according to shipping line they contract with. Absolute reliability could be a new concept to liner shipping. Supply chain and labour cost such as double driver should be saved to increase revenue. Shipping line helps inventory reduction for warehousing. Traditionally once or twice departure weekly, daily

departure is helpful. Industry standard of Asia-Europe trade will change shipping industry. Daily Maersk service does threaten other liner carriers to take instant actions. To defend these aggressive measures, alliance formations of major liner carriers such as G6, Evergreen and CKYH to improve market presence and customer service convenience. The alliance frameworks could bring lots of benefits to all members because the investment burden for single liner carrier to operate one service loop is extremely huge. Almost no single carrier can input 11 vessels to Asia Europe route to maintain service frequency, so alliances allow carriers to work effectively and take advantage of scale economies as well as reducing terminal and inland transportation costs.

For the future prospects, we will do our best to build win-win relationships with partners sharing the common values and interest. Long term commitment and relationship is important for success. To be the first choice of our client, we need to broaden the scope of our service menu and coverage. We will still serve the cargo movement as a shipping company, but we strengthen forwarding in logistics business. The differentiation strategy from competitors is to provide an extensive menu of additional services, including ocean and air forwarding, increasing points of contacting customer, pre-delivery inspection, vehicle distribution centers, inventory control, inland transportation, port infrastructure planning, coastal transportation, customs clearance, distribution and warehousing service. Customer wants more complex logistical service and supply chain solution rather than traditional shipping service.

The interview contents of executive C are as follows:

We believe the standards of quality are important for customer service. For example,

many fast food restaurants have procedure manual to define the uniform, rules, menus, how to cook and the staff's courtesy to customers. That is why they can expand their market world widely. Logistics business also needs standard to meet customer's needs since the operation is more complicated and changeable. On the other hand, firms need to strengthen management function and strategy to satisfy customers. We believe well management system would help us to improve efficiency as well as service quality.

From marketing perspective, the business cycle for forwarders in East Asia is in the recession period as one executive mentioned. The market structure and competition makes the providers difficult to survive. Though we already achieve the economies of scale to reduce our cost but our key weapons to gain core competency is through providing high quality service. For general customer, we will provide general or no frill services. Sales staff should have regular visit our important customer to understand their needs and adjust our operation to cater their requirement. They care about price as well as diversified services such transit time, logistics support, slot supply and customized ability. The entry and exit barrier of freight forwarder is much lower than shipping line and have more flexibility to change than carrier because the capital investment is lower. However, the competition is extremely high in Taiwan since there are too many service providers. Business should focus on strengthening relationship, defining standard and managing cost, streamline process, standard, lean organization structure, understanding customer's business to provide solutions.

As for the future, we firmly believe container shipping industry still has much potential to increase with annually 8% growth rates since the increasing demand of emerging countries and rising population. Logistics service providers should continue to understand customers' needs, deploying assets proficiently, and provide high quality,

low cost service. The company staff should realize the details the corporate goals and differentiation ideal. This is due to the capable staff could provide high value added solutions to solve customer's logistics problems. Therefore, the key strategy is to develop new business line and trained world class personnel. Appointing the local staff is not enough, so the talented foreign staff is very crucial to company growth understanding the core value of corporate group. The most important management resource of a non-asset capital is human resource. Talented staffs create values, define standards and set up strategies to bring companies growth.

5.2 Research originality and application

The originality of this research could be discussed from several perspectives. First, the major criticism of traditional QFD is based on the lack of proper budget management and satisfaction of service provider. This dissertation applies QFD design to collect response from customers to evaluate service quality of service provider. The budget management could be further discussed to improve the classical QFD method.

Second, the result of HoQ proposes the liner shipping and logistics service providers the direction of enhancing customer satisfaction and ranks the key technical measures. The example of business application from famous shipping publication may be helpful for decision makers to deeply understand the practical meaning and to redefine the customer service strategy.

Third, the comments of executives in East Asian countries may verify the research results and evaluate customer service issue from viewpoints of both academic and business perspectives.

Fourth, most of scholars explore liner shipping business in terms of freight rates and

supply/demand relationships. This study applies decision making approach to solve the current service quality issues. The business success relies on right response by decision makers to take appropriate measures to define future management direction.

Fifth, many of the executives we interviewed suggest the result of our academic studies regarding to shipping and logistics researches to explain their business practices. They ask “Can the result be really useful and have contribution for practical business world? ” They emphasize our research must have both academic and practical meaning since we are social science study. Author keeps these words in minds, so this research humbly takes their criticisms and provides their comments to verify the practical meaning of our findings.

Sixth, though author has valuable comments from practitioners, their comments are based on their working experience and insights toward industry. However, some issues they mentioned still worth further discussing.

Therefore, the further research on advance decision making process should be considered for executives to support them to make right judgement in daily or even long- term planning.

5.3 Research limit

Although this dissertation proposes clear direction of improvement and practical solution to enhance customer satisfaction by applying QFD, several research limits should be indicated to reveal the difficulties and barriers to investigate the voice of customer and important technical measures. We list several limits we face to get the correct data for research.

First, the customer service strategy could be considered top secret for both liner

carriers and logistics service providers. Though author makes consultation with executives to understand their strategies to improve service quality, author wonders if they are reluctant to tell something regarding to core strategy since this information is very confidential. They are helpful to complete the HoQ consultation; however, we think the accuracy of information may require further discussion even if we assume their comments are trustworthy. Furthermore, we believe the data we collecting by consultation with experts and practitioners may be more valid than the information by completing a large number of random sampling statistical process.

Second, since the customer service strategy is confidential information for operators, this dissertation obtains related information from famous shipping publication such as Lloyd's Fairplay, Lloyd's List, Drewry Shipping Consultants, Containerisation International (CI) and annul report to find the industry information. The publications are generally written by famous journalist and experiential consultants, so their viewpoints and judgements should be considered reliable without personal bias. However, we could not promise their data is perfect since these data is not directly obtained by researcher himself. We think even the comments of professional shipping experts may still have a lot of room for debating and discussion. On the other hand, annual report provides us the complete information regarding to business strategy, sustainability, health of finance and future prospects to overcome the market recession. As we know, many chairpersons propose ambitious strategies with positive and bright attitude to persuade investors to further investment or establish commitment from stakeholders. In this dissertation, we assume it is correct since annual report is the only direct source of information from industries.

Third, this dissertation applies FAHP and QFD method to solve the decision making

problems. QFD is featured by hearing the voice of customers to find suitable technical measures for improvement. However, QFD does not concern about the firm's capability, resources and financial health. Customer-oriented strategy is absolutely crucial for service providers, but the major issue is that not every firm could have the luxury to meet all customer needs within limited resources especially for small medium size firms. The individual situation of company should also be considered to execute suitable technical measures.

Fourth, the combination of FAHP and QFD are appropriate methodology for decision making which provide the decision maker the clear direction for quality improvement. We can easily understand the key technical measures and its applications regarding to "what" customer wants and "how" to satisfy them. However, we could not understand "how much" should we improve in details. For example, if the result shows us IT implementation is most important technical measures as the clear direction of improvement, we could also find related business practices easily to understand. But we could not exactly know the degree of improvement to make customer feel satisfied by this methodology.

The criticisms mentioned above describe the research limits in terms of data accuracy, methodology and practical application. On the other hand, the limits argue some issues this research could not explain clearly as well as make clear the main purpose and problem to solve in this dissertation. Under the limitations, the present study should be valid for proposed academic and practical literature, and majority part of this dissertation is presented in published academic journals for criticism by scholars and peer review process.

5.4 Summary

The main value of this dissertation is to explore the customer service issues from academic and practical perspectives for the complimentary information to explain research findings. Experiential comments from executives could further contribute the gap of customer service we could not find in the academic study though their personal judgements may not have strong theoretical basis. But their perspectives may be valuable of considering customer service strategies for decision makers.

There are several new and innovative issues regarding to the operations shipping and logistics industry such as CSR, environment, supply chain demand, strict security and cost management. The rapid improvement of technology, SCM, regulation and concept of management will also change customer requirement in very short time. Many issues and challenge is worth discussion for the future study.

5.5 Future study

The future research and suggestions could discuss the following topics:

- a. This research uses lots of information from famous shipping consultant publications. They may accurately conclude the phenomenon of entire market but could not reflect operations of the regional or individual service providers. Since the customer service strategy is very different from company to company. The empirical case study is proposed for exploring the strategies and service improvement project.
- b. Customer's requirements may alter with the constantly changing shipping market and new competitors. The continuous research for customer service is still necessary for service providers to adjust strategies in the fast changing and dynamic market.
- c. Strategic alliance of liner shipping operators could significantly improve the

performance and rationalize resource utilization. However, the arguments are if customer satisfaction really enhances after collaboration of liner carriers. Even some practitioners emphasize the shippers think the service quality is lower after alliances due to poor coordination of members. There are still many issues to discuss in the future study.

d. As to the findings of key technical measures in the dissertation, the further research regarding to their performance indicators or matrix could be discussed in future study.

e. The dissertation applies FAHP to calculate the relative weight of customer requirements. Author thinks that applying fuzzy theory would be more accurate than classical AHP method.

f. Green logistics is a very hot topic; however, the result of this dissertation reveals this technical measure has little contribution for customer satisfaction. The green logistics should be further discussed for future study.

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