

## **An Evaluation of Key Service Attributes of Ocean Container Carriers from the Ocean Freight Forwarder's Perspective**

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**Abstract:** The dramatic decrease in global demand due to the financial tsunami of 2008 forced the ocean container carriers (OCCs) to re-examine their maritime marketing strategies. In an attempt to help the OCCs establish effective marketing strategies, this study conducted a survey regarding the ocean freight forwarders' (OFFs) needs on the OCCs' service. An evaluation framework with 21 attributes was developed based on the concept of marketing mix. The fuzzy Delphi method and DEMATEL were adopted to synthesize the OFFs' opinions and examine the perceived causal relationships between the attributes. The analysis results showed that sales representative's expertise and transportation reliability are the most important attributes valued by the OFFs instead of transportation fee. The OFFs with various characteristics have different perspectives on the importance of attributes and their causal relationships. The results reflect the distinct capabilities of handling cargoes and negotiation powers in dealing with business partners of various-sized companies.

**Key Words:** ocean container carriers, ocean freight forwarders, maritime marketing strategies

### **1. INTRODUCTION**

In the twenty-first century, the environment has rapidly changed, and various industries are facing more competition due to globalization and internationalization. Ocean container transport is a mature global transport service industry. Since the 1960s, container carriers, ships, containers and terminal operators have all undergone significant innovation and development. Meanwhile, the impact of the global financial tsunami resulted in a serious global economic crisis in the third quarter of 2008, forcing many ocean container carriers (OCCs) to re-examine their maritime marketing strategies under this changing environment.

As a typical service industry, ocean container transport is characterized by intangibility, perishability, inseparability and variability; accordingly, the maritime marketing strategies significantly differ from those providing physical commodities. Conventionally, there are three steps in the process of developing marketing strategies including market segmentation, market targeting, and market positioning. Due to considerable differences in various customer needs, enterprises have been trying to segment the market, and target and position the niche market. To develop effective marketing strategies in the niche market, marketing mix is one of the most popular tools to be adopted. Marketing mix is a combination of all elements of the needs of a product or service. The purpose of using marketing mix to make the marketing decisions is to achieve the marketing objectives and enhance customer satisfaction and profits. This paper applies the concept of marketing mix to develop an evaluation framework for OCCs to segment the consumers in the container transport market, and establish the foundations of maritime marketing strategies.

OCC's customers can be divided into two types: "direct shippers" and "ocean freight forwarders (OFFs)". The OFFs usually collect small- and medium-sized shippers' cargos as well as co-loads, often making them hold a great quantity of cargos and become the major and/or based cargo sources of OCCs. In Taiwan, there are hundreds of OFFs; each OFF has its own specialized cargo types and specific service requirements from OCCs. Seeing the importance of OFFs to OCCs, Chen *et al.* (2009) applied the gap model to examine the service quality gap between OFFs and direct shippers in the Taiwan shipping industry. The result showed a lower service quality perception of OFFs than that of the direct shippers, and suggested the necessity for OCCs to improve their service quality, especially meeting the various needs of different types of OFFs.

The aim of this study is to identify the important attributes valued by the OFFs and their causal relationships. Considering their heterogeneous service needs, the OFFs are divided into groups based on two characteristics – company size and cargo type (in terms of its time sensitivity). Based on the concept of marketing mix, this study develops the evaluation framework using the fuzzy Delphi method. Moreover, the causal relationships are evaluated with the method of decision making trial and evaluation laboratory (DEMATEL). The data are collected based on a random sampling from the member list provided by the International Ocean Freight Forwarders and Logistics Association in Taiwan (IOFFLA). It is expected that the findings of this study will help OCCs to develop maritime marketing strategies, particularly for the needs of OFFs with various characteristics.

The remaining sections of this paper are organized as follows: The next section presents the basic concepts of marketing mix and the developed evaluation framework. Section 3 introduces the methodology used in this study including the survey, the fuzzy Delphi method, and the DEMATEL method. Section 4 follows with analysis results, and Section 5 provides discussions and concluding remarks.

## 2. MARKETING MIX AND EVALUATION FRAMEWORK

In literature, many studies have been trying to investigate the key service attributes and the importance of differentiated services. In the past, price was regarded as the most critical factor to select OCCs (McGinnis, 1990). However, the introduction of supply chain management has transformed selection behavior in the shipping industry, where satisfying the needs of shippers, products, and markets is as important as looking for the lowest price (McKinnon, 1989), and price is no longer the factor dominating the choice behaviors. According to Murphy and Hall (1995), enhancing service quality such as transportation reliability was more important than cheap shipping rates. Durvasula *et al.* (2000) also showed that transportation and documentation delays and uncooperative agents were the most critical issues jeopardizing the satisfaction of customers in the container shipping industry. To evaluate the evolving choice behaviors of OFFs, this study reviews relevant studies and is based on the seven Ps structure (*i.e.* Product, Price, Place, Promotion, People, Process, and Physical evidence) in the marketing literature (Booms and Bitner, 1981) to develop an evaluation framework as shown in Table 1.

This study uses transportation service to represent the first P, Product. The transportation service here contains three attributes including transportation reliability, schedule density and operation network. Transportation reliability and schedule density have been adopted as critical attributes in past studies (*e.g.* Brooks and Trifts, 2008; Lu, 2003). The operation network refers to the service area coverage and the number of ports the ship loads. The second P, Price, includes the three primary types of fees charged in the ocean container shipping service, including transportation fees, handling charges, and transportation surcharges. The handling charge is the charge due to loading or unloading cargos or other additional service charges such as THC, CFS charge, demurrage, detention charge, *etc.* The transportation surcharges include regular and irregular surcharges such as BAF, CAF, PSS, PCS, and IHC.

The third P, Place, refers to the distribution channel in this study. This study uses three types of channels to represent OCC's distribution channels including the *e*-channel, physical channel, and indirect physical channel. OCCs may provide *e*-channels for OFFs to purchase the transportation service (*e.g.* *e*-booking or *e*-payment) or query information such as schedule, or *e*-B/L. The physical channel refers to the branches that OCCs have in different locations. OFFs can directly contact sales representatives in these branches instead of through websites. The final channel type is the indirect physical channel, which refers to a third party authorized by OCCs to sell their shipping space.

This study considers three types of promotions to represent the fourth P. The first promotion type is different freight-fee packages such as tier rates, or free use of some containers. Such promotion is usually done by sales representatives when they negotiate with customers to sign a contract. The second promotion focuses on telling customers an OCC's service contents, such as the schedules or routes. Such promotion is usually done using media tools such as magazines or news. The third promotion is by telling customers the good reputation of an OCC.

The fifth P, People, in this study refers to sales representatives and staffs in an OCC's company. The associated attributes include the expertise, manner, and appearance of these people. The special knowledge of sales representatives could help OFFs to arrange cargos and routes, and have been regarded as an important attribute for OFFs to select OCCs (Lu and Marlow, 1999).

The manner of sales representatives and staffs has also been demonstrated to be critical to OFFs (Lu, 2003). This study adds the appearance of sales representatives and staffs to represent their images to OFFs.

This study uses physical facilities to represent the sixth P, Physical evidence. Physical facilities are usually connected to cargo handling efficiency. The associated attributes include container and container freight stations (CFSs), large container ships, and exclusive terminal use. OFFs usually have various types of cargos to ship; therefore, an OCC having various types of containers and CFS having the ability to handle these containers might be important to OFFs. Owning large container ships is positive to slot availability, which has been shown to be an important attribute to OFFs (Lu, 2003). Finally, the exclusive use of a terminal would increase the efficiency of handling cargos, which might also be a critical attribute to OFFs.

The seventh P, Process, is evaluated with three attributes: *e*-commerce system, documentation, and integrated supply chain operation. Using *e*-commerce systems such as enterprise resource planning (ERP) software has become a trend to improve resource management efficiency and maintain the relationship with OFFs. Moreover, the documentation process in handling cargo is complex and requires specific care. The final attribute, integrated supply chain operation, refers to the ability for an OCC to provide international supply chain service including intermodal freight transport service or door-to-door service.

Table 1 Evaluation framework of OCC selection based on 7Ps concept

7Ps	Contents in this study	Service attributes
Product	(A) Transportation service	(A1) Transportation reliability (A2) Schedule density (A3) Operation network
Price	(B) Freight fees	(B1) Transportation fee (B2) Handling charge (B3) Transportation surcharge
Place	(C) Distribution channel	(C1) <i>e</i> -channel (C2) Physical channel (C3) Indirect physical channel
Promotion	(D) Promotion	(D1) Sales promotion (D2) Advertisement in media (D3) Reputation
People	(E) Sales representatives and staffs	(E1) Expertise (E2) Manner (E3) Appearance
Physical evidence	(F) Physical facilities	(F1) Container and CFS (F2) Large container ship (F3) Exclusive terminal usage
Process	(G) Process management	(G1) <i>e</i> -commerce system (G2) Documentation (G3) Integrated supply chain operation

### 3. METHODOLOGY

#### 3.1 Survey

The survey was conducted in January 2010. Forty-six companies were randomly selected from the member list provided by the IOFFLAT. Their managers were contacted to ask their willingness to participate in a survey before the questionnaires were mailed out. We also phoned or met the respondents in person to ensure their understanding of questionnaire items. We finally had thirty-three participants and valid questionnaires; the response rate was 71.74%. The questionnaire contained three parts. In addition to the background information of the OFF such as company size and cargo type, the questionnaire asked the participants questions regarding their perceived importance of selected attributes while choosing OCCs as well as their perceived relationships between these attributes. The form of questionnaire items was designed according to the requirement of the adopted methodologies.

#### 3.2 Fuzzy Delphi

Delphi was developed by Dalkey *et al.* in 1948 as a tool to synthesize experts' opinions on a specific issue. While the conventional Delphi method has been widely adopted in various fields such as public policy decisions, strategic planning, and forecasting, it requires researchers to conduct several surveys when the consensus between experts is difficult to achieve. Moreover, the conventional Delphi method uses an arithmetic mean to represent the importance of an attribute, which is easily affected by extreme values. Accordingly, researchers have developed fuzzy Delphi methods to overcome the aforementioned issues. The fuzzy Delphi methods apply membership functions to represent the vagueness of experts' responses, which can reduce the number of surveys and also the impact of extreme values on the resulting attribute importance. This study adopts the process suggested by Chen and Hsieh (2000), as introduced below:

Step 1: Ask the respondents about their perceived importance of attributes in a five Likert-scale, *i.e.* from very important to unimportant.

Step 2: Code the results with a triangle membership function as shown below.

Table 2 Transformation between linguistic responses to fuzzy membership functions

Five-Likert scale	Associated triangular membership function
Very important	(0.7, 0.9, 0.9)
Important	(0.5, 0.7, 0.9)
Moderately important	(0.3, 0.5, 0.7)
Of little importance	(0.1, 0.3, 0.5)
Unimportant	(0.1, 0.1, 0.3)

Step 3: Calculate the triangular fuzzy numbers based on the participant's responses.

Suppose the perceived importance of attribute  $k$  given by expert  $l$  is  $\tilde{w}_{lk} = (L_{lk}, M_{lk}, U_{lk})$  where  $l = 1, 2, \dots, n$ ; for example, if the expert  $l$  perceives the  $k^{\text{th}}$  attribute as very important, then the corresponding  $\tilde{w}_{lk}$  is (0.7, 0.9, 0.9). Accordingly, the importance of attribute  $k$  can be computed by equation (1):

$$\tilde{w}_k = (L_k, M_k, U_k) \tag{1}$$

$$\text{where } k = 1, 2, \dots, n, L_k = \text{Min}_l \{L_{lk}\}, M_k = \frac{1}{n} \sum_{l=1}^n M_{lk}, \text{ and } U_k = \text{Max}_l \{U_{lk}\}$$

Step 4: Defuzzification to derive the importance of attributes.

This study applies the graded mean integration representation method to derive the importance of attributes as shown in equation (2):

$$S_k = \frac{L_k + 4M_k + U_k}{6} \quad (2)$$

### 3.3 DEMATEL

The method of DEMATEL was developed by Battelle Institute, Geneva, Switzerland in 1971 (Fontela and Gabus, 1976). This tool was developed to investigate the relationships between elements in a complicated system. The analysis process is described below:

Step 1: Ask the respondents about their perceived levels of influence from one attribute to the other attribute. This study adopts a five Likert-scale for respondents, *i.e.* from 0 to 4 where number 0 refers to the attribute has no influence on the performance of the other attribute while number 4 refers to strong influence of one attribute on the other attribute.

Step 2: Create direct-relation matrix.

Suppose there are  $n$  attributes. A direct-relation matrix is an  $n$  by  $n$  matrix,  $Z$ , where the element,  $Z_{ij}$ , refers to the perceived influence of attribute  $i$  on attribute  $j$ . The diagonal elements are assumed as 0.

Step 3: Standardize the direct-relation matrix.

Suppose  $\lambda = \frac{1}{\max\left(\max_{1 \leq i \leq n} \sum_{j=1}^n z_{ij}, \max_{1 \leq j \leq n} \sum_{i=1}^n z_{ij}\right)}$ . The standardized direct-relation matrix can be

computed as  $\mathbf{X} = \lambda \mathbf{Z}$ .

Step 4: Calculate direct/indirect matrix.

The direct/indirect matrix is to show the cumulated direct and indirect relationships between attributes, which can be computed by summing the standardized direct matrix and its self-multiplications until infinite times. The equation can be written as below:

$$\mathbf{T} = \lim_{k \rightarrow \infty} (\mathbf{X}^1 + \mathbf{X}^2 + \dots + \mathbf{X}^k) = \mathbf{X}(\mathbf{I} - \mathbf{X})^{-1} \quad (3)$$

Step 5: Draw causal diagrams.

Suppose  $t_{ij}$  is the element in the matrix  $\mathbf{T}$ . The row sum and column sum of  $\mathbf{T}$  are respectively denoted as  $D_i$  and  $R_j$ , and can be computed as  $D_i = \sum_{j=1}^n t_{ij}$  and  $R_j = \sum_{i=1}^n t_{ij}$ .

Accordingly,  $D_i$  is the sum of influences produced by the attribute  $i$  on all the other attributes. On the other hand,  $R_j$  is the sum of influences produced by all the other attributes on the attribute  $j$ .

The sum of  $D$  and  $R$  for an attribute is referred to its prominence, indicating the total influence, including the influence produced by this attribute and the influences affected by the other attributes. On the other hand, the difference between  $D$  and  $R$  for an attribute is referred to its relation. If  $D$  minus  $R$  is positive, then this attribute produces more influence than it is influenced. If the value is negative; then this attribute is more like an influenced attribute than an influencing attribute. A scatter plot with horizontal axis as prominence and vertical axis as relation is referred to a cause diagram.

## 4. ANALYSIS RESULTS

### 4.1 Characteristics of Respondents

The characteristics of collected respondents are summarized in Table 3. The collected respondents include OFFs from very young through more than 25 years. About forty percent of the OFFs have 100 or less employees. On the other hand, we also have one fourth of OFFs having more than 500 employees. About half of the OFFs handle high-value cargos such as IC; and the primary cargo values for the other half OFFs are relatively low, such as cloths or shoes. The cargo types, in terms of time sensitivity, also divides the respondents into two parts with similar size; about half handles time-sensitive cargos such as IC, fruits, *etc.*, and the other half handles time-insensitive cargos such as cloths, furniture, *etc.* About 70 percent of the respondents operate in the Asia market; about 18 percent operate in the European market and the remaining 12 percent operate in the American market.

Table 3 Characteristics of respondents

Characteristic	Count	Percentage
Total sample size	33	100.00
Company year		
Less than or equal to 10 years	6	18.18
11~15 years	6	18.18
16~20 years	5	15.15
21~25 years	7	21.21
More than 25 years	9	27.28
Company size (no. of employees)		
Less than or equal to 100 employees	13	39.39
101~200 employees	3	9.09
201~500 employees	9	27.27
More than 500 employees	8	24.25
Primary cargo value		
High ( <i>e.g.</i> IC, machine)	19	57.58
Low ( <i>e.g.</i> clothes, shoes)	14	42.42
Primary cargo type		
Time sensitive ( <i>e.g.</i> IC, fruit)	15	45.45
Time insensitive ( <i>e.g.</i> cloths, furniture)	18	54.55
Primary market		
America	4	12.12
Europe	6	18.18
Asia	23	69.70

### 4.2 Importance of Service Attributes

This study applies fuzzy Delphi to investigate the importance of OCC's service attributes from the OFFs' perspectives. We examine the importance of service attributes based on the overall dataset as well as the subsets of data. The subsets of data are derived based on the respondent's characteristics. This paper presents the results based on two clustering variables – company size and cargo type (in terms of its time sensitivity). The results are summarized in Table 4.

The top five attributes for the overall respondents, starting from the most important one, are sales representative's expertise, transportation reliability, transportation fee, *e*-channel, and sales representative's manner. It is noted that transportation fee, though important, is not the most

important one to OFFs. The two most important attributes – sales representative's expertise and transportation reliability – indicate that the OFFs' biggest concern is how to appropriately arrange their cargos based on the sales representative's special knowledge and reliable transportation service. The *e*-channel is the fourth important attribute to OFFs, just next to transportation fee, indicating that using information technology to help communications between the OFFs and OCCs and to provide the OFFs with convenient services (such as on-line cargo tracking, *e*-booking, and *e*-payment) has become crucial today. Finally, sales representative's manner is also crucial to the OFFs, suggesting their concern in resolving the service needs to be performed in a responsive way. Table 4 shows that for most 7P dimensions, at least one attribute ranks at the OFFs' top priorities, implying that the OFFs' needs on OCC service are comprehensive rather than partial; carrier's transportation service, freight fees, distribution channel, quality of sales representatives, physical facilities, and process management are all OFFs' concerns.

The importance rankings of attributes for different clusters partially differ from the rankings for the overall data. Small-sized OFFs have relatively higher concerns with freight fees compared to large-sized OFFs and the overall respondents. Transportation surcharges rank fourth for small-sized OFFs, which is extremely high compared to the ranking of this attribute for large-sized OFFs (rank 12). Small-sized OFFs also have more concerns with handling charge (rank 10) than large-sized OFFs (rank 17). On the other hand, large-sized OFFs rank the *e*-commerce system as relatively higher priority than overall respondents as well as the other clusters, indicating that large-sized OFFs may have relatively larger workflows and require the system to handle their daily operations more efficiently.

As for the comparison between OFFs handling time-sensitive cargos and those handling time-insensitive cargos, the first significant difference is the transportation fee; OFFs handling time-sensitive cargos have a relatively higher concern with the transportation fee. When customers have an urgent need for delivering goods, OFFs have only limited choices among OCCs, resulting in higher transportation fee and thus raising the OFF's concern. Moreover, these OFFs also place more value on the attributes related to delivery efficiency. For example, they have a relatively higher concern with the OCC's physical facilities including CFSs, large container ship, and exclusive terminal use.

Table 4 Overall and clustered defuzzied scores and rankings

Dimension	Attribute	Overall	Clusters				
			Company size		Cargo type		
			Less than 200 employees	More than 200 employees	Time sensitive	Time insensitive	
A Transportation Service	A1	Transportation reliability	0.7822 (2)	0.7583 (3)	0.8098 (1)	0.8176 (2)	0.7429 (3)
	A2	Schedule density	0.6422 (13)	0.6500 (13)	0.6667 (10)	0.6588 (13)	0.6476 (13)
	A3	Operation network	0.6711 (12)	0.6833 (10)	0.6667 (10)	0.6667 (11)	0.6857 (8)
B Freight Fees	B1	Transportation fee	0.7800 (3)	0.7833 (2)	0.7451 (4)	0.8255 (1)	0.7333 (4)
	B2	Handling charge	0.6800 (9)	0.6833 (10)	0.6275 (17)	0.6667 (11)	0.6476 (12)
	B3	Transportation surcharge	0.6756 (10)	0.7417 (4)	0.6588 (12)	0.6902 (8)	0.6857 (8)
C Distribution Channel	C1	e-channel	0.7467 (4)	0.7083 (6)	0.6980 (8)	0.6745 (10)	0.7429 (2)
	C2	Physical channel	0.6200 (15)	0.6000 (15)	0.6510 (13)	0.6431 (16)	0.6143 (14)
	C3	Indirect physical channel	0.5267 (21)	0.5167 (21)	0.6118 (20)	0.5725 (20)	0.5571 (18)
D Promotion	D1	Sales promotion	0.7000 (8)	0.6917 (9)	0.6902 (9)	0.7059 (7)	0.6762 (10)
	D2	Advertisement in media	0.5933 (17)	0.5500 (20)	0.6039 (21)	0.6039 (18)	0.5476 (19)
	D3	Reputation	0.6267 (14)	0.5583 (19)	0.6431 (14)	0.5706 (21)	0.5857 (16)
E Sales Representatives	E1	Expertise	0.8000 (1)	0.8167 (1)	0.8020 (2)	0.8098 (3)	0.8048 (1)
	E2	Manner	0.7356 (5)	0.7333 (5)	0.7059 (6)	0.7373 (5)	0.7048 (5)
	E3	Appearance	0.5667 (19)	0.5833 (16)	0.6196 (19)	0.6275 (17)	0.5762 (17)
F Physical Facilities	F1	Container and CFS	0.7111 (7)	0.6917 (8)	0.7784 (3)	0.8020 (4)	0.6524 (11)
	F2	Large container ship	0.5889 (18)	0.5833 (16)	0.6275 (16)	0.6510 (14)	0.5476 (19)
	F3	Exclusive terminal usage	0.5467 (20)	0.5750 (18)	0.6275 (17)	0.6431 (15)	0.5476 (19)
G Process Management	G1	e-commerce system	0.6733 (11)	0.6500 (12)	0.7216 (5)	0.6902 (9)	0.7000 (7)
	G2	Documentation	0.7289 (6)	0.7083 (6)	0.7059 (6)	0.7216 (6)	0.7048 (5)
	G3	Integrated supply chain operation	0.5978 (16)	0.6083 (14)	0.6353 (15)	0.6020 (19)	0.6143 (14)

### 4.3 Perceived Causal Relationships between Service Attributes

#### 4.3.1 Overall respondents

Based on the DEMATEL method, the causal diagram for the overall respondents is illustrated in Figure 1 and the associated direct/indirect matrix is summarized in Table 5. Following the sensitivity analysis, we retain eight attributes: A1, A3, B1, D1, D3, E1, E2, and G3. Among these significant attributes, D3 has the largest value of prominence (the horizontal axis), indicating that D3, “the carrier’s reputation”, has a large influence on the other attributes and is largely influenced by the other attributes (see Table 5 for details). Since the fuzzy Delphi results suggest that the ranking of reputation is in the bottom part among all attributes, this attribute is relatively less important to the OFFs to choose OCCs but highly influenced by other attributes. On the other hand, the attribute with the second largest prominence value is E1, sales representative’s expertise, which is also a top-priority attribute for OFFs to select OCCs. In other words, OCCs should value their sales representatives as an important marketing asset to attract OFFs.

As for the relation (the vertical axis) between attributes, the attribute G3 - integrated supply chain operation - has the most positive value, indicating this attribute is the most influencing attribute. The attribute with second largest positive value is E1, sales representatives’ expertise, indicating its influencing power on the other attributes, and, again, suggesting its importance to OCCs and OFFs. On the other hand, the attributes with the most negative relation are B1 and D1, indicating they are largely affected by other attributes. The B1 attribute, transportation fee which is also an important attribute based on the fuzzy Delphi results, is mostly influenced by E1 (sales representatives’ expertise) and A1 (transportation reliability). This result suggests that from the OFFs’ perspective, the transportation fee depends not only on the OCC’s service (transportation reliability) but also on the OCC’s people, *i.e.* how they communicate or negotiate with sales representatives.

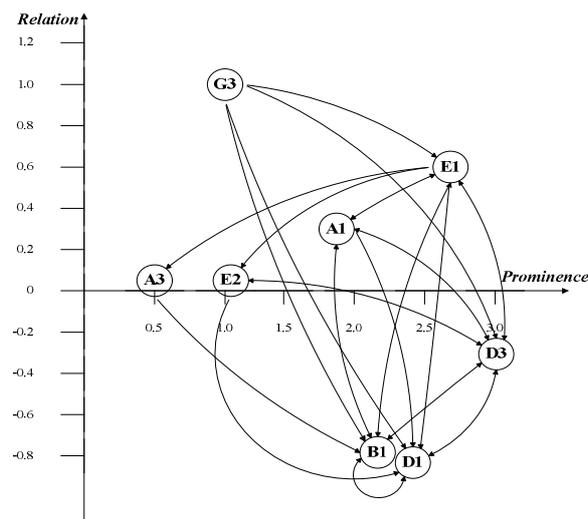


Figure 1 Causal diagrams for overall OFFs

Table 5 Direct/Indirect matrix for overall OFFs

		Influenced attributes							Sum
		A1	A3	B1	D1	D3	E1	E2	( $D_k$ )
Influencing attributes	A1	0	0	0.2824	0.2727	0.2901	0.2614	0	1.1066
	A3	0	0	0.2633	0	0	0	0	0.2633
	B1	0.2702	0	0	0.2664	0.2689	0	0	0.8055
	D1	0	0	0.2601	0	0.2793	0.2658	0	0.8052
	D3	0.2717	0	0.2706	0.2844	0	0.2736	0.2621	1.3624
	E1	0.2742	0.2611	0.2830	0.2993	0.2993	0	0.2710	1.6879
	E2	0	0	0	0.2633	0.2736	0	0	0.5369
	G3	0	0	0.2640	0.2671	0.2729	0.2615	0	1.0655
Sum ( $R_k$ )		0.8161	0.2611	1.6234	1.6532	1.6841	1.0623	0.5331	

### 4.3.2 Company size clusters

The causal diagrams and direct/indirect matrixes for small- and large-sized OFFs are illustrated in Figure 2, Table 6, and Table 7. The different perspectives between small- and large-sized OFFs can be easily observed by comparing the diagrams and tables. While some attributes are commonly significant for both small- and large-sized OFFs including A1, B1, D1, D3, E1, and E2, other attributes are uniquely significant to either small- or large-sized OFFs but not both. The most notable difference is the attribute G3 - carrier's integrated supply chain operation, which is uniquely significant to small-sized OFFs and also has great prominence. This attribute is also the most influencing attribute for the small-sized OFFs. This result might imply the limited capability of small-sized OFFs to provide customers with door-to-door service, thus relying more on carrier's integrated supply chain service.

There are some consensuses about the relation of attributes between small- and large-sized OFFs, but there is more disagreement. The two attributes where different-sized OFFs have consensus about their relation are E1 and D1; OFFs, no matter the size of their company, all regard E1 as an influencing attribute and D1 as an influenced attribute. On the other hand, small-sized OFFs perceive D3 and B1 as influencing attributes and A1 and E2 as influenced attributes, but large-sized OFFs perceive these attributes the other way around. In other words, small-sized OFFs think OCC's freight fees and promotions are the causes and OCC's transportation service and people service are the outcomes, but large-sized OFFs consider OCC's transportation and people services are the causes and their prices and promotions are the outcomes. This result might partially reflect the negotiation power perceived by different-sized OFFs in dealing with business partners.

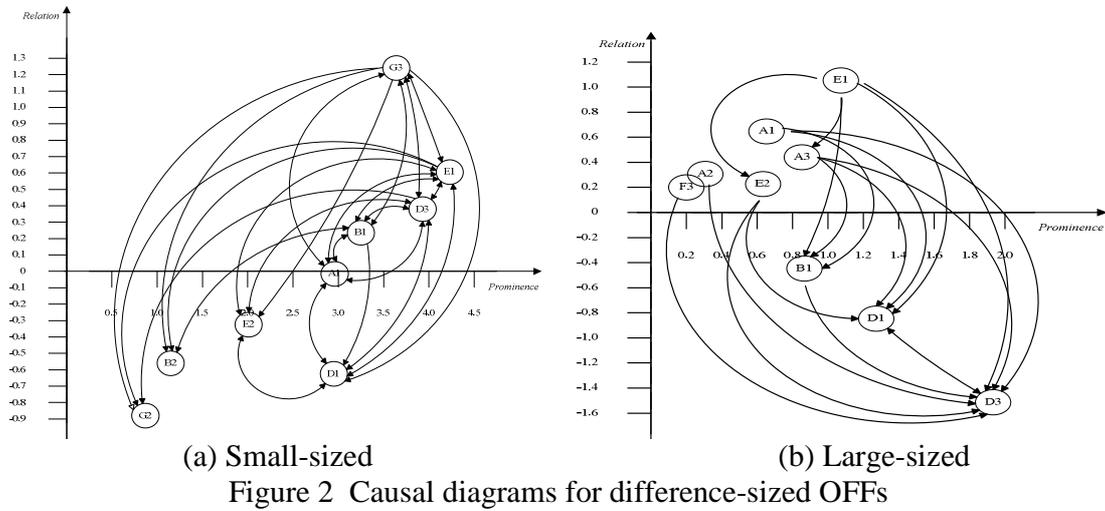


Table 6 Direct/Indirect matrix for small-sized OFFs

		Influenced attributes									Sum ( $D_k$ )
		A1	B1	B2	D1	D3	E1	E2	G2	G3	
Influencing attributes	A1	0	0.3026	0	0.2819	0.2934	0.2965	0	0	0.2813	1.4557
	B1	0.3067	0	0.2811	0.2884	0.2816	0.2965	0	0	0.2925	1.7468
	B2	0	0.2861	0	0	0	0	0	0	0	0.2861
	D1	0.2813	0	0	0	0.2920	0.3078	0.2837	0	0	1.1648
	D3	0.3237	0.3100	0	0.3113	0	0.3246	0.3003	0.2895	0.3088	2.1682
	E1	0.3082	0.3051	0.2842	0.3207	0.3133	0	0.2970	0.2929	0.3121	2.4335
	E2	0	0	0	0.2835	0.2842	0.2814	0	0	0	0.8491
G3	0.3048	0.3100	0.2879	0.3119	0.3059	0.3264	0.2920	0.3010	0	2.4399	
Sum ( $R_k$ )		1.5247	1.5138	0.8532	1.7977	1.7704	1.8332	1.1730	0.8834	1.1947	

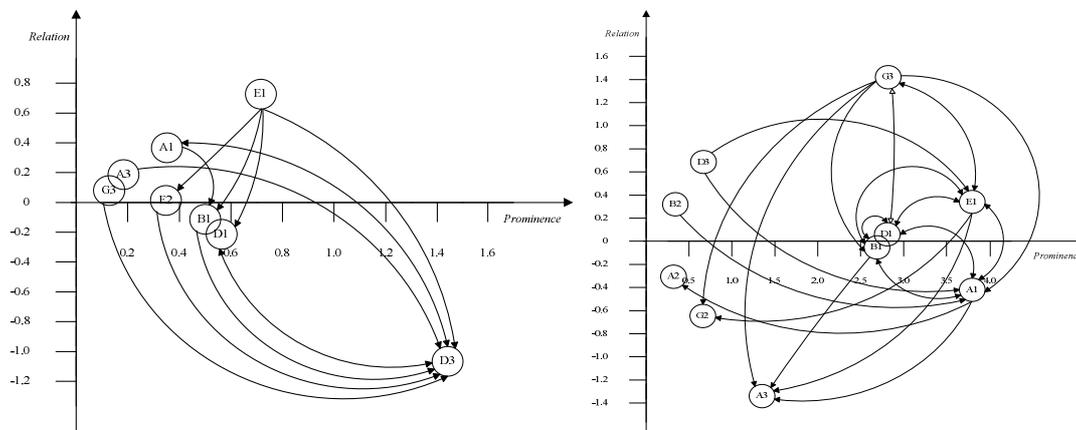
Table 7 Direct/Indirect matrix for large-sized OFFs

		Influenced attributes					Sum ( $D_k$ )
		A3	B1	D1	D3	E2	
Influencing attributes	A1	0	0.2144	0.2138	0.2306	0	0.6588
	A2	0	0	0	0.2138	0	0.2138
	A3	0	0.2217	0.2061	0.2216	0	0.6494
	B1	0	0	0	0.2054	0	0.2054
	D1	0	0	0	0.2155	0	0.2155
	D3	0	0	0.2115	0	0	0.2115
	E1	0.2048	0.2132	0.2284	0.2296	0.2024	1.0784
	E2	0	0	0.2001	0.2134	0	0.4135
F3	0	0	0	0.2011	0	0.2011	
Sum ( $R_k$ )		0.2048	0.6493	1.0599	1.7310	0.2024	

### 4.3.3 Clusters of cargos with different time sensitivity

The causal diagrams and direct/indirect matrixes for OFFs handling time-insensitive cargos and time-sensitive cargos are illustrated in Figure 3, Table 8, and Table 9. The two causal diagrams significantly differ. The attribute D3, reputation, is the most prominent attribute for OFFs handling time-insensitive cargos, but is one of the least important attributes for OFFs handling time-sensitive cargos. For OFFs handling time-sensitive cargos, the most prominent attributes are A1 (transportation reliability) and E1 (sales representative's expertise), indicating their needs for reliable delivery due to the special cargo characteristic. On the other hand, the attribute A1 is relatively less prominent for the OFFs handling time-insensitive cargos. For these OFFs, sales representative's expertise (E1), transportation fee (B1), and sales promotion (D1) are relatively more prominent than transportation reliability.

The attribute D3, carrier's reputation, plays a distinct role in OFFs handling time-insensitive and time-sensitive cargos. For OFFs handling time-insensitive cargos, carrier's reputation is the most influenced attribute while for those handling time-sensitive cargos, carrier's reputation is an influencing attribute. In addition to D3, the attributes A1 (transportation reliability) and D1 (sales promotion) also play opposite roles between these two types of OFFs. For OFFs handling time-insensitive cargos, carrier's transportation reliability is an influencing attribute and sales promotion is an influenced attribute while for OFFs handling time-sensitive cargos, it is the other way around.



(a) Time-insensitive  
 (b) Time-sensitive  
 Figure 3 Causal diagrams for OFFs with various time sensitivity cargos

Table 8 Direct/Indirect matrix for OFFs handling time-insensitive cargos

		Influenced attributes				Sum ( $D_k$ )
		B1	D1	D3	E2	
Influencing attributes	A1	0.1757	0	0.1881	0	0.3638
	A3	0	0	0.1737	0	0.1737
	B1	0	0	0.1710	0	0.1710
	D1	0	0	0.1813	0	0.1813
	D3	0	0.1803	0	0	0.1803
	E1	0.1724	0.1873	0.1939	0.1724	0.726
	E2	0	0	0.1798	0	0.1798
	G3	0	0	0.1710	0	0.1710
Sum ( $R_k$ )		0.3481	0.3676	1.2588	0.1724	

Table 9 Direct/Indirect matrix for OFFs handling time-sensitive cargos

		Influenced attributes								Sum ( $D_k$ )
		A1	A2	A3	B1	D1	E1	G2	G3	
Influencing attributes	A1	0	0.3322	0.3398	0.3420	0.3340	0.3437	0	0	1.6917
	B1	0.3622	0	0.3374	0	0.3326	0.3373	0	0	1.3695
	B2	0.3329	0	0	0	0	0	0	0	0.3329
	D1	0.3516	0	0	0.3371	0	0.3579	0	0.3328	1.3794
	D3	0.3449	0	0	0	0	0.3303	0	0	0.6752
	E1	0.3592	0	0.3384	0.3444	0.3587	0	0.3303	0.3434	2.0744
	G3	0.3650	0	0.3421	0.3465	0.3458	0.3573	0.3360	0	2.0927
Sum ( $R_k$ )		2.1158	0.3322	1.3577	1.3700	1.3711	1.7265	0.6663	0.6762	

## 5. DISCUSSIONS AND CONCLUDING REMARKS

### 5.1 Overall Respondents

The top two attributes for the overall respondents, starting from the most important one, are sales representative's expertise and transportation reliability; both attributes have high prominence. As for the relation, these attributes are influencing attributes, indicating that the OFFs' biggest concern is how to appropriately arrange their cargos based on the sales representative's special knowledge and reliable transportation service. For this reason, OCCs should value their sales representatives as an important marketing asset to attract OFFs. In other words, OCCs should train professional sales representatives and staffs to provide OFFs' needs for OCC service, and timely communication and coordination with OFFs. On the other hand, D3, "the carrier's reputation", is an attribute with the highest prominence but a low ranking of importance, indicating that the OCC's reputation is relatively less important to OFFs to choose OCCs but highly influenced by other attributes. Thus, in the long term, OCCs should establish good reputation through their good service quality or using promotional tools to have OFFs make a good impression.

For most 7P dimensions, at least one attribute ranks as OFFs' top priorities, implying that OFFs' needs in OCC service are comprehensive rather than partial. Thus, OCCs must ensure that they at least need to provide its service with basic service quality including transportation service, freight fees, distribution channel, and quality of sales representatives, physical facilities, and process management. Subsequently, OCCs can focus on particular markets and provide differentiated services.

### **5.2 Company Size Clusters**

Small-sized OFFs have a relatively higher concern with freight fees compared to large-sized OFFs. As for the relation, small-sized OFFs perceive D3 (reputation) and B1 (transportation fee) as influencing attributes and A1 (transportation reliability) and E2 (manner) as influenced attributes, but large-sized OFFs perceive these attributes the other way around. This result might partially reflect the negotiation power perceived by different-sized OFFs in dealing with business partners. Large-sized OFFs have more negotiation power because they may control relatively larger work flows and can reduce the freight fees by purchasing larger slots from OCCs. This understanding of negotiation power perceived by different-sized OFFs in dealing with business partners may allow OCCs to trade off one service attribute against another. For example, large-sized OFFs consider that OCCs providing an *e-commerce* system can promote convenience to the operation, and this type of OFFs has relatively lower concerns with freight fees compared to small-sized OFFs. They consider the transportation fee as an affected attribute rather than an affecting attribute. Thus, if an OCC is considering raising freight fees for this type of OFFs, they may need to devote their resources to promote their service quality of personnel and transportation, or strengthen the integrated supply chain operation to provide better service and handle their daily operations more efficiently.

### **5.3 Clusters of Cargos with Different Time Sensitivity**

As for the comparison between OFFs handling time-sensitive cargos and those handling time-insensitive cargos, the significant difference is for D3 - container carrier's reputation. OFFs handling time-sensitive cargos perceive D3 as an influencing attribute, but those handling time-insensitive cargos perceive this attributes in the other way around. It shows that for the OFFs handling time-sensitive cargos, carrier's reputation plays an important role. Thus, if an OCC has good reputation, it implies that this OCC is reliable when delivering time-sensitive cargos. Therefore, carrier's reputation becomes the main influencing attribute. Accordingly, OCCs who want to enter this market should accumulate good reputation, and then devote their resource to offer better services, like providing integrated supply chain operation and physical facilities such as CFS.

### **5.4 Data Validity and Estimation Results**

To enhance the internal validity of the data, we phoned or met the respondents in person to ensure their understanding of questionnaire items. We also conducted a pre-test to ensure the readability of the questionnaire and the appropriateness of item description in the questionnaire. In addition, all the questionnaire items have been extensively evaluated in the literature and shown satisfactory results. Based on these reasons, we consider the internal validity acceptable. On the other hand, the external validity and estimation results may be somewhat affected by the small sample size. To overcome this

issue, the survey was conducted very carefully. The sampling frame was derived from the IOFFLAT member list, including most OFFs in Taiwan. Instead of conventional statistical methods, we adopted fuzzy Delphi and DEMATEL to analyze our data, which has the advantage of reducing the impact of extreme values on the estimation results. Therefore, we consider the external validity and estimation results acceptable, although a larger sample size would be preferable to help increase data validity.

### ACKNOWLEDGEMENTS

The authors would like to thank the anonymous referees for their helpful comments and the support by the National Science Council of Taiwan (NSC 99-2410-H-019-005-MY3).

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