

MARKET SEGMENTATION AND POSITIONING FOR OCEAN CARRIERS: THE TAIWAN-SOUTH CHINA ROUTES

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ABSTRACT

Freight forwarders who had used ocean carriers to move cargo between Taiwan and South China were surveyed; this paper explores the segmentation of this market and the competitive positions of the ocean carriers. This study conducted factor analysis and two-step cluster analysis to group customers into two segments according to their characteristics and needs. Correspondence cluster analysis produced a perceptual map for each segment; each map revealed the carriers' relative positions, strengths, and weaknesses. Factor analysis categorized service attributes into four underlying latent factors: service performance, reputation/knowledge, freight charge/response, and information technology/communication. For each segment, correspondence cluster analysis created perceptual maps that revealed ocean carriers' key strengths and weaknesses of services. The firms on each map were classified into competitive groups. This paper concludes with managerial implications and directions for future research.

Keywords: market segmentation; brand position; cluster analysis; correspondence analysis; ocean carrier

1. INTRODUCTION

Ocean carriers have larger cargo capacities and lower freight rates than air transportation, but many international ocean carriers compete to serve a number of customers, most of which are international freight forwarding companies. In order to survive, a marine firm must understand its strengths and weaknesses; further, that carrier's operations and marketing must apply a positioning strategy to establish competitive advantage. A significant number of previous studies have examined ocean carriers' service attributes. Morash recognized service attributes as important determinants of customers' patronage and of company profits (Morash, 1994), but to the authors' knowledge, no article has yet examined ocean carrier positioning.

This research seeks to group international freight forwarders into segments and to map the competitive positions of the ocean carriers. This work shows that various service attributes are of interest to particular customer segments. This research defines freight forwarder segments by perceptions of ocean carrier service attributes, factor analysis, and cluster analysis. We use correspondence analysis to produce low-dimensional maps for each segment to indicate the ocean carriers' competitive positions. It can be difficult to justify relative positions of objects in perceptual maps; therefore, we used cluster analysis to group ocean carriers and service attributes explicitly, and we validated the results of cluster analysis by discriminant analysis. SPSS V12.0 was used for factor analysis, two-step cluster analysis, correspondence cluster analysis (*i.e.*, correspondence analysis plus hierarchical clustering analysis), and discriminant analysis.

This paper is structured as follows. Section 2 briefly reviews previous studies on service quality and segmentation for ocean carriers. Section 3 presents multivariate statistical methods for segmentation and positioning analysis. Section 4 describes the data collection and processing and interprets the estimation results. Finally, managerial implications and directions for future research are discussed in Section 5.

2. LITERATURE REVIEW

It is widely recognized that freight owners tend to choose ocean carriers with desirable service attributes. Collision (1984), for example, evaluated liner shippers on Central Alaskan service routes, on service attributes such as overall average time in transit, compliance with specific instructions, schedule reliability, and the ability to service outbound and inbound ports. Cullinane and Toy (2000) investigated choices of freight route and mode; they used content analysis and employed stated preference techniques to identify the major modal attributes (*e.g.*, cost/price/rate, speed, transit time reliability, characteristics of the goods) influencing decisions. Mangan *et al.* (2002) applied factor analysis, mean importance rating, and the Aaker and Day model to examine the Roll-on/Roll-off port/ferry route choice for freight transport. Three factors were extracted from 15 service attributes, namely port/ferry

on the cheapest overall route, availability of information on sailing options, and preference of consignor/consignee.

Lu (2003a) used structural equation modelling to find that some of the major factors that influence carrier choice include timing-related issues, pricing, warehousing, sales services, door-to-door, information, and advertising. Recently, Wen and Huang (2007) adopted factor analysis and a multinomial logit model to evaluate the service quality of ocean carrier choice by freight forwarders; results showed that transit time, frequency, record of cargo delay, freight rate, service convenience, and speed/reliability influence ocean carrier choice.

Market segmentation is the process of dividing a market into a small set of segments; each segment includes customers with similar characteristics or needs (Smith, 1956). Positioning refers to consumers' perceptions of a product or brand. Many articles have researched service quality, but few studies have addressed market segmentation and competitive positioning in marine transportation. The conventional approach requires specified segmentation variable(s), and a pre-determined number of segments. Some alternative segmentation approaches employ statistical classification techniques, such as cluster analysis, to evaluate respondents' similarities with regard to segmentation variables; that evaluation determines the number of segments and the membership of each segment (e.g., Mason and Gray, 1995; Lu, 2003b; Outwater *et al.*, 2004a, 2004b; Zhou *et al.*, 2004; Beirão and Cabral, 2008; Shiftan *et al.*, 2008; Wen *et al.*, 2008; Diana and Mokhtarian, 2009). For example, Lu (2003b) applied hierarchical cluster analysis to shippers' service requirements and classified users of international distribution centres into three segments; cargo safety was perceived as the most important service attribute. Most previous studies on positioning in the transportation industry have applied correspondence analysis to air carriers (Gursoy *et al.*, 2005; Wen *et al.*, 2008; Wen and Yeh, 2010). These studies identified closely competing airlines and their key differentiating attributes; but we do not know of any such study of ocean carrier positioning.

3. METHODOLOGY

3.1 Service Quality Variables

Forwarders offer freight services and serve as intermediaries between carriers and owners. With a rapid growth in international trade, a high percentage of shippers use international freight forwarders; this supports the argument that the role of the ocean freight forwarder continues to grow in importance (Murphy and Daley, 1997). Therefore, this study focuses on ocean carrier traits that affect choices made by freight forwarders.

This study uses 23 ocean carrier service attributes as variables for market segmentation and positioning, as shown in Table 1. These 23 items have appeared in previous studies and in a survey of marine transportation operations managers.

3.2 Factor Analysis

Past studies had identified a large number of service attributes; therefore, exploratory factor analysis was used to produce a small number of latent factors as a representation of a large number of observable attributes (Hair *et al.*, 2006).

Principal component analysis with a VARIMAX (orthogonal) rotation was used as the extraction method. Eigenvalues were plotted against a number of factors and checked for magnitudes greater than or equal to one. Observable attributes were retained in the final result if the factor loadings were greater than 0.45. Any factor was considered reliable if its coefficient alpha value was greater than 0.6 (Nunnally, 1978).

3.3 Two-Step Cluster Analysis

Cluster analysis was used to identify market segments on the basis of forwarders' perceptions of carriers' services. The result of factor analysis must be subjected to cluster analysis. Cluster analysis divides samples into several sub-groups (segments) with high homogeneity within clusters and high heterogeneity between different clusters (Hair *et al.*, 2006).

Simple clustering can be hierarchical or non-hierarchical (Chakrapani, 2004). Hierarchical clustering illustrates segments in tree diagrams; it is suitable for small samples. However, as the sample size increases, the computational burden increases and output interpretation often becomes difficult and subjective. On the other hand, non-hierarchical methods can analyze very large data sets; they allow the analyst to specify the number of clusters to be formed in advance, but it can be difficult to find an optimal number of clusters.

This study applies a two-step clustering method (*i.e.*, a combination of hierarchical and non-hierarchical cluster analyses); it divides the data into groups by a BIC (Bayesian information criterion) index that can overcome the traditional cluster analysis. This BIC automatically determines the number of clusters on the basis of objective statistical criteria and allows consideration of both continuous and categorical variables (Okazaki, 2006).

3.4 Correspondence Cluster Analysis

Positioning analysis often uses multidimensional perceptual maps to uncover competitive positions of competing products or brands. Two types of multivariate statistical methods, namely correspondence analysis and multidimensional scaling, have been applied to produce perceptual maps that graphically plot relationships between consumer perceptions of products and product attributes (Myers, 1996). Although the two approaches produce similar perceptual maps, correspondence analysis requires the respondent to put a check mark by each attribute that characterizes a brand, whereas multidimensional scaling requires respondents to rate products on scales. The data collection for correspondence analysis is quicker and easier than that of multidimensional scaling (Wen and Yeh, 2010). In this study,

correspondence analysis produces perceptual maps that show the relationships between ocean carriers, between attributes, and between carriers and attributes.

Correspondence analysis is a statistical method based on a contingency table of non-negative entries. Two categorical variables are tabulated as points in low-dimensional vector spaces (Greenacre, 1994). The contingency table is transformed into a graphical display that identifies the positions of competitive brands. The two-way contingency table in the present study consists of rows for ocean carriers and columns for carrier service attributes.

Correspondence analysis reduces multidimensional data into fewer (usually two) dimensions illustrated in one or more maps (Whitlark *et al.*, 2001). The number of dimensions is based on eigenvalues which indicate the relative contribution of each dimension to the explanation of data variance. The largest contribution of an attribute is shown by an axis on the map.

Traditional correspondence analysis requires the analyst to judge which objects ought to be grouped together in the perceptual map. The subjectivity inherent in such arbitrary judgements can be avoided by correspondence cluster analysis, which incorporates hierarchical cluster analysis into correspondence analysis (Lebart, 1994). Our hierarchical cluster analysis uses the X and Y coordinates from the correspondence analysis as inputs; the outputs of our correspondence cluster analysis are subjected to discriminant analysis.

4. DATA COLLECTION

A self-administered questionnaire was designed to collect survey data from freight forwarders that provide services between Taiwan and South China. This research only addresses the ocean carriers' regular liner services.

In terms the total dollars of import and export trade, China was one of the most important foreign trade partners for Taiwan in 2007; by 2008, China had become Taiwan's biggest source of orders. This underscores the importance of commercial relations between Taiwan and China. In practice, most destinations in China can be labelled as North, Central, or South China destinations. Taiwan-South China routes were chosen for study because these routes have many port throughputs and carrier operations. A list of freight forwarders that provide services between Taiwan and South China was assembled. The questionnaires were conveyed by e-mail and postal mail to the forwarders on the list that had addresses in Taiwan.

The survey instrument had three sections. The first section obtained profile information about respondents and carriers (*e.g.*, employment period, employment status, number of employees, and type of company ownership). The second section inquired how satisfied forwarders were with carriers; to indicate satisfaction in a carrier's service attribute, respondents simply put a check-mark by that attribute; respondents were not required to mark all carriers and attributes. The last section asked about the perceived importance of carriers' service attributes; each trait was assessed using a seven-point Likert scale ranging from 1 = "very unimportant" to 7 = "very important."

The survey was conducted from April, 2009 to June, 2009. Out of 600 distributed questionnaires, final analysis was based on 156 completed questionnaires, *i.e.* a response rate of 26.0% (=156/600). The majority of the respondents had an employment period of 1 to 5 years (41.0%). More than 70.0% of the respondents were managers, assistant managers, or operators (OP). 47.4% of the respondents' firms had less than 50 employees. The capital of most companies was under 10 million NTD (39.1%) and the most frequently reported shipping line was the Taiwan-China route (21.5%). The average monthly volume handled by the respondents' companies was under 200 TEU (55.1%). For purposes of this research, "average monthly volume" only refers to the most recent year and the Taiwan-China routes; the volumes handled for other routes did not enter the calculations.

Based on average scores analysis, the scores of service attributes were ranked in order from highest importance to lowest importance as shown in Table 2. Respondents perceived price factors (such as "reasonable pricing," "promptness in answering pricing inquiry," and "pricing flexibility") as important service attributes, with "reasonable pricing" as the least-favoured attribute. Staff service factors (such as "knowledge of sales personnel," "prompt response to shipper's complaints," and "politeness and attitude of sales personnel") ranked among the top five most important attributes.

5. RESULTS

5.1 Segmentation Analysis

Table 3 reports the estimation results of factor analysis. The results indicate that the Kaiser-Meyer-Olkin measure of sampling accuracy was well above 0.903, and Bartlett's test of sphericity's χ^2 was 2733.028 (with 253 degrees of freedom). As the KMO index was greater than 0.5 and Bartlett's test achieved a high level of significance, the results were desirable. The Cronbach's alpha of each factor was greater than 0.5, indicating high reliability levels. The design required eigenvalues greater than or equal to one and factor loadings greater than 0.45. The 23 service attributes were categorized into four multiple-item service factors, namely "service performance," "reputation/knowledge," "freight charge/response," and "information technology/ communication."

Subsequently, two-step cluster analysis was used to determine market segments on the basis of four multiple-item service factors. Additional segmentation variables included number of employees in Taiwan, sources of funding, the major shipping line of the China route, company's capital in Taiwan, and average monthly container volumes.

The BIC criterion divided the 156 respondents into two segments: 106 respondents were in Segment One and 50 respondents were in Segment Two. A comparison of the factor scores indicated that Segment One had highest centroid scores on service performance and reputation/knowledge, but it had negative scores on freight charge/response and information technology/communication. In this segment, the number of employees, company's capital,

and average container volumes per month were relatively small. Hence, the first segment was named the “small firms that emphasize service performance and reputation” segment. The other segment was named “large firms that emphasize freight charges and information technology.” Table 4 profiles the respondents for the two segments.

Segment One: Small firms that emphasize service performance and reputation

This segment represents 67.9% of the forwarder market in Taiwan. Most respondents (69.8%) in this segment had a small number of employees (*i.e.* less than 50 employees). The highest proportion of company’s capital was under NT\$10 million (54.7%), and more than 70% of the forwarders moved less than 200 TEU per month on average. This means that the forwarders in this segment were small companies.

Segment Two: Large firms that emphasize freight charges and information technology

The second market segment makes up 32.1% of the forwarder market in Taiwan. 46% of these firms had more than 500 employees in Taiwan. 28.0% of these respondents reported that their company’s capital in Taiwan was over 50 million and under 100 million, and 20.0% reported that their company’s capital was over 100 million. 72% of these companies moved an average of more than 300 TEU per month on Taiwan-South China routes.

5.2 Position Analysis

For each market segment, correspondence analysis was initially used to produce perceptual maps based on forwarders’ satisfaction levels. Hierarchical cluster analysis was adopted to identify carriers and service attributes in close proximity to each other on the perceptual maps. Discriminant analysis justified the grouping result.

Previous studies have shown that relevant data for such multidimensional analyses must exclude single occurrences and the lowest one-third of the frequency distribution (Lebart, 1998). Carriers selected by very few respondents were excluded from the contingency tables for correspondence analysis because such data might have obscured potentially significant patterns. The final result consisted of nine carriers: Wan Hai Lines Ltd. (WHL), Evergreen Marine Co., Ltd. (EMC), T. S. Lines Co., Ltd. (TS), Kanway Line Co., Ltd. (KHL), Yang Ming Marine Transport Co., (YM), Cheng Lie Navigation Co., Ltd. (CNC), Yi Tong Maritime Co., Ltd. (YTL), COSCO Container Line Ltd. (COSCO), and Orient Overseas Container Line Ltd. (OOCL).

Hierarchical cluster analysis produced the tree diagrams shown in Figure 1. The overall measure of heterogeneity increased as clusters were combined. The process culminated by producing a single cluster. The large changes in fusion levels indicate the best cut for the number of clusters. The largest change in fusion levels was at 15 units of distance. The tree diagram placed WHL, EMC and YM in one major group and the other carriers (*i.e.*, TS, KHL, CNC, YTL, COSCO and OOCL) in another group. The discriminant analysis revealed that

100% of carriers and attributes were correctly classified. These results indicate a high degree of statistical confidence in classification of group membership by hierarchical cluster analysis based on a two-dimensional map.

Table 5 shows that a two-dimensional solution for Segment One explained 70.0% of the total variance. Singular values for the correspondence analysis on nine carriers were 0.187 and 0.07. Because the three-dimensional solution only increased inertia by 8.2% and made the interpretation more difficult, the two-dimensional solution was adopted.

Figure 2 shows two dimensions for correspondence analysis of Segment One. Each attribute explains some percentage of the variance. The larger the absolute percentage of an attribute is in a dimension, the more importance that attribute has for the latent structure of that dimension. Table 6 shows that the first dimension is defined by two extremes: “reasonable pricing” (V1) and “pricing flexibility” (V2), which have the major absolute contributions to the dimension; “user-friendly website” (V19) and “company EDI interface” (V20) also have large contributions. Thus, the first dimension was called “pricing/information.” For the second dimension, the attributes with the largest weights were “reasonable pricing” (V1) and “user-friendly website” (V19), but these attributes made larger contributions to the first dimension. The other attributes that contributed to the second dimension include “frequency of sailing” (V8), “pickup and delivery service” (V14), and “equipment availability” (V11). Therefore, this dimension was named “schedule/equipment availability.”

Overall, WHL, EMC and YM are highly competitive in Segment One because they provide similar level of services in “equipment availability” (V11), “ability to provide special equipment” (V12), “ability to trace shipments” (V13), “user-friendly website” (V19), “company EDI interface” (V20), and “company reputation and image” (V21). In contrast, these carriers performed poorly on freight rates, because their locations on the map are far away from this attribute.

TS, KHL, CNC, YTL, COSCO and OOCL can be regarded as another competitive group. According to the tree diagram for Segment One, these carriers can be further subdivided into three sub-major classes. The first group of carriers includes TS, KHL and CNC, all of which perform well for “promptness in answering pricing inquiry” (V4), “speed on bill of lading” (V5), “prompt response to shipper’s complaints” (V6), “free time period” (V15), “knowledge of sales personnel” (V22), and “politeness and attitude of sales personnel” (V23). The second group consists of COSCO and OOCL, with regard to service attributes such as “customer relationships management” (V3), “bill of lading accuracy” (V9), and “safety of shipping” (V10); forwarders in this segment perceive similar performance between these two carriers. The third group has only a single carrier, YTL, which has unique features such as “reasonable pricing” (V1) and “pricing flexibility” (V2).

For Segment Two, the first and second axes explained 55.6% and 15.4% of the total inertia, respectively (Table 5). The singular values were 0.228 and 0.120, which indicated a good representation of the data in Table 5. The two dimensions of Segment Two were named based on the highest contributions (Table 6). Because two extremes, “pricing flexibility” (V2)

and “equipment availability” (V11), defined the first dimension, we named it “pricing/equipment availability.” The second dimension was explained by the attributes in the upper half of the map (*i.e.*, “company EDI interface” (V20) and “free time period” (V15)) and in the lower half of the map (*i.e.*, “promptness in answering pricing inquiry” (V4), “sailing schedule reliability” (V7), and “frequency of sailing” (V8)). Therefore, this dimension was named “information/schedule.”

Hierarchical cluster analysis of the X and Y coordinates from the correspondence analysis produced three main groups, as shown in Figure 3. Figure 4 illustrates the result of correspondence cluster analysis for Segment Two. The first group appears on the upper right side of the map and contains EMC and YM. The second group consists of WHL, CNC, COSCO, and OOCL; it is located on the bottom half of the map. The third group of carriers includes TS, KHL and YTL; it appears on the left half of the map. The discriminant analysis showed that 98.0% of carriers and attributes were correctly classified.

The forwarders in Segment Two considered EMC and YM to be competitors within the same group. Some services they provide scored better than others, *i.e.*, “ability to trace shipments” (V13), “pickup and delivery service” (V14), “knowledge of sales personnel” (V22), and “politeness and attitude of sales personnel” (V23). The second major competitive group included TS, KHL and YTL. They achieved satisfactory performance for “reasonable pricing” (V1), “pricing flexibility” (V2), “prompt response to shipper’s complaints” (V6), “free time period” (V15), and “provision of complete multimodal transport” (V16).

The third competitive group consisted of WHL, CNC, COSCO, and OOCL. This third group was divided into two sub-groups. The first sub-group included CNC, COSCO, and OOCL, which were surrounded by services such as “customer relationships management” (V3), “promptness in answering pricing inquiry,” “speed on bill of lading” (V5), “sailing schedule reliability” (V7), and “bill of lading accuracy” (V9). The second sub-group only included a single carrier, WHL, that was perceived to perform well for “frequency of sailing” (V8), “safety of shipping” (V10), “direct shipping to the port of destination” (V17), “availability of cargo space” (V18), and “company reputation and image” (V21).

6. DISCUSSION AND CONCLUSIONS

This research addresses market segmentation and position analysis with regard to ocean carriers for the Taiwan-South China routes. Ocean carriers that are aware of market segmentation and position will focus on their target market(s) and allocate resources more effectively and efficiently. In this study, customers reported that they were primarily concerned with reasonable pricing, promptness in answering pricing inquiries, knowledge of sales personnel, prompt response to shippers’ complaints, and politeness and attitude of sales personnel. Reasonable pricing was perceived as the most important attribute. Thus, a carrier that offers low freight rates can gain a competitive edge. The attitudes and responses of sales personnel are also critical. Competitive carriers might improve these attributes by personnel training programs. The results suggest that carriers’ strategies should reflect these service attributes.

Factor analysis and two-step cluster analysis were performed based on forwarders' perceptions of service attributes. Two types of forwarders were identified: "small firms that emphasize service performance and reputation" and "large firms that emphasize freight charges and information technology." The small forwarders cannot compete against the large ones on freight rates, and thus they pay considerable attention to service performance and company reputation. The large forwarders pay attention to freight charges and prefer to select carriers with advanced information technology.

For each of the two segments, correspondence cluster analysis produced perceptual maps that illustrated the relative positions of ocean carriers and their key strengths and weaknesses. Ocean carriers tend to compete against firms that share similar attribute profiles; groups of competing firms can be identified on the maps. Any carrier can choose a target market and establish a market strategy, either according to its competitive group, or according to customer perceptions of services. For example, WHL, EMC, and YM are grouped together in Segment One. WHL, CNC, COSCO, and OOCL also form a competitive group in Segment Two. Thus, WHL is positioned in a highly competitive situation in the two segments. WHL competes against two firms in Segment One and against three firms in Segment Two; WHL might choose to target the Segment One market in order to reduce the amount of competition. In Segment One, WHL, positioned in the upper-right quadrant, is closely related to schedule and information. Unfortunately, respondents perceived WHL to have poor performance for two important attributes, freight rates and pricing flexibility. Therefore, the managers of WHL could implement price improvements, such as fare discounts, to maintain current customers and to attract potential customers. In addition to strengthening competitive advantages with regard to the attributes that surround it, WHL could also plan strategies that reflect the strengths and weaknesses of its major rivals.

Any two firms that are close to each other on the map are similar with respect to some key attributes. For instance, in both segments, YM and EMC are close to each other. To target the customers in Segment Two, EMC might improve information technology to maintain its current competitive advantage. Likewise, EMC might tackle its weaknesses by reducing its freight rates.

When an ocean carrier is not closely associated with other carriers and has very few attributes near it, one may conclude that performance of that carrier is ordinary on the whole. In Segment One, YTL is positioned in the upper-left quadrant and not strongly related to other carriers. However, it achieves excellent performance on "reasonable pricing" and "pricing flexibility." In order to thrive in Segment One, YTL should maintain its competitive advantages on these two attributes and allocate company resources to improve other attributes that matter to customers in Segment One, such as service performance and reputation factors.

Large groups of firms with similar service attributes can be subdivided into sub-groups. Tree diagrams illustrate the competitive relationships between and among sub-groups. In Segment One, for example, TS, KHL, CNC, YTL, COSCO, and OOCL are regarded as a

major group of competitors; that group can be further subdivided into three sub-groups. Each of the carriers could develop strategies to differentiate its service from its major competitors in the sub-group. For example, OOCL and COSCO are located in close proximity to each other. To compete against COSCO, OOCL could maintain or even enhance its key advantages (*i.e.* customer relationships management, safety of shipping, and bill of lading accuracy) or improve its key weaknesses, such as frequency of sailing or pickup and delivery service.

The main limitation of this study is that only one market (Taiwan-South China) was selected, and therefore the findings cannot be applied to other routes with diverse market characteristics. Future research can undertake market segmentation and position analysis for sea routes in other regions.

REFERENCES

- Beirão, G. and J. S. Cabral (2008). Market segmentation analysis using attitudes toward transportation: exploring the differences between men and women. *Transportation Research Record*, 2067, 56-64.
- Brian, S. E., S. Landau and M. Leese (2001). *Cluster Analysis*. Oxford University Press, New York.
- Chakrapani, C. (2004). *Statistics in Marketing Research*. Oxford University Press, New York.
- Collision, F. M. (1984). Market segments for marine liner service. *Transportation Journal*, 24, 40-54.
- Cullinane, K. and N. Toy (2000). Identifying influential attributes in freight route/mode choice decisions: a content analysis. *Transportation Research Part E*, 36, 41-53.
- Diana, M. and P. L. Mokhtarian (2009). Grouping travellers on the basis of their different car and transit levels of use. *Transportation*, 36, 455-467.
- Greenacre, M. J. and J. Blasius (1994). *Correspondence Analysis in the Social Sciences*. Academic Press, London.
- Gursoy, D., M.-H. Chen, and H. J. Kim (2005) The US airlines relative positioning based on attributes of service quality. *Tourism Management*, 26, 57-67.
- Hair, Jr. J. F., R. E. Anderson, R. L. Tatham and W. C. Black (2006). *Multivariate Data Analysis*. Prentice Hall, New Jersey.
- Kent, J. L. and R. S. Parker (1999). International containership carrier selection criteria shippers/carriers difference. *International Journal of Physical Distribution and Logistics Management*, 29, 398-408.
- Lebart, L. (1994). *Complementary use of correspondence analysis and cluster analysis*. Academic Press, London.
- Lebart, L. (1998). *Visualization of Textual Data*. Academic Press, CA.
- Lu, C. S. (2003a). The impact of carrier service attributes on shipper-carrier partnering relationships: a shipper's perspective. *Transportation Research Part E*, 39, 399-415.
- Lu, C. S. (2003b). Market segment evaluation and international distribution centres. *Transportation Research Part E*, 39, 49-60.
- Mangan, J., C. Lalwani and B. Gardner (2002). Modelling port/ferry choice in RoRo freight transportation. *International Journal of Transport Management*, 1, 15-28.

- Mason, K. J. and R. Gray (1995). Short haul business travel in the European Union: a segmentation profile. *Journal of Air Transport Management*, 2, 197-205.
- Morash, E. A. and J. Ozment (1994). Toward management of transportation service quality. *Logistics and Transportation Review*, 30, 115-140.
- Myers, J. H. (1996). *Segmentation and Positioning for Strategic Marketing Decision*. American Marketing Association, Chicago.
- Murphy, P. R. and J. M. Daley (1997). Investigating selection criteria for international freight forwarders. *Transportation Journal*, 37, 29-36.
- Nunnally, J. C. (1978). *Psychometric Theory*. McGraw-Hill, New York.
- Okazaki, S. (2006). What do we know about mobile Internet adopters? a cluster analysis. *Information & Management*, 43, 127-141.
- Outwater, M. L., S. Castleberry, Y. Shiftan, M. Ben-Akiva, Y. S. Zhou, and A. Kuppam (2004a). Attitudinal market segmentation approach to mode choice and ridership forecasting. *Transportation Research Board*, 1854, 32-42.
- Outwater, M. L., V. Modugula, S. Castleberry, and P. Bhatia (2004b). Market segmentation approach to mode choice and ferry ridership forecasting. *Transportation Research Board*, 1872, 71-79.
- Shiftan, Y., M. L. Outwater, and Y. S. Zhou (2008). Transit market research using structural equation modelling and attitudinal market segmentation. *Transport Policy*, 15, 186-195.
- Smith, W. R. (1956). Product differentiation and market segmentation as alternative marketing strategies, *Journal of Marketing*, 21, 3-8.
- Wen, C.-H. and J.-Y. Huang (2007). A discrete choice model of ocean carrier choice. *Journal of the Eastern Asia Society for Transportation Studies*, 7, 795-807.
- Wen, C.-H., S.-C. Lai, and W.-Y. Yeh (2008). Segmentation and positioning analysis for international air travel market: Taipei-to-Tokyo route. *Transportation Research Record*, 2052, 46-53.
- Wen, C.-H. and W.-Y. Yeh (2010). Positioning of international air carriers using multidimensional scaling and correspondence analysis. *Transportation Journal*, 49, 7-23.
- Whitlark, D. and S. Smith (2001). Using correspondence analysis to map relationships. *Marketing Research*, 13, 23-27.
- Zhou, Y., K. Viswanathan, Y. Popuri, and K. E. Proussaloglou (2004). Transit district customers in San Mateo County, California: who, why, where, and how. *Transportation Research Record*, 1887, 183-192.

TABLE 1 – Service Quality of Ocean Carriers

Attributes	Sources
1. Reasonable pricing	Collision (1984); Kent and Parker (1999); Lu (2003)
2. Pricing flexibility	Collision (1984); Kent and Parker (1999); Lu (2003)
3. Customer relationships management	Lu (2003); Wen and Huang (2007)
4. Promptness in answering pricing	recommendation by experts and forwarders
5. Speed on bill of lading	Collision (1984); Wen and Huang (2007)
6. Prompt response to shipper's complaints	Lu (2003); Wen and Huang (2007)
7. Sailing schedule reliability	Collision (1984); Kent and Parker (1999); Lu (2003); Wen and Huang (2007)
8. Frequency of sailing	Collision (1984); Kent and Parker (1999); Lu (2003); Wen and Huang (2007)
9. Bill of lading accuracy	Kent and Parker (1999); Wen and Huang (2007)
10. Safety of shipping	Lu (2003)
11. Equipment availability	Collision (1984); Kent and Parker (1999); Lu (2003); Wen and Huang (2007)
12. Ability to provide special equipment	Collision (1984); Lu (2003); Wen and Huang (2007)
13. Ability to trace shipments	Collision (1984); Kent and Parker (1999); Lu (2003); Wen and Huang (2007)
14. Pickup and delivery service	Kent and Parker (1999); Lu (2003); Wen and Huang (2007)
15. Free time period	Wen and Huang (2007)
16. Provision of complete multimodal transport	Kent and Parker (1999)
17. Direct shipping to the port of destination	Lu (2003)
18. Availability of cargo space	Collision (1984); Kent and Parker (1999); Lu (2003); Wen and Huang (2007)
19. User-friendly website	recommendation by experts and forwarders
20. Company EDI interface	Collision (1984); Kent and Parker (1999); Lu (2003); Wen and Huang (2007)
21. Company reputation and image	Kent and Parker (1999)
22. Knowledge of sales personnel	Wen and Huang (2007)
23. Politeness and attitude of sales personnel	Kent and Parker (1999); Lu (2003); Wen and Huang (2007)

TABLE 2 – Mean Scores and Ranking of the Service Attributes

Attributes	Mean	Variance	Ranking
1. Reasonable pricing	6.54	0.80	1
2. Pricing flexibility	6.01	1.71	10
3. Customer relationships management	5.46	2.01	22
4. Promptness in answering pricing inquiry	6.29	1.35	2
5. Speed on bill of lading	6.04	1.81	7
6. Prompt response to shipper's complaints	6.17	1.79	4
7. Sailing schedule reliability	6.02	1.76	9
8. Frequency of sailing	5.92	1.72	12
9. Bill of lading accuracy	5.78	1.93	15
10. Safety of shipping	6.11	1.44	6
11. Equipment availability	5.81	2.05	14
12. Ability to provide special equipment	5.56	1.72	19
13. Ability to trace shipments	5.99	1.69	11
14. Pickup and delivery service	5.72	1.83	17
15. Free time period	5.76	1.90	16
16. Provision of complete multimodal transport	5.49	2.11	21
17. Direct shipping to the port of destination	5.60	1.90	18
18. Availability of cargo space	6.03	2.19	8
19. User-friendly website	5.55	2.74	20
20. Company EDI interface	5.26	2.33	23
21. Company reputation and image	5.85	2.31	13
22. Knowledge of sales personnel	6.20	1.37	3
23. Politeness and attitude of sales personnel	6.12	1.37	5

TABLE 3 – Factor Analysis of the Service Attributes

Items	Factor loadings	Eigenvalue	Cronbach's alpha	Percentage of variance explained
Factor 1: Service performance		11.443	0.949	30.860
7. Sailing schedule reliability	0.618			
8. Frequency of sailing	0.661			
9. Bill of lading accuracy	0.661			
10. Safety of shipping	0.652			
11. Equipment availability	0.801			
12. Ability to provide special equipment	0.687			
13. Ability to trace shipments	0.697			
14. Pickup and delivery service	0.757			
15. Free time period	0.772			
16. Provision of complete multimodal transport	0.653			
17. Direct shipping to the port of destination	0.800			
18. Availability of cargo space	0.713			
19. User-friendly website	0.488			
Factor 2: Reputation and knowledge		1.716	0.851	14.950
21. Company reputation and image	0.654			
22. Knowledge of sales personnel	0.809			
23. Politeness and attitude of sales personnel	0.766			
Factor 3: Freight charge and response		1.434	0.815	13.449
1. Reasonable pricing	0.562			
2. Pricing flexibility	0.757			
4. Promptness in answering pricing inquiry	0.767			
5. Speed on bill of lading	0.633			
6. Prompt response to shipper's complaints	0.648			
Factor 4: Information technology and communication		1.219	0.715	9.491
3. Customer relationships management	0.818			
20. Company EDI interface	0.805			

Note: Factor loadings smaller than 0.45 were excluded.

TABLE 4 – The Profile of the Respondents Among Two Segments

Characteristics	Segment One	Segment Two
Employment period		
Under 1 year	7.5	8.0
1-5 years	41.5	40.0
6-10 years	12.3	30.0
Over 11 years	38.7	22.0
Business or work position		
Assistant manager	12.3	6.0
Managers/assistant managers	36.8	32.0
Director	2.8	10.0
Operator (OP)	35.8	32.0
Sales representative	6.6	16.0
Customer service (CS)	4.7	4.0
Other	1.0	0.0
Established time of company		
Under 5 years	7.5	0.0
6-10 years	27.4	8.0
11-15 years	29.2	30.0
16-20 years	8.5	20.0
Over 21 years	27.4	42.0
Number of employees in Taiwan		
Under 50 people	69.8	0.0
51-100 people	19.8	26.0
101-200 people	6.6	6.0
201-500 people	3.8	22.0
Over 500 people	0.0	46.0
Sources of funding		
Exclusively Taiwanese capital	72.6	98.0
Exclusively foreign capital	9.4	2.0
Joint venture	18.0	0.0
Investment of carrier		
Have no carrier investment	96.2	94.0
Under 50% of stock ownership for shipping	3.8	6.0
Company's capital		
Under NT\$10 million	54.7	6.0
Over 10 million and under 20 million	26.4	18.0
Over 20 million and under 30 million	11.3	12.0
Over 30 million and under 50 million	1.9	16.0
Over 50 million and under 100 million	4.7	28.0
Over 100 million	1.0	20.0
Major shipping line		
North America route	13.3	11.9
Central & South America route	7.9	7.8
China route	22.7	20.1
Europe route	15.1	13.5
South East Asia route	20.5	16.4
North East Asia route	9.4	13.9
Australia route	6.3	8.6
Africa route	3.6	7.0
Other	1.2	0.8
Average container volumes per month of 2008		
Under 200 TEU	70.8	22.0
201-300 TEU	17.0	6.0
301-400 TEU	5.7	24.0
401-500 TEU	0.9	8.0
501-600 TEU	0.9	16.0
Over 600 TEU	4.7	24.0

Table 5 – Proportion of Inertia in Different Dimensions for Two Segments

Segment	Dimension	Singular value	Accounted for proportion of inertia (%)	Cumulative proportion of inertia (%)
Segment One	1	0.187	61.4	61.4
	2	0.070	8.6	70.0
	3	0.068	8.2	78.2
	4	0.064	7.3	85.5
	5	0.054	5.2	90.7
	6	0.050	4.3	95.0
	7	0.042	3.1	98.1
	8	0.033	1.9	100.0
Segment Two	1	0.228	55.6	55.6
	2	0.120	15.4	71.0
	3	0.091	8.8	79.8
	4	0.084	7.5	87.3
	5	0.065	4.4	91.7
	6	0.061	4.0	95.7
	7	0.048	2.4	98.1
	8	0.042	1.9	100.0

Table 6 – Contributions of Attributes to Dimension Variances

Attributes	Segment One		Segment Two	
	Dimension 1	Dimension 2	Dimension 1	Dimension 2
V1. Reasonable pricing	0.229	0.192	0.077	0.000
V2. Pricing flexibility	0.212	0.013	0.147	0.043
V3. Customer relationships management	0.010	0.081	0.002	0.004
V4. Promptness in answering pricing inquiry	0.018	0.016	0.046	0.077
V5. Speed on bill of lading	0.006	0.005	0.009	0.020
V6. Prompt response to shipper's complaints	0.025	0.000	0.064	0.009
V7. Sailing schedule reliability	0.000	0.031	0.001	0.175
V8. Frequency of sailing	0.014	0.108	0.008	0.067
V9. Bill of lading accuracy	0.000	0.020	0.007	0.000
V10. Safety of shipping	0.000	0.036	0.000	0.013
V11. Equipment availability	0.063	0.089	0.151	0.001
V12. Ability to provide special equipment	0.055	0.013	0.152	0.001
V13. Ability to trace shipments	0.023	0.006	0.000	0.021
V14. Pickup and delivery service	0.005	0.096	0.000	0.007
V15. Free time period	0.010	0.007	0.042	0.200
V16. Provision of complete multimodal transport	0.005	0.052	0.033	0.004
V17. Direct shipping to the port of destination	0.000	0.019	0.019	0.021
V18. Availability of cargo space	0.000	0.032	0.001	0.009
V19. User-friendly website	0.210	0.129	0.145	0.034
V20. Company EDI interface	0.080	0.012	0.038	0.263
V21. Company reputation and image	0.021	0.034	0.051	0.015
V22. Knowledge of sales personnel	0.000	0.001	0.003	0.005
V23. Politeness and attitude of sales personnel	0.011	0.009	0.004	0.011
Total	1.000	1.000	1.000	1.000

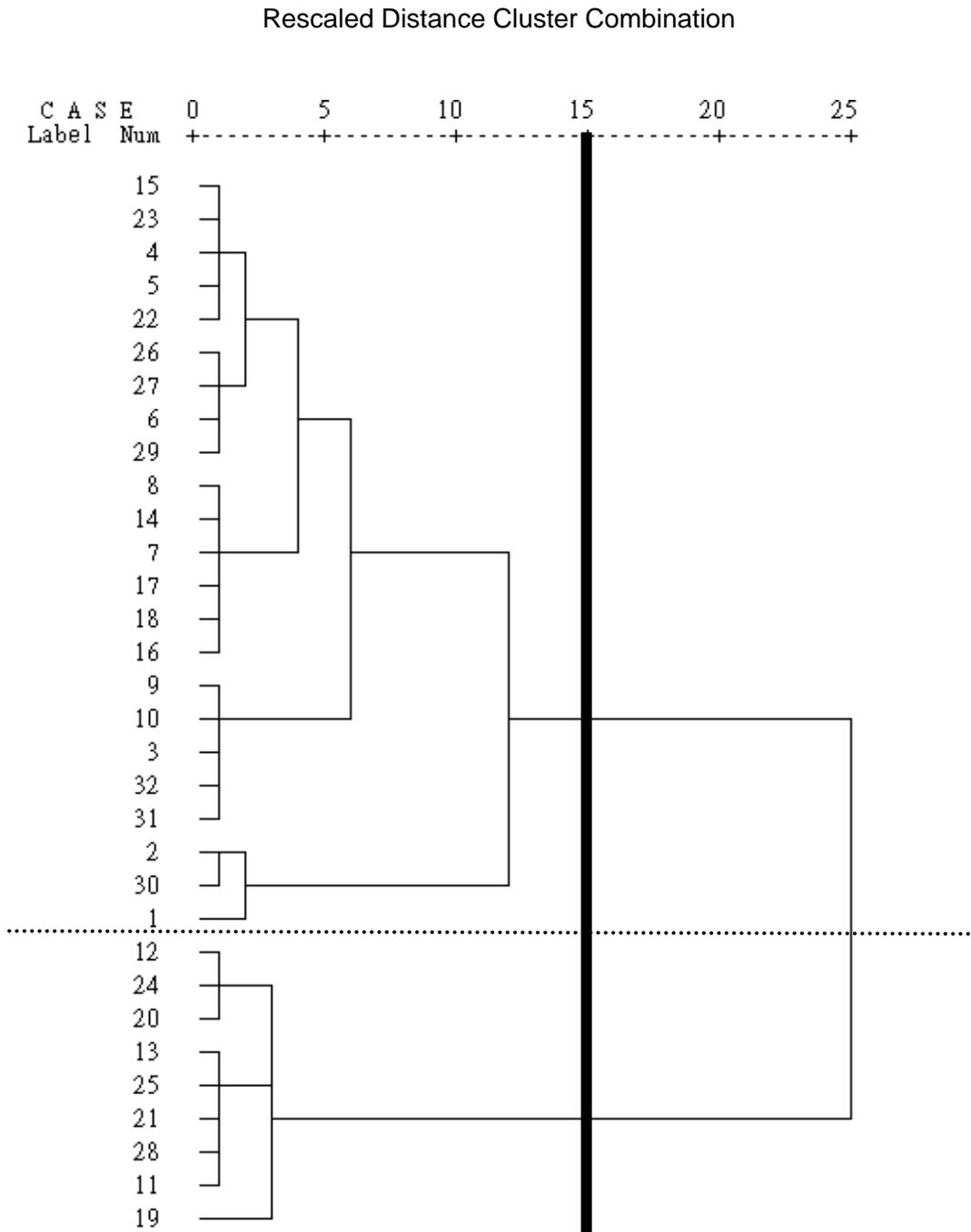
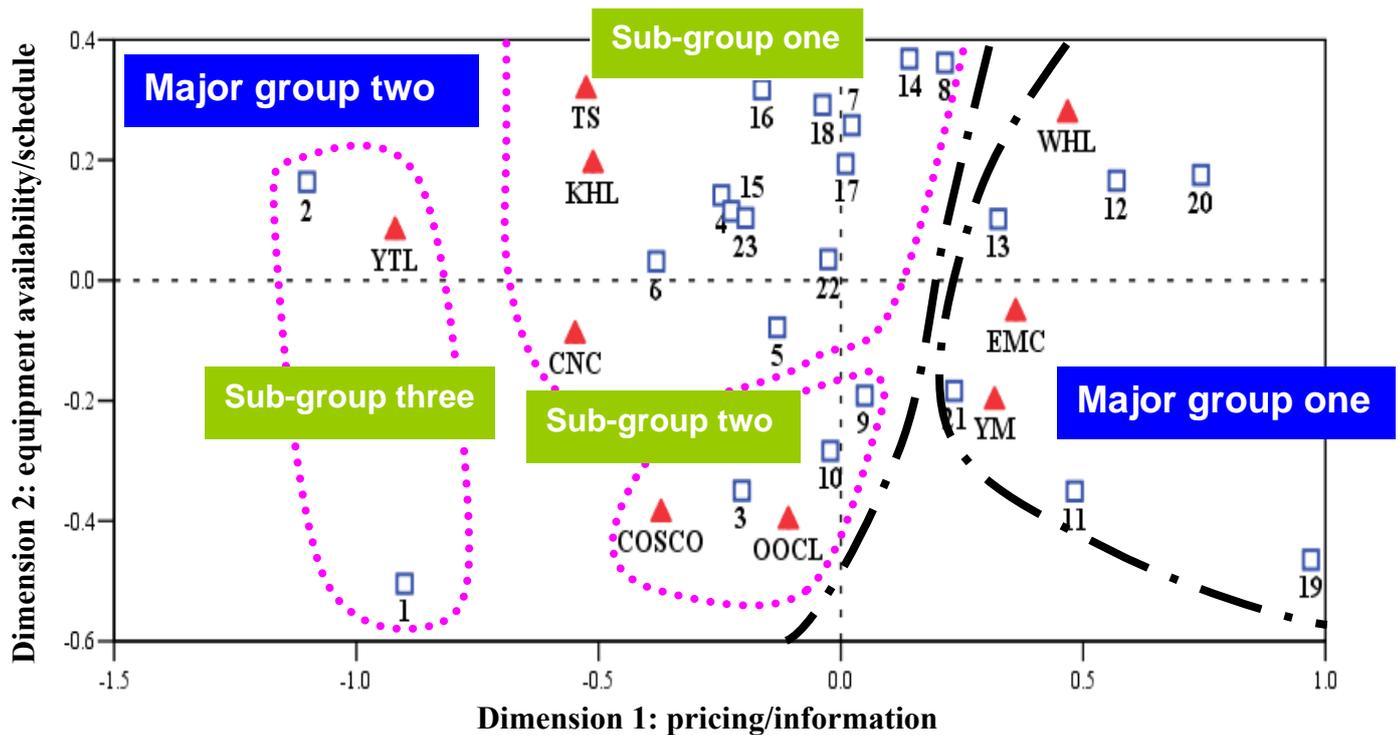


FIGURE 1 – Hierarchical Tree Diagram for Segment One



- | | |
|---|---|
| 1 = Reasonable pricing | 17 = Direct shipping to the port of destination |
| 2 = Pricing flexibility | 18 = Availability of cargo space |
| 3 = Customer relationships management | 19 = User-friendly website |
| 4 = Promptness in answering pricing inquiry | 20 = Company EDI interface |
| 5 = Speed on bill of lading | 21 = Company reputation and image |
| 6 = Prompt response to shipper's complaints | 22 = Knowledge of sales personnel |
| 7 = Sailing schedule reliability | 23 = Politeness and attitude of sales personnel |
| 8 = Frequency of sailing | WHL = Wan Hai Lines Ltd. |
| 9 = Bill of lading accuracy | EMC = Evergreen Marine Co., Ltd. |
| 10 = Safety of shipping | TS = T. S. Lines Co., Ltd. |
| 11 = Equipment availability | KHL = Kanway Line Co., Ltd |
| 12 = Ability to provide special equipment | YM = Yang Ming Marine Transport Co. |
| 13 = Ability to trace shipments | CNC = Cheng Lie Navigation Co., Ltd. |
| 14 = Pickup and delivery service | YTL = Yi Tong Maritime Co., Ltd. |
| 15 = Free time period | COSCO = COSCO Container Line Ltd. |
| 16 = Provision of complete multimodal transport | OOCL = Orient Overseas Container Line Ltd. |

FIGURE 2 – Relative Positioning of Carriers for Segment One

Rescaled Distance Cluster Combination

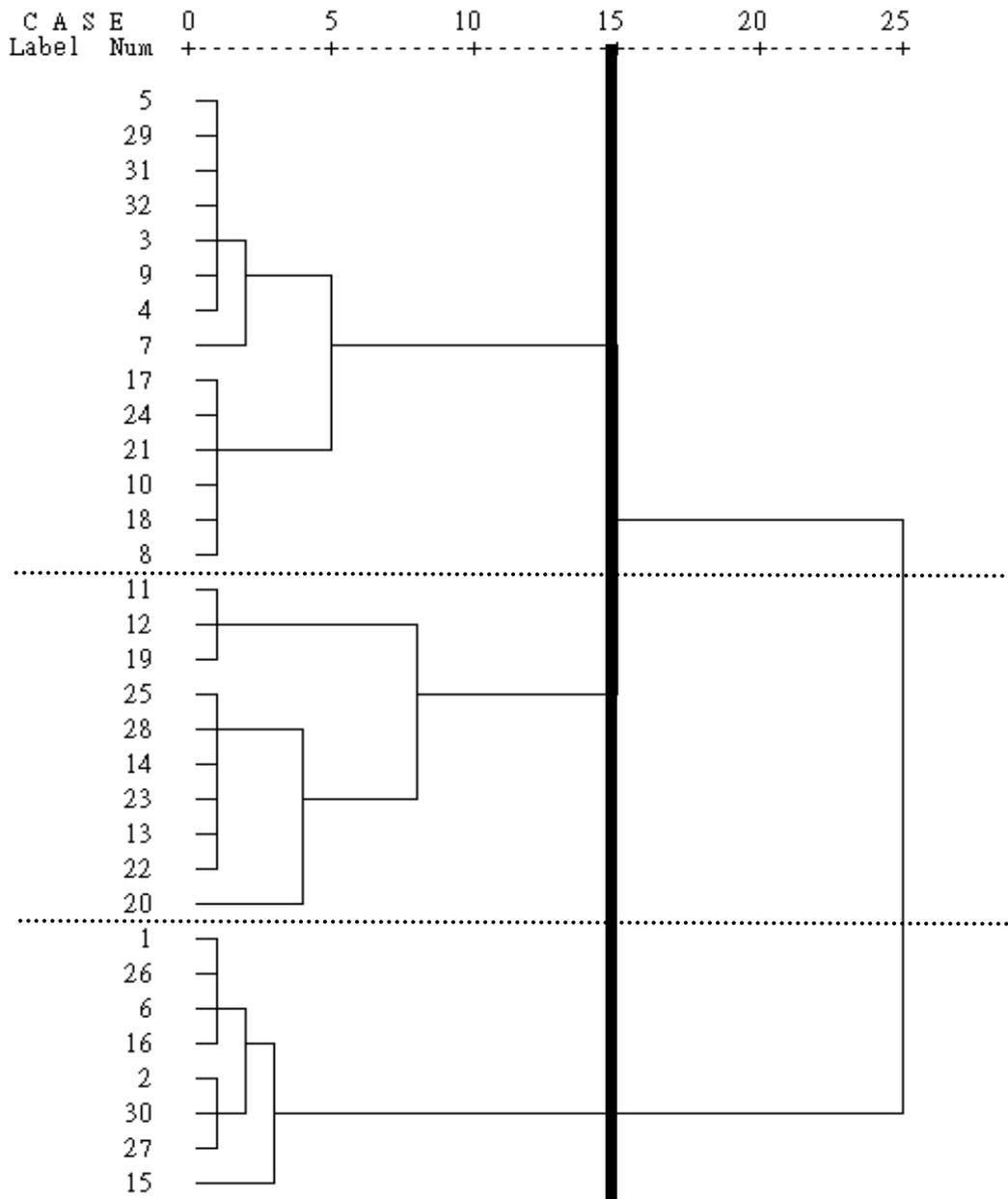


FIGURE 3 – Hierarchical Tree Diagram for Segment Two

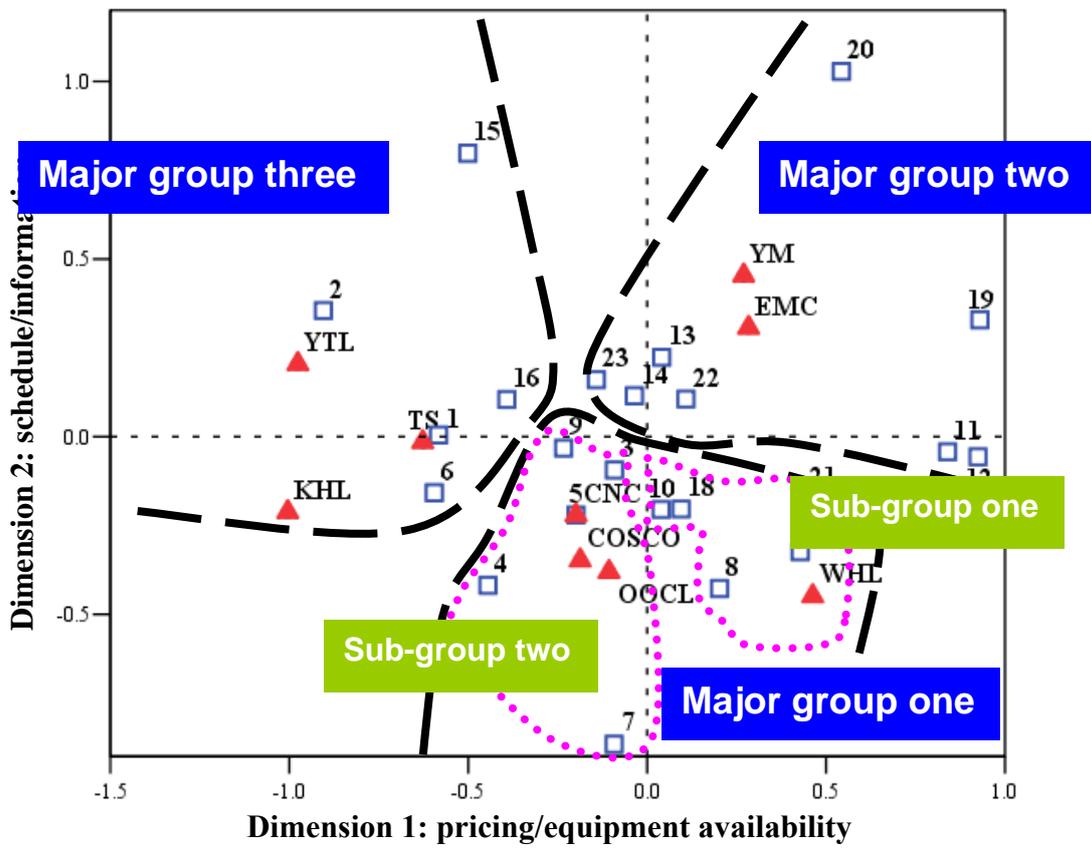


FIGURE 4 – Relative Positioning of Carriers for Segment Two