Journal of the Eastern Asia Society for Transportation Studies, Vol. 8, 2010

A Study on Success Factors of Development Strategies for Intermodal Freight Transport Systems

Yih-Ching JUANG
Associate Professor
Department of Shipping and Transportation Management
National Penghu University
300 Liu-Ho Road, Makung, Penghu
Taiwan 880
Fax +886-6-9265760
E-mail: ycjuang@npu.edu.tw

Michael ROE
Professor
The Business School
University of Plymouth
Drake Circus, Plymouth
United Kingdom PL4 8AA
Fax +00-44-1752585713
E-mail: mroe@plymouth.ac.uk

Abstract: Efficient sea transportation is heavily dependent on the smooth operation of modal interchange, meaning that intermodal transfer is a key element in successful shipping operations with massive transshipment in major seaports. Competition for intermodal links in container ports is sometimes a short-term objective towards the longer-term vision of establishing a container port logistics systems and a global logistics management center. This paper discusses the development strategies of container ports towards the intermodal freight transport systems, and real-world decision problems were examined. Having obtained a good understanding of the data acquired, shippers' perceptions of container transportation and port service were analyzed. The cross-tabulations together with the statistical techniques of factor analysis and a one-way analysis of variance (ANOVA) analysis were applied in order to analyze data comparisons and the relationship between the service purchase behavior and the degree of satisfaction for development strategies.

Key Words: container port logistics systems, intermodal freight transport systems, factor analysis.

1. INTRODUCTION

Containers for transport cargo units improve intermodality so that it becomes common for different ports to share the same hinterland, and they are pushed into port competition (Hoare, 1986). The rise of intermodal transport has resulted in dramatic changes in the pattern of freight transport and port competition in worldwide shipping (Hayuth, 1987). The intermodal system affords exporters and importers impressive opportunities for saving money, expanding markets, and increasing the value added related to distribution, but by far the greatest benefit they afford is the minimization of intermodal transfers. There will be a renewed focus on intermodal freight transportation driven by the changing requirement of global supply chains.

Extension of worldwide transportation needs to avoid the high cost of non-movement, even briefly at the point of interchange between modes. To achieve optimum transportation returns, goods in transit should move forward in a continuous manner. Industry and government are

concerned about the capacity of ports to handle steadily increasing volumes of intermodal containerized traffic, and the ability of ports to develop an intermodal freight transport system. Some actors in the supply chain have responded by providing value-added services in an integrated logistics package, transforming some container shipping lines into logistics management organizations. The fact that a growing number of ocean carriers expand their role by controlling the total logistics chain including inland transport, storage and distribution implies that criteria for port selection are related to the entire transportation journey and thus no longer restricted to maritime transport alone. Consequently, if a seaport does not succeed in attracting carriers, it will be exposed to the risk of substantial losses of container traffic. These developments force ports to make every effort to be competitive in terms of cost and quality of services and to develop the port area into a logistics park and distribution service center.

As major connecting nodes in national and international transport systems, ports play a very important role in the trade development of a regional economy. Container ports were the important nodal points in the entire global logistic chains of containerized freight transportation (Klink and van den Berg, 1998; Baird, 2006). Global trends in containerization inevitably affect container ports both directly and through changing the environment in which they operate. The new trends affecting the container freight industry are explored mainly by reviewing the recent literature on containerization (Slack et al., 1996, Alix et al., 1999, McCalla, 1999, Cullinane and Khanne, 2000, Hess and Rodrigue, 2004) and container port development in different parts of the world (Slack, 1990; Todd, 1990; Heaver, 1993; Comtois, 1994; Notteboom, 1997; Klink and van den Berg,1998; Rimmer, 1998; Wang, 1998; Loo, 1999; Helling and Poister, 2000; Jauernig and Roe, 2000; Woodburn, 2001; Barros and Athanassiou, 2004; Song and Yeo, 2004; Notteboom and Rodrigue, 2005; Notteboom and Rodrigue, 2008). The port, being an interface of land and sea transport, has been conceptualized as the first and most fundamental anchorage point for colonial powers to control the developing world. It was only at later stages that lateral interconnections and inland nodes were developed.

Planning for global logistics management centers implies a demand for good quality logistics services. Major enterprises assume the greatest competitive advantage when they are appropriately supported through key value-added logistics activities. Short-term challenges to intermodal links in container ports need to be overcome to approach the long-term vision of establishing port intermodal transport systems and appropriate management. Many countries seek to have a global logistics management center, since it is assumed to boost trading activities with other countries. Poor logistics support is one of the major reasons for the failure to attract foreign investors. Many actors in the supply chain have responded by providing value-added services in an integrated logistics package, and many container lines have transformed themselves into logistics management organizations. Logistics has the potential to become the next governing element of strategy as an inventive way of creating value for customers, a source of savings, and an important discipline in providing production flexibility.

Under these circumstances, carriers choose a network in which the port is merely one node, though an important one. Consequently, if a seaport does not succeed in attracting some of the carriers, it will be exposed to high risk of substantial loss of container traffic. There are two distribution strategies in a priority hierarchical process during which strategic operating alternatives are evaluated to determine the most cost-effective way of providing the required service level. They are optimal size and the number of transportation facilities. The

fundamental decisions forming the basis of logistics system planning are inventory policy, facility location and transport routing. These developments force ports to make every effort to be competitive in terms of cost and quality of services and to develop the port area into a logistics park and distribution service center. Logistics is marketing oriented and it plays a key role in satisfying the companies' customers, and achieving a profit for enterprises. The expanding literature on intermodalism in developed countries stresses the importance of the process to their economies, and knowledge of their intermodal transport systems is useful in attracting international investors.

We aim to test the developed survey results and analyses the research findings. We will focus on the survey assessment of results as well as on methodological aspects. In this paper, the data of evaluation are examined for the validity test of the overall criteria by using a questionnaire survey from shippers in Taiwan. The research measures the validity of the overall development strategies and the test shows that the overall development strategies have high reliability validity. More generally, its relevance and practicability to tackle real-world decision problems, particularly regarding group decision-making is to be examined. Having obtained a good understanding of the data acquired, this paper aims to test the design model developed for the research. Firstly, the shippers' perceptions of container transportation and port service are analyzed by performing cross-tabulations together with the statistical techniques of factor analysis. Secondly, a one-way analysis of variance (ANOVA) analysis was developed. The statistical techniques of factor analysis and ANOVA were used to utilize the data in order to analyze the relationship between the service purchase behavior and the degree of satisfaction. Finally, the factor analysis and ANOVA results were employed for the purpose of data reduction and analysis.

2. METHODS OF DATA COLLECTION

Transportation planning project selection is of critical importance to container carriers, port service providers and shippers in terms of achieving high customer service level, cost savings and efficiency in the overall supply chain. On the other hand, providers of transportation services have been interested in finding out the salient freight transport selection factors in order to be competitive within freight transport market. These facts have directed the attention of transport and logistics researchers towards the problem of freight transportation selection and as a result of this, much empirical research has been realized. Field research was conducted within the framework of this study reviewing the attributes used in transportation planning project selection criteria research. Along with the questions on importance ranking, data based on the survey for 15 development strategies in three alternative activities category factors that are likely to contribute to the success of container port operating were included in the questionnaire. This 15 strategies item importance scale was developed in order to measure the perception of the Taiwanese container transport shippers. The questionnaires in this research were carried out to acquire the weighting values of the selection factors and test the reliability effectiveness. The data collected from the questionnaires are explained in Table 1.

Table1. Profile of the questionnaires

Objective	Testing the effectiveness of the factors
Methods	Mail delivery questionnaire
Retrieve	248 copies
Reliability validity	Cronbrach's alpha reliability test

The questionnaires were mailed with a cover letter to the shippers. A sample of 1,000 shippers of various sizes ranging from small to large was surveyed by mailing questionnaires. The questionnaires designed for the study was pre-tested on a small group of shippers and finalized before it was utilized for the survey. In addition to the general questions on the nature and performance of each firm, respondents were asked to indicate their perceptions on each of these strategies according to a five-point Likert scale. The scale for each factor ranged from 1 = Least important to 5 = Most important. The questionnaire and the letter of request were provided in both Chinese and English. A stamped envelope was also sent for easy returning of the completed questionnaire. A total of 262 shippers responded to the questionnaire, giving a response rate of 26.2 per cent. Since 14 responses were not useable due to incomplete data, 248 responses were utilized for the study. The statistical techniques of strategy analysis and ANOVA were utilized for analyzing the data. All groups were fairly well represented by the sample shippers, while the electronic and computer equipment group accounted for nearly 50 per cent of all shippers, indicating its dominance in the current manufacturing industry as a shipper in Taiwan. The results of the strategies analysis show a set of three separately identifiable alternative activities as factors that have positive and significant impacts on the success of the sample shippers.

The majority of shippers (60.7 per cent) were private limited companies with the others comprising public limited companies (26.2 per cent), sole proprietorships (7.3 per cent) and partnerships (5.6 per cent). This profile of these shippers is displayed in Table 2. The numbers of small, medium and large shippers included in the sample were 40.3 per cent, 27.4 per cent and 32.3 per cent respectively. Thus, 67.7 per cent of shippers in the sample belonged to the small and medium enterprise (SME) category. This classification was based on a widely used criterion of defining shippers with 1-100 employees as a small-scale industry, and those with 101-300 employees as medium-scale industry. When the shippers' size was measured in terms of annual sales, 18.1 per cent of firms had sales less than 10 million New Taiwanese Dollars (NTDs, 1 US dollar about 33 NT dollars) while the majority of shippers (73.8 percent) had sales ranging from 11 million to 1,000 million NTDs. Only 8.1 per cent of firms had an annual sales turnover exceeding 1,000 million NTDs. Most of the sample shippers (64.5 percent) were engaged in export trade while only 35.5 per cent confined their sales to local customers. Most of the firms that sold their products only to overseas customers were in the electronic and computer industry.

Table 2. Profile of the sample shippers (n=248)

Forms of Organization	Shippers	%	Employees	Shippers	%
Sole proprietorship	18	7.3	1 – 100	100	40.3
Partnership	14	5.6	101 – 200	40	16.1
Private limited company	216	87.1	201 – 300	28	11.3
			> 300	80	32.3
All firms	248	100	Total	248	100
Sales (Millions of NTDs)	Shippers	%	Nature of Sales	Shippers	%
< 10	45	18.1	Both local and overseas	1880	75.8
11 – 100	88	35.5	Overseas only	60	24.2
101 – 1000	95	38.3			
> 1000	20	8.1			
Total	248	100	Total	248	100

3. RESULTS OF THE STATISTICAL ANALYSIS

The statistical analysis of data was carried out in three stages. Firstly, the technique of factor analysis was utilized to reduce the number of variables to meaningful factors, each representing separately identifiable characteristics that could be considered as a set of principal components or determinants of success for shippers. The factor analysis has the ability to summarise the data matrices, and detect the presence of meaningful patterns among a set of variables" (Dess and Davis, 1984). The correlation matrix produced by SPSS software showed a considerable number of correlations exceeding 0.3. Furthermore, the anti-image correlation matrix revealed that all of the measures of sampling adequacy were well above the acceptable level of 0.5, confirming the suitability of our data for a factor analysis. The descriptive statistics were used for ranking the alternative activities in their order of importance. An analysis of variance (ANOVA) was utilized to determine whether the respondents' perceptions on the importance of each factor varied between firms of different sizes. When the original 15 variable strategies were analysed by principle component factor analysis, a three factors solution with an eigen-value of ≥ 1 resulted. The analysis of the remaining 15 variables strategies yielded three significant factors which explained the total variance. The analysis of the remaining 15 variables strategies yielded three significant factors which explained 61.1 per cent of the total variance (see Table 3). These factors were also considered satisfactory according to the reliability test of Cronbach's alpha with a value greater than 0.6 (Cronbach, 1951). These three alternative activities factors and the 15 strategies variables loaded against each, along with the relevant statistical values, are given in Table 3. The factor loadings have ranged from 0.787 to 0.450. The higher a factor loading, the more its test reflects or measures a factor. The literature on factor analysis shows that loadings equal to or greater than 0.40 are considered large enough to warrant interpretation (Kerlinger, 1979). These factors, when ranked in their order of importance ranking in AHP survey are as follows: strategies of port service, marketing, and logistics. This relevant statistical values and raking order also are given in Table 4.

Table 3. Principal components factor analysis

Variables (Strategies)	*Factor 1: Port service*	*Factor 2: Marketing*	*Factor 3: Logistics*
Improve quality of port management	0.728		
Improve service of the people who assign in-port operations	0.708		
Improve efficiency of loading and discharging	0.703		
Establish service system of ship berthing	0.702		
Increase management of berth scheduling	0.657		
Industrialize port management		0.533	
Establish national trade area		0.507	
Develop recreation area		0.761	
Decrease port expense		0.731	
Develop tourism		0.614	
Simplify management of customs			0.569
Format intermodal links			0.786
Improve the system of transportation for exterior			0.758
Set up the port flow area			0.472
Establish check area for container depot			0.450
Eigen-value	**3.99**	**2.88**	**2.66**
Proportion of Variance explained	**24.4%**	**19.3%**	**17.4%**
Cumulative Variance Explained	***24.4%***	***43.7%***	***61.1%***
Alpha (α)	***0.85***	***0.75***	***0.77***

Table 4. Ranking of factors according to their importance

Factor	No. of variables	Mean	Standard Deviation	**Rank**
Factor 1: Port service	**5**	**4.4781**	**0.6487**	**1**
Factor 2: Marketing	**5**	**4.3264**	**0.6418**	**2**
Factor 3: Logistics	**5**	**4.2777**	**0.6491**	**3**

In order to examine possible differences in the perceived importance of factors according to the sizes of the respondents' shippers, the mean values of factors were further analyzed into three groups of firm size as shown in Table 5. The sample shippers were classified into three groups by the number of employees. The small shippers (S1) have less than 100 employees,

medium shippers (S2) with 101 to 300 employees, and large shippers (S3) with over 300 employees. Accordingly, the three groups consisted of 100 small shippers with a mean of 49.6 employees, 68 medium firms with a mean of 183.7 employees, and 80 large firms with a mean of 1151.6 employees. As for the statistical analysis, a One-Way ANOVA was utilized to determine whether there was a statistically significant difference between the means of factors among the above three groups of firms. In addition to determining the differences between means, one-way ANOVA post hoc multiple comparisons were also used to identify the means that would differ. The ANOVA results are shown in Table 5.

Table 5. ANOVA results of group differences between means of factors

	(S1) Small shippers	(S2) Medium shippers	(S3) Large shippers	Significance
	Mean	Mean	Mean	
Factor 1: Port service	$4.32^{a*,b*}$	4.57^{a*}	$4.59^{b*,\ c*}$	0.008^{**}
Factor 2: Marketing	4.18^{b**}	4.34^{c*}	$4.50^{b\ **}$	0.006
Factor 3: Logistics	4.11^{b**}	4.31^{c**}	4.46^{b**}	0.001^{**}

Notes:
1. a = S1 different from S2; b = S1 different from S3; and c = S2 different from S3.
2. Significance levels: * $P<.05$; and ** $P<.01$.

Ranking of the above three factors in order of their importance, along with mean and standard deviation, is shown in Table 6. The importance of these factors, as perceived by the respondents has been ranked on the basis of their mean values. The closer the mean to 5, the higher is the importance of the factor. Accordingly, the ranking followed their means ranged from 4.638 to 2.642.

Table 6. Intermodal transport system development strategies

Development strategies	Ranking	Mean	Standard Deviation
Improve efficiency of loading and discharging	1	4.638	0.44
Improve quality of port management	2	3.993	0.47
Decrease port expense	3	3.921	0.63
Simplify management of customs	4	3.897	0.53
Improve service of the people who assign in-port operations	5	3.801	0.55
Industrialize port management	6	3.748	0.77
Format intermodal links	7	3.579	0.77
Improve the system of transportation for exterior	8	3.500	0.77
Establish service system of ship berthing	9	3.475	0.93
Develop recreation area	10	3.385	0.87
Increase management of berth scheduling	11	3.365	0.87
Establish check area for container depot	12	3.345	0.86
Develop tourism	13	3.073	0.72
Set up the port flow area	14	2.740	0.79
Establish national trade area	15	2.642	0.90

(Note: 1= Lowest Importance; 5=Highest Importance)

4. RESULTS FINDINGS FOR DEVELOPMENT STRATEGIES

The Cronbach's Alpha coefficients (α) of the selection criteria construct for shippers' value from 0.85 to 0.77 in three factors group indicates reliability with high internal consistency of the construct. The survey results indicated some significant differences between the three groups of shippers in respect of three factors:

Factor 1: Port service:

- Improve quality of port management
- Improve service of the people who assign in-port operations
- Improve efficiency of loading and discharging
- Establish service system of ship berthing.
- Industrialize port management

Factor 2: Marketing:

- Establish national trade centre
- Develop recreation area
- Decrease port expense
- Develop tourism
- Increase management of berth scheduling

Factor 3: Logistics:

- Simplify management of customs

- Format intermodal links
- Improve the system of transportation for exterior
- Set up the port flow area
- Establish check area for container depot

Overall mean scores and standard deviations are ranked in order from highest importance to lowest importance in Table 6. '*Improve efficiency of loading and discharging'* (μ=4.638), '*Improve quality of port management*' (μ=3.993), '*Decrease port expense*' (μ=3.921) '*Simplify management of customs'* (μ=3.897) and '*Improve service of the people who assign in-port operations* '(μ=3.801) were determined as the most important top five development strategies of intermodal transport system selection criteria with respect to the perceptions of shippers' respondents.

Factor analysis and principal components analysis was applied for the determination of the main components of development strategies of intermodal transport system selection criteria. Table 4 reveals the three sets of factors obtained through the factor analysis of the strategies variable concerning the selection criteria. These factor analysis results are stated as follows:

Factor 1: Port service:
This factor was represented by 5 variables with factor loadings ranging form .728 to .657 (Cronbach's alpha = 0.85).

Factor 2: Marketing:
Five variables with loadings ranging from .761 to .533 (Cronbach's alpha =0 .75).

Factor 3: Logistics:
This factor comprised five variables with loading ranging from .786 to .450 (Cronbach's alpha = 0.77).

5. CONCLUSIONS

The results of the factor analysis show a set of three separately identifiable alternative activities factors that have positive and significant impact on the success of intermodal transport system development strategies in Taiwan. The empirical results suggest that there exist significant differences, especially regarding three alternative activities factors: "port service", "marketing" and "logistics". Firstly, "port service" activity gives more weights on efficiency and quality for port operation. Secondly, "marketing" activity was not seriously considered by shippers' except to decease port expenses. In addition, logistics operation factors such as management of customs, intermodal links, accessibility to port, is not seriously considered. These findings indicate that container port operators should put more considerable importance on "port service", while shippers have the specific interest in these factors. (Malchow and Kanafani, 2001).

In addition, the current study shows that shippers and liner operators possess similar perspective for the importance of container operations in port, which is not highly considered by terminal operators. Therefore, it is recommended that terminal operators make more efforts to reinforce their capabilities accommodating and supporting liner operations and strategies in order to obtain and maintain their competitive advantage and position. It has been a long controversial argument who has more influential power in the choice of the import/export and

transshipment ports between carriers and shippers. For instance, Slack (1985) argued that liner operators are the most significant actors in the development strategies of the port. According to D'Este and Meyrick (1992), port selection shifted from the shipper to the carriers since the shipping lines grew larger in their scale of operations. This is a similar view of Hayuth (1987), Hayuth and Fleming (1994), and Malchow and Kanafani (2001). On the contrary, Tiwary *et al.* (2003) argues that shippers possess stronger bargaining and/or influencing power against shipping lines and over liners' service design. According to them, the organization of global strategic alliances of shipping lines has redesigned liner service routes in response to economic growth and shippers' needs. These arguments can be compromised by the finding of a recent research that shipping lines select their calling ports directly considering shippers' requirements and shippers realize their preference for a port by the choice of a line providing service route passing through that port (Malchow and Kanafani, 2004).

In conclusion, ports, particularly container terminal operators, should focus their attention on the "port service" factors on which shippers and liners are commonly placing high priorities, when the terminal operators formulate, implement and evaluate their terminal management policy and operating strategy, as well as marketing plans. The current study mainly concentrated on different perspectives and priorities about port development strategies factors among shippers, carriers and terminal operators. It will be a meaningful future study to test the explanation power of the port choice factors and real influences of major market players on container port development strategies factors. For instance, it would be possible to collect the scores of various container terminals for each port development strategies factors and run a regression model examining the influences of these factors upon ports' market share and/or throughputs. In addition, a structural equation modeling could be employed to explore some direct and indirect relationships among port selection factors and port operational indices in further research.

REFERENCES

Alix, Y., Slack, B. and Comtois, C. (1999) Alliance or acquisition? strategies for growth in the container shipping industry, the case of CP ships. ***Journal of Transport Geography,* Vol.7, No. 1,** 203-208.

Baird, A. J. (2006) Optimising the container transhipment hub location in northern Europe, ***Journal of Transport Geography,* Vol. 14, No. 3,** 195-214.

Barros, C. P., and Athanassiou, M. (2004) Efficiency in Europe seaports with DEA: evidence from Greece and Portugal. ***Maritime Economics and Logistics,* Vol. 6,** 122-140.

Comtois, C. (1994) The evolution of containerisation in East Asia, ***Maritime Policy and Management,* Vol. 21, No. 1,** 195-205.

Cullinane, P. K. and Khanna, M. (2000) Economies of scale in large containerships: Optimal size and geographical implications. ***Journal of Transport Geography,* Vol. 8, No. 1,** 181 - 195.

Cronbach, L. J. (1951) Coefficient alpha and the internal structure of tests, ***Psychometrika,* Vol. 16, No. 3,** 297-334.

Dess, G. and Davis, P. (1984) Generic strategies as determinants of strategic group Membership and Organisational Performance, ***Academy of Management Journal,* Vol. 27,** 46-482.

D'Este, G. M. and Meyrick, S. (1992) Carrier selection in a RO/RO ferry trade Part 1. decision factors and attitudes, ***Maritime Policy and Management,* Vol. 19, No. 2,** 115-126.

Hayuth, Y. (1987) ***Intermodality: Concept and Practice***, Lloyd's of London Press, London, U.K.

Hayuth, Y. and Fleming, D.K. (1994) Concepts of strategical commercial location: the case of container ports, ***Maritime Policy and Management,*** **Vol. 21, No. 3,** 187-193.

Heaver, T. D. (1993) Rail freight service in Canada: restructuring for the North American market. ***Journal of Transport Geography,*** **Vol. 1, No. 1,** 156-166.

Hess, M. and Rodrigue, J. P. (2004) The transport geography of logistics and freight distribution, ***Journal of Transport Geography,*** **Vol. 12,** 171-184.

Hoare, A. G. (1986) British ports and their export hinterlands: A rapidly changing geography, ***Geographiska Annaler,*** **Vol. 68B, No.1,** 29-40.

Kerlinger, F. N. (1979) ***Behavioural Research: A Conceptual Approach,*** Holt, Rinehart and Winston, Inc., New York, U.S.A.

Klink, H. A. van, and van den Berg, G. C. (1998) Gateways and intermodalism. ***Journal of Transport Geography,*** **Vol. 6, No. 1,** 1-9.

Loo, B. P. Y. (1999) Development of a regional transport infrastructure: some lessons from the Zhujiang Delta, Guangdong, China. ***Journal of Transport Geography,*** **Vol. 7, No. 1,** 43-63.

Malchow, M. and Kanafani, A. (2001) A disaggregate analysis of factors influencing port selection, ***Maritime Policy and Management***, **Vol. 28, No. 3,** 265-277.

Malchow, M. and Kanafani, A. (2004) A disaggregate analysis of port selection, ***Transportation Research Part E***, **Vol. 40,** 317–337.

McCalla, R. J. (1999) Global change, local pain: intermodal seaport terminals and their service areas. ***Journal of Transport Geography,*** 7(1): 247-254.

Notteboom, T. E. (1997) Concentration and load centre development in the European container port system. ***Journal of Transport Geography,*** **Vol. 5, No. 1,** 99-115.

Notteboom, T. E. and Rodrigue, J. P. (2005) Port regionalization: towards a new phase in port development, ***Maritime Policy and Management,*** **Vol. 32, No. 3,** 297-313.

Notteboom, T. E. and Rodrigue, J. P. (2008) Containerization, box logistics and global supply chains: the integration of ports and liner shipping networks, ***Maritime Economics and Logistics,*** **Vol. 10, No. 1-2,** 152-174.

Rimmer, P. J. (1998) Ocean liner shipping services: Corporate restructuring and port selection/competition. ***Asia Pacific Viewpoint,*** **Vol. 39, No. 1,** 193-208.

Slack, B. (1985) Containerisation and inter-port competition, ***Maritime Policy and Management***, **Vol. 12, No. 4,** 293-304.

Slack, B. (1990) Intermodal transportation in North America and the development of inland load centres. ***Professional Geographer,*** **Vol. 42,** 72-83.

Slack, B., Comtois, C. and Sletmo, G. (1996) Shipping lines as agents of change in the port industry. ***Maritime Policy and Management,*** **Vol. 23, No. 1,** 289-300.

Tiwary, P, Itoh, H. and Doi, M. (2003) Shippers' port and carrier selection behaviour in China: a discrete choice analysis, ***Maritime Economics and Logistics***, **Vol. 5,** 23–39.

Todd, D. (1990) New port developments and balanced regional growth: a Taiwan example. ***Geoforum,*** **Vol. 21, No. 1,** 421-433.

Wang, J. J. (1998) A container load centre with a developing hinterland: a case study of Hong Kong. ***Journal of Transport Geography,*** **Vol. 6, No. 1,** 187-201.