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Factors Affecting Liners' Port Selection by Trade Route

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Foreword

It is my pleasure to present the result of joint-research done by KMI and the Port of Singaporean Authority (PSA). While both institutes interested in observing and analyzing recent change of major shipping lines' port selection mechanism, I had an opportunity to meet the Vice-President of PSA in an international forum. The meeting naturally led us to agree with conducting this joint-research, hoping that the result of the research will be mutually beneficial and also benefitting other maritime communities around the world.

At the first glance of this research report, I find that our original destination plan had to be slightly deviated due to constraints of budget and time dimensions. It is, however, noteworthy that the research shows the most updated information on what factors contemporary shipping lines are considering in choosing ports for their routing decision. Despite the fact that the research team, headed by Dr. Young-Tae Chang, made their utmost efforts to distribute survey questionnaires to almost complete list of shipping lines, the response rate was rather low. When budget and time allow them to do another phase of research in the future, I hope that more data can be collected and more rigorous methodologies can be employed. Finally, I would like to extol the devotion of Dr. Chang and his research team to this research in spite of their hectic schedule and difficulties.

President of Korea Maritime Institute

Dr. Jung-Ook Lee

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<SUMMARY>

Chapter 1. Introduction

Ports are perplexed when facing severe port competition and intimidated by the action of global alliances. Therefore, even today's market leader cannot be complacent. To maintain its market position, it should further expand to be ahead of its rival ports. In addition to the expansion, ports should respond to the various new requirements of liners, thus endeavoring to an ever changing environment. Otherwise, the ports are likely to be overtaken by their rivals and left behind. In sum, ports should continuously understand what factors are affecting liners decision in choosing ports.

Under these circumstances, the Port of Singaporean Authority (PSA) has wondered what other major shipping lines have plans for determining their hub ports in the future for fear that they should move away from the Port of Singapore as did the Maersk-Sealand line and the Evergreen line. Likewise, Korean government has similar interests in watching the behavior of major shipping lines' hub choices and the responsive strategies of hub ports like the Port of Singapore since the government has been planning to develop Korea as the Logistics Hub in North-east Asia. This was the common interest between the Port of Singaporean Authority and the Korea Maritime Institute since both are interested in developing and/or maintaining their country's ports as world leader. While having the common interests, the President of Korea Maritime Institute, Dr. Jung-Ook Lee and Vice-President of PSA, Mr. Goh Mia Hock, met in an international

conference and discussed about conducting a joint-research to address the issues. Therefore, they agreed to do the joint-research and our research team was directed by them. This was the backdrop from which sprung this joint-research between PSA and KMI.

Chapter 2. Overview of Port Competition in East Asia and Strategies of Korea and Singapore

This chapter aims to describe port competition in East Asia and strategies of both Korean and Singaporean governments. Basically this chapter intends to overview port competition in the region, and explain the two countries' strategies. To this end, the chapter will overview global changes in international trade, shipping industry and port business. Then, port competition in the region will be delineated. Particular examples are taken from the competition among Hong Kong, Singapore, Malaysian ports, Pusan and Kwangyang, Kaohsiung, Kobe, Shanghai and Yantian. Next sections are structured to explain what the current issues are in the two countries' port arena and how the governments formulate the strategy to handle the issues. Discussions and implications are followed.

All three countries in the range -China, Korea and Taiwan - are full steaming to comprehensively develop their container ports in a large scale. Their direction appears to arrive in the same destiny such as combining site expansion, deepening water depth, locating logistics center and Free Trade Zone within the port boundary, rationalizing inland transportation, and inviting foreign investors and specialized port operators. As China became the member of WTO by the end of

2001, the port competition would reach the highest level that we have never seen yet. In addition, when contemporary Post-Panamax vessels are overtaken by the mega-carriers 12,000 15,000 TEU- within less than then years, todays 9 10 port calling by major lines is more likely to be reduced to 3 4 calls at the maximum in East Asia. Therefore, the most important thing to the ports in the region may well formulate effective long-term port development and responsively adapt their plans to changing environment due to lingering uncertainties in ship size and other technology development. When faced with enormous rivalry requiring heavy investment, ports could explore the same path as those of shipping lines that is - alliance among rival ports.

It is a new approach, and some countries seem to have already selected this strategy like Wilhelmshaven between Bremen and Hamburg and another between Malmo in Sweden and Copenhagen in Denmark. (Sim 2001). No attempt has been made so far among the rival ports in East Asia except the fact that some ports such as PSA and Hong Kong based group (Hutchison) are investing in foreign ports as the international operators, but not as the alliances. High time, thus, may have arrived that the rival ports can explore this port alliances strategy to fight against lines alliances strategy.

When facing inter-port competition, port of Singapore adopted double-edged strategies: confrontation and strategic alliance. In terms of confrontation, on one hand, the port of Singapore has slashed since July 2002 the handling charges for all empty containers by 50 percent and offered a 10 percent rebate on all bills at the port's cargo terminals. The government is also open to allowing shipping lines to run their own dedicated berths and actively engaged in negotiations with shipping lines to discuss other opportunities for partnership and

collaborations, including very long-term agreements, joint ventures and dedicated terminals in Singapore. The government wants to enhance further the competitiveness of the port of Singapore by allowing new port operators to manage terminals in direct competition with PSA and Jurong Port.

On the other hand, the port of Singapore has also forged certain alliances and cooperative ventures with other ports even as far away as China, India and Africa, offering its capital and expertise in developing and managing state-of-the-art ports. Through these overseas ventures it hopes to build up stronger port linkages with other countries via the hub-spoke networks. And in this way it can maintain its position as a hub by having greater influence over the supply lines of transshipment cargo from other ports in the region. It is interesting to see if the policies of PSA will be effective or not and how other competing ports will also respond to them.

Chapter 3. Literature on Liners' Port Selection

Past research related to port calling selection factors can be classified into 3 groups: ship routing/scheduling using mathematical model, port selection, and hubbing behavior.

Most researchers' interest lies in creating an efficient shipping network. Various mathematical and heuristic models were used: linear programming model, integer-programming model, non-linear programming model, graph theoretic model and heuristic optimization model. All of them differ in their objective functions: some models aim to minimize cost while others maximize profit. They also differ in their usage of

constraints: some list just 4 constraints while others have 10. Most of them did not verify the validity of their models with shipping lines. There has been little such research done for container shipping as compared to bulk shipping and air transportation.

Researchers aim to uncover the reasons for port selection in shipping, e.g. size of local cargo base, geographical location, etc. One researcher had gone further to uncover the reasons for why certain ports were made 1st port of call and others last port of call. Logit regression and linear regression analysis in some studies were used to decide on the validity of the reasons.

There is a lot of literature which attempts to define transshipment. Some went further to discuss types of transshipment and even types of feeder services. The geography researchers have created a framework known as site/situation to study the phenomenon of hub selection. The framework included political and social factors. Many concentrate on comparing transshipment with direct calls (or multi-porting), their advantages and disadvantages. Some discuss on how to choose a hub. Some studies even identify cost drivers, such as vessel size, etc., which may cause one to decide on transshipment or direct calls.

Chapter 4. Methodology and Data

The major methodology of this research was to survey the major liners. After considering various factors affecting liners' decision on port selection from literature survey, a questionnaire was designed by PSA (see the PSA questionnaire form). Then the questionnaire was pre-tested about whether expressions in the form were easy for the

respondents to understand and also any important questions were missing or not. In other words, the research team in Korea visited major shipping lines in Korea to pre-test the questionnaires and found the expressions were not easy and there are some other important factors missing in the form. Therefore, the form had to be modified into using more communicable English and incorporating some other factors. The original form consisted of 20 questions and the modified form had 32 questions and also included general information about lines before asking the factors. We present both the questionnaires to show how we changed the form through the pre-test.

The survey form was distributed to the liners operating both on mainhaul services and on intra-Asia services. The mainhaul services are those on Far-East - Europe, Transpacific and Transatlantic shipping trade routes. In other words, the mainhaul service was to check decisions on trunk routes and the intra-Asia service on feeder route. We sent the form to these companies by mail inserting a formal letter to direct the form to a person specialized in route-selection.

Chapter 5. Survey Results

We calculated average scores for each variable from the sampled data (28 questionnaires) and found that there are six variables, which scored mean values less than 'two' and two variables, which scored mean values more than 'three'. This may be interpreted that the six variables reflect what factors the liners consider important in choosing ports and the two variables the ones that they consider unimportant. The most important factors in port selection seem to be cargo volume

in a local area of the port and volume of inducing cargoes by their own lines. This suggests that liners are concerned with securing cargo in port selection, looking at potential market size and their strength in the market.

The next important factors are cargo expenses, berth availability, port location and transshipment volume. Still these variables may reflect how the liners look at how expensive the port is and berth availability and the level of transshipment activity. Meanwhile, the liners seem to show that they are unconcerned with higher hierarchical services such as the strength of the legal and financial systems and presence of auxiliary services like bunker, ship-repair, lashing and tally, etc. These unimportant variables graded by the liners are mostly in the opposite direction with the advertising aspects of advanced ports like the Port of Singapore. Therefore, it was inferred that this phenomena may have been caused by the domination of smaller companies (feeder service providers) in the sample.

To check this, we grouped the sampled data into one for trunk route service and the other for intra-regional service (i.e., Intra-Asia service) then calculated again the mean value of each variable for the two groups and compared the results between the two groups. This comparison tells us that there is difference in the factors between the two groups.

First of all, bigger companies serving on trunk routes consider more factors in route decision-making processes and do not seem to ignore any other factors given in the questionnaires except the auxiliary service and the extensiveness of the service. Their biggest concern is, first, inducing cargo to their own lines, cargo expense and cargo volume in the local area. Compared with the smaller companies serving on feeder routes, the bigger companies appear to be faced with

more fierce competition and so they look at the size of the market and the expenses at the same time. In addition, the trunk route servers look at other various variables such as ones from land connection through berth length to the availability to cargo safety and profitability. In contrast with this, the feeder servers only look at berth availability, cargo expense and transshipment volume.

This is to say that the feeder liners are mostly concerned with seeing if there is cargo for them in the port, and then if it is reasonable to use the port at a secondary level. Other comprehensive services like land connection, service reliability, water draft, cargo safety and even profitability are beyond their primary interests in port selection. This is to suggest that they still fall in the traditional conventional market, whereby the running of their businesses is determined by market size and cost not by marketability and high quality services. Likewise, they are not so much concerned if these are constraints on overtime working, the legal and financial systems, the relationship between management and workers, auxiliary services and worldwide reputation.

Chapter 6. Conclusion

From our previous results and these statistical tests, it may be fair to say that the results verify that the trunk liners are faced with more fierce competition requiring them to provide more comprehensive and value-added services than the feeder liners.

All the results that we have analyzed thus far tell us the following policy implications for future port development in the world

Firstly, port should maintain their cargo volumes either handling

export/import cargo or transshipment cargo to be competitive. What is more important is that ports should be able to draw the attentions of liners on how the liners can induce cargoes to their own lines and persuade them to do so.

Secondly, cargo expense is still key a factor affecting liners' decision in port selection. Therefore charging competitive rates will lead to securing more cargo to the extent that the rates are not sacrificing service quality. Other types of port price like port dues do not seem to play a role in affecting the liners' decision.

Thirdly, ports that plan to be hub should provide and guarantee better comprehensive services such as efficient inland connection, reliable service, enough water draft, cargo safety and profitability, in particular for trunk route liners. In addition, Information Technology and a good relationship between management and workers can play a considerable role.

Fourthly, ports aiming to be feeder ports should focus on berth availability and should not highly concern themselves on extending working hours related to overtime work. The lack of concern related to overtime may have been caused by the limited set nature of our data, so caution should be taken in policy-formulation.

1. Introduction

1.1. Background

The world economy is now in recession. The September 11th terrorist attack added an extra layer of gloom to an already dismal year. By any standard, there is an exceptionally steep decline in industrial production.[1] This has led to major cargo bases being in freefall except in the Far-eastern region. For instance, the industrial production in the United States slumped to a worrying -5.8% in December 2001, compared with positive growth of 3.5% in the previous year. In Europe, the downturn has been less severe than in the United States, but still recorded -4.2% in November 2001.

The Japanese economy is the worst case out of the traditional strong economies, witnessing a fall of 14.9% in the industrial production in December 2001. Hopes for the world economy seem positive only in the Far-eastern Region. South Korea increased its output by 10.2% in 2001 to January 2002, China continues to grow at around 9% per annum. Taiwan is now growing briskly again. All these facts make for a murky picture of the world economy, but may also suggest that the worst may be over and the world shipping industry is maybe turning the corner now.[2]

As with the gloomy world economy, world shipping is also suffering a recession in almost every sector. The containership sector is the most miserable, stuck between declining demand and oversupply.

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1 Clarkson Research Studies, *Shipping Review and Outlook*, Spring 2002.
2 *Ibid*,

Container lifts in 2000 only increased by 2%, one of the slowest years on record, compared with 10% in 2000. In contrast with the downturn demand, the containership fleet between January 1999 and January 2004 will have expanded by 59% (Clarkson, 2002). Consequently, freight rates have dropped sharply and, therefore, the charter rate of containerships has been almost halved since late 2001 (see figure 1.1).

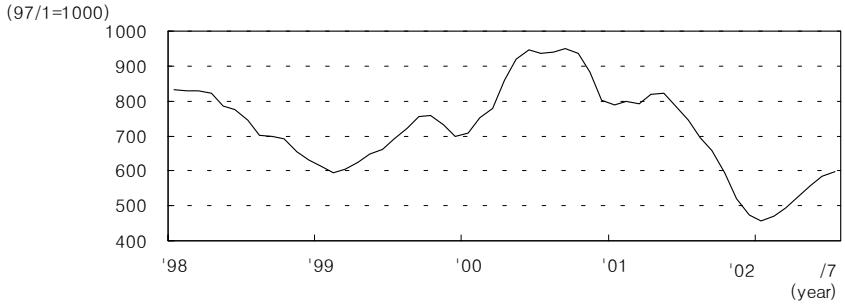

Figure 1-1. H-R Monthly Container Index

Meanwhile, containership companies (henceforth, liners) are facing persistent capacity increase demanded by shippers, who require liners to provide longer haul services and bigger vessels, and to increase the number of strings in trade routes. It is because the shippers' competitiveness nowadays, in turn, is likely to depend upon the efficiency of their Supply Chain Management system. Under these circumstances, liners constrained by limited resources tend to ally with other liners in sharing vessel space, marketing channels, and other resources. As a result, contemporary liner markets are dominated by these so called 'global alliances'. They exert enormous bargaining powers not only on shippers, but also on ports, with the latter being our concern in this report.

Today's container ports face unprecedented challenges. Considerable social and economic pressures encourage port development. Terminal authorities and proponents view ports as "engines for growth". However, the success of new proposals is not assured due to high costs, and the competition and strategic behavior between ports, placed on them by shipping lines, railroads and other stakeholders. Further, environmental issues are assuming an increasingly prominent role in shaping the nature, scale, and operation of ports and, by that, raising port costs related to mitigation and operation. Of the challenges that contemporary ports face, the seemingly most inflicting is to what extent the ports concerned should be expanded. The answer is not easy particularly in cases where port competition is severe. The global alliances' bargaining power aggravates port competition.

As the alliances continue to seek the formation of bigger alliances as many experts predict, ports may have two destinies: either becoming a stronger hub in the region or shrinking its role to a mere feeder port in the regional 'hub and spoke system'. This phenomenon is already observable in many parts of the world. For instance, on one hand, the advent of giant global alliances like Maersk-Sealand line once played off several ports in US East coasts when the line had to renew its long-term contract with the Port of New York and New Jersey around 1999. This event stirred the whole US East coast ports, once thinking themselves as future hub in the region.

Similarly, Maersk-Sealand switched its base port from Singapore to the Port of Tanjung Pelepas (PTP) recently, which may have influenced ensuing movement by Evergreen to PTP. It is reported that MOL/APL is seeking merge or acquisition with P&O Nedlloyd presumably to take advantage of this favorable position as a bigger

alliance. On the other hand, ports are perplexed when facing severe port competition and intimidated by the action of global alliances. Therefore, even today's market leader cannot be complacent. To maintain its market position, it should further expand to be ahead of its rival ports. In addition to the expansion, ports should respond to the various new requirements of liners, thus endeavoring to an ever changing environment. Otherwise, the ports are likely to be overtaken by their rivals and left behind. In sum, ports should continuously understand what factors are affecting liners decision in choosing ports.

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1.2. Objective and Scope

The major objective of this research is to find out what factors affect liners' port selection by trade route. Originally we planned to take one step forward in the direction of modeling liners' ship routing decisions based on case studies both in Singapore and Korea, and then generalizing our models. However, budget and time limitations have not allowed us to explore this to our satisfaction. So an in-depth case study and the modeling remains for further study, perhaps as follow-up research to this output.

We will focus our studies on two distinct routes: one on trunk routes covering trans-Pacific trade and trans-European trade between Far-east Asia, and North America and Europe, respectively; the other on short sea routes in intra-Asia trade.

2. Overview of Port Competition in East Asia and Strategies of Korea and Singapore

2.1. Introduction

Ports have been facing numerous challenges arising from various factors including changes in international trade pattern, shipping companies' evolving strategy and networking of different transportation modes. Contemporary ports are particularly concerned with handling longer distance cargoes for global carriers, intermodal demand for the ports, port financing for expansion and environmental issues. These require ports to provide more efficient, faster and clean services for the customers.

To respond to these challenges, some ports have taken ambitious steps toward large-scale long-term development plans whereas others seem relatively stagnant. Intermingled with hub-and spoke phenomena, port may have two ways in their future destiny: expansion into being hub strategy or shrinking into residing as spoke in the network. This observation can be more vividly found in the East Asian region, where economic growth is higher than any other region, thus more international cargoes are generated and economic dynamism puts the ports in the region into more competitive situation.

This chapter aims to describe port competition in East Asia and strategies of both Korean and Singaporean governments. Basically this chapter intends to overview port competition in the region, and explain the two countries' strategies. To this end, the chapter will overview

global changes in international trade, shipping industry and port business. Then, port competition in the region will be delineated. Particular examples are taken from the competition among Hong Kong, Singapore, Malaysian ports, Pusan and Kwangyang, Kaohsiung, Kobe, Shanghai and Yantian. Next sections are structured to explain what the current issues are in the two countries' port arena and how the governments formulate the strategy to handle the issues. Discussions and implications are followed.

2.2. International Trade And Maritime Industry

2.2.1. Overview of International Trade

To set the scene on global level, we should look at snap shots on international trade and what impacts the trade has on our domain - that is maritime industry. International trade has ever been increasing since Adam Smith authored "the Wealth of Nations" and follow-up scholars proved that all nations participating at international trade have mutually benefited.

World output has increased steadfastly in the past two decades, recording slightly more than 3 % of annual average (see table 2-1). Advanced economies show annual growth rate of 3.1 % and 2.7 % in 1980s and 1990s, respectively. During the same period, developing countries show 4.3 % and 5.5 %. From the table, we can see that Japanese economy flourished during 1980s then stagnated during 1990s. In contrast, US economy boomed during 1990s after passing through a long tunnel of slump in 1980s. Developing countries show much higher growth rates than

advanced economies. This growth was led by Asian region. Table 2-2 shows rather recent years' figure. Global economy has continued to strengthen in recent years, with GDP growth projected to increase in all major regions of the world. World output in 2001 has increased by 2.5 percent from 2000 and the annual increase is expected to be further bigger in coming years, somewhere between 2.8 % and 4.0 %.

World trade volume (goods and services) in 2001 has slightly decreased by 0.2 % from 2000 but the increase by 2003 is projected by the range of 2.5 % to 6.6%. This economic growth has been led by the continued growth of the U.S. economy; the robust upswing in Europe; the consolidation of the recovery in Asia from financial crisis.

Table 2-1. Summary of world output - real GDP base
(annual percent change)

Year	'82-'91	'92-'01	'92	'93	'94	'95	'96	'97	'98	'99	'00	'01
World	3.3	3.3	2.0	2.3	3.7	3.6	4.1	4.1	2.6	3.4	4.7	2.5
Advanced economies	3.1	2.7	2.1	1.4	3.3	2.7	3.2	3.4	2.4	3.2	3.9	1.2
USA	2.9	3.4	3.1	2.7	4.0	2.7	3.6	4.4	4.4	4.2	4.1	1.2
EU	2.6	2.1	1.2	-0.4	2.8	2.4	1.7	2.6	2.7	2.4	3.4	1.7
Japan	4.1	1.0	1.0	0.3	0.6	1.5	5.0	1.6	-2.5	0.2	2.2	-0.4
Others	4.3	4.1	3.4	4.1	5.8	5.0	4.1	4.7	1.0	5.5	5.3	1.6
Developing countries	4.3	5.5	6.3	6.4	6.7	6.1	6.5	5.7	3.5	3.8	5.7	4.0
Africa	2.3	2.5	-0.7	0.2	2.3	3.1	5.7	2.8	3.1	2.2	3.0	3.7
Asia	6.9	7.4	9.4	9.3	9.6	9.0	8.3	6.5	4.1	5.9	6.7	5.6
M.East &Europe	3.3	3.6	5.7	3.8	0.6	4.3	4.5	5.1	3.1	0.8	5.8	2.1

Source: IMF (2002)

Table 2-2. Overview of the world economic outlook projections (annual percentage change)

Year	2000	2001	Projections	
			2002	2003
World output	4.7	2.5	2.8	4.0
USA	4.1	1.2	2.3	3.4
Japan	2.2	-0.4	-1.0	0.8
Euro area	3.4	1.5	1.4	2.9
NICS	8.5	0.8	3.6	5.1
China	8.0	7.3	7.0	7.4
World Trade volume	12.4	-0.2	2.5	6.6

Source: IMF (2002)

Several factors can be attributed to the increase and transformation in the international trade. Among these, the first set of major players can be globalization of international/multinational corporations, introduction of World Trade Organization system and more forming of regional economic bloc.

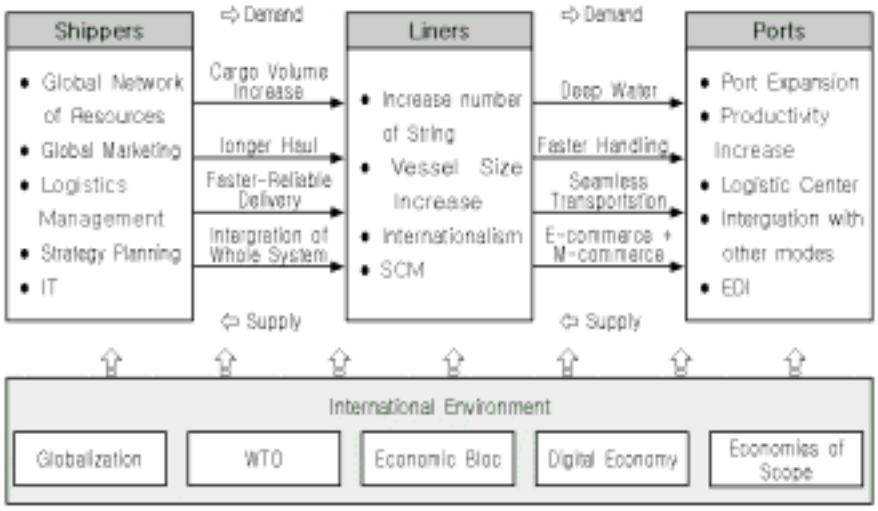
As countries opened their trade barriers increasingly and new economies emerged on international trade, for instance, China, more resources and services have been transferable more freely and cheaply among countries than previous period and the size of consumer's market has expanded from regional/sub regional level to global scale. The second important factor that influenced the international trade was the paradigm shift from mass production to lean production. The traditional economies of scale was not any more proper approach to the current customers, who have various types of tastes and preferences in products, therefore, not complacent with reliable goods.

The third factor should be the emergence of digital economy due to the rapid development of information technology. No doubt, we cannot ignore the importance of influence by this IT industry in every day's life.

2.2.2 Change in Maritime Industry.

While international trade has experiencing new environmental changes, maritime industry has also had to adapt itself to the change. By reading the literature and meeting the industry people, the author of this chapter framed the relationship of demand and supply between shippers, shipping lines and ports as in figure 2-1.

Figure 2-1. Contemporary demand and supply relationship between shippers, lines and ports



As the environment of international trade has changed influenced by those factors explained in the above, shippers may well have shaped their business in conformity with the changes. So they seem to have devoted themselves to five areas: global network of resources; global marketing; logistics management; strategy planning; and how to use IT.

To meet this demand, shipping lines have to increase their capacity of providing services either by increasing the number of strings or by upsizing their vessels. For instance, Lloyd's Shipping Economist shows a recent structure of strings in Asia/North America routes by major liner operators (Lloyd's Shipping Economist, April 2001 p. 17). Major lines are operating the strings of minimum 6 to 9. Of these, many strings are expanded to Europe to cover global passage. Considering the same number of strings in other areas, today's shipping lines have to own a great deal of vessels and run offices around the world.

This is not easy for even biggest shipping lines to provide the needed capacity. In addition, there seems to exist some degrees of barriers to penetrating or entering new markets in other regions than the lines' traditional home ground for expanding their services. Therefore, major shipping lines have explored to find some ways to resolve these problems. This takes the fashion mode of global/strategic alliances by major shipping lines. The purpose of participants in strategic alliances is to establish cooperative agreements on a global basis.

Shipping lines' concerns become naturally demand for the ports as in the diagram. Bigger vessels require ports to provide deep waters in approach channels and berths, and faster handling service of cargoes in terminals. Likewise, intermodal dimension forces ports to guarantee seamless transportation among different modes. In addition, IT factor generates a new dimensional cargo handling type of work to ports, so called, E-commerce so that ports have to handle traditional M-commerce (material) and new E-commerce. To respond to this demand forces, ports exert their utmost in various ways depicted in the diagram as

supply. To begin with, a definite answer, to the question of deep-water port must be port expansion in the direction of deepening, widening and lengthening channels, berths and turning basins as well. Major container terminals have already the water depth of 15-16 meters in the berths and some of them have plans to deepen this to the depth of 18.5 meters (Wilhemsshaven[3] in Germany and Sepetiba[4]). The second solution by the ports should be increasing productivity before or concurrently with trying the port expansion, focusing on cargo handling equipment, stacking areas and gate system for operational efficiency. In increasing the productivity in terminals, faster and larger cranes are the first thing explored.

Currently, a discharge rate of at least 35-40 moves per crane/hour is needed when handling large ships. One obvious way to increase productivity is to deploy more cranes per ship. At present the practical limit in handling the Maersk K class ships is 6 quay cranes. However, several ports are unable to allocate six cranes to one ship; only four quay cranes can be used at Southampton and Gothenburg, for example. This is partly because available quay length can only allow for up to four cranes. With the upsized vessel, number of boxes across on deck is also increased so that the outreach of crane should be lengthened long enough to reach this width.

Today's PostPanamax vessels can load 16-18 boxes across on deck and the outreach for this vessel should be 44-48 meters from seaside rail.

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3 Wilhelmshaven is a new deep-water container port in Germany by 2010, chosen by Hamburg, Bremen and Lower Saxony states. It plans to accommodate vessels over 10,000 TEU size and provide up to 24 berths. See Containerization International May 2001, p. 35.

4 See Baird (1999)

Major transport hub port has already ordered cranes with a 22-container (50+m) outreach, suitable for handling vessels of 8,000-10,000 TEU. Cranes of 60 m outreach are planned for installation at the new Altenwerder terminal in Hamburg on its completion within the next 2-3 years (Baird 1999). Similar developments are explored in trolley speed and hoist capacity. Alternatively, a ship could be served from both sides; with six double trolley cranes per side and each dual hoist crane producing 55 moves per hour, it is estimated that productivity could be as high as 660 moves per hour (Jordan 1997 and recited from Baird 1999).

A significant majority of respondents in Bairds survey thought that ports should provide more cranes per ship and also lager faster ones and introduction of more terminal automation was not deemed to be supported by them (Baird 1999). Similar concerns can be found from a research in North American context (Chang et. al. 2001).

Modern container ports tend to provide comprehensive logistics service within their areas. Port is not only the place to load and unload cargoes, but also the one for manufacturing, processing, warehousing, distribution and customs service. Examples are numerous in this area around the world and nowadays, ports become introducing Free Trade Zone within or in the vicinity of their boundary to promote more cargo works for the logistics service. Port is also exploring to have efficient intermodal linkage with other modes for inland transportation and/or relayed transportation to neighboring ports. The type of intermodal linkage depends upon ports' geographical structure, the relationship between foreland and hinterland, cost effectiveness and customer

preferences and history.

Concurrently with the logistics and intermodal service, ports should also provide high-tech EDI (Electronic Data Interchange) system both within port boundary and beyond it for their customers such as shipping lines, shippers, banks, insurance companies and governments. Real time transaction using the EDI among these parties and cargo tracking system are on the surge.

Thus far, global environmental change in international trade has made shippers, lines and ports more integrated with each other by physical transportation network composed of various modes, and also electronic data network thanks to the rapid development of IT industry in an unprecedented wider comprehensive scope. Every perspective of involved parties in the global network should be global whether their role in the entire network is central or peripheral.

Major world class shippers seem to be already in this mode since their approach to this challenge is supply chain management, covering ambit of logistics, strategy planning and integrated IT system. Shipping lines have experienced similar adaptation strategy, illustrated by global alliances, longer haul and bigger vessels as well as more comprehensive intermodal link, with all embodying advantages of current IT technology. Compared with these two parties (shippers and lines), ports seem to have been relatively less affected so far, however, new tides of globalization perception appear to be on the surge among forerunners of hub-class ports in the world. The height of this new tide looks the highest in East Asia due to the region's most active economic dynamism. Therefore, we focus on the current scene of this region in the next section, particularly

concerned with port competition in the region.

2.3. Port Competition in East Asia

2.3.1. Container Throughput and Transportation Infrastructure in East Asia.

World container trade in 2000 was 68 million TEUs (6.8% increase than 1999) and the lifts in world ports were 209 million TEUs (see table 2-3). The container trade is expected to reach 79 million TEUs in 2002 and the lifts 241 million TEUs in 2002. The annual growth rate during this period would be 9% for the container trade and 8% for the lifts in the ports. Of the lifts, Asia takes 47% of the world total by handling 99 million TEUs in 2000 and is expected to reach 114 million TEUs in 2002.

Since the world container trade shows strong growth rate in recent years and to be so in coming years, and Asia handles almost half the world container lifts, Asian ports are likely to take leading roles continuously in container throughput in the near future. At present, world four biggest container ports are all located in East Asia (see table 2-4 and figure 2-2) and the importance of the Asian ports is more likely to be further amplified in the near future due to economic growth in the region. The table shows most Asian ports handled impressive increase of container cargoes in 2001. The most remarkable increase was at the Port of Tanjung Pelepas in Malaysia with 388% growth during 2 years after opening.

Table 2-3. World container activity

Unit: Million TEUs

Year	1998	1999	2000	2001	2002	p.a. 98-02
Europe	42	45	49	52	56	7%
Asia	80	88	99	106	114	9%
N. America	24	26	29	32	34	9%
Others	28	29	32	35	38	8%
Total, m.teu lifts	174	189	209	225	241	8%
Total trade, m teu	57	62	68	73	79	9%
% growth	4.6%	9.1%	9.8%	7.8%	7.6%	

Source: Clarkson Research Studies (2001)
Notes: Container throughputs of 2001 and 2002 are estimated figures.

Figure 2-2. Ports in East Asia

Source: Containerization International, Yearbook 2001

Table 2-4. Selected container port throughput in Asia

year / port	M. TEU lifts				Year-on-year growth('98-01)
	1998	1999	2000	2001	
Colombo	1.71	1.70	1.73	1.73	0.39%
Dubai	2.80	2.85	3.06	3.50	7.72%
Hong Kong	14.58	16.21	18.1	18.0	7.28%
Kaohsiung	6.27	6.99	7.43	7.54	6.34%
Keelung	1.19	1.67	1.95	1.82	15.21%
Kobe	1.90	2.18	2.27	2.10	3.39%
Laem Chebang	1.56	1.83	2.20	2.34	14.47%
Manila	2.69	2.15	2.87	2.80	1.34%
Nagoya	1.46	1.57	1.91	1.89	8.99%
Tanjung Pelepas	-	-	0.42	2.05	388.10%
Port Klang	1.82	2.55	3.21	3.70	26.68%
Pusan	5.73	6.31	7.54	7.91	11.35%
Shanghai	3.07	4.21	5.61	6.33	27.28%
Singapore	15.10	15.95	17.04	15.52	0.92%
Tanjung Priok	2.13	2.12	2.48	2.22	1.39%
Tokyo	2.17	2.70	2.89	2.77	8.48%
Yokohama	2.09	2.17	2.32	2.40	4.72%

Source: Containerisation International Yearbook

Like the bloc economy movements of the EC and NAFTA, the Northeast Asian[5] region is increasingly discussing the need of the regional cooperation. The economic importance of the region in the world is rather significant. The Northeast Asian economies' share in world merchant trade was 18.1 percent and 14.5 percent of world export

5 In this chapter, Northeast Asia denotes Japan, China, Korea, Taiwan, Hong Kong.

and import, respectively in 1998. Three Northeast Asian countries - Japan, China and Korea- explain approximately 12.9 percent ($ 704 billion) of total world exports and about 9.2 percent ($515 billion) of total world imports. Their intra-regional trade (exports and imports among them) shares are about 9 - 31 percent of each country's total exports or imports[6].

Since the early 1970s the rapid growth of economies in the Northeast Asian region has been accompanied and stimulated by the establishment of a supra-regional transport network. Hubs occupy a key position within the networks, offering a variety of opportunities for global and regional marketing facilitated by frequent services and comparatively low distribution costs. During the 1980s, Tokyo emerged as a global, multimodal network hub on a par with London and New York. At a regional level, Hong Kong and Singapore have battled for the right to become the single network hub in the Asia-Pacific region.[7]

In recognition of the importance of the infrastructure, all countries in the region have been developing their transport network systems to become major logistic centers of Northeast Asia in one way or another. For instance, major ports of Japan appear ready to become regional hubs and a few ports of Korea, such as Pusan, Kwangyang, Inchon and Pyoungtaek (new port), are on the way to becoming a hub port. Likewise, China, Russia and North Korea are rushing into taking the initiative in the Tuman River Project, whereby they can develop strong emerging logistic centers in the region through port and inland

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6 Sang-yirl Nam, Competition and Complementarity in Northeast Asian Trade: Korea's Perspective, Working Paper 200-02, KIEP

7 Peter J. Rimmer, 1993, ' Taiwan's Future as a Regional Transport Hub', monograph.

transport developments as well as a free industrialized zone.

Upon completion of the project, it is projected that this area will function as a kind of 'economic corridor[8]' in this region. In line with this movement, Russia and China have already developed transcontinental railway networks (see figure 2-3) in order to meet the demand for the cargoes between Europe and Asia and the plan of the two Koreas through the reconnection of Korean railways[9] is under construction.

Thus far, all the tramper routes have been established in the region and container routes are either in active operation between Japan, China and Korea, or at developing stage among China, Russia, Japan and Korea. Container routes to and from North Korea are, at present, underdeveloped. However, they are likely to be open sooner or later.

As for the transcontinental railways, it is noteworthy that since the inception of service in 1972 handling 2,000 TEUs, TSR (Trans Siberia Railway) carried 138,000 TEUs in 1983. Then, remarkably declined to 8,000 TEUs in 1998 and slightly bounced back to 25,000 TEUs in 1999 (MOMAF). The decline was caused by sudden unsettlement after the collapse of former Soviet Union, and the frequent delay of cargoes (For instance, it was common to have a 1 to 2 week delay). TCR (Trans China Railway) with TMR (Trans Manchuria Railway) and TMGR (Trans Mongolia Railway) started competition with TSR from the mid-1990s in transporting cargo between Europe and Asia.[10]

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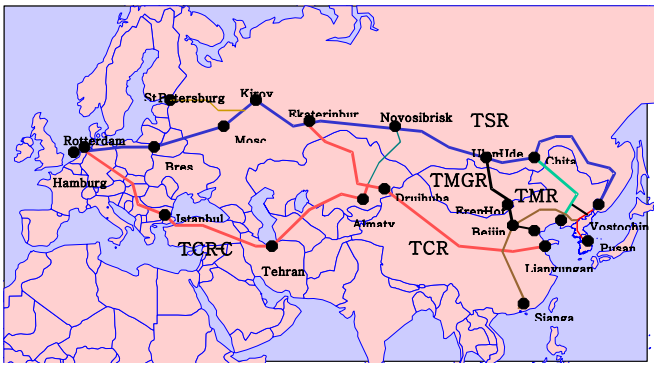
8 This concept was developed by Professor Peter J. Rimmer of Australian National University and means , in general, the most economically central area of region.

9 The two Koreas agreed in the accord of South-North exchanges and cooperation, taking effect on Feb. 19, 1992 (Chapter III, Article 19) that the two sides shall reconnect railroads and roads that have been cut off and shall open South-North sea and air transport routes (source: the Korea Herald Feb. 20, 1992). Then, while exploring two-Koreas' cooperation again recently during Kim Dae-Jung regime, Sept. 18, in 2000 witnessed ground-breaking ceremony to continue disconnected railway between South Korea and North Korea. The eventual connection with TSR and TCR will be completed by 2005.

10 TCR very often includes TMR and TMGR.

The Koreas are also planning to have an access to TSR and TCR via a reconnection of the Korea railways - that is TKR (Trans Korea Railway).[11] As for the China Land Bridge, the TCR was connected with the TSR in Novosibirsk in August, 1990, when a new rail of 460 km was constructed from Urumqi to Alataw Shankou (borderline of China to Kazakhstan). It became possible for the cargo between Europe and Far eastern Asia to pass through the Chinese railway, then to be connected with the TSR destined for Europe and/or Asia. The total length of the railway is 10,700 km inclusive of the TSR. China covers 4,111 km encompassing six provinces, (Jiangsu, Anhui, Henan, Shaanxi, Gansu and Xinjiang) from Lianyungang /Shanghai through Xian, Lanzhou, Urumqi to Alataw Shankou (See figure 2-3).

Figure 2-3. Transcontinental Railway System and Major Ports in Northeast Asia



Notes: -Trans Siberia Railway (TSR): Vladivostok/Nakhodka - Novosibirsk - Europe
-Trans China Railway (TCR): Lianyungang/Shanghai - Urumqi - Novosibirsk with TSR
-Trans Manchuria Railway (TMR): Dalian - Harbin - Chita with TSR
-Trans Mongolia Railway (TMGR): Tianjin - Ulaanbaatar - Ulan-Ude with TSR

11 On completion of the TKR, two lines in Korea are connected with the transcontinental railways. The first line along the west coast of Korea, called Kyoung-Ui-Sun meaning 'Seoul-Sinuiju-Line', can be connected with TMR. The second line along the east coast, called Kyoung-Won-Sun meaning 'Seoul-Wonsan-Line', can be connected either with TSR or with TMR.

In sum, future trade and investment prospects will be strongly influenced by the evolution of the pattern of trade specialization among the Northeast Asian economies and the policy framework from which these trade and investment flows occur.

As far as port competition in East China is concerned, there have been five major players traditionally: Kobe, Pusan, Kaohsiung, Hong Kong and Singapore. These five ports and other new comers have forced the port competition in the region to become very fierce over recent years. The new comers are Kwangyang in Korea, Shanghai and Yantian in China, Klang and Tanjung Pelepas in Malaysia (see figure 2-2). The Port of Tanjung Pelepas (PTP) is living up to its claim of being the fastest growing transshipment hub in South East Asia, scouting Maersk-Sealand line from Singapore. Just as PTP intimidates Singapore, Shanghai does so to Pusan and Kobe and Yantian does to Hong Kong.

This is likely that short-term competition is happening among port of vicinity like the cases of competition between Pusan, Kobe and Shanghai, another competition between Hong Kong, Kaohsiung and Yantian, and the other between Singapore and Tanjung Pelepas, on one hand and long-term competition seems taking the initial shape among all these ports one way or another on the other hand. In spite of the importance of the long-term competition, the ports in the region seem more concerned with the short-term competition with the vicinity ports for some years. Along this line, the competition in the region can be grouped into two: north tier among Pusan, Kobe and Shanghai and south tier among Kaohsiung, Hong Kong, Singapore, Yantian and Tanjung Pelepas. Further, as ship size increases from current 9,000 TEU ship on order basis to 12,000 TEU ship in the future, these ships

will reduce the number of calls on a trunk route considerably. Lloyd's Shipping Economist shows in its recent publication (vol. 23, April 2001) major operations on Asia/North America routes as at March 1, 2001. The ship size in the publication is mostly PostPanamax and the ships are calling at least five ports and in some cases nine or ten ports. However, as most academic and business people expect, the future 12,000 - 15,000 TEU ships are more likely to call only two or three ports in East Asia.

This size vessels are expected in service before 2010 by leading scholars and representing business executives (see Baird 1999) and if so, only two or three will survive as the *hub* in the region whereas others have to serve the winners as the *feeder* ports, losing their market shares enormously. Therefore, the major players together with the new comers seem ushering into fierce survival game by sharpening their swords- that is ambitious port expansion plan in the future. Table 2-5 shows current expansion plan of the major players.

Table 2-5. Port expansion plan of major players in East Asia

Port	Current no. of berth	Planned no. of new berth (2002-11)	Total no. of berth
Hong Kong	22	23	45
Singapore	41	39	80
Kaohsiung	27	23	50
Kobe	37	10	47
Shanghai	18	56	74
Pusan	19	33	49
Kwangyang	8	25	33

Source: KCTA

2.3.2. North-Tier Port Competition.

First, we can focus on the north-tier competition among Korea, Japan and China. Of these, China's growth is noteworthy both in cargo generation and port development. China handled 35.5 million TEUs in 2000. Of these, Hong Kong handled 18.1 million TEUs, Shanghai was 5.6million TEUs and other major ports were Yantian, Qingdao, Tianjin, and Gungzhou.

The total container cargo grew sharply even reaching 21% percent growth rate in 1997 (See table 2-6). Table 2-7 shows major characteristics of five container ports in China. It shows that Shanghai port has been most developed, but the water depth is very shallow, limiting its potential future growth. Yantian port, however, is emerging as a new hub port, capitalizing on its natural deep-water depth.

Table 2-6. Container Throughput in 10 Major Ports of China

Unit: 1000 TEU

Port	1998	1999	2000
Hong Kong	14,582	16,211	18,100
Shanghai	3,066	4,206	5,612
Yantian	1,040	1,580	2,144
Qingdao	1,213	1,543	2,114
Tianjin	1,018	1,302	1,708
Guangzhou	841	1,179	1,427
Xiamen	654	848	1,085
Dalian	526	736	1,011
Shekou	463	601	720
Ningbou	353	601	902
Fuzhou	252	318	400
Total	24,729	29,392	35,483
Growth rate (%)		18.9%	20.7%

Source: Hyoung-Geun Kim, Weekly Maritime Information, KMI (Korea Maritime Institute), Nov. 20, 2000
Up to 2000, Containerization International Yearbooks were used

Table 2-7. Major Characteristics of Five Container Ports in China

	Shanghai[+]	Tianjin	Qingdao	Dalian	Yantian[++]
No. of Terminal	6	1	1	2	2
No. of Berth	18	4	5	7	6
Quay Length(m)	4,676	1,300	1,189	918	1,900
Water Depth(m)	9.4-13.2	12	6-13	12-14	15-15.5
Ship/shore cranes (Ton*No)	60T*4 50T*20 35T*11 30.5T*6	40T*2[A]	40.5T*2 45.5T*1	30.5T*2 superpost Panamax*7	41T*62
Yard Storage Capacity(TEU)	101,800	22,100	6,840	30,566 plus[B]	25,000 plus[C]

Source: Containerization International Yearbook.
+: STC (3 terminals) plus SPA (3terminals)
++: Phase II container terminal was due by end of 1999 and so it is assumed that this terminal is completed as planned.
A: In addition to ship/shore container cranes, there are 5 mobile cranes (40t*1;25t*4) and 13-yard cranes (40t*7; 40.5t*6)
B: No data were available about storage of Dayaowan Container Terminal
C: 2nd phase data were not available.

It is noteworthy that Shanghai Port Authority formed 50-50 equity joint ventures (Shanghai Container Terminals Limited: SCT) with one of Hong Kong's largest companies, Hutchison Whampoa Limited and its subsidiary, Hong Kong International Terminals in August, 1993. SCT's total projected investment was 5.6 billion RMB with 2 billion RMB in registered capital. The joint venture term would last 50 years. The joint venture company took over operation of Shanghai's three main container terminal facilitates - Zhang Hua Bang, Jun Gong Lu, and Bao Shan and its top priority was the conversion of five general cargo berths (two in Zhang Hua Bang and three in Jun Gong Lu) to container berths, thus totaling twelve berths on the completion (See table 2-8).

Then, the company looked into potential sites in the municipality for new container terminals, including Wai Gao Qiao in Pudong and Jin Shan Zai along Hangzhou Bay. Shanghai Port Authority has been developing Wai Gao Qiao (hereafter WGQ) as a new main container terminal since 1991, completing its first and second phase development plan. The WGQ terminal is scheduled to be expanded in two more phases through year 2003, providing a capacity of 2.4 million TEUs.

Table 2-8. Shanghai Container Terminal Facilities

Terminal	Zhang Hua Bang	Jun Gong Lu	Bao Shan	Total
Quay Length(m)	783	858	640	2,281
Total Area(sq.m)	303,000	307,000	218,000	828,000
CFS Shed Area(sq.m)	6,841	6,841	10,426	24,108
Yard Capacity (TEU)	22,000	23,000	15,000	60,000
Gantry Cranes	8	7	5	20
Water Depth(m)	10.5-12.5	10.5	9.4	9.4-12.5

Source: Containerization International Yearbook

Shanghai's weakest point used to be the shallow water so that any vessel of 2,000 TEUs could call upon the port only in the high tide. The Ministry of Communications and the Shanghai Municipal Government ordered a technical study on the improvement of the fairway at the mouth of the Yanzi Jiang River and the deepening of the Hangzhou Bay fairway up to the water depth of 12.5 meters in order for third- and fourth-generation container vessels to pass.[12]

Consequently it deepened the water depth from 10.5 meter to 12.5 meter in the Zhang Hua Bang Terminal and from 8.5 meter to 9.4

12 Liu Hai Hu, Shanghai Port Greeting the 21st Century, In Asia-Pacific Ports Symposium Proceeding, Kobe, 1993, p.243.

meter in the Bao Shan Terminal during late 1990s. However, the water depth in the approach channel was only seven meters deep so the port deepened the channel to 8.5 meters by 1.5 meters from July 1st, 2000. But the water depth is still not deep enough to accommodate super Post-Panamax vessels like the 5,000-6,000 TEUs class, which require 15 meters water depth. Shanghai expects container growth of 1 million TEUs every year for five years. The container volume in 1999 already surpassed the capacity by one million TEUs and this lack of capacity is to be further worsened in the future without a breakthrough development plan. To resolve this problem, the port authority has been considering a new site for a deep-water port in Daxiao Yangsan islands area for some years, with a capacity of 22.4 million TEUs by 2020. This area is, at present, composed of two small island: Dayangshan and Xiaoyangshan.

Lloyd's List Maritime Asia publishes in its recent article (June 2001) that Shanghai will soon announce tenders for its Yuan 150bn (US$18.1bn) bid to become the world's busiest port, connecting the two islands with a capacity of 20 million TEUs over 52 berths just outside Shanghai waters. It is now full steam ahead for the project, which should be accepting its first loads in 2005. Reclamation and construction are still in the planning stages while dredging on a 50 ft-deep approach channel to the berths has already started. Shanghai Port Authority will operate the new port though foreign investments are welcomed within 49% stake due to a recently adopted government policy on foreign direct investment in Chinese ports. The new port can only be built requiring a great deal of landfilling and dredging so that the islands can be connected to be used as the quay structure of the port (See table 2-9).

Table 2-9. New terminal developments in Shanghai Pudong and Daxiao areas

Terminal	Period	Quay length (m)	Gantry cranes	Water depth (m)	Total area (m2)	Capacity (1000 TEU)
WGQ I	'91-93	900	9	12.0	498,200	1,200
WGQ II	'97-99	900	9	13.2	997,000	1,200
WGQ III	'99-01	600	4	13.2	630,000	800
WGQ IV	'00-03	1,250	12	13.0	1,000,000	1,600
DAXIAO	'01-20	-	-	15.0	-	20,000
Total		3,750	42		3,100,000	24,800

Source: a shipping company's meeting report on Shanghai terminals/KMI internal data.

Crossing the waters from China, Korea and Japan are reached. Since Korea's port plan is explained in the next section in detail, this section only handles Japanese plan. The Port of Kobe handled 2.10 million TEUs less than 2.27 million TEUs of 2000. Therefore, year-on-year growth rate is -7.3%. The port is only one having minus growth rate among major Asian container ports (see table 2-4).

Since the earthquake of 1995, Kobe has been suffering from losing cargoes to Pusan and Kaohsiung. It strives to attract former customers back to them, however, prescription so far seems ineffective as can be seen from stagnating cargo throughput. The port has three terminals with 37 berths at present and expansion plan of 10 berths in the future with six berths in Enterprising Zone and four berths in Roco Island. According to a study in Korea (KMI 1999), Kobe charges more than twice of Pusan and 36% more than Kaohsiung.

The same charging rate was done only by Hong Kong among competing ports in East Asia. The high cost in transshipment, in particular of Chinese cargoes to Europe and North America, has made the port left behind Pusan, Kaohsiung and Pusan (KCTA 2000). Kobe

leases most of the berths to major shipping lines. Due to the stagnation of the Port of Kobe, Japanese government seems to develop other ports as regional hub as is the case with Yokohama. The Port of Yokohama officially opened Minami Honmoku Pier Container Terminals MC-1 and MC-2 in early April 2001.

The new terminals, each with one berth, are the first in Japan to offer 16m draft, thereby enabling Yokohama to handle container ships up to 12,000 TEU in size. With an overall area of 35 ha, storage space of 17,000 TEU and five new super Post-Panamax gantry cranes, the terminals are claimed to be the largest and best equipped in Japan. Maersk Sealand has taken a keen interest in the development of the new terminals and now exclusively leases the berth at MC-2.

The 6,600 TEU vessel the Chastine Maersk, operating on the transpacific trade, made its inaugural call at Yokohama in April, 2001. The other terminal (MC-1) is a public facility. Development at Japanese ports has been static in recent years compared with other Asian countries, and this is a step towards attracting more cargo towards Japanese hub ports previously lost to Kaohsiung and Pusan. In 2001, Yokohama handled 2.40 million TEU, a year on year increase of only 3.6% (Containerization International yearbook 2002).

In response to requests and to facilitate imports, Japanese government has decided to carry out their improvements in harbor and airport infrastructure. As such, it aims to establish Foreign Access Zone (FAZ) for smoothly connecting international and domestic distribution systems, providing further means of access to imported goods for the Japanese people and companies, and assuring quick and efficient deliveries of foreign goods to meet user.

Yokohama Port Cargo Center (YCC) is the largest and most

advanced comprehensive logistics center in Japan with its total floor space of approximately 320,000 square meter. It is located on Daikoku Pier, one of the two main piers of the Port of Yokohama. YCC is capable of meeting every possible need of the users such as cargo storage, cargo sorting, distribution processing, display and sale, delivery, etc. It aims to strengthen logistics function of the Port of Yokohama and activate the economy of Japan (Lu 2000).

2.3.3. South-Tier Port Competition.

The south-tier competition is among Kaohsiung, Hong Kong[13], Singapore, China and Malaysia.

Taiwan has three major international container ports: Kaohsiung Harbour, Keelung Harbour and Taichung Harbour. Kaohsiung is the largest container port in Taiwan, which accounted for 67% of the total container traffic. It has remained in the top 5 position in the world since 1980, and Keelung has remained in the top 10 position since 1986.

Total container cargo in Taiwan reached 10,510,762 TEUs in 2000. This was 753,115 TEU more than the previous year. The average container trade growth between 1973 and 2000 was 14.2%, however, there was only 7.5% of growth rate in the period from 1996 to 2000. It is noted that transfer container traffic has tremendously increased from 0.66% of total container traffic (2,439 TEUs) to 40.2% (3,919,377 TEUs) in the period from 1973 to 1999. Kaohsiung is the major transfer port in Taiwan, over 90% of total container transshipments were transferred by it since 1988. Due to the rapid

13 Despite the fact that Hong Kong was transferred to China, it is separately treated here from China due to its independent status regarding the port development decision.

growth in transshipment, the government of Taiwan decided by decree to nominate Kaohsiung as a regional operations center in 1994. Kaohsiung has five container terminals: Terminal no. 1 to 5. Most berths are known to have the water depth of more than 14 meters. Shipping lines are renting most of the terminals and Terminal 1 is the only public use.

The Port of Kaohsiung now has 80 warehouses and shelter buildings whose total capacity is 708,932 tons. It has 19 locations of open squares whose total capacity is 70,890 tons. Recently, Taiwanese government is engaging in developing Taiwan as an Asia-Pacific Regional Operations Center (APROC). At the same time, the government is seeking for membership of the World Trade Organization (WTO). Furthermore, it is speeding up its pace of internationalization and economical liberalization. Kaohsiung Port Authority and Yang Ming Marine Transport Company have signed a contract on 22 August 2000 and will build mutually a global distripark (Lu 2000). In spite of these efforts, Kaohsiung has been surpassed by Pusan in 2000 giving ranking third to Pusan by a slight margin.

Whereas in the past shippers had little choice as to whether to use Hong Kong as the transshipment center for their cargoes, with the continuing improvement of transport infrastructure and the embracing of more modern logistics concepts and practices in the Chinese mainland, this is increasingly not the case. Shenzhen ports have been massively and very speedily developed in the past few years. Approximately half of Chinese mainland exports are handled through Hong Kong and around 90% of cargo emanating from South China passes through Hong Kong. But, two major ports at Shekou and Yantian are now in position to compete directly with Hong Kong.

Hutchinson Whampoa and Shenzen Dongpen Industries operate Yantian as a joint venture.[14]

In fact, since 1985, China has invested more in its port development than the rest of the world combined (Frankel, 1998). Yantian, which is operated by Hutchison Whampoa and Shenzhen Dongpen Industries in a joint venture, has five quays, each of which is capable of handling the latest generation of container ships. Shekou is operated on a joint venture basis between China Merchants, P&O, Swire Pacific and Modern Terminals Ltd. It has 2 berths with a total of 600,000 TEU annual capacity. Both ports have been built with additional space for container storage and future development and both are well connected to road and rail links within the Chinese mainland (Cullinane, 2000).

It is noteworthy that Yantian has enough water depth for big size vessels and well equipped with a great deal of container cranes. What is more, the Port of Yantian has on-dock railway track link up, with Yantian and Pighu Nan Railway station, which connects JingGuan railway at Pinghu Nan and Jingjiu railway at Chang-Ping.[15] In short, the Port of Yantian has advantageous factors to be a hub port in: 1) water depth, 2) modernized cranes, 3) on-dock railway system for long-distance inland transportation. It appears, therefore, to have great potential for full-fledged function in Chinese container transport network in the future.

In 1990, 28 shipping lines called directly to China and 55 to Hong Kong. By 1998, 91 lines called directly to China and 47 to Hong Kong (Drewry Shipping Consultants, 1999). According to an estimate

14 Kevin Cullinane, "The Competitive Position of the Port of Hong Kong," Proceedings of KASS and KOMARES' International Symposium: Challenge of the World Shipping and Response of the Korean Shipping in the 21st Century, Nov. 10-11, 2000, Seoul, Korea

15 Containerization International Yearbook, 2000, p. 139.

made by the Hong Kong Port and Maritime Board in 1997, in terms of cost, exporting a 40 foot laden container originating in the PRD direct from Shenzhen to America saves US$ 175 compared to transshipping through Hong Kong and for a 20 foot laden container to Europe, US$ 30 can be saved.

However, Chinese ports have a reputation for the clumsiness and bureaucratic complexity of its Customs procedures. Indeed, according to Shekou's own publicity, the traditionally complex Customs procedures in China are being rationalized and simplified. When this really does prove to be the case, the disincentives for using Chinese mainland ports for the entry or exit of cargoes will decrease significantly (Cullinane, 2000).

Kwai Chung Container Port in Hong Kong has one of the most advanced freight distribution center in the world. The Hong Kong International Distribution Center (HIDC) Office Tower is dedicated, ultra-modern, ten-floor grade office building designed with a separate entrance. Each floor has a gross floor area of 23,128 square feet divisible into smaller units, with sizes ranging from 913 to 2,873 square feet (Lu 2000).

Compared with PSA, Hong Kong is congested at the terminal gates caused by bustling with trucks, whereas in Singapore, they tend to be orderly to the point of being dull. The reason is that in Singapore, 80% of containers leave the same way they arrived - by boat- whereas in Hong Kong, almost all of the containers are driven through the gates, to and from the hinterland. In a word, Singapore is a "trans-shipment hub", whereas Hong Kong is a "local cargo port" (The Economist 2001). Cullinane (2000) argues that Hong Kong cannot rely solely upon the beneficial influences of present port choices, but must strive

to ensure that it maintain its non-cost advantage in terms of high levels of productivity and service quality, while at the same time seeking to minimize the price which is charged to its customers.

GHK (2000) have produced port cargo forecasts for Hong Kong up to the year 2020. The figure reveals that the predicted average annual growth rate for the cargo base over the next twenty years is 8.6%, while the equivalent figure for the port of Hong Kong is only 4.4%. All other things being equal, what this implies is that the market share of Hong Kong's main competitor ports in South China will grow from 16% as of 1999 to 55% by 2020 (Cullinane 2000).

A new Malaysian port, the Port of Tanjung Pelepas (PTP) has taken over the cargoes by Maersk-Sealand lines from PSA. Volumes in PTP surged to 2,050,000 TEUs in 2001, representing an increase of 388% over the previous year. The main reason for the increase is the completed transfer of Maersk Sealand's traffic from Singapore in December 2000. PTP increased its productivity by purchasing reachstacker, forklifts and 10 quay cranes as well as 36 RTGs in 2001. PTP is believed to provide the same service as PSA, but at a 30% discount (The Economist 2001).

PSA Corporation sees its future as lying in the leveraging of IT to ensure it stays ahead of the competition. Unlike the views on the competition with PTP, PSA takes a rather different view and believes that it competes with a much wider range of ports than just those next door. They realize that Singapore's traditional advantage in location is not any more enough for the port to dominate the region. Rather, it seems more important to ensure three factors of primary service: connectivity; customized service; and the IT back up it provides. In this regard, PSA's terminal connect to more than 300 shipping lines and

700 ports worldwide, while it provides customized agreements to customers achieving berthing on arrival for more than 90% of all ships calling at the port.

PSA invests around S$ 100m a year in IT research and development. Due to the limitation of space, PSA cannot provide dedicated berths, which resulted in Maersk's shift to PTP, to some extent. PSA attempts to provide 'catch up service' for any delayed ship in its schedule. With in excess of 200 moves per hour on an individual ship the vessel is able to make up for lost time. This high productivity will be largely based on IT development. Recent developments include remote controlled bridge cranes at Pasir Panjang Terminal, which enable up to five cranes to be controlled by a single operator. Currently, berths at the terminal can handle 750,000 to 800,000 TEUs per year, but PSA has set a target of 1m TEUs per year per berth (Lloyd's List Maritime Asia, 2001).

PSA has 4 major Distriparks totaling 600,000 square meters of warehouse area within the Singapore distribelt. They cater to the distribution requirements of manufacturers, central distribution center operators, freight forwarders, trader and specialized warehouse operators (Lu 2000). Meanwhile, PSA attempts to expand its international portfolio in container terminal operating business with China. It has already invested for operation in Dalian and Fuzhou and recently signed a joint-venture deal with Guangzhou Harbour Bureau. Major terminal operators are very keen to invest in Chinese ports because of the forecast 49-65% trade growth, equating to 61.3 million TEUs, over the next four years (CI 2001).

The port competition in East Asia was reviewed classified in two groups: north-tier competition among traditional major players - Kobe, Pusan -and dark horses such as Shanghai, Kwangyang and perhaps

Yokohama; south-tier competition among traditional three big players Kaohsiung, Hong Kong and Singapore- and new comers from Yantian in China, and Tanjung Pelepas in Malaysia. The boundary of divided battle ground between the two tier-frontiers may be loosened and finally merged into one grand frontier in the foreseeable future due to upsizing of ships and expansion of port activities. For instance, most of the competing ports in the region tend to consider all others in the range of possible competitors when planning their future port plans. As such, next section deals with the Korean perspectives in this context.

2.4. Korean Strategy

2.4.1. Container Throughput and Port Facilities in Korea.

In Korea, the total cargo containers were about 9.70million TEUs in 2001. The Port of Pusan handled 7.95 million TEUs in 2001 (including coastal container trade, it was 8.07 million TEU), eighty two per cent of the nationwide total, which ranked third in the world, surpassing the Port of Kaohsiung. The portion of containers handling at the Port of Pusan out of national container total has been deceasing slightly. This trend is believed to be augmented as the Port of Kwangyang (new port) is developed according to its development plan (See table 2-10).

Table 2-10. Container throughput by port in Korea

Unit: TEUs / %

Year	National total	Pusan	Inchon	Oolsan	Kwangyang	Others
1995	4,800,977 (100.0)	4,502,596 (93.8)	236.641 (4.9)	42.567	-	19,173 (0.4)
1996	5,202,898 (100.0)	4,760,507 (91.5)	348,727 (6.7)	47,003 (0.9)	-	46,661 (0.9)
1997	5,820,725 (100.0)	5,233,880 (89.9)	432,795 (7.4)	93,009 (1.6)	-	61,041 (1.1)
1998	6,371,535 (100.0)	5,752,955 (90.3)	401,536 (6.3)	125,829 (2.0)	32,135 (0.5)	59,080 (0.9)
1999	7,393,323 (100.0)	6,310,664 (85.4)	447,162 (6.0)	149,493 (2.0)	415,399 (5.6)	70,605 (1.0)
2000	8,842,628 (100.0)	7,424,871 (84.0)	483,324 (5.5)	236,296 (2.7)	615,327 (7.0)	82,692 (1.0)
2001	9,701,533 (100.0)	7,953,624 (82.0)	537,786 (5.5)	258,468 (2.7)	811,178 (8.4)	140,477 (1.4)

Source: Korea Container Terminal Authority
Bracket: portion of each port out of the national total.
Coastal container cargo (domestic trade) excluded.

Six specialized container terminals handle the cargo containers in Pusan with the total annual capacity of 4.66 million TEUs as of April, 2002. Since the cargoes demanded in Pusan surpassed the total capacity of all the six specialized terminals, conventional piers had to handle 2.6 million TEUs to supplement the gap between supply and demand of container port facilities. The characteristics of the six container terminals in Pusan and the other in Kwangyang Port are shown in table 2-11.

Table 2-11. Characteristics of specialized container terminals in Pusan and Kwangyang

	The port of Pusan						KwangYang	
	Jasung -dae	Shinsun -dae	Gamman	New Gamman	Uam	Kam-chon	First Phase	Second P.(II-I)
Construct. period	'74-'96	'85-'97	'91-'97	'95-2001	'95-'99	'88-'97	'87-'2001	'95-2001
Start of Operation	Sep, 1978	June, 1991	April, 1998	April, 2004	Sep., 1996	Nov., 1997	July, 1998	April,2002
Operator	Hutchison	PECT	4+ companies	Dongbu	WTC	Hanjin	4+ companies	KIT, Dongbu
Quay length	1,447 m	1,200 m	1,400 m	826 m	500 m	600 m	1,400 m	1,150
Water depth	12.5 m	14-15 m	15 m	12-15 m	11 m	13 m	15 m	12-15
Annual Capacity	1.0 mil.TEU	1.2 mil.TEU	1.2 mil.TEU	0.65 mil.TEU	0.27 mil.TEU	0.34 mil.TEU	1.2 mil.TEU	0.81 mil.TEU
Berthing Capacity	50,000 DWT*4; 10,000 DWT*1	50,000 DWT*4	50,000 DWT*4	50,000 DWT*2 5,000 DWT*1	20,000 DWT*1 5,000 DWT*2	50,000 DWT*2	50,000 DWT*4	50,000 DWT*2 20,000 DWT*2
Con. Cranes	11	11	12	7	4	4	8	

Source: Korea Container Terminal Authority
+ HJ (Hanjin), Hutchison, Sebang, Korea Express
Capacity as of April, 2002

The table shows that three terminals in Pusan can handle about one million TEUs, respectively, with each terminal accommodating four 50,000 DWT ships. The other three terminals can handle three to six hundred thousand TEUs per terminal. The Jasungdae terminal was

developed in two phases as the first specialized container terminal in Korea. It used to be run as a state-run company before being privatized in September 1999. The Port of Pusan lacks container yard area within the terminal and therefore, most of containers have to be transferred to the 26 Off-Dock Container Yards dispersed in the city. This causes increased traffic congestion in the city.

2.4.2. Container Port Development Plan in Korea.

To secure port facility capacity in Korea, MOMAF strives to: 1) develop Pusan and Kwang-Yang port as hub port so called Two-Port System; 2) establish feeder service system in each regional block; 3) establish the connection with the inland transportation system; 4) induce private capital for timely development of several ports; 5) and develop and introduce duty-free zone in the hinterland with a view to activating the port (Y. Kim 2000).

As for the two port system, Pusan plans to develop a new container port (Kaduck New Container Port) in two phases by 2011, with a view to providing 30 berths and having the annual capacity of 6.0 million TEUs. Kwangyang has also developed its second phase plan(II-II) from 1995 to 2003 in addition to its present terminal, totaling eight berths (first phase 4 berths, second phase(II-I) 4 berths by 2001). The new development by the second phase (II-II) provides two berths for 50,000 DWT ship class and another two berths for 20,000 DWT ship class, resulting in the annual capacity of 3.02 million TEUs in total. To expedite construction of container port facilities and to manage all the container terminals in Korea, Korean government established Korea

Container Terminal Authority (KCTA) in 1991.

Before 1991, port income from container terminals as well as general cargo and bulk terminals was transferred directly to the National Treasury, which is controlled, by the Ministry of Economy and Finance. The Budget Authority assigned the entire port budget that is necessary for the development and operations of the ports. But it took very long time to acquire port budget, since it needs strong and patient discussion with the budget authority, ministerial discussion and also consent from parliament. Furthermore it was very difficult for securing sufficient investment budget for the development of the ports, since priority to the port investment was not high compared with other infrastructure.

KCTA was given the right to borrow existing container terminals from Korea Maritime and Port Authority for nothing, therefore, taking over the management of Jasungdae, and Shinsundae terminals as well as semi-exclusive container terminal in the port of Incheon (terminal 4). KCTA was given the right to issue bond to finance the investment money, guaranteed by government. Consequently, it could finance huge amount of fund from international financial institutions.

In addition, the KCTA can lease the terminals to private sector for rent since it does not operate terminals, but only manages them. Finally, KCTA was empowered to construct new container terminals (H. Kim 2000). KCTA, thus far, developed 22 berths both in Pusan and Kwangyang including, Gamman Terminal, Uam terminal and Kwangyang Port terminals. KCTA is expected to play the leading role in future container development as in table 2-12.

Table 2-12. Container development plan in Korea

Unit: No. of berths

	Pusan				Kwangyang				Total			
Financial source	G.	K	P	total	G.	K	P	total	G.	K	P.	total
Till '01	7	14	-	21	-	8	-	8	7	22	-	29
2002-11	12	8	10	30	-	25	-	25	12	33	10	55
Total	19	22	10	51	-	33	-	33	19	55	10	84

Source: KCTA
G. stands for government; K for KCTA; P for private sectors.

Korean government is ambitious in developing the two ports as the regional hub. Pusan is one of the cheapest ports in East Asia in handling cargoes. KMI research (KMI 1999) shows comparative index of handling charges among competing ports. Shanghai is very slightly cheaper than Pusan, but Pusan is much cheaper than any other ports in the region.

Pusan has particularly comparative advantage in transshipment cargoes as shown by KCTA study (KCTA 2000) in terms of cost and facilities, and recent years' sharp increasing in these cargoes has made Pusan emerge as powerful transshipment port. Table 2-13 presents a very sharp increase in transshipment cargoes in 2001. Year-on-year growth rate of the transshipment cargo was 27% nationwide in 2001. Pusan handled 8.07 million TEUs, out of which Pusan handled 2.94 million TEUs for transshipment cargoes, taking 36% of the total container cargo.

Pusan's surpassing Kaohsiung in world ranking of container ports to the third can be attributed much to the increase of transshipment cargo. Encouraged by this increase in recent years, Korea government has amended its original container cargo demand for the ports more

aggressively (see table 2-14). As the government increased the predicted container cargoes, it also had to increase berth productivity from 250,000 TEU per berth to 300,000 TEU per berth not to incur too much budget on building new capacities in proportion to the increased demand for the facilities.

Table 2-13. Recent years' container throughput in Korea

Unit: 10,000 TEUs

		1998	1999	2000(a)	2001(b)	Growth (b/a)
National Total	Total cargo	673	767	912	999	1.10
	T/S	(127)	(166)	(245)	(311)	1.27
Pusan	Total	595	644	754	807	1.07
	T/S	(127)	(163)	(239)	(294)	1.23
Kwangyang	Total	11	48	68	86	1.26
	T/S	(0)	(3)	(6)	(17)	2.83
Others	Total	67	75	90	106	1.17
	T/S	(0)	(0)	(0)	(0)	

Source: H. Kim (2001)

Table 2-14. Amended prediction container cargo in Korea

Unit: thousand TEU

1999 (actual)		2001	2006	2011	Growth (%)
Original prediction	7,670	9,854	13,955	19,224	7.9%
	(1,661)	(1,740)	(2,663)	(4,076)	(7.8%)
Amended prediction	7,670	11,031	19,266	29,668	11.9%
	(1,661)	(3,219)	(8,005)	(13,176)	(18.8%)

Source: MOMAF
Parenthesis indicates transshipment cargoes.

2.4.3. Port Privatization and Other Strategy in Korea.

Containers cargoes were transported dominantly by roadway (86.6%), then railway (11.0%) and coastal shipping handled only 2.4% in 2001. This heavy reliance on roadway caused congestion, pollution and other types of environmental stress. To resolve this problem, the government explores to increase the proportion by coastal shipping for the transport to and from the hinterland. In addition, the government has striven to induce private investment in port construction and also operation not only from domestic sectors, but also from foreign investors. From the second phase port of Kwangyang onward, the government actively encourages to attract foreign investment as well as the new port development in Pusan, where already a consortium of private companies, is formed in constructing ten berths (see table 2-12).

Along the same line, the government has also attempting to privatize their ports either to private companies for operational purpose or to local municipalities for the whole delegation of port development and management such as Pusan and Incheon. However, the delegation to the municipalities has been protracted due to different views between central agencies and the local governments and financial clearance issues of accumulated debts. In this regard, Kim (H. Kim 2000) well describes the port privatization process in Korea as in the following:

As for the container port privatization in Korea, Shinsundae Container Terminal was the first to be privatized in Korea in 1991. The terminal was the 2nd exclusive container terminal in Korea and leased to PECT (Pusan East Container Terminal Co.), which is a consortium composed of existing 10 stevedoring companies and a

public corporation. Then BCTOC in Jasungdae Terminal was privatized in 1999, when Hyundai Merchant Marine Co. Ltd. purchased it for 20 years.

However the terminal resold to Hutchison in February of 2002 for the financial problem of HMM. Meanwhile, in 1994, 4 berths of Gamman Container Terminal in the Port of Pusan, and another 4 berths in the port of Kwangyang were to be leased to 4 private companies. However, construction work of these terminals was delayed, and furthermore the difficulty with negotiating dock laborers made the opening of the terminals delayed till 1998. (H. Kim 2000) H. Kim (2000) argues that the most conspicuous obstacle to private sector's participation is the attitude of docker's union. They resist to the decasualization policy suggested by government. To cope with this situation, government now plans to reform current docker's employment system fundamentally. Recently, 3 berths in New Gamman Terminal and 4 berths in the port of Kwangyang were opened and operated by private companies.

Finally, the government introduces Customs Free Zone (CFZ) in three port areas: Pusan, Incheon and Kwangyang in 2001 planning to implement it in 2002. The main purpose of CFZ is to stimulate port activities in a wider ranges as is the case with other Asian competing ports in the direction of meeting customers' demand for more efficient supply chain management.

Since this approach has been just adopted after a certain feasibility study, there seem still remaining issues as to whether this system will work effectively as planned or be in conflict with existing system. The basic direction of introducing the CFZ must be on the right path in view of other countries' development plan and success stories.

Therefore, while implementing the new CFZ system with trial-and-errors, Korean ports are likely to adapt themselves to new environmental challenges as the success history of Korean development, in general, has shown us up to date.

2.5. Singaporean Strategy[16]

Singapore is a premier logistics hub of Southeast Asia attracting a number of international manufacturing firms operating as distribution centers from all over the world and international logistics services providers. There are over 6,200 businesses in the industry employing about 97,000 people with gross receipts totaling S$28 billion. Many of these logistics companies are transnational with their parent companies located in the United States, Northeast Asia and Western Europe, and are operating in Singapore to serve the local and multinational manufacturing companies based in Singapore. Most of the international manufacturing firms have chosen Singapore as their regional headquarters and production base for their high-valued manufactured products.

16 This section is taken from a presentation paper in a recent international logistics seminar in Seoul, organized by Korea Maritime Institute as a part of a contract project on logistics hub development funded by MOMAF. The author of the paper is Prof. Jose Tongzone, at Singaporean National University and the project investigator is Dr. Chin-Soo Lim, KMI. Both of them allowed us to use the presentation paper in this report and we would like to express our sincere gratitude for their generous cooperation. Though we planned to describe this part by the third author of this report, he was not in a position to state it publicly. Therefore, the citation of the paper is an excellent surrogate to accomplish our report. Once again, we deeply acknowledge the permission by Prof. Tongzone and Dr. Lim.

2.5.1. Logistics Facilities (main container terminals, distribution centre)

The ability of Singapore to provide world class logistics services has greatly hinged on its superior infrastructure both in sea and air transport. Its port infrastructure has defined its capacity to handle vessels and container flows. It is generally divided into physical and soft elements. Physical infrastructure includes not only the operational facilities (such as the number of berths, the number of cranes, yards and tugs, and the area of storage space) but also the inter-modal transport[17] (such as roads and railways). The soft infrastructure refers to the manpower employed. Maximum deployment of both types will assist in reducing vessel turn-around, thereby increasing the port's capacity to accommodate more vessels and container flows.

Port of Singapore

The port of Singapore has a well-developed port infrastructure, not only in terms of the number of container terminals, container berths, cranes and adequate storage facilities, but also in terms of the quality of the cranes, quality and effectiveness of the port/inter-port information systems, approach channel provided, preparedness of port management and a wide range of port-related and ship related services offered. Table 2-15 presents Singapore's container terminal facilities and their facilities.

17 Inter-modal transport is a transport of unit loads by the co-ordinated use of more than one transport mode.

Table 2-15. Singapore's Container Terminal Facilities

Terminal	Area (hectares)	Draft (meters)	Berths	Cranes	Ground Slots	Reefer (Points)
Tanjung Pagar	80	11.0-14.8	6-main 2-feeder	29-QC 95-RTG	15,940	840
Keppel	96	9.6-14.6	4-main 10-feeder	36-QC 106-RTG 13-RMG	20,230	936
Brani	79	12.0-15.0	5-main 4-feeder	29-QC 105-RTG 5-RMG 2-BC	15,424	1,344
Pasir Panjang	84	15.0	6-main	24-QC 44-BC 15-RMG	14,020	648

Table 2-16. compares the port of Singapore with similar ports and other rival ports in the region in terms of physical infrastructure and average ship delays.

Table 2-16. Adequacy of Port Infrastructure: Comparative Study of Selected Ports

Port	Number of Container Berths	No. of Container Shipcalls	Delays (hours)	Number of along the shore cranes
Port of Singapore	37	24,015	2.3	118
Port of Klang	13	4,889	-	31
Port of Bangkok	20	2,415	-	-
Port of Manila	10	5,463	22.0	19
Port of Tanjung Priok	25	3,239	50.0	10
Port of Rotterdam	30	5,544	1.7	66
Port of Melbourne	12	823	8.0	16
Port of Auckland	3	2,381	-	7
Port of Felixstowe	13	2,677	0.6	29

Sources: Taken from interviews, and respective ports' publications.

To be a hub port requires in particular an adequate number of berths and other required port facilities to deal with significant volumes of cargo traffic, high frequencies of ship visits and very large ships. It also requires a well-motivated, skilled and cooperative workforce to handle the high level of co-ordination required as a hub port. To meet these requirements, the port of Singapore has ensured that its port facilities are adequate to handle future increases in cargo traffic and ship visits in the region by investing in port expansion and upgrading. It has also adopted a remuneration system that encourages high productivity and cooperation, rather than confrontation, from port workers. By tying the remunerations to performance, the system encourages high productivity and dedication. The harmonious and constructive relations between the management and port workers' union have also played an important role in helping the port employees adapt to the fast-changing and competitive business environment as well as in maintaining constructive communications to avoid any violent and disruptive confrontations.

The newly completed development of the Pasir Panjang terminal, which first opened in 1998 (after completing the first phase of the project), will give an extra handling capacity of 18 million TEUs. Once this terminal becomes fully operational, the port's total container handling capacity is expected to be roughly 36 million TEUs per annum. In addition, the port's terminals are supported by a number of district parks, providing over half a million square metres of warehousing in total. A district park is a large covered warehouse, which provides automated storage facilities. Customers can process their documents, pack and unpack, mark, label and assemble their goods for distribution to other distribution centres.

Changi Airport

Changi Airport received a total of 20 best airport awards and accolades from major international publications and organizations. Changi is connected to 140 cities in 50 countries by 60 airlines operating more than 3,282 weekly scheduled flights. Total passenger traffic registered at Changi Airport was 28.1 million while total airfreight reached 1.5 million tonnes in 2001.

The logistics needs of cargo agents, shippers and consignees are served by the Changi Airfreight Centre (CAC) which offers the benefit of a 24 hour one-stop service centre and a free trade zone (FTZ) where companies can easily move, consolidate, store or repack cargo without the need for documentation or customs duties. Only goods that are leaving the CAC need documentation to pass through the centralized customs and security checkpoint making the end of the FTZ. CAC contains 8 airfreight terminals, five cargo agents building and ten freighter aircraft parking bays. The 8 airfreight terminals are operated by the two ground handling companies - Singapore Airport Terminal Services (SATS) and the Changi International Airport Services (CIAS). For express and courier shipments, there is an Express and Courier Centre within the CAC set up especially for this special type of cargo. A second Express and Courier Centre has been added to CAC's capacity to handle such time-sensitive shipments.

Almost every aspect of the cargo handling process in the CAC involves the use of technology to increase the efficiency of cargo handling. State-of-the-art infrastructure such as automated stacker systems, mechanized materials handling systems and container/pallet elevating transfer vehicles speed up the handling process within the

airfreight terminals by automating many of the tasks that once required manual labour. One of the most useful tools that has been in used by the air cargo community since 1989 is TradeNet. It expedites cargo documentation by providing a link between the cargo community and other regulatory bodies such the Trade Development Board (TDB) and the Customs & Excise Department. Today, virtually all trading declarations sent by the cargo community can be processed within 30 minutes and some even under 5 minutes. Complementing this is the Advance Clearance for Courier and Express Shipments System (ACCESS) which enables the Customs & Excise Department to clear all incoming and courier and express shipments before their physical arrival in Singapore. This allows shipments which are due for inspection by Customs to be packed separately for clearance at the centralized checkpoint.

Changi Airport is committed to providing capacity ahead of demand to cater to the growing needs of the Singapore air freight industry. With an expected increase in cargo volumes, much investment has been sunk into developing the infrastructure for handling cargo. Construction of the 3rd passenger terminal building has commenced on 7 October 2000 and is scheduled for completion in 2007 which will provide the airport with an additional handling capacity of 20 million passengers. This will bring the total handling capacity of Changi Airport to 65 million passengers a year. The upgrading at Terminal 1 was due to be completed in September 2002. CAAS will embark on a $200 million upgrading programme for Terminal 2 in the later part of 2002.

2.5.2. Key Success Factors

The government of Singapore has identified logistics as one of the areas where Singapore is considered to have a competitive advantage and an area that should be further developed to strengthen Singapore's role as a leading globally integrated logistics hub.

A number of factors were identified to be Singapore's sources of competitive advantage as a logistics hub, including strategic location allowing coverage of a large number of countries, adequate and highly efficient infrastructure, high connectivity, internationalization and language skills, strong government support with transparent policies, and availability of logistics professionals and harmonious management-labour-government relations.

A. Strategic location

Singapore is located along the Straits of Malacca, which is a main shipping route between East and West. Refer to Figure 2-4. It was estimated that over 600 ships transit the straits every day (The Business Times Shipping Times, 16 October 1997:1). It is also fortunate to enjoy natural deep waters and harbors, which allows it to service ships with deeper draughts without necessarily resorting to extensive and expensive dredging operations. The waterways serving as entrants to Singapore allow even the largest ships to use them. Singapore does not have typhoons and other natural calamities, which make port operations and freight movements safe and reliable.

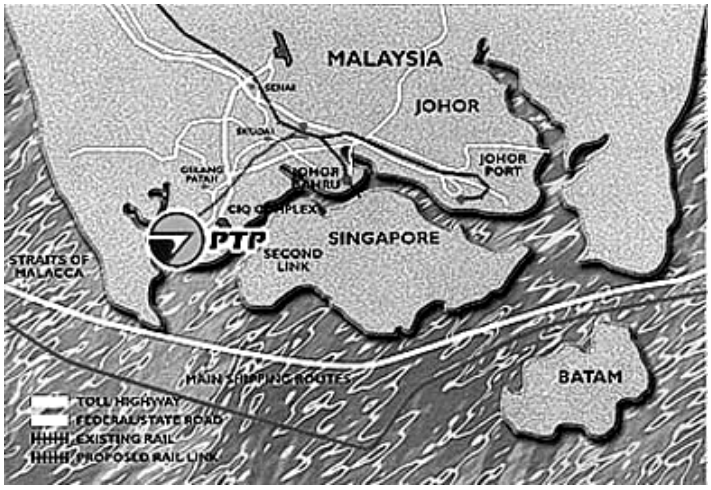


Figure 2-4. Location of Singapore

Singapore is located close to some of the world's dynamic economies. Even before rapid economic development of these economies started, Singapore has already played an entrepot role, servicing as a gateway to Singapore's hinterland. The remarkable economic development and growing trade orientation of its close Asian neighbors have only heightened its entrepot role. Although the 1997/98 economic crisis has adversely affected its logistics business, the long-term future for the region is bright and will remain one of the most dynamic regions in Asia.

B. Adequate and highly efficient infrastructure

Singapore's adequate and highly efficient infrastructure is particularly manifested in its sea-air transport and telecommunication sectors. For example, in the case of port infrastructure, Tongzon and Ganesalingam

(1994) and Tongzon (1995) have shown the port of Singapore to be in the same league (similar in contexts) as the ports of Rotterdam, Hong Kong and Kaohsiung, and that the port of Singapore has outshone all other similar ports in the area of ship turnaround time, labour efficiency, crane efficiency and in the utilization of other port assets. Singapore's high level of efficiency has made it more economical for shipping lines to call at her port, despite its relatively high port charges. As Table 2-17 shows, compared to its regional rivals and like-for-like ports, Singapore's port charges are much higher, but its ship turnaround time is one of the lowest ones.

Table 2-17. Like for Like Comparative Performance of Singapore based on Selected Indicators (2000)

	Port Chargesa (US$)	Ship Turn- around time (hours)	Connectivity to other ports
Port of Singapore	155.0	12	740
Port of Klang	50.0	12.5	500
Port of Bangkok	23.37	15	-
Port of Tanjung Priok	-	-	-
Port of Manila	24.74	-	-
Port of Rotterdam	-	-	1000
Port of Melbourne	23.28	-	200
Port of Auckland	26.52	14.9	160
Port of Felixstowe	108.51	-	365

Notes: - : not available; Ranks from 5 (highest) to 1 (lowest); a Represented by container handling rates per FCL; Exchange rates used: US$1=S$1.74, US$1=RM3.80, US$1=THB42.8, US$1=48.50 pesos; US$0.49=AUD$1; US$1=NZ$ 2.47; US$1=0.6912 pounds.
Source: Fairplay Port Guide 1999/2000; www.cosco.com.au/ports.htm.

C. High Connectivity

Cargoes, while waiting to be transported at a logistics hub, are costly and counter-competitive in terms of transit time. Whenever possible, operators should strive for tight connection between feeder and mother carriers. A country that provides an exhaustive and fast connectivity to other places of destination is capable of assuming the role of a logistics hub for a defined region.

The port of Singapore is linked by 400 shipping lines to practically 740 ports worldwide. Practically all the major international carriers and shipping lines, 400 of them, call at Singapore. Its high port connectivity and ship frequencies cover all parts of the globe with concentration in Southeast Asia. This wide ranging port connectivity allows shipping lines to maximize slot utilization on their mother vessels by offering more choice of feeders to various trade routes.[18] Shippers are also able to move their products to/from the markets faster and at lower inventory costs.

D. Internationalization and English Language Skills

Singapore is one of the most open economies with an international trade component much greater than the value of its GDP. This openness, brought about by its most liberal trade and investment policies, has made the economy attractive for logistics and export-oriented companies.

English is Singapore's official language and means of communication

18 In terms of connections, at the port of Singapore daily there are 3 sailings to the US, 4 to Japan, 5 to Europe and 22 to South and Southeast Asia.

in business and at the government level. The ability to speak and write English is useful since English is an international language used in many business transactions. Knowledge of the English language also allows one an easy access to information and new ideas available in international organizations and other foreign sources, which may be required for business operations. Since Singapore's laws, rules and regulations are written in English, foreigners have found it easier to understand and interpret them. Doing business in Singapore is much easier and more convenient for foreign businessmen.

E. Strong government support with transparent policies

The government of Singapore has played a critical role in achieving the logistics hub status for Singapore. The government of Singapore in particular has formulated and effectively implemented policies and strategies to create an environment that nurtures openness, efficiency and accountability in its logistics operations and services.

Singapore's type of government intervention is a combination of no distortion and dirigiste. It encourages competition and operational efficiency by adopting a policy of openness (no import restrictions, price controls or subsidies). On other hand, it intervenes in the economy directly (i.e. running government enterprises) and indirectly by way of regulations and other policies affecting the private sector.

The port of Singapore is a good example of this type of government intervention. The port is run on a commercial basis, self-financing, and is expected to compete with other ports on equal footing. However, this is also a public port and is expected to operate with objectives consistent with the national development agenda and priorities of the

government of Singapore. The Port of Singapore Authority (PSA), operating on 1 April 1964 and later renamed into Maritime and Port Authority of Singapore (MPA) with the corporatization of PSA in 1997, is a statutory board whose main task is to regulate and control navigation and shipping in the port area and is under the Ministry of Communications.

F. Availability of logistics professionals

The importance of developing a ready pool of skilled logistics professionals to manage increasingly complex logistics operations is vital. A wide variety of courses are available at training institutes, polytechnics and universities. These range from certificates to diploma and full-fledged graduate and post-graduate degree programs. A multi-agency effort by TDB, EDB, CAAS, MPA, and NSTB, the Logistics Institute-Asia Pacific was established in 1999 to provide world-class training to meet the demands of the dynamic global logistics industry. TDB will also work closely with the Ministry of Manpower to formulate a Logistics Manpower Road map to develop manpower capabilities in the logistics industry.

G. Harmonious government-labour-management relations

Logistics requires a well-motivated and cooperative workforce to handle the high level of co-ordination required. Singapore adopted a remuneration system that encourages high productivity and cooperation, rather than confrontation, from transport workers. By tying the remunerations to performance, the system encourages high productivity

and dedication. The harmonious and constructive relations between the government, management and the workers' unions have also played an important role in helping the workers adapt to the fast-changing and competitive business environment as well as in maintaining constructive communications to avoid any violent and disruptive confrontations.

In a nutshell, the success of Singapore as a logistics hub is attributable not so much to its geographical location as to the determined effort to build world-class infrastructure with highly efficient transportation system and create an environment conducive to doing business for domestic and foreign investors. In particular, its sea, air and land sectors have achieved world-class standards - its air and seaports have remained major hubs with excellent facilities and efficient operations.

But behind all these other factors lies the crucial role of the government. The involvement of the government thorough agencies such as the Trade Development Board (TDB), Port of Singapore (PSA), Civil Aviation Authority of Singapore (CAAS) and the Maritime and Port Authority (MPA) is critical for its success. As a facilitator, initiator and provider of logi-structure, the government of Singapore has been involved in a range of joint government-private sector activities from financing of private sector initiatives, employment of IT, development of skilled and appropriate manpower and provision of hard infrastructure such as congestion-free roads, efficient sea and airports.

2.5.3. National Policy and Contents of the logistics policy

The logistics agenda is set and driven by the Singapore Trade Development Board (TDB). To enhance the development of the

logistics sector and address the needs of this sector, a steering committee spearheaded by the TDB and consisting of 14 government agencies (Civil Aviation Authority of Singapore; CAAS), Economic Development Board (EDB), Jurong Town Corporation (JTC), Land Transport Authority (LTA), Maritime Port Authority (MPA), National Computer Board (NCB), National Science and Technology Board (NSTB), Port of Singapore Authority (PSA), Trade Development Board (TDB), Urban Redevelopment Authority (URA), Customs and Excise Department (CED), Inland Revenue Authority of Singapore (IRAS), Monetary Authority of Singapore (MAS) and Productivity and Standards Board (PSB) and the private sector drew up a Logistic Masterplan which focused on 6 key strategic thrusts to advance Singapore's logistics industry (TDB 1999). These are:

Strategy 1: Develop an integrated and globally connected infrastructure.
Strategy 2: Develop a conducive IT-based operating environment and competent IT capabilities.
Strategy 3: Enhance integrated logistics operations.
Strategy 4: Attract international logistic hub activities and solutions based services and internationalized Singapore logistics.
Strategy 5: Develop world-class expertise and skills.
Strategy 6: Enhance market access to facilitate expansion of international networks.

E-Logistics

The importance of e-commerce in business means that it is the key to Singapore becoming a premiere integrated transport and logistics

hub. In response, the TDB encourage local logistics providers to use IT in enhancing logistics performance. The Gartner Group predicted that Business-to-Business e-commerce within the Asia-Pacific will soar from US$18 billion in 1999 to US$272 billion in 2003, accounting for 20% of the world's e-commerce market. Singapore will witness annual growth of 110% for indirect Business-to-Business e-commerce and 70% for direct Business-to-Business e-commerce. Logistics will be a key-supporting infrastructure for the successful development of e-commerce in Singapore as well as the region.

The main emphasis is to ensure the adoption of e-commerce as the critical enabling tool for the logistics industry in Singapore. The TDB is formulating an IT Action Plan for the logistics industry, in close collaboration with the Infocomm Development Authority (IDA) and other key Government agencies. The Plan involves a three-pronged approach in enhancing internal operations within companies; connectivity among related companies to foster collaboration as well as international linkages with overseas business partners. The aim is to develop a conducive IT-based operating environment and competent IT capabilities within the logistics industry such that companies can leverage on the opportunities offered by e-commerce.

Creating greater market access

International logistics hub missions have been carried out to key and emerging markets such as the EU, the US, Taiwan and Mexico to enhance the global reach of Singapore logistics companies. The TDB actively participates in international forums and meetings that will promote Singapore's development as a transport and logistics hub and

has plans to groom local logistics companies into bigger players by assisting in brand development and set up overseas marketing offices in target markets. Companies planning to expand businesses overseas can draw on TDB's package of assistance, which covers activities such as overseas marketing office development plans and participation in TDB-organized or approved market promotion activities.

Intensification of hub promotion

The achievement of hub status is measured by the ability to attract volume of traffic but also key or major corporations. For example, to be a major air hub an airport must attract at least 2 major airline alliances to operate from its premise. A critical mass of key players in air, shipping and logistics is a necessary condition for Singapore to be a logistics hub. However, this has to be complimented by a liberal market environment and regulatory framework. More logistics flagship events and forums will also be staged in Singapore. This will serve as vital marketing and networking platforms for global industry players. Targets for the next 3 to 5 years include launching another 24 logistics hub projects and achieve 10th position as most important maritime nation by UNCTAD.

Singapore was ranked the 11th most important maritime nation in the world in 1999 by the United Nations Conference on Trade and Development (UNCTAD). This is one above a previous ranking as the 12th most important nation in 1997 and was the sixth jump in rankings since 1991. 1998 saw the tonnage controlled from Singapore grow by an impressive 20 %, significantly higher than the previous year's 9 % increase. This improvement reflects Singapore's growing stature in the

international maritime arena.

Enhancing capabilities of logistics companies

In 1999, six projects under the Logistics Enhancement and Applications Programme (LEAP), were undertaken. These six new programs directed at creating new logistics capabilities and enhancing competitiveness are listed below (Chin and Tongzon, 2001):

LogisNet

To develop a web-site for enquiries or information on Singapore's logistics sector. It will have an on-line directory of logistics companies in Singapore and will facilitate logistics providers, users and auxiliary service providers in exchanging information.

Impact of IT on Logistics Operations

To assess the state of IT usage and the impact of IT on logistics operations through a survey

LEAP 99 Seminar Series

To help industry keep up to date with industry trends and strategic developments in the international logistics scene

International Logistics Hub Promotion Initiative

To showcase Singapore's logistics capabilities, facilitate Singapore companies[1] strategic tie-ups with overseas companies and encourage overseas logistics companies to use Singapore as a hub

Electronic Freight Container Sea

To develop a Radio Frequency communication protocol for electronic freight container seals

Pallet Standard

To develop pallet size standards so as to reduce supply chain costs and increase productivity in the Fast Moving Consumer Goods industry.

Increase market access to facilitate world-wide linkages

Negotiations were concluded with Germany on a bilateral shipping agreement. In addition, International Understanding of Maritime Transport Principles has been concluded between the Organisation of Economic Cooperation Development (OECD) and Dynamics Non-member Economies (DNME). The strategic use of such shipping agreements will ensure that major shipping routes and carriage of cargoes remain open to Singapore based shipping companies.

Logistics manpower development

The importance of developing a ready pool of skilled logistics professionals to manage increasingly complex logistics operations is vital. A wide variety of courses are available at training institutes, polytechnics and universities. These range from certificates to diploma and full-fledged graduate and post-graduate degree programs. A multi-agency effort by TDB, EDB, CAAS, MPA, and NSTB, the Logistics Institute-Asia Pacific was established in 1999 to provide world-class training to meet the demands of the dynamic global logistics industry. TDB will also work closely with the Ministry of Manpower to formulate a Logistics Manpower Road map to develop

manpower capabilities in the logistics industry.

The Logistics Specialist Manpower Program was launched in January 2000, a joint effort by EDB and local polytechnics. The course provides potential and existing workers with certifiable skills in logistics and includes modules on e-commerce, chemical logistics and inventory management.

The Logistics Institute-Asia Pacific (TLI-AP) was also set up to lead in logistics R&D and spearhead the implementation of new business models and the Asia-Pacific logistics solutions. The TLI-AP is a partnership between the Georgia Institute of Technology and the National University of Singapore for research and education programs in global logistics. It is modelled after The Logistics Institute (TLI) at Georgia Tech, which has wide industry recognition as one of the premier institutes for education and research in logistics. The partnership of TLI-AP with Georgia Tech provides expertise that caters to the logistics needs of the industries across the world today, focusing on global logistics, information technology, industrial engineering and supply chain management.

The Singapore Trade Development Board (TDB), in collaboration with the Infocomm Development Authority of Singapore (IDA) and the Chartered Institute of Transport Singapore (CITS) launched Asia's first professional accreditation program for logistics professionals in August 2000. The Certified Professional Logistician (CPL) program is part of the overall plan to develop a critical mass of logistics professionals to propel the industry towards the e-logistics frontier.

A benchmark of excellence for measuring competency and proficiency within the profession of logistics and supply-chain management, the CPL program represents the hallmark of logistics professionalism.

Successful candidates will achieve international recognition from CIT's 28 international affiliates under the global CIT network, and reputable universities. CPL holders can also be considered for exemption from certain subjects of the Masters of Science (Logistics) program offered by the Nanyang Technological University (NTU). To ensure that the program remains a defined benchmark of excellence that will be earned only by a select group of logistics professionals, 16 leading practitioners from the academic, public and private sectors in the logistics field have been enlisted to form a CPL Qualification Review Board (QRB). These members will assess the competency of each candidate seeking qualification. To ensure consistently high academic standards, senior professors from National University of Singapore and NTU will undertake the role of setting and marking the examination.

Collaboration with the private sector

In 1999, TDB set up the Advisory Committee on Logistics comprising of 15 members from the private sector. It is tasked with reviewing policies that can impact the logistics sector, identify emerging international trends as well as new value-added logistics hub services that Singapore should concentrate on developing. It identifies issues and recommends strategies and policies to ensure the attractiveness of Singapore as a premier integrated logistics hub.

Enhancing Singapore into a Global Integrated Logistics Hub

In line with the government's effort to reinvent Singapore to deal with the new challenges and business opportunities, an Economic Review Committee (ERC) was formed to formulate Singapore's strategies.

Singapore's ERC Working Group on Logistics (WGL, 2002) recommended key strategies to achieve the proposed vision - develop Singapore into a leading global integrated logistics hub, with robust maritime, aviation and land transport capabilities supporting the global economy. These strategies were derived based on an analysis of Singapore's competitive advantages and constraints.

2.5.4. Analysis of Competition with Neighboring Countries

Although Singapore's logistics industry possesses certain strengths and competitive advantages against its neighboring countries, as discussed in the preceding section, there is increasing regional competition as many countries have ambitions to become regional/global logistics hubs. Many countries, such as Hong Kong, Taiwan, Malaysia, Thailand and the Philippines are positioning themselves to be logistics hubs. Hong Kong has more recently placed greater emphasis on developing its logistics sector. To this end, it has created new institutional set-ups such as the Steering Committee on Logistics Development to promote the logistics industry.

Reportedly, Hong Kong will be placing emphasis on strengthening transport connectivity and collaboration amongst the players in the logistics chain. Taiwan has drawn up a blueprint to develop itself into a global logistics centre. Taiwan's efforts appear to be centered on e-commerce development, customs reforms and infrastructural enhancements. Malaysia, Thailand and the Philippines are allocating more resources to upgrade their logistics infrastructure, develop competencies and attract international integrated logistics service providers. With so many alternatives coming on stream, the impact of

competition cannot be underestimated and the sustainability of Singapore's position as an international logistics hub remains in question. Thus, Singapore has explored various ways to deal with this increasing competition from its neighbors which challenge its position.

Case study for port competition (Singapore vs. port of Tanjung Pelepas)

The recent move by Maersk-Sealand and Evergreen to transfer their main transshipment operations from Singapore to the port of Tanjung Pelepas has sent a warning signal to the port of Singapore that regional port competition has to be taken seriously. Indeed, although the new port at the southern tip of Malaysia has just commenced its operation in 2000, it has already made some achievements in terms of throughput. It won the Best New Container Port Award last year making the fastest growing port in the world, moving 108 in world ranking to 26. As can be shown in Figure 2-5, the growth rate is phenomenal, in contrast to the declining growth rate experienced by the port of Singapore. Other neighboring ports are also showing positive growth rates.

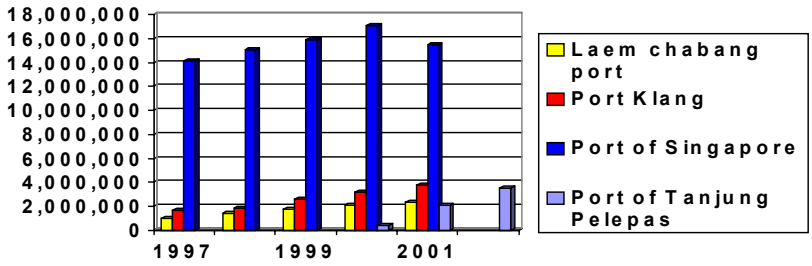


Figure 2-5. Comparison of Selected Ports Container handling from 1997-2001 (TEU's)

Source: Computed from figures taken off official websites, newspapers and Fairplay Portguide 1999/2000

It is clear that the port of Tanjung Pelepas poses the biggest threat to the port of Singapore's position as the premier transshipment hub in the region. One major selling point of this new port is that it is new, flexible, has state-of-the-art facilities, good financial backing, room to expand, ability to cater to post-Panamax vessels, adequate warehousing facilities, advanced IT system and an initial base cargo. The port is also willing to offer dedicated berths to certain customers, something the port of Singapore does not. It has hinterland links with the rest of Malaysia and Thailand. These links will get a further boost when a 31-km rail line connecting the port of Tanjung Pelepas to Malaysia's national railway grid [Keretapi Tanah Melayu (KTM) railway] will become operational by March 2002 (The Straits Times, 19 January 2002: A27). This grid stretches from Perlis and into Thailand in the north, and passes through Pahang on its way to Kelantan on the east coast.

Another factor is its close proximity to the natural beneficial geographical location which Singapore enjoys and which contributes to its success. As Figure 2-4 shows, it is also close to the busiest shipping route. The proposed construction of petrochemical, bunkering and freight facilities on 1,600 ha of land in Pontian district , north of Johore Baruh, which faces the port of Tanjung Pelepas, will further strengthen the port's strategic location (The Straits Times, 22 January 2002:A7).

The move of Maersk Sealand to the port of Tanjung Pelepas has offered cargo owners an alternative to ship their cargoes where the costs are much lower compared to the cost structures at the port of Singapore.

Table 2-18 shows that Tanjung Pelepas is estimated to charge about 30% less than Singapore. Already the port of Tanjung Pelepas managed to capture 1.8 million TEUs from Singapore or more than 10 percent of Singapore's throughput in 1999 (Investors Digest, September 2000). Further, the recent decision by Taiwanese shipping lines Evergreen to move its operations from the port of Singapore to the port of Tanjung Pelepas due mainly to their significant cost differences will further add to the attractiveness of the port to cargo owners as their port of choice (The Straits Times, 19 January 2002: 5).

Table 2-18. Container handling charges per container for the ports

	Port Klang		Port of Singapore		Laem Chabang		PTP*	PTP*
	20ft	40ft	20ft	40ft	20ft	40ft	20ft	40ft
FCL	190 (US$50)	285 (US$75)	270 (US$155)	382 (US$220)	972 (US$23)	1462 (US$34)	189 (US$109)	267 (US$154)
LCL	330 (US$87)	490 (US$129)	565 (US$325)	786 (US$452)	2500 (US$58)	3995 (US$93)	395 (US$227)	550 (US$316)
Transshipment	160 (US$42)	240 (US$63)	174 (US$100)	252 (US$145)	462 (US$11)	697 (US$16)	121 (US$70)	176 (US$101)

Notes:
Exchange rate used are US$1=S$1.74, US$1=RM3.8 and US$1=THB42.8
Port Klang: RM, Port of Singapore S$, Laem Chabang THB, PTP S$ (Port of Tanjung Pelepas)
*PTP's rates are calculated at estimated of 70% of Singapore's rates as according to industry estimates

In the light of growing inter-port competition and the need to consider the customers needs, the port of Singapore has adopted a policy of confrontation and strategic alliances. In terms of confrontation, the port of Singapore has slashed since July 2002 the handling charges for all empty containers by 50 percent and offered a 10 percent rebate on all bills at the port's cargo terminals. This is the first time that discounts are offered to all port users. In a major

shift to counter the moves made by the port of Tanjung Pelepas, the government is now open to allowing shipping lines to run their own dedicated berths and actively engaged in negotiations with shipping lines to discuss other opportunities for partnership and collaborations, including very long-term agreements, joint ventures and dedicated terminals in Singapore. The government wants to enhance further the competitiveness of the port of Singapore by allowing new port operators to manage terminals in direct competition with PSA and Jurong Port.

It continues to capitalize on its comparative strength in the area of information technology. Apart from its present containers and vessels automated tracking system, it has implemented a system whereby shipping and cargo information can be accessed through the internet. Through the down-sized windows-based PORTNET, the customers are linked with the port of Singapore and with relevant government agencies such as the Maritime and Port Authority, Trade Development Board and customs. This internet-based system has 52 modules and 400 sub-modules offering a wide range of services, including berth application, submission of import status of cargo and 24-hour tracking of containers. Subscribers pay a one-time set-up fee and a transaction fee each time they access the system.

Advanced cargo-handling equipment, such as fourth generation quay cranes, double trolley cranes and double-stack trailers are used. And the management is further upgrading its cargo-handling technology by almost entirely automating its terminal operations. In the new Pasir Panjang terminal mentioned, containers are handled and transported by computer-controlled machines. The port management is currently testing automatic guided vehicles (AGV) capable of navigating autonomously

and stacking containers by remote-controlled machines. The port management is currently testing automatic guided vehicles (AGV) capable of navigating autonomously and stacking containers by remote-controlled bridge cranes. It wants to build up a strong research and development capability in port and maritime fields and currently undertaking a study of highly automated container terminals to handle jumbo container ships.

The government has tried to promote Singapore as a total logistics centre where door-to-door services are available with state-of-the-art logistical facilities and infrastructure. The government has recently promoted Singapore as International Maritime Center where a whole range of maritime services are available, adding value to the activities of the shipping lines by promoting bunkering industry, ship registry and other maritime related activities including marine finance, insurance, brokerage and others that make up a one-stop shop centre. To attract more ships to register in Singapore, the Approved Shipping Enterprise Scheme (AIS) has been extended.

To increase its ability to respond to demands from fast changing business environment and deal with increasing threats from other port competitors with lower port charges, it has adopted a policy of corporatization. Since 1997, the corporatized port of Singapore has been able to provide value-for-money services to its customers with even greater speed, quality and reliability. It has been able to maintain and further improve its efficiency by liberalizing its towage services and looking for ways by which competition could be enhanced.[19] It continues to offer major shipping lines priority berthing in exchange

19 There is currently a proposal under consideration which allows new port operators to manage terminals in direct competition with PSA Corporation and Jurong Port.

for meeting certain conditions such as meeting a minimum number of containers per year. And it has continually been looking for ways to reduce port dues and concentrate on its commercial operations.

Based on a policy of active engagement with other ports, the port of Singapore has been marketing its consultancy services internationally, particularly in information technology-based port operations and port terminal logistics management. The port of Singapore has also forged certain alliances and cooperative ventures with other ports even as far away as China, India and Africa, offering its capital and expertise in developing and managing state-of-the-art ports. Through these overseas ventures it hopes to build up stronger port linkages with other countries via the hub-spoke networks.[20] And in this way it can maintain its position as a hub by having greater influence over the supply lines of transshipment cargo from other ports in the region. Further, investments in overseas international terminals can affect its overall position in three ways.

Firstly, profits reaped from these overseas investments can serve to counter losses PSA would otherwise incur from reducing its charges to meet competition from rival ports in the region. Secondly, profits made can be used to develop and facilitate other strategies employed by PSA to maintain its position as a transshipment hub. Thirdly, diversification prevents over-reliance on Singapore, so that losses can be minimized should the home market be affected by economic conditions.

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20 The port of Singapore aims to achieve 20 percent of its annual revenue derived from these overseas ventures, particularly from various strategic alliances and investments in the logistics business and port terminal development It is currently involved in projects in China, India, Indonesia, Vietnam, South Korea, Hong Kong. Italy and quite recently Brunei.

2.6. Discussions

Ports have been facing numerous challenges arising from various factors including changes in international trade pattern, shipping companies' evolving strategy and networking of different transportation modes. Contemporary ports are particularly concerned with handling longer distance cargoes for global carriers, intermodal demand for the ports, port financing for expansion and environmental issues. These require ports to provide more efficient, faster and clean services for the customers.

To respond to these challenges, we have seen some ports have taken ambitious steps toward large-scale long-term development plans like Shanghai, Hong Kong, Singapore and Yantian and Tanjung Pelepas. Some others seem relatively stagnant, as is the case with perhaps Japanese ports. Intermingled with hub-and spoke phenomena, port may have two ways in their future destiny: expansion into being hub strategy or shrinking into residing as spoke in the network. This destiny will be expedited by the speed of upsizing of vessels. Container history appears to have told us that our prediction on ship size has been underestimated or put differently, perhaps pessimism on the size factor has been shown as coward's position. In this regard, some lines are already in the vanguard of ordering next step of mega carriers. As one of forerunners in this frontier, China Shipping's move to 9,000 TEU ships (top single engine size today) is a significant change of pace (Clarkson Research Study 2001).

As the lines demand deeper-water depth in ports, ports are likely to deepen and widen their approach channels and berth side depth as well as turning basin. As mentioned, Germany plans to develop a new

deep-water port up to 18.5 meter to accommodate over 10,000 TEU vessels in Wilhelmshaven. Big lines like Maersk-Sealand are always concerned with putting their brand new biggest vessels in service and any existing ports not ready for their new demand are more likely to be rejected by the lines when renewing their contracts. There are numerous examples belonging to this category of renewals over the history of port contract with lines. In this regard, Asian ports seem less aggressive in preparing the future path for the mega-carriers in their plan. For instance, though Korea plans to develop 55 berths by year 2011, all of them have the water depth of less or equal to 15 meters in the plan. Shanghai seems to be in similar situation. One noteworthy thing in this respect is that Yokohama already developed 16 meter draft to accommodate 12,000 TEU vessels, attracting much attention from Maersk-Sealand group. In case Maersk-Sealand sets their chart again in the north-tier competition ports in the future, this itself will have enormous impact on market sharing among the rivals.

Furthermore, it may have domino effect onto other global alliances since the author of this chapter has always felt that Maersk-Sealand has acted as the opinion leader in port selection business and would do so in the future. If so, the present happy news among competing ports in the north-tier range may be reversed, retaliated by Japanese ports. As we have seen, all three countries in the range -China, Korea and Taiwan - are full steaming to comprehensively develop their container ports in a large scale. Their direction appears to arrive in the same destiny such as combining site expansion, deepening water depth, locating logistics center and Free Trade Zone within the port boundary, rationalizing inland transportation, and inviting foreign investors and specialized port operators.

As China became the member of WTO by the end of 2001, the port competition would reach the highest level that we have never seen yet. In addition, when contemporary Post-Panamax vessels are overtaken by the mega-carriers 12,000 15,000 TEU- within less than then years, todays 9 10 port calling by major lines is more likely to be reduced to 3 4 calls at the maximum in East Asia. Therefore, the most important thing to the ports in the region may well formulate effective long-term port development and responsively adapt their plans to changing environment due to lingering uncertainties in ship size and other technology development. When faced with enormous rivalry requiring heavy investment, ports could explore the same path as those of shipping lines that is - alliance among rival ports. It is a new approach, and some countries seem to have already selected this strategy like Wilhelmshaven between Bremen and Hamburg and another between Malmo in Sweden and Copenhagen in Denmark (Sim 2001).

No attempt has been made so far among the rival ports in East Asia except the fact that some ports such as PSA and Hong Kong based group (Hutchison) are investing in foreign ports as the international operators, but not as the alliances. High time, thus, may have arrived that the rival ports can explore this port alliances strategy to fight against lines alliances strategy.

Finally, we have seen that when facing inter-port competition, port of Singapore adopted double-edged strategies: confrontation and strategic alliance. In terms of confrontation, on one hand, the port of Singapore has slashed since July 2002 the handling charges for all empty containers by 50 percent and offered a 10 percent rebate on all bills at the port's cargo terminals. The government is also open to allowing shipping lines to run their own dedicated berths and actively

engaged in negotiations with shipping lines to discuss other opportunities for partnership and collaborations, including very long-term agreements, joint ventures and dedicated terminals in Singapore. The government wants to enhance further the competitiveness of the port of Singapore by allowing new port operators to manage terminals in direct competition with PSA and Jurong Port.

On the other hand, the port of Singapore has also forged certain alliances and cooperative ventures with other ports even as far away as China, India and Africa, offering its capital and expertise in developing and managing state-of-the-art ports. Through these overseas ventures it hopes to build up stronger port linkages with other countries via the hub-spoke networks. And in this way it can maintain its position as a hub by having greater influence over the supply lines of transshipment cargo from other ports in the region. It is interesting to see if the policies of PSA will be effective or not and how other competing ports will also respond to them.

3. Literature on Liners' Port Selection

Past research related to port calling selection factors can be classified into 3 groups: ship routing/scheduling using mathematical model, port selection, and hubbing behavior.

Ship routing and scheduling using mathematical model

Most researchers' interest lies in creating an efficient shipping network. Various mathematical and heuristic models were used: linear programming model, integer-programming model, non-linear programming model, graph theoretic model and heuristic optimization model. All of them differ in their objective functions: some models aim to minimize cost while others maximize profit. They also differ in their usage of constraints: some list just 4 constraints while others have 10. Most of them did not verify the validity of their models with shipping lines. There has been little such research done for container shipping as compared to bulk shipping and air transportation.

Port selection

Researchers aim to uncover the reasons for port selection in shipping, e.g. size of local cargo base, geographical location, etc. One researcher had gone further to uncover the reasons for why certain ports were made 1st port of call and others last port of call. Logit regression and linear regression analysis in some studies were used to decide on the validity of the reasons.

Hubbing behavior

There is a lot of literature which attempts to define transshipment.

Some went further to discuss types of transshipment and even types of feeder services. The geography researchers have created a framework known as site/situation to study the phenomenon of hub selection. The framework included political and social factors. Many concentrate on comparing transshipment with direct calls (or multi-porting), their advantages and disadvantages. Some discuss on how to choose a hub. Some studies even identify cost drivers, such as vessel size, etc., which may cause one to decide on transshipment or direct calls.

3.1. Mathematical Models for ship routing and scheduling

Although 90% of the world's cargo (in tonnage-term) is transported by sea, there is still relatively little work done on optimization based routing and scheduling of ships. This is despite the fact that there exist models and solution algorithms which have revolutionized the operations of the trucking industries.[21]

Although, recently, there have been some studies on the optimization models for the routing and scheduling of ships, the great majority have been on industrial carriers, bulk carriers or tankers[22]. The objective for all these past works were similar in trying to address the common problem of scheduling vessels to move commodities from one or more load ports and delivered to one or more destination ports with or

21 Federgruen, A. and D. Simchi-Levi, Analysis of Vehicle Routing and Inventory Routing, Handbooks in Operations Research and Management Science, Vol 8, Network Routing, M.O. Ball, T.L. Magnanti, G.L. Nemhauser (Eds), 297 - 373, 1995

22 Seong-Cheol Cho and A. N. Perakis, Optimal Liner Fleet Routeing Strategies, Maritime Policy and Management 1996, 23, 249 - 259. Seung-June Hwang et al22 listed eight past research done in solving routing and scheduling problems for bulk carriers or tankers.

without specified time windows. However the methodology employed were varied, they are as below:

random search of cheapest schedule out of many generated schedules

single step cost minimization heuristic

Dantzig-Wolf decomposition approach

Lagrangian relaxation approach

Set partitioning approach

Path flow formulation

Travelling salesman problem formulation

Among the work being done in liner fleet management, there have been more heuristic approaches rather than operations research even though the field of operations research has long established various systematic mathematical techniques for the optimal routing and scheduling of transportation needs. One possible reason for the lack of operations research techniques applied in fixed liner fleet management is the complexity of liner shipping which involved frequent changes in freight rate, cargo demand, shipping environment and even international regulations.

However they have been some recent attempts on applying the operations research techniques to liner shipping problem. Perakis and Jaramillo[23,24] had developed linear programming model to minimize total fleet operating and layup cost. In this model, they actually predetermined the routes (sequences of ports of call) and developed the model to assign each ship to some of these predetermined routes. One weakness in this formulation is that the linear programming formulation required rounding of the number of ships allocated to each route, which led to sub-optimal results. Rana and Vickson[25,26] presented nonlinear programming models to maximize total profit by finding an optimal sequence of ports of call. Rana and Vickson used Lagrangian relaxation and decomposition methods to solve their problem. The weakness in their approach is that the methodology is developed for only one container vessel and its nonlinear methodology is deemed too complicated for real life application.

Powell and Perakis[27] built an integer programming model to minimize the operating cost for operating fleet given route, ship availability and service contraints. Powell and Perakis work was an extension of Perakis and Jaramillo, in that they tried to solve the same problem using integer programming instead of linear programming. Their methodology has the advantage of ease in use. However the conditions are

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23 ' Perakis A. N. and Jaramillo D. I., Fleet Deployment Optimization for Liner Shipping, Part 1, Maritime Policy and Management 1991, 18, 183 - 200

24 Perakis A. N. and Jaramillo D. I., Fleet Deployment Optimization for Liner Shipping, Part 2, Maritime Policy and Management 1991, 18, 235 - 262

25 Rana, K. and Vickson R. G., A Model and Solution Algorithm for Optimal Routeing of a Time-Chartered Containership, Transportation Science 1988, 22, 83 - 95

26 Rana, K. and Vickson R. G., Routing Containerships Using Lagrangean Relaxation and Decomposition, Transportation Science 1991, 25, 201 - 214.

27 Powell B. J. and Perakis A. N., Fleet Deployment Optimization for Liner Shipping : An Integer Programming Model, Maritime Policy and Management, 1997, 24, 183 - 192

deterministic and lack the dynamism of real-life situation, for example, change in trade flow pattern.

From literature on mathematical modelling of liner routeing strategies, it appeared that researchers are generally less concerned about the conditions of the ports in routeing decision. In routeing decision, they focused more on factors listed below:

Cargo demand from port x to port y : it is common sense that routeing should follow cargo flow and less on conditions of the port. However almost all the models assume that cargo demand is deterministic, known and occurs uniformly during the planning horizon (which in real life is never the case).

Vessel availability : it is assumed that any liner company has only a finite number of vessels and vessel of a particular type. This is obviously a reasonable constraint faced by all liners.

Vessel/ route compatibility : this is perhaps the only factor in which the physical conditions and service levels of ports become important as the port may constrain the type of vessel to be deployed. Other constraints are regulatory such as government rejection of vessels of certain flags.

Service frequency : it is a driver which originate from liners themselves. It is part of liners differentiation strategy to capture market share.

Lay-up time : it is idle time when vessels are drydocked for repair and maintenance.

Since most of the factors above are dynamic in nature whereas the model is deterministics, it is important that assumptions and constraints have to be changed periodically for these models to be implementable in real life.

Interestingly Powell and Perakis[28] did attempt to apply their model in a real situation in a company known as FMG liner shipping company. In applying their model, the company saved around US$ 1.3 million.

3.2. Port Selection Criteria Study

As for the port selection criteria studies, they have differed over time, along trade routes, cargo, methodologies, sampled data and surveyed entities or parties. Of these myriad of studies, we can describe four studies as representative:

Black (1985) explored the criteria shippers employ in the port selection process. By focusing on the containerized traffic between the North American Mid-West and Western Europe, the factors considered by exporters and freight forwarders were examined. He found that the decision-makers are influenced more by price and service considerations of land and ocean carriers than by perceived differences in the ports of entry and exit. Interestingly, port structures did not appear to play

28 Powell B. J. and Perakis A. N., Fleet Deployment Optimization for Liner Shipping : An Integer Programming Model, Maritime Policy and Management, 1997, 24, 183 - 192

an important role in the routing decisions. In the final part of the paper, he implied that the port selection can be made more by ocean carriers rather than the exporters and forwarders, who by then were deemed to be main players. In his survey, he asked respondents to tick five factors out of given 11 factors that they consider important in port selection. His finding was that the five factors were number of sailings, freight rates, proximity of port, congestion and intermodal link.

Bird and Bland (1988) did a similar study focusing on freight forwarders collecting 72 interviews from 11 European countries. They used seven Likert scale in the questionnaires. They found that the freight forwarders chose ports for the main reason of the frequency of shipping services. Time spent en route and labor problems at ports were also major concerns of the respondents. In addition, port charges and guaranteeing of 'delivered price' seem to have affected the port selection. While describing the research process, they expressed the language difficulty in making the researchers understood during the interview and also in the questionnaires due to different culture and jargon.

Quite recently, Machow and Kanafani (2001) explored what factors affect the port selection for US export cargo liners. They used four factors such as oceanic distance, land distance, frequency of ship sailings and vessel capacity by employing multinomial logit model. The model was estimated for combined shipments, and one model was estimated for each of four commodity types (bulk, foods, fabrics and manufactured). They ran the model using a nested logit model structure among eight sea ports. They found that the oceanic distance and inland distance affected port selection in a negative way. It is noteworthy that they described various papers in the beginning of their report, the majority of which expressed that port selection has changed from shippers to carriers.

Lago et. al. (2001) examined the routes of vessels along the U.S. West Coast between 1993 and 1999. They examined changes in the number of ports visited by each vessel and changes in the port visited at entrance to or clearance from the US ports. They found that the West coast port routing involved one more port call in the string than the East coast port routing whereby, the string on the East coast used 3 to 4 port calls. They also found that carriers tend to choose the number of ports before specifying the ports. Another finding is that shorter route with lesser volume does not have a scale economy and location also influences the port selection since customers tend to be closer to foreign destinations with preference being the first call from import and being the last call for export. For this reason, centrally located ports, i.e., Oakland, could be squeezed out by other ports.

Overviewing the literature, it seems that most studies have focused on the concerns of shippers and freight forwarders rather than carriers even though some authors implied that carriers may be the main key players in port selection. However, as far as we know, any rightful amount of attention has not drawn the carriers' decision-making mechanism and/or factors in port selection researches thus far. This may be a gap between preceding studies or perhaps advancing our research arena one step forward since recent papers emphasize more roles played by the carriers in port selection.

3.3. Hub Behavior Study

There is lots of literature that attempt to define transshipment.

Concerning the definition of transshipment D. K. Fleming[29] broadly defines that "transshipment means cargo transfer from one transport conveyance -any mode- to another" and narrowly "ship-to-ship and ship-shore-ship transfers entailing a temporary parking of containers before connections are made and a time interval of several days." According to him the function of transshipment is an accommodation to the needs of carriers pursuing higher load factors and fewer port calls, at the same time offering shippers more service frequencies between more origins and destinations.

E. G. Frankel shows more supply chain management oriented perspective for the objectives of transshipment. He remarks that the purpose of transshipment is not only to reduce the total cost of collecting and distributing the containers carried by a mainline container vessel, but also to improve just-in time delivery of cargo, reduce transit inventory, and make the total movement of containerized cargo more seamless. In other words, the objective is not just to reduce origin-to-destination transport and handling or transfer costs but to make the whole supply chain, including its inherent transactions, more efficient and more responsive to the demands of a global market place.[30]

Regarding the meaning of hub, Y. Hayuth and D. K. Fleming[31] define it as "situated either at the intersection of main sea routes or at one end of such routes at a place where the main flow of container traffic splits into 'feeder' flows to and from ports in neighboring areas." In his recent research, Fleming refers to O'Kelly's work to conceptualize hub as

29 Douglas K. Fleming, A Geographical Perspective of the Trnashipment Function, International Journal of Maritime Economics, 2000, volume II, number 3, 163-176

30 Ernst G. Frankel, Economics of Transhipment In Container Shipping Logistics.

31 Yehuda Hayuth, Douglas K. Fleming, Concepts of strategic commercial location: the case of container ports, Maritime Policy and Management, 1994, volume 21, number 3, 187-193

follows; "hubs are special nodes that are part of a network, located in such a way as to facilitate connectivity between interacting places." Gylfi Palsson[32] defines hub-and-spoke system as follows. "A hub-and-spoke system is where cargo to a region is delivered to a primary hub in another region. The cargo is then disbursed from that primary hub to other areas in the region, whether by vessels, rail, trucks or inland waterways. Similarly exports from the region are accumulated in the primary hub, from where it is collected. These primary ports tend to be larger, have longer berths and have deeper drafts than secondary ports, and are usually specially equipped and operated to allow for a quick turnaround time of vessels."

The distinguishable perspective of research on port selection and hub behavior is that carriers not shippers determine ports and transshipment hubs these days. As a matter of fact slumps which transshipment hubs are experiencing in recent times are caused by carriers' sudden decisions to shift their transshipment operations elsewhere of by strong demands from shippers for direct service. Hayuth[33] says that the interaction of integrated transport service on a global scale and the creation of multimodal transport companies operating in a deregulated environment allow carriers much more control over the cargo and its routing and greater latitude in port selection than in the past.

In addition, they point out that, in general, liners design overall transport itinerary considering cost and market demand firstly, and then select specific calling ports. According to Fleming, individual shipping lines make their transshipment location decisions from a range of possible

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32 Gylfi Palsson, Multiple Ports of Call versus Hub-and Spoke, Containerized Maritime Trade between West Africa and Europe, Africa Region, The World Bank, 1998.1

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

locations sprinkled along a trade route, and within limits set by customers (i.e. other carriers' advertised service) and by other factors endogenous and exogenous to the firm. In other words, as Hayuth and Fleming remark, the carriers evaluate the locational characteristics of a port in the light of their own intercontinental networks. A carrier operating on a long distance trade route is primarily concerned with the selection of an efficient and marketable general transport itinerary. Specific port choice, in a sense, is a secondary concern.

Geography researchers have created a framework known as site/situation to study the phenomenon of hub selection.[34] Firstly, site considerations related to the microgeography and economic dimensions of port characteristics, for instance, deep water, ample maneuvering room, plentiful shore-side backup space and labor cost etc. In addition, political, social, environmental, and regulatory factors relating to site development also can be considered; all these things can be weighed, measured, and translated to terms that enable business decisions to be made. From the concept of site, we can induce some determinants for port of call selection such as, draft, length of berth, efficiency of yard operation (availability of vessel berth, ability of cargo stowage planning, IT connectivity, capacity of equipment), labor cost, customs regulation and legal or financial system of the port's country etc.

Secondly, situation refers to its external relationships with tributary hinterlands, overseas forelands, and other ports etc. It is a macrogeographic characteristic and the port's relative location is on of the most significant situational features. A strategic location relative to

34 The concepts, popularized by Edward Ullman in the U.S. and James Bird in Britain, of site and situation have been used by both urban and transportation geographers in their studies of cities, seaports, and air hubs.

sources and destinations of cargo and/or relative to the main corridors of ocean trade endows the port with an 'en route' quality which Fleming and Hayuth call 'intermediacy'. Recently the concept of intermediacy is extremely important for transshipment port's potential since ship-shore-ship transshipments are double-counted, and in particular, rationalization in liner shipping and the strategic alliances between container lines lead toward more traffic concentration. All great container ports possess the intermediacy characteristic to some degree, when one takes into account the full intermodal journey.

A port's overland access to local and distant hinterland is very crucial for traffic generating. 'Situation' or 'intermediacy' is more important concept than 'site' since, as mentioned above, liner's primary choice is the general route or itinerary after that the specific port choice. In other words, the total intermodal route considerations, more than the specific qualifications of the individual ports, are the main determinants of which ports become the favored load centers. However, naturally, the selection of one specific port of call from a set nearby intra-regional alternatives is generally concerned with site more than situation, especially when the locational attributes at macroscale are roughly equivalent. From the concepts of situation/intermediacy some important determinants such as port location (along main shipping routs), transshipment cargo volume as well as local cargo volume, feeder connectivity, landward intermodal access etc. can be borne out.

Many researchers concentrate on comparing transshipment with direct calls (or multi-porting), in considering their advantages and disadvantages. H.T.Boisch[35], director of Hapag-Loyd Singapore summarizes that the advantages from hub port system are 1) optimize

35 Helmut T. Boisch, Direct Calls or Transshipment.

the ship system cost (i.e. the slot cost), 2) economy of scale 3) more flexibility for feeder ports, more sailings per week compared to a weekly direct call. According to Frankel, consideration of the economies of transshipment must include all logistics as well as value added activity costs and benefits contributed by transshipment activities.

For instance, transshipment can generate opportunities for cargo consolidation/de-consolidation and value added activities such as assembly, calibration, and customizing to meet specific local or time varying demands. To make transshipment attractive the economic and operational benefits must outweigh added economic and operational costs such as additional handling costs, port dues, and possible extra voyage distances for deviations. Gylfi Palsson also remarks that the hub-and-spoke system is important to driving down transportation costs, because vessels used in this system are larger and more economical than usually possible in a system with multiple port of call. An efficient land based intermodal network further enhances such gains

On the other hand, there are some disadvantages such as 1) feeder and transshipment cost, 2) only very few ports are suitable as major Hub, 3) general customer preference is still for direct service. As a matter of fact, the question of 'direct call or transshipment' is not a new one. However, for instance, some feeder ports in Asia have grown so drastically, that the port volume itself is raising the question of direct call. The growing intra-Asia trade will have a major impact on the deployment and scheduling of carriers.

Concerning the impact of port cost, Boisch asserts that the port cost can be a determining factor for a direct call. The port cost per call range from about USD 40,000 in China, USD 25,000 in Japan to

around USD 10,000 further south and to below USD 1,000 in Jeddah. For example, the Grand Alliance calls at seven different ports in Japan, altogether the number of Japanese port calls are up to 24 calls per week at a cost of over USD 31million per annum. In view of the slim or even negative margins, this justified a critical schedule review.

One big disadvantage of Japanese ports is the limited working hours, in general only 16 hours a day. According to Boisch the most important factors determining direct call are 1) cargo volume, 2) efficient port and terminal operation (no navigational restrictions, e.g. draft), 3) port and terminal cost, and 4) political & labor stability. Among them, the cargo volume has to be sufficient to warrant a call. Of course, the savings in feeder and transshipment cost have to be higher than the deviation cost.[36] In addition, he emphasizes that hub ports have to be highly efficient and able to move at least 2,500 containers per 24 hours to correspond to 8,000TEU or 10,000TEU vessel in the near future.

To analyze the economies of transshipments, Frankel calculates the costs and quality of service of the transshipment system using a simple example. The results are compared with the cost and quality of service of direct mainline vessel delivery. Assuming the transshipment port is a cargo hub, the cost differential between direct delivery and transshipment can be calculated by computing the sum of the costs of transshipment service. On one hand, the costs of transshipment are 1) Mainline service to/from transshipment port, 2) unloading and loading

36 The direct deviation cost is for port charges and for fuel. The fuel cost are not only for the deviation itself, but also for the higher speed on the long hauls to make up for the extra time. However, in the case for a line wants to add a port having two days deviation into its round trip, most of the times, there is not two days reserve in the schedule. The result will be to add one more ship to the loop, making it one week longer for the round trip.

at the transshipment port, 3) waiting at the transshipment port including stacking/ unstacking 4) feeder transport between transshipment port and feeder ports and 5) unloading and loading at the feeder ports.

On the other hand, the costs of direct service are 1) mainline service to region, 2) unloading and loading at hub and feeder (regional) ports. According to his calculation, assuming there are four feeder ports and one hub/transshipment port within a distance 600nm between those ports, a mainline vessel calling only at the transshipment port could make 78% more round trips than the same vessel using a direct delivery circular route. In detail, a transshipment plus four feeder port route with the transshipment port handling 40% and each other port 15% of the trading volume, the transshipment with direct feeder delivery alternative has a 22% cost advantage over the all-mainline alternative.

From the cost analysis above, we can choose some useful determinants for selecting both transshipment ports and direct calling ports such as port dues (including tug, pilot, line handling etc), cargo expenses (cargo handling charges), cargo volume (local and transshipment), port location, feeder connectivity, productivity, overtime working, profitability of handling cargo at the port and port extensiveness of port services, etc.

4. Methodology and Data

4.1. Methodology

The major methodology of this research was to survey the major liners. After considering various factors affecting liners' decision on port selection from literature survey, a questionnaire was designed by PSA (see the PSA questionnaire form). Then the questionnaire was pre-tested about whether expressions in the form were easy for the respondents to understand and also any important questions were missing or not. In other words, the research team in Korea visited major shipping lines in Korea to pre-test the questionnaires and found the expressions were not easy and there are some other important factors missing in the form. Therefore, the form had to be modified into using more communicable English and incorporating some other factors. The original form consisted of 20 questions and the modified form had 32 questions and also included general information about lines before asking the factors. We present both the questionnaires to show how we changed the form through the pre-test.

The survey form is to be distributed to the liners operating both on mainhaul services and on intra-Asia services. The mainhaul services are those on Far-East - Europe, Transpacific and Transatlantic shipping trade routes. In other words, the mainhaul service is to check decisions on trunk routes and the intra-Asia service on feeder route. We sent the form to these companies by mail inserting a formal letter to direct the form to a person specialized in route-selection. The originally designed questionnaire is in Appendix and the modified one is shown

as this:

From Dr. Young-Tae Chang
Director, Policy and Market Analysis Div., Korea Maritime Institute
11-6, Shinchun-dong, Songpa-ku, Seoul
138-730, Korea
Tel: +82-2-2105-2822
Fax: +82-2-2105-2759
Email: ytchang@kmi.re.kr

To whom it may concern,

August 20, 2002

Please accept our sincere gratitude to you very much for your taking time to read this letter and questionnaire.

We (Korea Maritime Institute and Port of Singaporean Authority) are conducting a joint-research for a pure academic purpose on **how container lines choose ports on their routing** in order for ports to respond to customer's needs more efficiently. Korea Maritime Institute is a governmental research institute to formulate maritime policies as well as fisheries.

For this research, we prepared a questionnaire with thirty-two questions. It would take about ten minutes to complete the questionnaire. We would appreciate your filling out the questionnaire yourself or passing it to someone that you think more appropriate. Just in case that there will be different people involved in port selection, for instance, one specialized in marketing side and the other in operation side, we enclose another extra copy.

Once again appreciating your cooperation in advance, I look forward to your response at your earliest convenience.

Sincerely Yours,

Young-Tae Chang, Ph.D.
Director, Policy and Market Analysis Division
Korea Maritime Institute

Factors Affecting Liners' Port Selection by Trade Routes

The aim of the survey is to gather information about the factors which shipping lines consider when they select their port-of-calls for their mainhaul and regional (i.e., Intra-Asia) services as well as near-sea services. This survey would allow us to analyse the needs and wants of liners and we are sure that the result would benefit and perhaps even improve the operating environment of the shipping industry as a whole.

This questionnaire should take no longer than 8 - 10 minutes to complete and all information will be held in the strictest confidence.

Kindly mail the completed questionnaire to the address in the below:

Dr. Young-Tae Chang, Korea Maritime Institute
11-6, Shinchun-dong, Songpa-ku, Seoul, 138-730, Korea

Or fax the completed questionnaire to us at Fax No:
+82-(2)-2105-2759/2839

Or email: ytchang@kmi.re.kr or sylee@kmi.re.kr

THANK YOU FOR YOUR TIME AND COOPERATION.

1. Corporate Background Information

1) Name of the company/location (address):
2) Name of the parent company/location (address):
3) Date of establishment:
4) Number of Employees: Total _____ overseas _____
5) Total Turnover of year 2001 (sales revenue: US $):
6) Trade Volume (Import/Export) per year (Ton/TEU):
7) Total number of foreign subsidiary:
8) Average vessel size on route (TEU):
   (If you have services on trunk route and regional seas, please indicate the vessel size separately by route)
9) Indicate the countries and ports where your subsidiaries are located.

Asia	Europe	North America	Central/South America	Africa	Total

2. Factors Affecting Liners' Port Selection by Trade Route

When choosing or advising on a port-of-call for your service, how important is for you to find information listed below. To answer, please put a tick in the box beside the number, which most accurately reflects your situation:

	SCALE	1 IMPORTANT	2	3	4	5 UNIMPORTANT
1	Port due + tug, pilot, line handling, etc.	1	2	3	4	5
2	Cargo expense (cargo handling charges)	1	2	3	4	5
3	Port location (along main shipping routes)	1	2	3	4	5
4	Cargo volume local to the port	1	2	3	4	5
5	Volume of inducing cargoes by your line	1	2	3	4	5
6	Volume of transshipment at the port	1	2	3	4	5
7	Port land-ward intermodal access (i.e., by truck and rail)	1	2	3	4	5
8	Port feeder connectivity to other ports	1	2	3	4	5
9	Port reliability of services	1	2	3	4	5
10	Availability of vessel berth on arrival in port	1	2	3	4	5
11	Ability of cargo stowage planning	1	2	3	4	5
12	Entering niche market	1	2	3	4	5
13	Port's ability to accommodate special requirements	1	2	3	4	5
14	Port extensiveness of services (value-added service like processing, packing, and other various services by port)	1	2	3	4	5
15	Information Technology (IT) connectivity	1	2	3	4	5
16	Capacity of port equipment	1	2	3	4	5

IMPROTANT UNIMPROTANT

IMPROTANT UNIMPROTANT

IMPROTANT UNIMPROTANT

17	Ease of communication with port's staff	1	2	3	4	5
18	Port's operator reputation worldwide	1	2	3	4	5
19	Competing carriers already call at the port	1	2	3	4	5
20	Port's management-worker relationship	1	2	3	4	5
		IMPROTANT				UNIMPROTANT
21	Presence of auxiliary services (e.g. bunker, shiprepair, lashing, tally, etc)	1	2	3	4	5
22	Strength of legal/financial system of the port's country	1	2	3	4	5
23	Overtime working	1	2	3	4	5
24	Customs regulation	1	2	3	4	5
25	Safety of cargo in port	1	2	3	4	5
		IMPROTANT				UNIMPROTANT
26	Profitability of handling cargo at the port	1	2	3	4	5
27	Length of berth	1	2	3	4	5
28	Water draft on approach channel and by berth	1	2	3	4	5
29	Rate of lashing and tally, etc.	1	2	3	4	5
30	Easiness of slot exchange agreement with other lines	1	2	3	4	5
		IMPROTANT				UNIMPROTANT
31	Varying service areas	1	2	3	4	5
32	Balancing inbound and outbound cargo	1	2	3	4	5

Respondent's Name _____ Title _____

Phone _____ Fax _____ E-mail _____

4.2. Data

We researched on how liners operate on both the trunk routes and feeder routes. A major source for this information was taken from 'Containerization International 2002'. We listed major shipping lines in trunk routes of Trans-Pacific and Far-East to European routes and also along Intra-Asia routes in order to ensure more distribution of the questionnaire. The company names are in the Appendix. The number of companies we selected for the distribution of questionnaires was one hundred sixty. We mailed the questionnaires in early September with a return deadline to late November. We could collect only twenty eight, therefore, the sample covers only 17.5%.

While distributing the questionnaires, we promised that we would not disclose the company names in our report since companies seem to be sensitive to letting their internal information known to the public and therefore, reluctant to giving the information. For this reason, we only present descriptive statistics on the general information without specifying any names.

As one can see in the table below, some companies were reluctant to provide information like total number of employee, turnover, handled volume, average vessel size etc. Of the twenty eight companies, the trunk route service providers were thirteen (46% of the total number) and the remaining fifteen companies (54% of the total number) were Intra-Asia service providers. The data show that the total number of employee ranges between 150 people and 13,200 with the workforce abroad ranging between 3 and 7,048. The biggest company in the workforce employed (13,200 people based in Middle East) did not use any foreign employee, whereas one big company in Europe employed

88% foreigners. The turnover ranged between 37 million dollars and 6.6 billion dollars with the average being 1.5 billion dollars. The container volumes that the companies carried ranged between 98,600 TEU and 3,184,000 TEU with the average being about one million TEU. The average vessel size ranged between 400 TEU and 5,500 TEU.

Table 4-1 Descriptive Statistics of company information

	N	Minimum	Maximum	Mean	Std. Deviation
Toatal Employee	22	150	13200	2223.73	3479.99
Employee Overseas	18	3	7048	1075.61	1872.48
Turnover (US$)	21	37000000	6663000000	1507750290.38	1813101619
Handled Volume (TEU)	17	98600	3184000	1082584.71	962589.81
Overseas Offices	20	1	290	50.40	71.14
Average Vessel size (TEU)	21	400	5500	2091.48	1832.16
Valid N (listwise)	15				

We were interested in seeing how much the value per TEU that the companies carried is and so calculated the value per TEU by dividing turnover by handled volume per company then averaging the values per TEU by company. It ranged between 370 US dollars and 4,504 US dollars and the average was 1,191 US dollars as in the following table.

Table 4-2 Ratio of overseas employee and value per TEU

	N	Minimum	Maximum	Mean	Std. Deviation
Toatal Employee	22	150	13200	2223.73	3479.99
Employee Overseas	18	3	7048	1075.61	1872.48
RATIOFN	18	1.51	88.00	34.6320	26.3201
Turnover (US$)	21	37000000	6663000000	1507750290.38	1813101619.14
Handled Volume (TEU)	17	98600	3184000	1082584.71	962589.81
VALPETEU	17	370.00	4504.76	1191.1116	1016.6704
Valid N (listwise)	15				

5. Survey Results

The main purpose of the survey is to see what factors affect liner's port selection. To this end, it must be the first step to check how importantly each variable was graded by the respondents. Therefore, the score of each variable was averaged then sorted in an ascending order. The result is presented in table 5-1.

The liners revealed that cargo volume local to the port (Variable 4) and volume of inducing cargoes by their own lines (Variable 5) were the foremost important factors in choosing ports. Next important factors were cargo expense (Variable 2), berth availability (Variable 10), port location (Variable 3) and transshipment volume (Variable 6). Since these six variables showed the scores less than 2, it can be stated that the liners consider these six factors the most importantly in port selection.

Second important factors were feeder connection, berth length, water draft, reliability of service, land connection, balancing between import cargo and export cargo, port equipment, etc. As can be seen in graph 5-1, the six variables are located inside the important plane denoted by value '1' line and most of variables are between '2' and '3'. Only two variables are lower than 3 and these are the strength of the legal and financial system of the port's country (Variable 22) and presence of auxiliary services such as bunker, ship-repair, lashing, tally etc. (Variable 21).

Table 5-1 Descritive Statistics of Variables

	N	Minimum	Maximum	Mean	Std. Deviation
4) Cargo Volume	28	1	3	1.14	.45
5) Inducing Cargo	27	1	2	1.19	.40
2) Cargo Expense	28	1	4	1.64	.78
10) Berth Availability	28	1	3	1.71	.81
3) Port Location	28	1	4	1.82	.98
6) T/S Volume	28	1	4	1.89	.79
8) Feeder Connection	28	1	4	2.00	1.02
27) Berth Length	28	1	3	2.00	.86
28) Water Draft	28	1	4	2.07	.90
9) Rellability of Service	28	1	3	2.07	.81
7) Land Connection	28	1	4	2.11	.96
32) Balancing bet. I/B & O/B	27	1	5	2.15	1.10
16) Port Equipment	28	1	4	2.25	.97
12) Niche Market	28	1	3	2.29	.81
29) Rate of Lashing	28	1	4	2.29	1.05
1) Port Due	28	1	4	2.29	1.05
25) Cargo Safety	28	1	4	2.32	1.02
19) Competing Carriers	28	1	5	2.36	1.16
26) Prorfitability	28	1	4	2.36	1.16
24) Customs Requlation	28	1	4	2.46	.96
11) Stowage Plan	28	1	5	2.57	1.03
13) Special Requirement	28	1	4	2.61	.83
15) IT	28	1	5	2.61	.79
17) Communication w/ staffs	28	1	5	2.64	1.16
31) Varying Service	26	1	4	2.73	.87
20) Mgt/Worker Relation	28	1	4	2.75	.84
30) Slot Exchange	28	1	5	2.75	1.08
14) Extensivenes of Service	28	1	5	2.79	.79
23) Overtime Working	28	1	5	2.82	1.09
18) Worldwide Reputation	28	1	5	2.89	1.10
22) Legal/finance System	28	1	5	3.04	1.20
21) Auxillary Service	28	1	5	3.11	.92
Valid N (listwise)	26				

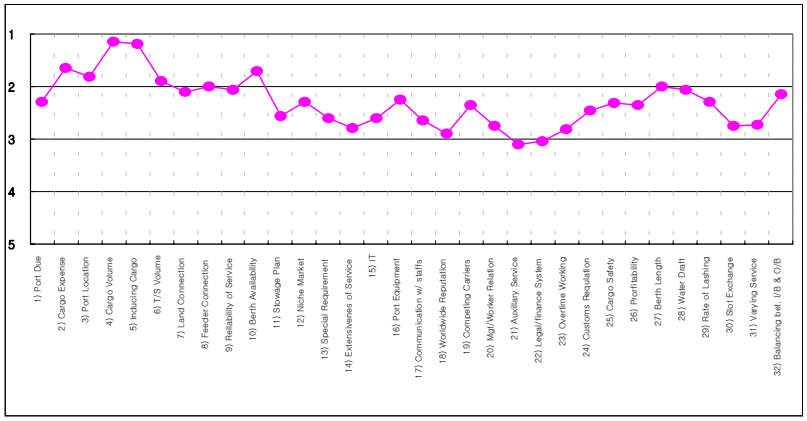

Figure 5-1. Mean Value of Variables

These results suggest that liners look at market size and cargo expense in port selection and put less emphasis on more complicated and value-added services. This is somewhat different from the advertising aims of advanced ports like the Port of Singapore. So it may have been caused by more dominating figures of the sampled data by smaller shipping companies, which provide mostly intra-regional services like Intra-Asia service and short-sea services (feeder service). Therefore, we checked if there is any difference between mega-carriers (trunk route companies) and these small companies.

The results are presented in table 5-2 and 5-3 for trunk route liners and Intra-Asia liners, respectively. We can see from the tables that there is a considerable difference between trunk route liners and Intra-Asia liners in port selection criteria. Interestingly, the trunk route liners consider more factors than the regional liners. This phenomena is shown in comparing the total mean values between the trunk line and the regional line (see table 5-4).

In other words, since the trunk liners consider more variables important than the regional liners, the total mean value of all the variables is lower than the mean of the regional liners. Specifically, the trunk liners consider cargo inducing possibility, cargo expense and cargo volume in the port area to be the most important whereas the regional liners cargo volume and the inducing cargo possibilities. It is noteworthy that the regional liners' scores on these factors are lower than the trunk liners'. This implies that the regional liners seem to depend upon the cargo volumes more heavily than the trunk liners, since the latter seem to consider a larger number of factors in port selection.

Secondly, there are two more factors that both the trunk and regional liners consider important but at a secondary level. These are berth availability and transshipment volume. In addition to these two factors, the trunk liners look at other factors, such as land connections, reliability of service, port location, berth length, water draft, feeder connection, cargo safety and profitability in the order of the variable scores in table 5-2. Compared with these figures, the regional liners, however, seem to put much less emphasis on some of these variables in port selection, in particular on such factors as water draft, reliability of service, land connection, cargo safety and profitability. This difference may come from the fact that the liners usually operate small vessels in rather smaller markets so they do not have to worry about the water draft, service reliability, cargo safety and even profitability as much as do the trunk liners, who provide more comprehensive and value-added service to bigger markets with bigger vessels.

Thirdly, the trunk liners do not seem to consider auxiliary service and the extensiveness of port services important whereas the regional liners seem to ignore more factors such as overtime working, port country's legal and financial system, work relationship between management and workers, auxiliary service and world wide reputation of a port. This is again likely to be caused by the different nature of the trunk and regional liners in their market and business characteristics. The comparative factors between the trunk liners and regional liner are summarized in table 5-5.

In sum, we calculated average scores for each variable from the sampled data (28 questionnaires) and found that there are six variables, which scored mean values less than 'two' and two variables, which scored mean values more than 'three'. This may be interpreted that the

six variables reflect what factors the liners consider important in choosing ports and the two variables the ones that they consider unimportant. The most important factors in port selection seem to be cargo volume in a local area of the port and volume of inducing cargoes by their own lines. This suggests that liners are concerned with securing cargo in port selection, looking at potential market size and their strength in the market. The next important factors are cargo expenses, berth availability, port location and transshipment volume. Still these variables may reflect how the liners look at how expensive the port is and berth availability and the level of transshipment activity.

Meanwhile, the liners seem to show that they are unconcerned with higher hierarchical services such as the strength of the legal and financial systems and presence of auxiliary services like bunker, ship-repair, lashing and tally, etc. These unimportant variables graded by the liners are mostly in the opposite direction with the advertising aspects of advanced ports like the Port of Singapore. Therefore, it was inferred that this phenomena may have been caused by the domination of smaller companies (feeder service providers) in the sample. To check this, we grouped the sampled data into one for trunk route service and the other for intra-regional service (i.e., Intra-Asia service) then calculated again the mean value of each variable for the two groups and compared the results between the two groups. This comparison tells us that there is difference in the factors between the two groups.

First of all, bigger companies serving on trunk routes consider more factors in route decision-making processes and do not seem to ignore any other factors given in the questionnaires except the auxiliary service and the extensiveness of the service. Their biggest concern is,

first, inducing cargo to their own lines, cargo expense and cargo volume in the local area. Compared with the smaller companies serving on feeder routes, the bigger companies appear to be faced with more fierce competition and so they look at the size of the market and the expenses at the same time. In addition, the trunk route servers look at other various variables such as ones from land connection through berth length to the availability to cargo safety and profitability.

In contrast with this, the feeder servers only look at berth availability, cargo expense and transshipment volume. This is to say that the feeder liners are mostly concerned with seeing if there is cargo for them in the port, and then if it is reasonable to use the port at a secondary level. Other comprehensive services like land connection, service reliability, water draft, cargo safety and even profitability are beyond their primary interests in port selection. This is to suggest that they still fall in the traditional conventional market, whereby the running of their businesses is determined by market size and cost not by marketability and high quality services. Likewise, they are not so much concerned if these are constraints on overtime working, the legal and financial systems, the relationship between management and workers, auxiliary services and worldwide reputation.

Table 5-2. Descriptive Statistics of Trunk Route Liners [a]

	N	Minimum	Maximum	1.25	Std. Deviation
5) Inducing Cargo	12	1	2	1.25	.45
2) Cargo Expense	13	1	2	1.31	.48
4) Cargo Volume	13	1	3	1.31	.63
7) Land Connection	13	1	3	1.54	.78
9) Rellability of Service	13	1	3	1.54	.78
3) Port Location	13	1	4	1.62	.96
10) Berth Availability	13	1	3	1.25	.87
27) Berth Length	13	1	3	1.69	.75
28) Water Draft	13	1	3	1.69	.85
8) Feeder Connection	13	1	4	1.77	1.01
6) T/S Volume	13	1	4	1.85	.80
25) Cargo Safety	13	1	4	1.85	.99
26) Prorfitability	13	1	4	1.92	1.32
1) Port Due	13	1	4	2.00	1.15
16) Port Equipment	13	1	4	2.00	1.00
32) Balancing bet. I/B & O/B	12	1	4	2.08	1.00
15) IT	13	1	3	2.23	.73
20) Mgt/Worker Relation	13	1	3	2.31	.75
23) Overtime Working	13	1	4	2.31	1.18
24) Customs Requlation	13	1	4	2.31	.95
11) Stowage Plan	13	1	4	2.31	1.03
12) Niche Market	13	1	3	2.31	.85
13) Special Requirement	13	1	4	2.38	1.04
17) Communication w/ staffs	13	1	4	2.38	1.19
19) Competing Carriers	13	1	5	2.46	1.20
29) Rate of Lashing	13	1	4	2.54	1.13
31) Varying Service	11	1	4	2.73	1.10
18) Worldwide Reputatio	13	1	4	2.77	1.09
22) Legal/finance System	13	1	5	2.77	1.17
30) Slot Exchange	13	1	5	2.77	1.09
14) Extensivenes of Service	13	1	5	2.92	1.04
21) Auxillary Service	13	1	5	3.08	1.04
Valid N (listwise)	11				

a. Trunk vs. IA = 1.00

Table 5-3. Descriptive Statistics of Intra-Asia Liners [a]

	N	Minimum	Maximum	Mean	Std. Deviation
4) Cargo Volume	15	1	1	1.00	.00
5) Inducing Cargo	15	1	2	1.13	.35
10) Berth Availability	15	1	3	1.80	.77
2) Cargo Expense	15	1	4	1.93	.88
6) T/S Volume	15	1	3	1.93	.80
3) Port Location	15	1	4	2.00	1.00
29) Rate of Lashing	15	1	4	2.07	.96
8) Feeder Connection	15	1	4	2.20	1.01
32) Balancing bet. I/B & O/B	15	1	5	2.20	1.21
12) Niche Market	15	1	3	2.27	.80
19) Competing Carriers	15	1	4	2.27	1.16
27) Berth Length	15	1	3	2.27	.88
28) Water Draft	15	1	4	2.40	.83
16) Port Equipment	15	1	4	2.47	.92
1) Port Due	15	1	4	2.53	.92
9) Rellability of Service	15	2	3	2.53	.52
7) Land Connection	15	1	4	2.60	.83
24) Customs Requlation	15	1	4	2.60	.99
14) Extensivenes of Service	15	2	3	2.67	.49
25) Cargo Safety	15	1	4	2.73	.88
26) Prorfitability	15	1	4	2.73	.88
30) Slot Exchange	15	1	5	2.73	1.10
31) Varying Service	15	1	4	2.73	.70
11) Stowage Plan	15	1	5	2.80	1.01
13) Special Requirement	15	2	4	2.80	.56
17) Communication w/ staffs	15	1	5	2.87	1.13
15) IT	15	2	5	2.93	.70
18) Worldwide Reputatio	15	1	5	3.00	1.13
21) Auxillary Service	15	2	5	3.13	.83
20) Mgt/Worker Relation	15	2	4	3.13	.74
22) Legal/finance System	15	1	5	3.27	1.22
23) Overtime Working	15	2	5	3.27	.80
Valid N (listwise)	15				

a. Trunk vs. IA = 2.00

Table 5-4. Comparison of Average between Trunk and IntraAsia

	N	Minimum	Maximum	Mean	Std. Deviation
TRUNKAVG	32	1.25	3.08	2.1016	.5164
IAAVG	32	1.00	3.27	2.4644	.5500
Valid N (listwise)	32				

Table 5-5. Comparison of Factors between trunk and regional liners

Factors	Trunk Route Liners	Intra-Asia Liners
Most Important	Inducing cargo (1.25) Cargo expense (1.31) Cargo volume (1.31)	Cargo volume (1.00) Inducing cargo (1.13)
2nd Most Important	**Land connection (1.54)** **Service reliability (1.54)** Port location (1.62) Berth availability (1.62) Berth length (1.69) **Water draft (1.69)** Feeder connection (1.77) Transshipment volume (1.85) **Cargo safety (1.85)** **Profitability (1.92)**	Berth availability (1.80) Cargo expense (1.93) Transshipment volume (1.93)
Unimportant	Auxiliary service (3.08) Extensiveness of service (2.92)	Overtime working (3.27) Legal/financial system (3.27) Manage/work relation (3.13) Auxiliary service (3.13) Worldwide reputation (3.00)

Notes:

A. the figures in the parenthesis refer to the score of the variables from the previous tables: 1: important; 5: unimportant

B. the factors between most important, 2nd most important and unimportant categories was arbitrarily chosen, based on the results of the survey.

C. The bold faced factors in 2nd most important category are the ones that the trunk liners considered as important, but the regional liners less important.

There should be some caveats in interpreting the results shown in the tables from 5-1 to 5-5. Although we calculated the scores of all the variables graded by the respondents and compared the variables between the trunk route liners and feeder liners, we have not tested any statistical significance on the difference between the two groups yet. In other words, even if we seem to have derived what factors the two group consider as important and unimportant in port selection from mere mean calculation and compared them between groups, it has not been subjected to any rigorous statistical test. We have attempted to test this argument by

employing a standard statistical test (T-test) to see if there is a statistically significant difference between the two groups. The results are shown in table 5-6. First, we calculated the detailed statistics of the variables (see Appendix 3). Then we tested the two groups' mean values by variable using T-test in table 5-6. Since there are two assumptions (equal variances between two groups and unequal ones) regarding variances in the two group t-test, we should look at the significance figures by using Levene's Test to check which assumption is deemed to be effective.

For instance, from the first variable in the table (Cargo Expense), we see that the Levene's Test for Equal variances is 0.272 (less than our 5% significance level) and therefore, we cannot reject the null hypothesis that the two variances are equal. This leads us to look at t-test figures along the Equal variances row resulting in -2.274 for a t-statistic and 0.031 for significance. The t-value and significance figure tell us that there is significant difference in Cargo Expense factor between trunk route group and feeder group when choosing ports. Likewise, by looking at all the F and T statistics and significance estimates, we can come to conclusion that there are eight variables showing statistical significance as in table 5-6. All the test results for all 32 variables are placed in Appendix 4.

They are cargo expense, land connection, reliability of service, water draft, cargo safety, overtime working (these are shown bold-faced), IT and Management/worker relationship. The first six variables are shown in table 5-5 and the seventh and eighth variables are not shown in the table since their mean values are rather high and therefore, not included in the list of major variables. But it should be noted that statistically they are significant. In addition, it is noteworthy that the first five variables are significant as important factors and the sixth variable is again significant

as unimportant factor. From our previous results and these statistical tests, it may be fair to say that the results verify that the trunk liners are faced with more fierce competition requiring them to provide more comprehensive and value-added services than the feeder liners.

Table 5-6. Independent Samples Test

		Levene's Test for Equality of Variances		t-test for Equality of Means		
		F	Sig.	t	df	Sig. (2-tailed)
Cargo Expense	Equal variances	1.259	.272	-2.274	26	.031
	Unequal variances			-2.368	22.168	.027
Land Connection	Equal variances	.043	.837	-3.482	26	.002
	Unequal variances			-3.499	25.817	.002
Reliability of Service	Equal variances	3.204	.085	-4.043	26	.000
	Unequal variances			-3.929	20.398	.001
IT	Equal variances	1.309	.263	-2.598	26	.015
	Unequal variances			-2.592	25.198	.016
Mgt/Worker Relation	Equal variances	.162	.690	-2.917	26	.007
	Unequal variances			-2.915	25.357	.007
Overtime Working	Equal variances	3.552	.071	-2.545	26	.017
	Unequal variances			-2.476	20.610	.022
Cargo Safety	Equal variances	.098	.757	-2.510	26	.019
	Unequal variances			-2.489	24.379	.020
Water Draft	Equal variances	.126	.726	-2.222	26	.035
	Unequal variances			-2.217	25.180	.036

6. Conclusion

Today's container ports face unprecedented challenges. Considerable social and economic pressures encourage port development. Terminal authorities and proponents view ports as "engines of growth". However, the success of new proposals are not assured due to high costs, as well as competition and strategic behavior between ports, by shipping lines, railroads and other stakeholders.

Further, environmental issues are assuming an increasingly prominent role in shaping the nature, scale, and operation of ports and, by that, raising port costs for mitigation and operation. Of the challenges that contemporary ports face, the seemingly most inflicting is to what extent the ports concerned should be expanded. The answer is not easy particularly in cases where port competition is severe. The bargaining power of the global shipping liners' alliances aggravates port competition. As the alliances continue to seek bigger alliances, as many experts predict, ports may have two destinies: either becoming a stronger hub in the region or shrinking to a mere feeder port in the regional 'hub and spoke system'. This phenomenon is already observable in many parts of the world.

For instance, on one hand, the advent of giant global alliances like the Maersk-Sealand-line once played off several ports on the US East coasts when the line had to renew its long-term contract with the Port of New York and New Jersey around 1999. This event stirred the whole of the US East coast ports, once thinking themselves as a future hub in the region. Similarly, Maersk-Sealand switched its base port from Singapore to the Port of Tanjung Pelepas (PTP) recently, which

may have influenced the ensuing movement by Evergreen to PTP. It is reported that MOL/APL is seeking a merger or acquisition with P&O Nedlloyd presumably to take advantage of this favorable position as a bigger alliance.

On the other hand, ports are perplexed when facing severe port competition and intimidated by the play of global alliances. Therefore, even today's market leader cannot be complacent. To maintain its market position, leaders should further expand to maintain their advantages over rival ports. In addition to expansion, ports should respond to various new requirements of the lines, thus endeavoring to adapt to an ever changing new environment. Otherwise, the ports are likely to be overtaken by their rivals and left behind. In sum, ports should continuously understand what factors are affecting liners decision in choosing ports.

At this juncture, we have focused on our studies on two distinct routes: one on trunk routes covering trans-Pacific trade and trans-European trade between Far-east Asia, and North America and Europe, and; the other on short sea route in Intra-Asia trade, respectively.

We researched how liners operate on both the trunk routes and feeder routes. A major source for this information was taken from 'Containerization International 2002'. We listed major shipping lines in trunk routes of Trans-Pacific and Far-East to European routes and also Intra-Asia routes for distribution of the questionnaire. The number of companies we selected for the distribution of questionnaires was one hundred sixty, but could collect only twenty eight. Therefore, the sample covers only 17.5%.

From the sample, we calculated an average score for each variable from the sampled data (28 questionnaires) and found that there are six

variables, which scored mean values less than two and two variables, which scored mean values more than three. This may be interpreted that the six variables reflect what factors the liners consider important in choosing ports and the two variables the ones that they consider unimportant. The most important factors in port selection seem to be cargo volume in the local port area and volume of inducing cargo to their own lines. This is the sign that liners are mostly concerned with capturing cargo in port selection, usually looking at a potential market size and their strength in the market.

The next tier of important factors are cargo expense, berth availability, port location and transshipment volume. Still these variables may reflect that the liners look at how expensive the port is and if berths are available and if there is heavy transshipment activity. Meanwhile, the liners seem to show that they are unconcerned with higher hierarchical services such as the strength of legal and financial systems of a port country as well as presence of auxiliary services like bunker, ship-repair, lashing and tally, etc. These unimportant variables graded by the liners are mostly in the opposite direction of the advertising aims of advanced ports like the Port of Singapore.

Therefore, it was inferred that this phenomena may have been caused by the dominating nature of smaller companies (feeder service providers) in the sample. To check this, we grouped the sampled data into one for trunk route service and the other for intra-regional service (i.e., Intra-Asia service) then calculated again the mean value of each variable for the two groups and compared the results between them. This told us that there is difference in the factors between the two groups. First of all, bigger companies serving on trunk routes consider more factors in the route decision-making processes and do not seem

to ignore any other factors we provided in the questionnaires except for the auxiliary service and the extensiveness of service. Their first concern is inducing cargo to their own lines, cargo expense and cargo volume in the local area.

Compared with the smaller companies serving on feeder routes, the bigger companies appear to be faced with more fierce competition and so they look at the size of the market and the expense item at the same time. In addition, the trunk route servers look at other various variables such as ones from intermodal hinterland connection through berth length and availability to cargo safety and profitability. In contrast with this, the feeder servers only look at berth availability, cargo expense and transshipment volume. This is to say that the feeder liners are mostly concerned with seeing if there is cargo for them in the port, berth availability and then finally if it is reasonable to use the port.

Other comprehensive services like intermodal hinterland connection, service reliability, water draft, cargo safety and even profitability are beyond their primary interests in port selection. This is again, maybe, to say that they still fall in the traditional conventional market, whereby success in running their businesses is determined by market size and cost not by marketability and high quality services. Likewise, they are not so much concerned with overtime issues, the legal and financial systems, the relationship between management and workers, auxiliary services and worldwide reputation.

Finally, there should be some caveats in interpreting the results. Although we calculated the scores of all the variables graded by the respondents and compared the variables between the trunk route liners and feeder liners, we have not tested any for statistical significance on

differences between the two groups yet. In other words, even if we seem to have concluded what factors the two groups consider important and unimportant in port selection from mere mean calculation and then compared them between the groups, it is still far from any rigorous statistical test. We have attempted to test this argument by employing a standard statistical test (T-test) to see if there is statistically significant difference between the two groups. We came to the conclusion that there are eight variables showing statistical significance.

They are cargo expense, land connection, reliability of service, water draft, cargo safety, overtime working, IT and Management/worker relationship. The first six variables are shown in table 5-5 and the seven and eight variables are not shown in the table since their mean values are rather high and therefore, not included in the list of major variables. But it should be noted that statistically they are significant. In addition, it is noteworthy that the first five variables are significant as important factors and the sixth variable is again significant but as an unimportant factor. From our previous results and these statistical tests, it may be fair to say that the results verify that the trunk liners are faced with more fierce competition requiring them to provide more comprehensive and value-added services than the feeder liners.

All the results that we have analyzed thus far tell us the following policy implications for future port development in the world

Firstly, port should maintain their cargo volumes either handling export/import cargo or transshipment cargo to be competitive. What is more important is that ports should be able to draw the attentions of liners on how the liners can induce cargoes to their own lines and persuade them to do so.

Secondly, cargo expense is still key a factor affecting liners' decision in port selection. Therefore charging competitive rates will lead to securing more cargo to the extent that the rates are not sacrificing service quality. Other types of port price like port dues do not seem to play a role in affecting the liners' decision.

Thirdly, ports that plan to be hub should provide and guarantee better comprehensive services such as efficient inland connection, reliable service, enough water draft, cargo safety and profitability, in particular for trunk route liners. In addition, Information Technology and a good relationship between management and workers can play a considerable role.

Fourthly, ports aiming to be feeder ports should focus on berth availability and should not highly concern themselves on extending working hours related to overtime work. The lack of concern related to overtime may have been caused by the limited set nature of our data, so caution should be taken in policy-formulation.

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com.niceshipping.com/ACL/eindex.htm
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Ahrenkiel Liner Service (HK) Ltd
1005-6, Cigna Tower, 482 Jaffe Rd, Causeway Bay
Hong Kong, China
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Website : www. ahrenkiel.net
C/O : Fred Lee, General Manager

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C/O : Emilio Silva Nogueira de Sa, Contracts & Operations Manager

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Antillean Marine Shipping Corp
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Website : www.antillean.com
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C/O : Susan Fleming, Marketing Manger

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Atlas Shipping Lines Ltd
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APPENDIX 2. Originally designed questionnaire

PSA
The World's Port of Call

INDUSTRY SURVEY
CONFIDENTIAL

KMI

Factors Affecting Liners' Port Selection by Trade Routes

We would like to invite you to take part in this industry survey by completing this questionnaire and returning it to us as soon as possible.

The aim of the survey is to gather information about the factors which shipping lines consider when they select their port-of-calls for their mainhaul and Intra-Asia services. This survey would allow us to analyse the needs and wants of liners and we are sure that the result would benefit and perhaps even improve the operating environment of the shipping industry as a whole.

This questionnaire should take no longer than 8 - 10 minutes to complete and all information will be held in the strictest confidence.

Kindly fax the completed questionnaire to us at Fax No : 65-6279 5713 or +82-(2)-2105-2759

Or email : sglie@hq.psa.com.sg or ytchang@kmi.re.kr or sylee@kmi.re.kr

THANK YOU FOR YOUR TIME AND COOPERATION.

Name : _____.

Company : _____

_____.

Designation : _____.

Section A : Mainhaul Services (Europe-Far East, Transpacific or Transatlantic Shipping Services)

When choosing or advising on a port-of-call for your mainhaul service, how important is for you to find information listed below. To answer, please put a tick in the box beside the number which most accurately reflects your situation :

	SCALE 1 NOT IMPORTANT	2	3 IMPORTANT	4	5 VERY IMPORTANT
1	Port average vessel rate	} 1	} 2	} 3	} 4 } 5
2	Port average gross crane rate	} 1	} 2	} 3	} 4 } 5
3	Port location (along main shipping routes)	} 1	} 2	} 3	} 4 } 5
4	Port handling charges	} 1	} 2	} 3	} 4 } 5
5	Cargo volume local to the port	} 1	} 2	} 3	} 4 } 5
6	Port land-ward intermodal access	} 1	} 2	} 3	} 4 } 5
7	Port feeder connectivity to other ports	} 1	} 2	} 3	} 4 } 5
8	Port reliability of services	} 1	} 2	} 3	} 4 } 5
9	% of vessel berth on arrival in port	} 1	} 2	} 3	} 4 } 5

10	Port's ability to accommodate last minute changes	} 1	} 2	} 3	} 4	} 5
11	Port's ability to accommodate special requirements	} 1	} 2	} 3	} 4	} 5
12	Port extensiveness of services	} 1	} 2	} 3	} 4	} 5
13	Port information technology (IT) connectivity	} 1	} 2	} 3	} 4	} 5
14	Age of port equipments	} 1	} 2	} 3	} 4	} 5
15	Ease of contact of port's staff	} 1	} 2	} 3	} 4	} 5
16	Port's operator reputation worldwide	} 1	} 2	} 3	} 4	} 5
17	Competing players already call at the port	} 1	} 2	} 3	} 4	} 5
18	Port's management-worker relationship	} 1	} 2	} 3	} 4	} 5
19	Presence of auxiliary services (eg bunker and shiprepair)	} 1	} 2	} 3	} 4	} 5
20	Strength of legal/financial system of the port's country	} 1	} 2	} 3	} 4	} 5

Section B : Intra Asia Services

When choosing or advising on a port-of-call for your Intra Asia service, how important is for you to find information listed below. To answer, please put a tick in the box beside the number which most accurately reflects your situation :

	SCALE	1 NOT IMPORTANT	2	3 IMPORTANT	4	5 VERY IMPORTANT
1	Port average vessel rate	1	2	3	4	5
2	Port average gross crane rate	1	2	3	4	5
3	Port location (along main shipping routes)	1	2	3	4	5
4	Port handling charges	1	2	3	4	5
5	Cargo volume local to the port	1	2	3	4	5
6	Port land-ward intermodal access	1	2	3	4	5
7	Port feeder connectivity to other ports	1	2	3	4	5
8	Port reliability of services	1	2	3	4	5
9	% of vessel berth on arrival in port	1	2	3	4	5
10	Port's ability to accommodate last minute changes	1	2	3	4	5
11	Port's ability to accommodate special requirements	1	2	3	4	5
12	Port extensiveness of services	1	2	3	4	5
13	Port information technology (IT) connectivity	1	2	3	4	5
14	Age of port equipments	1	2	3	4	5
15	Ease of contact of port's staff	1	2	3	4	5
16	Port's operator reputation worldwide	1	2	3	4	5

17	Competing players already call at the port	} 1	} 2	} 3	} 4	} 5
18	Port's management-worker relationship	} 1	} 2	} 3	} 4	} 5
19	Presence of auxiliary services (eg bunker and shiprepair)	} 1	} 2	} 3	} 4	} 5
20	Strength of legal/financial system of the port's country	} 1	} 2	} 3	} 4	} 5

Appendix 3. Group Statistics

	Trunk vs. IA	N	Mean	Std. Deviation	Std. Error Mean
1) Port Due	1.00	13	2.00	1.15	.32
	2.00	15	2.53	.92	.24
2) Cargo Expense	1.00	13	1.31	.48	.13
	2.00	15	1.93	.88	.23
3) Port Location	1.00	13	1.62	.96	.27
	2.00	15	2.00	1.00	.26
4) Cargo Volume	1.00	13	1.31	.63	.17
	2.00	15	1.00	.00	.00
5) Inducing Cargo	1.00	12	1.25	.45	.13
	2.00	15	1.13	.35	9.09E-02
6) T/S Volume	1.00	13	1.85	.80	.22
	2.00	15	1.93	.80	.21
7) Land Connection	1.00	13	1.54	.78	.22
	2.00	15	2.60	.83	.21
8) Feeder Connection	1.00	13	1.77	1.01	.28
	2.00	15	2.20	1.01	.26
9) Reliability of Service	1.00	13	1.54	.78	.22
	2.00	15	2.53	.52	.13
10) Berth Availability	1.00	13	1.62	.87	.24
	2.00	15	1.80	.77	.20
11) Stowage Plan	1.00	13	2.31	1.03	.29
	2.00	15	2.80	1.01	.26
12) Niche Market	1.00	13	2.31	.85	.24
	2.00	15	2.27	.80	.21

13) Special Requirement	1.00	13	2.38	1.04	.29
	2.00	15	2.80	.56	.14
14) Extensivenes of Service	1.00	13	2.92	1.04	.29
	2.00	15	2.67	.49	.13
15) IT	1.00	13	2.23	.73	.20
	2.00	15	2.93	.70	.18
16) Port Equipment	1.00	13	2.00	1.00	.28
	2.00	15	2.47	.92	.24
17) Communication w/ staffs	1.00	13	2.38	1.19	.33
	2.00	15	2.87	1.13	.29
18) Worldwide Reputation	1.00	13	2.77	1.09	.30
	2.00	15	3.00	1.13	.29
19) Competing Carriers	1.00	13	2.46	1.20	.33
	2.00	15	2.27	1.16	.30
20) Mgt/Worker Relation	1.00	13	2.31	.75	.21
	2.00	15	3.13	.74	.19
21) Auxillary Service	1.00	13	3.08	1.04	.29
	2.00	15	3.13	.83	.22
22) Legal/finance System	1.00	13	2.77	1.17	.32
	2.00	15	3.27	1.22	.32
23) Overtime Working	1.00	13	2.31	1.18	.33
	2.00	15	3.27	.80	.21

24) Customs Regulation	1.00	13	2.31	.95	.26
	2.00	15	2.60	.99	.25
25) Cargo Safety	1.00	13	1.85	.99	.27
	2.00	15	2.73	.88	.23
26) Prorfitability	1.00	13	1.92	1.32	.37
	2.00	15	2.73	.88	.23
27) Berth Length	1.00	13	1.69	.75	.21
	2.00	15	2.27	.88	.23
28) Water Draft	1.00	13	1.69	.85	.24
	2.00	15	2.40	.83	.21
29) Rate of Lashing	1.00	13	2.54	1.13	.31
	2.00	15	2.07	.96	.25
30) Slot Exchange	1.00	13	2.77	1.09	.30
	2.00	15	2.73	1.10	.28
31) Varying Service	1.00	11	2.73	1.10	.33
	2.00	15	2.73	.70	.18
32) Balancing bet. I/B & O/B	1.00	12	2.08	1.00	.29
	2.00	15	2.20	1.21	.31

Appendix 4. Independent Samples Test

		Levene's Test for Equality of Variances		t-test for Equality of Means		
		F	Sig.	t	df	Sig. (2-tailed)
1) Port Due	Equal variances assumed	.577	.454	-1.363	26	.185
	Equal variances not assumed			-1.340	22.829	.193
2) Cargo Expense	Equal variances assumed	1.259	.272	-2.274	26	.031
	Equal variances not assumed			-2.368	22.168	.027
3) Port Location	Equal variances assumed	.041	.841	-1.034	26	.311
	Equal variances not assumed			-1.037	25.696	.310
4) Cargo Volume	Equal variances assumed	21.859	.000	1.896	26	.069
	Equal variances not assumed			1.760	12.000	.104
5) Inducing Cargo	Equal variances assumed	2.309	.141	.755	25	.458
	Equal variances not assumed			.733	20.463	.472

6) T/S Volume	Equal variances assumed	.256	.617	-.288	26	.776
	Equal variances not assumed			-.288	25.420	.776
7) Land Connection	Equal variances assumed	.043	.837	-3.482	26	.002
	Equal variances not assumed			-3.499	25.817	.002
8) Feeder Connection	Equal variances assumed	.018	.895	-1.122	26	.272
	Equal variances not assumed			-1.122	25.447	.272
9) Reliability of Service	Equal variances assumed	3.204	.085	-4.043	26	.000
	Equal variances not assumed			-3.929	20.398	.001
10) Berth Availability	Equal variances assumed	.644	.430	-.594	26	.557
	Equal variances not assumed			-.589	24.319	.561
11) Stowage Plan	Equal variances assumed	.090	.767	-1.271	26	.215
	Equal variances not assumed			-1.269	25.305	.216
12) Niche Market	Equal variances assumed	.196	.662	.131	26	.897

	Equal variances not assumed			.131	24.841	.897
13) Special Requirement	Equal variances assumed	7.645	.010	-1.337	26	.193
	Equal variances not assumed			-1.283	17.796	.216
14) Extensivenes of Service	Equal variances assumed	2.138	.156	.856	26	.400
	Equal variances not assumed			.816	16.519	.426
15) IT	Equal variances assumed	1.309	.263	-2.598	26	.015
	Equal variances not assumed			-2.592	25.198	.016
16) Port Equipment	Equal variances assumed	.001	.981	-1.289	26	.209
	Equal variances not assumed			-1.281	24.627	.212
17) Communication w/ staffs	Equal variances assumed	.692	.413	-1.099	26	.282
	Equal variances not assumed			-1.095	24.936	.284
18) Worldwide Reputation	Equal variances assumed	.147	.705	-.546	26	.590
	Equal variances not assumed			-.548	25.683	.589

19) Competing Carriers	Equal variances assumed	.019	.893	.436	26	.666
	Equal variances not assumed			.435	25.196	.667
20) Mgt/Worker Relation	Equal variances assumed	.162	.690	-2.917	26	.007
	Equal variances not assumed			-2.915	25.357	.007
21) Auxiliary Service	Equal variances assumed	.274	.605	-.159	26	.875
	Equal variances not assumed			-.157	23.010	.877
22) Legal/finance System	Equal variances assumed	.114	.739	-1.097	26	.283
	Equal variances not assumed			-1.101	25.738	.281
23) Overtime Working	Equal variances assumed	3.552	.071	-2.545	26	.017
	Equal variances not assumed			-2.476	20.610	.022
24) Customs Regulation	Equal variances assumed	.125	.726	-.797	26	.433
	Equal variances not assumed			-.799	25.694	.432
25) Cargo Safety	Equal variances assumed	.098	.757	-2.510	26	.019
	Equal variances not assumed			-2.489	24.379	.020

26) Profitability	Equal variances assumed	4.824	.037	-1.932	26	.064
	Equal variances not assumed			-1.878	20.479	.075
27) Berth Length	Equal variances assumed	1.154	.293	-1.837	26	.078
	Equal variances not assumed			-1.859	25.995	.074
28) Water Draft	Equal variances assumed	.126	.726	-2.222	26	.035
	Equal variances not assumed			-2.217	25.180	.036
29) Rate of Lashing	Equal variances assumed	.975	.333	1.196	26	.242
	Equal variances not assumed			1.182	23.798	.249
30) Slot Exchange	Equal variances assumed	.054	.818	.086	26	.932
	Equal variances not assumed			.086	25.489	.932
31) Varying Service	Equal variances assumed	3.315	.081	-.017	24	.986
	Equal variances not assumed			-.016	15.845	.987
32) Balancing bet. I/B & O/B	Equal variances assumed	.367	.550	-.269	25	.790
	Equal variances not assumed			-.275	24.960	.786