PORTS' SUPPLY CHAIN MANAGEMENT (SCM) STRATEGIES AND THEIR IMPACTS ON PERFORMANCE

- A PARTIAL LEAST SQUARES APPROACH ON THE USERS OF BUSAN PORT

by

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This work has not previously been accepted in substance for any degree and is not concurrently submitted in candidature for any degree.

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ABSTRACT

Based on the combined view of Resource Based Theory (RBT) and Supply Chain Management Theory (SCMT), this study aims to investigate the impact of Port Authorities' (PAs') SCM strategies on Port focused Supply Chains' (PSCs) SCM strategies, PSCs' resources, and PSCs' Supply Chain Performance (SCP). Considering the different roles of PAs and private players in ports, the concept 'Port focused Supply Chain' (PSC), including container terminals, inland transport companies and depots, is adopted for the current study.

After a literature review and exploratory factor analysis, twelve specific variables, i.e. PAs' 'concessions', 'using IT', 'marketing', 'support for hinterland and FTZ', PSCs' 'vertical integration', 'relationship orientation', 'skills', 'physical 'resources', and PSCs' 'reliability', 'flexibility', 'costs', and 'service effectiveness' were chosen for the PLS (Partial Least Squares) analysis.

The questionnaire survey was distributed to 1,208 surveyees, i.e. experts in headquarters, branches, agents of the shipping liner companies and freight forwarders using Korean and Chinese ports. From 12th March to 3rd May 2007, 124 responses were collected.

It is shown that PAs' 'using IT' strategy can positively affect PSCs' SCP through 'PSCs' relationship orientation', and 'skills'. Among the variables of PSCs' SCM, 'relationship orientation' makes a stronger impact on PSCs' resources than 'vertical integration'. 'Skills' is more powerful in determining PSCs' SCP than 'physical resources'. While 'physical resources' has a significant relationship with two variables (cost and service effectiveness), 'Skills' has positive influences on all the four variables of PSCs' SCP. Singapore's SCP

exceeded the SCP scores of other rivals, i.e. Hong Kong, Busan, Shanghai, and Gwangyang port. Except Shanghai port, the container cargo volumes of the other four ports were consistent with their SCP.

In conclusion, the implication for PAs can be that PSCs' performance can be improved by utilizing coherent SCM strategies. Further research investigating the impacts of PAs' SCM strategies is recommended.

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ACT: Asia Container Terminals Ltd. (Hong Kong Port)

AHP: Analytic Hierarchy Process

AVE: Average Variance Extracted

BOT: Build, Operate, Transfer

BPA: Busan Port Authority

CFA: Confirmatory Factor Analysis

COSCO: China Ocean Shipping (Group) Company

CTMTs: Container Terminal Management Companies

DEA: Data Envelopment Analysis

DPCT: Dongbu Pusan Container Terminal (Busan Port)

DPI: Dubai Port International Terminals Ltd. (Hong Kong Port)

EDI: Electronic Data Interchange

EFA: Exploratory Factor Analysis

EPZ: Export Processing Zone

FDI: Foreign Direct Investment

FEZ: Free Economic Zone

FTZ: Free Trade Zone

HBCT: Hutchison Busan Container Terminal (Busan Port)

HIT: Hong Kong International Terminals (Hong Kong Port)

HPH: Hutchison Port Holdings

IMF: International Monetary Fund

IT: Information Technology

JV: Joint Venture

LSQ: Logistics Service Quality

LV: Latent Variable

MAUT: Multi-Attribute Utility Theory

MCAR: Missing Completely at Random

MOC: Ministry of Communication (People's Republic of China)

MOMAF: Ministry of Maritime Affairs and Fisheries (Republic of Korea)

MLTM: Ministry of Land, Transport, and Maritime Affairs (Republic of Korea)

NIPALS: Nonlinear Iterative Partial Least Squares

NMAR: Not Missing at Random

NYK: Nippon Yusen Kaisha Line

OLS: Ordinary Least Squares regression

OOCL: Orient Overseas Container Line

PA: Port Authority (PAs: Port Authorities)

PLS: Partial Least Squares approach to SEM

PNC: Pusan Newport Company (Busan Port)

PSA: Port of Singapore Authority

PSCs: Port focused Supply Chains

PTP: Port of Tanjung Pelepas

QQCT: Qianwan Container Terminal Co. Ltd. (Qingdao)

RBT: Resource Based Theory

RES: Resources

RFID: Radio Frequency Identification

SCM: Supply Chain Management

SCMT: Supply Chain Management Theory

SCO: Supply Chain Orientation

SCP: Supply Chain Performance

SCT: Shanghai Container Terminals Ltd. (Shanghai Port)

SEM: Structural Equation Modelling

SEZ: Special Economic Zone

SFA: Stochastic Frontier Analysis

SIPG: Shanghai International Port Group

TPL: Third Party Logistics

T/S: Transhipment

Chapter 1
Introduction

1.1 Research Background and Motivation

There is a clear trend for maritime and port players to gain greater control of the logistics chain through various forms of co-operation including strategic alliances, mergers, etc. Heaver *et al.* (2000: 372p) clearly raised a question about the future role of port authorities (hereinafter PAs) in the turbulent environment as follows:

"If the concept of the logistics chain is indeed translated into a more pronounced vertical integration of shipping companies, stevedores, hinterland transport modes and (possibly) shipping agents, what will be the role of port authorities? Will port authorities become fully-fledged partners in the logistics chain, will their involvement be restricted to a supporting role (safety, land-use and concession policy), or might they disappear from the scene entirely?"

Regarding this issue, Juhel (2001: 139p) illustrated the importance of PAs' strategies to integrate public and private players into supply chain as below:

"Port authorities are likely to have a major role to play in fostering the development of an effective cooperation between interested public and private players, which will be required to make it possible to achieve the expected benefits of integrated transport and logistic operations."

Based on such discussions, some questions needed to be considered: which PAs' measures would be most appropriate to integrate all players into supply chains? Then, how these PAs' measures affect a port's performance? In traditional views on the selection of ports, cost factor is regarded as the salient factor regarding port choice (Lirn, 2005). However, it is stipulated that quality factors are important as well when the other conditions are similar owing to the fierce competition among ports (Paixão and Marlow, 2003; Slack and Frémont, 2005). Furthermore, it is claimed that empirical research is urgently needed in terms of the logistics chain as a whole as well as the cost structure of the individual market player (Heaver *et al.*, 2000).

In regional sense, it is recognized that Eastern Asia is the most rapidly growing area in terms of container cargoes. Compared to Europe's container cargoes, Eastern Asia's cargo handling portion has been outgrown. The importance of this area has recently been elucidated by Yeo (2006). Focusing on container ports in Korea, China, and Japan in Northern East Asia (Korea, China, Japan, Mongolia, and the Russian Federation), Yeo (Ibid.) investigated the competitiveness of container ports. Table 1.1 shows the trend of container cargoes from 1978 to 2003. From 1978 to 2003, the share of Eastern Asian region out of the world total has grown from 24% to 43.3%. This is a startling contrast to Northern Europe's decline of share out of the world total from 25% to 12%. This strong surge of Eastern Asian region clearly suggests the necessity of studies focusing on container terminals and port authorities' (PAs) strategies in this region.

Table 1.1 Container cargoes statistics from 1978 to 2003

		Eastern Asia (Singapore- Japan)	**Asia** (India -Russia)	**Northern Europe** (N. France-Malmö)	**Europe** (N. Europe, Black Sea, Med. sea	**World Total**
1978	TEU	6,490,840	6,790,573	6,759,870	8,900,149	27,038,796
	No of Ports	14	19	41	69	175
	% out of continent	95.6%		75.9%		
	% out of World	**24%**		**25%**		100%
1983	TEU	11,547,701	12,649,699	9,907,308	13,942,546	45,957,306
	No of Ports	28	38	60	108	339
	% out of continent	91.3%		71%		
	% out of world	**25.1%**		**21.6%**		100%
1988	TEU	23,407,649	26,202,830	14,100,813	19,378,295	72,928,023
	No of Ports	36	50	61	105	370
	% out of continent	89.3%		72.8%		
	% out of world	**32.1%**		**19.3%**		100%
1993	TEU	42,598,420	4,823,8022	16,821,647	24,678,498	112,439,485
	No of Ports	45	61	53	104	382
	% out of continent	88.3%		68.2%		
	% out of world	**37.9%**		**14.9%**		100%
1998	TEU	68,632,664	80,388,474	26,701,771	41,764,128	171,528,276
	No of Ports	44	60	53	106	342
	% out of continent	85.4%		63.9%		
	% out of world	**40%**		**15.6%**		100%
2003	TEU	131,126,298	149,601,496	36,463,927	61,261,209	303,108,850
	No of Ports	66	79	43	101	360
	% out of continent	87.6%		59.5%		
	% out of world	**43.3%**		**12%**		100%

Source: Tabulated by the author from Containerisation International Yearbook 1980, 1985, 1990, 1995, 2000, 2005

Table 1.2 displays the estimated world container handling statistics by region which implies the importance of Northeast Asia (Far East Asia) in terms of container handling share.

Table 1.2 World container handling statistics by region

Container handled in region (000 TEU*)	1980	1990	2000	2004	2005	2006	2007	2008**
North America	9,531 (24.5%)	16,659 (18.9%)	30,841 (13.0%)	40,812 (11.3%)	44,500 (11.2%)	46,885 (10.6%)	47,789 (9.6%)	48,607 (9.0%)
West Europe	11,753 (30.2%)	22,552 (25.6%)	51,603 (21.8%)	70,846 (19.6%)	75,528 19.0%)	81,378 (18.4%)	91,131 (18.4%)	97,198 (18.0%)
North Europe	8,647 (22.3%)	15,996 (18.2%)	31,661 (13.4%)	42,403 (11.7%)	45,889 (11.5%)	49,884 (11.3%)	55,874 (11.3%)	60,155 (11.1%)
South Europe	3,106 (8.0%)	6,556 (7.4%)	19,943 (8.4%)	28,443 (7.9%)	29,639 (7.4%)	31,494 (7.1%)	35,257 (7.1%)	37,043 (6.9%)
Far East	7,694 (19.8%)	23,062 (26.2%)	71,590 (30.3%)	122,314 (33.8%)	137,275 (34.5%)	156,714 (35.5%)	180,020 (36.2%)	199,878 (37.0%)
South East Asia	1,871 (4.8%)	9,679 (11.0%)	34,360 (14.5%)	51,818 (14.3%)	54,812 (13.8%)	59,744 (13.5%)	67,472 (13.6%)	73,046 (13.5%)
Mid East	1,943 (5.0%)	3,583 (4.1%)	11,085 (4.7%)	20,057 (5.5%)	22,383 (5.6%)	24,487 (5.5%)	28,252 (5.7%)	31,747 (5.9%)
Latin America	2,358 (6.1%)	5,074 (5.8%)	17,907 (7.6%)	25,136 (6.9%)	27,886 (7.0%)	31,435 (7.1%)	35,020 (7.1%)	37,774 (7.0%)
Carib/C. America	1,816 (4.7%)	3,311 (3.8%)	9,978 (4.2%)	13,116 (3.6%)	14,309 (3.6%)	16,155 (3.7%)	18,142 (3.7%)	19,353 (3.6%)
S. America	543 (1.4%)	1,763 (2.0%)	7,929 (3.4%)	12,020 (3.3%)	13,576 (3.4%)	15,280 (3.5%)	16,878 (3.4%)	18,422 (3.4%)
Oceania	1,611 (4.1%)	2,334 (2.6%)	5,025 (2.1%)	7,293 (2.0%)	7,492 (1.9%)	7,931 (1.8%)	8,538 (1.7%)	9,013 (1.7%)
South Asia	249 (0.6%)	1,780 (2.0%)	5,481 (2.3%)	8,600 (2.4%)	9,779 (2.5%)	11,532 (2.6%)	13,612 (2.7%)	15,407 (2.8%)
Africa	1,471 (3.8%)	2,721 (3.1%)	7,390 (3.1%)	12,178 (3.4%)	13,932 (3.5%)	15,721 (3.6%)	17,634 (3.6%)	19,488 (3.6%)
Eastern Europe	374 (1/0%)	628 (0.7%)	1,125 (0.5%)	3,018 (0.9%)	4,309 (1.1%)	5,404 (1.2%)	7,159 (1.4%)	8,452 (1.6%)
World	**38,855**	**88,071**	**236,407**	**362,161**	**397,895**	**441,231**	**496,625**	**540,611**

Source: Drewry, 2008

*** Statistics include empties and transhipment, **2008 statistics were estimated**

Table 1.2 shows that Northeast Asia (Far East) accounts for 37% of global container port handling in 2008. The shift of the centre of container activity to the East in terms of cargo volume is recognized. The share was increased from 19.8% in 1980 to the level of 37%. Compared to the share of Northeast Asia, the proportion of North America had been shrinked from 24.5% in 1980 to 9% in 2008. However, it should be remarked that North America and Western Europe generate the demand that employs a disproportionate amount of container cargo handling in Northeast Asia (Drewry, 2008). In that sense, the role of Northeast Asian container ports can be recognized as export bases to North America and Western Europe.

Recently, a recession all around the world economy has been noticed. Table 1.3 describes the overview of the world economic outlook projections by IMF.

Table 1.3 Overview of the world economic outlook projections

Percentage change	2007	2008	2009 projection	2010 projection
World output	5.2	3.4	**0.5**	3.0
Advanced economies	2.7	1.0	**-2.0**	1.1
US	2.0	1.1	**-1.6**	1.6
Euro Area*	2.6	1.0	**-2.0**	0.2
Newly industrialized Asian economies	5.6	2.1	**-3.9**	3.1
China	13.0	9.0	**6.7**	8.0
India	9.3	7.3	**5.1**	6.5
Brazil	5.7	5.8	**1.8**	3.5
Russia	8.1	6.2	**-0.7**	1.3

Adopted from IMF World Economic Outlook Update: IMF, 2009

*** Advanced economies: US, Euro Area, Japan, UK, Canada, and Other advanced economies (including newly industrialized Asian economies)**

*** Euro area includes Germany, France, Italy, and Spain**

IMF forecasts that the world growth in 2009 is projected to fall to 0.5%, which is its lowest level since World War II (IMF, 2009). Especially, U.S. and Euro area, which provide the major impetus for Northeast Asian container volume, are projected to record minus growth, -1.6% and -2.0% each in 2009. This probably results in the fall of the growth rate of export countries including China, Korea, and Taiwan under the drag of falling export demand and financing, lower commodity prices, and much tighter external financing constraints (Ibid.). China is expected to slow from 9% growth in 2008 to 6.7% in 2009. Newly industrialized Asian economies including Korea are projected to grow around -3.9%.

Growth rate of container cargoes across the world is forecasted as 8.6% in 2009 which was reduced from 8.9% in 2008 (Drewry, 2008). It was expected that there will be a minimal bounce back of 8.7% growth in 2010. However, there is a possibility that container cargo handling will sharply fall according to the global recession.

Considering the points addressed above, it is posited that the competition between ports will be much tougher. Futhermore, relevant SCM strategies of ports may play a key role in the survival of ports. Hence, proper understandings about SCM strategies in Northeast Asian container ports will be an important topic to study.

1.2 Research Objectives and Questions

Considering turbulent environment of container ports which are located in Northeast Asia as discussed in the previous section, some research questions can be asked to tackle this issue for Port Authorities in this area. Especially, Korea's container ports, e.g. Busan and Gwangyang, are competing against major container ports such as Hong Kong, Shanghai and newly emerged ports in Northern China which used Korean ports for feeder services (Yeo, 2006).

On top of this, the key question of the current study can be *"what are the key strategies of PAs' to enhance Port focused Supply Chains' (PSCs') performance and how these PAs' measures affect PSCs' performance[1] in the context of supply chain management (SCM)?"* To clarify what a port service provider supply chain is, this study adopts a PSC concept. A port supply chain including a Port Authority is different from those of container handling and inland transport service providers (See section 2.7.2).

Furthermore, this question can be developed to "how do these key factors affect the performance of PSCs in the context of SCM?" In the stance of a PA, it should be considered what kind of PAs' strategies can effectively affect the PSCs' performance.

These questions were examined by implementation of online questionnaire because it is a very efficient tool in terms of distribution and coding and analysis (See section 5.2.5). The field work was conducted from 12th of March 2007 to 3rd of May 2007. Out of 1208 sample frame acquired from Shipping Directory Korea 2005/6 and Containerization International Yearbook 2006 (See section 5.4.2), 124 effective replies were acquired.

To answer these questions, four major objectives are established as follows:

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1) PSCs includes port operators, inland transport service providers, and depots

1) To define PA's key strategies enhancing PSCs' performance in terms of SCM and related factors;

2) To investigate the relationship among PAs' such strategies, PSCs' performances and related factors;

3) To provide a conceptual model that is applicable to explain and predict actual selection of PSCs in the context of SCM;

4) To measure the performance of Busan port and compare it to that of its major competitors in East Asia in the context of SCM.

To accomplish the four major objectives, the definitions of key concepts will be provided in chapter four (See section 4.1) based on the discussions in chapter two (literature review). The four major variables are Port Authorities' (PAs) Supply Chain Management (SCM) strategies, Port focused Supply Chains' SCM strategies, PSCs' resources, and PSCs' Supply Chain Performance (SCP).

PAs' SCM strategies can be defined as *"PAs' systemic, strategic coordination of the traditional business functions and the tactics across these functions within a Port Authority and across business within the port focused supply chain, for the purpose of improving the long-term performance of the port focused supply chain as a whole (e.g. privatisation, support for hinterland &FTZ, Using IT, Marketing)"*. Definition of PSCs' SCM strategies is *"PSCs' systemic, strategic coordination of the traditional functions to improve the long-term performance of individual stevedoring and inland transport companies and the PSC as a whole (e.g. vertical integration, relationship orientation)"*. 'PSCs' resources' is delineated as *"PSCs' entire set of the organisations' physical or intangible assets, attributes, information, knowledge, process and system (e.g. relational resources, skills, and physical resources)"*. Finally, PSCs' SCP is regarded as *"Performance of a PSC as a whole (e.g. reliability, cost, service effectiveness, and flexibility)"* (See section 4.1).

The relationships between four main variables are hypothesized as three main hypotheses (See section 4.3). Hypothesis one is that PAs' SCM strategies have a positive influence on PSCs' SCM strategies. The second hypothesis can be PSCs' SCM strategies have a positive influence on PSCs' resources. The last main hypothesis is 'PSCs' resources' has a positive influence on PSCs' SCP. Then, twenty six detailed relationships of sub-indicators will be hypothesized in chapter four (See section 4.3). Finally, the relationships between the four basic variables are divided into 20 hypotheses (See section 7.5.1), and then, tested by Partial Least Squares (PLS) technique by SmartPLS version 2.0.

To enhance the relevance of the main data analysis, a case study, an interview with experts, a pilot study, and survey on SCP of 5 selected container ports were implemented (See section 5.2.3)

1.3 Research Scope and Sample

Taking account of their regional importance, the current study focuses on the port users of Korean and Chinese ports in dynamic Northeast Asia.

Table 1.4 illustrates the change of shares of Northeast Asian container ports from 1985 to 2006 by country based statistics.

Table 1.4 Northeast Asian countries' share in world total

		1985	1990	2000	2005	2006
Korea	Container Volume (000TEUs)	1,246	2,348	9,030	15,113	15,711
	Share (%)	2.2%	2.7%	3.9%	3.9%	3.7%
Japan	Container Volume (000TEUs)	5,517	7,956	13.130	17,055	18,274
	Share (%)	9.9%	9.3%	5.7%	4.4%	4.3%
China	Container Volume (000TEUs)	446	1,204	40,984	89,847	108,225
	Share (%)	0.8%	1.4%	17.7%	22.9%	25.2%
Taiwan	Container Volume (000TEUs)	3,075	5,430	10,511	12,791	13,102
	Share (%)	5.5%	6.3%	4.5%	3.3%	3.0%
Northeast Asia	Container Volume (000TEUs)	10,284	16,938	73,655	134,806	155,312
	Share (%)	18.4%	19.8%	31.8%	34.4%	36.1%
World Total	Container Volume (000TEUs)	55,903	85,596	231,689	391,883	429,802
	Share (%)	100%	100%	100%	100%	100%

Adjusted from Containerization International Yearbook, 2003, 2008; MOMAF, 2008

*** Container Volume handled by China after 1997 includes Hong Kong's statistics**

The share of China ports' handled container volume had increased drastically throughout the period from 1985 (0.8%) to 2006 (25.2%). Korea maintains its share around 4%. The share of Japan had been decreased continually from 9.9% in 1985 to 4.3% in 2006. Taiwan's container cargo volume trend shows that it is similar to that of Japan.

This highlights the importance of China and Korea. This can be identified by the cargo statistics about top 12 container ports. Table 1.5 depicts the change of container cargo volume of 12 major container ports in the world.

Table 1.5 Statistics on top 12 container ports in the world from 2006 to 2008

Ranking ('08)	Ranking ('07)	Port	2006		2007		2008	
			Volume (000TEU)	Growth Rate (%)	Volume (000TEU)	Growth Rate (%)	Volume (000TEU)	Growth Rate (%)
1	1	Singapore	24,792	6.9	27,936	12.5	29,918	7.1
2	2	Shanghai	21,710	20.1	26,150	20.5	27,980	7.0
3	3	Hong Kong	23,230	4.1	23,998	1.5	24,248	1.0
4	4	Shenzhen	18,469	14.0	21,099	14.2	21,400	1.5
5	5	Busan	12,039	1.7	13,261	10.2	13,426	1.2
6	7	Dubai	8,923	17.1	10,700	20.0	12,000	12.1
7	11	Ningbo	7,068	36.2	9,360	32.4	11,226	19.0
8	12	Guangzhou	6,600	40.9	9,200	39.4	11,001	18.8
9	6	Rotterdam	9,600	4.3	10,791	11.5	10,830	0.4
10	10	Qingdao	7,702	22.1	9,460	22.8	10,320	9.1
11	9	Hamburg	8,862	9.6	9,890	11.7	-	-
12	8	Kaohsiung	9,775	3.2	10,257	4.9	9,677	-5.7

Source: portcontainer website, 2009; MPA, 2009; PDC, 2009; MLTM, 2009a

Among top 12 container ports, six ports are from China. Busan port from Korea maintains the 5th place with healthy growth rate in 2007 and 2008. It is noticed that Kaohsiung recorded -5.7% of container cargo handling statistics in 2008. No ports from Japan are in the list of top 12 ports.

Figure 1.1 illustrates the changes of Asian container trunk route from 1990. In 1993, Asian major trunk route was relatively simple with Singapore, Hong Kong, Taiwan (Kaohsiung, Keelung), Japan (Kobe, Osaka, Nagoya, Yokohama, and Tokyo), and Busan port.

From mid 1990s, Lam chabang and Port of Tanjung Pelepas (PTP) were newly introduced into the trunk route. Also, many Chinese ports, e.g. Shanghai, Shenzhen, Dalian, Qingdao, and Tianjin, were called by major container shipping lines owing to the drastic increase of export cargoes.

Since mid 2000s, Shanghai port has been played a role as a major calling port in the trunk route connected with Singapore, Hong Kong, Shanghai, and Busan. Also, Port Kelang, PTP of Malaysia, Qingdao and Dalian in North China, Kaohsiung, Tokyo and Yokohama of Japan play roles as multicores (HLI, 2005).

Recently, a strong surge of Chinese ports like Shenzhen, Ningbo, Guangzhou, and Qingdao also has been recognized in Table 1.5.

In Table 1.6, the growth rate of eight ports located in East Asia between Jan. 2008 and Jan. 2009 are presented.

Table 1.6 Major container ports' statistics in Jan. 2008 and Jan. 2009

	Statistics in Jan. 2008 (000TEU)	Statistics in Jan. 2009 (000TEU)	Growth Rate
Singapore	2,455	1,974	-19.6%
Shanghai	2,350	1,950	-17.0%
Hong Kong	2,110	1,622	-23.1%
Busan	1,075	883	-17.9%
Ningbo	869	798	-8.2%
Gwangyang	148	115	-22.3%
Qingdao	836	853	2.0%
Dalian	366	388	6.0%

Source: portcontainer website, 2009; MPA, 2009; PDC, 2009; MLTM, 2009a

Except two ports in North China, i.e. Qingdao, and Dalian, most of ports, i.e. Singapore, Shanghai, Hong Kong, Busan, Ningbo, and Gwangyang, recorded minus growth rate ranging from -8.2% to -23.1% through 2008. It may be interpreted that more severe competition among ports will be unavoidable.

The importance of China and Korea has already been addressed. Port users, i.e. container shipping liner companies' headquarters worldwide, shipping companies' branches, and freight forwarders based in Korea and China will be regarded as the survey population. The population would be around 1,200 in number and will be discussed in detail in chapter five.

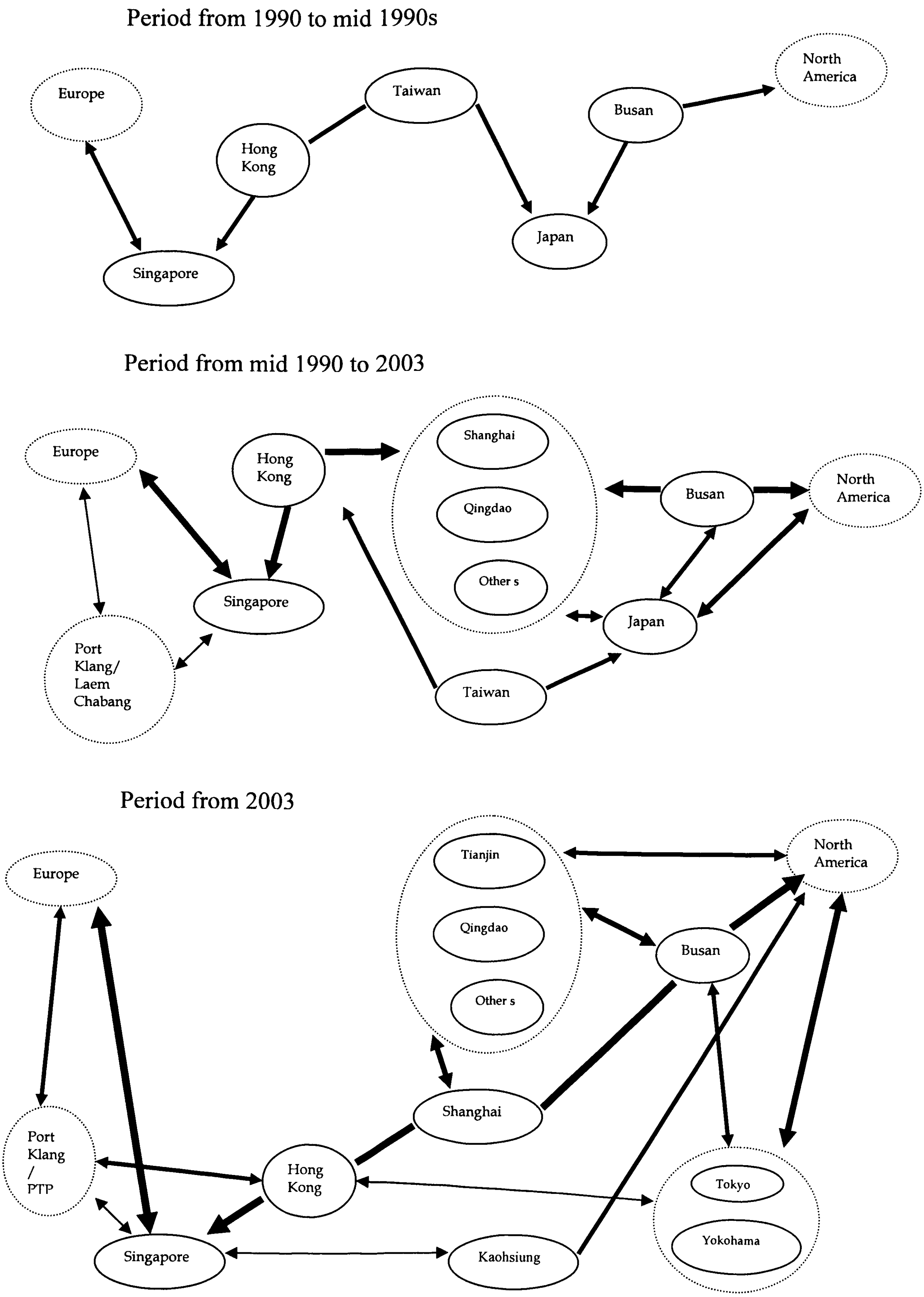

Figure 1.1 Changes of Asian container trunk route (Source: HLI: Hanjin Logistics Institute, 2005)

1.4 Thesis Structure and Framework

To accomplish the research objectives outlined above, the current study is structured into eight chapters as presented in Figure 1.2.

Chapter one introduces the research background, the key questions, the objectives of research. Then, the scope of the study is described. Finally, the structure and framework for the entire study are provided.

Chapter two examines the existing literature on traditional views on firms' (or ports') governance, i.e. Transaction Cost Theory (TCT), Porter's Competitive Strategy Framework. Then, traditional theories on ports, i.e. port selection & performance are covered. New views on ports' competence, Resource Based Theory (RBT), and Supply Chain Management Theory (SCMT) are investigated and provided as a combined theoretical basis for the current research. Finally, based on such framework, all related variables, e.g. PAs' SCM strategies, Port focused Supply Chains' (PSCs: container stevedoring companies and inland transport service provider, and depot operators) SCM strategies, PSCs' resources, and PSCs' Supply Chain Performance (SCP), are defined with regard to the first objective in section 1.2, and the related literature is reviewed.

Based on the defined variables and research model, chapter three mainly investigates characteristics of Busan & Shanghai port including container routes, physical resources, and the PAs' SCM strategies. These examples supply practical implications on this research.

In chapter four, a conceptual model, hypothesized relationships among related variables, and the final model is portrayed. As described earlier, the final variables are chosen among four basic variables as stipulated in chapter two. Regarding the second and third objective addressed in section 1.2, hypothesized relationships between variables are provided in chapter four.

Chapter five deals with research design and methodology. Regarding the research design, basic philosophy, approach, strategies, time horizons, and data collection methods are decided. Regarding basic philosophical position, the present study is situated in postpositivism, which supports mainly use of quantitative methods, e.g. survey and Partial Least Squares approach to SEM (PLS) (See section 5.7.1). However, for a triangulated research, implementing a case study, a pilot study, an interview with experts, and survey on SCP of 5 selected ports is discussed. Then, the conduct of empirical research, e.g. contents of questionnaire and sampling designs is summarized. Next, validity and reliability issues are discussed. Finally, the characteristics of PLS are covered with emphasis on the relevance of this technique to the current research.

Results of descriptive statistics are scrutinized and the implications on the current research are explained in chapter six. Firstly, response rate are summarized. Then, the overall descriptive statistics for respondents is reviewed. Descriptive statistics for ports for the questionnaire answer and the descriptive analysis on responses of main questions_are prepared. Finally, SCP of five major container ports in Eastern Asia, e.g. Busan, Shanghai, Hong Kong, Singapore, and Gwangyang port are compared and analyzed.

Bearing the relationships among variables in mind, actual relationships are investigated using Partial Least Squares (PLS) method in chapter seven (See section 5.7). Firstly, data preparation and screening issues including missing data, outliers, and normality are discussed. Through exploratory factor analysis (EFA), validity matters are also checked. Then, weights of items will be investigated and implications will be found. Finally, hypothesized relationships will be tested by using PLS techniques.

Finally, in chapter eight, conclusions are drawn through the discussions about empirical findings. Major container ports including Busan port in East Asia region are evaluated using performance indicators in the context of SCM. Then, the contribution and limitation of the current research are considered. Next, some suggestions are described for the future research in the similar area.

Figure 1.2 Research structure and framework

Chapter 1: Introduction	Research background, objectives, and structure
Chapter 2: Literature Review	**-Traditional views**: Transaction Cost Theory, Porter's framework, Theories on Port's performance, Port Selection **-New views:** Resource based Theory (RBT), Supply Chain Management Theory (SCMT) - **Theoretical base**: RBT+SCMT - **Defining concepts**: PAs' SCM, PSCs' SCM, PSCs' resources, PSCs' SCP
Chapter 3: Characteristics of Busan & Shanghai port	- Container routes / Physical resources - SCM strategies: Concession Policy, Using IT, Marketing, Support for Hinterland and FTZ of Busan & Shanghai port
Chapter 4: Research Model	PAs' SCM → PSCs' SCM → PSCs' resources → PSCs' SCP
Chapter 5: Resaerch Methodology	- Research Design - Questionnaire & sampling desing - Validity and reliability issue - Data Analysis Technique: Partial Least Squares (PLS)
Chapter 6: Descriptive Statistics	- Response rate, Overall sample demographic profile, overall descriptive statistics for respondents, descriptive statistics of Response, Supply Chain Performance (SCP) of five selevted ports
Chapter7: Statistical Analysis	- Data preparation & Screening - Validity check: Exploratory Factor Analysis (EFA) - Measurement model: Weights of items - Structural model: Hypotheses test
Chapter 8: Discussions and Conclusions	- Result of hypotheses testing - Implications and Limitations - Suggestions for the future studies

Chapter 2

Literature Review

Presenting an overview of the trends of theories about firms' (or ports') governance and competence, this chapter shows the motivation for the thesis, and why it is needed, and its significance in the context of existing theories. The purpose of literature review is to frame the study, distinguish the research from other work and present a clear definition of key terms (Rugg and Petre, 2004). To this end, a comprehensive collection of literature has been reviewed including journals, books, seminal papers, and internet sources.

To accomplish the above aim, this chapter provides an overview of Transaction Cost Theory (TCT), Porter's Competitive Strategy Framework, Port Selection Theory, and theory on Port Performance as traditional theories. Then, this chapter addresses Resource Based Theory (RBT), and Supply Chain Management Theory (SCMT) as new views. A comprehensive view of SCMT and RBT as an alternative to explain ports' performance or competitive advantage is demonstrated. A conceptualised diagram of literature review structure is presented in figure 2.1 for a clear explanation of the chapter.

Figure 2.1 Structure of the literature review (Source: Author)

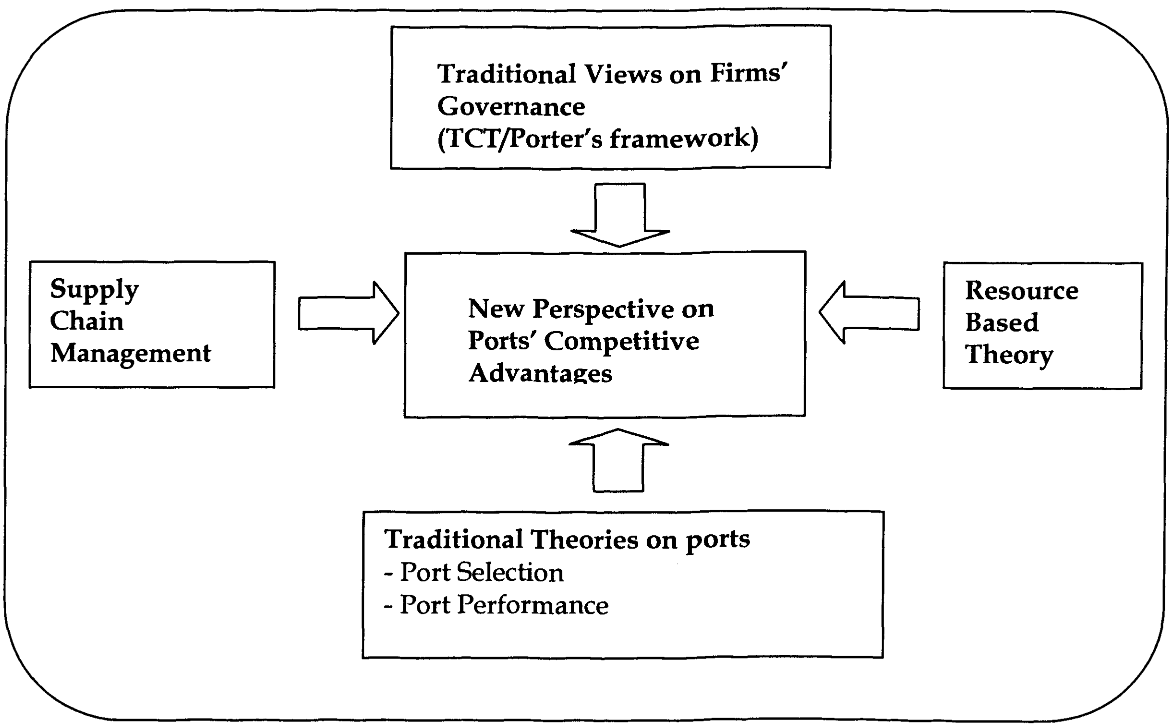

Figure 2.1 illustrates that new perspective on ports' competitive advantage will be provided based on the four major theories, i.e. traditional views on firms' governance and competence, traditional theories on ports, SCMT and RBT. To reach the new perspective on ports competitive advantages, traditional views on firms' governance and competence, i.e. Transactional Cost Theory (TCT) and Porter's Competitive Strategy Framework will be reviewed. Then, port selection and port performance theories also will be covered. RBT and SCMT will be covered to form a new perspective on ports' competitive advantages. Based on this discussion, new perspective on ports' competitive advantage will be provided mainly based on SCMT and RBT. To identify key concepts, similar but detailed framework for the current research will be developed in the figure 2.8 after the discussions on literature review on four major theories (See section 2.7).

Regarding views on firms' governance, there are two main theoretical analyses of a firm, i.e. contractual (Transactional Cost Theory or Analysis) and competence perspectives (Porter's Competitive Strategy Framework, Resource Based Theory) (Foss, 1993: Hodgson, 1998). Concentrating on vertical integration issue, Foss (Ibid.) finds a firm in contractual theory as a reactive entity, not a proactive entity in competence perspectives encompassing learning, innovation, and the pursuit of sustained competitive advantage center stage. His study gives a broad picture on theoretical progress of theories on firms from contractual to competence perspectives. In this section, pros and cons about those two perspectives will be reviewed. Additionally, there is an increasing awareness on a keen interest on Supply Chain Management Theory in the field of logistics and port industry, which will be discussed in detail in section 2.6. Considering the above general trends of theories on firms (or ports), literature review will be implemented in the sequence of general theories, applied theories in the field of logistics (or ports), limitations, and implications to the thesis for each theory in relation to presentation of individual theory in each section. Consequently, the research gaps and the reason the author chooses combined views with RBT and SCMT based on competence perspective are described.

Special interests are devoted to the applied theories to the logistics or ports industry rather than general theories. This will be discovered in section 2.7.

On the basis of literature review on basic theories, the theoretical model of this research using variables including ports' (PAs' and Port focused Supply Chains') SCM strategies, ports' resources, performance (supply chain performance) and ports' competitive advantages will be constructed in chapter four (Research Model and Hypothesis) with the conceptual model and hypotheses. The definition of Port focused Supply Chain (PSC) will be provided in chapter two (See section 2.7.2.1) and chapter four (See section 4.1). Then, the specific observed variables for each main variable will be introduced in chapter five (See section 5.3) in relation to the contents of the questionnaire. Literature search was undertaken through three databases (ABI Inform, ERIC, and Zetoc) and manual search of major journals on port or logistics, e.g. Maritime Policy and Management, Maritime Economics and Logistics, Transportation Research, and Journal of Business Logistics, etc..

From section 2.1 to 2.6, main trends on theories from traditional, e.g. Transaction Cost Theory (TCT), Porter's Competitive Strategy Framework, Port Selection Criteria, to new views, e.g. Resource Based Theory (RBT), and Supply Chain Management Theory (SCMT) will be covered. This will provide a basic rationale for conceptual model which adopts a combined view between RBT and SCMT (See Section 4.2). Then, in section 2.7, literature review on four main variables, e.g. PAs' SCM strategies, PSCs' SCM strategies, PSCs' resources, and PSCs' SCP, including detailed sub-concepts will be implemented to assist in making hypotheses for the research and measures for questionnaire (See section 4.3 and 5.3). As stipulated in chapter four, this research hypothesizes positive relationships between four main variables.

2.1 Transaction Cost Theory (TCT)

2.1.1 General TCT

As introduced by many researchers (Chen *et al.*, 2002; Jung, 2003; Lee, 2005; Sharma and Pillai, 2003), Coase is known as the origin of the Transaction Cost Theory (hereafter TCT). Raising the point about the limitation of the price mechanism as resource allocator, Coase (1937) suggests the alternative of price mechanism such as entrepreneur-co-ordinator.

The 'transaction cost' is interpreted as 'a cost of using the price mechanism' while addressing the issue of "*the main reason why it is profitable to establish a firm would seem to be that there is a cost of using the price mechanism*" (Ibid. 390p). Discovering what the relevant prices is one of the example of the cost when organising production through the price mechanism. According to Coase's view, the core of the TCT can be summarized as the avoidance of using the price mechanism and hiring hierarchy (or Organization) for efficient production or resource allocation. In connection with this, Hobbs (1996: 17p) defines 'transaction costs' as 'the costs of carrying out any exchange, whether between firms in a market place or a transfer of resources between stages in a vertically-integrated firm' and provides three types of transaction cost as information costs, negotiation costs, and monitoring costs.

Reviewing TCT in the context of marketing, Sharma and Pillai (2003) recognized Williamson's works (1975; 1985; 1996) as contributions to the maturation of TCT. Williamson (1975) summarized the factors that supported the hiring hierarchy theory (organizational failures framework) as follows: Bounded rationality, opportunism, uncertainty, small numbers (of bargaining indeterminacies), information impactedness, and atmosphere.

Developing Williamson's factors, Hobbs (1996) presents four key concepts of TCT as 'Bounded rationality', 'Opportunism', 'Asset specificity', and 'Informational asymmetry'. 'Bounded rationality' can be defined as the tendencies that make non-perfect rational decisions owing to the physically limited possible alternatives (Ibid.).

As Hobbs (Ibid.) quotes Williamson's work, 'opportunism' is self-interest seeking with guile (Williamson, 1979). 'Asset specificity' is closely related to the post-contractual opportunistic behaviour when one partner invests on resources have little or no value in an alternative use (Hobbs, 1996). 'Informational asymmetries' can de defined as the lack of balance of information owing to only availability to selected parties. It is also stressed that information asymmetries can lead to opportunistic behaviour (Hobbs, 1996).

Because TCT was initiated as a theory of a firm's existence, there are some issues about the TCT's distinction against competitive advantages related theories. Williamson (1999) discusses the difference of governance (TCT) and competence perspectives in strategy research. It can be assumed that governance perspective and competence theory are represented respectively by TCT and Porter's competitive strategy framework. Based on RBT, Mahoney (2001) maintains that RBT is a theory of firm rents, and TCT is a theory of the existence. According to his view, RBT seeks to delineate the set of market frictions that would lead to firm growth and sustainable rents while TCT seeks to find out why people make organizations rather than using price mechanism. Thus, these two theories are complementary.

Concentrating on manufacturing studies based on TCT, Grover and Malhotra (2003) illustrate that there are studies on the TPL (third party logistics), vertical integration, alliances, and outsourcing in the TCT perspectives.

The author assumes TCT as a supplement of the RBT and SCM theory. TCT's relationships with SCM theory and RBT will be discussed later in this chapter.

2.1.2 TCT on Logistics (including Port and Shipping Industries)

In the field of logistics (or ports), the main discussions of TCT are focused on the reason of Supply Chain Management and vertical integration of organizations. Compared with manufacturing studies, little use has been made of TCT in the field of logistics or ports. As Panayides (2002) points out, some studies on ports are focused on the operational and technical integration of intermodal transport (e.g. Konings, 1996; Semeijin and Vellenga, 1996) rather than the economic integration, and coordination of the intermodal transport system. Maltz (1993) implements an empirical study on using private fleet (or third party logistics) in the US trucking business. Recognizing the importance of human assets among TCT variables (specific assets: human asset, dedicated assets; uncertainty: external, internal uncertainty), shipper is inclined to increase the use of private fleet if the shipper perceives that carrier changes would be costly or require significant carrier retraining. That means logistics managers see using private fleet as a way to reduce transaction cost rather than as a means of providing specialized service. Hobbs (1996) brings TCT to logistics in the context of Supply Chain Management. He maintains that the reduction of the transaction costs is the key of the supply chain management as a tool of vertical co-ordination within a supply chain (Ibid.). Co-operation, teamwork, and the rapid interchange of data among companies are provided as the elements that make possible the reduction of transaction costs.

Compared with RBT, TCT is described as a useful tool for decision of outsourcing. According to Skojett-Larsen's view (1999), using Third party logistics (TPL) can reduce the transaction cost by shrinking the actual number of transport firms used and entering into close and long-term cooperation with a few key operators. However, close cooperation can result in the risk of opportunistic behaviour. Therefore, it could be necessary to incorporate safeguards and credible commitments in TPL agreement. Hence, it is pointed out that the limitation of TCT is relationships based on strong trust and openness (Ibid.).

Even though it is not directly related to the logistics, pertaining to reduction of transaction cost, E-commerce or information technology can be regarded as offering opportunities to extend existing works (Grover and Malhotra, 2003). Golicic *et al.* (2002) suggest that the avoidance of high uncertainty in e-commerce business can be explained by TCT and RBT in the light of relationship management in supply chains.

Grounded in TCT, Panayides (2002) explains the vertical structures and re-organisation among intermodal firms. He concludes that TCT can provide the understanding what is the most efficient system for organizing integration through 3 ways including spot market contract, long-term contract with inland distributors, and vertical integration with distributors by joint venture, and acquisition or forming own logistics organization.

It should be noted that the listed studies might not be a comprehensive profile of all logistics-related works; however, they provide a representation of the application of the theory in logistics area. Thus, it can be understood that there are studies on the TPL (Third Party Logistics), reasons for SCM, impact of e-commerce, and governance structure of intermodal transport.

Table 2.1 Studies on Transaction Cost Theory (TCT) in logistics

Author	Research Focus	Findings	Research Methods and Sample
Maltz (1993)	Private fleet use (against Third-Party Logistics)	In the US trucking market, outsourcing is influenced by transaction cost. On the contrary, Private fleet is used for reducing risk of dependence on third parties.	Questionnaire survey (logistic professionals in 488 organizations in consumer goods, chemical, pharmaceutical, and automotive industries)
Hobbs (1996)	Supply Chain Management	TCT provides an explanation for the existence and structure of firms and for the nature of vertical co-ordination within a supply chain.	Conceptual Research
Skjoett-Larsen (1999)	Comparison between three different theoretical approaches to Supply Chain Management	TCT is useful in outsourcing decision. Network approach and RBT provide better understandings of partnership in a long-term relationship.	Conceptual Research
Golicic *et al.* (2002)	E-commerce and its impact on supply chain relationships	Application of TCT and RBT in explaining interorganizational relationship management in e-commerce is supported because e-commerce's high uncertainty characteristics.	In-depth Interviews (Eight B2B companies -2-4 employees per 22 sites of each company) - Grounded Theory
Panayides (2002)	Governance structure of Intermodal Transport firms	The governance structure in intermodal transport is dependent on transaction costs, production costs, and the strategic considerations.	Secondary Data -Conceptual Research

Source: Tabulated by the author

As Das and Teng (2000) discussed studies on strategic alliances applied TCT, vertical or horizontal integration of shipping liners can be explained by TCT in terms of internalisation and market exchanges.

Regarding the horizontal integration, literatures with regard to horizontal strategic alliances among mega-carriers seem to be based on TCT. Ryoo (1999) summarizes the studies on the main benefits of liner shipping co-operations from 1976 to 1997. However, it is unclear which theories were about TCT, and which were about RBT in the studies considered by Ryoo. Panayides and Cullinane (2002) introduced some general studies based on various approaches including TCT, game theory, strategic behaviour model, social exchange theory, power-dependence theory, and RBT.

Recognizing the instability of strategic alliances in liner shipping, Midoro and Pitto (2000) stressed that high level of trust should be firmly established to achieve stable alliances relationship (reduction in the number of partners, differentiation in their roles and contributions, and co-ordination of sales and marketing activities). Slack *et al.* (2002) also agreed to the above view in terms of volatility of container shipping alliances. When emphasized on the instability of trust, it can be posited that these works can be regarded as TCT based studies.

2.1.3 Limitations & implications

The above discussions support an argument that TCT can be a useful tool to explain TPL (Third Party Logistics), reason for SCM, impact of e-commerce, and governance structure of intermodal transport. However, as discussed later, TCT has been criticised by some authors.

The weaknesses of TCT vis-à-vis RBT (or capabilities views of the firm) are witnessed by many researchers (Langlois, 1992; Hodgson, 1998; Skoett-Larsen, 1999; Madhok, 2002; Mentzer *et al.*, 2004).

Hodgson (1998) criticizes that TCT has limitations in three aspects, i.e. 1) Given, atomistic individuals, 2) Assumption of a uniformity of technology, and 3) A focus on comparative static explanations (neglect of technological innovation and dynamic change). He lays out that the assumption of given and atomistic individual is the key difference against competence-based theories such as Resource Based Theory (RBT). He suggests that a competence-based view can be an alternative to TCT and a hybrid explanation can be useful (Ibid.). Furthermore, as the viability of competence-based theories, learning capacities related to cultural development and cultural transmission within organizations are stressed.

Langlois (1992) emphasises that transaction costs reach zero in the long run and the firm's internal capabilities through learning provides the firm with cost superiority over the market. Skjoett-Larsen (1999) maintains that TCT is not very well suited for an explanation of the SCM concept. Such integrated cooperation, which is a prerequisite in SCM, involves too large risk of opportunistic behaviour.

Trying to build a unified theory in the field of logistics, Mentzer *et al.* (2004) point out that TCT does not provide an appropriate explanation about the growing number of long-term, committed, and strategic partnerships between buyers and sellers. Based on the above discussions, the differences between the two theories are tabulated in below Table 2.2.

Table 2.2 Comparison between TCT and RBT

	Transaction Cost Theory	**Resource-based theory**
Broad theoretical arena	Theory of **the** firm	Theory of **a** firm
Behavioural Assumptions	Bounded Rationality, **Opportunism**	Bounded Rationality, **Trust**
Primary theoretical question	Why do firms exist?	Why do firms differ?
Time dimension	Static	Dynamic
Primary driver	Search for efficient governance structure	Search for competitive advantages
Primary focus of analysis	Transaction attributes (e.g. asset specificity)	Resource attributes (e.g. value, stickiness)
Primary emphasis	(Transaction) Costs	Firm resources, **skills, knowledge,** routines
Viability	Decisions on outsourcing	Corporate **culture, learning, long term partnerships**

Source: Adjusted from Skoett-Larsen, 1999: 46p; Madhok, 2002: 540p; Hodgson, 1998: 189p

As described in Table 2.2, there are some characteristics of TCT, i.e. static time dimension, opportunism behavioural assumptions, and concentration on costs rather than skills and knowledge, are criticized by competence theories.

Dynamic transaction costs are suggested as an alternative against TCT's a static aspect, and defined as 'the cost of persuading, negotiating, coordinating, and teaching outside suppliers' by Langlois (1992: 113p). Furthermore, the representative of the TCT, Williamson (1999) admits that competence theories are more concerned with learning.

In logistics research area, Wagner and Frankel (2000) stress the importance of establishing stable and long-term relationships rather than cost reduction. In port area, Olivier (2005) criticises that Panayides' TCT view is not suitable to explain societal aspects of governance including cultural embeddedness of partnerships which are strong in China. According to his view, vertical disintegration of carriers separating their port operations as stand-alone business units is neglected. Concentrating on Keiretsu network (vertical integration of Japanese car assemblers and car carriers) based on national ties, trust, reciprocity, and formalized corporate networks, Hall and Olivier (2005) criticise TCT cannot appreciate the contingent and historical nature of economic organization.

The above discussions validate an argument that the TCT can be a useful tool to explain the reason why companies adopt a Supply Chain Management strategy. Furthermore, the benefits of introducing e-logistics are strongly supported by TCT. However, the necessity of combining relationship strategy, long-term relationships, dynamic aspects like learning, and cultural & historical relationships lead to other perspectives.

2.2 Porter's Competitive Strategy Framework

2.2.1 General Porter's framework

Porter's framework posits that firms compete within the same industry with homogeneity and mobility of the resources (Barney, 1991; Lee, 2005). Porter (1985) describes four dimensions of competitive scope, i.e. segment, vertical, geographical, and industry scope that can have a powerful effect on competitive advantage. Porter (1980) developed a typology of three generic strategies, i.e. cost leadership, differentiation, and focus, for creating a defensible position and outperforming competitors in a given industry. Lower cost is defined as *"the ability of a firm to design, produce, and market a comparable product more efficiently than its competitors."* A definition of differentiation is expressed as *"the ability to provide unique and superior value to the buyer in terms of product quality, special features, or after sale service"* (Porter, 1990: 37p). Focus is defined as "focusing on a particular buyer group, segment of the product line, or geographic market" (1980: 38p). Through focus strategy, a firm can achieve differentiation or low cost (Ibid.).

Porter asserts (1990) that if a company possesses sustainable competitive advantages, the company can succeed in the long run. Lee (2005: 42p) defines competitive advantage as *"some uniquely held characteristics of the firm either in product or process which cannot be easily imitated by competitors without incurring non competitive investment costs"*.

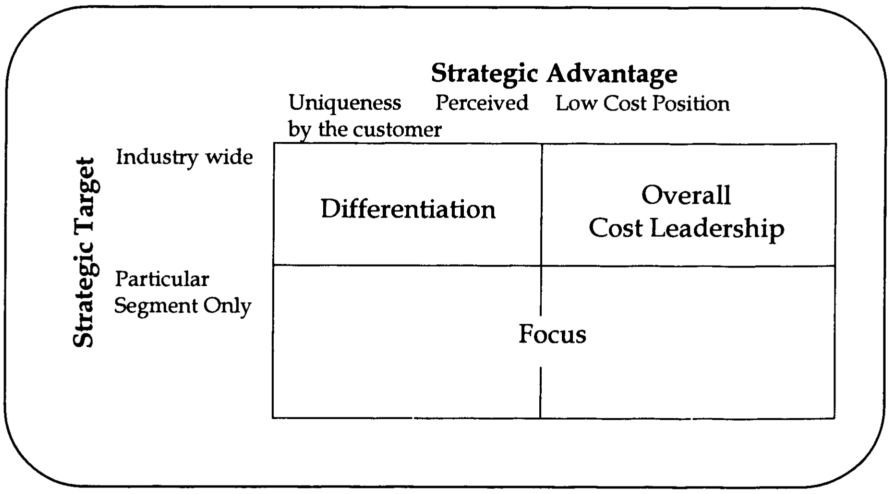

Figure 2.2 Three generic Strategies (Source: Porter, 1980: 39p)

Porter (1985) recognizes 'value chain' as a basic tool for diagnosing competitive advantage and finding ways to create and sustain it. He stresses that many systematically divided discrete activities, not as a whole, can produce competitive advantage (Ibid.). He classifies this value chain activities into two types, i.e. primary activities (inbound logistics, operation, outbound logistics, marketing and sales, and service) and support activities (infrastructure, human resource management, technology development, and procurement).

Adopting the value chain concept, Porter (Ibid.) stresses vertical linkages between suppliers' value chain and a firm's value chain in the context of SCM. These vertical linkages provide opportunities for a firm to enhance its competitive advantage by improving the performance of suppliers' value chain or coordination between a firm's and suppliers' chains. This implies Porter's view also posits that SCM enhances a firm's performance through coordination among members of value chain. Furthermore, he points out that the information systems provide opportunity to create benefits to companies as many SCM studies stress (Ibid.). The contributions of Porter's framework to strategic management are highlighted by Hoskisson *et al.* (1999).

Regarding the internet and competitive advantage, Porter (2002) stressed that internet should be understood as complement of conventional ways of business to produce sustainable competitive advantage. The necessity of integration into the overall value chains was stipulated as well.

2.2.2 Porter's framework on the Port and Shipping Industries

In the field of port and shipping industries, some studies generally introduce Porter's framework (Robinson, 2002; Panayides and Cullinane, 2002).

Brooks (1993) and Cerit (2000) apply Porter's framework to investigate shipping industry. Brooks (1993) explicates ocean container carriers' competitive advantage through Porter's view. He adopts Porter's three generic strategies that employed by container shipping companies as cost leadership, differentiation, and focus strategies. In recognition of the limitation of cost leadership, he stresses the importance of vertical integration and EDI systems for sustaining competitive advantage. In the context of international marketing, Cerit (2000) implements factor analysis and reliability analysis (Cronbach's alpha) to find factors affecting operational and functional variables of maritime transport, service quality determinants, and the level of the importance of each specific variable to the customer of Turkish maritime transport, i.e. Turkish dried fruit exporters.

Recognizing Porter's framework as a critical theoretical basis in understanding how firms create competitive advantages, Robinson (2002) suggests that the port is a third party service provider as one element in the value-driven chain systems (supply chain) of individual firms. Based on the framework of the value-delivery system, Jonsson and Gunnarsson (2005) explore the relationship between internet technology and supply chain performance.

2.2.3 Limitations & implications

The limitation of Porter's framework and necessity of a new perspective, e.g. RBT have been indicated by many studies (Lynch *et al.*, 2000; Hoskisson *et al.*, 1999; Fahy and Hooley, 2002).

Hoskisson *et al.* (1999) introduce some critics about Porter's view, e.g. Rumelt's view (1991) that stresses the importance of heterogeneity within the same industry rather than industry membership in explaining economic performance of a firm. Lynch *et al.* (2000) argue that Porter's framework is incapable of explaining the different levels of performance in the same industry as well as in case of using the same strategy. Recognizing the existence of challenges for a theory of strategy, i.e. difficulties to develop a theory of strategy with limited complexity, chain of causality (Questions continue to arise why some firms attained favourable position etc.), and time horizon, and difficulties of empirical testing with cross section data. Porter (1991) pointed out the necessity of developing a dynamic theory of strategy. Using concepts such as 'activities as source of competitive advantage', and 'drivers' (reasons of creating superior value than others, e.g. learning, vertical integration, government regulation), he stressed the importance environmental determinants, e.g. presence of local rivalry, home demand, presence of home based-suppliers and related industries. He also posited that environment affects both a firm's initial conditions, and its managerial choices. Maintaining that resources are only meaningful in the context of performing certain activities to achieve certain competitive advantages, he concluded that RBT (Resource based theory) could not be an alternative theory of strategy for the purpose of searching dynamic theories. However, he conceded that RBT adds an important dimension to the concepts of activities and drivers.

As claimed in many studies, the necessity to adopt a new perspective is recognized with regard to analyzing firm-level factors which determine the competitive advantage, owing to the limitation of Porter's view (Fahy and Hooley, 2002). To this end, RBT (Resource Based Theory) and SCMT (Supply Chain Management Theory) will be discussed as main theoretical bases of the current study.

2.3 Port Selection Criteria

2.3.1 General Port Selection Criteria

There is a body of research on port selection criteria. Song (2002) provides a summary of studies on port selection criteria, i.e. Foster (1978), Slack (1985), Murphy *et al.* (1992), and Malchow and Kanafani (2001). He suggests important dimensions for hub-port including port location, port infrastructure and superstructure, port service, port charge and cost, carriers' service in port, port connectivity, hinterland accessibility, and distribution centres & info-structure. Other important factors from these studies are cost of transport & port charges, number of sailings, road and rail services, and inland distances etc.

Because of an emerging carriers' dominant role, carriers' perspective has become popular in port selection studies. Chang *et al.* (2002) surveyed 160 major shipping line companies and separated them and grouped into global liners and regional liners. They found the most important factors for regional liners in port selection were cargo volume and global liners' look at the size of the market and the expense item, and other various variables such as intermodal hinterland connection through berth length and availability to cargo safety. Furthermore, they listed eight factors, i.e. cargo expense, land connection, reliability of service, water draft, cargo safety, overtime working, IT, and management/worker relationship.

Lirn *et al.* (2004) provide useful analysis tools on transhipment port selection factors by adopting Analytic Hierarchy Process (AHP). The main criteria are carriers terminal cost (38.12%), port geographical location (35.12%), port physical and technical infrastructure (16.38%), and port management & administration (10.38%). Song and Yeo (2004) apply similar criteria into Chinese container terminals to assess their competitiveness. Recently, Guy and Urli (2006) utilize the criteria from Lirn *et al.* (2004) and Song and Yeo's (2004) research for comparisons between Montreal and New York port.

2.3.2 Limitations & implications

In the recent studies, it is recognized that port choice is about choosing one within a supply chain. In the context of SCM, Herfort (2002) maintains that two key factors related to the integration of a port into an automotive supply-chain in Europe are geo-strategical position of the port and economy & overall costs. It is stipulated that port location, infrastructure, and service are crucial in decision making process of port choice. Based on Robinson's value-driven chain system, Magala and Sammons (2008) argue that port users, e.g. shippers, choose a package of logistics services rather than a port *per se*. Thus, under the new circumstances, it is stressed that new criteria should reflect the competition of ports in supply chain.

To overcome the limitation of traditional port selection theory, a new perspective on performance indicators that reflect the SCM context, i.e. Supply Chain Performance (SCP) will be discussed later in this chapter.

2.4 Port Performance

2.4.1 Studies on traditional port performance indicators

As Talley (1994) introduces, one of the traditional port performance indicators is comparing actual throughput with its optimum throughput for a specified time period, which is decided by physical maximum throughput that can be handled by a port. Recent studies still use port traffic as an important port performance (Pettit and Beresford, 2008). Because port logistics costs are incurred by shipping lines and inland carriers, performance indicators related to economic optimum throughput rather than physical one, i.e. efficiency or effectiveness have been used popularly like the study by Mentzer and Konrad (1991). Effectiveness is concerned with 'how well a port provides service to users'. Efficiency is about 'how well a port utilizes its available resources' (Talley, 1994: 342p).

As Wang and Cullinane (2006) recognize, Data Envelopment Analysis (DEA) and Stochastic Frontier Analysis (SFA) are widely employed to measure port efficiency. DEA is defined as a nonparametric method of measuring the efficiency of a decision-making unit (DMU) with multiple inputs and/or multiple outputs (Ibid.). Considerable research using DEA has been undertaken (Roll and Hayuth, 1993; Bonilla *et al.*, 2002; Barros and Athanassiou, 2004; Park and De, 2004; Wang and Cullinane, 2006; Lin and Tseng, 2007; Garcia-Alonso & Martin-Bofarull, 2007).

SFA is also adopted by many studies for measuring port's efficiency (Coto-Millán *et al.*, 2000; Notteboom *et al.*, 2000; Cullinane *et al.*, 2002; Cullinane and Song, 2003; Trujillo and Tovar, 2007). SFA has advantages of managing random shocks and/or measurement errors. Moreover, traditional hypothesis tests can be utilized and easier to handle environmental variables (Trujillo and Tovar, 2007).

In other perspective, Tsamboulas (2001) briefly introduces traditional logistics measurement systems aiming to capture five types of performance including asset management, cost, customer service, productivity, and logistics quality.

2.4.2 Limitations & implications

Traditional performance indicators, e.g. efficiency, are inappropriate for measuring performance in terms of SCM properly as discussed earlier. The importance of measuring performance of container terminals in the context of global supply chain management is recognized by recent studies.

Acknowledging the importance of port supply chain, Lee *et al.* (2003) suggested a measure for performance of entire supply chain as container handling time, number of vessels to be serviced, port time, and berth utilization. However, this measure focuses on effectiveness rather than supply chain performance as a whole. Based on SCM perspective, Tsamboulas (2001) introduces 'intermodal performance' and 'measures' that of European terminals.

Panayides (2006b) stresses the importance of agility which contains being proactive along supply chains, integration organisational and intermodal integration, and partnership.

These discussions suggest that SCM context should be pondered for the development of port performance. To this end, Supply Chain Performance (SCP) will be considered as a major performance indicator for ports (or ports in supply chain). Regarding SCP, further details will be discussed later in this chapter (see section 2.7.4).

2.5 Resource Based Theory (RBT)

2.5.1 General Resource Based Theory

Originated from Penrose's work (1959) which argued the firm as a collection of productive resources (Hoskisson, 1999), RBT was rehighlighted by Wernerfelt (1984) in 1980s. Concentrating on the strategic management studies, Hoskisson *et al.* (1999) revealed that RBT was one of dominant theories about a firm's performance.

The distinctive difference between General Porter's Competitive Strategy Framework and RBT is that, as Hoskisson *et al.* (Ibid.) neatly observed, RBT emphasizes on a firm's internal strengths and weaknesses rather than external opportunities and threats. Stressing the importance of the exploitation of a firm's core competences to create radical new products, however, their work failed to provide academic interest somehow. Prahalad and Hamel's (1990) paper is regarded as one of the important works at the very early stage for RBT (Newbert, 2007)

Barney is recognized as a provider of the first formalization of the comprehensive theoretical framework to identify the needed characteristics of firm resources to achieve sustainable competitive advantages (Hoskinsson *et al.*, 1999; Peng, 2001; Newbert, 2007). Firm resources were defined as *"something including all assets, capabilities, organizational processes, firm attributes, information, knowledge, etc. controlled by a firm that enables the firm to conceive of and implements strategies that improve its efficiency and effectiveness"* (Barney, 1991: 101p). He distinguished competitive advantages from sustained competitive advantages (Ibid.).

As Newbert (2007) has elucidated Barney's point, valuable and rare resource/capability may achieve competitive advantage in the short term, inimitable and non-substitutable resources enable a firm to accomplish sustained competitive advantages (See figure 2.3).

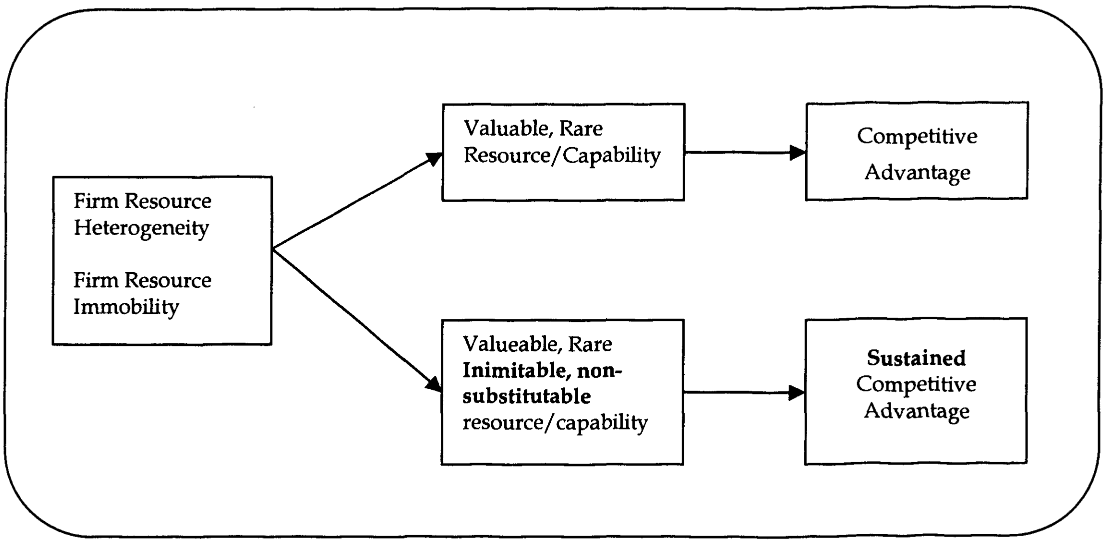

Figure 2.3 Barney's conceptual model (Source: Adopted from Barney, 1991: 112p; Newbert, 2007: 123p)

Grant (1991) suggested the five-stage procedure for strategy formulation: analysing a firm's resource-base; appraising the firm's capabilities; analysing the profit-earning potential of the firm's resources and capabilities; selecting a strategy; and extending and upgrading the firm's pool of resources and capabilities.

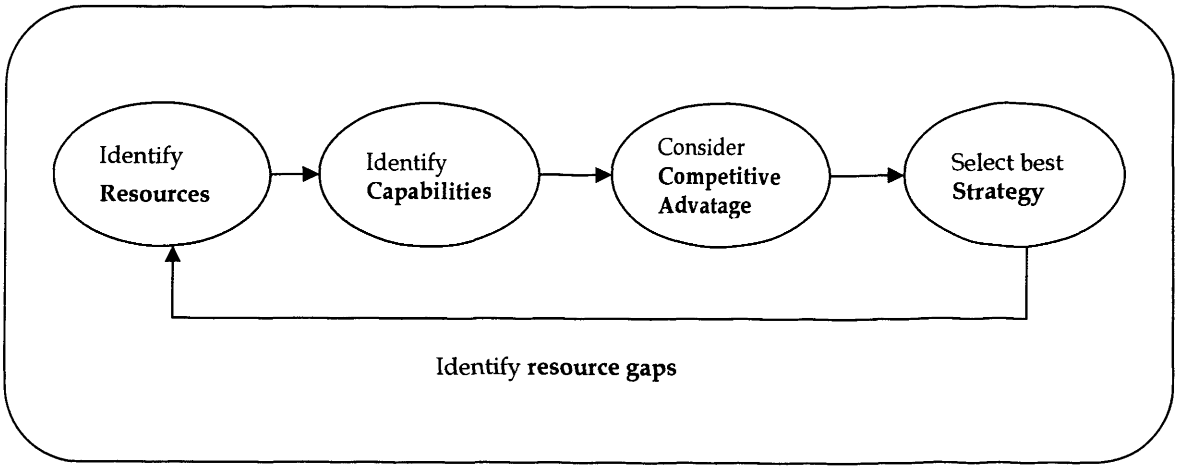

Figure 2.4 A Resource-based Approach to strategy analysis (Source: Adopted from Grant, 1991: 115p)

One of his contributions to RBT was to distinguish resources from capabilities. He defined a capability as 'the capacity for a team of resources to perform some task or activity'. While resources are the source of a firm's capabilities, capabilities are the main source of its competitive advantage (Grant, 1991).

The present research, mainly based on Barney's view, combines Grant's and Barney's view. According to this integrated perspective, a conceptual sequence can be developed for the present research.

Recently, to overcome the static nature of Barney's view, resource exploitation (Mahoney and Pandain, 1992) and dynamic capabilities (Teece *et al.*, 1997; Eisenhardt and Martin, 2000) were discussed (Cited in Newbert, 2007). Eisenhardt and Martin (2000: 1105p) reclarified 'dynamic capabilities' as from 'routines to learn routines' to 'a set of specific and identifiable processes such as product development, strategic decision making, and alliancing'. Dynamic capabilities have been stressed because of the importance of adapting in environments of rapid technological change (Teece *et al.*, 1997).

Eisenhardt and Martin (2000) also stressed the crucial role of market dynamism on the pattern of effective dynamic capabilities. In the stable and predictable industry structures (e.g. paint industry or pharmaceutical companies) to which traditional sustained competitive advantage concept can be applied, effective dynamic capabilities depend on existing knowledge.

On the contrary, in the very dynamic or so called high-velocity industry in which market boundaries are unclear and successful model is vague, dynamic capabilities rely heavily on rapidly creating situation-specific new knowledge rather than existing knowledge (Ibid.). The evolution of dynamic capabilities takes places through the path shaped by learning mechanisms (Ibid.). It is emphasised that Barney's assumption of persistent heterogeneity is wrong because effective commonalities have commonalities (or best proactive) across the firm (Ibid.). Furthermore, it is argued that long-term competitive advantage lies in the resource configurations that managers build using dynamic capabilities, not in the capabilities themselves (Ibid.).

Later on, as Hoskisson *et al.* (1999) pointed out, research on RBT has been more specialized in many areas, e.g. comparison with five approaches (Conner, 1991), combining with institutional view (Oliver, 1997), applying in marketing

(Srivastava *et al.*, 2001), logistics (Mentzer *et al.*, 2004), and International Business (Peng, 2001) so on.

Especially, shipping and port industries are typical multinational businesses and these industries can be supported and explained well by RBT. Peng (2001) designated that RBT contributed to multinational corporations (MNCs) and market entries, especially in three new areas (strategic alliances, international entrepreneurship, and emerging market strategies). His research highlighted the nature of resource overcoming the liability of foreignness, elucidating the resources that provide the foundation for product and international diversification (Cited in Barney *et al.*, 2001).

Adopting the RBT, Mentzer *et al.* (2004) clarified the importance of the strategic role of logistics in the firm performance. They argued that logistics capabilities were a source of competitive advantage (Ibid.; Olavarrieta and Ellinger, 1997).

In the meantime, the port supply chain is different in some ways against manufacturing supply chain (Lee *et al.*, 2003). It is suggested that differences should be recognized when the RBT is applied in shipping and port industries compared with manufacturing industry. Therefore, the discussion in RBT in port and shipping industries will be discussed in next section in detail (see section 2.5.2).

2.5.2 RBT in port and shipping industries

As Panayides and Cullinane (2002) maintain, empirical research based on RBT using 'competitive advantage' concept in liner shipping industry (or port) has been quite limited. It has been recognized that there are few conceptual studies e.g. Brooks (1993) and Cerit (2000), using Porter's view and RBT together in port and shipping research area.

However, recently, there is an increasing awareness about port and shipping related literature using RBT. Heaver (2001) proposes a framework for the strategies of liner shipping companies based on RBT. Concentrating on the economics of vertical control in liner shipping and logistics, he seems to adopt similar logic with Grant (1991) in the sequence of strategies-resources-capabilities (or logistical service quality)-competitive advantage.

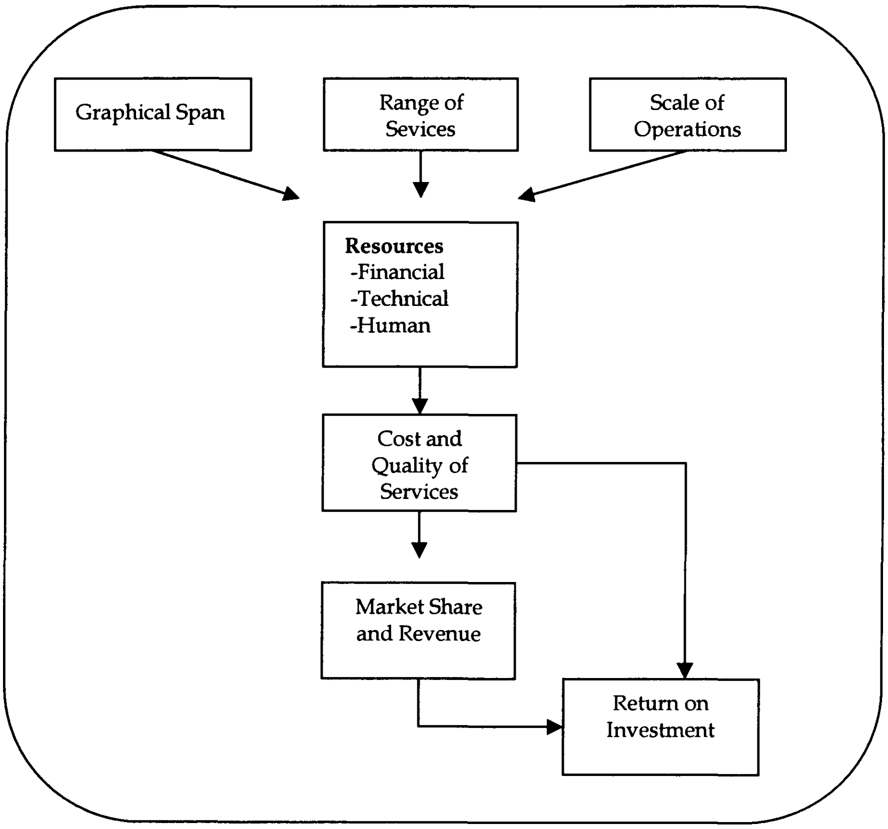

Figure 2.5 A framework for the strategies of liner shipping companies (Source: Heaver 2001: 212p)

As Olivier (2005) acknowledged the contribution, Panayides and Cullinane (2002) suggest Porter's framework, RBT and Supply Chain Management Theory as relevant theoretical basis for the empirical studies on competitive advantage of shipping companies. Olivier (2005) asserts that RBT is more suitable for explaining private entry in global container terminal network rather than transaction cost theory. Furthermore, he maintains that RBT has strength in explicating cooperative agreements, e.g. alliances, vertical and horizontal integration strategies which are directly related to SCM strategies (Ibid.).

Combining RBT and SCMT, Robinson (2006) lays out the principle that critical assets of landside chain that are indispensable, unique, and scarce will provide the basis for chain power by investigating the integration of the landside chains of Melbourne port. Such framework including RBT and SCMT can be useful to understand the current research.

As discussed earlier (see section 2.5), RBT has distinctions whereby making many advantages over other theoretical bases possible.

2.5.3 Implications for the current research

Considerable research recognizes the strength of RBT over TCT explaining SCM (Skjoett-Larsen, 1999; Mentzer *et al.*, 2004; Lee, 2005).

Skjoett-Larsen (1999) maintains that the strength of RBT would be better description of the interorganizational partnership development in the long term. Mentzer *et al.* (2004) propose a framework that includes resource management, logistics capabilities, management of shareholder's goals, competitive advantage, customer satisfaction, long-term profitability, and survival of a firm. Lee (2005) stresses that RBT is an effective tool to explain logistics and supply chain management issues and analyses the relationships between firms' integrated supply chain management and their sustainable competitive advantage.

Thus, RBT and SCMT can be recognized as a useful theoretical tool as combined one to explain a port's competitive advantage.

2.6 Supply Chain Management Theory (SCMT)

2.6.1 General SCMT

SCM seems to have ambiguity in terms of its theoretical origin, despite of its popularity (Mentzer *et al.*, 2001). The examples of Supply Chain Management (SCM) include procurement, production, marketing, sales, and distribution (Houlihan, 1987 Cited in Svensson, 2002). Also, the management of multiple relationships across the supply chain is often regarded as SCM (Lambert *et al.*, 1998). Svensson (2002) stresses the relationship between marketing and SCM based on Alderson's functionalist theory of marketing.

Cooper *et al.* (1997) aver that SCM encompasses logistics. Lambert *et al.* (1998) maintain that logistics management is a part of SCM as claimed by 'the council of logistics management' in 1986. Larson and Halldorsson (2004) provided four perspectives on logistics versus SCM, i.e. relabeling (Logistics are same with SCM), traditionalist (Logistics include SCM), unionist (SCM includes Logistics), and intersectionist (Logistics and SCM share some parts). Through survey on 208 logistics educators, they concluded that there are actual four groups of opinions on the logistics vs. SCM issue.

According to Mentzer *et al.* (2001), there are two categories of perspective on SCM. One is SCM as a management philosophy and the other is a set of management processes.

Mentzer *et al.* (Ibid. 7p) summarize the characteristics of SCM as a management philosophy as "*1) A systems approach to viewing the supply chain as a whole, and to managing the total flow of goods inventory from the supplier to the ultimate customer; 2) A strategic orientation toward cooperative efforts to synchronize and converge intrafirm and interfirm operational and strategic capabilities into a unified whole; 3) A customer focus to create unique and individualized sources of customer value, leading to customer satisfaction*". Mentzer *et al.* (Ibid.) provide various activities necessary to successfully implement a SCM philosophy including integrated behaviour, mutually sharing information, mutually sharing risks and rewards, cooperation, the same goal and the same focus on serving customers, integration of processes, and partners to build and maintain long-term relationships.

Considerable studies assuming SCM as a process (Cooper *et al.*, 1997; Ellam and Cooper, 1990; La Londe, 1997) are reported by Mentzer *et al.* (2001). This view understands SCM as "*the process of managing relationships, information, and materials flow across enterprise borders to deliver enhanced customer service and economic value through synchronized management of the flow of physical goods and associated information from sourcing to consumption*" (Mentzer *et al.*, 2001: 10p).

Mentzer *et al.* (Ibid. 11p) also elucidate the concept of supply chain orientation (SCO) apart from SCM. They defined 'supply chain orientation' as "*the recognition by an organization of the systemic, strategic implications of the tactical activities involved in managing the various flows in a supply chain.*" It is clearly maintained that the possession of SCO does not mean the implementation of SCM. In considering all aspects of SCM, they (Ibid. 18p) specify the concept SCM as "*the systemic, strategic coordination of the traditional business functions and the tactics across these business functions within a particular company and across business within the supply chain, for the purposes of improving the long-term performance of the individual companies and the supply chain as a whole.*"

It is also suggested that the consequences of SCM would be improving profitability, competitive advantage, and customer value/satisfaction of a supply chain as well as its participants in the following model of SCM (Ibid; Lai *et al.*, 2002).

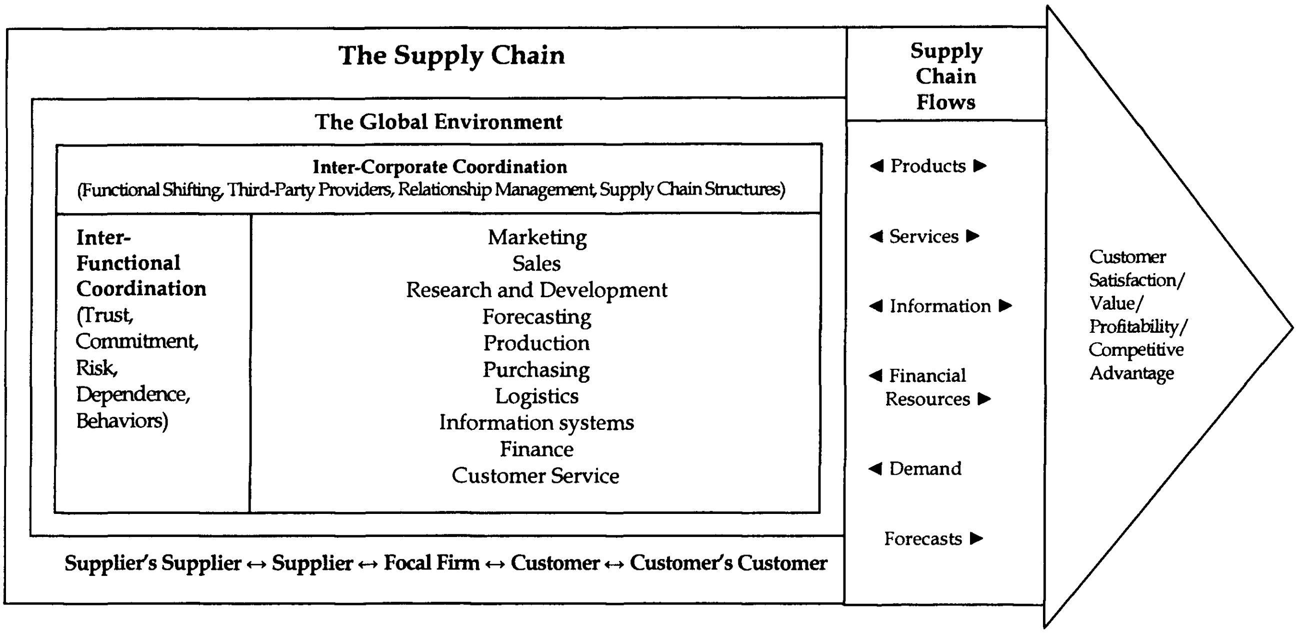

Figure 2.6 A model of Supply Chain Management (Source: Mentzer *et al.*, 2001: 19p)

2.6.2 SCMT in port and shipping industries

A huge amount of SCMT literature can be found in logistics based on manufacturing industry. However, concentrating on the SCMT in port and shipping industries, SCMT in logistics will be covered in the current research.

Sachan and Datta (2005) analyse 442 papers published from 1999 to 2003 in three journals, i.e. Journal of Business Logistics, International Journal of Physical Distribution & Logistics Management, and Supply Chain Management. Quantitative research methods prevail with 50 percent of the papers mainly using descriptive analysis as data analysis technique. SEM studies occupy share of 8.59%. The percentages of qualitative research method, e.g. case studies have been increased during 5 years. They recognized the research gap with regard to inter-organizational level studies. In regional context, studies on North America and Europe are dominating with 82.7%.

In terms of maritime related SCM, Kuipers (2005) points out the SCM-maritime transport paradox which means there is difference between manufacturing SCM and maritime transport SCM.

Table 2.3 the SCM-maritime transport paradox

SCM-characteristics	Characteristics maritime transport
High differentiation for logistics services	Limited possibilities for service differentiation
High flexibility related to unique customer demands	Container operations are a mass market with very little possibilities for unique customer demand
High speed	Slow speed
Increased knowledge intensity and need for developing industrial relations and high levels of trust	Container operations hardly integrated in specific industrial processes or supply chains

Source: Kuipers, 2005: 220p

Despite the SCM-maritime transport paradox, Kuipers (2005: 227-8p) claims that it is clear there is a demand for *"high differentiated logistics services; increasing levels of flexibility related to unique customer demand; high speed services; and an increased knowledge intensity and the need for developing industrial relations and high levels of trust in the industrial network as a whole"*.

Bearing the difference between SCM of manufacturing industry and logistics in mind, SCMT studies in port and shipping industries are reviewed from now on.

López and Poole (1998) introduce the term 'port logistics chain' to address a quality assurance system, e.g. ISO standard as a means of signalling quality to the customers in the case of Valencia port. Frankel (1999) asserts that total trans-ocean supply chains include not only land and sea transport but also inter- and intra-modal transfer links as well as storage or buffer and inspection links. Each of these imposes not only time and cost on the transport chain but also introduce uncertainty and risk. He stresses that uncertainty and risks, e.g. reduction of inventories, time and schedule risk are the most expensive and least controllable elements in a trans-ocean supply chain, and effective supply chain management must now devote much of its efforts to control and reduce such risks.

Elucidating the limits of ports as 'places', 'operating systems', and 'administrative units', Robinson (2002) claims that ports must be seen as elements in value-driven chain systems or in value chain constellations. Furthermore, he recognizes a port as a third party service provider which is intervening in import and export supply chain. Also, it is stressed that competitions actually take place in the form of competition among port supply chains.

Lee *et al.* (2003) implement a simulation study using 'port supply chain' concept including supplier, ship, port, and distributor. The following figure 2.7 illustrates this concept. Lee *et al.* (2003) also highlight the difference between manufacturing and port supply chains as stipulated in Table 2.4.

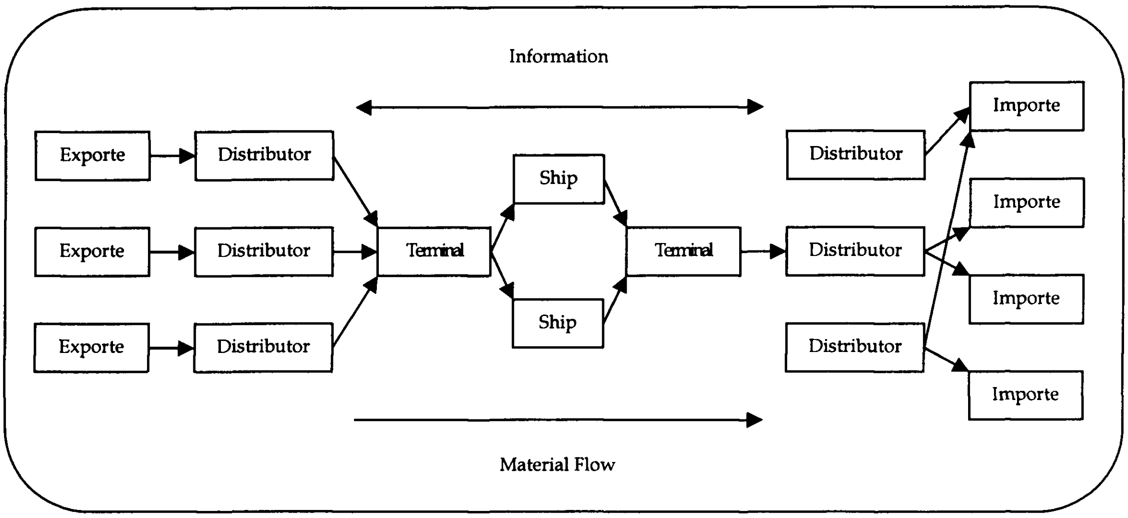

Figure 2.7 Schematic diagram of a port supply chain (Source: Lee *et al.*, 2001: 245p)

Table 2.4 Comparison between manufacturing and port supply chains

	Manufacturing supply chain	Port supply chain
Objective in business entity	Same objective (low conflict) -Supplier: inventory -Manufacturer: inventory -Distributor: inventory	Different objective -Shipper: port dwell time -Ship: turnaround time -Port: resource management
Value-added business process	Manufacturing and assembly	Logistics (include load/unload)
Objective in business process	Lower inventory cost	Lower port time
Initiative in business process	Manufacturer	Ship and port
Business entity	Supplier, manufacturer, assembler, distributor	Supplier, ship, port, distributor

Source: Lee *et al.*, 2003: 245p

Carbone and Martino (2003) investigate the Renault's supply chain in port of Le Havre. Using four variables (relationships, supplied services, information and communication technologies, and performance measurement), they conclude that the higher the level of integration among the actors of a supply chain, the higher the performance for the entire chain.

Through interviews and questionnaires with experts in 73 ports, Bichou and Gray (2004) suggest a profit-based aggregate performance indicator (Key Performance Indicator: KPI model). Recognizing the importance of understanding supply chain above the level of individual firm, they (Ibid.)

maintain that ports have an important role to play in the integration of three types of channel, i.e. logistics, trade, and supply channels.

Using a Confirmatory Factor Analysis (CFA), Panayides and Song (2007) investigate the relevance of four parameters, i.e. relationship with users, value added services, inter-connecting inter-modal infrastructure, and channel integration practices, for measuring container terminal supply chain orientation. It is noticed that there is a problem with regard to using formative measures with SEM technique. This issue will be discussed later in chapter 5 (See section 5.5.2).

Adopting multiple regression with data from the questionnaire survey for managers of 300 ports and container terminals worldwide, Song and Panayides (2008) empirically prove the positive relationship between value added services and cost/ability of customisation by the ports, positive influence of use of technology on quality of the ports' service, and positive influence of relationship with the shipping line on the ports' reliability and responsiveness.

2.7 RBT & SCMT approach: Identifying key concepts

As discussed previously, the current research adopts the combination of RBT and SCMT as its theoretical basis. Figure 2.8 illustrates the scheme of this research.

Considering that the salient purposes of the literature review are to: 1) frame the problem under scrutiny; 2) identify relevant concepts, methods/techniques and fact; and 3) position the study (identifying research gap) (Ghauri and Grønhaug, 2002), it is needed to focus on the key concepts of this study which will be used in the hypotheses and model. Concepts can be defined as the blocks to build theory and elucidate the research and its points (Bryman and Bell, 2003). Concepts may provide an explanation of a certain aspect of the social world, or they may stand for things researchers want to explain. A concept in quantitative research is to be measured (Ibid.).

Thus, the main concepts will be clearly defined in the following section, thereby validating the overall theoretical model.

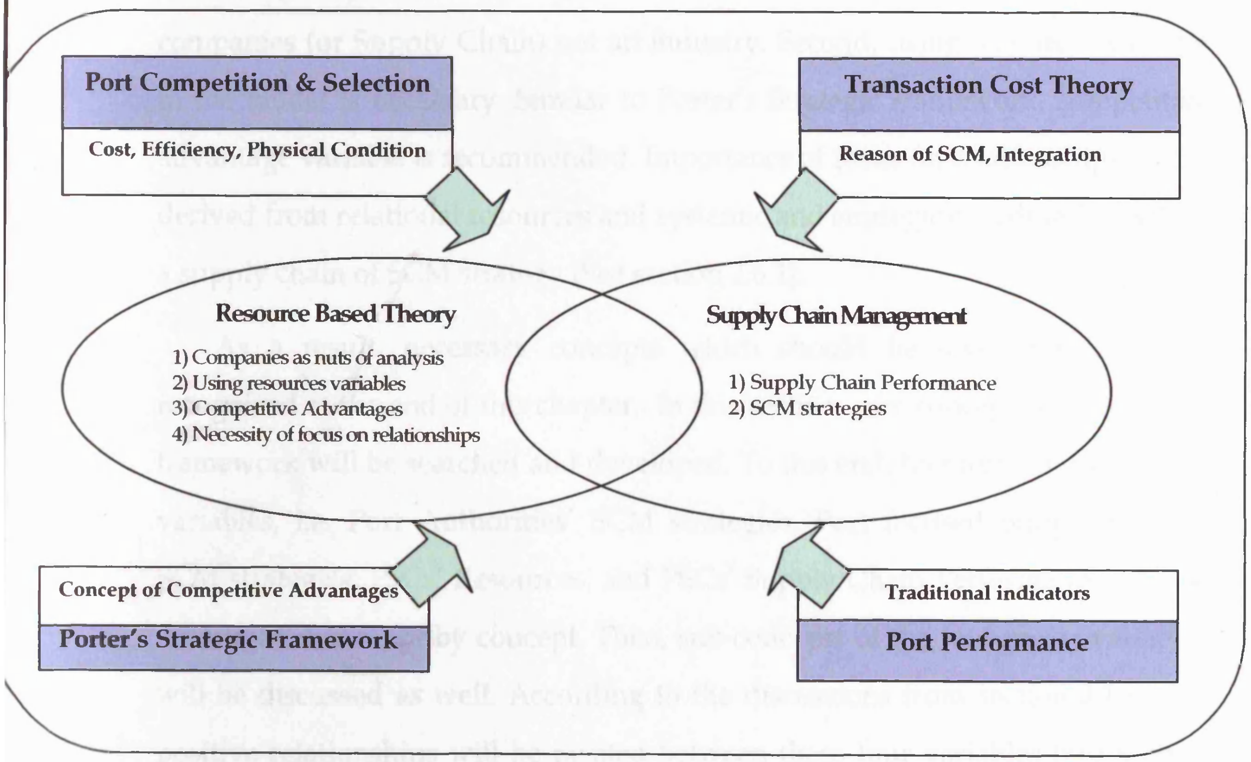

Figure 2.8 Framework for the current research (Source: Author)

Figure 2.8 provided a framework for the current research which was based on discussion from section 2.1 to 2.6. Based on the framework presented in figure 2.1, some implications to this research are added reflecting literature review on TCT, Porter's strategic framework, traditional theories on Port selection criteria and performance, RBT, and SCMT.

Considering implications of TCT, benefits of SCM and firm's integration strategies are recognized (See section 2.1.3). This encouraged adopting SCMT as a main basic theoretical base. Furthermore, integration strategies as a tool of SCM strategies can be considered as a variable in the research model. Literature review on traditional port performance indicators and port selection criteria shows that new port performance indicators are needed in the light of supply chain performance as a whole (See section 2.3 and 2.4). In this regard, SCMT can be understood as one of the major theoretical background providing new performance indicators, i.e. Supply Chain Performance which can comply with the supply chain concept. The concept of competitive advantage will be searched based on the suggestions of Porter's strategic theory and RBT. RBT suggests four interesting implications for this research. First of all, units of analysis are companies (or Supply Chain) not an industry. Second, using resources variable in the model is necessary. Similar to Porter's Strategic framework, competitive advantage variable is recommended. Importance of focus on relationships can be derived from relational resources and systemic and strategic coordination within a supply chain of SCM strategy (See section 2.6.1).

As a result, necessary concepts which should be investigated can be recognized at the end of this chapter. In this section, core concepts related to the framework will be searched and developed. To this end, literature on four major variables, i.e. Port Authorities' SCM strategies, Port focused Supply Chains' SCM strategies, PSCs' Resources, and PSCs' Supply Chain Performance, will be investigated concept by concept. Then, sub-concepts of the four major variables will be discussed as well. According to the discussions from section 2.1 to 2.6, positive relationships will be posited between these four variables (See section 4.3).

2.7.1 PAs' Supply Chain Management (SCM) strategies

According to the discussions in the section 2.6.1, the SCM (Supply Chain Management) strategy is related to improving the long-term performance of both individual parties in supply chain and supply chain as a whole (Mentzer *et al*, 2001). Based on the above definition of SCM, PAs' various strategies can be reviewed in the context of SCM. As Mentzer *et al.* (2001) stress, the purpose of SCM is improving the long-term performance of the individual companies and the supply chain as a whole through systematic and strategic coordination. Therefore, some port policies aiming to enhance the performance of stevedoring and inland transport companies in port (or hinterland) can be recognized as SCM related strategies.

Bichou and Gray (2004) imply that SCM approach to ports may be useful in highlighting the strategic role and future potential of ports within the framework of international business in general. Furthermore, Juhel (2001) stressed the importance of the role of PAs in fostering the development of an effective cooperation between interested public and private players.

2.7.1.1 Definition of 'Port Authority' (PA)

Regarding the term, 'port authority', it is recognized that there are ambiguous uses of similar terms, e.g. port authority (Martin and Thomas, 2001; Notteboom and Winkelmans, 2001a; Van Der Lugt and De Langen, 2007), port administration (Cullinane and Song, 2001), and public sector (Notteboom and Winkelmans, 2001b).

Notteboom and Winkelmans (2001a) briefly introduce two types of port exploitation, i.e. the 'landlord port' and 'service port'[1]. In the case of the landlord port, PAs provide the necessary port infrastructure, i.e. quays, locks, docks and yards. Financial support from national government is the common

[1] Juhel (2001: 147p) introduced three types of port operating structures, i.e. service port, tool port, landlord port. In case of the tool port, the port authority owns the infrastructure, the superstructure and heavy equipment. Nevertheless, the landlord port authority owns the basic infrastructure only.

case. The PAs in case of service port have wider responsibilities including the maintenance of maritime access routes and operation of terminals.

Based on the landlord port concept, Van der Lugt and De Langen (2007: 2p) define a PA as *"a land manager with responsibility for a safe, sustainable, and competitive of the port."* Martin and Thomas (2001) provided the traditional 'port authority's role as the provision of the basic port infrastructure and ensuring services with fair and equitable prices. Furthermore, Baird's port function matrix provides three essential functions, i.e. regulatory, landowner, and operator (Cited in Cullinane and Song, 2001). On the basis of the above discussions, a PA is defined as public or private organizations in charge of regulatory, leasing lands or operating services including the provision of basic port infrastructure, safety, navigation, ensuring competitiveness, fair and equitable prices, or container handling services.

In Asia's major container ports, e.g. Singapore, Busan, and Shanghai, the actual structure of PAs are complex and changed bit by bit. In case of Singapore port, in the first place, Singapore central government (Maritime and Port Authority: MPA) owned actual container terminals and facilities. Then, corporatized (100% owned by government) PSA Corporation Ltd is a private terminal operator. In this case, MPA and PSA are PAs. Established in 2004, Busan Port Authority owns the majority of terminals and facilities (Korea Maritime Institute: KMI, 2004). Before 2004, MOMAF (Ministry of Maritime Affairs and Fisheries) owned container terminals and KCTA (Korea Container Terminal Authority) was the lesser of the facilities. Therefore, MOMAF and BPA are regarded as the port authority of Busan port[2]. All Chinese ports are owned by the central government. In case of Shanghai port, it is regulated by the Shanghai Harbour Bureau in terms of basic port services of safety and navigation. The Shanghai Container Terminals Ltd. which is a joint venture of Shanghai Port Container Co. (SPC) with Hutchison Whampoa Ltd. is in charge of terminal operation (SCT, 2008). The government of the Hong Kong Special

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2) MOMAF was emerged into Ministry of Land, Transport, and Maritime Affairs (MLTM) in March 2008, owing to the reorganization of the Korean government.

Administrative Region (HKSAR) is the lesser of land sites to the five private terminal operating companies, i.e. HIT, Modern Terminal, ACT (Asia Container Terminals Ltd.), COSCO/HIT, and DPI.

2.7.1.2 Privatisation

Finding a clear definition of privatisation is elusive in the literature review (Cullinane and Song, 2002; Cullinane *et al.*, 2005b). Following Ircha's (2001b) view, Cullinane *et al.* (2005b: 434p) defined port privatisation as *"all manners of steps taken to enhance the commercial orientation of port operations."* Notteboom and Winkelmans (2001b: 243p) describe a privatisation as *"the transfer of public assets, i.e. the transfer of ownership of state assets from the public to the private sector or the transfer of provision of services from public bodies to private enterprise."*

Baird (1995) provided four main models of port administration in terms of three factors, i.e. utility (cargo-handling) function, regulatory function, and land/terminal ownership. The four models for port administration are pure public sector (all three elements are controlled by public sector), PUBLIC/private (utility function is controlled by private sector), PRIVATE/public (utility function and land/terminal ownership are controlled by private sector), and pure private sector (all three elements are controlled by private sector).

Having analyzed the privatisation of the top 100 container ports, Baird (2002) listed the most common methods, i.e. corporatization, concession/lease, management contract, build-operate-transfer (BOT), joint venture, sale of port land, and others. Concession was the most common method that was used by 52% of ports. BOT and corporatization, and joint venture followed.

Van Niekerk (2005) provided five forms of private participation being: 1) management contracts, 2) lease contracts, 3) concessions, 4) joint ventures, and 5) build, operate, transfer (BOT) agreements.

In terms of co-operation agreements between major players in container ports, Heaver *et al.* (2005) specify various activities, i.e. dedicated terminals, financial stakes of port authorities, financial stake in hinterland terminals, and alliances between port authorities, can be understood as SCM strategies (See Table 2.5).

Table 2.5 Co-operation agreements between various market players

Market Players	Shipping companies	CTMTs*	Hinterland transport	Port Authorities
CTMTs*	Financial stake of shipping company in CTMTs; joint ventures; dedicated terminals	Participation in capital	Joint Ventures	Financial stakes Port Authorities
PAs	Dedicated terminals	Financial stakes port authorities	Financial stake in hinterland terminals	Alliances between Port Authorities

Source: Heaver *et al.*, 2005: 147p

*** CTMTs: Container terminal management companies**

The advantages of privatisation are surveyed as sharing investment, improved productivity, helping trade growth, management expertise, and others (Baird, 2002). These advantages are posited to be strongly connected to SCM strategies of PAs.

Concession Policy or dedicated terminal

Concession can be defined as a privatisation strategy including allocation of a certain area of the port to a stevedoring terminal operator for a determined period of time, with or without the requirement to build or develop new facilities (Juhel, 2001).

In Baird's view (2002), concession (or dedicated terminal) is the most common measure for port privatisation. For the global terminal operators, bidding for concessions is one of the most important strategic strategies with making acquisitions (Midoro *et al.*, 2005). Furthermore, Midoro *et al.* (2005) stressed 'dedicated terminals' as a strategy for cutting costs and controlling integrated transport chains. Like the case of Ningbo port in China, PAs can employ differentiation strategy from other competitors by attracting deliberately shipping liner companies rather than terminal operators, or vice versa (Cullinane *et al.*, 2005).

PAs' financial stakes on terminal operators

Heaver *et al.* (2000) stipulated the examples of financial stakes of PA, e.g. 30% ECT by Rotterdam, ECT in Trieste, Sea-ro in Zeebruge. This PAs' SCM policy is strongly related to the concession policy, as Midoro *et al.* (2005) clearly describe that Port authorities often purposely force to set up joint venture (JV) in the process of concession in the context of the competition between liners and stevedores. The forcing power is come from the necessity of facing the increasing bargaining power of the big alliances of carriers to stevedores and that of avoiding losing customers to stevedores.

Regarding the JV policy, some differences are recognized in the cases of Shanghai and Busan port (See section 3.3). Shanghai port concentrates on concessions to a global terminal operator, i.e. Hutchison group. However, Busan port aims to generate intra-port competition among terminal operators. In terms of choosing between concentrating on stevedores or liners in concession procedure, the interesting implications can be stipulated in the case of competition between Shanghai and Ningbo port (Cullinane and Wang, 2005).

Management contract

Retaining the ownership of assets, a PA can utilize a management contract with private contractors in charge of a package of expertise to effectively operate and manage the port or terminal (Baird, 2000). For the provision of private service, PAs can introduce 'management contract' where an operator will be paid a management fee for the operation under specific conditions in terms of tariff (Juhel, 2001). In this case, the involvement of the private side would be the least among types of privatisation (Van Niekerk, 2005).

Build-Operate-Transfer: BOT

BOT (Build-Operate-Transfer) is the term for a privatisation model that uses private investment to guarantee infrastructure development (Lu *et al.*, 2003). In case of the BOT, private sector involvement is the most among the private participation options (Van Niekerk, 2005).

Sale of port land (or business)

This is the sale of port business including the land, infrastructure, superstructure and assets through the transfer or ownership from the public to the private sector. Baird (2000) called this method as 'sale of port land'. This was a method adopted by the British government for port privatisation from 1983 (Ibid.).

Corporatization/leasing of port assets

Corporatization means establishing 100% state-owned company to take over the business of providing port services, while the port assets are leased to the private sector (Baird, 2000). Hirst (2000) claims that corporatized ports are likely to obtain more responsiveness to customer and work more closely with customers (Cited in Everett, 2003). The main task of the port corporatisation is to provide terminals for private sector companies to lease and operate.

The following Table 2.6 illustrates the studies on the port privatisation.

Table 2.6 Studies on port privatisation

Author	Concepts	Methods	Types	Key Findings
Baird (1995)	Four models of port administration	Case Study	-Pure public sector -PUBLIC/private -PRIVATE/public -Pure private sector	Owing to UK government's pure private sector approach: 1) Ports have generally been sold below their market value 2) In some cases, there were no competing bids. 3) Privatisation resulted in esturial monopolies and no increase of competition within and between ports.
Baird (2000)	Port privatisation	Conceptual Research	-Commercialisation -Corporatisation/leasing of port assets -Concessions -Management contract -Build, operate, and transfer (BOT) -Joint Venture -Sale of port assets	Privatisation in the Port should be regarded as one of options to enhance the performance of port (The UK case demonstrates some weaknesses of the privatisation).
Turner (2000)	Terminal leasing policy	Simulation Research	- Container terminal leasing policy	Leasing policy does not increase key performance (Total time in port, TEU throughput/vessel)
Baird (2002)	Methods of privatisation used by ports	Fact finding Survey (Not an empirical survey)	-Corporatization -Concession/Lease -Management contract -Build-Operate-Transfer (BOT) -Joint Venture -Sale of port land -Other	<Main advantages of privatisation> -Sharing investment -Improved productivity -Helps trade growth -Management expertise -Others
Cullinane and Song (2002)	Port privatisation	Conceptual Research	-Privatisation of the financing of a service -Privatisation of the production of service -Liberalisation: relaxation of any statutory monopolies -Denationalisation and load-shedding	Privatisation is only a partial factor regarding improvement in economic efficiency, financial and operational performance.
Cullinane *et al.* (2005b)	Port Privatisation	DEA (Data Envelopment Analysis)	-Port privatisation	Privatisation→ Improved Efficiency (Not supported)
Van Niekerk (2005)	Port reform (Private participation)	Conceptual Research	-Management contracts -Lease contracts -Concessions -Joint ventures -Build, Operate, Transfer (BOT) agreements	Private participation might end up with natural monopolies. To avoid monopolistic behaviour, a sound regulatory framework is necessary.

Source: Tabulated by the author

2.7.1.3 Support for Hinterland and FTZ

Hinterland

The hinterland can be defined as "*continental area of origin and destination of traffic flows through a port*" (Winden and Klink, 1998: 2p). UNESCAP (2005: 16p) describes port hinterland as "*the land area located in the vicinity of a port such as immediately nearby or within the port boundary, and functioning interactively and closely with a port by providing various business activities, whether or not the hinterland is within the administrative jurisdiction of the port authority.*" Hinterland access is an important issue in ports competitiveness (Van der Horst and De Langen, 2007). Attracting port users is only possible when the port and their hinterland transport network are efficient and effective (Ibid.). Thanks to the expansion of ports' hinterlands, shipping lines could rationalize their itineraries by reducing the number of port call, creating load-centre ports. Expansion of hinterlands enables further increases in vessel size with growth of terminal size (Midoro *et al.*, 2005).

The hinterland issue is closely engaged with Free Trade Zone. The demands for the SCM have enlarged the information activities and value-added services like light assembly and processing, procurement of raw materials and parts, consolidation, testing, and packaging (UNESCAP, 2005).

Stipulating regionalization as 'expansion of the hinterland reach of the port for linking it more closely to inland freight distribution centres', Notteboom and Rodrigue (2005) pinpointed that PAs should be engaged in the development of inland freight distribution, information systems, and intermodality to achieve competitive advantages. Furthermore, Winden and Klink (1998) insist the need for knowledge base embedded in bank, insurance companies, consultants, planning specialists, technology suppliers, education and research institute, and the port authority, etc. as well as transport companies.

There are few empirical studies about the hinterlands' impacts on other variables, e.g. ports' competitive advantages, and supply chain performance, etc.

Free Trade Zone (FTZ)

The common aspects of FTZ are provided by UNESCAP (United Nations Economic and social commission for Asia and the Pacific), these being: 1) above average business infrastructure; 2) more flexible business regulations; 3) an offshore location; 4) focus on export; and 5) attractive incentive packages (UNESCAP, 2005). FTZ is one of the efforts to make simpler border crossing and strengthen international logistics activities. Including final processing, assembly, packaging, labelling, warehousing, and inventory control, it is treated as a foreign territory in terms of customs (Runager, 1990; Cited in Peng and Vellenga, 1993). Furthermore, the general objectives of the FTZ are: 1) generation of foreign exchange earnings; 2) providing jobs and creating income; 3) attracting foreign direct investment; and 4) generating technological transfer, knowledge, spill-over, and demonstration effects (UNESCAP, 2005).

From the ports' point of view, the concept of logistics FTZs or logistic parks are suggested (Ibid. 24-25p). The core part of the FTZ policy is providing spaces for these SCM activities. These logistics-oriented FTZs are not the same concept as the traditional labour related one.

There are similar concepts related to FTZ, e.g. Special Economic Zone (SEZ), Free Economic Zone (FEZ), Export Processing Zone (EPZ) and so on (See section 3.3). In Korea, FEZ is operated as a broader concept of FTZ (MOMAF, 2006c). In China, there are similar but different concepts Waigaoqiao Bonded zone, Pudong new district in Shanghai which includes Jinqiao Export Processing Zone, Lujianzui Finance & Trade Zone, and Zhangjang Hi-Tech Park (Pudong new district website, 2008). The FTZ related policies of Korea and China will be discussed in chapter three (See section 3.3). Again, there are few empirical studies on the link between FTZs and their wider impacts on performance in relation to SCM.

2.7.1.4 Using Information Technology

The importance of using Information technology in SCM is pinpointed by a wide range of studies. Kia *et al.* (2000) explained that a complex-supply chain, through IT (or EC), can achieve increased efficiency and reduced costs by tighter links among multiple participants. Lee *et al.* (2000) discussed the importance of Electronic Data Interchange (EDI) system. Stough (2001) stressed that the information technology, e.g. intelligent transportation systems which are a complex of IT and telecommunication technologies that are applied to transportation infrastructure are driving change in supply chain management and its organization.

Recognizing the importance of B2B services of a port in terms of SCM, e.g. one of the port communities systems like 'portsnportals' of Hutchinson Port Holding, Evangelista (2005) pointed out the significance of interaction with other players, e.g. hinterland and inland transport through 'Information and communication Technology' (ICT).

Robinson (2006) stressed the value of the real-time information and e-Business systems as a key to effective integration and efficiency in landside chain including PA, terminal, rail operator, trucking operator, and depot.

Stough (2001) stated that IT technologies, e.g. ATMS (Advanced Traffic/Transportation Management System), VMS (Variable Message Signs), and ATIS (Advanced Transportation Information System), are developed by public sectors like in Busan port U-Port plan (MOMAF, 2006b). Therefore, it is posited that IT based SCM strategies could be categorized in PAs' SCM strategies, rather than PSCs'. However, there are not many empirical studies investigating the impact of IT adoption in container terminal industry.

Table 2.7 illustrates studies on the SCM strategies based on IT technologies.

Table 2.7 Studies on IT technologies

Author	Concepts	Methods	Types	Key Findings
Lee *et al.* (2000)	EDI system for container cargo logistics	Conceptual Research	-EDI (Electronic Data Interchange)	Factors for successful EDI systems: 1) planning, requirement analysis and design of EDI, 2) inclusion of customs, 3) sharing system of cargo data, 4) EDI s/w for the user, and 5) facilitation of communication between trading partners and the transport sector.
Kia *et al.*(2000)	Information technology in port terminal operations	Simulation	-Microwave technology -Tagging technology -Barcode scanner -Radio frequency microcircuit system (RF) -Voice recognition technology	Electronic devices → reduction of crane service time, ship time, straddle service time, time in human resources, occupancy of stacking area
Stough (2001)	New technologies in logistics management	Conceptual Research	-Radiofrequency identification (RFID) -Global positioning systems (GPS) -Computer hardware and software for total supply chain management	Technologies such as barcodes, RFID, and GPS are contributing to an integrated approach to logistics management and driving change in SCM.
Banister and Stead (2004)	Information & Communications Technology (ICT)	Conceptual Research	-E-Commerce -Just-in-time production -Logistics and freight distribution -E-marketing and publicity	ICT→Necessity of intermodal perspective, sustainable supply chains, and impact of technology and flexibility
MOMAF (2006b)	U-PORT	Government plan	-RFID based intelligent logistics system (RFID, DGPS, RTLS:Real time Location System) -Single window information system (Export/Import information) -SP-IDC (Shipping & Port Internet Data Center)	U-port→ Real time, paperless, and one stop service

Source: Tabulated by the author

2.7.1.5 Marketing

Marketing is defined as "*the process of planning and executing the conception, pricing, promotion, distribution of ideas, goods, and services to create exchanges that satisfy individual and organizational goals*" by the American Marketing Association (1985) (Cited in Min and Mentzer, 2000: 766p).

Using a broad marketing concept, Min and Mentzer (2000) stressed the necessity of marketing for implementing SCM. The broad 'marketing concept is similar to 'relationship orientation' that will be discussed later in this section. Similarly, Cahoon (2007) suggested four major components of seaport marketing, i.e. marketing communications, community liaison, trade and business development, and customer relationship management (CRM).

Using the empirical study of the Australian seaport, Cahoon (2007) stressed the importance of 'marketing communications' (advertising, publicity, public relations, personal selling, and sales promotion) for seaports as a matter of survival and growth. Pando *et al.* (2005) listed the uses of communications budget of PAs being: press advertising (25.3%), publications (21.1%), public relations (19%), and commercial visits (18.5%).

In the context of PAs' support of marketing, it is empirically stipulated that the existence of common port marketing is an important indicator for the development of marketing (Ibid.). To this end, Ministry of Maritime Affairs and Fisheries (MOMAF) in Korea planned 'target marketing' which would be coordinated by itself aiming all members' participation, i.e. regional office, Busan Port Authority (BPA), city of Busan, terminal operators, and port labour (MOMAF, 2006a).

2.7.2 Port focused Supply Chains' SCM strategies

2.7.2.1 Port focused Supply Chains (PSCs)

There are several SCM-related concepts have been used in port industry e.g., 'supply chain', 'port supply chain', 'port-oriented supply chain', and 'hinterland chain' etc.. Through clarifying these concepts, PSC is derived as a main concept representing private port players in terms of SCM for the current research.

Supply Chain

Supply Chain generally means 'manufacturing supply chain' which is comprised of supplier, manufacturer, assembler, and distributor (Lee *et al.*, 2003). Logistics management is regarded as a part of SCM (Lambert, 2001), therefore, 'supply chain' is regarded as the widest concept including port supply chain. Including suppliers, manufacturers, inter-and-intra-modal transfer links, as well as land and sea transport in the concept, Frankel (1999) employed the 'total trans-ocean supply chain'. Robinson (2002) posits a port as a third party service provider in the supply chain of individual firms and one element in import and export supply chain between producer and consumer.

Port Supply Chain

Lee *et al.* (2003) provided the entities of 'Port Supply Chain' as suppler, ship, port, and distributor (Lee *et al.*, 2003). Robinson (2002) described that 'port-oriented chain systems' members are shipping line, shipping agent, stevedoring company, customs agent, freight forwarders, rail operator, trucking company, and depot. It should be noted that port users are combined with the port service providers in port supply chain as well.

Port-oriented landside Supply Chain

Robinson (2006) used the concept 'port-oriented landside Supply Chain'. The landside supply chain seems to include players, e.g. port authority, terminal, rail operator, trucking operator, and depot (Ibid.). It is not clear whether landside supply chain includes port authority, customs and inspection services. In this research, it is assumed that port oriented landside supply Chain includes port authority, customs and inspection services for the clear comparison with PSC concept in terms of exclusion of public players in PSC. Four patterns of landside links are: 1) a rail link to an intermodal terminal with trucking links to customers; 2) a road link to a depot within inward trucking to customers; 3) a direct delivery trucking pattern from terminal to customers; and 4) a truck-linked pattern of container storage, off-hire depots that cluster around the port/terminal location.

Hinterland Transport Chain

Stipulating the necessity of coordination in the port of Rotterdam, Van der Horst and De Langen (2007) claimed that the 'hinterland chain' involves shipping lines, container terminal operator, Barge operator, road haulage, shipper, and public players, e.g. customs, port authority, and inspection services.

Port-focused Supply Chain

The current study employs the concept 'Port-focused Supply Chain (PSC)'. It is a term to include all private players landside related to the provision of services to the customers, i.e. shipping line companies, freight forwarders, and shippers. It is different from 'Port Supply Chain', 'Port oriented landside Supply Chain', and 'Hinterland Chain' because public players i.e., customs, inspection services, and port authority are not related. This concept is introduced to find out the relevance of PAs' SCM related strategies into private port service providers SCM and its' resources and performances.

The customers of PSCs, e.g. shipping lines and freight forwarders demand higher terminal productivity, priority servicing and flexibility, less landside costs as well (Notteboom, 2004). For example, in Busan port, there are several terminal operators which own trucking company, odcy (off deck container yard), and inland depot in Yang-san (BPA, 2005). They do play as one container up/off load and storage, and transportation service provider. Furthermore, they offer total service under integrated service rates. Such PSCs in Busan port compete with another in the port or other PSCs in Shanghai port as transhipment service providers.

It is posited that the PSC, as a private port oriented inland supply chain, plays a role as an entity of actual competition in the port in accordance with the port authority. PSC can be defined as 'supply chain including all private players related to provision of services to the customers, i.e. shipping companies, freight forwarders, and shippers (Public players, e.g. port authority, customs, and inspection services are not included)' (See section 4.1). As stipulated in figure 2.9, depots and transport service providers, e.g. rail operators, and trucking operators, are included in PSC concept.

Figure 2.9 Concept of Port focused Supply Chain (PSC)

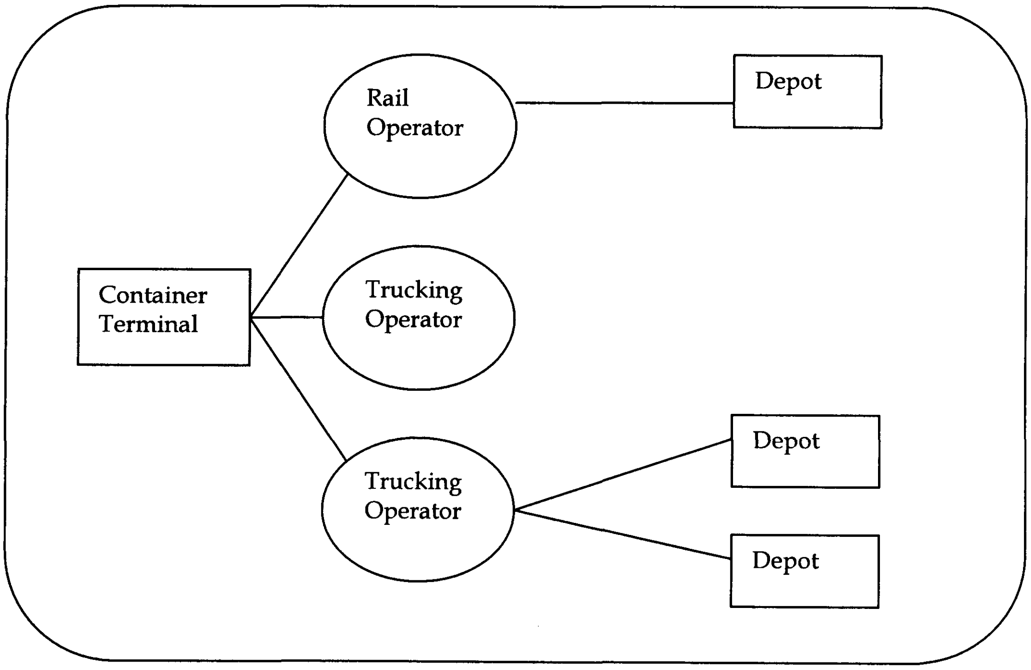
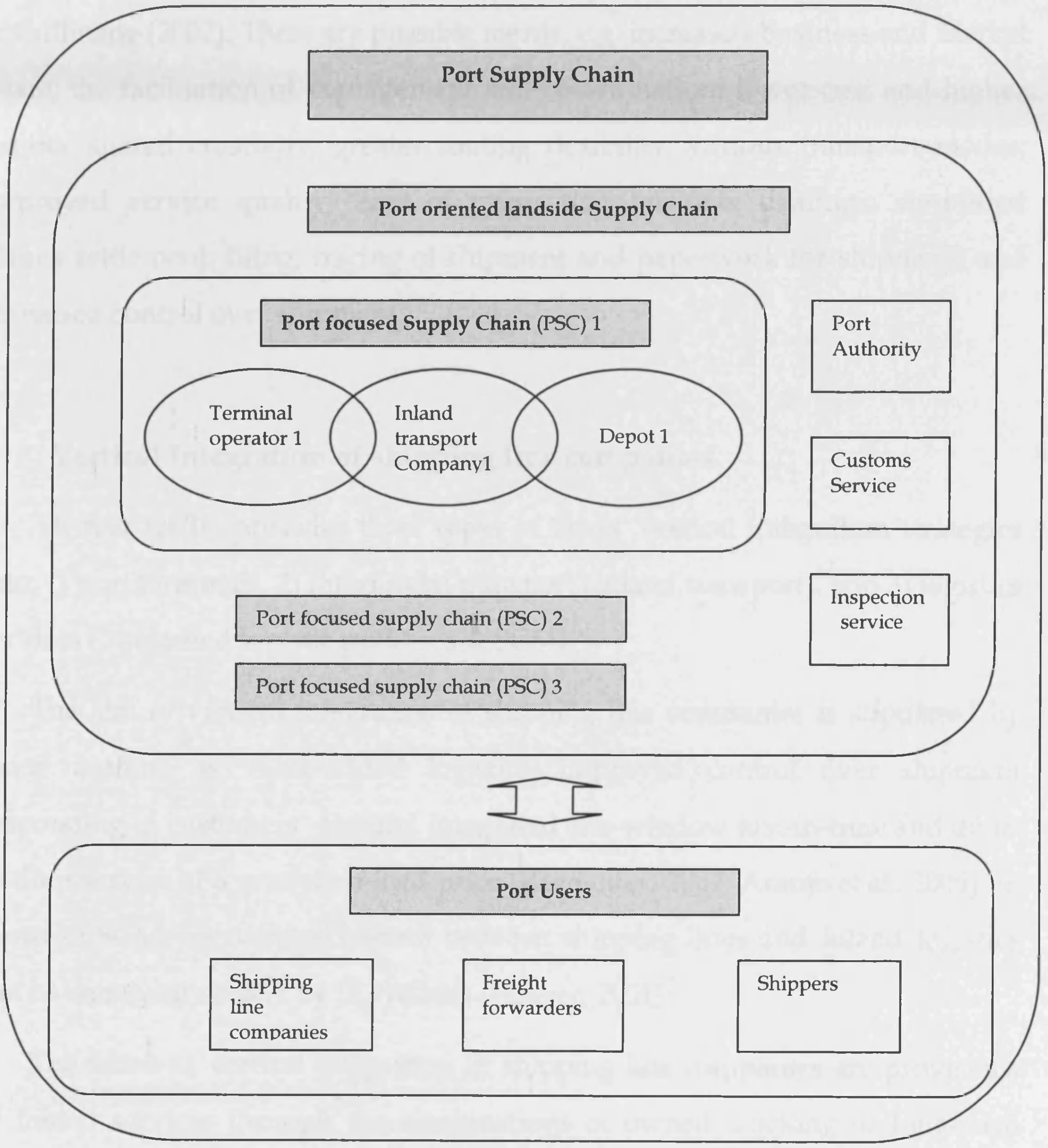


Figure 2.10 illustrates the relationships among the SCM related concepts including 'Port focused Supply Chain'.

Figure 2.10 Relationship between PSC and other concepts



Source: Author

2.7.2.2 Vertical Integration

Vertical integration in the current study is defined as 'liners' or 'stevedores' integration strategies into inland transport or logistics service' in the context of PSCs. The literature with regard to potential advantages of vertical integration mainly by ocean carriers is broadly reviewed by Panayides (2002) and Panayides & Cullinane (2002). There are possible merits, e.g. increased business and market share; the facilitation of management and co-ordination; lower cost and higher profits; shared creativity, greater routing flexibility; various transport modes; improved service quality; ease of transacting business dealings; simplified claims settlement, filing, tracing of shipment and paperwork for shipment; and increased control over shipment.

Vertical Integration of shipping line companies

Heaver (2001) provides three types of liners' vertical integration strategies into: 1) port terminals, 2) intermodal transport (Inland transport), and 3) logistics services (Integrated logistic packages & SCM).

The aim of vertical integration of shipping line companies is stipulated by many authors as value-added logistics, improved control over shipment responding to customers' demand integrated one-window just-in-time and door-to-door service at a predetermined price (Panayides, 2002; Araujo *et al.*, 2005). In terms of SCM, the vertical control between shipping lines and inland logistics can be enhanced mainly by IT systems (Heaver, 2001).

The forms of vertical integration of shipping line companies are provisions of inland services through the combinations of owned trucking or long-term contracts and short-term purchases of trucking, rail, and other services (Heaver, 2005). Furthermore, liners can provide door-to-door services and integrated logistic packages including freight forwarding & SCM. Examples include Maersk Logistics, Evergreen Container Terminal Thailand Ltd., Cosco Logistics, and Hanjin Logistics (Maersk Logistics, 2008; ECTT, 2008; Cosco Logistics, 2008;

Hanjin Logistics, 2008). Sharing resources on inland logistics among global shipping alliances are also detected (Notteboom, 2004).

Vertical Integration of terminal operators into inland transport

In the current study, the emphasis is on the vertical integration of container terminal operators into inland transport or logistics service which is achieved by setting up their own logistics companies, through direct involvement in intermodal rail and road transport or by integrating inland terminals in their logistics networks (Araujo *et al.* 2005p). In general, there are four types of vertical integration, i.e. integration into road haulage, rail, inland depots, and logistics company (Araujo *et al.*, 2003).

Examples of container terminal operators' vertical integration are Hutchison's inland container depots in Guanlan and Shenzhen in 1997 (YICT website, 2008). Furthermore, HPH established road haulage companies, i.e. Maritime Haulage Limited (MHL) in the UK and Maasvlakte Transport Services in Rotterdam through ECT (Araujo *et al.*, 2005). In Germany, Eurogate provides rail shuttle service which is named 'BoxXpress' to Munich, Stuttgart, Nurenberg and Augsburg (Gouvernal and Daydou, 2005). Furthermore, it is noted that global container operators, e.g. HPH and PSA, have subsidiary logistics service companies (SupplyLine and PSA Logistics) and involve in partnerships and joint ventures with logistics companies (Araujo *et al.*, 2003). Eurogate group has subsidiaries including 'Oceangate Distribution GmbH' which is specialized in value added services and transport management in Hamburg-Altenwerder in Germany and Sogemar in Italy (Oceangate, 2008).

Scarcity of empirical studies on impact of vertical integration

Panayides and Cullinane (2002) succinctly pointed out the scarcity of the empirical research on the impact of vertical integration into profits of liner shipping, and competitive advantage. Furthermore, they suggested Porter's framework and the RBT (Resource Based Theory) as a possible platform for related studies. Research gaps in empirical studies on container terminals' vertical integration into inland transport strongly justify the necessity for the current research (See Table 2.8).

Table 2.8 Studies on vertical integration

Author	Concepts	Methods	Types	Key Findings
Heaver (2001)	Vertical integration of Liners	Conceptual Research	From warehousing to full supply chain management services - Value added logistics services -Purchase of inland transport: long-term contracts or short-term purchases	Liners can benefit from integrated transport, logistics, and IT capabilities, the business of lines and logistics services are likely to come closer together.
Panayides and Cullinane (2002)	Liners' vertical integration into intermodal transport	Conceptual Research	Shipping companies' vertical integration into intermodal transport	Porter's framework and RBT will be a useful tool for empirical study on the relationship between vertical integration into transport and performance.
Notteboom (2002)	Vertical integration of container terminal operators	Descriptive Research	-Involving in intermodal rail transport -Setting up road haulage companies -Integrating inland terminals -Value-added logistics services	Vertical integration can be a useful tool to integrated logistics. But, a better structural co-ordination and co-operation with other market players can be efficient tool.
Araujo *et al.* (2003)	Stevedores' logistic services	Descriptive Research	-Integrating into rail transport -Integrating into road haulage companies -Integrating inland terminals -Setting up owned subsidiary logistics company -Networks of partnerships and joint ventures	It is clear that the trend towards strategic partnerships and consolidation in container terminal operations.
Notteboom (2004)	Vertical integration into inland transport and logistics of liners and stevedores	Descriptive Research	< Liners> -Integrated logistic packages -Selective investments with sub-contracting of less critical services -Sharing resources on inland transport among global alliances < Stevedores > -Involving in intermodal rail transport -Setting up road haulage company -Integrated inland terminals -Value-added logistical services	-Liners: paradigm shifting from operational costs at sea to integrated logistics solution -Terminal operators: From local port level to terminal network effect
Gouvernal and Daydou (2005)	Developing and commercializing rail services	Descriptive Research	-Setting up rail services organizations -Agreements for rail service provision (cooperation with national railway company, dedicated trains, contracts, shareholder, joint venture, subsidiary)	Germany and the Netherlands involve more in rail service provision than in France and the UK.
Araujo *et al.* (2005)	Vertical Integration of Liner shipping companies and Terminal operators	Descriptive Research	-Integrating into rail transport -Integrating into road haulage companies -Integrating inland terminals -Setting up owned subsidiary logistics company -Networks of partnerships and joint ventures	Vertical integration optimizes the terminal and port function within logistics networks

Source: Tabulated by the author

2.7.2.3 Relationship Orientation

'Relationship orientation' is a multi-dimensional concept including communication, trust, bonding, long-term orientation, and other non-economic and social dimensions (Pillai and Sharma, 2003; Panayides, 2007). Panayides adopts Harker (1999)'s definition of 'relationship orientation' as the *"proactive creating, development and maintenance of relationships with customers and other parties that would result in mutual exchange and fulfillment of promises at a profit"* (Cited in Ibid. 70p). Sometimes 'relationship orientation' is confused with supply management capabilities (Chen *et al.*, 2004). In the current study, 'relationship orientation' is posited as a strategy of Supply Chain Management like part of Wisner's (2003) 'supply chain management strategy' (Min and Mentzer, 2000) and 'strategic supply management strategy' (Paulraj and Chen, 2007; Chen *et al.*, 2004). This view is also supported by the definition of SCM that Mentzer *et al.* (2000: 18p) adopted as follows: *"The systemic, strategic coordination of the traditional business functions and the tactics across these functions within a particular company and across business within the supply chain, for the purpose of improving the long-term performance of the individual companies and the supply chain as a whole."* Furthermore, Martin and Grbac (2003) maintained the overlap between the supplier relationship side of SCM and market orientation.

Because of the dependency of SCM on partnership and cooperation (Brewer and Speh, 2000), there is an increasing awareness of the 'relationship orientation' (or relationship policies) strategies in logistics and port industries (Lee *et al.*, 2003; Paixão and Marlow, 2005; Panayides and So, 2005; Panayides and Song, 2007). There are various terms to be used in logistics representing 'relationship orientation', e.g. Supplier partnering, partnership factors, supply chain management strategy, market orientation, relationship orientation, and relationship with users as specified in Table 2.9. The relationship between 'relationship orientation' and 'SCM' is strongly suggested by a body of research, e.g. Panayides and Song's work (2007) suggesting 'relationship with users as one of the measurement instruments for port supply chain orientation (See Table 2.9).

Table 2.9 Studies on relationship orientation

Author	Concepts	Methods	Measurements	Key Findings
Nielson (1998)	Used as a concept including trust etc.	-Questionnaire -SEM	-Trust -Relationship specific assets -Commitment to relationship -Closeness -Joint Working -Information Sharing	Trust→Assets Trust→Closeness Trust→Commitment Closeness→Joint Working Closeness→Info sharing Joint Working→Benefits Info Sharing→Benefits
Tan *et al.* (1999)	Customer relations focus	-Questionnaire - Regression	-Quality assurance program for supplier's process / products -Manufacturing personnel visit supplier's facility regularly -Commodity management teams set supplier performance targets -Annual price negotiations for key input items -Use suppliers' technical support and test capabilities -Share confidential information with suppliers -Decentralized purchase orders and daily supply flows -Decentralized purchasing of low volume, low cost items	Customer relations focus → performance
Min and Mentzer (2000)	Supply Chain Management	-Conceptual research	-Market Information -Information Sharing -Close long-term relationships -Inter-firm Cooperation	Market Orientation, relationship marketing are positively related to the SCM
Scannell *et al.* (2000)	JIT Purchasing, Supplier Partnering, and Supplier Developmen t	-Questionnaire -Factor Analysis	- Management Commitment -Closer relationship/Trust-based relationship - Shared Resources/Joint Improvement efforts - Long-term contracts - Benefit and risk Sharing - TQM focus - Total cost focus - Measurement - Reduced Supply Base	-Three concepts have a positive influence on performance (Three SCM processes (3 concepts) are complementary and constitute essential elements for effective upstream SCM (27p)).
Gibson *et al.* (2002)	Critical Success factors for logistics partnership	-Questionnaire -Factor Analysis (Principal Component Analyses)	-Trust -Information Sharing -Shared risk and reward (Others: Planning, Control/power, Flexibility, Rules of Engagement, Channel Perspective, Effectiveness, Cost Focus)	-Shipper Ranking : 1) Cost 2) Effectiveness, 3) Trust, 4) Flexibility -Carrier Ranking : 1) Trust, 2) Effectiveness, 3) Flexibility, 4) Cost
Wisner (2003)	Supply Chain Management Strategy	- Questionnaire - SEM	- Creating a greater level of trust throughout the supply chain - Increasing firm's JIT capabilities - Establishing more frequent contact with supply chain members - Creating a compatible supply chain communication and information system - Creating formal info sharing agreements with suppliers/customers - Informally sharing information with suppliers/customers	Supplier → SCM Customer→SCM Supplier→Customer Customer→Supplier SCM→Performance *(Supplier: Supplier Management Strategy* *Customer: Customer Relationship Strategy* *SCM: Supply Chain Management Strategy* *Performance: Firm Performance)*
Pillai and Sharma (2003)	Relational orientation	Conceptual Research	-Trust -Commitment -Information Exchange	Relational orientation moves to transactional orientation in mature relationships
Martin and Grbac (2003)	market orientation	-Questionnaire - Regression	-Customer oriented information -Competitor-oriented information -Cross-functional information	C→E and C→D B→C and A→B→C D→E (Partially)

			dissemination -Response to competitors -Responsiveness to customers	A→B→D and B→D→E (Partially) B→D and B→C→D C→E and C→D→E (A: Info Orientation *B: Sharing Information* *C: Strength of Supplier Relationship* *D: Responsiveness to Market* *E: Performance)*
Lee *et al.* (2003)	Strategic factors of improving a port supply chain	-Simulation	-Supply-chain relationship -Supply-chain information	Strategic factors have a positive influence on port supply chain's performances.
Hult *et al.* (2005)	Market Orientation	-Questionnaire -Hierarchical regression	-Competitor Orientation (Share information, discussion about competitors' strategies) -Customer Orientation (Customer Satisfaction, value for customer, measurement of customer satisfaction) -Interfunctional coordination (Integration of service, responsiveness)	- MO→OR - MI→OR - OR→Perform *(MO: Market Orientation* *OR: Organizational responsiveness* *MI: Market information processing* *Perform: Performance)*
Panayides and So (2005)	Relationship orientation (TPL)	-Questionnaire -Structural Equation Modelling (SEM)	- Trust - Bonding - Communication - Share Value - Empathy	- RO→LSQ - RO→Perform - LSQ→Perform *(RO: Relationship orientation* *LSQ: Logistics Service Quality* *Perform: LSP's Performance)*
Panayides and Song (2007)	Relationship with users (in container port)	-Questionnaire -SEM (Confirmatory Factor Analysis)	- Strategic partnership - Mutual trust - Work together for service quality - Work together to reduce costs - Measure customer satisfaction	CFA test is valid
Paulraj and Chen (2007)	Strategic Supply Management	-Questionnaire -SEM	- Strategic Purchasing - Interfirm Communication - Cross-Organizational Teams - Supplier Integration	TU→SSM SSM→BP SSM→SP *(TU: Technology Uncertainty* *SSM: Strategic Supply Management* *BP: Buyer Performance* *SP: Supplier Performance)*
Panayides (2007)	Relationship Orientation	-Questionnaire (TPL Hong Kong) -SEM	-Trust -Bonding -Communication -Shared Value -Empathy	OL→RO→LSE→FP *(OL: Organizational learning* *RO: Relationship Orientation* *LSE: Logistics Service Effectiveness* *FP: Firm Performance)*

Source: Tabulated by the author

2.7.3 Resources

Because this research adopts a combination of RBT and SCMT as a main theoretical framework, the 'resources' variable in this study is very importance. In that sense, general definition and typology of resources will be discussed in the context of general RBT first. Then, literature on detailed resources, e.g. financial resources, skills, relational resources, and physical resources, will be covered to provide a base for choosing variables of current research model.

2.7.3.1 Definition and Typology of Resources

Barney (1991: 101p) defined 'resources' as 'an entire set of the organisations' physical or intangible assets, attributes, information, knowledge, process and system'. In the context of container port supply-chain element, Lee *et al.* (2003) identified five resource elements, i.e. harbour equipment (berth, yard, gate etc.), transportation (container crane etc.), computer system, labour (Management, operations, technicians information etc.), and operational policy (Berth allocation, yard planning, stowage planning, logistics planning etc.).

As illustrated in Table 2.10, there is no consented typology of resources of the firm (or container terminal). According to the review of firms' resources, the current research adopts the typology of financial resources, skills, physical resources, and market oriented resources (or organizational resources) based on Turnbull *et al.* (1996) and Morgan and Hunt's (1999) views.

Del Canto and Gonzalez (1999) provided three types of firm specific factors: financial, physical, and intangible resources. Summarizing various studies about firm's resources, Morgan and Hunt (1999) suggested 7 categories of resources, i.e. financial, legal, physical, human, organizational, informational, and relational resources. They stressed that these seven resources are combined to create higher-order resources, or competencies, which can be the source of a competitive advantage. Based on the 'Interaction approach', Turnbull *et al.* (1996) provided three categories of resources i.e. 'financial resources', 'network position', and 'skills'.

In the literature regarding container terminals, the main focus is on human resources and physical resources (Yi *et al.*, 2000; Lee *et al.*, 2003; Marlow and Paixão, 2003). As discussed earlier in this chapter, Heaver's (2001) framework adopts three resources, i.e. financial, technical, and human resources.

Table 2.10 summarizes the literature regarding the typology of resources of the firm.

Table 2.10 Typology of resources of firms

Author	Concepts	Types
Barney (1991)	Resources	-Physical Capital resources (Physical technology, plant and equipment, geographic location, and its access to raw materials) -Human Capital resources (Training, experience, judgment, intelligence, relationships, and insight of individual managers and workers) -Organisational resources (Formal reporting structure, formal and informal planning, controlling and coordinating systems, and informal relations among groups within a firm and between a firm and those in its environment)
Turnbull *et al.* (1996)	Resources (basis for the interdependence of companies in business relationships)	- Financial Resources - Network Position (Access, Brand, reputation etc.) - Skills (product technology, process technology, marketing technologies)
Del Canto and Gonzalez (1999)	Resources	-Financial Resources (Financial Autonomy, Leverage) -Physical Resources (Assets) -Intangible Resources (Human resources, Commercial resources)
Morgan and Hunt (1999)	Resources	-Financial -Legal -Physical -Human -Organizational (organizational culture, routines, brands) -Informational -Relational (trust, commitment, loyalty)
Yi *et al.* (2000)	Container Terminal Resources	-Port Facilities (Basic: Water area, Outer facility, Functional: Mooring facility, Navigation aid facility, Cargo Handling equipment, Cargo storage and handling facility, Storage facility, Vessel control facility, Computer system) -Port Labour (Director, Manager, Operator, Technician, System Engineer)
Jung (2003)	Transport Resources	-Service-related Resources (Financial Resources, Low technique Resources, High technique Resources) -Market-related Resources
Marlow and Paixão (2003)	Resources of Container terminal	-Human Resources -Information technology/information systems -Cargo handling equipment -Quays, berths, aprons, storage or yard capacity -Dredged channels and quays
Mentzer *et al.* (2004)	Resources	-Tangible Resources (Plants, equipment, raw materials, distribution centers, and logistics networks) -Intangible Resources (Relationships, corporate culture, management skills, logistics expertise, and customer loyalty

Source: Tabulated by the author

2.7.3.2 Financial Resources

Morgan and Hunt (1999: 283p) delineated 'financial resources' as the 'capitalization that a firm has at its disposal'. 'Financial resources' includes debt, equity, retained earning, etc. (Del Canto and Gonzalez, 1999).

Turnbull *et al.* (1996) acknowledged that financial resources affect a company's ability to acquire new resources, or to use the resources of others. It is easily understood that global terminal operators like PSA, HPH have better financial resources. Thus, it is obvious that global terminal operators and shipping liner companies are able to acquire new resources, or to use the resources by the concession of the container terminals.

It is difficult to hypothesize that SCM strategies directly enhance financial resources. Midoro *et al.* (2005) insisted that financial power and technical and managerial capability drove the competition for supply chain control between global carriers vs. global terminal operators. This means financial resources can be the reasons for the supply chain management rather than a result of SCM. In terms of possibilities about sustainability, it is posited that financial resources are unlikely to achieve a sustainable competitive advantage owing to the lack of heterogeneity (Morgan and Hunt, 1999).

Considering above discussions and the necessity of simplicity of the model, it was decided that financial resources should be dropped as a variable for the statistical test.

2.7.3.3 Skills

'Skills' is recognized as one component of human resources, i.e. skills, knowledge, and the vision of a firm's employees (Morgan and Hunt, 1999). 'Skills' is one of the most important resources of a firm in achieving lower cost levels and higher quality products (Kaleka, 1999). Marlow and Paixão (2003) maintained the importance of investment on human resources as one of the core competencies of ports. Furthermore, they suggested that human resources including knowledge and skills were key source to accomplish agility. Turnbull *et al.* (1996) described that 'skills' is a set of technologies, i.e. product technology (designing products or services), process technologies (ability to manufacture), and marketing technologies (relationship competence, skills in managing relationships). Del Canto and Gonzàlez (1999) pointed out that employee's knowledge, experience and skills could be classified as intangible resources together. In terms of 'skills' of container terminals, Yi *et al.* (2000) categorized the type of the human resources in the form of container terminal labour as management, operation, technical (parts, electric power, machines), and information system department.

Wright *et al.* (2001) suggested that broad 'skill' concept contained the stock of intellectual capital in a firm, i.e. human capital (the knowledge, skills, and abilities of people), social capital (the valuable relationships among people), and organization capital (the processes and routines within the firm). Their 'human capital' can be regarded as 'skills' concept that adopted in the current study.

With a conceptual approach, Mentzer *et al.* (2004) hypothesized the relationship between intangible resources, i.e. management skills and knowledge, and logistics capabilities. Furthermore, it was suggested that logistics capabilities is positively related to competitive advantage.

In terms of empirical testing, it can be generally stated that most of studies on skills did not adopt empirical approach in logistics studies. Especially in the field of port and shipping studies, it is recognized that empirical studies to deal with relationship between skills and port's performances are scarce.

2.7.3.4. Relational Resources (or Marketing specific Resources)

There are various terms to denote a firm's brand, reputation, trust, customer loyalty, and commitment, e.g. network position, marketing specific resources, organizational &, relational resources, and relational capabilities (See Table 2.11). Turnbull *et al.* (1996) defined the 'network position' as the combination of a company's relationships and the rights and obligations which go with them including access to a major consumer market, brand (as a measure of reputation). It is suggested by literature review that a firm's reputation is one of the most important intangible resources (Del Canto and Gonzalez, 1999). Morgan and Hunt (1999) diagnosed organizational resources including organizational culture and routines, valuable brands, and quality control systems. According to them, relational resources contain trust, commitment, or loyalty. Furthermore, they stressed that the competitive advantages gained through both resources were highly sustainable. In some studies, commitment is regarded as a measure of loyalty (Turnbull *et al.*, 1996).

Srivastava *et al.* (2001) stressed that the role of marketing specific resources, e.g. brands, customer and distribution relationships to achieve sustainable competitive advantage were recognized by early supporters (i.e. Barney, Grant and Wernefelt) of RBT. Furthermore, they insisted that market based assets were the resources satisfying both marketing specific and potentially possess at least some of the desired RBT attributes such as rare and inimitable. Relational market-based assets are relationships with channels, customer, networks, and eco-systems. They stressed that these relational assets were based on factors like 'trust' and 'reputation' (Ibid.).

In logistics research, Mentzer *et al.* (2004) recognized relationships and customer loyalty as intangible resources. Stressing the importance of the 'lean port network', Marlow and Paixão (2003) stressed that the port's development of relationships with other players (e.g. inland terminals) was expected to bring a minimisation of costs by responding to demands caused by market uncertainty, the development of trust and long-term relationships and reliable services.

Table 2.11 Studies on the types of relational resources

Author	Concepts	Types
Barney (1991)	Organisational Resources	-Formal reporting structure -Formal and informal planning -Controlling and coordinating systems and informal relations among groups within a firm and between a firm and those in its environment
Turnbull *et al.* (1996)	Network Position	-Access -Reputation (Brand) - Expectations
Morgan and Hunt (1999)	Organisational /Relational Resources	-Organizational (Corporate culture routines, organizations' structure, valued brand names, and the administrative history of the firm) -Relational (relationships between various constituencies within the organization, between the organization and its various external partners: trust, commitment, loyalty)
Srivastava *et al.* (2001)	Relational Market-Based Assets	-relationships with customers -relationships with channels -relationships with strategic partners -relationships with providers of complementary goods and services -relationships with outsourcing agreements -relationships with networks and eco-system
Mentzer *et al.* (2001)	Single company Antecedents to SCO(Supply Chain Orientation) and SCM	-Trust -Commitment -Interdependence -Organizational Compatibility
Mentzer *et al.* (2004)	Intangible Resources	-Relationships -Corporate culture -Management skills -Logistics expertise -Customer loyalty
Panayides (2006b)	Relational capabilities	-Inter-organisational relationships -Trust -Commitment -Adaptation
Panayides and Song (2007)	Relationship with users (Among Port-supply chain orientation)	-Strategic partnership -Mutual trust -Work together for service quality -Work together to reduce costs -Measure customer satisfaction

Source: Tabulated by the author

2.7.3.5 Physical Resources

'Physical resources' is delineated as 'the tangible assets that are used by a firm to produce and market goods and services' (Morgan and Hunt, 1999: 284p).

Lee *et al.* (2003) listed physical resources of port industry, i.e. harbour equipment (berth, yard, gate, etc.), transportation (container crane, yard trailer, and transfer crane), computer system (hardware, software, network, DB etc.). Marlow and Paixão (2003) described physical resources of container ports as 'information systems', cargo handling equipment (i.e. gantry cranes, fork-lifts, reach-stackers, and straddle carriers), quays, berths, aprons, storage or yard capacity, and dredged channels and quays.

The importance of 'physical resources' is recognized mainly by studies on port selection or competitiveness studies. Using AHP (Analytic Hierarchy Process), Song and Yeo (2004) described port facility as one of the factors to find out Chinese ports' competitiveness along with cargo volume, port location, and service level. They assumed that port facilities include both infrastructure and superstructure, such as berths, cargo equipment and stowage capacity. Like general RBT, they posited positive relationships between physical resources and a port's competitiveness.

Regarding transhipment port selection, Lirn *et al.* (2004) delineated port physical and technical infrastructure as one the four major criteria with port geographical location, port management and administration, and carriers' terminal cost. They stipulated 13 sub category of physical and technical infrastructure. Among them, six sub categories regarding port infrastructure facilities and equipment, i.e. available number of berths, back-up space on terminal, infrastructure, degree of integration, port equipment, and superstructure can be regarded as ports' physical resources.

2.7.4 Supply Chain Performance

In the current study, Supply Chain Performance (SCP) is defined as 'PSCs' performance as a whole which is estimated by its customers, i.e. liners, and freight forwarders' (See section 4.1). SCP concept is originated from manufacturing Supply Chain (Stewart, 1995; Supply-Chain Council, 2006). Measuring the supply chain's performance is discussed by considerable research. Recognizing the necessity of new supply chain measurement, Van Hoek (1998) provides a preliminary framework developing from 1) cost level, 2) customer service/market extension into 3) integration and market creation stage.

Stewart (1995) used four measurement areas including delivery performance; flexibility and responsiveness; logistics cost; and asset management. Stressing the importance of the integrated SCM measurement, Bechtel and Janyaram (1997) summarize the measures claimed by various studies in measurement area, i.e., service, cost, productivity asset/utilization, time. Beamon (1999) suggests three elements of measurement of SCP, i.e. resources (efficiency), output (customer service), and flexibility (ability to respond to changing environment).

Recognizing that SCP in transport is different from that of manufacturing supply chain (Bechtel and Jayaram, 1997), Lai *et al.* (2002; 2004) expand SCP concept into transport supply chain. Based on the SCOR model by supply chain council (2006), they focused on the customers of transport logistics firm, i.e. shippers at the input side and consignees at the output side.

In port industry, Carbone and De Martino (2003) give some considerations on the key performance indicators in line with automotive and port SCM matrix. The effort to set up to supply chain performance measure was endeavoured by Bichou and Gray (2004). They developed a profit-based aggregate performance which is called as 'Key Performance Indicator (KPI) model'.

It is recognized that there are similar concepts of SCP, e.g. Logistics Service Quality (LSQ) and Competitive Advantage. Studies on those two concepts will be illustrated in Table 2.13 and 2.14. The similarity of the concepts between SCP and competitive advantage will be discussed in detail in chapter four (See section 4.2). In table 4.2, sources of major SCP items, reliability, cost, service effectiveness, and flexibility, were stipulated. Sources of reliability are Supply Chain Council (1996), Beamon (1999), Gunasekaran *et al.* (2001), Lai *et al.* (2002), and Carbone and De Martino (2003). Stewart (1995), Supply Chain Council (1996), Beamon (1999), Lai et al. (2002), and Carbone and De martino (2003) recognized cost as a sub item for SCP. Regarding service effectiveness, Bechtel and Jayaram (1997), Beamon (1999), Gunasekaran *et al.* (2001), and Lai *et al.* (2002) used service effectiveness variable. Flexibility was recognized as one of the sub variable of SCP by Stewart (1995), Supply Chain Council (1996), Gunasekaran et al. (2001), and Paixão and Marlow (2003). In conclusion, four major SCP items, i.e. reliability, cost, service effectiveness, and flexibility can be singled out as the important and usable sub-items for SCP.

Table 2.12 Studies on the Supply Chain Performance

Author	Concepts	Research Method	Measurements	Key Findings
Stewart (1995)	Supply Chain Excellence	Conceptual Research	-Delivery Performance -Flexibility and Responsiveness -Logistics cost -Asset management	Measures for supply chain excellence were established
Supply Chain Council (1996)	Supply Chain Operations Reference Model (SCOR)	Conceptual Research	-Supply Chain reliability -Flexibility and responsiveness -Costs -Assets	Providing SCOR model
Bechtel and Jayaram (1997)	Supply Chain Management Measurement	Conceptual Research	-Service -Cost -Productivity Asset/Utilization -Time	Differences in Supply Chains in Manufacturing vs. service companies (logistics).
Beamon (1999)	Supply Chain Performance	Conceptual Research (Developing a numerical Model for flexibility)	-Resources Performance (Total cost, Distribution cost, Manufacturing cost, Inventory, Return on investment: ROI) -Output (Sales, Profit, Fill rate, On-time deliveries, Backorder/stockout, Customer response time, Manufacturing lead time, Shipping errors, Customer complaints) -Flexibility (Volume flexibility, Delivery flexibility, Mix flexibility, new product flexibility)	Developing of numerical models of flexibility
Scannell *et al.* (2000)	SCM's competitive performance	Empirical Research (Factor Analysis)	-Flexibility (Volume, mix, changeover, modification flexibility) -Innovation (Product, design quality, process) -Quality (product durability, product reliability, conformance to specification) -Cost (cost reduction, low production cost)	**SCM → SCP** (SD→ C flex & P inno & low pro; SP→Vol & Mod Flex; SP → Low pro & overall C; JIT→C &Vol & mix & mod flex; JIT→Confo; JIT→Low pro)

				SD: Supplier Development *C flex : Changeover flexibility* *Pinno: Process innovation* *Low pro: low production cost* *SP: Supplier Partnering* *Vol flex: Volume flexibility* *Mod flex: Modification flexibility* *Overall C: Overall cost reduction* *JIT: JIT purchasing* *Confo: Conformance to specifications*
Gunasekaran *et al.* (2001)	Supply Chain Performance Metrics (Plan; Source; Production; Delivery; Customer Service and satisfaction Performance)	Conceptual Research	< Delivery Performance > -Delivery lead time -Number of faultless deliveries -Effectiveness of delivery invoice methods -Information richness in carrying out delivery -Response to number of urgent deliveries -Total distribution cost < Customer Service & Satisfaction > -Flexibility to meet particular customer needs -Customer query time -Level of customer perceived value of product	Providing a framework at four basic links in a supply chain: plan, source, make/assemble, and deliver
Lai *et al.* (2002)	Supply Chain Performance in transport logistics	Empirical Research (Confirmatory Factor Analysis)	<Service effectiveness: Reliability> -Fulfill promises to customers -Solve customers' problem -Perform services for customers right the first time -Provide services at the time promised to the customers -Keep customers' records accurately <Service effectiveness: Responsibility> -Tell customers exactly when services will be performed -Give prompt services to customers -Willingness to help customers -Timely response to customers' requests <Operations efficiency: Cost> -Reduce order management costs -Reduce costs associated with facilities/equipment/manpower used in providing the services -Reduce warehousing costs -Reduce transportation costs -Reduce logistics administration costs <Operations efficiency: Asset> -Improve the rate of utilization of facilities/equipment/manpower -Improve number of cash to cash cycle time -Improve net asset turns	26-item SCP measurement instrument was tested and proved to be valid and reliable

Paixão and Marlow (2003)	Flexibility within a port environment	Conceptual Research	-Access/distribution -Expansion -Launch -Material handling -Process -Product -Routing -Target -Volume	To meet uncertainty, port operators should apply agility to their operations. *(Agility: A strategy responsible for strengthening the links between the internal and the external business environments, as it is a knowledge-based strategy that helps any business to move quickly in the new economy)*
Carbone and De Martino (2003)	KPI (Key Performance Indicator) of ports in supply chain	Case Study - Renault automotive supply chain involving in the port of Le Havre	< Procurement management > -Transport and handling costs -Transit time <Inventory management: parts> -Reliability -Total logistics costs <Manufacturing management /inventory management-Vehicles> -Transit time -Consignment security -Transport and handling costs < Physical distribution > -Availability of real time information -Transport and handling costs -Reliability	Using 4 variables(Relationships, supplied services, information and communication technologies, performance measurement) The higher the level of integrating among the actors of a supply chain the higher the performance for the entire chain.
Gunasekaram *et al.* (2004)	Supply chain performance measurement	Empirical Research (Descriptive level: Ratings on metrics)	Same as Gunasekaram *et al.* (2001)	Providing a framework for performance measures and metrics (Four major supply chain activities/processes: Plan, source, make/assemble, and deliver) (Strategic, tactical, and operational level)
Lai *et al.* (2004)	Supply Chain Performance of transport logistics	Empirical Research (CFA, ANOVA) (Self assessment)	Same as Lai *et al.* (2002)	Firms in the transport logistics industry in Hong Kong were expending a lot of effort on their SCP (There is no difference in terms of SCP among Air and sea transport, freight forwarding, and third-party logistics).
Bichou and Gray (2004)	Supply Chain Performance	Conceptual Research (with a simple descriptive study)	Profits < Aggregate performance=total performance=Performance B+ Performance D> -Performance A=current profit -Performance B=new performance-Performance A -Performance C= Port profit from each channel (Cargo, Mode, Customer/suppliers) -Performance D=new performance (from new channel/process organization)-Performance C	Developing a Key Performance Indicator (KPI) model (There is a lack of familiarity with logistics and SCM concepts)

Source: Tabulated by the author

Table 2.13 Studies on Logistics Service Quality

Author	Concepts	Research Method	Measurements	Key Findings
Parasuraman *et al.* (1988)	Service quality (SERVQUAL)	Empirical Research	-Tangibles -Reliability -responsiveness -Assurance -Empathy	Developing 5 dimensions of service quality (22-item) (SERVQUAL)
Mentzer *et al.* (1999)	Logistics service quality	Empirical Research (Confirm-atory Factor Analysis)	-Information Quality -Ordering Procedures -Ordering Release quantities -Timeliness -Order Accuracy -Order Quality -Order Condition -Order Discrepancy Handling -Personnel Contact Quality	Developing logistics service quality and testing it by CFA prove measures are valid and reliable
Mentzer *et al.* (2001)	Logistics service quality	Empirical Research (SEM)	-Order placement (Personnel Contact Quality; Order Release Quantities; Information Quality; Ordering Procedures) -Order Receipt (Order Accuracy; Order Condition; Order Quality; Timeliness; Order Discrepancy Handling) - Satisfaction	Perceptions of order placement activities → Perception of Order Receipt → Satisfaction Level Response
Stank *et al.* (2003)	Logistics service performance of TPL provider	Empirical Research (SEM)	-Operational Performance (Meets promised deadlines; Delivers undamaged orders; Delivers accurate orders) -Relational Performance (Knows your needs well; Cooperates with you to help do the job well; Makes recommendations for continuous improvement on an ongoing basis) -Cost Performance (Provides services that result in the lowest total cost logistics solution; Offers competitive prices for services)	Relational Performance (RP) →Customer Satisfaction → Customer Loyalty → Market Share RP→ Operational Performance RP → Cost Performance
Panayides & So (2005)	Third-Party logistics service quality	Empirical Research (SEM)	-Reliability -Timely responsiveness -Accuracy in documentation -Accuracy in information -Service fulfilment -Problem solving ability -Empathy	- RO→LSQ - RO→Perform - LSQ→Perform *(RO: Relationship orientation* *LSQ: Logistics Service Quality* *Perform: LSP's Performance)*
Panayides (2007)	Logistics Service Effectiveness	Empirical Research (SEM)	-On-time service delivery -Timely response to clients' request -Accurate client record keeping -Accurate information delivery to clients -Fulfill promises to clients -Solve clients' problems -Willingness to help clients	OL→RO→LSE→FP *(OL: Organizational learning* *RO: Relationship Orientation* *LSE: Logistics Service Effectiveness* *FP: Firm Performance)*

Source: Tabulated by the author

Table 2.14 Studies on competitive advantage

Author	Concepts	Research Method	Measurements	Key Findings
Cerit (2000)	Maritime transport service characteristics competitive position	Empirical Research (Factor Analysis)	<Price and Differentiation Factors > -Transport quality -Transport price -Responsiveness towards the customer -Reliability of the transport service -Competence of the transport personnel <Service quality factors for the transport service> -Safety, security and confidentiality -Tangibles in the transport service -Access to the Transport personnel -Courtesy of transport contact personnel -understanding/knowing the customer -Credibility of the transport personnel -Communication with the customers	A factor analysis extracts three main determinants (13 factors) 1) transport function and the effects of competitive environment; 2) effects of functional/operational determinants of maritime transport service on competitive position; and 3) effect of maritime transport service determinants on competitive position
Scanell *et al.* (2000)	Competitive performance	Empirical Research (Factor Analysis)	-Flexibility (Volume flexibility, Mix flexibility, changeover flexibility, Modification flexibility) -Innovation (Product innovation, Design quality, Process innovation) -Quality (Product durability, Product reliability, Conformance to specification) -Cost (Cost reduction, Low production cost)	1) USCM →Flexibility 2) USCM→Innovation *(Not supported)* 3) USCM→Quality Performance *(Not supported)* 4) USCM→Cost Performance *(USCM: Upstream SCM strategy: Supplier development; Supplier partnering; JIT purchasing)*
Panayides and Cullinane (2002)	Competitive Advantage in liner shipping	Conceptual Research	-Cost Advantage -Service performance -Economic performance (return on assets and growth in sales)	Resource based theory and Porter's competitive strategy framework can be theoretical basis for the empirical research on competitive advantage in liner shipping.
Paixão and Marlow (2003)	Four dimensions that support the development of Agility	Conceptual Research	-Enriching the customer -Cooperating to enhance competitiveness -Adaptability -Leveraging the impact of people and information	To meet uncertainty, port operators should apply agility to their operations. *(Agility: A strategy responsible for strengthening the links between the internal and the external business environments, as it is a knowledge-based strategy that helps any business to move quickly in the new economy)*
Hult *et al.* (2005)	Firm's Performance	Empirical Research	-Organization Responsiveness	Market Orientation → Responsiveness

		(OLS regression)	-Performance (Return on investment: ROI; Return on assets: ROA; Return on equity: ROE)	Marketing information processing → Responsiveness Responsiveness → Performance
Lagoudis *et al.* (2006)	Factors contributing to higher performance in the ocean transportation industry	Empirical Research (Multi-attribute utility theory: MAUT)	-Quality -Service -Cost -Cycle time	The research shows a clear shift towards quality from cost in the Greek ocean shipping industry

Source: Tabulated by the author

2.8 Concluding Remarks

This chapter has investigated the studies on theories, bases of firm's (or port's) competence, i.e. TCT, Porter's framework, Port performance, Port selection theory, RBT, and SCMT. The combined view of RBT and SCMT is posited as a relevant theoretical framework for the current research. To apply this framework to the study on PAs' SCM strategies and their impacts on PSCs' (Port focused Supply Chain) SCM strategies, PSCs' resources, and PSCs' Supply Chain Performance (SCP), concepts are defined and related literatures are reviewed.

As the result of literature review, several points are suggested.

1) Recognizing the limits of TCT, Porter's framework, Theories on Port's selection & performance, it is found that the combining RBT and SCMT can successfully elucidate the PAs' SCM strategies and PSCs' SCP (or competitive advantage) issue in the port and shipping industries.

2) There are research gaps in empirical studies on PAs' SCM, PSCs' SCM, PSCs' resources, and PSCs SCP (or competitive advantage). Furthermore, empirical studies with regard to relationships between these variables are rare in the port and shipping industries, especially in Northeast Asia. Thus, the aim of the current research to accomplish empirical research on the variables would be justified.

3) Recently, Covariance based Structural Equation Modelling (SEM) is adopted in considerable studies with regard to SCM and competitive advantage. Therefore, SEM could be an option to implement the research. However, it is

recognized recently that there are many misunderstandings in establishing measures in formative way using SEM. This issue will be addressed in chapter five (See section 5.5).

4) It is found that measures of SCP and competitive advantage are similar. It is likely that these two constructs can be regarded as one. This issue will be discussed in detail in chapter four. Lai *et al. (2002)* stress the research gap about a study finding the relationship between SCP and competitive advantage.

Considering these theoretical bases, in the next chapter, SCM strategies of Busan port and Shanghai port will be investigated.

Chapter 3
Characteristics of Busan & Shanghai port

This chapter deals with characteristics of Busan and Shanghai port as a case study. As stipulated in chapter five, the methodological position of this research rests on postpositivism, which supports mainly the use of quantitative methods, e.g. survey and PLS approach to SEM as well as the inclusion of qualitative methods (See section 5.2.1). A case study is introduced as a complementary measure. To this end, chapter investigates cases of Busan and Shanghai port which can give us some ideas on difference of two ports' strategies which leads to different performance. With this case study, other efforts for triangulated research, i.e. pilot survey, interview with experts, and survey including SCP of five chosen container ports, may support more strongly the relevance of main quantitative research (See section 5.8).

In this chapter, first of all, characteristics of container routes involving Busan and Shanghai port will be introduced. Then, physical resources and SCM strategies of two ports will be discussed. Lastly, implications for the research will be provided as concluding remarks.

3.1 Container Routes involving Busan & Shanghai port

As discussed in chapter one (See section 1.1), container ports in Northeast Asia play a role as an export base for North America and North Europe.

Figure 3.1 depicts the geographical location of Northeast Asian ports, especially Busan port.

Busan port is located on the trunk route connecting Europe, Asia, and North America. The port has enjoyed the advantage of location between China and Japan. Also, it can be a starting and ending point of continental railways, i.e. TCR (Trans China Railways), and TSR (Trans Siberian Railways) in the future.

Figure 3.1 Geographical location of Busan port (Source: PSA, 2009)

Table 3.1 clarifies the change of container cargo volumes on the trunk route from Northeast Asia.

Table 3.1 Container cargo volume estimation in trunk routes involving Busan & Shanghai port

		2003	2004	2005	2006	2007	2008
North Europe/Northeast Asia	Eastbound (000TEU) (Growth year-on-year)	3,243 (8.6%)	3,708 (14.3%)	3,838 (3.5%)	4,003 (4.3%)	4,218 (5.4%)	4,158 (-1.4%)
	Westbound (000TEU) (Growth year-on-year)	5,406 (24.5%)	6,238 (15.4%)	6,852 (9.8%)	7,805 (13.9%)	9,101 (16.6%)	9,563 (5.1%)
Transpacific	Eastbound (000TEU) (Growth year-on-year)	9,817 (9.6%)	11,334 (15.4%)	12,840 (13.3%)	14,119 (10.0%)	14,352 (1.6%)	13,919 (-3.0%)
	Westbound (000TEU) (Growth year-on-year)	4,378 (11.0%)	4,676 (6.8%)	5,019 (7.3%)	5,398 (7.6%)	6,258 (15.9%)	7,069 (13.0%)

Source: Adapted from Drewry, 2008)

On transpacific routes, eastbound cargo volume (Northeast Asia→ North America) reached 13,919 thousand TEUs which is almost double figure compared to westbound cargo volume of 7,069 thousand TEUs. This fact supports that Northeast Asia serves as an export base for North America. However, owing to the global recession from US market, growth rate 2007/8 remains -3.0% (Drewry, 2008).

Compared to that of transpacific routes, in case of North Europe/Northeast Asia, westbound cargo volume, 9,563 thousand TEUs, occupies a majority share compared to that of eastbound (4,158). Westbound cargo volume increased at a rate of 5.1%.

Table 3.2 Statistics on container handled by Busan port on regional basis

Container handled (000TEU)	Total	N.E Asia	Other Asia	Middle East	Europe	Africa	North America	C. & S. America	Oceania	Others
2006	12,011	5,853 (48.7%)	1,148 (9.6%)	507 (4.2%)	864 (7.2%)	144 (1.2%)	2457 (20.5%)	696 (5.8%)	342 (2.8%)	0.7 (0.006%)
2007	13,259	6,374 (48.1%)	1,297 (9.8%)	601 (4.5%)	1,025 (7.7%)	242 (1.8%)	2,579 (19.5%)	787 (5.9%)	352 (2.7%)	1.6 (0.01%)

Source: Adapted from MLTM, 2008b

Table 3.2 stipulates the statistics on regional destination (or origin) of container cargo handled by Busan port in 2006 and 2007. Northeast Asia occupies almost 50%. Then, North America is the second largest destination (or origin) of container cargoes from Busan port with 20.5% in 2006 and 19.5% share in 2007. However, cargoes destined to Europe or originated from Europe recorded share of 7.2% in 2006 and 7.7% in 2007.

Table 3.3 illustrates the number of container services from Busan port. Seventy eight shipping liner companies (15 Korean, 63 foreign companies) provided 310 services from Busan port in 2008. 77% of services cover Southeast Asia, Japan, China, and North America. This fact indicates that Busan port is one of the main hubs in Northeast Asia.

Table 3.3 Number of container services from Busan port

Region	Number of Services				Percentage (%)
	2006	2007	2008	Change of No. services 07/08	
Southeast Asia	44	55	68	+13	21.0
Japan	60	61	57	-4	18.4
China	39	53	46	-7	14.8
North America	36	43	38	-5	12.3
South America	20	29	31	+2	10.0
Europe	19	18	22	+4	7.1
Australia	10	16	17	+1	5.5
Russia	9	16	16	-	5.2
Middle East	9	3	7	+4	2.4
Other	9	7	8	+1	2.4
Total	255	301	310	+9	100

Source: BPA, 2008b

Compared to 2007, nine services were added to the following regions: Europe (4); South America (2); Middle East (4); and Australia (1) while there was a reduction in service connected to China from 53 in 2007 to 46 in 2008. This represents a recent tendency of direct calling of shipping liners from China to North America or China to Japan (BPA, 2008b). The competition between Busan and Shanghai as a transhipment hub of container cargoes from North China is expected to be more severe.

The share of container services in Southeast Asia reached 21.0% in terms of the number of services. The number of services to Southeast Asia increased from 55 in 2007 to 68 in 2008. Considering the increase of services covering North and South America at the same time, despite the decrease of five services between Busan and North America, it is posited that overall callings at North America ports were not actually reduced (Ibid.).

3.2 Physical Resources of Busan & Shanghai port

Before the author examines SCM strategies of Busan & Shanghai port Authorities, physical resources of Busan & Shanghai port will be reviewed. As it is recognized in section 2.7.3.5, physical resources of container ports are information systems, cargo handling equipment, quays, berths, aprons, storage or yard capacity, and dredged channels and quays. Among these physical resources, mainly berths and container handling capacity will be covered in this section.

Table 3.4 describes the present container terminal facilities, i.e. physical resources, in Busan and Gwangyang port.

Table 3.4 Container terminals in Busan and Gwangyang

	Container Terminals	Berth Capacity	Length (m)	Draft (m)	Cargo Handling Capacity (thousandTEU)	Operation Date
Busan port	Subtotal	28 berths	8,473		9,940	
	Jasungdae	50,000×4 10,000×1	1,447	12.5~15.0	1,500	1978. Sep.
	Shinsundae	50,000×4	1,200	14.0~15.0	1,600	1996. Jun.
	Gamman	50,000×4	1,400	15.0	1,560	1998 Feb.
	Uam	20,000×1 5,000×2	500	11.0	260	1996. Sep.
	Gamcheon Hanjin	50,000×2	600	13.0	660	1997. Nov.
	Shingamman	50,000×2 5,000×1	826	7.5~15.0	610	2002. Apr.
	New port 1-1	50,000×3	1,050	16.0	1,200	2006. Jan.
	New port 1-2	50,000×3 30,000×1	1,050 400	16.0	1,200 170	2007. Jan.
	General piers*	(18)	(3,367)		1,180	
	Pier 1	(10,000×2)	(437)	8.3~9.1	120	
	Pier 2	(20,000×1)	(200)	9.6~10.0	80	
	Central pier	(10,000×3)	(446)	8.5~9.0	180	
	Pier 3	(10,000×1)	(200)	8.3	60	
		(10,000×2)	(450)	8.3~8.8	120	
		(20,000×1)	(200)	8.3~9.0	80	
	Pier 4	(10,000×3)	(612)	7.5~8.0	240	
		(20,000×1)	(154)	8.4	80	
	Pier 7	(5,000×2)	(337)	3.0~10.0	220	
		(6,000×1)	(131)	10.0~11.0		
		(15,000×1)	(200)	9.8~10.7		
Gwangyang port	Subtotal	16	5,100			
	Phase 1	50,000×4	1,400	15.0	1,600	1998. Mar.
	Phase 2-1	50,000×2 20,000×2	700 450	12.0~15.0	1,140	2002. Apr.
	Phase 2-2	50,000×2 20,000×2	700 450	12.0~15.0	1,140	2004. Nov.
	Phase 3-1	50,000×4	1,400	17.0	1,600	2007. Jul.

Source: MLTM, 2008b

*** General piers will be developed as a business complex (North port redevelopment project)**

There are 28 container berths in 3 areas in Busan Port (North port, Gamchun port, and New port area).

It is recognized that there will be strong competition between Korea and China in terms of container terminals (Yeo, 2006). The port of Busan has taken advantage of China's poor port infrastructures, i.e. water depth and that of Japan's port management bureaucracy to develop as a major container transhipment port in the region (Frémont and Ducruet, 2005). However, Chinese government's significant investments in container ports and the involvement of many of the leading global terminal handling companies in the management poses an enormous challenge to Busan (Ibid.). To tackle on this challenge, Korean government tries to support physical resources in Busan and Gwangyang port significantly.

Table 3.5 presents that Korean government's plan on Busan New Port development with 30 berths by 2015. Totally, there will be around 50 berths in Busan port by 2015 including berths in North, and New port. In Table 3.6, it is illustrated that there would be 25 berths by 2015 in Gwangyang port.

Table 3.5 Port development plan of Busan New Port

	Total	2005	2006	2007	2008	2009	2011	2015
Number of berths	30	3	3	1	4	7	9	3
- Government	5	-	-	1	-	4	-	-
- Private Capital	25	3	3	-	4	3	9	3
Cumulative berths	30	3	6	7	11	18	27	30
Capacity of New port (10 thousand TEUs)	1,062	120	240	257	371	605	965	1,062
Capacity of North Port (10 thousand TEUs)	641	598	737	737	737	737	641	641
Total Capacity (10thousand TEUs)	1,703	718	977	994	1,108	1,342	1,606	1,703

Source: MLTM, 2008a

Table 3.6 Port development plan of Gwangyang Port

	Total	1997	2001	2004	2007	2008	2009	2011	2015
Number of berths	25	4	4	4	4	-	-	4	5
- Government	1	1	-	-	-	-	-	-	-
- Private Capital	24	3	4	4	4	-	-	4	5
Cumulative berths	25	4	8	12	16	16	16	20	25
Total Capacity (10 thousand TEUs)	1,245	160	274	388	548	548	548	685	885

Source: MLTM, 2008a

In China, there are also large scale port developments being implemented in Shanghai, Ningbo, and Shenzhen etc. Table 3.7 describes port development plan of major Chinese ports, i.e. Shanghai, Ningbo, and Shenzen. By 2015, there will be around 66 berths in Shanghai, around 50 berths in Ningbo, and around 27 berths in Shenzhen. It is posited that there is not much difference in terms physical resources in comparison of numbers of container berths in Busan and Shanghai port.

Table 3.7 Port development plan of major Chinese ports

Port	Berths ('08. April)	Short term Plan	Long term Plan	Present status
Shanghai	45	16 berths by 2008 (2.6km-Yangshan)	-21 Berths by 2011 -22 Berths by 2020	SCT 10 berths WGO 19 Yangshan 16 berths (Total 12,487m)
Ningbo	16	5 berths by 2008 (Chuangshan) 5 berths by 2009 (Jingtang)	7 berths by 2012 (Jingtang) 27 berths after 2012 (Jingtang)	Beirun 7, Chuangshan 10, Tassie 4 (Total berth length 5.058m)
Shenzen	24	6 berths by 2008 (Yantian)	3berths by 2015 (Shekou)	Shekou 6, Chiwan 9, Yantian 9 (Total berth length 9,025m)

Source: MLTM, 2008b

For the rational adjustment of the national port policy, Chinese government (Ministry of Communication: MOC) designates Shanghai as the main hub-port in Yangtze River Delta area (Wang and Slack, 2004). Korean government are trying to build two major container ports, i.e. Busan and Gwangyang.

Ranked as 5th biggest container port in the world with 13,426 thousand TEU of container handling in 2008, Busan port is the biggest port in Korea with cargo handling share of more than 70%. Table 3.8 shows the container cargo handling trends of major ports in Northeast Asia. Positioned as the 2nd place in the world container port in 2008, Shanghai port handled 27,980 thousand TEU (See Table 1.5 in section 1.3). In China, it is noted that three major container ports, i.e. Shanghai, Shenzhen, and Ningbo recorded high growth rate from 14.2% to 32.6%. Compared to Chinese ports, Busan and Gwangyang port showed less strong growth with 10.2% and -1.9% growth rates in 2007. However, the growth rates of Chinese ports in 2008 ranged from 1.4% to 19.9%, which were lower than that of 2007.

It is assumed that these low or minus growth rate can influence the decisions of Korean or Chinese governments on construction of new berths in Busan and Shanghai port.

Table 3.8 Container cargo handling statistics

Port Cargo (000TEU)	2001	2002	2003	2004	2005	2006	2007	2008	07/06	07/08
Busan	8,073	9,453	10,408	11,492	11,843	12,039	13,261	13,426	10.2%	1.2%
Gwangyang	855	1,080	1,185	1,322	1,441	1,756	1,723	1,810	-1.9%	5.0%
Shanghai	6,334	8,612	11,283	14,557	18,084	21,719	26,150	27,980	20.4%	6.99%
Shenzhen	5,070	7,614	10,615	13,650	16,197	18,469	21,099	21,400	14.2%	1.4%
Ningbo	1,210	1,860	2,772	4,006	5,191	7,060	9,360	11,226	32.6%	19.9%

Source: Adapted from: MLTM, 2008b; MLTM, 2009; portcontainer website, 2009

As Table 1.6 suggested (See section 1.3), the worldwide economic crisis resulted in the sharp downturn of container cargo handling statistics over most of the major container ports including Singapore (-19.6%), Shanghai (-17%), Hong Kong (-23.1%), Busan (-17.9%), and Ningbo (-8.2%) when compared between Jan. 2008 and Jan. 2009. Only Northern Chinese ports, e.g. Qingdao and Dalian recorded positive growth rate (2.0%/6.0%) in Jan. 2009 compared to that of Jan. 2008.

Therefore, competition between Shanghai and Busan expected to be fiercer to acquire transhipment cargoes such as container from North China to North America and Western Europe.

3.3 SCM strategies of Busan and Shanghai port

As discussed earlier in chapter two, SCM strategy is about improving the long-term performance of both individual parties of supply chain and supply chain as a whole (Mentzer *et al.*, 2001). Considering that quality factor is important especially in the case of fierce competition when the other conditions, e.g. physical resources, are similar, SCM strategies can make difference in the competition among container ports. PAs' SCM strategies included 'concessions', 'using IT', 'marketing', and 'support for hinterland and FTZ'.

Concessions

The concession policy of Busan port is not clear whether it concentrates on liners or global terminal operators. It can be generally stated that Busan port's concession policy is based on attracting liners, although now it appears to concentrate on attracting global operators. In Busan, there are six container terminals in the north harbour and one terminal in the new port area. Six container terminals in the north harbour are Jasungdae terminal (or HBCT: Hutchison Busan Container Terminal), Shinsundae Container terminal (operated by PECT: Stevedoring companies consortium 70% & Korean Container Terminal

Authority 30%), Gamman container terminal (operated by Sebang Co. & Hanjin Shipping Co.), Shingamman Container Terminal (Operated by Dongbu Pusan Container Terminal: DPCT;Dongbu Corporation 65%, Peony Investment S.A. 15%, Evergreen International Storage & Transport Corporation 15%, Shinyoung Corporation 5%) (DPCT website, 2008), Uam terminal (operated by Korea Marine Transport Co.), and Gamcheon Hanjin Container terminal (Hanjin shipping) (BPA, 2008a). In the new port area, 9 berths of phase 1-1 and 1-2 are operated by PNC (Pusan Newport Company), and shareholded by Samsung 25%, DP world 25%, Hanjin Heavy Industry 10.22%, Hyundai Construction 9.28%, Korea Container Terminal Authority 9%, Kumho Construction 6.95%, Daewoo Construction 5.73% (PNC, 2008). It is noted that Korean government is not allowing one dominant terminal operator. It seems that the port authority aims to endeavour intra-port competition among terminal operators.

In case of Shanghai, the Shanghai Container Terminals Ltd. which is a joint venture of Shanghai Port Container Co. (SPC) with Hutchison Whampoa Ltd. is in charge of terminal operation (SCT, 2008). Even, 30% of stake of SIPG (Shanghai International Port Group) in Yangshan Deepwater port has been sold to China Merchants in 2005 (Cullinane and Wang, 2005), it may be generally interpreted that Shanghai port is dominated by a global terminal operator, i.e. Hutchison (Shanghai CT 37%, Shanghai Pudong ICT 30%, Shanghai Mindong 50%, and Yangshan 32%) (Ocean Shipping Consultants, 2006) unlike Ningbo port's recent attracting future investment funds from liners, e.g. OOCL, MSC, Lloyd Triestino, China Merchant Holdings etc. (Cullinane and Wang, 2005).

Support for Hinterland and FTZ

There are several concepts being used including 1) SEZ (Special Economic Zone), Free Economic Zone (FEZ), 2) Export Processing Zone (EPZ), 3) Free Trade Zone (FTZs) or logistic park (LP), 4) Industrial zones or complexes, and 5) Distribution zone or complexes (UNESCAP, 2005).

Free Economic Zone is a broader concept. It is focused on foreign capital inducement and designated by the minister for planning & finance based on the law on the designation and operation of Free Economic Zone (KorCham, 2007). With regard to Busan New Port, 5 regions of 104.8 million square meters of Busan-Jinhae Free Economic Zone were designated and have been operated from July 2003 (PNC, 2008). Korea operates 6 areas of FEZ in Korea (Incheon, Gwangyang, Busan/Jinhae, Gunsan/Saemanguem, Hwanghae, and Daegu/kyungbuk) (MLTM, 2008d). FEZs usually cover large areas, e.g. residential areas including hospitals, schools and other business and supporting facilities and infrastructure to promote Foreign Direct Investment (FDI).

Export Processing Zone (EPZ) is regarded as a traditional zone acting as a manufacturing/processing works for exports (UNESCAP, 2005). FTZ or logistic park is focused on international trade, especially value-added logistic activities involving light manufacturing and processing. FTZ is normally outside of customs territory. The concept of FTZ is very similar to an EPZ.

An industrial zone is a platform for a manufacturing industry and provides industrial clusters. In general, this type of zone is not outside of customs territory (Ibid.) High-technology industrial development zones and Economic and technological development zones (ETDZs), such as the Shanghai Zhangjiang Hi-tech park located in Pudong New Area, is closely connected to industrial zone concept.

Basically, Korean government introduced FTZs in port hinterland areas such as Busan, Gwangyang, Incheon, and Incheon airport. This FTZs are logistics-oriented zones for international transhipment, distribution, procurement and entrepot trade (Ibid.). Logistics oriented FTZs or logistic parks are a cluster of logistic related businesses, e.g. CFS, storage, consolidation and distribution, and value added services (Ibid: 24p).

Considering narrow hinterland in the north harbour in Busan Port, Korean government provides hinterland itself and FTZ services in the new port area. The hinterland of Busan port is designated as FTZ by 'Law on the designation and operation of Free Trade Zone' by the minister for knowledge and economy (MLTM, 2008c). Combining provision of hinterland with FTZ, Korean government reduce taxes (the corporation tax, income tax, acquisition tax, registration tax, property tax, integrated land tax) or exempt/refund taxes (customs, value-added tax, tax on liquor, special excise tax, transportation tax) based on the law. There are two kinds of Free Trade Zone, i.e. industrial complex type, and airport, port & logistics one. In the FTZ, hinterland complex is supposed to be designated by the minister for Land, Transport, and Maritime Affairs (MLTM, 2008c). This hinterland complex is regarded as FTZ or port hinterland by the port authority.

In May 2007, there were 3 companies using Busan North harbour hinterland, and 22 companies operated in the hinterland of the new port area (MOMAF, 2007). From Table 3.9 to 3.11, present and future Busan port's FTZ, FEZ, and Hinterland of Busan New Port are illustrated.

Table 3.9 Port FTZ designation statistics in Busan

Designation Statistics (000 ㎡)	**Present FTZ**	**Future FTZ Area**
Yongdang Area (Including Pusan East Container Terminal, Yongdang LME storage)	1,123	72
Kamchun	277	770
Namhang	28	
Busan-Jinhae (New port Area)	4,077	
Total	5,505	842

Source: MLTM, 2008c

Table 3.10 Free Economic Zone of Busan port

	Free Economic Zone
Location	Busan city (Kangseo-Gu) and Jinhae city (Kyungnam province) 5 areas 16 zones
Size	104.8 ㎢
Development period	1-1 phase: by 2006 1-2 phase: by 2010 2 phase: by 2020
Estimated development Budget	7690 billon Korean won
Portfolio of Central gov. and Private capital	Central Government: 27.7% Local Government: 40% Private capital:32.3%

Source: Kor Cham, 2007

Table 3.11 Hinterland development plan of Busan New Port

	Total	2006	2007	2008	2009	2010	2011	2015
Cumulative Total	670	73	73	142	142	170	464	670
- Northern (10,000 ㎡)	170	73	-	69	-	28	-	-
-Southern (10,000 ㎡)	142	-	-	-	-	-	46	96
-Ungdong (10,000 ㎡)	358						248	110

Source: MLTM, 2008a

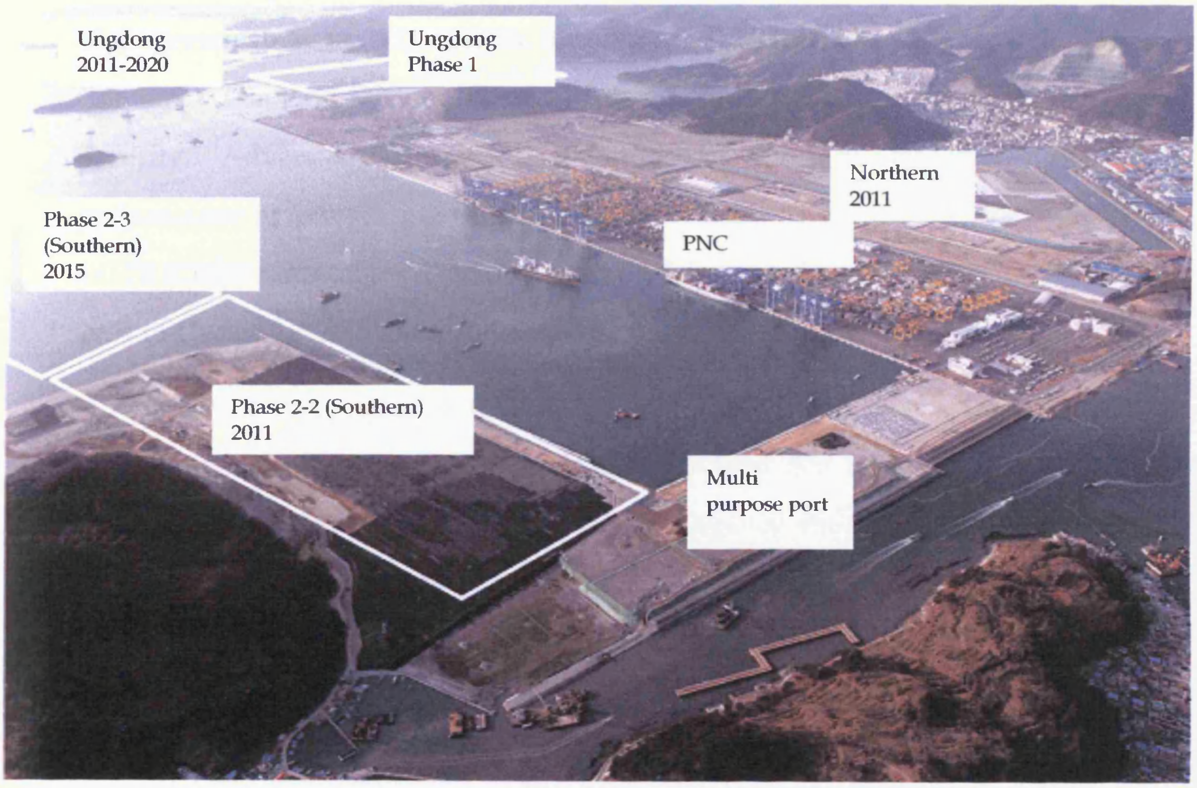


Figure 3.2 FTZ designation plan in Busan New port area (Source: MLTM, 2008d)

In China, Waigaoqiao FTZ with 10 ㎢ established in 1990. In the hinterland of Yangshan terminal, Luchao distripark (112 million square meters) was designated and has been operated from 2005 (Waigaoqiao Free Trade Zone Administration, 2005). The FTZ area is closely connected with Pudong new area, 533 million square meters, which includes Jinqiao Export Processing Zone, Lujianzui Finance & Trade Zone, and Zhangjang Hi-Tech Park (Pudong new district website, 2008).

Comparing Korea's FEZ (104.8 ㎢) and China's Pudong new area (522 ㎢), in terms of amount & numbers of foreign direct investment, Pudong new area is more successful than Korea's FEZ (KorCham, 2007). In 2005, Pudong new area induced 5.6 billion US dollars (1,734 investments) compared to 0.6billion US dollars of Korean FEZ (8 investments) (Ibid.).

Using information technology

Korean government implements the U-port plan containing Port Management Information system, Shipping & Port Internet Data Center, Global Container Tracking System, General Information Center on Maritime Safety & Security, Advanced Terminal Operating System, to enhance the port performance by integrating the information system (MOMAF, 2006b). Especially GCTS (Global Container Tracking System) has been developed from December 2004 to December 2007 based on RFID technology.

SP-IDC (Shipping & Port-Internet Data Center) integrates and shares all data from Korean government (MOMAF was emerged into Ministry of Land, Transport, and Martime Affaris in 2008), CIQ agency and terminal operators. To enhance efficiency of container terminals, Real Time Location System (RTLS) based YT Multi Cycle System (RYMS) is adopted (MLTM, 2009b). For the real time inspection of dangerous container cargoes using satellite, Ubiquitous Sensor Network (USN) based GCTS (Global Container Tracking System), u-DGMS will be applied at a testing level from 2009. Considering the difficulties to facilitate social infrastructure, U-port project aims to enhance service quality to acquire competitive advantage of Korean ports (Ibid.). Korean government plans to build infrastructure for RTLS/USN system in Busan port in 2009. From 2010 to 2011, this system is supposed to be applied to Busan New port and Gwangyang port, and Incheon port. After 2012, the system will be applied to all Korean ports and be exported to some overseas partner ports

Shanghai International Port Group Co. started the RFID (Radio Frequency Identification) system service on the Yangtze River, the Sino-US, and the SINO-

European route in May 2007 (TMCNET, 2007). Shanghai International Port Group began testing a new 'E-tag' system which enables PA to track containers electronically during international movement from Shanghai to Savannah in June 2008 (3PLwire, 2008). Therefore, it can be generally regarded that two ports are at a similar level in terms of IT.

Marketing

There was no specific marketing organization for Busan port before the establishment of Busan Port Authority in January 2004 (BPA, 2008a). In BPA, the marketing team with 6 members was organized. Korean government planned to implement target marketing for shippers using transhipment service, e.g. exporters or importers of textile, machine, plastic, electronic goods in Shanghai, Qingdao, Tianjin, Dalian, Ningbo in China, Hakata, Yokohama, Tomakomai, Nagoya, Kobe, and Tokyo (MOMAF, 2006a).

There is no clear sign of marketing for Shanghai port. It is posited that based on the explosive demand for the port users, there is not much room to develop marketing strategies.

3.4 Concluding Remarks

In this chapter, characteristics of two competing Asian container ports, i.e. Busan and Shanghai, including container routes involving two ports, physical resources, and SCM strategies of Busan and Shanghai port were discussed.

It should be noted that case study in this chapter is a trial of implementing triangulation under the limitation of as described in chapter five (See section 5.8).

As expounded earlier, Korean and Chinese government are competing to develop better physical resources in Busan and Shanghai port respectively. It is regarded that physical resources include cargo handling equipment, quays, berths, aprons, storage or yard capacity, and dredged channels and quays.

However, regarding 'support for hinterland and FTZ', Shanghai is posited as enjoying a better position. Shanghai is regarded to be more successful than Busan port in the aspect of 'expansion flexibility' which will be covered in chapter six (See section 6.4). Busan port is suffering from lack of hinterland compared to its' rivals. In section 6.4, the score of 'expansion flexibility' of Shanghai port (3.99) was higher than that of Busan port (3.61).

In general, Busan port is regarded as having more advanced or similar IT technologies and marketing compared to Shanghai port. As to 'using IT' strategy, questionnaire revealed that score for reduction of order management costs of Busan port (3.91) is higher than that of Shanghai port (3.40).

Regarding concession policy, Chinese government would seem to have more clear priorities in coordinating port in the rivalry. It should be noted that concession policy is closely connected with who is the major terminal operator in the port and the players' abilities. In Korea, so-called two port system including Busan and Gwangyang may impede the development of Busan port.

Chapter 4

Research Model

Having considered the discussions about basic theories, i.e. a combined view of Supply Chain Management Theory (SCMT) and Resource Based Theory (RBT) in the previous chapter two, the focus of this chapter is on the development of a conceptual model and integrated hypotheses regarding the relationships between variables in the model.

In making a decision on what to be included in the model, it is virtually impossible to incorporate all potential causal variables mentioned in the literature. Kline (2005) suggests that a researcher must rely on his/her judgement about the most crucial variables. Bearing this in mind, a simplified model will be provided.

Furthermore, it should be highlighted whether a data analysis technique can handle the suggested research model. Compared to SEM (less than 100 variables), in PLS, much larger/complex models with many latent variables and indicators in each block, e.g. 100 variables with 1,000 indicators can be dealt with (Chin, 1998) (See section 5.7.2). These factors will be considered when establishing a research model. PLS is sometimes described as a 'soft modelling' technique because its focus is on prediction, not on explanation, lack of well-understood relationships of the independents to the dependent is not critical in PLS (Garson, 2007). As a consequence, exploratory search for relationships between variables not supported fully by theories can be analysed using PLS method.

This chapter is organized into four parts. First of all, the definition of key concepts will be examined. Then, a conceptual model will be explicated. Next, research hypotheses will be developed. Finally, the research model is portrayed in this chapter based on Resource Based Theory (RBT) and Supply Chain Management Theory (SCMT).

4.1 Definitions of key concepts

Concepts can be defined as blocks to build theory and elucidate the research and its points (Bryman and Bell, 2003). Table 4.1 illustrates the definitions of concepts adopted in the current research based on the discussions in chapter two. Basically, there are five concepts, e.g. Port Authorities' Supply Chain Management (SCM) strategies, Port focused Supply Chains' (PSCs) SCM strategies, PSCs' resources, PSCs' Supply Chain Performance, and PSCs' competitive advantage.

Table 4.1 Definitions of key concepts

Concepts	Definitions	Sources
Supply Chain Management	The systemic, strategic coordination of the traditional business functions and the tactics across these functions within a particular company and across business within the supply chain, for the purpose of improving the long-term performance of the individual companies and the supply chain as a whole	Mentzer *et al.*, (2001)
Port focused Supply Chain (PSC)	Supply chain including all private players related to provision of services to the customers, i.e. shipping companies, freight forwarders, and shippers. (Public players, e.g. port authority, customs, and inspection services are not included)	The author
Port Authorities' SCM strategies	Port Authorities' systemic, strategic coordination of the traditional business functions and the tactics across these functions within a Port Authority and across business within the port focused supply chain, for the purpose of improving the long-term performance of the port supply chain as a whole *(e.g. privatisation, support for hinterland &FTZ, Using IT, Marketing)*	Adapted from Mentzer *et al.* (2001)
PSCs' SCM strategies	PSCs' systemic, strategic coordination of the traditional functions to improve the long-term performance of individual stevedoring and inland transport companies and the PSC as a whole *(e.g. vertical integration, relationship orientation)*	Adapted from Mentzer *et al.* (2001)
PSCs' resources	PSCs' entire set of the organisations' physical or intangible assets, attributes, information, knowledge, process and system *(e.g. relational resources, skills, physical resources)*	Adapted from Barney (1991)
PSCs' Supply Chain Performance (SCP)	Performance of a PSC as a whole *(e.g. reliability, cost, service effectiveness, flexibility)* (Shipping liner companies and Freight Forwarders as customers)	Adapted from Lai *et al.* (2004)
PSCs' Competitive Advantage	Uniquely held characteristics of the PSC which cannot be easily imitated by competitors without incurring non-competitive investment costs. (e.g. reliability, cost, service effectiveness, flexibility)	Adapted from Porter (1990)

Source: Tabulated by the author

4.2 Conceptual Model

As discussed in chapter two, RBT and SCMT are both basic theoretical bases for this research.

In terms of RBT, Grant's procedure for strategy formulation is adopted to explain relationships between firms' resources, capabilities, competitive advantage, and their strategy (Grant, 1991).

Capabilities are defined as 'complex bundles of individual skills, assets and accumulated knowledge exercised through organizational processes that enable firms to co-ordinate activities and make use of their resources (Olavarrieta and Ellinger, 1997: 563p).

Figure 4.1 provides the logical order of relationships between those 4 factors: strategy→resources→capabilities→competitive advantage. Taking into account the above logical sequence, SCM strategies can be combined into this diagram. As defined earlier in this chapter, the purpose of SCM is improving the long-term performance of individual companies and the supply chain as a whole. Mentzer *et al.* (2001) proposed that the implementation of SCM enhanced customer value and satisfaction, thereby leading to enhanced competitive advantage for the supply chain, as well as each member firm. As a result, it can be concluded that SCM strategies aim to acquire the enhanced performance or sustainable competitive advantage.

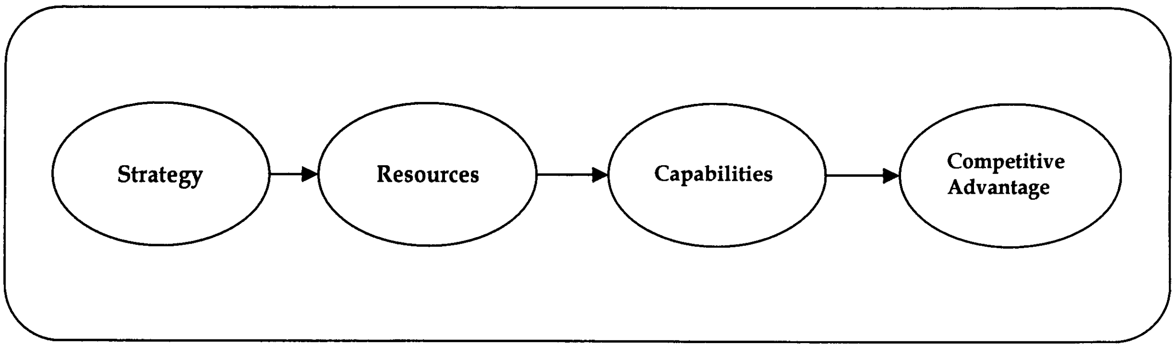


Figure 4.1 Grant's model for the strategy formulation (Source: Adopted from Grant, 1991: 115p)

Discussing the possibilities of harmonization between RBT and SCMT, furthermore, Cox and Hines (1997) stress the importance of the key resources in any supply chain to achieve sustainable business success (Cited in Robinson, 2002: 251p). Skjoett-Larsen (1999) recognizes RBT as one of the possible approaches towards SCM among compared three approaches, i.e. transaction cost analysis, network perspective, and Resource Based View. Therefore, using two concepts under the scheme of RBT can be justified. SCM strategies can be posited to be positively related to resources. In line with this discussion, the integrated diagram with RBT and SCMT can be drawn including Supply Chain Performance (SCP). As Lai *et al.* (2004: 321p) discussed, SCP can be posited as a mean to achieve competitive advantages. "*The challenge for firms in achieving a competitive edge is to manage their supply chain performance (SCP) to gain advantages in cost and service differentiation.*" In this case, SCP can be regarded as capabilities.

However, the work of the literature review regarding the measures of competitive advantage and SCP suggests that SCP can be viewed as a similar concept with competitive advantage. Table 4.2 shows the result of comparisons between studies on SCP and competitive advantage measures.

Table 4.2 Measures of SCP & competitive advantage

Measures	**Sources**	
	SCP	**Competitive Advantage**
Reliability (Quality)	-Supply Chain Council (1996) -Beamon (1999) -Gunasekaran *et al.* (2001) -Lai *et al.* (2002) -Carbone and De Martino (2003)	-Cerit (2000) -Scannell *et al.* (2000)
Cost (Cost Advantage)	-Stewart (1995) -Supply Chain Council (1996) -Beamon (1999) -Lai *et al.* (2002) -Carbone and De Martino (2003)	-Cerit (2000) -Scannell *et al.* (2000) -Panayides and Cullinane (2002) -Greenwald and Kahn (2005) -Lee (2005) -Lagoudis *et al.* (2006)
Service Effectiveness	-Bechtel and Jayaram (1997) -Beamon (1999) -Gunasekaran *et al.* (2001) -Lai *et al.* (2002)	-Cerit (2000) -Panaydies and Cullinane (2002) -Greenwald and Kahn (2005) -Hult *et al.* (2005) -Lagoudis *et al.* (2006)
Flexibility	-Stewart (1995) -Supply Chain Council (1996) -Gunasekaran *et al.* (2001) -Paixão and Marlow (2003)	-Scannell et al. (2000) -Lee (2005)
Innovation		-Scanell *et al.* (2000) -Lee (2005)

Source: Tabulated by the author

For the measures of SCP or competitive advantage, there are common factors including reliability (Quality), cost, service effectiveness, and flexibility. Some factors are listed not common between SCP and competitive advantage including innovation, economic performance (return on investment, return on assets, return on equity), cycle time, and competitive position in market (market share, sales growth rate compared to competitors, and sales growth rate compared to market growth). Considering the similarity of measures between two constructs, it is decided to use SCP as competitive advantage in the context of supply chain.

With regard to the SCM strategy, the construct can be divided into two concepts: SCM strategy performed by PA and by PSC (Port focused Supply Chain) (see section 2.7.2.1).

Summing up the discussions, the current study aims to examine the relationships between four variables, i.e. PAs' SCM strategy, PSCs' SCM strategy, PSCs' resources, and PSCs' SCP. The Conceptual model amongst these variables is illustrated in Figure 4.2.

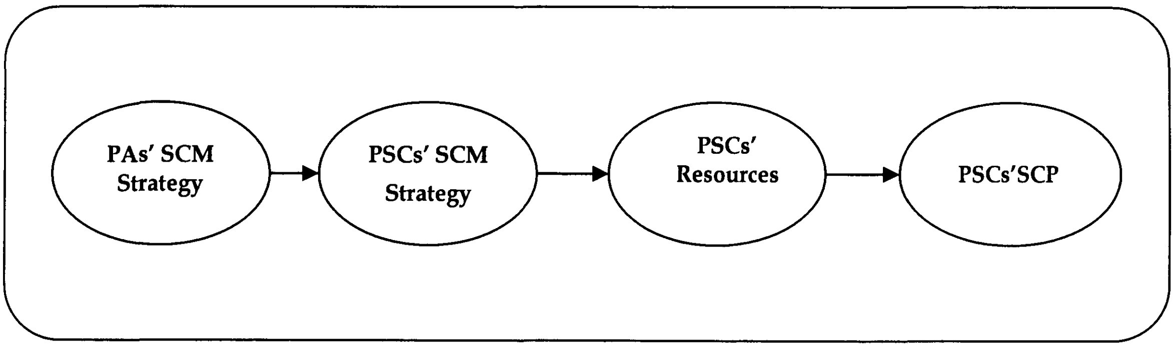


Figure 4.2 Basic conceptual model for the present study (Source: Adopted from Grant, 1991: 115p and Mentzer et al., 2001: 12p)

4.3 Hypotheses

As illustrated in the basic conceptual model (Figure 4.2), the aim of the current study is to examine the relationships between four concepts, i.e. PAs' SCM strategies, PSCs' SCM strategies, PSCs' resources, and PSCs' SCP. The assumed relationships amongst these variables are hypothesized in Table 4.3.

Recognizing the basic model, it is stipulated that the detailed relationships should be described. For example, there can be several strategies employed by PA's for SCM in a port, e.g. 'privatisation (including concession policy)', 'support for hinterland & FTZ', 'using IT', and 'marketing' as discussed in chapter two (See section 2.7.1).

There are PSCs' SCM strategies affecting PSCs' resources, e.g. 'vertical integration', 'relationship orientation', as investigated in chapter two (See section 2.3.2). With regard to the resources, it is noted that there are several resources that can be used in this model such as 'skills (or technologies)', 'relational resources', and 'physical resources' (See section 2.7.3).

Through the literature review, it is recognized that PSCs' SCP can be measured by several sub-constructs like 'reliability', 'flexibility', 'service effectiveness', and 'costs' etc. (See section 2.7.4).

Bearing the above detailed sub-constructs in mind, in this section, detailed components of basic constructs will be provided along with the discussions in chapter 2. Then, specific relationships among these constructs will be revealed by the literature review.

Table 4.3 Basic hypotheses

Hypotheses	Abbreviation
H_1: Port Authorities' SCM strategies have a positive influence on PSCs' SCM strategies.	PAs' SCM → PSCs' SCM
H_2: Port focused Supply Chain's SCM strategies have a positive influence on PSCs' resources.	PSCs' SCM → PSCs' RES
H_3: 'PSCs' Resources' has a positive influence on PSCs' Supply Chain Performance (SCP).	PSCs' RES → PSCs' SCP

4.3.1 Relationships between PAs' SCM and PSCs' SCM

As discussed in chapter two, port authorities' SCM strategies are listed as 'privatisation', 'support for hinterland & FTZ', 'using IT', and 'marketing'. To achieve objectives, e.g. contribution to cost minimization for logistics chain, maximization of cargo handling, and maximization of profit, port authorities utilize the tools including maritime access, land (hinterland) and concession policy and socio-economic negotiation (Heaver *et al.*, 2000).

'Privatisation' → PSCs' SCM strategies

'Privatisation' is one of the most important strategies of PA about expediting integration in PSCs. As Panayides (2006b) strongly suggested, concept of integration, i.e. physical (intermodal), economic/strategic (vertical integration, governance structure) or organisational (relational, people and process integration across organisations) integration, is at the centre of maritime logistics. Privatisation, especially concession policy, is the most important prerequisite for vertical integration. A dedicated terminal is close to 'vertical integration' issues from carrier strategy (Cariou, 2001). 'Vertical integration' is the transformation of terminal operators into logistics organizations offering warehousing, distribution, and low end value-added logistical services (Notteboom, 2002). Along with above organisational integration by Panayides (2006b), Hirst (2000; Cited in Everett, 2003) points out that corporatized ports are far more responsive to customer needs and are prepared to work more closely with their customers to obtain better transport solutions. This implies the relationship between 'privatisation' and 'relationship orientation'.

Because PSC concept was developed by author, studies on relationship between port privatisation and ports' SCM strategies will be discussed here. However, there are few empirical studies to prove the positive relationships between 'port privatisation', and ports' SCM strategies. This relationship can be presumed from the studies regarding relationships between 'privatisation' and key performance (See section 3.3.2: Table 2.6.). Baird (2000: 2002) and Cullinane and Song (2002) suggests that 'port privatisation' is one of options to enhance the port performance. Turner (2000), Cullinane *et al.* (2005b) failed to prove the positive relationships between 'privatisation' and key performance.

'Using IT' → PSCs' SCM strategies

Evangelista (2005) recognizes the crucial role of IT as a key integration element. Heaver (2001) claimed that ocean carriers' vertical integration into logistics can be enhanced by 'using IT' strategy and the greater importance of supply chain management. Kia *et al.* (2000) stressed that Information technology (or electronic commerce) enables the integration of the tighter links in the supply chain. Stough (2001) also maintained that technologies such as barcodes, RFID, and GPS contributed to an integrated approach to logistics management and drove change in SCM. In line with these views, Banister and Stead (2004) proposed that 'using IT' has a positive influence on the necessity of intermodal perspective, sustainable supply chains, and impact of technology and flexibility (See Table 2.7).

Thus, the positive influence of 'using IT' into 'vertical integration' appears to be posited. All members of a PSC in terms of landside port supply chain) can be closely integrated by using real-time information and e-Business systems (Robinson, 2006).

'Marketing' → PSCs' SCM strategies

Pando *et al.* (2005) highlight joint marketing at commercial ports as one of decisive factors for the future of commercial ports. Recognizing marketing as a broad concept that is a kind of market orientation, Min and Mentzer (2000) propose that marketing concept is a necessary component for implementing SCM, i.e. market information, information sharing, close long-term relationships, and inter-firm cooperation. This implies that 'marketing' is positively influencing on PSCs' SCM strategies like 'relationship orientation'.

Support for hinterland & FTZ → PSCs' SCM strategies

As discussed in chapter two (See section 2.7.1.3), 'support for hinterland and FTZ' is closely connected to the demand for the SCM, e.g. the information activities and value-added services like light assembly and processing, procurement of raw materials and parts, consolidation, testing, and packaging (UNESCAP, 2005). Consequently, it seems to be posited that the integration to achieve competitive advantage is positively influenced by PAs' support for hinterland and FTZ. The core part of the FTZ policy is providing spaces for SCM activities (Ibid.).

< Table 4.4 Hypothesized relationships between PAs' SCM and PSCs' SCM >

Hypotheses
H_1: PAs' SCM strategies have a positive influence on PSCs' SCM strategies.
$H_{1\text{-}1}$: Privatisation → Vertical Integration
$H_{1\text{-}2}$: Using IT → Vertical Integration
$H_{1\text{-}3}$: Marketing → Vertical Integration
$H_{1\text{-}4}$: Support for Hinterland & FTZ → Vertical Integration
$H_{1\text{-}5}$: Privatisation → Relationship Orientation
$H_{1\text{-}6}$: Using IT → Relationship Orientation
$H_{1\text{-}7}$: Marketing → Relationship Orientation
$H_{1\text{-}8}$: Support for Hinterland & FTZ → Relationship Orientation

4.3.2 Relationships between PSCs' SCM and 'Resources'

Based on the conceptual model, it is posited that SCM strategies are able to enhance PSCs' resources (Mentzer *et al.*, 2001). Heaver's (2001) framework for the strategies of liner shipping companies can be employed in the case of terminal operators. Further detailed relationships are discussed in this section.

It is stipulated that resource-based competitive advantages gained through 'human resources', 'relational resources' (trust, commitment), and 'organizational resources' (brands, routines, quality control system) are likely sustainable (Morgan and Hunt, 1999). However, competitive advantages through 'financial resources', 'legal resources', and 'physical resources' are unlikely sustainable (Ibid). Based on the above discussion, the relationships among PSCs' SCM, 'relational resources' and 'skills' will be posited.

The detailed relationships between PSCs' SCM strategies and PSCs' resources are illustrated in Table 4.5.

Table 4.5 Hypothesized relationships between PSCs' SCM and resources

Hypotheses
H_2: PSCs' SCM strategies have a positive influence on PSCs' resources.
$H_{2\text{-}1}$: Vertical Integration → Relational Resources
$H_{2\text{-}2}$: Relationship Orientation → Relational Resources
$H_{2\text{-}3}$: Vertical Integration → Technologies (or Skills)
$H_{2\text{-}4}$: Relationship Orientation → Technolgies (or Skills)
$H_{2\text{-}5}$: Vertical Integration → Physical Resources
$H_{2\text{-}6}$: Relationship Orientation → Physical Resources

'Vertical Integration' → 'PSCs' Resources'

Notteboom (2002) claims that terminal operator's vertical integration or structural co-ordination with other market players can be answers to the trend towards integrated logistics. As Araujo *et al.* (2005) maintain that vertical integration optimizes the terminal and port function within logistics networks. This implies that 'vertical integration' seems to be positively related to relational resources.

As Panayides and Cullinane (2002) insist the immense relevance of empirical assessment of vertical integration by Porter's framework as well as RBT, the relationship between 'vertical integration' and 'resources' (Relational Resources, Skills) are generally hypothesized based on the conceptual model. Table 2.8 in chapter two illustrates that many conceptual (or descriptive) studies, e.g. Heaver (2001), Notteboom (2004), Gouvernal and Daydou (2005), address the clear trend towards vertical integration of liners or terminal operators and their close relationships with enhancing performance. Based on the RBT and SCMT, positive influences of 'vertical integration' on PSCs' SCP through 'PSCs' resources' are hypothesized.

'Relationship Orientation' → 'PSCs' Resources'

'Relational resources' are positively influenced by 'relationship orientation'. Some empirical studies support that 'relationship orientation', e.g. information sharing, long-term contracts, sharing value with customers, customized service, and customer relationship management, positively influence relational resources, e.g. trust, commitment (Nielson, 1998; Martin and Grbac, 2003; Hult *et al.*, 2005).

The positive relationship between 'relationship orientation' and skills (or technologies) is hypothesized based on the general Resource-Based theory.

Marlow and Paixão (2003) stressed the importance of the 'human resources' including 'skills' to respond to volatile demand caused by market uncertainty, time sensitive customers, avoiding operational and logistical constraints, or changes in trade flows given the reliability of the system. They (Ibid.) also emphasized that the port's development of relationships with other players (e.g. inland terminals) is expected to bring the development of trust and long-term relationships. By implementing 'relationship orientation', the effort by PSC to develop 'skills' may be improved by identifying which best practices should be adopted and in which processes they should implement those best practices to drive agile ports to become more agile.

It is maintained that co-operation with customers enable to create tailored services that are more difficult to imitate (Jensen, 2003). This can be supporting that 'relationship orientation' is positively related to service design technology.

Based on the general RBT, a positive relationship between 'relationship orientation' and 'physical resources' can be hypothesized. Considering the definition of SCM that the research has taken, it is assumed that to satisfy their users, PSCs had tendency to provide better 'physical resources' including modern IT system, more sophisticated cargo handling equipment, and more spacious storage etc.

4.3.3 Relationships between 'PSCs' resources' and SCP

Based on the combined view of RBT & SCMT (See figure 4.2), it is considered that PSCs' resources have a positive influence on PSCs' SCP (or competitive advantage). Table 4.6 stipulates the detailed hypothesized relationships between PSCs' resources and PSCs' SCP.

Table 4.6 Hypothesized relationships between 'PSCs' resources' and SCP

Hypotheses
H_3: 'PSCs' Resources' has a positive influence on PSCs' Supply Chain Performance (SCP).
$H_{3\text{-}1}$: Relational Resources → Reliability
$H_{3\text{-}2}$: Physical Resources → Reliability
$H_{3\text{-}3}$: Skills (or Technologies) → Reliability
$H_{3\text{-}4}$: Relational Resources → Costs
$H_{3\text{-}5}$: Physical Resources → Costs
$H_{3\text{-}6}$: Skills (or Technologies) → Costs
$H_{3\text{-}7}$: Relational Resources → Service Effectiveness
$H_{3\text{-}8}$: Physical Resources → Service Effectiveness
$H_{3\text{-}9}$: Skills (or Technologies) → Service Effectiveness
$H_{3\text{-}10}$: Relational Resources → Flexibility
$H_{3\text{-}11}$: Physical Resources → Flexibility
$H_{3\text{-}12}$: Skills (or Technologies) → Flexibility

'Relational Resources' → PSCs' SCP

Tan *et al.* (1999) supported the positive relationships between 'relationship orientation' and performance including market share and profitability. As discussed in chapter two, main researchers on RBT, i.e. Barney (1991), Grant (1991), and Wernerfelt (1984) recognized the relationships with between marketing specific resources such as customer and distribution relationships in gaining and sustaining competitive advantage (Cited in Srivastava *et al.*, 2001).

'Physical Resources' → PSCs' SCP

General RBT assumes positive relationships between physical resources and PSCs' SCP. As discussed in section 2.5.1, Barney suggested that valuable, rare, inimitable, non-substitutable resources can have positive influence on competitive advantages or supply chain performance.

'Skills' → PSCs' SCP

Stressing the hard-to-imitate characteristics of human resources, Marlow and Paixão (2003) stressed the importance of investment on human resources as a core competency. Knowledge and skills are described to have a positive influence on agility[1]. Skills or knowledge can help a firm create competitive advantage (Mentzer *et al.*, 2004; Wright *et al.*, 2001).

4.3.4 Relationships between PAs' SCM and PSCs' SCP

It has already been discussed the whole logical procedure of relationship, i.e. PAs' SCM strategies→PSCs' SCM strategies → PSCs' resources → PSCs' SCP. Furthermore, detailed relationships, i.e. PAs' SCM strateges →PSCs' SCM strategies; PSCs' SCM strategies→PSCs' resources; PSCs' resources→PSCs' SCP, are hypothesized in the above section.

For the simplicity of the model, direct relationships between PAs' SCM and PSCs' SCP is withdrawn from the research model. However, it is also important to investigate the academic background of this relationship for a big picture.

'Privatisation' → PSCs' SCP

Midoro *et al.* (2005) stressed 'dedicated terminals' as a strategy for cutting costs and controlling integrated transport chains.

As discussed earlier (See section 2.7.1.2 & Table 2.6), there are not clear pictures regarding the evidence that 'privatisation' has a positive influence on the performance of a port. Privatisation in a port is regarded as one of components to improve the performance of the port (Baird, 2000; Cullinane and Song, 2002). However, in some empirical studies using simulation and Data

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[1] Agility is the concept that including flexibility and the responsiveness to rapid change of customer demand (Marlow and Paixão, 2003). Considering flexibility and service effectiveness are components of SCP, agility can be posited as a similar concept to SCP.

Envelopment Analysis, the hypothesized relationship between 'privatisation' and 'improved efficiency' is not supported (Turner, 2000; Cullinane *et al.*, 2005b).

Applying a frontier production function, Cullinane *et al.* (2002) describe a certain level of relationship between the degree of private sector participation and the level of productive efficiency in Asian ports.

In a nutshell, not many empirical studies support privatisation's positive influence on enhancing of port performance.

'Using IT' → PSCs' SCP

The importance of using information technology in SCM to achieve reduced costs, increased efficiency, and integration is stipulated by many authors (Kia *et al.*, 2000; Lee *et al.*, 2000; Stough, 2001; Evangelista, 2005; Robinson, 2006).

Using simulation method, Kia *et al.* (2000) find that using information technology could reduce crane service time, ship time, straddle service time, time in human resources, and occupancy of stacking area. Thus, in general sense, a relationship between 'using IT' and PSCs' SCP can be hypothesized.

Marketing → PSCs' SCP

Panayides and Cullinane (2002) maintain that marketing strategy is pivotal to accomplish competitive advantage. Min and Mentzer (2000) provide an iterative model of marketing concept, a market orientation, relationship marketing, supply chain management, and differential advantage.

As discussed earlier (See section 2.7.1.5), Cahoon (2007) contends that marketing communications (advertising, publicity, public relations, personal selling, and sales promotion) for seaports are salient for ports' survival and growth. Therefore, in general sense, a positive relationship between 'marketing' and PSCs' SCP can be hypothesized.

'Support for hinterland and FTZ' → PSCs' SCP

Because the core part of the hinterland and FTZ policy is providing spaces for SCM activities (UNESCAP, 2005), the positive relationship between 'support for hinterland & FTZ' and PSCs' SCP can be posited. As discussed in chapter two (See section, 2.7.1.3), Van der Horst and De Langen (2007) claim that attracting port users is only possible when the port and their hinterland transport network are efficient and effective. Notteboom and Rodrigue (2005) stipulate the necessity of PAs' engagement in SCM activities, e.g. development of inland freight distribution, information systems, and intermodality, to achieve competitive advantage.

4.3.5 Relationships between PSCs' SCM and SCP

From the basic conceptual model, positive relationships between PSCs' SCM and SCP are generally posited (See figure 4.2). Theoretical background for the relationship between two major PSCs' SCM strategies, e.g. 'vertical integration' and 'relationship orientation', and PSCs' SCP will be found as below.

'Vertical Integration' → PSCs' SCP

Heaver (2001) maintained that one of the benefits of liners' vertical integration strategy is opportunities for cost reduction and shared expertise. This logic can be employed in the case of terminal operators and PSCs. Panayides (2006b) stressed that integration can enhance agility, which involves being proactive along supply chains, facilitation of intermodal integration, as well as organisational integration and partnership.

Panayides and So (2005) asserted that integration between logistics and supply chain partners has been widely advocated as a prerequisite for the improvement of operational performance. Bichou and Gray (2004) supported this argument by stressing the integration role of ports along three channels: 1) trade channels, 2) Supply Channels (shippers), and 3) logistics channels (ship owners, intermediaries, landside transport).

The studies about potential advantages of vertically integrated intermodal transport structure are concisely reviewed by Panayides and Cullinane (Ibid.), i.e. increased market share, the facilitation of management and co-ordination, low cost structure and higher profits, greater routeing flexibility, shared creativity along logistical process, for shippers, improvement in service quality, ease in transacting business dealings, simplified claims settlement, filing, tracing of shipment and paperwork needed for shipment, and increased control over shipment.

From the above studies, the following possible relationships can be induced from vertical integration to 1) market share, 2) co-ordination, 3) low cost, and 4) flexibility for shipping liners.

Empirical studies on the relationship between vertical integration of ports and SCP are scarce.

'Relationship Orientation' → PSCs' SCP

SCM creates competitive advantage by providing efficiencies and better customer value produced through reducing costs and increasing responsiveness to customers' needs (Martin and Grbac, 2003).

Panayides and So (2005) urge that their findings suggest that relationship marketing was extremely beneficial in the context of supply chains. They maintain that relationship orientation increases the logistics service quality (LSQ), and LSQ is the predictor of LSP performance. Their LSQ concept is including reliability, time responsiveness, accuracy in documentation, accuracy in information, service fulfillment, problem solving ability, and empathy. Therefore, LSQ can be regarded as SCP in this research.

Stressing the importance of the 'lean port network', Marlow and Paixão (2003) claim that the port's development of relationships with other players (e.g. inland terminals) is expected to bring a minimisation of costs by responding to demands caused by market uncertainty, the development of trust and long-term relationships and reliable services. Panayides and So (2005) maintained the statistically significant relationship between 'relationship orientation' and 'logistics service quality', and LSP performance. Despite the problem of using formative measures in SEM, the implication of this study can be beneficial for the research.

In terms of port supply chain, Lee *et al.* (2003) argue that the information sharing strategy with the high level of information sharing between ship operator and terminal operator increases the number of vessels to be serviced by adopting simulation.

4.4 Final Model and Concluding Remarks

Based on the conceptual research model, further detailed hypothesized relationships have been discussed in this chapter. Combining Resource-based theory and Supply Chain Management view, figure 4.3 illustrates the hypothesized relationships among 4 variables (13 detailed variables), i.e. PAs' SCM strategies, PSCs' SCM strategies, PSCs' resources, and PSCs' SCP.

It is pointed out that there were not many empirical studies regarding the model (Panayides and Cullinane, 2002) which are based on RBT and SCMT. To tackle this matter, data analysis technique, PLS (Partial Least Squares approach to Structural Equation Modelling) is adopted to handle a relatively new theoretical model with a large number of indicators when measures are not well formed (Chin, 1998a). The issues with PLS will be discussed in chapter five.

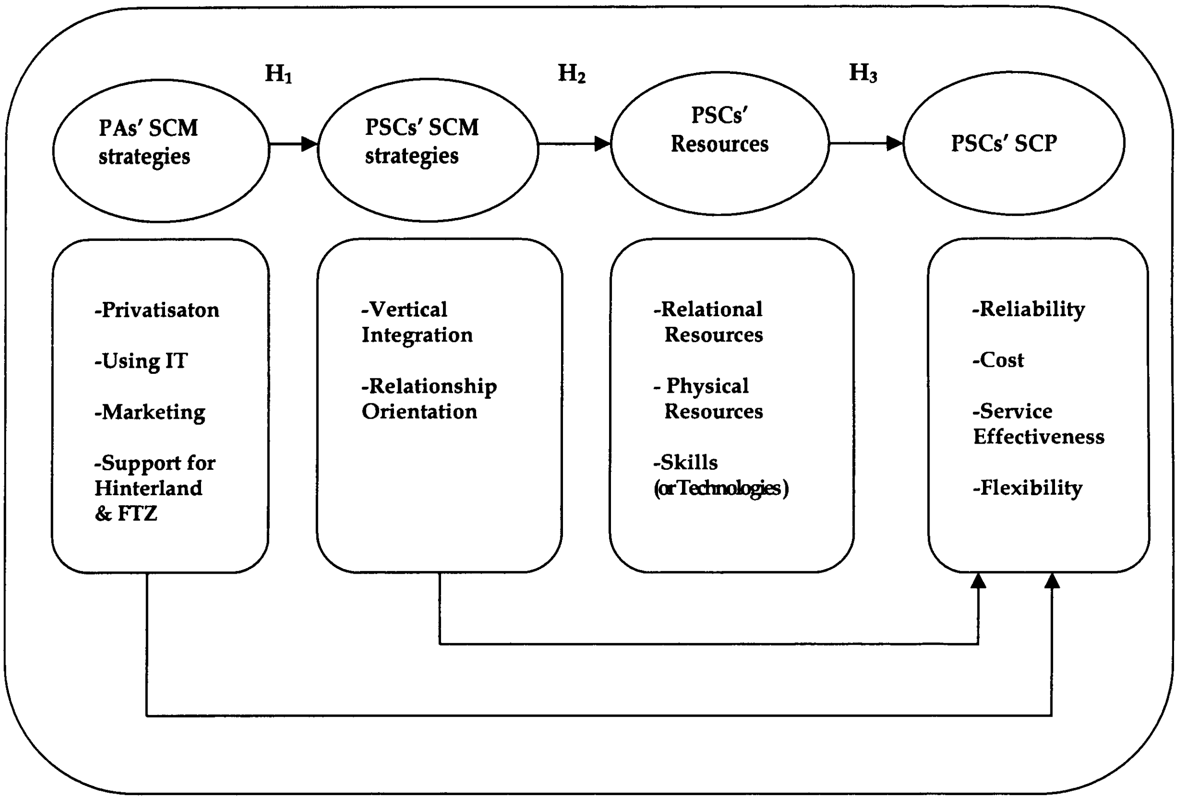

Figure 4.3 Model for the current study (Source: Author)

Chapter 5
Research Design & Methodology

Considering the theoretical bases and hypotheses for this research provided by the previous chapters, this chapter focuses on building a framework for the actual collection and the analysis of data.

This chapter is basically organized into five parts (See figure 5.1). Research design literature will be briefly covered. Second, Saunders *et al.*'s (2000) research process approach will be taken to systematically describe the research design of the current study (See figure 5.2.). The third section deals with actual data collection, i.e. questionnaire design using Churchill and Iacobucci's (2002) nine-step questionnaire development process and sampling design. Then, validity and reliability issues will be discussed. Finally, Partial Least Squares approach to Structural Equation Modelling (PLS) will be introduced as the main data analysis technique in this research.

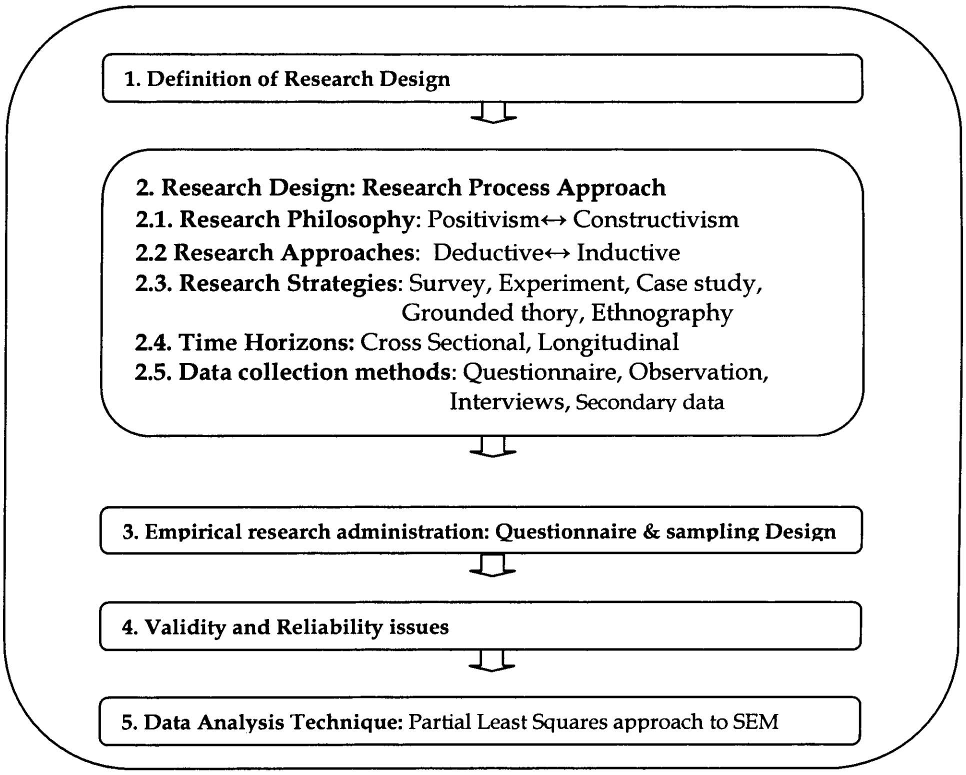

Figure 5.1 Framework for research design and methodology (Source : Adapted from Saunders *et al.*, 2000: 85p)

5.1 Research Design

Ghauri and Grønhaug (2002: 47p) define that research design is 'overall plan for relating the conceptual research problem to relevant and practicable empirical research'. In contrast to research design, a research method is simply a technique for collecting data (Bryman and Bell, 2003). Through literature review, researchers can get the better clarification of research topic. Then, hypotheses (or assumptions), concepts, and models follow in more systematic way. The conceptual research is connected through research design to empirical research including data collection, analysis, interpretations, and conclusions. Robson (1993) supported the perspective described above, by insisting the association of research design with implementing projects.

Therefore, to fulfill empirical research successfully, it is salient to make proper decisions about the priority given to a range of dimensions of the research process (See figure 5.2).

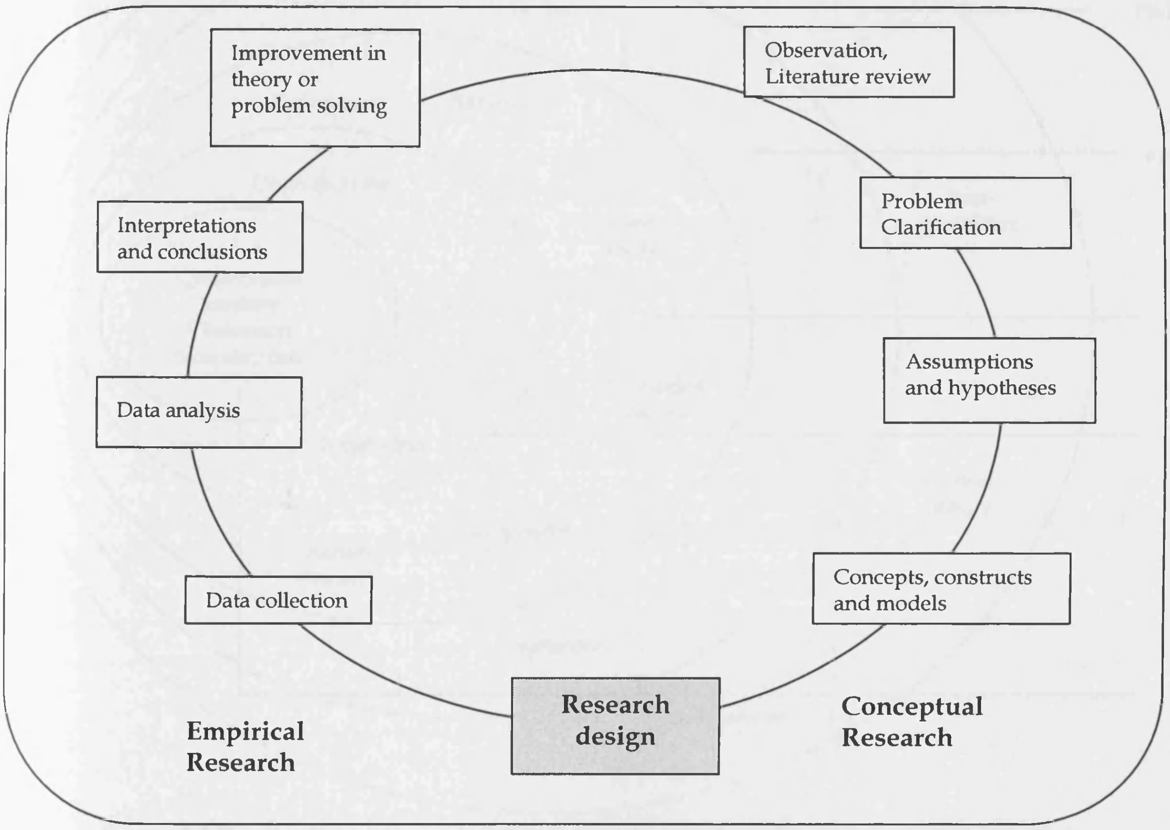

Figure 5.2 The wheel of research (Source: Ghauri and Grønhaug, 2002: 17p)

5.2 Research Process Approach

Saunders *et al.* (2000) provide a research process onion for the research design. Figure 5.3 illustrates the five categories, e.g. research philosophy, research approaches, research strategies, time horizons, and data collection methods.

Research philosophy is concerned with distinction science from non-science, procedures should be followed, and conditions for a scientific explanation (Smith, 2000). Research approach is a choice between testing and building theory. Research strategy is a general plan of answering the research questions, e.g. survey, case study etc. Time horizon is related to a snapshot or diary approach. Data collection method is about a choosing way of data gathering.

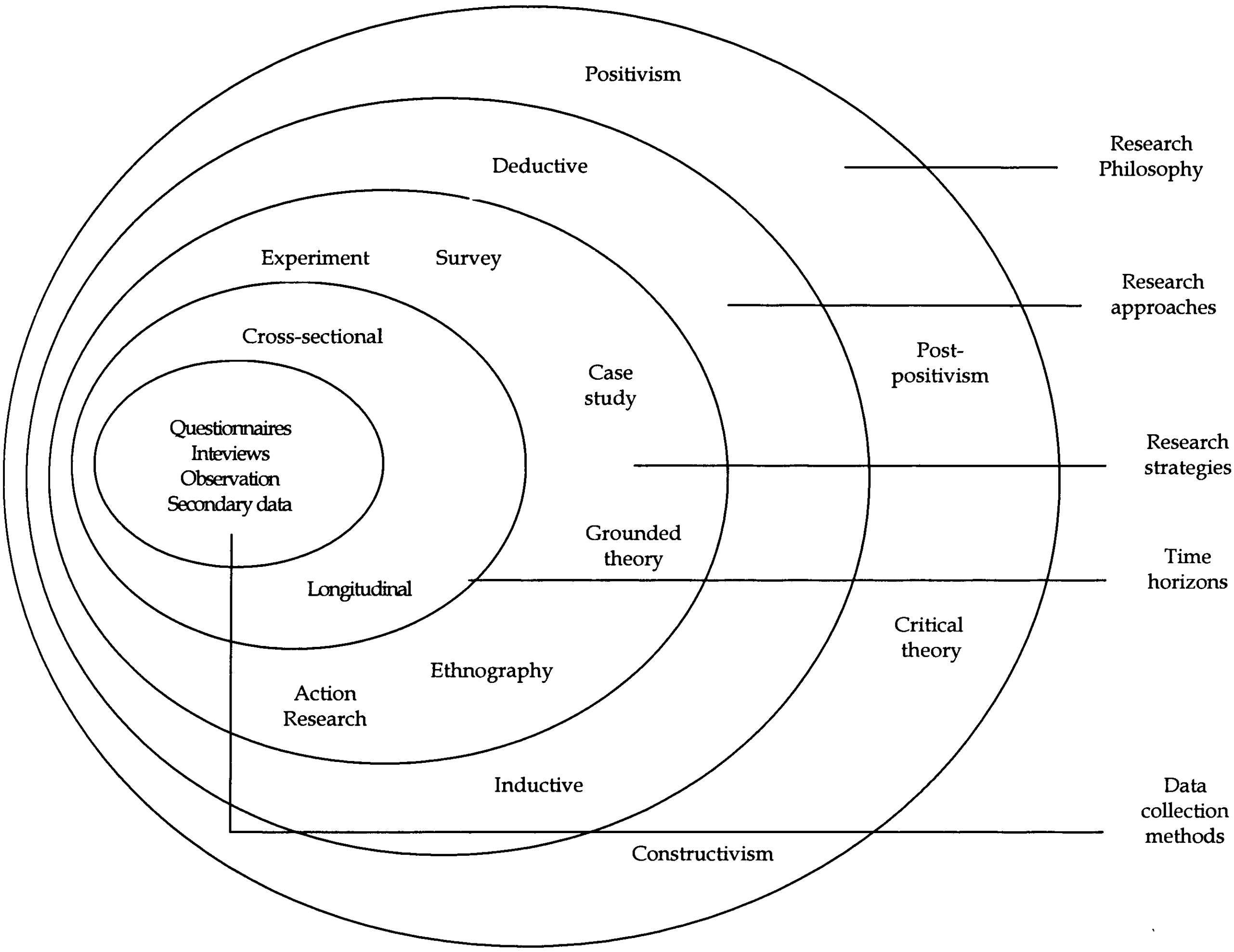

Figure 5.3 Research process onion (Source: Adapted from Saunders *et al.*, 2000: 85p)

5.2.1 Research Philosophy

The philosophy in social science research is important owing to uncertainty of social sciences compared with natural sciences (Sayer, 1992). Benton and Craib (2001: 3p) elucidated the point through providing questions about social science research as follows;

1) "Can there be objective knowledge of society when the investigators as well as the subject matter are all part of society?"

2) "What are the proper methods of investigation of social processes? "

3) "What are we doing when we attempt to study human social life in a systematic way?"

To answer the questions mentioned above, the discussions can be organized into three parts regarding academic discipline of philosophy: epistemology, ontology, and methodology. The discussions will be based on four major axiomatic paradigms, i.e. positivism, postpositivism, critical theory, and constructivism (Lincoln and Guba, 2003).

Table 5.1 Comparisons between major scientific paradigms

Item	**Positivism**	**Postpositivism**	**Critical Theory**	**Constructivism**
Ontology (theory of existence)	naïve realism -"real" reality but apprehendable	critical realism -"real" reality but only imperfectly and probabilistically apprehendable	historical realism -virtual reality shaped by social, political, cultural, economic, ethnic and gender values; crystallized over time	relativism -local and specific constructed realities
Epistemology (theory of knowledge)	dualists/objectivist; findings true	modified dualist/objectivist; critical tradition/community; findings probably true	transactional/subjectivist; value-mediated findings	transactional/ subjectivist; Created findings
Methodology	experimental/manipulative/survey; Verification of hypotheses; chiefly **quantitative** methods	modified experimental/manipulative: Critical multiplism; Falsification of hypotheses; **may include qualitative** methods	dialogic/dialectical	hermeneutical/dia-lectical
Inquiry aim	explanation	prediction and control	critique and transformation; restitution and emancipation	understanding; reconstruction
Nature of Knowledge	verified hypotheses established as facts or laws	nonfalsified hypotheses that are probable facts or laws	structural/historical insights	individual reconstructions coalescing around consensus
Philosophers	Comte Hume	K. Popper Thomas Kuhn	Habermas Frankfurt school	Foucault

Source: Adapted from: Lincoln and Guba, 2003: 256-7p; Healy and Perry, 2000: 119p

Epistemology

Epistemology is defined as *"philosophical enquiry into the nature and scope of human knowledge, concerned with distinguishing knowledge from belief, prejudice and so on', in a nutshell, theory of knowledge"* (Benton and Craib, 2001: 181p).

Positivists assert that hypotheses can be tested, thereby allowing explanations of laws to be assessed (Bryman and Bell, 2003). Therefore, Positivism is regarded as *"an epistemological position that advocates the application of the methods of the natural sciences to the study of social reality and beyond"* (Ibid. 14p).

Postpositivists, e.g. K. Popper and T. Kuhn, are assumed as modified dualists and objectivist in their epistemological position (Lincoln and Guba, 2003: 256p). Dualism is *"a tendency to see divide the world into binary opposites: reason and emotion, culture and nature, body and mind and so on"* (Benton and Craib, 2001: 180p).

Critical theory proposed by Frankfurt School and Habermas concentrated on the meaning that individuals give to their actions (Benton and Craib, 2001 115p). The culture, the form of life, the tradition, etc. define what is true, what exists. Different traditions delineate different realities, which is called value-mediated findings.

Constructivism assumes transactional/subjectivist epistemological position. Max Weber emphasizes that 'the task of causal explanation is undertaken with reference to the interpretive understanding of social action rather than to external forces that have no meaning for those involved in that social action' (Bryman and Bell, 2003: 16p).

Ontology

Ontology is the answer to the question 'what kinds of things are there in the world?', namely, concerned with the theory of what exists (Sayer, 1992: 155p).

Positivism posits that 'real' reality can be apprehended, that is objectivism. Objectivism (Bryman and Bell, 2003) is an ontological position that asserts that social phenomena and their meanings have an existence that is independent of social actors (Lincoln and Guba, 2003). It implies that social phenomena and the categories that we use in everyday discourse have an existence that is independent or separate from actors.

Assuming 'critical realism' as it's ontology, postpositivism argues that there is a world independent of our beliefs about it, and that both natural and social sciences are concerned with investigating underlying structures (Benton and Craib, 2001).

Critical theory, e.g. Habermas and Frankfurt school, presumes that virtual reality is shaped by social, political, cultural, economic, and ethnic values.

Constructivism provides relativism as its ontological basis which means there are only local and specific constructed realities. It posits that there is only a specific version of social reality rather than one can be regarded as definitive (Bryman and Bell, 2003).

Methodology

Figure 5.4 illustrates a representative range of methodologies and their related paradigms.

Positivism mainly relies on quantitative methods, e.g. experimental/manipulative methods (Lincoln and Guba, 2003). In business studies, survey and multivariate techniques can be regarded based on positivism (Healy and Perry, 2000).

Postpositivism adopts modified experimental/manipulative methods and may include qualitative methods. Survey and Structural Equation Modelling (or PLS) can be regarded based on postpositivism (Ibid.).

Methodology of Critical theory is dialectic, a way of thinking commonly associated with Hegel and Marx. Instrumental case study, In-depth interviewing, focus groups, and critical ethnography studies can be recognized as a methodology from critical theory (Benton and Craib, 2001).

Constructivism adopts hermeneutical or dialectical methodology.

Hermeneutics is a science of interpretation and understanding, originating in the interpretation of sacred texts (Ibid.). In business studies, interpretive case study, holistic ethnography and grounded theory can be categorized as the methods of constructivism (Ibid.).

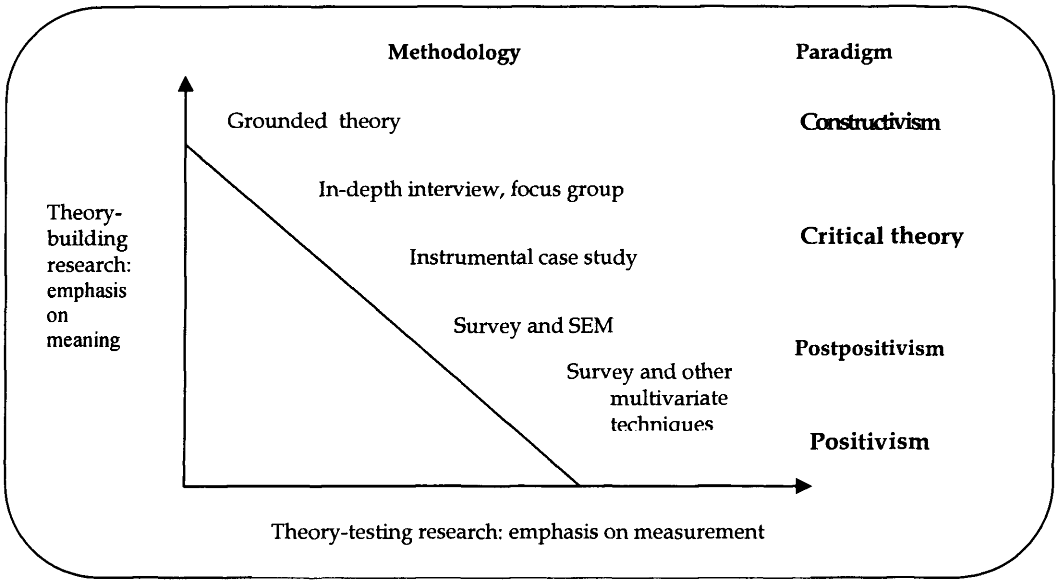

Figure 5.4 Methodologies & paradigms (Source: Healy & Perry 2000: 121p).

The position of the present study

The present study aims to find out relationships among ports' SCM strategies, Resources, and SCP and provides a conceptual model that is applicable to explain and predict port users' Post focused Supply Chains (PSCs) selection.

Considering the research aims, this research is deemed to be placed mainly on postpositivism.

The ontological position of the current research is based on postpositivism (or critical realism) that a 'real' world exists only imperfectly apprehensible (Healy and Perry, 2000: 118p). Causal impacts cannot be fixed and only are contingent on their environment (Ibid.). Combining positivism and constructivism, Cupchik (2001) maintained 'contructivist realism' as an alternative ontology (2001). Constructivist realism posits that social phenomena exist in communities quite independently of researchers and the fundamental goal of social science should be to find out the processes that underlie observed social phenomena (Ibid.). Therefore, postpositivism and constructivist realism can be the ontological standpoint of view of this research.

The epistemological position of the present study is also situated in postpositivism. Postpositivism researchers (or realism researcher) accept that there is a real world to discover even if it is only imperfectly and probabilistically apprehensible. This can be called as value-aware different from researchers from other paradigms (positivism: value free; critical theory and constructivism: value-laden), (Healy and Perry, 2000). In postpositivism, the conceptualization will be treated as simply a way of knowing reality rather than that of reflecting reality (Bryman and Bell, 2003). However, hypothetical entities to account for regularities are acceptable for this research (Ibid.).

The methodological position of this research rests on postpositivism, which supports mainly the use of quantitative methods, e.g. survey and PLS approach to SEM as well as the inclusion of qualitative methods. The author is content with the Cupchik's view that qualitative methods provide a basis for in-depth account of underlying processes, while quantitative methods precisely analyze the functional relations (Cupchik, 2001). As constructivist realism maintained, qualitative and quantitative methods are complementary (Ibid.).

Considering the predictive characteristics of the PLS approach to SEM (Chin, 1998), the present study can be placed between postpositivism and critical theory (See figure 5.4). Healy and Perry (2000: 123p) argued that postpositivism (realism) research was primarily regarded as theory-building, rather than the testing of the relevance of a theory to a population.

5.2.2 Research Approaches

Research approach is with regard to the use of theory (Saunders *et al.*, 2000). There are three types of research approaches: deductive, inductive, and abductive (Kovács and Spens, 2005). The deductive approach will be done by deducing a hypothesis from theory and testing this hypothesis. Called as the 'theory testing' approach (De Vaus, 2001), this is a search to explain causal relationships between variables. The inductive approach is characterized by gaining an understanding of the meanings humans attach to events, a collection of close understanding of the research context and building theory. The abductive approach (or retroduction) is epitomized as the systematized creativity or intuition in research to develop new knowledge (Cited in Kovacs and Spens, 2005: 136p). The abductive approach differs from other approaches in its research process, from rule to result to case (See figure 5.5). In abductive reasoning, the case presents a plausible but not logically necessary conclusion, provided that its anticipated rule is correct (Danermark, 2001; Cited in Kovács and Spens, 2005).

Deductive approach is posited to be predominant in logistics research (Kovács and Spens, 2005). The present study adopts a mix of deductive and abductive approach because the causal relationships in port related competence are little researched and no general framework has been given.

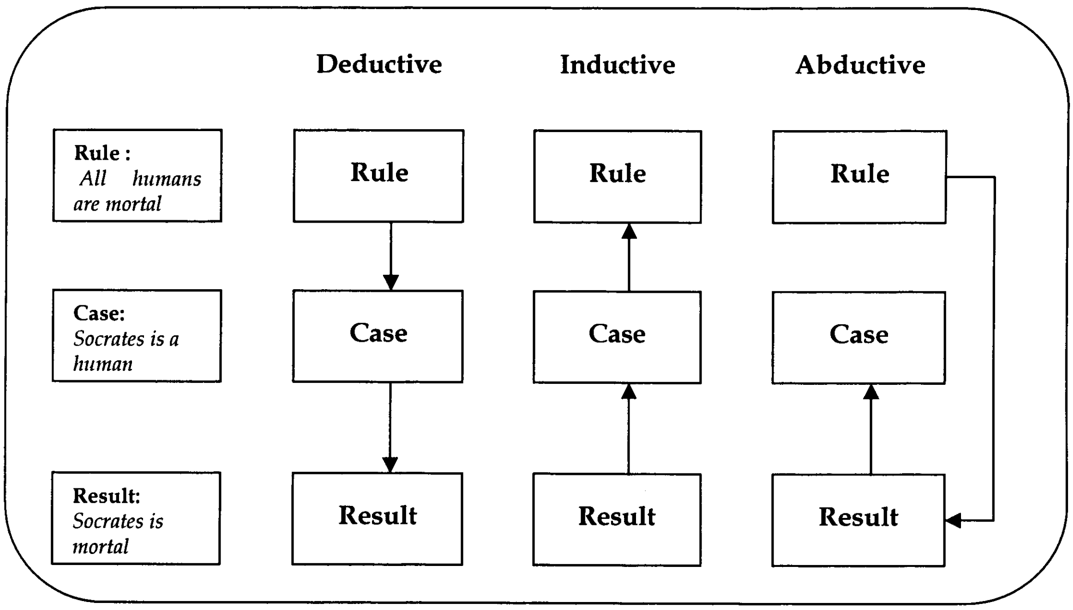

Figure 5.5 Processes of research approaches (Source: Adapted from Kovács & Spens, 2005: 137p)

As Chin (1998a) insists, PLS will be used for testing the appropriateness of a block of indicators in a predictive sense and for suggesting potential relations among blocks without necessarily making any assumptions regarding which Latent Variable model generates the data.

Based on basic RBT (Resource-based theory), relationships between four variables (i.e. PA's SCM strategies, PSCs' SCM strategies, PSCs' resources, PSCs' SCP) are provided. However, the relationships between sub-variables are not given, therefore, data analysis result will be utilized to suggest theory development and provide a conceptual model. In this sense, the present study will be adopting a mixture of deductive and abductive research approach.

Figure 5.6 illustrates the research process of abductive research. Like induction, abductive approach starts with real-life observations. Then, theory matching follows to find a new matching framework or to extend the theory (Kovács and Spens, 2005: 139p). The last step is the empirical testing of the hypotheses.

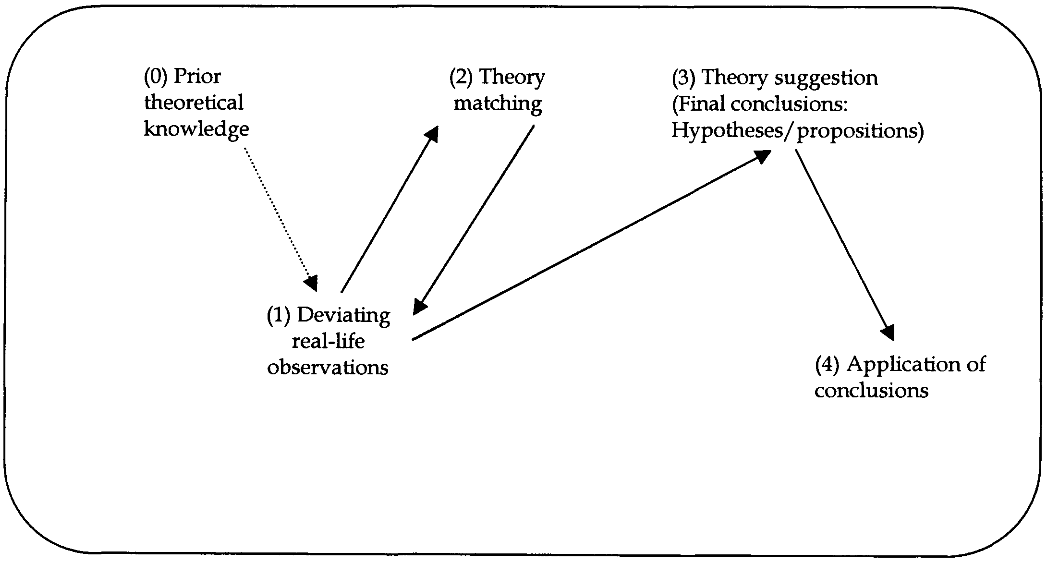

Figure 5.6 Abductive research process (Source: Kovács & Spens, 2005: 139p)

5.2.3 Research Strategies

Robson (1993) suggested three traditional research strategies, i.e. experiment, survey, and case study. Saunders *et al.* (2000) also introduced grounded theory, ethnography, and action research as research strategies.

Experiment measures the effects of manipulating one variable on another (Robson, 1993). Hawthorne experiment is a famous example of social experimental research (Bryman and Bell, 2003). Survey collects information in a standardized form from groups of people (Robson, 1993). The survey is an effective tool to get opinions, attitudes and descriptions as well as case-and-effect relationships (Ghauri and Grønhaug, 2002). Case study develops detailed intensive knowledge about a single case, or a small number of related cases (Robson, 1993). Grounded theory generates a theory from data gathered by a series of observations. Theory is grounded in such a continual reference to the data (Saunders *et al.*, 2000). Similar to case study, Ethnography, through involvement with the group, seeks to provide a written description of the implicit rules and traditions of a group (Robson, 1993). Action research can be defined as an approach in which the action researcher and a client collaborate in the diagnosis of a problem and in the development of a solution based on the diagnosis (Bryman and Bell, 2003).

Considering postpositivism philosophical position and mixture of deductive and abductive approach, survey and case study are posited as possible research strategies. Generally, survey uses questionnaires or interview techniques for recording the verbal behaviour of respondents (Ghauri and Grønhaug, 2002). Postal (or web-based) self administered survey is considered as a major research strategy because it is: 1) the easiest way of retrieving information about the past history of a large set of people, 2) efficient at providing large amount of data, at relatively low cost, in a short period of time, 3) allowing anonymity, which can encourage frankness when sensitive areas are involved (Robson, 1993).

However, the disadvantages of self-administered surveys should be recognized, i.e. 1) low response rate, 2) ambiguities and misunderstandings, and 3) possibility of not seriously exercised by respondents.

Case study is also one of the most frequently applied research strategies. Eisenhardt (1989) argues that case studies are suitable when research areas are new or existing theory seems inadequate (Cited in Ghauri and Grønhaug, 2002). It is flexible in terms of quantitative and qualitative dichotomy. Data may include documentary sources, archival letters, direct observation, participant observation and even questionnaire (Burton, 2000). However, one of the disadvantages of case studies, because of their intensive nature, is focusing on a small number of cases. Therefore, the representativeness of the findings can be seriously questioned. Furthermore, the researcher's close involvement may influence on the results (Robson, 1993).

Table 5.2 illustrates how three major research approaches can be used according to the conditions, e.g. type of question, requirement for control over events, and focus on current events.

Table 5.2 Appropriate uses of different research strategies

Strategy	**Type of research question**	**Requires control over events?**	**Focus on current events?**
Experiment	How, why	Yes	Yes
Survey	Who, what*, where, how many, how much	No	Yes
Case Study	How, why	No	Usually but not necessarily

-**some what questions are exploratory; any of the strategies could be used*

Source: Robson, 1993: 43-4p; Yin, 2003: 5p

The present study adopts postal (or web-based) survey as a main research strategy rather than case study because it focuses on describing the situation in the population relating to the topic (Robson, 1993). Furthermore, the future necessity of exploratory and quantitative research about port selection behaviour lead to the consideration on survey methods combined with quantitative data analysis technique, e.g. Partial Least Squares or Structural Equation Modelling (Lirn, 2005).

To enhance the relevance of the main survey and quantitative data analysis, this research choose to implement alternative combined strategies, i.e. interview with experts, pilot survey, case study for Busan and Shanghai port in chapter three, and survey on SCP of five chosen ports. Interview with experts to check the contents of questionnaire was implemented with three supervisors in Cardiff University, one manage of container terminal in Korea, and one government official (See section 5.3). As stipulated in section 5.3, a pilot test was conducted with 15 shipping liners experts of Korea during 13th to 21st of November 2006. Then, a case study on Busan and Shanghai port was implemented in chapter three in terms of physical resources and SCP strategies of two ports. Lastly, SCP of five container ports was investigated with main survey (See section 6.4).

Figure 5.7 illustrates the measures for triangulated research to enhance the relevance of the study.

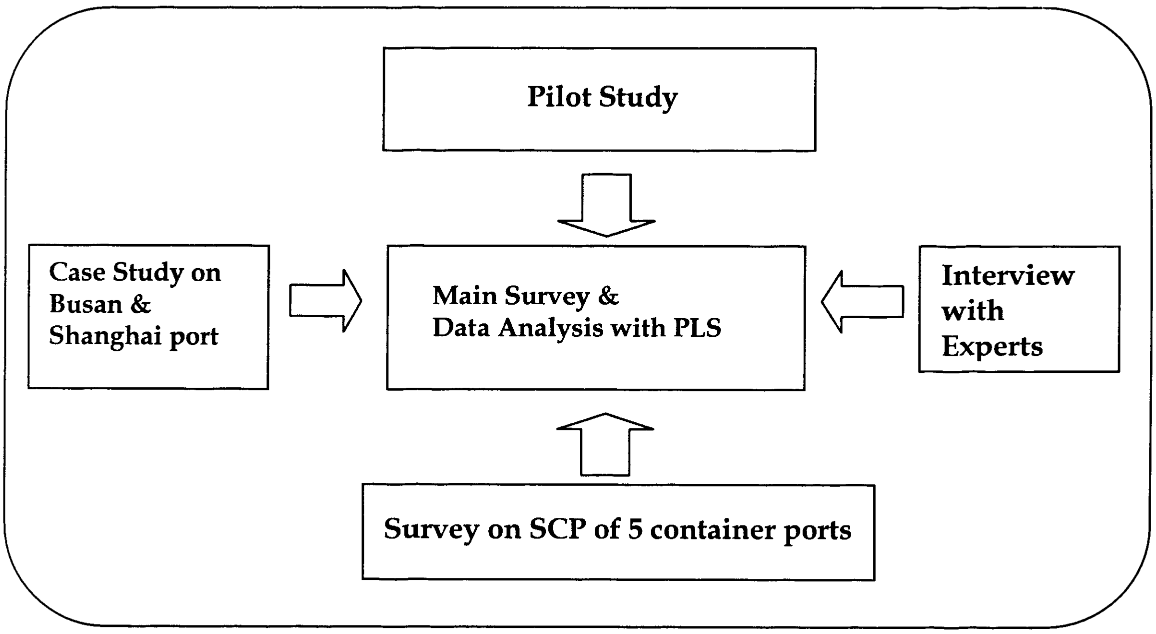

Figure 5.7 Research strategies to implement a triangulated research (Source: Author)

5.2.4 Time Horizons

Cross-sectional design utilizes data on more than one case and at a single point in time in order to collect a body of quantitative or quantifiable data in connection with two or more variables, which are then examined to detect patterns of association (Bryman and Bell, 2003). It is most widely used design in social research for quick acquirement of the result (De Vaus, 2001). It is also ideal for descriptive analysis (Ibid.). Because of its characteristics, it is strongly connected to the survey strategy (Saunders *et al.*, 2000).

In longitudinal design, 1) data are collected for each item or variable for two or more distinct time periods; 2) the subjects or cases analysed are the same or at least comparable from one period to the next; 3) the analysis involves some comparisons of data between or among periods (Burton, 2000).

Positing the key determinants for designing time horizon, i.e. time constraints, the abilities of subjects and the nature of the research problem, a cross-sectional study with survey strategy is adopted (Ibid.).

5.2.5 Research Purpose

Considering the purpose of enquiry, research can be classified as exploratory, descriptive, and explanatory purposes (Robson, 1993).

The aim of exploratory studies is concerned with gaining initial ideas about and insights into an issue or problem where there are few or no earlier studies to refer to (Aaker and Day, 1990). It is usually, but not necessarily, qualitative study (Robson, 1993).

Descriptive study's purpose is to provide an accurate snapshot of some aspects of persons, events or situations (Aaker and Day, 1990). For descriptive study, it is required that a researcher knows which information should be gathered based on extensive previous knowledge (Robson, 1993).

Explanatory (or causal) research seeks an explanation of a situation or problem, usually in the form of causal relationships. It includes qualitative and quantitative studies as well (Ibid.).

Even though a survey can be implemented to achieve any of the research purposes whether exploratory, descriptive or explanatory (Robson, 1993), it should be clarified what kinds of purposes the research has. Given the nature of the research object, the current research adopts explanatory study for finding the causal relations between PAs' SCM strategies, PSCs' SCM strategies, PSCs' resources, and PSCs' SCP. However, in terms of prediction purposes of PLS (See section 5.7), it has an exploratory aspect as well.

5.2.6 Data Collection Methods

Robson (1993) suggested three criteria about selecting the data collection methods. A rational choice would be the most suitable method under the circumstances, i.e. the research problems, questions, and a decision on research strategy. Then, the availability of the method should be considered. The final criterion, practicalities mean that the methods should be within the constraints of available time and resources.

A questionnaire is a general term to include all techniques of data collection in which each person is asked to respond to the same set of questions in a predetermined order (De Vaus, 1991; Cited in Saunders *et al.*, 2000). Especially, self-completed questionnaires are very efficient tools saving time and effort in terms of distribution and coding and analysis. However, it should be constructed with clear and careful wording of questions. Sometimes interpretation can be problematic (Robson, 1993).

An interview is a flexible and adaptable way of finding information. However, it is time-consuming in terms of collecting as well as interpreting data. Furthermore, the accessibility is hard to be achieved in some areas (Robson, 1993).

Observation is defined as *"a data collection tool entails listening and watching other people's behaviour in a way that allows some type of learning and analytical interpretation"* (Ghauri and Grønhaug, 2002: 90p). A major advantage of observation is accurate understandings through its directness. Disadvantages are 1) difficulties to translate the events into scientifically useful information (Ibid.), and 2) the extent to which an observer affects the situation under observation (Robson, 1993).

Secondary data is the data which researchers have not been involved in the collection of those data (Bryman and Bell, 2003). The benefits of using secondary data are: 1) saving cost and time, 2) high-quality data, 3) opportunity for longitudinal analysis, 4) subgroup or subset analysis, 5) more time for data analysis, 6) new interpretation by reanalysis, and 7) the wider obligations for the business researcher etc. (Ibid.). The limitations of secondary data can be 1) lack of familiarity with data, 2) complexity of data, 3) no control over data quality, and 4) absence of key variables (Ibid.).

Among four data collection methods in figure 5.3, i.e. questionnaire, interview, observation, and secondary data, 'primary data' were regarded as suitable because of the unavailability of the secondary sources with regard to the relationships between four main variables in research model.

In accordance with the survey as the main research strategy and PLS approach to SEM as the data analysis technique (See figure 5.4), online questionnaire is adopted as the primary method among four choices. However, as explained in section 5.2.3, a case study method was adopted to supplement main quantitative method for a triangulated study.

The choice of specific type of questionnaire and its advantages and disadvantages will be followed in the next section (See section 5.3).

5.3 Questionnaire Design

Having chosen a survey and questionnaire as the research strategy and data collection method, it is necessary to design a questionnaire ensuring the validity and reliability of the data. Therefore, the questionnaire should be designed clearly and accurately as to achieve research objective.

To this end, Churchill and Iacobucci's nine-step procedure for developing a questionnaire is adopted (2002). Figure 5.8 illustrates the sequence of the procedure from specifying needed information to pretesting a questionnaire and revision.

However, it should be noted that designing a questionnaire is regarded as an art and not a science, thus each step will be followed only as a checklist or guideline (Ibid.).

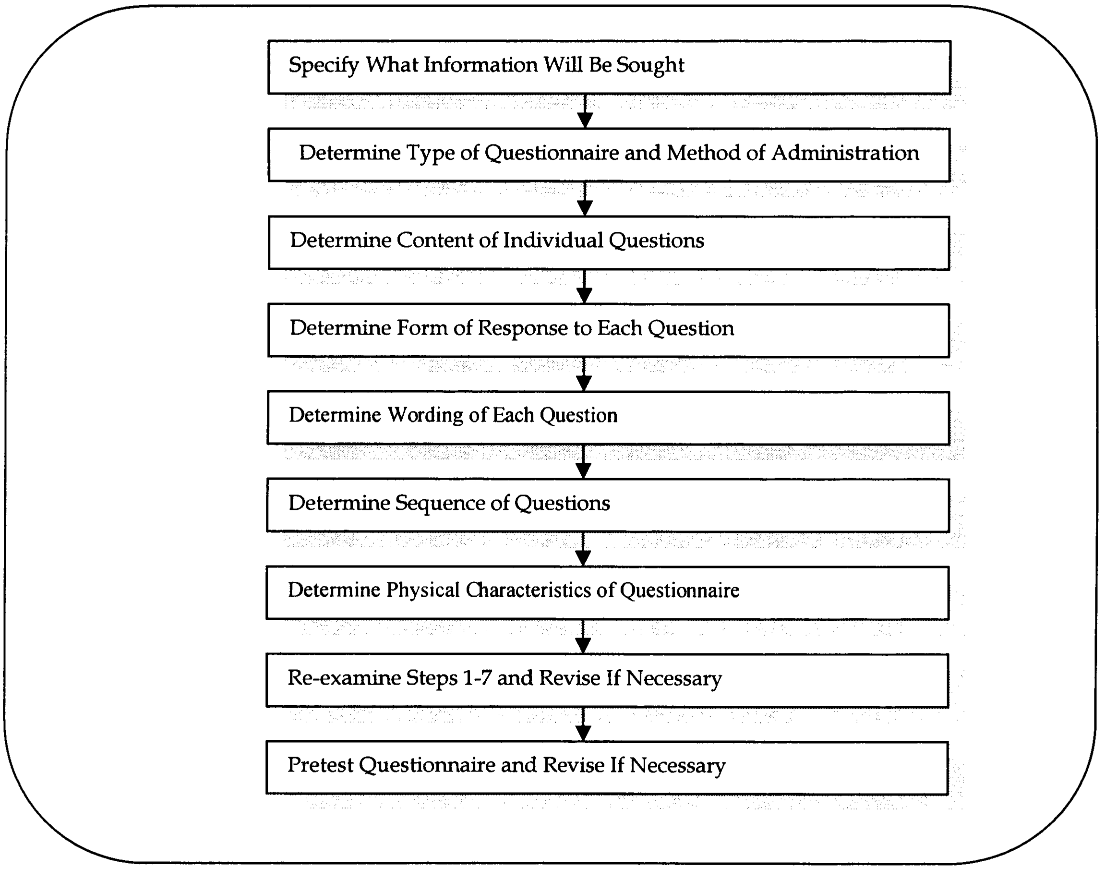

Figure 5.8 Procedure for developing a questionnaire (Source: Churchill and Iacobucci, 2002: 315p)

Information Sought

In the current study, the scope of the survey is closely connected to research hypotheses because they contain the detailed listing of the information needed. Since this research has an explanatory research purpose as well, sufficient prior knowledge is crucial to formulate specific hypotheses for investigation (Churchill and Iacobucci, 2002). Furthermore, the information should be collected from the right people and in the right units.

Specifically, the questionnaire measurement instruments are determined by the hypotheses constructs as follows: 1) Port authorities' SCM strategies, 2) PSCs' SCM strategies, 3) PSCs' resources, and 4) PSCs' Supply Chain Performance (SCP).

Type of questionnaire and method of administration

There are five types of questionnaire, i.e. self-administered (e.g. on-line, postal, delivery and collection) and interviewer administered (telephone, structured interview) (Saunders *et al.*, 2000). Figure 5.9 illustrates these five types of questionnaire.

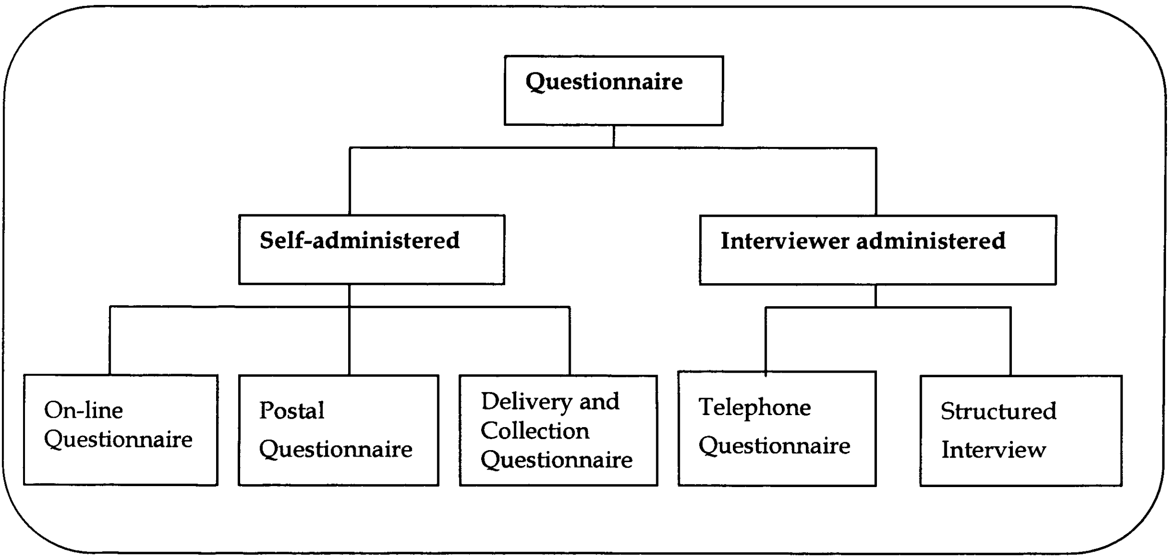

Figure 5.9 Type of questionnaire (Source: Saunders *et al.*, 2000: 280p)

This study initially adopted postal questionnaire supplemented with on-line questionnaire. The advantage of using the combination of two types of questionnaire is that managers in the port and shipping industries would feel more comfortable completing the questionnaire on-line because of the international characteristics of the business and there would be no need to return the response by post (Bryman and Bell, 2003).

However, the problems of post-delivery with English addresses in China had leaded to employ on-line questionnaire only. Bryman and Bell (Ibid.) pointed out the advantages and disadvantages of online surveys compared to postal questionnaire surveys. The advantages are low cost, faster response, attractive formats, mixed administration, unrestricted geographic coverage, fewer unanswered questions, and better response to open questions. The disadvantages are low response rate, restricted online population, motivation, confidentiality and anonymity issues, and multiple replies.

Saunders *et al.* (2000) provided various factors influencing on the choice of questionnaire, e.g. respondents' characteristics; likelihood of contamination; size of sample; likely response rate; and length of questionnaire etc.

Regarding the size of sample, on-line questionnaire is favoured in terms of higher response rate than that of postal questionnaire (Griffs *et al.*, 2003; Cobanoglu *et al.*, 2001, Cited in Bryman and Bell, 2003). The recommended sample size in Structural Equation Modelling (hereafter SEM) is at least more than 100 (Klein, 2005). Partial Least Squares approach to Structural Equation Modelling (hereafter PLS) is more flexible than SEM concerning sample size (Chin, 1998). Considering rapidly changing and severe competition in logistics business environments, realistic response rate would be 10-15% as suggested in Griffs *et al.*'s (2003) study. Thus, a survey population more than 1,000 is highly recommended to achieve from 100 to 200 responses for PLS and SEM analysis.

Due to the sample size, language issue, and vast regional coverage (Korea and China), it was justifiable to implement online questionnaire rather than postal, telephone or structured interview.

Contents of individual questions

Individual questions were developed according to the discussion in chapter two on individual constructs and in chapter four on research model as follows: (1) Port Authorities' SCM strategies, (2) Port focused Supply Chains' (PSCs') SCM strategies, (3) PSCs' Resources, and (4) PSCs' Supply Chain Performance (SCP).

From Table 5.3 to 5.6 illustrate the measures (or indicators) developed for actual content of individual questions.

PAs' SCM strategies contain four sub-constructs, i.e. 'privatisation', 'support for hinterland and FTZ', 'using IT', and 'marketing', which previous discussion had shown were significant determinants for PSCs' SCM strategies. The relevant measures for each sub-construct were identified through extensive review of the related literature.

Table 5.3 Measures of PAs' SCM strategies

Construct	*Proxy*	Sources
Privatisation	Concentrating on concession to global operator	Araujo *et al.*, (2003), Slack and Frémont (2005)
	Concentrating on concession to Shipping Company	Slack and Frémont (2005)
	Concessions to Hybrid operator	Slack and Frémont (2005)
	PAs' financial stakes into stevedoring company	Notteboom (2002), Midoro *et al.* (2005), Notteboom and Winkelmans (2001a), Heaver *et al.*, (2000), Baird (2002), Van Niekerk (2005)
	Build Operate Transfer (BOT)	Baird (2002), Van Niekerk (2005)
	Management Contract	Baird (2002), Van Niekerk (2005)
	Sale of port land	Baird (2002), Van Niekerk (2005)
	Lease Contract (except concession)	Van Niekerk (2005)
Support for hinterland & FTZ	Hinterland provision (including logistics companies)	Juhel (2001), UNESCAP (2005), Van Der Horst and De Langen (2007)
	Free Trade Zone	Peng and Vellenga (1993), Notteboom and Winkelmans (2001a), UNESCAP (2005)
Using IT systems	Single window EDI in operations & custom clearance	Garstone (1995), Lee *et al.* (2000), MOMAF (2006)
	Support for Automated Container Identification using RFID (Radio Frequency Identification)	Kia *et al.* (2000), MOMAF (2006)
	Support for Container Tracking Information System)	Kia *et al.* (2000), Stough (2001), MOMAF (2006)
Marketing	Common port marketing	Pando *et al.* (2005), Min and Mentzer (2000), MOMAF (2006)
	Existence of marketing Department	Pando *et al.* (2005)

Source: Tabulated by the author

Table 5.3 illustrates the measures of PAs' SCM strategies. Regarding 'privatisation', eight measures for 'privatisation' were selected mainly based on the studies by Baird (2002) and Van Niekerk (2005) (See Table 2.6 in chapter two). Considering the importance of the 'concessions' in the privatisation of ports, the types of 'concessions', i.e. concentrating on global operator, shipping company, and hybrid operator are included in measures (Slack and Frémont, 2005). This is justified by the discussion by Cullinane *et al.* (2005a) which specify Chinese port's strategies, e.g. Shanghai port's strategy concentrating on global operators and Ningbo port's strategy concentrating on shipping lines.

As discussed in chapter two, hinterland and FTZ are closely engaged each other (UNESCAP, 2005). Considering the scarcity of empirical studies on this issue, hinterland provision and operating Free Trade Zone are directly adopted as measures for this sub-concept. The logic of using these measures are validated by many studies (Peng and Vellenga, 1993: Juhel, 2001: Notteboom and Winkelmans, 2001a: UNESCAP, 2005: Van Der Horst and De Langen, 2007).

With regard to the sub construct, 'using IT', measures have been developed based on many studies, i.e. Garstone (1995), Kia *et al.* (2000), Stough (2001), Lee *et al.* (2000), and MOMAF (2006b). Based on Kia *et al.* (2000) 's study, 'support for automated container identification using RFID (Radio Frequency Identification)' and 'support for container tracking information system' were adopted as measures. According to considerable studies, e.g Garstone (1995) and Lee *et al.* (2000), and a report of central government, i.e. Ministry of Maritime Affairs and Fisheries of Korea (MOMAF, 2006b), 'single window EDI in operations & custom clearance' is used as a measure.

As stipulated by Pando *et al.* (2005), 'common marketing' has great importance in marketing. It is acknowledged that a greater percentage of ports in European and North American countries have a common marketing organization. The importance of 'common marketing' is supported as Spanish port managers claims that internal competition and internal co-ordination at a port are the main problems for the development of marketing in the future (Ibid.). As Pando *et al.* (2005) tested a hypothesis that greater levels of specialization at a port are linked to more developed marketing, quality and communication systems, existence of marketing department is posited as a measure for marketing activities of port authorities (Ibid.).

Table 5.4 Measures of PSCs' SCM strategies

Construct	Proxy	Sources
Vertical Integration	Operating warehousing & value-added logistical service	Notteboom (2002) , Arauijo *et al.* (2005), Oceangate website (2008)
	Integration strategies with road haulage companies	Notteboom (2002), Araujo *et al.* (2005)
	Integration strategies with railway companies	Notteboom (2002), Gouvernal and Daydou (2005)
	Operating inland terminals	Notteboom (2002) , Araujo *et al.* (2005)
Relationship Orientation	Communication (Information Sharing)	Nielson (1998) , Min and Mentzer (2000), Gibson et al. (2002), Wisner (2003) , Lee, *et al.* (2003), Pillai and Sharma (2003), Panayides and So (2005), Panayides (2007)
	Long-term contracts and incentives	Scannell *et al.* (2000), Min and Mentzer (2000)
	Increasing JIT capabilities	Wisner (2003)
	Share Value with customers	Tan *et al.* (1999), Panayides and So (2005), Nielson (1998)
	Customized service	Wisner (2003)
	Customer relationship management (Maintaining a stable partnership)	Wisner (2003) , Lee *et al.* (2003), Hult *et al.* (2005)

Source: Tabulated by the author

Table 5.4 illustrates the measures of PSCs' SCM strategies. Owing to the scarcity of the empirical studies on 'vertical integration', types of vertical integration is used to develop measures. As to 'vertical integration', Notteboom's (2002) types of vertical integration of container terminal operators, i.e. 'integration strategies with road haulage companies', 'integration strategies with railway companies', 'operating inland terminals', and 'operating warehousing & value-added logistical service' were employed.

In making an assessment of 'relationship orientation', this thesis measured 6 indicators, i.e. 'communication (information sharing)', 'long-term contracts and incentives', 'increasing JIT capabilities', 'share value with customers', 'customized service', and 'customer relationship management' based on various sources such as studies by Nielson (1998), Min and Mentzer (2000), Lee *et al.* (2003), and Panayides and So (2005). As discussed in chapter two, the importance of 'relationship orientation' in SCM is recognized (See section 2.7.2.4). With respect to measures, Panayides (2007) investigated the relationship between 'relationship orientation' into logistics 'service effectiveness' and 'firm performance using trust, bonding, communication, shared value and empathy. Measures are selected through careful considerations on related studies (See Table 2.9). Some studies include trust as a measure for 'relationship orientation', e.g. Gibson *et al.*, Wisner (2003), Pillai and Sharma (2003), Panayides and So (2005), and Panayides and Song (2007), and Panaydies (2007). However, 'trust' was removed because it was categorized as a measure for relational resources.

Table 5.5 Measures of PSCs' resources

Construct	*Proxy*	*Sources*
Relational Resources	Trust	Morgan and Hunt (1999), Mentzer *et al.* (2001), Bennett and Gabriel (2001)
	Commitment to relationship with users	Morgan and Hunt (1999), Mentzer *et al.* (2001), Panaydies (2006b)
	Loyalty	Morgan and Hunt (1999), Mentzer *et al.* (2004)
Skills	Service Design technology (New service design)	Turnbull *et al.* (1996)
	Cargo Handling technology	Turnbull *et al.* (1996)
	Marketing technologies (Analysis of customer requirements and relationship management)	Turnbull *et al.* (1996)
	R&D capabilities	Marlow and Paixão (2003)
Physical resources	Information technology/Information systems	Marlow and Paixão (2003)
	Cargo handling equipment	Marlow and Paixão (2003)
	Quays, berths, aprons, storage or yard capacity	Marlow and Paixão (2003)
	Dredged channels and quays	Marlow and Paixão (2003)
	Road and railway capability (or infrastructure)	Marlow and Paixão (2003)

Source: Tabulated by the author

In Table 5.5, measures of PSCs' resources are described.

'Relational resources' was evaluated using three indicators, i.e. 'trust', 'commitment to relationship with users', and 'loyalty', mainly based on studies by Morgan and Hunt (1999) and Mentzer *et al.* (2001). As addressed in chapter two, considerable studies, e.g. Mentzer *et al.* (2004) and Marlow and Paixão (2003), stressed the importance of the ports' relationships with other players.

With respect to measures for 'skills' (or technologies), Turnbull *et al.*'s study (1996) is adopted. As discussed in chapter two, Turnbull *et al*'s study stressed the importance of marketing technologies which contains the analysis of customer requirements and relationship management. Therefore their measures are appropriated for the model including 'relationship orientation', 'relational resources'.

For 'physical resources', Marlow and Paixão's (2003) provided physical resources of container ports as 'information systems', 'cargo handling equipment' (i.e. gantry cranes, fork-lifts, reach-stackers, straddle carriers), 'quays, berths, aprons, storage or yard capacity', 'dredged channels & quays', and 'road & railway capacity'.

Table 5.6 Measures of PSCs' SCP

Construct	*Proxy*	*Sources*
Reliability	Reliability of transit time/transport availability	Marlow and Paixão (2003)
	Accuracy of information regarding status of shipment	Marlow and Paixão (2003), Panayides and So (2005)
	Level of damages in shipment	Marlow and Paixão (2003)
Costs	Value for money	Marlow and Paixão (2003)
	Level of overall transport cost	Marlow and Paixão (2003)
	Reduction of order management cost (EDI)	Lai *et al.* (2002)
	Reduction of facilities/equipment cost	Lai *et al.* (2002)
	Reduction of warehousing costs	Lai *et al.* (2002)
	Reduction of transportation costs	Lai *et al.* (2002)
	Reduction of logistics administration costs	Lai *et al.* (2002)
Service Effectiveness	Fulfill promises to port users (on-time service)	Lai *et al.* (2002)
	Solve port users' problem	Lai *et al.* (2002), Panayides and So (2005)
	Perform services for port users right the first time	Lai *et al.* (2002)
	Lower Port time (Lead-time to service delivery)	Marlow and Paixão (2003)
	Level of conflict with other multimodal processes	Marlow and Paixão (2003)
	Responsiveness of transport suppliers in meeting customers' requirements	Beamon (1999)
Flexibility	Access /distribution flexibility (Hinterland & foreland)	Paixão and Marlow (2003)
	Expansion flexibility (Invest for future investment)	Paixão and Marlow (2003)
	Launch flexibility (Introducing new tailored services)	Paixão and Marlow (2003)
	Process flexibility (Speed that port can make decisions)	Paixão and Marlow (2003)
	Product flexibility (Transfer cargo from mode to mode)	Paixão and Marlow (2003)
	Routing flexibility (Convey through diversified route)	Paixão and Marlow (2003)
	Target flexibility (Deliver more tailored services to the different market segments)	Paixão and Marlow (2003)
	Volume flexibility	Paixão and Marlow (2003)

Source: Tabulated by the author

Table 5.6 describes measures of PSCs' SCP. With regard to the measures of PSCs' SCP, major studies that were used are research by Stewart (1995), Supply Chain Council (1996), Bechtel and Jayaram (1997), Scannell *et al.* (2000), Gunasekaran *et al.* (2001), Lai *et al.* (2002), Lai *et al.* (2004), and Marlow and Paixão (2003). Four constructs of SCP, i.e. 'reliability', 'costs', 'service effectiveness', and 'flexibility' were selected based on discussions in chapter two, especially studies by Lai *et al.* (2002), Lai *et al.* (2004), and Marlow and Paixão (2003) (See section 2.7.4).

In respect of 'reliability', three indicators, i.e. 'reliability of transit time/transport availability', 'accuracy of information regarding status of shipment', and 'level of damages in shipment', were adopted according to study by Marlow and Paixão (2003) owing to specialized aspect into context of container terminal.

Regarding 'costs', seven indicators were used based on studies by Lai *et al.* (2002) and Marlow and Paixão (2003). The measures are 'value for money', 'level of overall transport cost', 'reduction of order management cost', 'reduction of facilities/equipment cost', 'reduction of warehousing cost', 'reduction of transportation cost', and 'reduction of logistics administration cost'.

Concerning 'service effectiveness', studies by Beamon (1999), Lai *et al.* (2002), Marlow and Paixão (2003), and Panayides and So (2005) were used. Six indicators taken were 'fulfill promises to port users (on-time service)', 'solve port users' problem', 'perform services for port users right the first time', 'lower Port time (Lead-time to service delivery)', 'level of conflict with other multimodal processes', and 'responsiveness of transport suppliers in meeting customers' requirements'.

In relation to 'flexibility', in the context of port environment, types of flexibility were provided by Paixão and Marlow (2003). Eight measures except 'material handling flexibility' were adopted because this study aims to investigate container terminal operator's context only. Material handling is the capacity that port equipment has in handling different types of cargo (Paixão and Marlow, 2003). Seven measures that were taken are 'access /distribution flexibility (Hinterland & foreland)', 'expansion flexibility (Invest for future investment)', 'launch flexibility (Introducing new tailored services)', 'process flexibility (Speed that port can make decisions)', 'product flexibility (Transfer cargo from mode to mode)', 'routing flexibility (Convey through diversified route)', 'target flexibility (Deliver more tailored services to the different market segments)', and 'volume flexibility'.

Form of response to each question

Having decided the contents, the particular form of the response to each question should be adopted (Churchill and Iacobucci, 2002).

There are two main forms of response, i.e. open-ended and closed (fixed-alternative) response (Fowler, 2002). Contrasting to the open response with no acceptable responses, a list of acceptable responses is provided to the respondent in closed response (Ibid.). The closed response contains multichotomy, a dichotomy, or scale (Churchill and Iacobucci, 2002).

The advantages of the open-ended questions are 1) using respondents' own terms, 2) allowance for unusual responses, and 3) usefulness for exploring new areas (Bryman and Bell, 2004). However, closed responses are preferred for 1) reliability on questionnaire performance, 2) reliability on interpretation of the answers, and 3) possibility of acquiring more answers analytically interesting (Fowler, 2002).

The current research employed the Likert scale in closed response, in which the author asks the respondent how strongly they agree or disagree with a statement, or series of statements (Saunders *et al.*, 2000). The major advantage of the Likert scale is relative ease in being able to develop the questionnaire with a response categorization system rather than the Thurstone scale, Guttman Scale (Robson, 1993)[1].

To avoiding the problem from lacking of knowledge about questions, a 'don't know' option is taken as a form of not applicable, 'N.' (Fowler, 2002).

Table 5.7 Measurement Scale

Constructs	Scale Construction
Four Constructs (PA's SCM strategies, PSCs' strategies, PSCs' Resources, PSCs' SCP	**Seven points scale**: (1) Very poor↔ (7) Excellent, (N) Not applicable
Actual Supply Chain Performance in 5 Asian major ports (Busan, Shanghai, Hong Kong, Singapore, Gwangyang)	**Five points scale**: (1) Very poor, (2) Poor, (3) Neutral, (4) Good, (5) Excellent * There is no 'N' option because respondents were asked to fill in the actual score by numbers.

Source: Author

1) In the Thurstone scale (equal appearing interval scale), collected a large number of statements are rated by 50-100 judges. In case of Guttman (The cumulated) Scale, a large number of statements are answered by a standardization group and a scalogram analysis is carried out to develop cumulatd scale (Robson, 1993).

Wording of each question

According to Churchill and Iacobucci's recommendation (2002), an effort was made for actual phrasing with using simple word and avoiding ambiguous words; leading questions; implicit alternatives; generalizations and estimates; double-barrelled questions.

Owing to the large number of questions and necessity to make simple questions, simple form of options were followed by one heading questions. (e.g. How do you rate the SCM strategies of your PSC partners/providers compared to their main competitors? - Integration strategies with road haulage companies, etc.).

Before the pilot questionnaire survey, actual wording is checked with three supervisors in Cardiff University, one manager of container terminal in Gwangyang in Korea, and one government official in Ministry of Maritime Affairs and Fisheries of Korea (Director).

Sequence of questions

The sequence of questions is considered to be in a 'right' order (Ghauri and Gronhaug, 2002). The relatively ease of answering questions and positive questions placed first. Then, more complicated and sensitive questions are followed (PAs' SCM →PSCs' SCM → PSCs' Resources → PSCs' SCP→ SCPs of 5 Asian ports).

Because of the large number of questions, the questionnaire started from PAs' SCM directly with logical sequence order to PSCs' SCP. Then more complicated and sensitive rating of SCPs' of 5 major Asian container ports is positioned later.

This was also in line with the recommendation that there should also be a logical order from general to specific questions. (Ibid.).

Physical characteristics of questionnaire

The current research employs the on-line questionnaire via e-mail and website simultaneously.

For the introduction, the introductory e-mails attached with MS word questionnaire file are planned to invite respondents to participate on the survey. The attached e-mail survey is recommended in terms of a much wider range of embellishments than embedded one (Bryman and Bell, 2003). To ensure a high level of responses, a page of introductory letter is headed in the attached file (Saunders *et al.*, 2000). For the respondents who would like to answer the web questionnaire, the web-site address (www.geocities.com/honglaehyung/survey.htm) was linked in the e-mails. According to the Saunders *et al.*'s (2000) recommendation, the attached questionnaire is adjusted within optimal length, i.e. no more than eight A4 pages.

Re-examination and revision of the questionnaire

According to Churchill and Iacobucci's recommendation (2003), the first draft is revised and each question reviewed to ensure the question is not confusing, ambiguous, potentially offensive, leading or bias inducing.

After the re-examination, it is posited that there was nothing to be revised at that stage. However, it was supposed to be rechecked by pretest of questionnaire which will be explained in below section 'pretest questionnaire and revision'.

Pretest questionnaire and revision

Pretest is the most crucial stage for the real test of the questionnaire administration (Ibid.). For the further refinement of the instrument, Korean version of pilot test was conducted with 15 shipping liners experts (twelve managers, two academic scholars, and one government official) of Korea during 13th to 21st of November 2006. Because of restricted network with Chinese shipping experts, only one Chinese freight forwarder was contacted for the pilot test through the consultation with the supervisors. However, there was no reply. As the result, no Chinese expert was included in the pilot test. A total of seven valid responses and one comment were collected in the pilot test. Based on the responses, some modifications were made to the questionnaire. Table 5.8 illustrates the major changes.

Table 5.8 Major modifications to the questionnaire

	Before Pilot Test	After Pilot Test
PAs' SCM strategy (Q1)	Q1. How do you rate the SCM strategy of your main export/import port in Korea or China **(Please specify the port………..located port for branch or Agents)** compared to its major competitors?	Q1. How do you rate the SCM strategy of your main export/import port in Korea or China, compared to its major competitors? **(Please specify the port to which you are referring……………………………….)**
Vertical Integration (Q2)	Operating (Shareholding) road haulage companies Operating (Shareholding) railway companies	Integration strategies with road haulage companies Integration strategies with railway companies
Overall port transport cost (Q4)	Reduction of Overall port transport cost	Level of overall port transport cost

Source: Author

Having found a few cases of skipping answering the referring ports, question 1 was rephrased to elucidate the researcher's intention. Only three respondents out of the seven actually identified the name of the port.

Then, regarding the 'vertical integration' strategies, the actual word 'operating (Shareholding)' was replaced by 'integration strategies with' for embracing any form of vertical integration.

Having noticed one case of misunderstanding, the SCP item: 'reduction of overall transport cost' was changed into 'level of overall transport cost' to prevent the opposite ranking (e.g. if cost is low, somebody can respond like 1 or 2 despite of the actual scale 1, 2 are representing very poor and poor) .

After the revision of the English version, Korean and Chinese questionnaires are also refined, because the actual sample respondents are mainly Korean and Chinese people.

5.4 Sampling Design

Procedure for drawing a sample would be (1) defining the population, (2) identifying the sampling frame, (3) selecting a sampling procedure, (4) determining the sample size, (5) selecting the sample units, and (6) collecting data from the sampled units (Ghauri and Grønhaug, 2002; Churchill and Iacobucci, 2002).

5.4.1 Defining the population

Population is defined as the totality of cases that conforms to some designated specifications (Ibid.).

In container port communities, there are players including terminal operators, shipping line companies, feeder operators, freight forwarders, road haulers, and the rail operators (Martin and Thomas, 2001). Among them, shipping line companies and freight forwarders can be described as container port users.

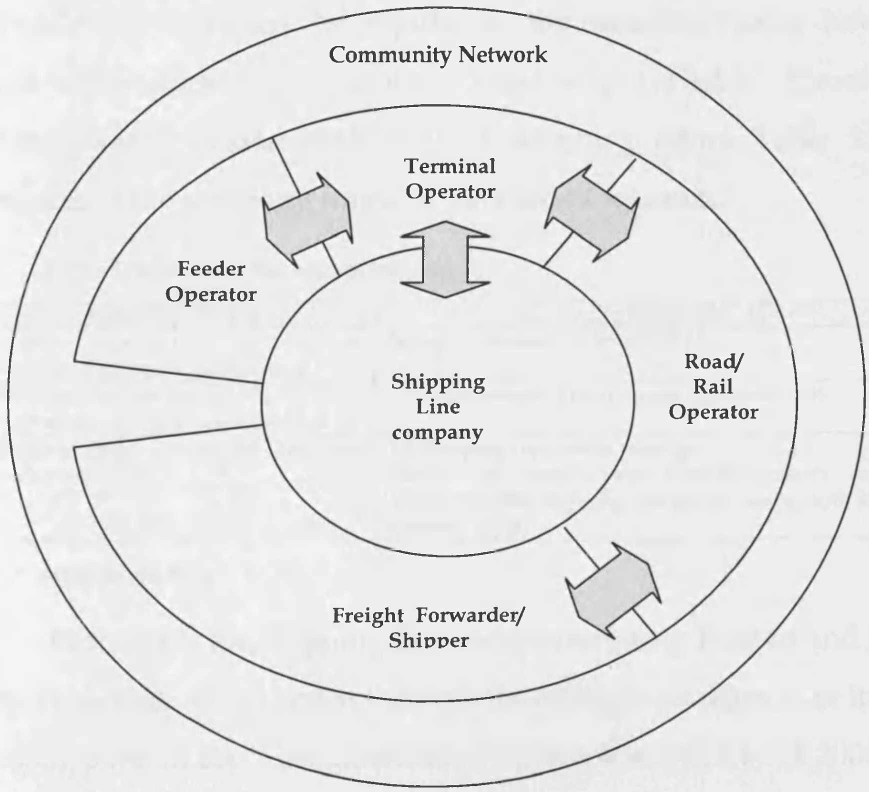

Figure 5.10 Container terminal players (Source: Martin and Thomas, 2001: 286p)

In the current research, the users of PSCs in Korean and Chinese main container ports are specified as the population. According to figure 5.10, shipping line companies (including feeder operators) and freight forwarders, i.e. users of terminal operator, road/rail operator, can be defined as the population of this research.

As discussed in chapter two (RBT in port and shipping industries), Robinson (2006) maintained that port-oriented landside chain is comprised of shipping line company, port authority, terminal, rail operator, trucking operator, and depot. Shipping liner companies contract with PSCs, i.e. trucking companies, rail companies, terminals and depots, directly or through a freight forwarder to provide services for their customers.

5.4.2 The sampling frame

Sampling frame is a listing of units from which the actual sample will be drawn (Ghauri and Grønhaug, 2002). The sampling frame should have three characteristics, i.e. comprehensiveness, probability of selection, and efficiency (Fowler, 2002). Given the population, the sampling frames have been searched and unfortunately no sampling frame was available. Therefore, a sampling frame was provided with manual searching effort. Table 5.9 illustrates the sources of the sampling frame of the current research.

Table 5.9 Sources for sampling frame

Sampling Target	Source
Korean shipping liners, agents, branches, and freight forwarders	Shipping directory Korea 2005/6
Shipping liner companies HQ (Korean and Chinese ports customers)	Containerisation International Yearbook 2006
Shipping liner companies branches and agents in China	88 Shipping companies websites (Based on search over Containerisation International Yearbook 2006-shipping companies using both Korean and Chinese ports)

Source: Author

First of all, the shipping line companies using Korean and Chinese ports at the same time were chosen through the arduous searches over its information on calling ports in the 'Containerisation International Yearbook 2006'.

Then, managers' available e-mail addresses of the branches and agents were checked through the websites and shipping directory Korea 2005/6. This directory includes shipping companies' branches and agents located in Korea and China.

It should be noted that only Korean freight forwarders, rather than Chinese freight forwarders, are included owing to the research focus mainly on the users of the Korean ports. Considering the fact that research aims was to survey the users of Korean and Chinese ports, Chinese freight forwarders are excluded for the high probability of not using Korean ports. The exclusion of Chinese freight forwarders is also due to the difficulties to acquire comprehensiveness with the sample frame. After investigation of related websites, e.g. www.freghtnet.com, it was realized that it is difficult to acquire a complete list of Chinese freight forwarders' e-mail addresses.

As the result, the total number of sampling frame is summed up 1,208 (Shipping companies HQ: 76; Branch/Agencies in Korea and China: 387; Korean freight forwarders 745).

5.4.3 The sample procedure

Sample procedure is consisted of probability and non-probability samples (Ibid.). In probability sampling, statistical inferences about the population can be made from the responses of the sample. In contrast, non-probability sampling does not allow making such statistical inferences (Robson, 1993). In probability sample procedure, there are simple random sampling, systematic sampling, stratified random sampling, and multi-stage cluster sampling (Bryman and Bell, 2003). The non-probability samples include convenience sampling, snowball sampling, and quota sampling.

Among them, stratified random sampling was considered as a possible sampling procedure owing to the identifiable characteristics of populations (Fowler, 2002). As discussed earlier, the population is composed of shipping companies' headquarters using Korean and Chinese container ports (not restricted to Korean and Chinese shipping companies), its branches or agents, and Korean freight forwarders. The advantage is that stratified random sampling can ensure the sample will be distributed in the same way as the population in terms of the stratifying criterion (Bryman and Bell, 2003).

Considering the number of the population is not so big, the employment of sampling procedure will be concluded after considering the issues like data analysis technique, and response rate (Luck and Rubin, 1987).

5.4.4 Determining the sample size

To ensure the valid estimates of population parameters, the nature of the data analysis technique should be considered in deciding the sample size (Ibid.). In the covariance based Structural Equation Modelling (hereafter SEM), less than 100 sample size is regarded as small, between 100-200 is regarded as medium, and more than 200 as large (Kline, 2005). Furthermore, the model's complexity must be taken into consideration as well. Compared to SEM, Partial Least Squares approach to SEM (hereafter PLS) requires a relatively small sample size (Chin, 1998a; Morgan *et al.*, 2007). The sample size requirement is the bigger one among either (a) the block with the largest number of formative indicators (i.e. the largest measurement equation), or (b) the dependent latent variable with the largest number of independent variables impacting it (i.e. largest structural equation) (Chin, 1998a). The largest numbers of formative indicators are eight in PSCs' flexibility. As a consequence, it is assumed that the least requirement number of sample sizes would be eighty.

Response rate (Luck and Rubin, 1987) is another issue to be discussed. Given the target, it is necessary to predict response rate for deciding the sample sizes. Griffis *et al.* (2003) addressed that the range of the response rates reported in the Journal of Business Logistics during 1997 to 2001 was from 4.0% to 32.7%. In their research, electronic survey recorded 14.3% response rates compared to that of paper survey: 10.10%. As a result, to aim for a reasonable target response of web-based research as 7% as conservative level, the author has chosen the sample size at least '1,143' to acquire more than 80 responses. Considering the data analysis technique (PLS), size of population, and expected response rate, it has been decided that population (1,208) was to be used for the survey. For that reason, it is not necessary of 'selecting the sample units' and 'collecting data from the sampled units' stages.

5.5. Issues on emergent construct (formative indicators)

5.5.1 Definition of formative indicators

Even though the concept of formative measurement (or indicator, item, observed variable) is not familiar in logistic research, especially in psychology, there has been an increasing awareness whereby researchers distinguish the difference between latent variable with reflective indicators (or effect) and emergent variable with formative indicators (or causal, composite) (Bollen and Lennox, 1991; MacCallum and Browne, 1993; Edwards and Bagozzi, 2000).

Reflective indicators (or measures) can be defined as indicators caused by constructs (latent variables) because they represent the reflection of a construct. On the contrary, it is called formative when measures are viewed as causes of constructs (Ibid.). Dropping or replacing a reflective observable does not change the nature of the concept; however, omitting a formative item results in the difference of the concept (Bollen and Lennox, 1991).

Figure 5.11 illustrates the difference between latent variable with reflective indicators and emergent variable with formative indicators.

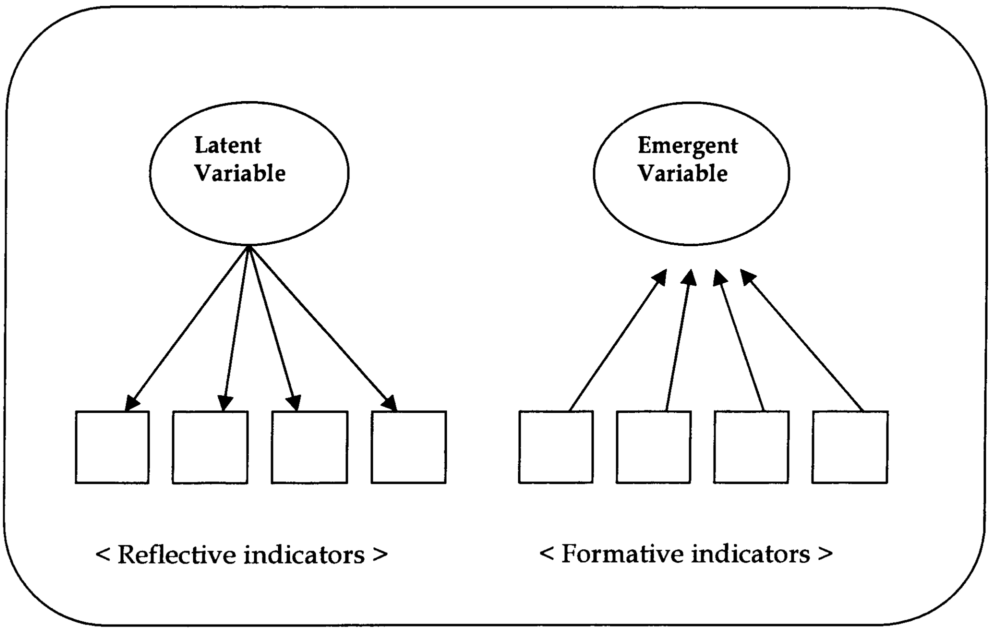

Figure 5.11 Reflective and formative indicators (Source: Chin, 1998a: 306-7p)

5.5.2. Problems of using formative indicators in SEM

Cohen *et al.* (1990) stipulated that a body of published SEM studies mistreated formative indicators as reflective through the application of SEM (Cited in Chin, 1998a). Considerable studies using formative measures are found in logistics area including port and shipping industry as well (Bennett and Gabriel, 2001; Lai *et al.*, 2002; Shang, 2002; Wisner, 2003; Lee, 2005; Panayides and So, 2005; Panayides and Song, 2007; Bichou and Bell, 2007).

Strongly suggesting the use of reflective measures in SEM, Howell *et al.* (2007; 216p) asserted the problems of using formative measures in SEM as follows: *"With formative measurement, there are no strictly epistemic relationships to fall back on and the estimated relationships between the construct and its measures must be defined in terms of other constructs in the model."*

MacCallum and Browne (1993) pointed out that the presence of casual indicators could have problematic implications for the implied relationships among the measure variables in SEM analysis.

Despite the problems described above, it is pointed out that the SEM with formative indicators is acceptable under some circumstances. As MacCallum and Browne (1993) maintained, all of problems, e.g. identification, the occurrence of implied covariances of zero among some measured variables, and the existence of equivalent models, can be managed, although their resolution may involve altering the original model in terms of its substantive meaning or parsimony, or both. In that case, it is recommended that formative indicators be modelled as separate constructs, at least until the equivalence of their relationships with antecedents and/or consequences can be established despite of the lack of parsimony (Howell *et al.*, 2007). Lastly, according to Bagozzi's (2007) recommendation, a formative latent variable predicting only a single variable should be deleted.

In summary, it is recommended that a SEM analysis should be implemented only with reflective measures. In the case of using formative measures, PLS is more suitable than SEM (See section 5.7.2).

5.6. Model evaluation

5.6.1. Assessing the overall model

Examining the distribution-free assumption of PLS, Wold (1980, 1982b) asserted the necessity of using prediction-oriented measures that are nonparametric[1] (Cited in Chin, 1998a). To this end, effect size test using R^2 and bootstrapping are introduced to examine the overall model evaluation and predictive relevance.

Effect size test

R^2 means the proportion of the dependent variables' variance shared with the optimally weighted independent variables (Cohen *et al.*, 2003). Using R^2, effect size, f^2 whereby identifying whether the impact of an independent variable on a dependent variable has substantive impact can be calculated as below (Chin, 1998a):

$$f^2 = \frac{R^2_{included} - R^2_{excluded}}{1 - R^2_{included}}$$

where $R^2_{included}$ is the R squares when the predictor variable is used and $R^2_{excluded}$ is the R-square when the predictor variable is omitted.

f^2 of 0.02, 0.15, and 0.35 are adopted as a small, medium, and large effect gauge at the structural level (Ibid.).

Bootstrapping

Bootstrapping is delineated as a technique for model estimation by repeated sampling (Hair *et al.*, 1998). Parameter estimates and standard errors are calculated on the basis of empirical observations rather than statistical assumptions. It is described as another nonparametric approach for estimating the precision of the PLS estimates (Chin, 1998a).

1) Parametric statistics require interval level outcome variables that are normally distributed in the population. Non-parametric statistics does not assume a normal distribution (De Vaus, 2001: 102p). In nonparametric data analysis, the form of relationship is developed by the data themselves absent any assumption about the form of the relationship (Cohen *et al.*, 2003: 252p).

5.6.2. Reliability and Validity

Measurement indicators should meet two criteria, validity and reliability, to avoid measurement errors (de Vaus, 2001). Trochim (2000: Cited in de Vaus, 2002: 25p) elucidated the four types of relationships between reliability and validity, these being:

"1) A reliable and valid measure will consistently hit the bull's eye; 2) a reliable but invalid measure will be consistent but consistently off target; 3) an unreliable but valid measure is scattered unpredictably around the target in a random fashion; and 4) an unreliable and invalid measure would not hit the same place consistently and would be biased in terms of the part of the target it hits ".

Recognizing the limitation of formative indicators with SEM, the current research adopted some variables from existing studies implementing PLS as a data-analysis technique. It should be noted that there are limits on reliability and validity in case of using only formative measures (Chin, 1998a). With only formative measure, a researcher can demonstrate only the predictive capabilities of the block of measures (Chin, 1998a). Further details about formative measures will be discussed in this section.

Reliability can be defined as "*the extent to which measures elicit consistent responses*" (de Vaus, 2002; 25p). Reliability can be assessed by R^2, Cronbach's alpha (Hair *et al.*, 1998), Construct Reliability and Variance Extracted. Because composite reliability and variance extracted are only available with reflective measures (Chin, 1998a), the current research which is using only formative indicators cannot adopt Cronbach's alpha for reliability.

Cronbach's alpha: internal consistency

Cronbach's alpha is 'a measure of the intercorrelations between the various indicators utilized to capture the underlying construct' (Ghauri and Grønhaug, 2002: 69p). Ranging between 0 and 1.0, higher Cronbach's alpha values represent more reliable (Hair *et al.*, 1998). The generally agreed upon lower limit for Cronbach's alpha is 0.70, although it may decrease to 0.60 in exploratory research (Ibid.).

Composite reliability

Internal consistency for a given block of indicators can be assessed by composite reliability (Chin, 1998a).

$$\text{Composite reliability} = \frac{(\Sigma\lambda_i)^2}{(\Sigma\lambda_i)^2 + \Sigma\varepsilon_j}$$

Where λ_i is the component loading to an indicator and

ε_j is the measurement error (1-λ_i^2).

With the minimum level of 0.50, the recommended level of composite reliability is 0.70 (Hair *et al.*, 1998). However, composite reliability is only applicable for latent variables with reflective indicators (Chin, 1998a).

Average Variance Extracted: AVE

Average variance extracted represents the overall amount of variance in the indicators accounted for by the latent construct (Hair *et al.*, 1998).

It is calculated as:

$$\text{AVE} = \frac{\Sigma\lambda_i^2}{\Sigma\lambda_i^2 + \Sigma\varepsilon_j}$$

where λ_i is the component lading to an indicator and

ε_j is the measurement error (1-λ_i^2).

A guideline suggested is over 0.50 for a construct (Chin, 1998a). However, AVE can be applied only for reflective indicators either.

Validity is "*the extent to which a scale or set of measures accurately represents the concept of interest*" (Hair *et al.*, 1998). De Vaus (2001) claims that there is no ideal way of measuring validity.

Validity can be tested by criterion, construct, content, convergent, and discrimination methods (De Vaus, 1998). Construct validity contains face, content, criterion-related, predictive, concurrent, convergent, and discriminant validity, as well as internal consistency (Young, 2008). As Campbell and Fiske (1959) elucidated, construct validity is often examined using the multitrait-multimethod matrix.

Combining the convergent validity and discriminant validity

To test convergent and discriminant validity, De Vaus (2002) suggested a correlation matrix of the variables. The high correlations among the items of same variable and low correlations between the items of each variable mean the convergent validity and discriminant validity.

Convergent validity

A measure has convergent validity when the indicators for one variable are highly intercorrelated (De Vaus, 2002). Unidimensionality and convergent validity refer to the existence of one latent trait or the construct underlying a set of measures (Gerbing and Anderson, 1988).

In case of reflective indicator, convergent validity can be assessed by examining individual item loadings on the construct they are expected to measure. Chin (1998) provided the standardized loadings should be greater than 0.707.

Discriminant validity

Discriminant validity represents that the argument that two different concepts should not correlate with one another (De Vaus, 2002; Churchill and Iacobucci, 2002).

1) Comparison between AVE and square of the correlations

Chin (1998a) recommended comparing the AVE and the square of the correlations among constructs. If AVE is larger than the square of the correlations, then it means the discriminant validity of the variable.

Because AVE is only available to reflective indicators, this method can not be implemented for formative indicators.

2) Cross loadings or Factor loadings

Discriminant validity can be checked by the comparisons of the loadings of items on their respective latent variables to the loadings of the indicators on other latent variable can be done in case of reflective measures (Ibid.). It is pointed out that the discriminant validity can not be calculated by cross loadings when the measurement items are formative (Ibid. Gefen and Straub, 2005).

Alternative for discriminant and convergent validity

As some researchers claimed, factor analysis (or Principal Factor Analysis) can be posited as an alternative to check discriminant and convergent validity (De Vaus, 2002; Gefen and Straub, 2005). Exploratory Factor Analysis (EFA) is an efficient method that defines possible relationships in only the most general form before using multivariate techniques for estimating relationships (Hair *et al.*, 1998). In other words, the aim of factor analysis is to orderly simplify a number of interrelated measures (Child, 1990). As Kline (2005) asserts, EFA does not require *a priori* hypotheses about how indicators are related to underlying factors or even the number of factors.

Hence 'the minimum number of factors needed to account for the maximum portion of the variance represented in the original set of variables' (Hair et al., 1998), a principal component analysis, with the varimax rotation is employed in this research. The 'Kaiser-Guttman rule' is selected to determine the number of factors by ascertaining how many eigenvalues are greater than 1.0 (Loehlin, 1992). Based on the sample size (124), the factors with factor loadings less than 0.5 are deleted (Ibid.).

Content Validity

Content validity means how well the measures gauge the concept as a researcher has defined it (De Vaus, 2001). Expert opinion and theoretical basis are the foundation for establishing content validity whereby making item content is representative (Kline, 2005). To this end, measures were designed on the basis of the theories through literature review and checked by some experts as described in this chapter (section 5.3).

5.7. Data Analysis Method/Technique

This study aims to investigate the empirical relationships between the PAs' SCM strategies, PSCs' SCM strategies, PSCs' resources, and PSCs' SCP. Recently, the necessity to adopt 'Structural Equation Modelling' is stressed in port and shipping area, e.g. the port selection decision criteria or relationships between strategies, competitive advantage and performance (Panayides and Cullinane, 2002; Lirn, 2005). PLS approach to SEM (PLS) is chosen among common methods used in logistics area, i.e. Multi-attribute utility theory (MAUT), Analytic Hierarchy Process (AHP), and covariance-based approach to SEM (SEM).

Assuming participants can choose attributes that are known with certainty, MAUT can be performed by taking the seven steps, these being: 1) identifying objectives and functions, 2) identifying stakeholders, 3) identifying attributes, and construct value tree, 4) assessing relative importance of weights, 5) ascertaining attribute scales, 6) aggregation of weights and utilities, and 7) performing sensitivity analysis (Lagoudis *et al.*, 2006). AHP is delineated as an established methodology in decision-making and in ranking priorities, with quantifiable and/or intangible criteria (Song and Yeo, 2004). It takes three-stage approach, i.e. 1) establishing decision-making hierarchy, 2) determining weights on criteria and alternatives, and 3) evaluating overall ranking of alternatives.

Despite their advantages such as ease of comprehension, no sampling restrictions, and the comparison of more than two factors (Lagoudis *et al.*, 2006), MAUT and AHP are not employed. The reason for this is that a SEM base approach, e.g. PLS or SEM can generally provide flexibility when dealing with: 1) relationships in a model using multiple predictor and criterion variables, 2) unobservable latent variables, 3) model errors in measurements for observed variable, and 4) confirmatory analysis, i.e. statistical test on measurement assumption before substantive/theoretical test (Chin, 1998a).

The comparison between PLS and SEM and the rationale to employ PLS are laid out in the following section (5.7.2) in detail.

5.7.1. Basic concepts of PLS

PLS can be defined as a kind of structural equation modelling technique using an estimation method to obtain parameter estimates, i.e. a fixed point or component-based least squares procedure (Morgan *et al.* 2007).

PLS is an alternative to canonical correlations[1)], OLS regression or structural equation modelling (SEM) for analysis of systems of independent and responsive variables (Garson, 2007).

It uses mainly a series of interdependent Ordinary Least Squares (OLS) regression technique to minimize residual variances, placing minimal demands on data in terms of measurement scales, sample size, and distributional assumptions[2)] (Chin, 1998a; Fornell and Bookstein, 1982; Wold, 1982) (Cited in Morgan *et al.*, 2007).

Three steps are taken to calculate the weights, and subsequent loadings and path estimates. Firstly, an iterative scheme of regressions (single or multiple) dependent on the particular model is performed until a solution moves towards a set of weights used for estimating the latent variables (LV) scores. Then, as step 2 and 3, simple non-iterative applications of OLS regression for obtaining loadings, path coefficients, and mean scores and location parameters for the LV and observed variables are performed (Chin, 1998a).

The PLS can directly estimate component scores of latent (or emergent) variable. It is claimed that the main purpose of the PLS approach is a prediction by obtaining fixed and definite values of the variables (Ibid.).

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1) Canonical Analysis is based on measuring a series of canocial correlations that each product moment correlation between weighted linear combinations of the k(x) variables of X and the k(y) variables of Y (Cohen *et al.*, 2003: 609p).

2) Ordinary least squares (OLS) is the commonly used method to seek to minimize the sum of the squared differences between the observed and predicted squares of dependent variable, Y (Ibid.: 124p)

5.7.2. Criteria for choosing between PLS and SEM

Because SEM is widely used in logistics studies, researchers are likely to choose SEM over PLS without proper consideration. To avoid a wrong choice, it is crucial to check the criteria for choosing between PLS and SEM.

Stan and Saporta (2007) provided the criteria for choosing between the PLS and SEM (See Table 5. 10).

Table 5.10 Criteria for choosing between PLS and SEM

Criteria	PLS	SEM
1) Objective/Implications	Prediction oriented/ Optimal for prediction accuracy	Parameters estimation oriented/ Optimal for parameter accuracy
2) Approach/ Latent variables	Variance based/ Each latent variable is a linear combination of its own manifest	Covariance based/ The latent variables are estimated using the whole set of manifest variables
3) Relationship between a latent variable and its manifest variables	Formative or reflective way	Reflective way only
4) Model complexity	Large complexity (e.g.100 latent and 1,000 manifest)	Small/moderate complexity (e.g. less than 100 manifest)
5) Sample size	Minimal recommendations range from 30 to 100 cases	Minimal recommendations range from 200 to800
6) Theory requirements	Flexible	Strong assumptions
7) Missing data treatment	NIPALS algorithm	Maximum likelihood method
8) Identification	Under recursive models is always identified	Depends on the model; ideally need 4 or more manifest per latent to be over determined, 3 to be just identified
9) Restrictions on distribution, normality and multicollinearity	Fewer restrictions compared to SEM	More restrictions

Source: Adopted from Stan and Saporta, 2007: 758p

1) PLS is prediction oriented rather than explanation (parameters estimation oriented) (Chin, 1998a). PLS predicts based on respectively the inner (relationship among latent variables) and outer (relationship between indicators and its latent variables) relations (Wold, 1981). Instead, SEM is parameter[1)]-estimation oriented. SEM calculates parameter estimates to get the optimal fitting function between the correlations in the sample and those implied by the parameter estimates (Chin, 1998a). Differing from SEM that calculates consistent parameter estimation, PLS estimates the case values of all Latent Variables that are limitedly consistent by getting weighted averages of their block of indicators increased in definitely in size (Wold, 1981).

1) Parameter is "a characteristic of an entire population, such as the mean" (Brace *et al.*, 2006).

2) PLS is a variance-based approach. Variance is closely related to standard deviation. It mirrors the average distance of cases from the mean (De Vaus, 2002). Covariance is defined as *"a statistic representing the degree to which two variables vary together"* (Howell, 1999: 457p). In PLS, latent variables are calculated as a linear combination of the associated manifest variables, whereas SEM estimates each latent variable using all manifest variables (Stan and Saporta, 2007).

3) As discussed earlier, formative indicators can be dealt with PLS rather than SEM (See section 5.6).

4) In PLS, much larger/complex models with many latent variables and indicators in each block can be dealt with compared to SEM (Chin, 1998a). Stan and Saporta (2007) suggest that 100 latent variables and 1,000 indicators can be handled by PLS. In SEM, less than 100 manifest variables (indicators) are depicted as acceptable (Ibid.).

5) As stated earlier, PLS requires relatively small sample size (See section 5.5). Stan and Saporta (2007) depicted a minimum requirement for sample size from 30 to 100, whereas more than 200 in SEM. The sample size requirement is decided by choosing bigger one by comparison between (a) the block with the largest number of formative indicators and (b) the dependent latent variable with the largest number of independent variables (Chin, 1998a).

6) When a researcher is not certain with structural model or measures, it is recommended to employ PLS as a data analysis technique (Chin, 1998a). In other words, if the research locus is relatively new or theoretical model or measures are not well formed, PLS is the proper solution (Ibid.). Therefore it can be used as an exploratory analysis as a prelude to an interpretive technique such as SEM (Garson, 2007).

7) With regard to missing data treatment, PLS adopts NIPALS (Nonlinear iterative partial least squares) approach (Stan and Saporta, 2007). Wold (1973: 384p) reiterated that *"in comparison with maximum likelihood method[1], NIPALS is often more general, and typically so since it works with a small number of zero intercorrelation assumptions between residuals and variables"*. Hence NIPALS approach makes for models that give a closer fit to the given observations, as is reflected in successful application to real-world data (Cited in Chin, 1998a).

8) Identification is *"the degree to which there is a sufficient number of equations to solve for each of the coefficients (unknowns) to be estimated"* (Hair *et al.*, 1998: 580p). There are three cases regarding the identification, i.e. under-identified (cannot be solved), justidentified (number of equations equals number of estimated coefficients with no degrees of freedom), and overidentified (more equations than estimated coefficients and degrees of freedom greater than zero). Overidentified model is regarded as acceptable (Ibid.).

The determinate nature of PLS approach avoids parameter identification problems that can occur under covariance-based analysis (Bollen, 1989) (Cited in Chin, 1998a).

9) It is maintained that PLS has fewer restrictions than SEM in terms of distribution and normality (Gefen *et al.*, 2000; Chin, 1998) (Cited in Bontis and Serenko, 2007). Furthermore, PLS can handle multicollinearity (whether the indicators are relatively independent of one another) (Chin, 1998a).

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[1] Maximum likelihood estimation is a commonly employed estimation method in structural equation models. It is a procedure which iteratively improves parameter estimates to minimize a specified fit function (Hair *et al.*, 1998: 581p).

5.7.3 Implications for the present study

PLS has some advantages over SEM, e.g. fewer restrictions in terms of distribution, normality, multicollinearity, formative indicators, and the number of indicators etc.

PLS can be the suitable technique to tackle this issue because PAs' SCM strategies' impact on PSCs' resources, and PSCs' SCP are relatively new in terms of theoretical model and measures are not well formed (Chin, 1998a).

Furthermore, most studies have adopted formative indicators in SEM studies in port and shipping area. To make most of the measures developed by the former studies, therefore, it is needed to hire the tool that can handle formative measures.

Hence, the present research adopts relatively many emergent variables and formative indicators, PLS is more appropriate technique in terms of handling with latent variables with many numbers of indicators (Chin *et al.*, 2003). PLS can handle formative indicators. Cohen *et al.* (1990) pointed out that a body of studies mis-using formative indicators in SEM-based research and its' treatment as reflective measures have been recognized (Cited in Chin, 1998a).

Next, the easy and speedy computer work gives instant estimation (Wold, 1981). Then, considering the number of population and expected response rates, it can be reasonable to have 100 - 200 responses (See section 5.5.1). Therefore, PLS is a more practical technique. Finally, social science data like the present study, often do not satisfy the requirements of multinormality and interval scaling, or attain the sample size required by maximum likelihood estimation (Formell and Bookstein, 1982). Consequently, it is justified of using a flexible tool like PLS.

5.8 Concluding Remarks

This chapter has dealt with intrinsic methodological issues in the current research.

Considering there are few empirical studies related to the research area, the current research adopts a mix of deductive and abductive approaches on the basis of postpositivism. Regarding research strategies, web-based survey is performed focusing on describing the situation in the population relating to the topic (Robson, 1993). Bearing time constraints and the nature of the research problem in mind, a cross-sectional study is employed as time horizon criteria. Then, the focus goes to the research object, considering PLS as a half exploratory and half explanatory tool, and aspect. The current research pursues exploratory/explanatory study for finding the causal relations between PA's SCM strategies, PSCs' SCM strategies, PSCs' resources, and PSCs' SCP.

To this end, online questionnaire (e-mail and web-based) was chosen among four data collection methods and PLS approach to SEM as data analysis technique. It has been stressed that special care (e.g. using formative indicators) should be taken to choose between PLS and SEM. For an actual questionnaire design, Churchill and Iacobucci's nine-step procedure for developing a questionnaire was adopted and three versions of questionnaires (English, Korean, Chinese version) are set up. For the survey, the total number of the population was 1,208 (Shipping companies HQ: 76; Branch/Agencies in Korea and China: 387; Korean freight forwarders 745). It was decided to use the total population as the sampling frame, considering the data analysis technique and response rates. Covered model evaluation, reliability and validity issues, it is noted that there is less evidence about reliability and validity when using only formative indicators. Therefore, exploratory factor analysis is suggested as a supplement in terms of ensuring validity.

Considering the limitation of using PLS with only formative measures, a case study or an in-depth interview can be considered as alternatives. As explained in section 5.2.1, this study acknowledged the abductive research approach. However, due to limitations on time and resources, it was decided to implement web-based survey and data analysis using PLS based on research philosophy of postpositivism

It should be remarked that an effort to implement triangulated research was made under the given circumstances. This includes case studies in chapter three regarding the SCM strategies of Busan and Shanghai port, interviews with three supervisors and one manager of container terminal, and one government official, pilot surveys with 15 experts on shipping industry, and main survey including Supply Chain Performance of five chosen container ports. This strategy is in line with postpositivism as research philosophy, and abductive research approaches as already discussed in this chapter.

In following chapters six, and seven, the statistical analysis based on the methodology that was expounded in this chapter, will be discussed with descriptive findings, the result of reliability, validity, and hypotheses tests.

Chapter 6
Descriptive Statistics

This chapter presents the descriptive picture of the responses from the questionnaire survey and tries to grasp the essence of basic statistics concerning the respondents' characteristics and the general trends of the constructs examined in the present study. Descriptive statistics is defined as 'a set of statistical tools that allows researcher to accurately describe a large volume of data with just a few values' (Brace *et al.*, 2006: 56p). The role of descriptive statistics is to provide readers with an understanding of what the data look like by using a few indicative or typical values.

In order to illustrate an overview of respondents and responses, this chapter discusses the participants' response rate, respondents' demographic statistics, descriptive research findings presented by construct basis, and descriptive statistics on SCP of five major container ports in Asia.

6.1 Response Rate and Non-Response Bias

The survey was conducted from 12th of March 2007 to 3rd of May 2007. Data collection was initially intended to acquire the data from Korean and Chinese companies together. Therefore, a postal survey in Korea and China was prepared in November 2006. Because Chinese New Year's Day is one of the biggest holidays in Korea and China, postal survey was postponed until February 2007. However, it was found that postal survey in China was impossible with an English address in January 2007 because of the internal problems of Chinese post office. Therefore, postal survey was changed into web and e-mail survey after consultations with three supervisors.

Because the web site was constructed to supplement postal questionnaire, it is possible to adopt an on-line survey method as an alternative. To make the most of the e-mail survey, the sample frame was decided as 1,208 anticipating 7% of responses to get 80 or more (See section 5.4.4).

Table 6.1 presents the final response rate of the on-line survey. 124 responses are recognized as enough numbers for PLS (Chin, 1998a). 71% of non-delivered questionnaires belong to Freight Forwarders (290 out of total 409 non-delivered questionnaires). Two questionnaires were discarded because these were from non-container dealing companies.

Table 6.1 Final response rate

	Number Distributed	Non-delivered	Effectively Delivered	Refused	Total Responses	Discarded	Effective questionnaire	Response Rate
	(1)	(2)	(3)=(1)-(2)	(4)	(5)	(6)	(7)=(5)-(6)	(8)=(7)/(3)
HQ	76	2	74	1	16	-	16	21%
Branch/ Agency	387	117	270	31	59	1	58	21%
Forwarder	745	290	455	15	44	1	43	9%
Others	-	-	-	-	5	-	5	-
Un-identified					2		2	-
Total	**1,208**	**409**	**799**	**47**	**126**	**2**	**124**	**16%**

Source: Author

Regarding the non-response bias, the 'selective extrapolation method' is recommended on the basis of the assumption that subjects who respond less readily are more like nonrespondents (Armstrong and Overton, 1977). Selective extrapolation can be implemented by Mann-Whitney test and Wilcoxon matched-pairs signed-ranks test comparing the last quartile respondents with the first quartile respondents. Table 6.2 presents the result of non-response bias test. Those two tests are nonparametric tests of difference and are used to explore whether two data sample are different (Brace *et al.*, 2006). The result shows that there is no significant difference between two groups ($P>0.05$). Only two variables (PA3: Concessions to Hybrid operator; SCP3: Level of damages in shipment) are recognized as having p-values less than 0.05. Therefore, it is assumed that non-response bias is not a critical issue in this research.

Table 6.2 Summary of Non-respondents' Bias Test

	Mann-Whitney U	Wilcoxon W	Z	Asymp. Sig. (2-tailed)
PA1	326.5	704.5	-.902	.367
PA2	384.5	819.5	-.355	.722
PA3	270.0	648.0	-2.046	.041
PA4	358.5	764.5	-.098	.922
PA5	339.5	690.5	-.434	.664
PA6	263.0	563.0	-1.20	.230
PA7	346.5	752.5	-.064	.949
PA8	319.0	697.0	-1.214	.225
PA9	437.5	872.5	-.180	.857
PA10	342.0	807.0	-1.231	.218
PA11	364.0	799.0	-.893	.372
PA12	414.5	879.5	-.087	.931
PA13	404.0	839.0	-.261	.794
PA14	338.0	744.0	-1.104	.270
PA15	394..5	829.5	-.413	.680
SCM1	464.0	960.0	-.015	.988
SCM2	415.5	911.5	-.729	.466
SCM3	429.0	894.0	-.530	.596
SCM4	332.5	797.5	-1.779	.075
SCM5	359.0	824.0	-1.378	.168
SCM6	410.0	845.0	-.595	.552
SCM7	413.0	878.0	-.765	.444
SCM8	366.0	831.0	-1.476	.140
SCM9	367.5	832.5	-1.445	.148
SCM10	414.5	849.5	-.528	.597
RES1	401.0	779.0	-.283	.778
RES2	456.0	952.0	-.357	.721
RES3	470.0	966.0	-.153	.878
RES4	459.5	924.5	-.082	.934
RES5	396.5	831.5	-.802	.423
RES6	449.5	945.5	-.232	.817
RES7	456.0	952.0	-.361	.718
RES8	443.0	939.0	-.331	.741
RES9	450.5	946.5	-.436	.663
RES10	414.0	910.0	-.752	.452
RES11	413.5	909.5	-.972	.331
RES12	455.5	951.5	-.141	.888
SCP1	437.0	902.0	-.418	.676
SCP2	377.5	873.5	-1.499	.134
SCP3	261.0	726.0	-3.007	.003
SCP4	478.5	974.5	-.030	.976
SCP5	463.5	959.5	-.244	.807
SCP6	371.5	836.5	-1.194	.233
SCP7	442.5	938.5	-.554	.579
SCP8	401.0	897.0	-1.145	.252
SCP9	443.5	939.5	-.531	.595
SCP10	363.5	859.5	-1.50	.134
SCP11	397.5	893.5	-1.204	.134
SCP12	427.0	923.0	-.771	.441
SCP13	439.0	935.0	-.596	.551
SCP14	440.0	905.0	-.369	.712
SCP15	403.0	899.0	-.930	.352
SCP16	479.0	975.0	-.022	.983
SCP17	437.0	933.0	-.189	.850
SCP18	429.5	925.5	-.526	.599
SCP19	429.5	894.5	-.526	.599
SCP20	452.5	917.5	-.186	.852
SCP21	461.5	926.5	-.052	.958
SCP22	427.5	892.5	-.342	.732
SCP23	435.0	931.0	-.222	.824
SCP24	437.5	933.5	-.407	.684

See Table 6.8 for the abbreviation of items

6.2 Overall Sample Demographic Profile

This section illustrates an overview of the research sample profile.

Figure 6.1 and Table 6.3 present overall descriptive statistics for respondents and companies. With regard to working experience, figure 6.1 illustrates that the largest working experience group had 9-16 years working experience (35.5%) with 44 respondents out of 124, followed by 17-24 years (29%: 36 out of 124), 1-8 years(16.9%: 21), and over 25 years (16.1%: 20). Average of working experience in total is 15.95 years. In the field of shipping companies (HQs, branches, and agencies), respondents had worked for 16.72 years. The average in freight forwarding business was 15.77 years, which is less than working experience of respondents in shipping companies. Respondents in other business type had worked around 6.25 years.

As to Job position, CEO level (18-20) is the largest group of the respondents, followed by manager level (14-17), 38.7% with 48 responses, clerk level (14.4%: 18), and no answer (1.6%: 2). In total, average position is located in manager level (14-17) around 16.68. In shipping companies, average job position is 16.52. Respondents who work for freight forwarders are positioned around 17.43. Therefore, it can be assumed that average respondents belong to manager level. Respondents in other business type have positions at the level of 12.40.

Considering the characteristics of the respondents' work experience and position, it can be posited that the responses are from respondents who possessed expertise and reliable knowledge in the field of shipping and freight forwarding business.

About business type, 35.5% (44) went to freight forwarder, which is the largest group. 30.6% (38) were shipping liner agency. Then branch (16.1%) and Shipping Company (headquarter) 12.9% (16) follow. Overall, 59.6% of respondents belong to the shipping companies, and 35.5% falls into forwarders category. Considering the number of questionnaire distributed to shipping companies, 463 (38%), and to freight forwarders, 745 (62%), it is assumed that respondents in shipping companies more actively participated in answering the questionnaire.

Regarding container volume handled by shipping companies, the sample shows that 39.2% (29 out of 74) of respondents' shipping companies handled over 100,000 TEUs, and 25.7% (19 out of 74) of respondents handled less than 10,000 TEUs. 17.6% (13 out of 74) respondents handled from 10,000 to 99,999 TEUs. Respondents with no answer were 17.6% (13 out of 74). In a nutshell, respondents' shipping companies are relatively big scale companies.

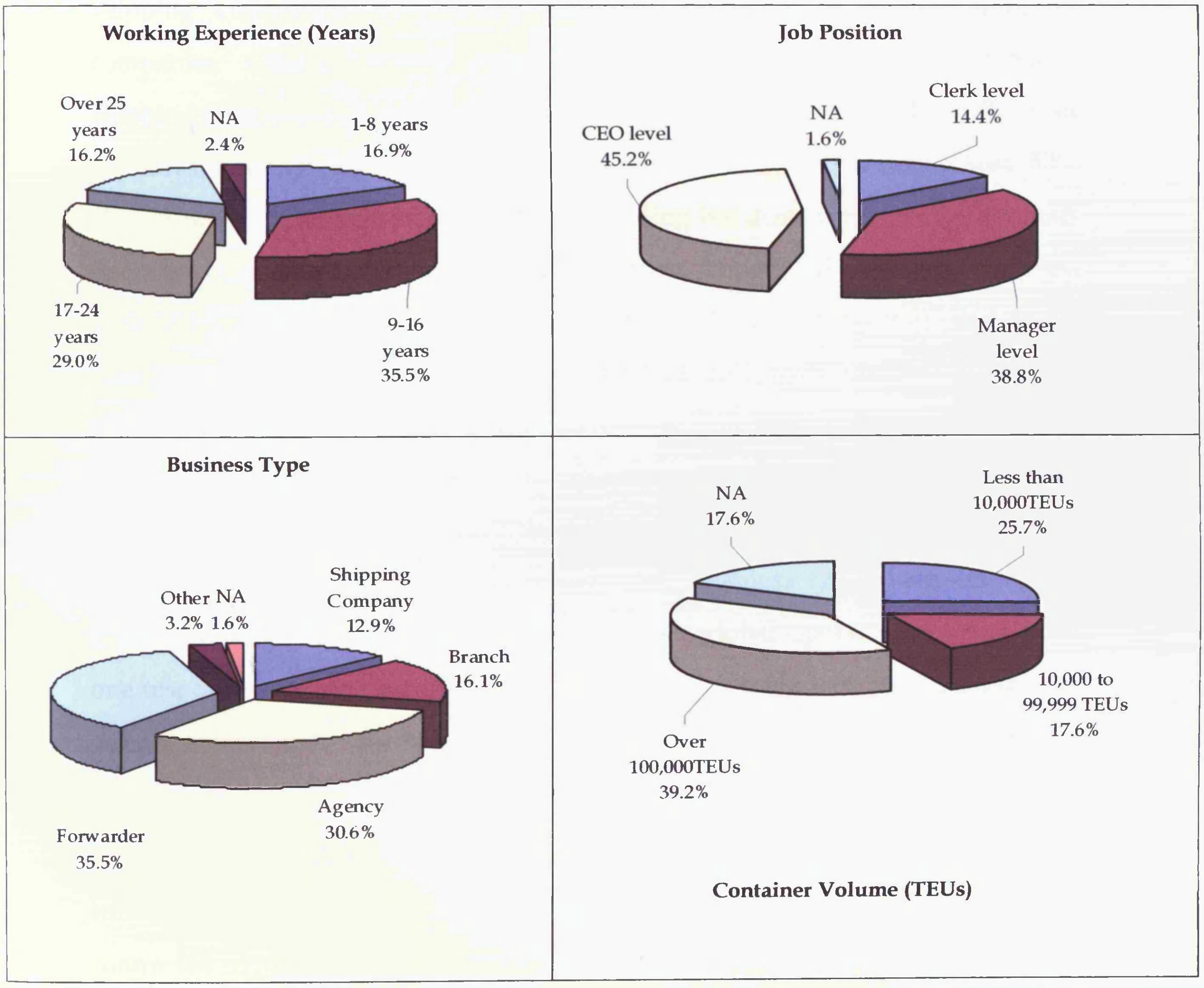

Figure 6.1 A Pictorial profile of the survey respondents and companies (Source: Author)

When it comes to stevedoring service provider, most of the port users were using local operators (42.7%: 53). Then, users of global shipping company follow with percentage of 24.2% (30). 19.4% respondents (24) were using global terminal operator. Global shipping companies using own terminal were around 4% (5). 4.8% respondents each (6) chose other types of service providers and did not answer at all. In case of shipping companies, respondents answered that their companies were using local operators (34 out of 74, 45.9%). Then 27% (20 out of 74) of respondents in category of shipping companies replied that they were using global terminal operators. 9.5% (7 out of 74) of respondents in shipping companies were using terminals operated by global shipping companies. Others followed with 6.8% (5 out of 74). 5.4% of respondents in shipping companies (4 out of 74) were using their own terminal. 4.1% (3 out of 74) of respondents did not answer the question. In freight forwarding area, 50% (22 out of 44) respondents in freight forwarding business were using terminals operated by global shipping lines. Respondents using local operators followed with 38.6% portion (17 out of 44). Respectively 4.5% of answers (2 out of 44) were from respondents using global operator and with no answers. One respondent (2.3%) belonged to others category. There was no answer for using global shipping lines own terminal by respondents from freight forwarding business, which enables to assume the relevance of result. There were four responses from respondents who ticked other business type. Two among six answers were using local operator, one was for global operator, and the other one response was for global shipping companies. Among two respondents who did not answer their business type, one was using global operator, the other did not response.

In summary, shipping line companies have mainly used terminals operated by local operators and global terminal operator. Freight forwarders have mainly contracted with operators runned by global shipping companies and local operators.

PSC type can be defined as a type how players in PSC are combined and used by users of PSC. It is recognized that there are two types, i.e. separate contracts of operating and inland transport service and total package by one PSC. Regarding PSC type, most of the port users were using separate contracts (64.5%:80 out of 124). Then, users of operator/inland transport provider package were only 23.4% (29 out of 124). 4.8% of respondents (6) used other types of services. 7.3% port users (9) did not answer. In shipping business, 58.1% of respondents (43 out of 74) were using separate contracts. 28.4% of respondents (21 out of 74) working for shipping companies answered that they are using operator/inland transport provider package. 4 answers (5.4%) from shipping companies fall into 'others' category. 6 respondents (8.1%) did not answer. In case of freight forwarding business, 77.3% (34 out of 44) respondents replied that their companies were using separate contracts. Only 13.6% (6 out of 44) respondents working for freight forwarding business answered that they were using package services. Two answers (4.5%) fall into others category. Two respondents in freight forwarding business did not answer. Among four respondents who ticked others category, two respondents (50%) answered that their companies were using package services and two responses out of four (50%) went into separate contracts category. Among respondents who did not answer business type, one respondent chose separate contracts and the other did not answer about PSC type. Considering the statistics about PSC type, it is assumed that shipping line companies have more actively used operator/inland transport provider package rather than freight forwarders.

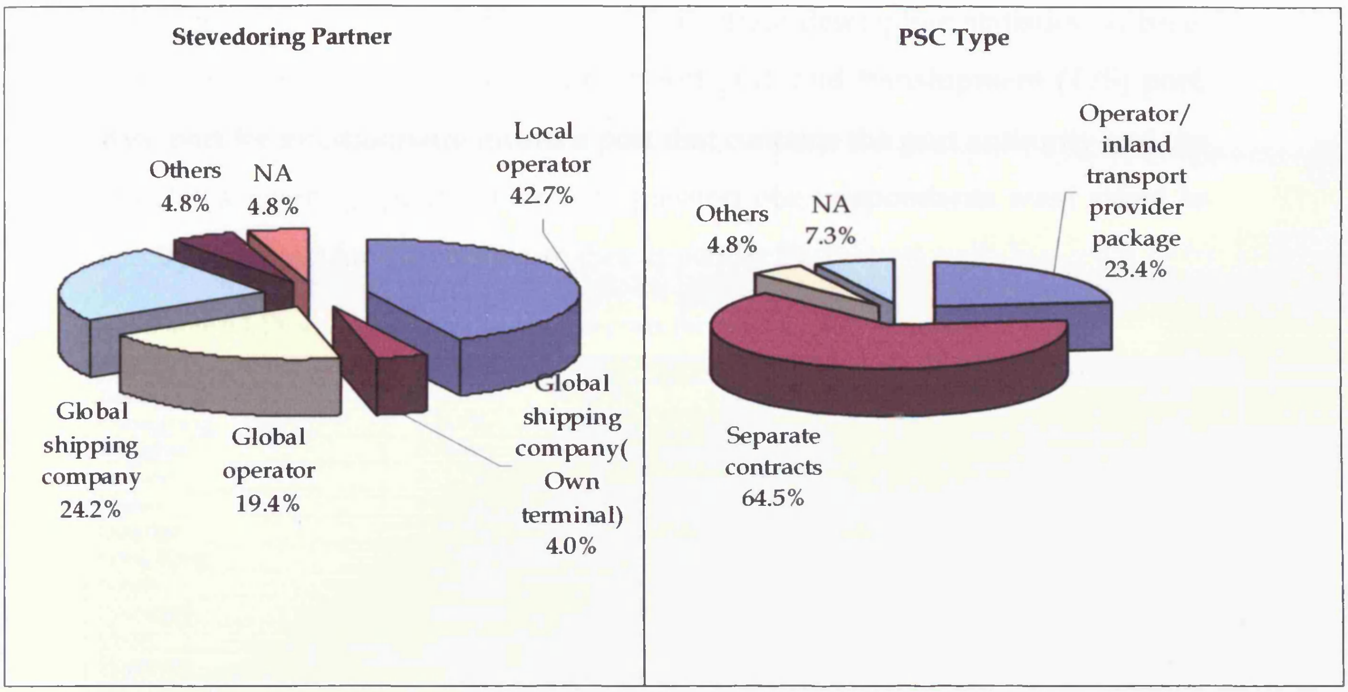

Figure 6.2 A pictorial profile of the survey respondents and companies (Source: Author)

Table 6.3 Overall descriptive statistics for respondents

Demographic Variable	Category	Frequency (n=124)					
		SL	*FF*	Others	NA	Total	%
Working Experience	1~8 years	11(14.9%)	6(13.6)	3(75%)	1(50%)	21	16.9
	9~16 years	25(33.8%)	18(40.9%)	1(25%)	0	44	35.5
	17~24 years	22(29.7%)	14(31.8%)	0	0	36	29.0
	Over 25 years	14(18.9%)	6(13.6%)	0	0	20	16.1
	NA	2(2.7%)	0(0%)	0	1(50%)	3	2.4
Job Position	10~13 (Clerk level)	10(13.5%)	5(11.4%)	2(50%)	1(50%)	18	14.4
	14~17 (Manager level)	33(44.6%)	12(27.3%)	2(50%)	0	48	38.7
	18~20 (CEO level)	29(39.2%)	27(61.4%)	0	0	56	45.1
	NA	1(1.4%)	0	0	1(50%)	2	1.6
Business Type	Liner Shipping Company	16				16	12.9
	Branch	20				20	16.1
	Agency	38				38	30.6
	Freight Forwarder		44			44	35.5
	Other			4		4	3.2
	NA				2	2	1.6
Container Volume -Shipping companies (Year 2005, n=74)	Less than 10,000TEUs	19	-	-	-	19	25.7
	10,000~99,999TEUs	13				13	17.6
	100,000TEUs or more	29				29	39.2
	NA	13				13	17.6
Stevedoring operator partner	Local operator	34(45.9%)	17(38.6%)	2(50%)	0	53	42.7
	Global shipping company (own terminal)	5(6.8%)	0	0	0	5	4.0
	Global operator	20(2.7%)	2(4.5%)	1(25%)	1(50%)	24	19.4
	Global shipping company	7(9.5%)	22(50%)	1(25%)	0	30	24.2
	Others	5(6.8%)	1(2.3%)	0	0	6	4.8
	NA	3(4.1%)	2(4.5%)	0	1(50%)	6	4.8
PSC Type	Operator/inland transport provider package	21(28.4%)	6(13.6%)	2(50%)	0	29	23.4
	Separate contracts	43(58.1%)	34(77.3%)	2(50%)	1(50%)	80	64.5
	Others	4(5.4%)	2(4.5%)	0	0	6	4.8
	NA	6(8.1%)	2(4.5%)	0	1(50%)	9	7.3

Source: Author

Figure 6.3 and from Table 6.4 to 6.7 illustrate descriptive statistics on base-ports for questionnaire, export port, import port, and transhipment (T/S) port. Base port for questionnaire means a port that contains the port authority and the PSC for answering questionnaire. In question one, respondents were asked to specify base port for questionnaire (See appendix 2).

Table 6.4 Descriptive statistics of base-ports for questionnaire answer

Port	SL	FF	Others	NA	Frequency	Percentage
Busan	42 (56.8%)	36 (81.8%)	2 (50%)	1 (50%)	81	65.3%
Gwangyang	5 (6.8%)	1 (2.3%)	1 (25%)	0	7	5.6%
Shanghai	5 (6.8%)	0	0	0	5	4.0%
Incheon	3 (4.1%)	0	0	0	3	2.4%
Masan	3 (4.1%)	0	0	0	3	2.4%
Qingdao	2 (2.7%)	0	0	0	2	1.6%
Hong Kong	1 (1.4%)	0	0	0	1	0.8%
Ningbo	1 (1.4%)	0	0	0	1	0.8%
Pyungtaek	1 (1.4%)	0	0	0	1	0.8%
Ulsan	1 (1.4%)	0	0	0	1	0.8%
Singapore	0 (0)	1 (2.3%)	0	0	1	0.8%
NA	10 (13.5%)	6 (1.4%)	1 (25%)	1 (50%)	18	14.5%
Total	74 (100%)	44 (100%)	4 (100%)	2 (100%)	124	100%

Source: Author

Table 6.4 presents the statistics of base-ports for the questionnaire answer. As to **base port** for questionnaire, overall, the majority of respondents were using Busan port (65.3%). Then, Gwangyang (5.6%), Shanghai (4%), Incheon (2.4%), Qingdao (1.6%), Masan (2.4%), others (4%), and no answer (14.5%) follow. In case of shipping liner companies, 56.8% of respondents (42 out of 74) had replied that they regarded Busan port as base port for the questionnaire. Then, Gwangyang and Shanghai ports follow with five frequencies each (6.8%). Three respondents (4.1%) each had responded that they posited Incheon and Masan port as their base ports. Then, there were two respondents (2.7%) who ticked Qingdao port. One respondent (1.4%) each designated Hong Kong, Ningbo, Pyungtaek, Ulsan as base ports. 13.5% of respondents from shipping liner business did not answer about their base port. In freight forwarding business, 81.8% of respondents regarded Busan port as their main base port for questionnaire. One respondent (2.3%) had answered Gwangyang was base port. There was one respondent who selected Singapore as base port. Six respondents (1.4%) ticked NA category.

It is posited that respondents from freight forwarding business have mainly used Busan port. Respondents from shipping business were more various in geographical senses.

Table 6.5 Descriptive statistics for export-port

Port	SL	FF	Others	NA	Frequency	Percent
Busan	32 (43.2%)	37 (84.1%)	2 (50%)	1 (50%)	72	58.1%
Gwangyang	3 (4.1%)	2 (4.5%)	1 (25%)	0	6	4.8%
Shanghai	6 (8.1%)	0	0	0	6	4.8%
Incheon	3 (4.1%)	2	0	0	5	4.0%
Hong Kong	4 (5.4%)	0	0	0	4	3.2%
Masan	3 (4.1%)	0	0	0	3	2.4%
Qingdao	3 (4.1%)	0	0	0	3	2.4%
Ulsan	3 (4.1%)	0	0	0	3	2.4%
LA	2 (2.7%)	0	0	0	2	1.6%
Tianjin (Xingang)	0	2 (4.5%)	0	0	2	1.6%
Busan/Shanghai	1 (1.4%)	0	0	0	1	0.8%
Ningbo	1 (1.4%)	0	0	0	1	0.8%
Qinhuangdao	1 (1.4%)	0	0	0	1	0.8%
Colombia	0	1 (2.3%)	0	0	1	0.8%
Japan	1 (1.4%)	0	0	0	1	0.8%
NA	11 (14.9%)	0	1 (25%)	1 (50%)	13	10.5%
Total	74 (100%)	44 (100%)	4 (100%)	2 (100%)	124	100%

Source: Author

Table 6.5 provides the descriptive statistics for export port. Regarding **export port**, the sample shows that Busan port is the top export port with 72 frequencies (58.1%) followed by Gwangyang (4.8%: 6), Shanghai (4.8%: 6), Incheon (4%: 5), Hong Kong (3.2%: 4), others (14.5%: 18), and no answer (10.5%: 13). In liner shipping business, 43.2% of respondents (32 out of 74) had answered that Busan port was their base port. Shanghai port was designated as export port with 6 frequencies (8.1%). Then, Hong Kong port (5.4%: 4), Masan (4.1%: 3), Qingdao (4.1%: 3) ports followed. One response each was recognized with Busan/Shanghai, Ningbo, Qinhungdao, and Japan. The answer 'Japan' is supposed to be from a respondent who use many Japanese ports at the same time. Frequency of no response was 11 (14.9%). Respondents in freight forwarding business indicated that the most general export port was Busan port (84.1%: 37 out of 44). Then, two each answer went into Gwangyang and Tianjin port (4.5%: 2 out of 44). One respondent (2.3%) responded with Colombia as export port.

Table 6.6 Descriptive statistics for import-port

Port	SL	FF	Others	NA	Frequency	Percent
Busan	28 (37.8%)	24 (54.5%)	1 (25%)	1 (50%)	54	43.5%
Shanghai	8 (10.8%)	5 (11.4%)	1 (25%)	0	13	10.5%
Incheon	4 (5.4%)	6 (13.6%)	0	0	10	8.1%
Gwangyang	3 (4.1%)	1 (2.3%)	0	0	5	4.0%
Dalian	4 (5.4%)	0	0	0	4	3.2%
LA	2 (2.7%)	1 (2.3%)	0	0	3	2.4%
Hong Kong	1 (1.4)	1 (2.3%)	0	0	2	1.6%
Qingdao	2 (2.7%)	0	0	0	2	1.6%
America	1 (1.4%)	0	0	0	1	0.8%
Busan/Shanghai	1 (1.4%)	0	0	0	1	0.8%
China	1 (1.4%)	0	0	0	1	0.8%
Germany	0	1 (2.3%)	0	0	1	0.8%
Haipong	0	0	1 (25%)	0	1	0.8%
Hamburg	0	1 (2.3%)	0	0	1	0.8%
Kobe	1 (1.4%)	0	0	0	1	0.8%
Masan	1 (1.4%)	0	0	0	1	0.8%
Ningbo	1 (1.4%)	0	0	0	1	0.8%
Osaka	0	1 (2.3%)	0	0	1	0.8%
Pyungtaek	0	1 (2.3%)	0	0	1	0.8%
Shenzhen	0	1 (2.3%)	0	0	1	0.8%
Tianjin (Xingang)	0	1 (2.3%)	0	0	1	0.8%
Ulsan	1 (1.4%)	0	0	0	1	0.8%
Yokohama	1 (1.4%)	0	0	0	1	0.8%
NA	14 (18.9%)	0	1 (25%)	1 (50%)	16	12.9%
Total	74 (100%)	44 (100%)	4		124	100%

Source: Author

In Table 6.6, the statistics for import port are presented. With regard to **import port**, Busan port also ranked top as an import port for the respondents (43.5%: 54). Shanghai (10.5%: 13), Incheon (8.1%: 10), Gwangyang (4%: 5), Dalian (3.2%: 4), others (18%), and no answer (12.9%: 16) followed. In liner shipping business, Busan port was recognized as the most frequently named import port with 28 answers (37.8%). Shanghai port recorded relatively high percentage (10.8%) with eight answers. This result raised the point that Chinese port played a role as a major export base to North America or Europe. Incheon (5.4%) followed with 4 answers (5.4%).

In freight forwarding business, Busan port was ranked as the 1st import port with 24 responses (54.5%). Compared with the percentage in case of export port, 84.1% (37 out of 44), Busan port recorded relatively low responses. The result reflected the relevant reality that East Asian ports including Busan and Shanghai were mainly used as export ports towards Northern America or Europe. Then, Incheon (13.6%: 6), Shanghai (11.4%: 5) followed. Nine ports, i.e. Gwangyang, LA, Hong Kong, Germany, Hamburg, Osaka, Pyungtaek, Shenzhen, and Tianjin, recorded one response each.

Table 6.7 Descriptive statistics for transhipment-port

Port	SL	FF	Others	NA	Frequency	Percent
Busan	27 (36.5%)	21 (47.7%)	1 (25%)	1 (50%)	50	40.3%
Hong Kong	6 (8.1%)	8 (18.2%)	1 (25%)	0	15	12.1%
Shanghai	9 (12.2%)	3 (6.8%)	0	0	12	9.7%
Gwangyang	5 (6.8%)	2 (4.5%)	1 (25%)	0	8	6.5%
Singapore	3 (4.1%)	4 (9.1%)	0	0	7	5.6%
Incheon	1 (1.4%)	1 (2.3%)	0	0	2	1.6%
Tianjin (Xingang)	1 (1.4%)	0	0	0	1	0.8%
Masan	1 (1.4%)	0	0	0	1	0.8%
Ningbo	1 (1.4%)	0	0	0	1	0.8%
Dubai	0	1 (2.3%)	0	0	1	0.8%
NA	20 (27%)	4 (9.1%)	1 (25%)	1 (50%)	26	21.0%
Total	74 (100%)	44 (100%)	4	2	124	100%

Source: Author

Table 6.7 describes the statistics for **transhipment ports**. Regarding T/S port, 40.3% (50) of respondents used Busan port. Then, other ports, i.e. Hong Kong (12.1%: 15), Shanghai (9.7%: 12), Gwangyang (6.5%: 8), Singapore (5.6%: 7), Incheon (1.6%: 2), Tianjin (0.8%: 1), Masan (0.8%: 1), Ningbo (0.8%: 1), and Dubai (0.8%: 1) followed. Twenty six respondents (21%) did not answer.

In case of liner shipping business, 36.5% respondents (27 out of 74) responsed that their companies used Busan port as their T/S ports. Shanghai port was the 2nd most called port for T/S with 9 answers (12.2%). Hong Kong followed with 6 responses (8.1%). Five answers went to Gwangyang with 5 frequencies (6.8%). The next port was Singapore with 3 answers (4.1%). Four ports, i.e. Incheon, Tianjin, Masan, Ningbo, received one response each (1.4%). 27% respondents (20) did not answer at all.

Among freight forwarding companies, twenty-one respondents (47.7%) replied that their companies used Busan port as a main T/S port. Hong Kong was the second biggest T/S port for respondents in freight forwarding business with eight answers (18.2%). Then, other ports, i.e. Singapore (9.1%: 4), Shanghai (6.8%: 3), Gwangyang (4.5%: 2), Incheon (2.3%: 1), and Dubai (2.3%: 1) followed. Four respondents (9.1%) did not answer about their T/S ports.

Figure 6.3 illustrates the overall response rate about four types of base ports, i.e. base port, export port, import port, and T/S port. It is recognized that the respondents of this questionnaire have mainly used Busan port. The difference of percentage of Busan port (Base port: 65.3%, export port: 58.1%, import port: 43.5%, T/S port: 40.3%) according to types of ports suggests that Busan port served as a major container port which dominates export, import and transhipment for respondents of this questionnaire. Compared to this fact, the percentages of Shanghai port, i.e. Base port: 4%, export port: 4.8%, import port: 10.5%, T/S port: 9.7%, imply that it may played a role as an import port and T/S port mainly for respondents of this questionnaire.

Other major container ports were Gwangyang and Incheon. Gwangyang port was used as Base port: 5.6%, export port: 4.8%, import port 4%, and T/S port 6.5%. According to this result, it can be posited that Gwangyang port is not as big as Busan and Shanghai. Considering its' volume, it is recognized as a T/S port. For Incheon port, respondents responded with percentage according to types of ports, i.e. Base port: 2.4%, export port: 4%, import port: 8.1%, and T/S port: 1.6%. Therefore, it can be assumed that Incheon port was recognized as an import port for the users of Korean and Chinese ports.

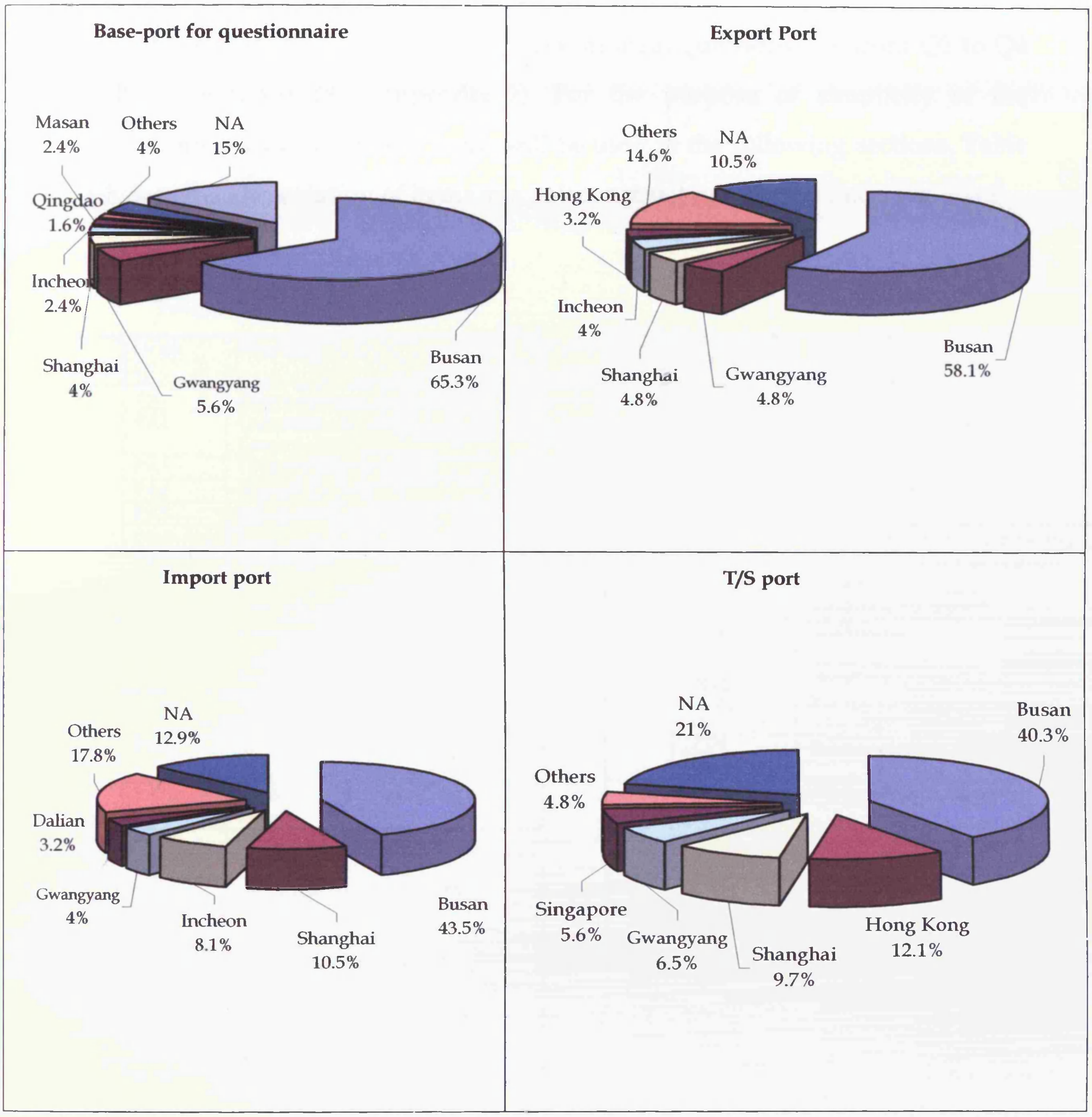

Figure 6.3 A pictorial profile of the using ports (Source: Author)

6.3 Descriptive Statistics for Main Questions

In this section, statistics for answers on main questions, i.e. from Q1 to Q4 will be provided (See appendix 2). For the purpose of simplicity of the presentation, abbreviation of items will be used in the following sections. Table 6.8 presents abbreviation of items as a sub construct to measure main variables.

Table 6.8 Abbreviation of Items

	Items	Measures
Privatisation	PA1	Concentrating on concession to global operator
	PA2	Concentrating on concession to Shipping Company
	PA3	Concessions to Hybrid operator
	PA4	Financial stakes of PAs
	PA5	Build Operated Transfer (BOT)
	PA6	Management Contract
	PA7	Sale of port land
	PA8	Lease contract (except concession)
Hinterland & FTZ	PA9	Hinterland provision (including logistics companies)
	PA10	Free Trade Zone
Using IT	PA11	Single window EDI in operations & custom clearance
	PA12	Support for Automated Container Identification using RFID (Radio Frequency Identification)
	PA13	Support for Container Tracking Information System
Marketing	PA14	Common port marketing (PA)
	PA15	Existence of marketing department (PA)
Vertical Integration	SCM1	Integration strategies with road haulage companies
	SCM2	Integration strategies with railway companies
	SCM3	Operating Inland terminals
	SCM4	Operating Warehousing & value-added logistical service
Relationship Orientation	SCM5	Communication (Information Sharing)
	SCM6	Long-term contracts and incentives
	SCM7	Increasing Just in Time (JIT) capabilities
	SCM8	Share Value with customers
	SCM9	Customized Service
	SCM10	Customer relationship management (Maintaining a stable partnership)
Relational Resources	RES1	Trust
	RES2	Commitment to relationship with users
	RES3	Loyalty
Technologies (Skills)	RES4	Service Design technology(New Service Design)
	RES5	Cargo Handling technology
	RES6	Marketing technology (Analysis of customer requirements and relationship management)
	RES7	R&D capabilities

	Items	Measures
Physical Resources	RES8	Information systems
	RES9	Cargo handling equipment
	RES10	Quays, berths, aprons, storage or yard capacity
	RES11	Dredged channels
	RES12	Road & Railway capability (or Infrastructure)
Reliability	SCP1	Reliability of transit time/transport availability
	SCP2	Accuracy of information regarding status of shipment
	SCP3	Level of damages in shipment
Cost	SCP4	Value for money
	SCP5	Level of Overall port transport cost
	SCP6	Reduction of order management cost (EDI)
	SCP7	Reduction of facilities/equipment cost
	SCP8	Reduction of Warehousing costs
	SCP9	Reduction of transportation costs
	SCP10	Reduction of logistics administration costs
Service Effectiveness	SCP11	Fulfill promises to port users (on-time service)
	SCP12	Solve port users' problem
	SCP13	Perform services for port users right the first time
	SCP14	Lower port time
	SCP15	Level of conflict with other multimodal processes
	SCP16	Responsiveness in meeting customers' requirements
Flexibility	SCP17	Access/distribution Flexibility (hinterland & foreland)
	SCP18	Expansion flexibility (invest for future requirement)
	SCP19	Launch flexibility (introducing new tailored services)
	SCP20	Process flexibility (speed that port can make decisions)
	SCP21	Product flexibility (transfer cargo from mode to mode)
	SCP22	Routing flexibility (convey through diversified route)
	SCP23	Target flexibility (deliver tailored services to the different market segments)
	SCP24	Volume flexibility

First, the respondents were asked to specify their evaluation on PAs' SCM strategies. PAs' SCM strategies were measured through a seven-point Likert scale ranging from very poor (1) to excellent (7). In Table 6.9, descriptive statistics for PAs' SCM strategies is presented.

Table 6.9 Descriptive statistics for PAs' SCM strategies

Construct		Response Scale (%)									Mean	SD
		(1)	(2)	(3)	(4)	(5)	(6)	(7)	(N)	No response		
Port Authorities' SCM Strategies	PA1	3.2	10.5	12.9	36.3	15.3	12.1	0.8	8.1	0.8	3.98	1.31
	PA2	5.6	10.5	8.1	26.6	28.2	11.3	3.2	5.6	0.8	4.16	1.47
	PA3	4.8	10.5	16.9	33.1	18.5	8.9	0.8	5.6	0.8	3.85	1.32
	PA4	3.2	12.1	19.4	30.6	14.5	10.5	1.6	7.3	0.8	3.86	1.35
	PA5	0.8	11.3	16.9	18.5	24.2	16.9	3.2	7.3	0.8	4.28	1.42
	PA6	4.0	5.6	13.7	37.9	18.5	8.1	0.8	8.1	3.2	4.00	1.22
	PA7	9.7	9.7	15.3	32.3	12.1	8.1	0.8	10.5	1.6	3.62	1.44
	PA8	5.6	8.1	19.4	26.6	20.2	10.5	1.6	7.3	0.8	3.93	1.40
	PA9	5.6	14.5	14.5	25.0	14.5	14.5	7.3	2.4	1.6	4.05	1.66
	PA10	4.0	22.6	11.3	25.0	9.7	13.7	10.5	2.4	0.8	4.00	1.76
	PA11	4.0	8.1	11.3	18.5	16.1	23.4	13.7	3.2	1.6	4.68	1.69
	PA12	6.5	14.5	14.5	23.4	16.9	12.9	5.6	4.8	0.8	3.97	1.63
	PA13	8.9	13.7	16.9	19.4	21.0	10.5	4.8	4.0	0.8	3.85	1.65
	PA14	4.0	11.3	21.8	33.1	12.9	9.7	1.6	4.0	1.6	3.79	1.33
	PA15	4.0	11.3	24.2	23.4	17.7	11.3	1.6	4.8	1.6	3.85	1.40

See Table 6.8 for the abbreviation of items

Overall, a notable observation was that the majority of respondents perceived that PA's SCM strategies were almost around at the mid-point four (3.99). The mean of items was ranged from 3.62 (PA7: Sale of port land) to 4.68 (PA11: Single window EDI in operations& custom clearance). Six items (PA2: Concentrating on concession to shipping company, PA5: BOT, PA6: Management Contract, PA9: Hinterland provision, PA10: Free Trade Zone, PA11) were above the mid-point four. Especially, it is noted that the respondents recognized 'concessions' (PA1,2,3), 'support for hinterland and FTZ' (PA9,10), and 'using IT' strategy (PA11,12,13) as significantly above the mid-point. (Regarding the abbreviation of items, see table 6.8).

Table 6.10 Descriptive statistics for PSCs' SCM strategies

Construct		Response Scale (%) (1)	(2)	(3)	(4)	(5)	(6)	(7)	(N)	No response	Mean	SD
PSCs' SCM strategies	SCM1	4.8	16.1	22.6	29.8	16.9	7.3	0	2.4	0	3.61	1.29
	SCM2	12.1	16.1	19.4	31.5	15.3	3.2	0	2.4	0	3.32	1.35
	SCM3	12.1	12.9	17.7	29.8	16.1	7.3	0	3.2	0.8	3.49	1.44
	SCM4	2.4	12.1	20.2	31.5	16.9	12.1	1.6	1.6	1.6	3.94	1.33
	SCM5	5.6	15.3	15.3	32.3	20.2	7.3	1.6	1.6	0.8	3.76	1.38
	SCM6	4.0	9.7	18.5	28.2	20.2	14.5	1.6	2.4	0.8	4.04	1.39
	SCM7	2.4	15.3	18.5	25.0	21.8	14.5	0.8	1.6	0	3.97	1.39
	SCM8	7.3	16.9	17.7	29.0	17.7	6.5	3.2	1.6	0	3.66	1.47
	SCM9	6.5	18.5	21.0	31.5	12.1	8.1	0.8	1.6	0	3.52	1.37
	SCM10	4.0	12.9	25.8	28.2	16.1	8.1	3.2	1.6	0	3.79	1.38

See Table 6.8 for the abbreviation of items

Upon the examination of PSCs' SCM strategies, a seven-point Likert scale ranging from very poor (1) to excellent (7) was used as well. In Table 6.10, descriptive statistics for PSCs' SCM strategies is illustrated. The mean for PSCs' SCM strategies (SCM1-10) is calculated as below mid-point level four (3.71). Overall, it is noted that the evaluation from the respondents was relatively low. Only one item from 'relationship orientation' (SCM6: Long-term contracts and incentives) was above the average level four. The lowest PSCs' SCM strategy was SCM2 (Integration strategy with railway companies). Then, another vertical integration strategy (SCM3: operating inland terminals) follows as the next low item with the mean 3.49. It can be generally stated that the respondents evaluate the PSCs' SCM strategies as relatively low level.

Table 6.11 Descriptive statistics for PSCs' resources

Construct		Response Scale (%) (1)	(2)	(3)	(4)	(5)	(6)	(7)	(N)	No response	Mean	SD
Resources	RES1	0.8	9.7	12.1	29.0	31.5	12.9	2.4	0.8	0.8	4.31	1.25
	RES2	0.8	8.9	11.3	30.6	28.2	16.1	2.4	0.8	0.8	4.37	1.26
	RES3	1.6	10.5	24.2	32.3	13.7	14.5	0	2.4	0.8	3.92	1.26
	RES4	1.6	5.6	25.8	34.7	20.2	9.7	2.4	0	0	4.05	1.20
	RES5	0.8	1.6	12.1	25.8	32.3	20.2	6.5	0	0.8	4.75	1.20
	RES6	3.2	8.1	19.4	38.7	21.0	6.5	3.2	0	0	3.98	1.26
	RES7	4.0	12.9	25.8	29.8	14.5	9.7	0	2.4	0.8	3.69	1.28
	RES8	0.8	6.5	12.1	26.6	29.0	17.7	6.5	0.8	0	4.57	1.32
	RES9	0.8	1.6	6.5	21.0	33.1	30.6	4.8	0.8	0.8	4.98	1.23
	RES10	1.6	1.6	5.6	24.2	29.0	28.2	7.3	1.6	0.8	4.96	1.22
	RES11	0.8	4.0	13.7	32.3	23.4	17.7	4.0	3.2	0.8	4.49	1.23
	RES12	1.6	8.1	17.7	30.6	19.4	18.5	1.6	1.6	0.8	4.23	1.31

See Table 6.8 for the abbreviation of items

Regarding PSCs' resources, a seven-point Likert scale ranging from very poor (1) to excellent (7) was also used. In Table 6.11, descriptive statistics for PSCs' resources is described. The mean of items (4.36) reveals that the respondents' perception on PSCs' resources is well above the mid-point four. Most of responses were above the mid-point level four. Only three items (RES3: 'loyalty' 3.92, RES6: 'Marketing technology' 3.98, RES7: 'R&D technology' 3.69) recorded as having the mean value less than four. In particular, 'R&D capabilities' (RES7) is the item that had the lowest score. It is observed that the item RES9 ('Cargo handling equipment') ranked the highest item to record the mean value of 4.98.

Table 6.12 Descriptive statistics for PSCs' Supply Chain Performance

Construct		Response Scale (%)									Mean	SD
		(1)	(2)	(3)	(4)	(5)	(6)	(7)	(N)	No response		
Supply Chain Performance	SCP1	0	4.8	19.4	31.5	24.2	18.5	0.8	0.8	0	4.35	1.16
	SCP2	0.8	4.0	15.3	26.6	21.8	27.4	4.0	0	0	4.63	1.30
	SCP3	1.6	6.5	15.3	29.0	22.6	21.0	3.2	0.8	0	4.41	1.33
	SCP4	0.8	12.1	12.1	37.9	26.6	9.7	0.8	0	0	4.10	1.19
	SCP5	4.0	14.5	21.0	26.6	19.4	12.9	1.6	0	0	3.88	1.42
	SCP6	4.0	4.0	21.0	31.5	15.3	20.2	1.6	1.6	0.8	4.20	1.36
	SCP7	3.2	8.9	23.4	33.9	21.0	8.1	1.6	0	0	3.91	1.25
	SCP8	2.4	12.1	24.2	32.3	17.7	9.7	1.6	0	0	3.86	1.28
	SCP9	3.2	16.1	25.0	29.0	14.5	10.5	1.6	0	0	3.73	1.36
	SCP10	3.2	16.1	16.9	35.5	14.5	12.9	0	0.8	0	3.81	1.33
	SCP11	2.4	8.1	21.0	29.0	24.2	12.9	1.6	0.8	0	4.11	1.29
	SCP12	3.2	14.5	23.4	27.4	20.2	9.7	0.8	0.8	0	3.80	1.32
	SCP13	4.0	16.1	22.6	25.8	15.3	15.3	0.8	0	0	3.81	1.43
	SCP14	1.6	6.5	17.7	32.2	20.2	16.1	4.8	0.8	0	4.32	1.34
	SCP15	3.2	7.3	16.9	48.4	11.3	10.5	0.8	0.8	0.8	3.93	1.18
	SCP16	2.4	14.5	16.1	24.2	21.8	16.9	3.2	0	0.8	4.13	1.47
	SCP17	3.2	9.7	25.0	29.8	15.3	13.7	1.6	0.8	0.8	3.93	1.35
	SCP18	3.2	11.3	25.8	29.0	20.2	7.3	1.6	0.8	0.8	3.81	1.28
	SCP19	3.2	12.1	21.0	32.3	16.9	11.3	0.8	0	2.4	3.87	1.31
	SCP20	4.0	12.1	21.8	30.6	21.8	5.6	2.4	0.8	0.8	3.82	1.32
	SCP21	2.4	11.3	21.8	29.0	21.8	12.1	0	0.8	0.8	3.94	1.27
	SCP22	3.2	5.6	21.8	30.6	20.2	14.5	1.6	0	2.4	4.12	1.30
	SCP23	4.0	14.5	20.2	29.0	21.8	8.1	0	1.6	0.8	3.76	1.30
	SCP24	3.2	10.5	22.6	28.2	18.5	14.5	0.8	0.8	0.8	3.97	1.35

See Table 6.8 for the abbreviation of items

In measuring SCP, a seven-point Likert scale ranging from very poor (1) to excellent (7) was also used. In Table 6.12, the result of response on PSCs' SCP is illustrated. The respondents recognize PSCs' SCP as close to neutral level four with the mean value of 4.01. The lowest item was SCP9 ('Reduction of transport cost') with the mean value 3.73. The highest item was the item from 'reliability', SCP 2('Accuracy of information regarding status of shipment') with the mean of 4.63.

6.4 *Descriptive Statistics on SCP of five selected Ports*

To compare the level of SCP in the major container port in Asia, five ports, i.e. Busan, Shanghai, Hong Kong, Singapore, and Gwangyang port, are selected and respondents are asked to evaluate PSCs' SCP. Table 6.13 illustrates statistics on supply chain performance (SCP) of the five ports.

Table 6.13 Overall Supply Chain Performance (SCP) of 5 ports

Items		BU	SH	HK	SI	GW
Reliability of transit time	SCP1	3.98	3.41	4.31	4.52	3.44
Accuracy of information	SCP2	4.10	3.44	4.25	4.49	3.81
Level of damages in shipment	SCP3	3.94	3.45	3.82	4.11	3.75
Value for money	SCP4	3.55	3.60	3.67	3.94	3.38
Level of overall transport costs	SCP5	3.46	3.73	3.53	3.75	3.52
Reduction of order management costs(EDI)	SCP6	3.91	3.40	3.93	4.01	3.70
Reduction of facilities/equipment costs	SCP7	3.53 (3.5377)	3.54	3.66	3.72	3.50
Reduction of warehousing costs	SCP8	3.38	3.49	3.39	3.45	3.61
Reduction of transportation costs	SCP9	3.47	3.53	3.57	3.63	3.43
Reduction of logistics administration costs	SCP10	3.50	3.38	3.70	3.82	3.49
Fulfill promises to port users(on-time operation)	SCP11	3.80	3.30	4.04	4.17	3.71
Solve port user's problem	SCP12	3.66	3.09	3.79	3.91	3.57
Perform services for port users right the first time	SCP13	3.69	3.27	3.80	3.94	3.66
Lower port time	SCP14	3.81	3.38	3.79	3.98	3.77
Level of conflict with other multimodal processes	SCP15	3.50 (3.500)	3.27	3.72	3.84	3.50 (3.505)
Responsiveness in meeting customer's requirements	SCP16	3.71	3.16	3.82	3.95	3.67
Access/distribution Flexibility	SCP17	3.60	3.52	3.73	3.86	3.49
Expansion flexibility	SCP18	3.61	3.99	3.59	3.74	3.83
Launch flexibility	SCP19	3.45	3.31	3.72	3.89	3.44
Process flexibility	SCP20	3.48	3.23	3.77	4.01	3.53
Product flexibility	SCP21	3.71	3.41	3.92	4.08	3.36
Routing flexibility	SCP22	3.88	3.67	4.11	4.24	3.14
Target flexibility	SCP23	3.56	3.32	3.80	3.99	3.27
Volume flexibility	SCP24	3.64	3.61	3.88	4.06	3.33
Total		**87.93**	**82.51**	**91.30**	**95.08**	**84.90**
Mean		**3.66**	**3.44**	**3.80**	**3.96**	**3.54**

N: BU: 108, SH : 99, HK: 97, SI: 95, GW: 102

Regarding 'reliability', the 'reliability of transit time' (SCP1) of the five major container ports in Asia was measured. Singapore ranked as 1st with score of 4.52. Then Hong Kong (4.31), Busan (3.98), Shanghai (3.41), and Gwangyang (3.44) followed. This sequence is along with the ranking of container ports in 2006 with the exception of Shanghai port, i.e. 1st Singapore: 24,792,400TEU, 2nd Hong Kong:

23,538,580, 3rd Shanghai: 21,710,000, 5th Busan 12,038,786, 56th Gwangyang 1,755,813 (Containerization International Yearbook, 2008). It is posited that Shanghai port recorded a high container traffic ranking owing to its status as world's export base to world. As to SCP2 (accuracy of information), Singapore ranked as 1st with 4.49 point. Second position was taken by Hong Kong port (4.25), third place was possessed by Busan port (4.10). Then, Gwangyang (3.81) and Shanghai (3.44) followed. On SCP3 (level of damages), Singapore also ranked top with highest score (4.11). Unlike the previous items, Busan was the second with 3.94. Hong Kong recorded as 3rd port with 3.82 point. Gwangyang port was situated at 4th place. The last place was taken by Shanghai (3.45).

On cost, there were six items from SCP4 to SCP10. In case of SCP4 (value for money), Singapore (3.94) and Hong Kong (3.67) also were ranked as 1st and 2nd place. Shanghai recorded 3.60 point as 3rd place port. Then, Busan (3.55) and Gwangyang (3.38) followed. This result shows that Shanghai has a strong advantage about cost competitiveness over Busan and Gwangyang ports. With regard to SCP5 (level of overall transport costs), Singapore ranked as the cheapest port (3.75). Then, in line with SCP 4, Shanghai port was recognized as a port that secondly costs less (3.73). Hong Kong (3.53) and Gwangyang (3.52) followed. In particular, Busan port scored lowest point (3.46). When it comes to SCP6 (reduction of order management costs), Singapore remained as the 1st port with the highest score (4.01). Then, Hong Kong (3.93), Busan (3.91), Gwangyang (3.70), and Shanghai followed (3.40). In the aspect of reduction of facilities/equipment costs (SCP7), Singapore also occupied the 1st place (3.72). The next cheapest port was Hong Kong (3.66). Then, Shanghai (3.54), Busan (3.53), and Gwangyang (3.50) followed. In terms of the reduction of warehousing costs (SCP8), Gwangyang scored the highest point (3.61). Shanghai was the next port (3.49). Then, Singapore (3.45), Hong Kong (3.39), and Busan (3.38) were placed. Singapore topped (3.63) the list for SCP9 (reduction of transportation costs). Hong Kong was rated as the second cheapest port (3.57). Then, Shanghai (3.53), Busan (3.47), and Gwangyang (3.43) followed. In respect of SCP10 (reduction of logistics administration costs), Singapore scored highest point

(3.82). Like many other cases, Hong Kong was recognized as the second port (3.70). Then, Busan (3.50), Gwangyang (3.49), and Shanghai (3.38) followed.

To measure service effectiveness, six items, i.e. from SCP11 to SCP16 were adopted. With respect to SCP11 (fulfill promises to port users), Singapore was placed as the top port (4.17). As expected, other ports, i.e. Hong Kong (4.04), Busan (3.80), Gwangyang (3.71), and Shanghai (3.30) followed. As to SCP12 (solve port user's problem), as usual, Singapore was the first port (3.91). Then, other ports were placed in the sequence of Hong Kong (3.79), Busan (3.66), Gwangyang (3.57), and Shanghai (3.09). The result of measuring SCP13 (perform services for port users right the first time) of the five ports shows that Singapore was the most competitive port (3.94). Then, other ports, i.e. Hong Kong (3.80), Busan (3.69), Gwangyang (3.66), and Shanghai (3.27), followed. In case of lower port time (SCP 14), Singapore was also recorded as the top port (3.98). Busan port was placed in the second position (3.81). Then, Hong Kong (3.79), Gwangyang (3.77), and Shanghai (3.38) were placed in order. Regarding SCP15 (level of conflict with other multimodal processes), Singapore was rated as the most convenient port (3.84). Then, Hong Kong (3.72), Gwangyang (3.505), Busan (3.500), and Shanghai (3.27) followed. The order of scores with regard to SCP 16 (responsiveness in meeting customer's requirements) was recognized as follows: Singapore (3.95), Hong Kong (3.82), Busan (3.71), Gwangyang (3.67), and Shanghai (3.16).

On flexibility, the result shows that the order of scores followed a sequence of Singapore, Hong Kong, Busan, Shanghai, and Gwangyang in five cases (SCP17, SCP21, SCP22, SCP23, and SCP24) out of eight. The measurement on SCP17 (access/distribution flexibility) presents that Singapore was the most flexible port (3.86). The second most flexible port was Hong Kong (3.73). The other ports were rated in the order of Busan (3.60), Shanghai (3.52), and Gwangyang (3.49). Concerning expansion flexibility (SCP18), the sequence of scores was as follows: Shanghai (3.99), Gwangyang (3.83), Singapore (3.74), Busan (3.61), and Hong Kong (3.59). With respect to SCP 19 (launch flexibility), Singapore scored the highest (3.89). Then, Hong Kong (3.72), Busan (3.45), Gwangyang (3.44), and Shanghai (3.31) were placed. About process flexibility (SCP20), the order of scores of the five ports was as follows: Singapore (4.01), Hong Kong (3.77), Gwangyang (3.53), Busan (3.48), and Shanghai (3.32). Regarding product flexibility (SCP21), Singapore was the first port (4.08). The second one was Hong Kong (3.92). The others followed the order of Busan (3.71), Shanghai (3.41), and Gwangyang (3.36). As pointed earlier, SCP22 was ended up with the sequence of Singapore (4.24), Hong Kong (4.11), Busan (3.88), Shanghai (3.67), and Gwangyang (3.14). With regard to target flexibility (SCP23), the same order of scores, i.e. Singapore (3.99), Hong Kong (3.80), Busan (3.56), Shanghai (3.32), and Gwangyang (3.27), was recognized. Finally, on volume flexibility (SCP24), Singapore recorded the highest score (4.06). Then, Hong Kong (3.88), Busan (3.64), Shanghai (3.61), and Gwangyang (3.33) followed.

In a nutshell, the overall results stipulate the fact that if a port has higher SCP scores, then it may handle more container cargoes with some exceptions like Shanghai port case. Singapore' SCP has exceeded SCP scores (95.1) of other rivals (Hong Kong: 91.3; Busan: 87.9; Gwangyang: 84.9; Shanghai: 82.5). Singapore was rated as the most competitive port in all items except SCP8 (reduction of warehousing costs: 3rd), and SCP18 (expansion flexibility: 3rd).

Hong Kong was recognized as the second competitive port in terms of SCP (91.30). In most of the cases, it acquired 2nd highest scores. However, it showed weakness in SCP5 (level of overall transport costs: 3rd), SCP8 (reduction of warehousing costs: 4th), and SCP 18 (expansion flexibility: 5TH). It is posited that the low score on SCP5 is owing to its traffic between mainland China and Hong Kong.

In case of Busan port, overall, it was recognized as 3rd port in terms of SCP (87.93). It had advantages in some aspects like SCP3 (level of damages, 2nd), SCP14 (lower port time, 2nd). However, Busan port showed its' weakness on SCP4 (value for money: 4th), SCP 18 (expansion flexibility: 4th), and SCP20 (process flexibility: 4TH). Therefore it is revealed that Busan port should enhance its overall SCP especially on 'costs', and 'flexibility'.

Gwangyang was recorded as 4th competitive port among the five Asian container ports. It shows its advantages on the reduction of warehousing costs (SCP8: 1st), expansion flexibility (SCP18: 2ND), level of conflict with other multimodal processes (SCP151 3RD), and process flexibility (SCP20: 3RD). However, its weakness was shown in many aspects like 'value for money' (SCP4: 5TH), and overall flexibilities (SCP17, SCP21, SCP22, SCP23, SCP24: 5TH).

Shanghai was rated as 5th port among 5 ports in the aspect of SCP. However, it showed its strong points like value for money (SCP4: 3RD), level of overall transport costs (SCP5: 2ND), reduction of warehousing costs (SCP8: 2ND), reduction of transportation costs (SCP9: 3RD), and expansion flexibility (SCP18: 1ST).

A further discussion will follow in chapter eight (See section 8.1.4).

6.5 Concluding Remarks

This chapter has presented basic statistics from an initial analysis of data collected from the questionnaire survey. Through the basic analysis of descriptive statistics on respondents' perceptions are revealed as follows:

1) With the response rate of 16%, 124 of valid response were received. 59% of respondents were from the shipping liner companies.

2) Most of the respondents answered questionnaire based on Busan port (65%). Main respondents have used Busan port as an export (58.1%), an import (43.5%), and a T/S port (40.3%)

3) Respondents have used mainly local operator (42.7%) and global shipping companies (24.2%). As reviewed in section 3.3, there are a few local container operators in Busan, e.g. Shinsundae container terminal, Shingamman container terminal, and Uam terminal except Pusan New port (by DP world), Hutchison terminal (by Hutchison), Gamman (by Sebang & Hanjin Shipping Co.) and Gamchun Hanjin terminal (by Hanjin Shipping Co.). Also, the capacity of convention container terminals in Busan port was around 8,176 thousand TEUs

(pier1, 2, 3, 4, central pier, pier 7) (BPA, 2005). Therefore, this result was supposed to be relevant. 64.5% of respondents used separate contracts rather than total package.

4) PAs' SCM strategies were acknowledged as being close to the mid-point four (3.99).

5) The respondents perceived PSCs' SCM strategies as being below mid-point level four (3.71).

6) The mean of the items (4.36) revealed that the respondents' perception on PSCs' resource was well above the mid-point four.

7) The respondents recognized PSCs' SCP as close to neutral level four with the mean value of 4.01

8) Regarding SCP of major container ports in Asia, it is shown that competitive ports like Singapore (3.96) and Hong Kong (3.80) recorded high SCP score. Busan port occupied a status at middle level (3.66). Gwangyang was the fourth competitive with the mean of scores of 3.54. Shanghai was rated as the least competitive port in terms of SCP (3.44). However, it showed its strong points in transportation costs, warehousing costs, and expansion flexibility.

In the next chapter, data analysis using PLS will be implemented with the sequence of data preparation & screening, validity check, measurement model (weights of items), and structural model (hypothesized testing).

Chapter 7
Statistical Analysis

7.1 *Framework*

Throughout this chapter, Partial Least Squares approach to structural equation modelling (PLS) is performed to find out the relationships between the latent variables using SmartPLS 2.0 software package[1].

This chapter is organised into four parts. First, data preparation and screening, e.g. treating missing data, and outliers are implemented and non-normality problems are discussed. Exploratory factor analysis (EFA) is, then, considered with all observed variables for the least level of validity. Next, for weights and t-statistics of items are interpreted in the measurement model. Finally, the hypothesized relationships between variables are tested by PLS and conclusions are uncovered.

Figure 7.1 displays the statistical data analysis process in this research.

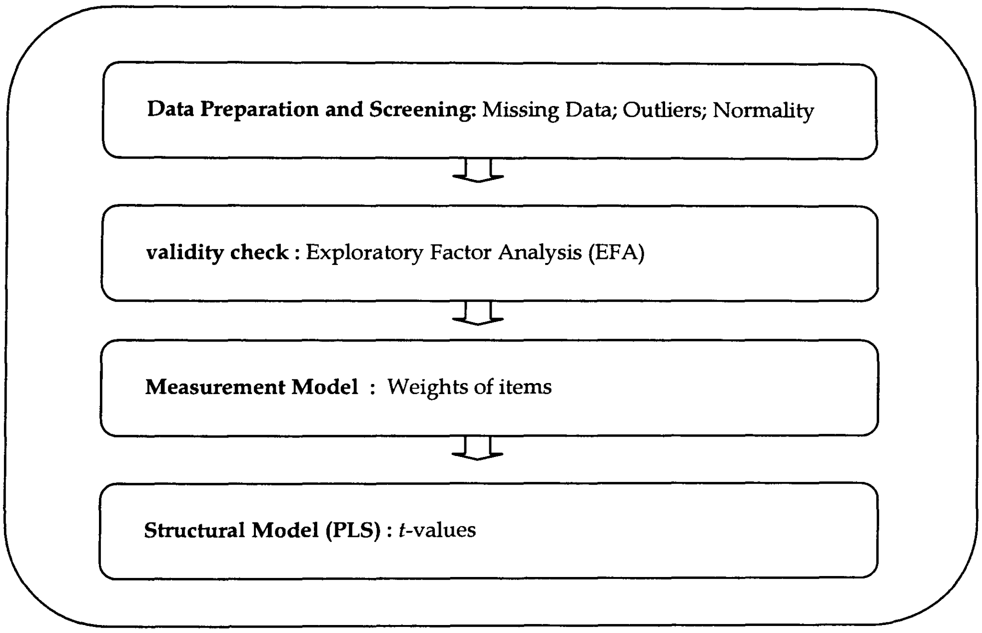

Figure 7.1 Data analysis process for PLS (Source: Author)

[1] The smartPLS 2.0 was downloaded from the website (www.smartpls.de) which is run by the university of Hamburg (Ringle *et al.*, 2005). Temme *et al.* (2006: 19p) compared PLS software packages e.g., PLS-Graph, PLS-GUI, SPAD-PLS, and SmartPLS. SmartPLS is a free graphical based PLS software which is almost equivalent to LVPLS in function and providing more user-friendly tools (Garson, 2007).

7.2 Data Preparation and Screening

Owing to PLS's assumptions about the distribution of the manifest variables, traditional parametric testing techniques are unsuitable (Kocabasoglu, 2002).

As discussed in section 5.7.2, PLS has fewer restrictions than SEM in terms of distribution and normality. Unlike PLS, in Kline's (2005) view, data preparation and screening are crucially important in SEM for following reasons; 1) Usual SEM estimation methods require certain assumptions about the distributional characteristics of the data, 2) Improperly prepared and screened data can make SEM computer programs fail to yield a logical solution. In SEM, normally data preparation includes diagnosing the normality of missing data, deleting of cases more than 10% of missing data, missing data imputation, treatment outliers using Mahalanobis distance (Hair *et al.*, 1998; Kline, 2005; Tabachnick and Fidell, 2001), and normality test based on the skewness and kurtosis values.

Considering the distribution-free assumption of PLS, only missing data treatment will be implemented and the basic level of outlier and normality issues will be discussed in the following section. The data preparation and screening will be described in the order of 1) missing data, 2) outliers, and 3) normality.

7.2.1 Missing Data

Since 'not applicable' answer in the questionnaire is allowed, missing data should be treated properly in data preparation and screening.

Tabachnick and Fidell (2001) indicate that the missing data is one of the most pervasive problems in data analysis, presenting three primary concerns of missing data as the pattern, the amount, and the reason of missing. The inclusion of missing data produces problems through 1) confusing real responses with non-responses, 2) distorting results, 3) destroying the ordinal or interval character of variable, and 4) inflating or deflating summary statistics and scale scores. On the other hand, the exclusion of missing data has a harmful impact on data analysis via a biased sample and distortion of patterns as well as sample size decrease (de Vaus, 2002). If patterns are found and the extent of the missing data is big enough to treat, then, it is assumed that any statistical results based on these data would be biased (Hair *et al.*, 1998). It is called as non-ignorable or not missing at random (NMAR). If the pattern of missing is completely at random (MCAR), the result from these data is presumed to generate acceptable results (Ibid.).

Three methods are recommended for diagnosing the randomness of the missing data (Ibid.). 1) The first method is assessing the missing data process of a single variable by forming two groups. If the variable is metric (e.g. an attitude or perception), then t tests can be performed. 2) The second one is utilizing dichotomised correlations to assess the correlation of missing data for any pair of variables. 3) The third one is an overall test of randomness that determines whether the missing data can be classified as MCAR.

The randomness of the missing data is examined by independent *t*-test method as Hair *et al.* (1998) suggest. Based on responses wave, survey respondents are divided into two groups and t-test is undertaken. If Levene's $p>0.05$, then, there is equality of variance (Brace *et al.*, 2006; Lai *et al.*, 2002). In Table 7.1, it can be seen that all variables have equality (or similarity) of variance.

Table 7.1 Summary of Levene's test for Variance

	Items	F	Levene's P (Sig.)	T
Privatisation	PA1	1.505	.222	.144
	PA2	.125	.725	-.736
	PA3	.033	.857	.652
	PA4	.324	.571	-.554
	PA5	.013	.910	-.263
	PA6	.485	.488	.938
	PA7	.070	.792	.724
	PA8	.695	.406	1.091
Hinterland & FTZ	PA9	.032	.859	.113
	PA10	1.500	.223	.830
Using IT	PA11	.631	.429	1.464
	PA12	.356	.552	.336
	PA13	.766	.383	.877
Marketing	PA14	.579	.448	-.384
	PA15	1.300	.257	.117
Vertical Integration	SCM1	1.693	.196	.886
	SCM2	.899	.345	1.033
	SCM3	.538	.465	.219
	SCM4	2.390	.125	.753
Relationship Orientation	SCM5	.000	.984	1.033
	SCM6	.044	.833	.452
	SCM7	.111	.740	.915
	SCM8	.315	.576	1.293
	SCM9	1.960	.164	.660
	SCM10	.003	.958	.851
Relational Resources	RES1	.939	.334	.288
	RES2	.012	.913	.411
	RES3	.633	.428	.943
Skills	RES4	.042	.837	-298
	RES5	.415	.521	1.111
	RES6	.785	.377	-.285
	RES7	.037	.847	-782

	Items	F	Levene's P (Sig.)	T
Physical Resources	RES8	.023	.881	-.039
	RES9	.002	.966	.163
	RES10	.170	.681	.232
	RES11	1.063	.305	.705
	RES12	.258	.612	1.339
Relia bility	SCP1	.326	.569	.205
	SCP2	.396	.531	.830
	SCP3	.003	.959	2.389
Cost	SCP4	.831	.364	-.302
	SCP5	.872	.352	-.189
	SCP6	.040	.843	.146
	SCP7	1.120	.292	.789
	SCP8	.042	.838	1.476
	SCP9	.500	.481	.462
	SCP10	.718	.398	1.144
Service Effectiveness	SCP11	.243	.623	-.201
	SCP12	.010	.921	-.217
	SCP13	.250	.618	.688
	SCP14	.016	.901	.314
	SCP15	.527	.469	.768
	SCP16	.007	.932	-.114
Flexibility	SCP17	.210	.648	-.259
	SCP18	.006	.936	-1.060
	SCP19	.288	.593	.129
	SCP20	.011	.915	-.824
	SCP21	.058	.810	-.212
	SCP22	.371	.544	.687
	SCP23	.317	.575	.226
	SCP24	1.340	.249	-.134

See Table 6.8 for the abbreviation of items

Some researchers appear to claim that a few missing scores in a large sample may be of little concern if the omitted observations are random and most methods to deal with incomplete observations assume the ignorable data loss pattern (Hair *et al.*, 1998; Kline, 2005). However, Kline (1998) suggests that missing data should probably constitute less than 10% of the data (Cited in Byrne, 2001).

For that reason, it seems to be reasonable that more than 10% of missing data should be considered carefully. PA6 (Management Contract) and PA7 (Sale of port land) are identified as having more than 10% of missing data. This can be probably accounted for non-familiarities of port authorities' strategies (especially port of Bussan) with these two strategies. As de Vaus (2002) recommends, because those two missing values are concentrated in variables themselves which are not central to the analysis, those two items are dropped from the analysis.

Table 7.2 lists the overall statistics of the missing data.

Table 7.2 Summary statistics of the missing data

	Items	NA	No Answer	Sum (%)
Privatisation	PA1	10	1	11 (8.9)
	PA2	7	1	8 (6.5)
	PA3	7	1	8 (6.5)
	PA4	9	1	10 (8.1)
	PA5	9	1	10 (8.1)
	PA6	10	4	14 (11.3)
	PA7	13	2	15 (12.1)
	PA8	9	1	10 (8.1)
Hinterland & FTZ	PA9	3	2	5 (4.0)
	PA10	3	1	4 (3.2)
Using IT	PA11	4	2	6 (4.8)
	PA12	6	1	7 (5.6)
	PA13	5	1	6 (4.8)
Marketing	PA14	5	2	7 (5.6)
	PA15	6	2	8 (6.5)
Vertical Integration	SCM1	3	0	3 (2.4)
	SCM2	3	0	3 (2.4)
	SCM3	4	1	5 (4.0)
	SCM4	2	2	4 (3.2)
Relationship Orientation	SCM5	2	1	3 (2.4)
	SCM6	3	1	4 (3.2)
	SCM7	2	0	2 (1.6)
	SCM8	2	0	2 (1.6)
	SCM9	2	0	2 (1.6)
	SCM10	2	0	2 (1.6)
Relational Resources	RES1	1	1	2 (1.6)
	RES2	1	1	2 (1.6)
	RES3	3	1	4 (3.2)
Skills	RES4	0	0	0 (.0)
	RES5	0	1	1 (.8)
	RES6	0	0	0 (.0)
	RES7	3	1	4 (3.2)

	Items	NA	No Answer	Sum (%)
Physical Resources	RES8	1	0	1 (.8)
	RES9	1	1	2 (1.6)
	RES10	2	1	3 (2.4)
	RES11	4	1	5 (4.0)
	RES12	2	1	3 (2.4)
Relia bility	SCP1	1	0	1 (.8)
	SCP2	0	0	0 (.0)
	SCP3	1	0	1 (.8)
Cost	SCP4	0	0	0 (.0)
	SCP5	0	0	0 (.0)
	SCP6	2	1	3 (2.4)
	SCP7	0	0	0 (.0)
	SCP8	0	0	0 (.0)
	SCP9	0	0	0 (.0)
	SCP10	0	1	1 (.8)
Service Effectiveness	SCP11	1	0	1 (.8)
	SCP12	1	0	1 (.8)
	SCP13	0	0	0 (.0)
	SCP14	1	0	1 (.8)
	SCP15	1	1	2 (1.6)
	SCP16	0	1	1 (.8)
Flexibility	SCP17	1	1	3 (2.4)
	SCP18	1	1	2 (1.6)
	SCP19	0	3	3 (2.4)
	SCP20	1	1	2 (1.6)
	SCP21	1	1	2 (1.6)
	SCP22	0	3	3 (2.4)
	SCP23	2	1	3 (2.4)
	SCP24	1	1	2 (1.6)

See Table 6.8 for the abbreviation of items

De Vaus (2002) introduces three general methods treating missing data including 1) listwise deletion, 2) pairwise deletion, and 3) imputation.

Listwise deletion and pairwise deletion are for general statistical analysis. Those two deletions assume a MCAR data loss pattern (Kline, 2005). The listwise method omits a case if it has a missing value on any of the list of variables in the analysis. The pairwise method excludes a case that has a missing value on either of the pair of variables for which a relationship is being examined (de Vaus, 2002) and is the most popular method for missing data (Byrne, 2001).

The imputation is a method that substitutes a valid value, e.g. mean and regression-based value, for the missing value (de Vaus, 2002). Single imputation methods, including mean substitution, regression based imputation, assume that the data loss pattern is MCAR as well as available case methods (Kline, 2005). Regression based imputation is more sophisticated than two methods that have already been described and provides much better predictions than simply using a group mean (Ibid.).

The present study applies the regression imputation method available in SPSS program. Using the missing analysis option in SPSS, regression imputation is implemented following de Vaus's (2002) recommendation.

7.2.2 Outliers

An outlier can be defined as *"a case with such an extreme value on one variable (a univariate outlier) or such a strange combination of scores on two or more variables (multivariate outlier)"* (Tabachnick and Fidell, 2001; 67p).

Univariate outlier is easy to find by inspecting frequency distributions of z-scores and graphical methods such as histograms and box plots (Kline, 2005; Tabachnick and Fidell, 2001). Seven point likert scale is adopted in the questionnaire, thus, univariate outliers are not identified in the present study.

Multivariate outlier can be detected by Standardized residuals, Mahalanobis distance, Leverage statistic, and Cook's distance (de Vaus, 2002). Mahalanobis distance is recommended as the diagnostic method for multivariate outliers by many authors (Hair *et al.*, 1998; Kline, 2005; Tabachnick and Fidell, 2001).

Mahalanobis distance (D^2) is specified as *"a measure of the distance in multidimensional space of each observation from the mean center of the observations."* A small set of observations with the highest Mahalanobis values presumably causes a substantial break in the distribution. Therefore, a Significance testing with Mahalanobis distance can be executed and a very conservative level, such as $p<0.001$, is used (Hair *et al.*, 1998; 66p: Tabachnick and Fidell, 2001; 68p; Kline, 2005: 52p).

Even in the studies adopt covariance-based SEM, the case with outlier is retained for generalizability unless there is proof that they are unusual and not representative of any observations in the population (Ibid; Lee, 2005; 147p, Yousafzai, 2005; 169p: Shang, 2002; 106p).

Therefore, issues of outlier will be cleared and every single case will be kept in the current research.

7.2.3 Normality

Normality is 'the degree to which the distribution of the sample data corresponds to a normal distribution' (Hair *et al.*, 1998; 38p). The violation of normality assumptions may cause the underestimation of fit indices and standard errors of parameter estimates (Ibid. Cited in Yousafzai, 2005).

The PLS approach is distribution-free (Wold, 1982a) (Cited in Chin, 1998a). The ability that can handle with non-normality is one of the advantages of using PLS method (Limayem *et al.*, 2000).

Normality can be measured at univariate and multivariate level. As Kline (2005; 49p) demonstrates, multivariate normality means that (1) 'all the univariate distributions are normal, (2) the joint distribution of any pair of the variables is bivariate normal, and (3) all bivariate scatter plots are linear and homoscedastic. Multivariate normality of all observed variables is one of a standard distribution assumption in SEM (Arbuckle, 2005).

A basic test for normality is based on the skewness and kurtosis values. Skewness is a 'measure of the symmetry of a distribution'. Skewness values falling outside the range of -1 to +1 indicate a substantially skewed distribution (Hair *et al.*, 1998). It is noted that most of the skewness scores are negative, which means that most of the scores are over the mean (Kline, 2005). Kurtosis is a 'measure of the peakness of flatness of a distribution'. A positive value depicts a relatively peaked distribution; a negative value represents a relatively flat distribution (Hair *et al.*, 1998; 37p).

However, bootstrapping presents an opportunity to treat normality issues owing to the advantage that it can generate an approximate standard error for every estimate that program computes (Arbuckle, 2005). It implements sampling with replacement from the original sample and the replacement of the observations after sampling allows the researcher to create as many samples as needed without duplication of samples except by chance (Hair *et al.*, 1998). The current study adopts the bootstrapping to tackle on non-normality issue.

7.3 Exploratory Factor Analysis: Validity check

Exploratory Factor Analysis (EFA) is an efficient method that defines possible relationships in only the most general form before using multivariate techniques for estimating relationships (Hair *et al.*, 1998). The aim of factor analysis is to orderly simplify a number of interrelated measures (Child, 1990). As Kline (2005) asserts, EFA does not require a priori hypotheses about how indicators are related to underlying factors or even the number of factors. Modification of items by EFA before the CFA in covariance-based SEM studies is posited as inappropriate (Chin, 1998b). It is strongly suggested that if researchers are looking for exploration and model development, PLS can be considered as a data analysis methodology (Ibid.). Furthermore, it is not recommended to amend measurements by EFA, therefore, in the current research the EFA will be used for deciding whether to keep or drop a manifest variable as a whole in terms of validity of constructs (De Vaus, 2002). Using formative measures cause difficulties to assess reliability and validity of measures (See section 5.6.2).

In this research, a principal component analysis, with the varimax rotation is employed hence 'the minimum number of factors needed to account for the maximum portion of the variance represented in the original set of variables' (Hair *et al.*, 1998; 102p)[1]. The factor rotation redistributes the variance from

[1] Common Factor Analysis and (Principal) Component Analysis exist. There are three types of total variance regarding factor analysis: (1) common, (2) specific and (3) error. Component analysis considers the total variance and derives factor that contain small proportions of uniques variance and error variance. Common factor analysis covers common variance only and has several problems such as factor indeterminancy (different factor scores can be calculated) and complicated computation (Hair *et al.*, 1998).

earlier factors to later ones, achieving a simpler, theoretically more meaningful factor pattern. There are *orthogonal rotation* (the simplest case of rotation with 90 degrees axes) and oblique *rotation* (axes are not maintained at 90 degrees) (Ibid.). There is no compelling analytical reason to choose one rotational method. Varimax rotation is applied to achieve a clearer separation of the factors between two orthogonal rotation methods including Quartimax and Varimax rotation (Ibid. 110p). The general rule for determining the number of factors would be that based on the sample size (124), the factors with factor loadings less than 0.5 are deleted (Ibid.).

7.3.1 PAs' and PSCs' SCM Strategies (PA and SCM)

The EFAs with varimax rotation are implemented on the variables with regard to PAs' and PSCs' SCM strategies. As discussed in chapter five, six variables ('privatisation', 'support for hinterland & Free Trade Zone', 'using Information Technology', 'marketing', 'vertical integration', and 'relationship orientation') are used in the EFA (See section 5.3).

Table 7.3 EFA result on PAs' SCM and PSCs' SCM strategies

Construct			Factor						
			1	2	3	4	5	6	7
PA's SCM strategies (PA)	Privatisation	PA1						.777	
		PA2						.738	
		PA3						.034	.682
		PA4						.360	.683
		PA5						.417	
		PA8						.398	
	Support for hinterland & FTZ	PA9				.792			
		PA10				.769			
	Using IT	PA11			.588				
		PA12			.826				
		PA13			.739				
	Marketing	PA14					.815		
		PA15					.897		
PSCs' SCM Strategies (SCM)	Vertical Integration	SCM1		.734					
		SCM2		.757					
		SCM3		.818					
		SCM4		.739					
	Relationship Orientation	SCM5	.684						
		SCM6	.694						
		SCM7	.763						
		SCM8	.808						
		SCM9	.823						
		SCM10	.863						
Eigenvalues			8.905	2.085	1.717	1.246	1.170	1.089	1.021
% of Variance			38.716	9.065	7.463	5.419	5.086	4.736	4.438
Cumulative %			38.716	47.781	55.244	60.663	65.749	70.485	74.923

In Table 7.3, the seven components are generated with loaded items. It is showed that all variables are proved to be proper measures except 'privatisation'. With the problems of missing data (PA6, 7), the result of the EFA suggests that the variable 'privatisation' should be treated carefully. According to EFA, a combination of PA3 (Concessions to Hybrid operator), PA4 (PAs' financial stakes in stevedoring company) can be treated as independent variable. Thus, the variable 'privatisation' is considered as invalid as a construct. The difficulties of measuring improved efficiency and productivity after privatisation are already stipulated by Cullinane and Song (2002).

In terms of the importance of the concessions in SCM, it can be considered to maintain only 'concessions', rather than privatisation as a bigger concept. Long-term leases and concessions are the most popular form of privatisation retaining port authority regulatory functions of port authorities. (Peters, 2001: Baird, 2002). As discussed earlier in chapter two (See section 2.7.1.2), there are a body of studies describing the two main entity related to 'concessions' in terms of terminal operating entities, i.e. global terminal operators and liners (See Table 7.4). Furthermore, the DP world's acquisition of P&O ports and hybrid operators' (P&O ports, APM terminal) little appearance in Korea suggests that the indicator PA3 (concessions to Hybrid operator) can be deleted. Compared to this, there were P&O terminals in Shekou and Qingdao in 2003 (Slack and Frémont, 2005). APM terminal has shares in Dalian (Dalian CT: 4.9%; Dalian Port CT: 30%), Qingdao (QQCT: 20%), Tianjin (North Basin B: 30%), Shanghai (SECT: 49%), Xiamen (Songyu CT: 50%), Yantian (ICT: 10%), Guangzhou (Nansha Phase: 11.2%), and Busan (PECT new berth: 49%) (Ocean Shipping Consultants, 2006).

Table 7.4 Studies on the types of international container terminal operators

Author	Concepts	Methods	Types of concession
Peters (2001)	Structure of the global stevedoring industry and the major participants	Conceptual Research	-The first operators to expand their operations on a geographical basis -The second wave of operators seeking expansion internationally -Major ocean carrier terminal investors
Araujo *et al.* (2003)	Structure of ICTOs (International Container Terminal Operators)	Descriptive Research	-Same as Peters (2001) -The first operators to expand their operations on a geographical basis (HPH, P&O ports, SSA) -The second wave of operators seeking expansion internationally (PSA, CSX, Eurogate) -Major ocean carrier terminal investors (Maersk/APM terminals)
Araujo *et al.* (2005)	Structure of ICTOs	Descriptive Research	Same as Araujo *et al.* (2003)
Slack and Frémont (2005)	Terminal operating entities	Case study	-Terminal operating companies -Hybrids -Shipping lines company
Cullinane *et al.* (2005a)	Concession strategy	Case study	-Attracting mainly terminal operators in concessions - Attracting mainly Shipping liner companies in concession
Midoro *et al.* (2005)	International terminal operators	Descriptive Study	-Pure stevedores -Global carriers

Source: Tabulated by the author

Table 7.5 Result of EFA after adjusting 'privatisation'

Construct			Factor					
			1	2	3	4	5	6
Port Authorities' SCM strategies (PA)	Concession	PA1						.831
		PA2						.799
	Support for hinterland & FTZ	PA9				.816		
		PA10				.803		
	Development IT systems	PA11			.623			
		PA12			.832			
		PA13			.758			
	Marketing	PA14					.837	
		PA15					.901	
PSCs' SCM Strategies (SCM)	Vertical Integration	SCM1		.726				
		SCM2		.762				
		SCM3		.846				
		SCM4		.754				
	Relationship Orientation	SCM17	.663					
		SCM18	.670					
		SCM19	.733					
		SCM10	.812					
		SCM11	.837					
		SCM12	.875					
Eigenvalues			7.946	1.947	1.426	1.184	1.147	1.017
% of Variance			41.821	10.246	7.507	6.234	6.036	5.351
Cumulative %			41.821	52.067	59.574	65.808	71.844	77.195

See Table 6.8 for the abbreviation of items

Table 7.5 illustrates those changes of the concept 'privatisation' (deleting PA3, 4, 5, 6, 7, 8, 9) leads the clearer EFA result. Thus, six components are extracted from 'PAs' SCM strategies' and PSCs' SCM strategies. It is recognized that identified six factors account for approximately 77% of the total variance based on the 19 significant items. The six factors are being: 1) 'concessions', 2) 'support for hinterland and FTZ', 3) 'using IT', 4) 'marketing', 5) 'vertical integration', and 6) 'relationship orientation'.

7.3.2. PSCs' Resources and Supply Chain Performance (SCP)

Table 7.6 demonstrates the result of the first EFA of PSCs' resources (RES) and PSCs' SCP (SCP).

Table 7.6 Result of the first EFA of RES and SCP

Construct			Factor				
			1	2	3	4	5
Supply Chain performance (SCP)	Reliability	SCP1					.678
		SCP2					.683
		SCP3					.681
	Cost	SCP4			.653		
		SCP5			.732		
		SCP6			.248		
		SCP7			.567		
		SCP8			.719		
		SCP9			.773		
		SCP10			.471		
	Service Effectiveness	SCP11	.692				
		SCP12	.743				
		SCP13	.724				
		SCP14	.339				(.546)
		SCP15	.118				
		SCP16	.611				
	Flexibility	SCP17				.517	
		SCP18				.431	
		SCP19				.526	
		SCP20				.555	
		SCP21				.542	
		SCP22*				.743	
		SCP23				.637	
		SCP24				.712	
Resources (RES)	Relational Resources	RES1	.365				
		RES2	.443				
		RES3	.481				
	Skills	RES4	.523				
		RES5	.213	(.696)			
		RES6	.527				
		RES7	.588				
	Physical Resources	RES8		.540			
		RES9		.755			
		RES10		.841			
		RES11		.784			
		RES12		.648			
Eigenvalues			18.609	2.346	1.351	1.214	1.083
% of Variance			51.693	6.517	3.753	3.371	3.007
Cumulative %			51.693	58.210	61.962	65.333	68.340

See Table 6.8 with regard to the abbreviation of items

The EFA with PSCs' resources (RES) and SCP is implemented in this section. As revealed in Table 7.6, five components with an eigenvalue of greater 1.0 are diagnosed.

Three factors, i.e. 'service effectiveness', 'relational resources', and 'skills', shares items in the factor 1. This can be interpreted in two ways. The first meaning can be that those constructs have causal correlations (De Vaus, 2002). The second possible implication is that those two constructs are similar each other and one of them can be deleted. As De Vaus (Ibid.) stipulates that if some variables are correlated, those variables can emerge with same factor even though these are not the same thing. In this sense, two variables from resources are supposed to be correlated with 'service effectiveness'. However, it is problematic that 'relational resources' and 'skills' belong to the same factor. Furthermore, all loading values of 'relational resources' are lower than minimum level of loading, 0.5. Therefore, it is decided to drop the construct, 'relational resources' in the data analysis.

Having recognized the limitation of the first EFA, the second factor analysis is implemented without 'relational resources'. Table 7.7 presents the result of the EFA after the adjustment of the constructs. Clearer separations between the factors compared to Table 7.6 suggest that the deletion of 'relational resources' can be justified along with the theoretical discussion.

Considering the discussions in chapter two, measures related to resources and SCP are posited to be more valid than newly developed measures, e.g. PAs' SCM strategies and PSCs' SCM strategies. Thus, no further EFA is implemented despite some minor problems.

Considering the ability to handle non-normality and multi-collinearity of PLS, some problems with regard to multi-collinearity between the measures can be regarded as not serious problems in the data analysis.

Table 7.7 Result of the second EFA of RES and SCP

Construct			Factor 1	2	3	4	5
Supply Chain performance (SCP)	Reliability	SCP1					.668
		SCP2					.678
		SCP3					.693
	Costs	SCP4			.654		
		SCP5			.731		
		SCP6			.267		
		SCP7			.573		
		SCP8			.732		
		SCP9			.778		
		SCP10			.484		
	Service Effectiveness	SCP11	.700				
		SCP12	.731				
		SCP13	.718				
		SCP14	.342				
		SCP15	.121				(.555)
		SCP16	.595				
	Flexibility	SCP17				.540	
		SCP18				.458	
		SCP19				.544	
		SCP20				.574	
		SCP21				.558	
		SCP22*				.735	
		SCP23				.654	
		SCP24				.714	
Resources (RES)	Skills	RES4	.505				
		RES5	.206	(.698)			
		RES6	.503				
		RES7	.580				
	Physical Resources	RES8	(.581)	.541			
		RES9		.755			
		RES10		.842			
		RES11		.785			
		RES12		.651			
Eigenvalues			16.960	2.338	1.338	1.203	1.080
% of Variance			51.395	7.085	4.055	3.646	3.273
Cumulative %			51.395	58.480	62.534	66.180	69.453

*** Numbers in brackets mean that there are higher loadings in the other factors**

7.4 Outer Model (Measurement Model)

Outer model is defined as a model which shown how each of indicators relates to its latent variables (Chin, 1998a). Measurement model is delineated as *"a submodel in SEM that 1) specifies the indicators for each construct, and 2) assesses the reliability of each construct for estimating the causal relationships"* (Hair *et al.*, 1998: 581p). In this section, reliability & validity issues, and weights of each variable in outer model (measurement model) will be discussed.

7.4.1 Evaluation of reliability and validity

As discussed earlier in chapter five, using formative measures has limits on reliability and validity. Therefore, Cronbach's alpha, Composite reliability, and Average Variance Extracted can not be calculated in case of using only formative measures (See section 5.6.2). When a researcher uses reflective indicators, the convergent validity of scales can be assessed by examining the individual item loadings. Standardized loadings should be greater than 0.707 in general (Chin, 1998a). A lower bond of 0.5 or 0.6 is sufficient for newly developed scales (Ibid.).

7.4.2 Weights as the relative importance of indicators

Weights can be interpreted as the makeup and relative importance of each indicator in the creation of the component (Chin, 1998a). With formative measures, PLS analysis should be based on the weights not on loadings (Ibid.). As Chin points out, comparing loadings among indicators within a block makes no sense.

Illustrating the weights of individual indicators, the implications on the research with regard to the theoretical aspects will be discussed in this section. Furthermore, t-statistics will be investigated. Considering the nature of formative measures, all items are reserved regardless of low weight value or insignificant t-values to prevent the changes of the capacity of the measurement model (Diamantopoulos and Winklhofer, 2001).

PAs' SCM strategies

The 'concessions' measures how successfully PAs' concession strategy has been implemented. The result (Table 7.8) indicates that concession to shipping companies (weight value: 0.628) is slightly more important than concession to global terminal operators (0.544). T-statistics of both items are significant in the $p<0.05$ level. It is relevant because more than 60% of respondents are users of Busan port. Besides DP world in Busan new port (Overtake of share of CSX) and HPH's overtake of Jasungdae terminal from HMM (Hyundai Merchant Marine), the PA of Busan Port seems to be keen on concession to shipping companies, e.g. Gamman and Gamchun Hanjin (by Hanjin Shipping co.), and Shingamman (by Evergreen).

The construct 'support for hinterland and FTZ' investigates how a port authority provides enough hinterland and proper service with regard to Free Trade Zone in the hinterland. Provision of hinterland (PA9: 0.677) is more important than FTZ (0.416) in the creation of the component.

'Using IT' is the construct to capture the level of how information technology is utilized to enhance PSCs' performance by the port authority. The result shows that support for container tracking information system (0.615) is most important in making of the construct.

'Marketing' measures the extent of the level of PAs' activities to attract cargoes from the port users like shipping companies and shippers. Common port marketing is the most important items with the weight 0.753.

Table 7.8 Weights: PAs' SCM strategies (restandardised)

Construct	Item No.	Item	Weights	T-statistics
Concession	PA1	Concentrating on concession to global operator	0.544	1.766
	PA2	Concentrating on concession to Shipping company	0.628	2.180
Support for Hinterland & FTZ	PA9	Hinterland provision	0.677	2.013
	PA10	Free Trade Zone	0.416	1.141
Using Information Technology	PA11	Single window EDI in operations & custom clearance	0.298	2.040
	PA12	Support for automated container identification using RFID	0.269	1.719
	PA13	Support for container tracking information system	0.615	4.023
Marketing	PA14	Common port marketing	0.753	2.660
	PA15	Existence of marketing department	0.292	0.930

(Source: Author)

PSCs' SCM strategies

'Vertical integration' measures the level of integration into inland transport or related services by container terminal operators in terms of PSC. Items have low t-statistics from 0.818 to 1.811. Except SCM1 (Integration strategies with road haulage companies), all items have t-statistics which shown are insignificant at $p<0.05$ level. The most important item is 'integration strategies with road haulage companies (weight: 0.482). The next important one is operating warehousing & value added logistical service (weight: 0.327).

The construct 'relationship orientation' is intended to capture the level of proactive creating, development and maintenance of relationships by PSCs with customers and other parties that would result in mutual exchange and fulfillment of promises at a profit (Panayides, 2007). Three items, i.e. (SCM5, SCM6, and SCM7) are statistically significant at 0.05 levels with t-values from 2.046 to 3.075. Other three indicators are insignificant with t-values from 0.388 to 0.803. The item SCM5 (Communication or Information sharing) is the most crucial factor in making the 'relationship orientation' construct with weight 0.412. The item SCM10 (Customer relationship management) is also important as expected by many studies. Only one item that has negative weight value (-0.064) was SCM 9 (Customized service).

Table 7.9 Weights: PSCs' SCM strategies

Construct	Item No.	Item	Weights	T-statistics
Vertical Integration	SCM1	Integration strategies with road haulage companies	0.482	1.811
	SCM2	Integration strategies with railway companies	0.134	0.818
	SCM3	Operating inland terminals	0.234	0.958
	SCM4	Operating warehousing & value-added logistical service	0.327	1.490
Relationship Orientation	SCM5	Communication (Information Sharing)	0.412	3.075
	SCM6	Long-term contracts and incentives	0.115	0.803
	SCM7	Increasing Just in Time (JIT) capabilities	0.278	2.008
	SCM8	Share value with customers	0.105	0.710
	SCM9	Customized service	-0.064	0.388
	SCM10	Customer relationship management	0.307	2.046

Source: Author

PSCs' resources

The concept 'PSCs' skills' aims to measure the extent to which PSCs utilize the technology such as new service developing, cargo handling, marketing, and R&D and innovation to provide services to port users.

All t-statistics of items are statistically significant at 0.05 level except cargo handling technology (t=1.629). The weights for 'R&D capabilities' and 'service design technology' are around 0.4. 'Marketing technology' (0.209) and 'cargo handling technology' (0.184) follow in terms of weight values. It is interesting that 'cargo handling technology' has the least weight value forming the skills concept.

'Physical resources' refers to the level of PSCs' possession of physical resources for the provision of port related service. T-statistics of items except RES10 (Quays, berths, aprons, storage or yard capacity) and RES11 (Dredged channels) are significant at p=0.05 level. Information systems (RES8: 0.522) and Road& Railway infrastructure (RES12: 0.510) are most important in terms of weights. 'Cargo handling equipment' follows with weight value 0.234. It is noted that weights of RES 10 (-0.019) and RES11 (-0.072) are negative. It implies that port users posit basic infrastructures of port are given. Furthermore, 'service differentiation' can be realized more by information systems and road & railway infrastructure.

Table 7.10 Weights: PSCs' resources

Construct	Item No.	Item	Weights	T-statistics
Skills	RES4	Service design technology (New service design)	0.398	4.077
	RES5	Cargo handling technology	0.184	1.629
	RES6	Marketing technology	0.209	2.120
	RES7	R&D capabilities	0.400	4.997
Physical Resources	RES8	Information technology/systems	0.522	4.285
	RES9	Cargo handling equipment	0.234	1.649
	RES10	Quays, berths, aprons, storage or yard capacity	-0.019	0.124
	RES11	Dredged channels	-0.072	0.571
	RES12	Road&Railway capability (or infrastructure)	0.510	4.643

Source: Author

PSCs' SCP

Weights of PSC's SCP were provided in Table 7.11. PSCs' SCP is comprised of 'reliability', 'costs', 'service effectiveness', and 'flexibility'.

'Reliability' measures the level that port users appreciate how PSCs' services are reliable. SCP2 (Accuracy of information) has t-statistics which is significant at p=0.001 level. Other two items, e.g. SCP1 (Reliability of transit time/transport availability), and SCP3 (Level of damages in shipment) are insignificant at 0.05 level. In terms of weight, SCP2 (Accuracy of information regarding status of shipment) is most important to comprise the concept 'reliability' with the weights value 0.718. Other two items have low weights around 0.2.

The concept 'costs' captures the level of how much port users' costs are saved by PSCs. Among seven items, four items, i.e. SCP4, SCP6, SCP7, and SCP10 have t-statistic which are significant at p=0.05 level. Other three indicators (SCP5, SCP8, and SCP9) are recognized statistically insignificant with t-statistics from 0.044 to 0.897. The item SCP7 (Reduction of facilities/equipment cost) records the highest weight value 0.356. Then, SCP10 (Reduction of logistics administration cost: 0.287) and SCP6 (Reduction of order management cost: 0.249) follow.

'Service Effectiveness' is intended to catch the level of how PSCs' services are effective to users. Among 6 items, four indicators, i.e. SCP11, SCP14, SCP15, and SCP16 are significant with t-statistics from 1.671 to 2.920. The items SCP12 (Solve port users' problem), SCP13 (Perform services for port users right the first time) are delineated as insignificant at p=0.05 level. Lower port time (SCP14) is the salient factor with the highest weight 0.338. Then, it is recognized that two items SCP11 (Fulfill promises to port users: On-time service: 0.332) and SCP16 (Responsiveness in meeting customers' requirements: 0.311) with weight values around 0.3.

'Flexibility' is supposed to measure how PSCs are able to change their service and adapt to different conditions for customers' benefit. Among 8 indicators adopted from Paixão and Marlow's work (2003: 368p), three items including SCP19 (Launch flexibility), SCP21 (Product flexibility), SCP24 (Volume flexibility) are significant at p=0.05 level. Meanwhile, other five items are proved to be insignificant with t-statistics from 0.171 to 1.260.

In terms of weight value, the item SCP19 (Launch flexibility: Introducing new tailored services) has highest value, 0.428. The second highest weight value is 0.337 of the item SCP21 (Product flexibility: Transfer cargo from mode to mode). Then, the indicator SCP24 (Volume flexibility) follows with weight 0.278. The other five items (SCP17, SCP18, SCP20, SCP22, and SCP23) have weights from -0.059 to 0.152.

Table 7.11 Weights: PSCs' SCP

Construct	Item No.	Item	Weights	T-statistics
Reliability	SCP1	Reliability of transit time/transport availability	0.227	1.228
	SCP2	Accuracy of information regarding status of shipment	0.718	4.310
	SCP3	Level of damages in shipment	0.192	1.532
Cost	SCP4	Value for money	0.176	1.732
	SCP5	Level of overall port transport cost	0.126	0.897
	SCP6	Reduction of order management cost (EDI)	0.249	1.896
	SCP7	Reduction of facilities/equipment cost	0.356	2.443
	SCP8	Reduction of warehousing costs	-0.029	0.240
	SCP9	Reduction of transportation costs	0.006	0.044
	SCP10	Reduction of logistics administration costs	0.287	2.276
Service Effectiveness	SCP11	Fulfill promises to port users (on-time service)	0.332	2.920
	SCP12	Solve port users' problem	0.143	1.027
	SCP13	Perform services for port users right the first time	-0.050	0.299
	SCP14	Lower port time	0.338	2.984
	SCP15	Level of conflict with other multimodal processes	0.159	1.671
	SCP16	Responsiveness in meeting customers' requirements	0.311	2.861
Flexibility	SCP17	Access/distribution flexibility (Hinterland & foreland)	-0.026	0.171
	SCP18	Expansion flexibility (invest for future requirement)	0.112	0.866
	SCP19	Launch flexibility (Introducing new tailored services)	0.428	2.504
	SCP20	Process flexibility (Speed that port can make decisions)	-0.059	0.419
	SCP21	Product flexibility (Transfer cargo from mode to mode)	0.337	2.476
	SCP22	Routing flexibility (Convey through diversified route)	-0.058	0.392
	SCP23	Target flexibility (Deliver tailored services to the different market segments)	0.152	1.260
	SCP24	Volume flexibility	0.278	1.674

Source: Author

7.5 Structural Model (Inner Model)

7.5.1 Overall relationships between variables

In this section, the hypothesised relationships among the twelve variables ('concessions', 'using IT', 'marketing', 'support for hinterland and FTZ', 'vertical integration', 'relationship orientation', 'skills', 'physical resources', 'reliability', 'costs', 'service effectiveness', and 'flexibility') are explored using PLS. Bootstrapping, a resampling technique, is utilized to create 500 re-samples to examine the stability of the estimates as discussed in chapter five (See section 5.6.1).

First of all, the overall model is analyzed with path coefficients and t-values.

The result for the overall model is provided in Table 7.12 and Figure 7.2. It is recognized that all the relationships among PAs' SCM strategies, PSCs' SCM strategies, PSCs' Resources and PSCs' SCP are partially supported. Overall, the basic conceptual model is proved to be significant. Therefore, it can be argued that the combination of RBT (Resource-based Theory) and SCMT (Supply Chain Management Theory) are useful tools to explain port and shipping industry as the study suggested earlier in chapter two.

In general, among PAs' SCM strategies, 'using IT' is the most important variable which affecting both 'vertical integration' (standardized coefficient: 0.327) and 'relationship orientation' (0.381). 'Marketing' (0.148) and 'Support for hinterland and FTZ' (0.126) have a positive influence only on 'relationship orientation'. 'Concessions' (0.175) is positively related only to 'vertical integration'. Among PSCs' SCM, 'relationship orientation' is the variable that is related to both PSCs' resources, i.e. 'skills' (0.478) and 'physical resources' (0.501). 'Vertical integration' has positive influence (0.258) only on 'skills'. 'Skills' is significantly related to all PSCs' SCP variables, i.e. 'reliability' (0.562, 'flexibility' (0.724), 'costs' (0.575), and 'service effectiveness' (0.611). 'Physical resources' affects only cost (0.296) and service effectiveness (0.232).

Therefore, it can be argued that 'using IT' can enhance PSCs' SCP through the 'relationship orientation' and skills in port industry.

In the following section, the twenty hypothesized relationships with regard to 12 variables will be investigated in detail.

Table 7.12 Summary of hypothesized relationships

Hypotheses	Independent Variables	Endogenous Variables	R^2	Standardized Coefficient	t-statistics	Result
$H_{1\text{-}1}$	Concessions	Vertical Integration	0.274	0.175	1.716*	Sig
$H_{1\text{-}2}$	Using IT			0.327	3.909***	Sig
$H_{1\text{-}3}$	Marketing			0.085	0.850	Non
$H_{1\text{-}4}$	Hinterland & FTZ			-0.005	0.045	Non
$H_{1\text{-}5}$	Concessions	Relationship Orientation	0.453	0.145	1.550	Non
$H_{1\text{-}6}$	Using IT			0.381	5.075***	Sig
$H_{1\text{-}7}$	Marketing			0.148	1.766*	Sig
$H_{1\text{-}8}$	Hinterland & FTZ			0.126	1.855*	Sig
$H_{2\text{-}1}$	Vertical Integration	Skills	0.563	0.258	3.323***	Sig
$H_{2\text{-}2}$	Relationship Orientation			0.478	7.121***	Sig
$H_{2\text{-}3}$	Vertical Integration	Physical Resources	0.409	0.126	1.368	Non
$H_{2\text{-}4}$	Relationship Orientation			0.501	6.492***	Sig
$H_{3\text{-}1}$	Skills	Reliability	0.426	0.562	3.958***	Sig
$H_{3\text{-}2}$	Physical Resources			0.165	1.162	Non
$H_{3\text{-}3}$	Skills	Costs	0.626	0.575	4.651***	Sig
$H_{3\text{-}4}$	Physical Resources			0.296	2.470**	Non
$H_{3\text{-}5}$	Skills	Service Effectiveness	0.620	0.611	5.727***	Sig
$H_{3\text{-}6}$	Physical Resources			0.232	2.098*	Sig
$H_{3\text{-}7}$	Skills	Flexibility	0.630	0.724	6.497***	Sig
$H_{3\text{-}8}$	Physical Resources			0.155	1.367	Non

$|t| > 3.090$, $p < 0.001$***
$|t| > 2.326$, $p < 0.01$**
$|t| > 1.645$, $p < 0.05$*

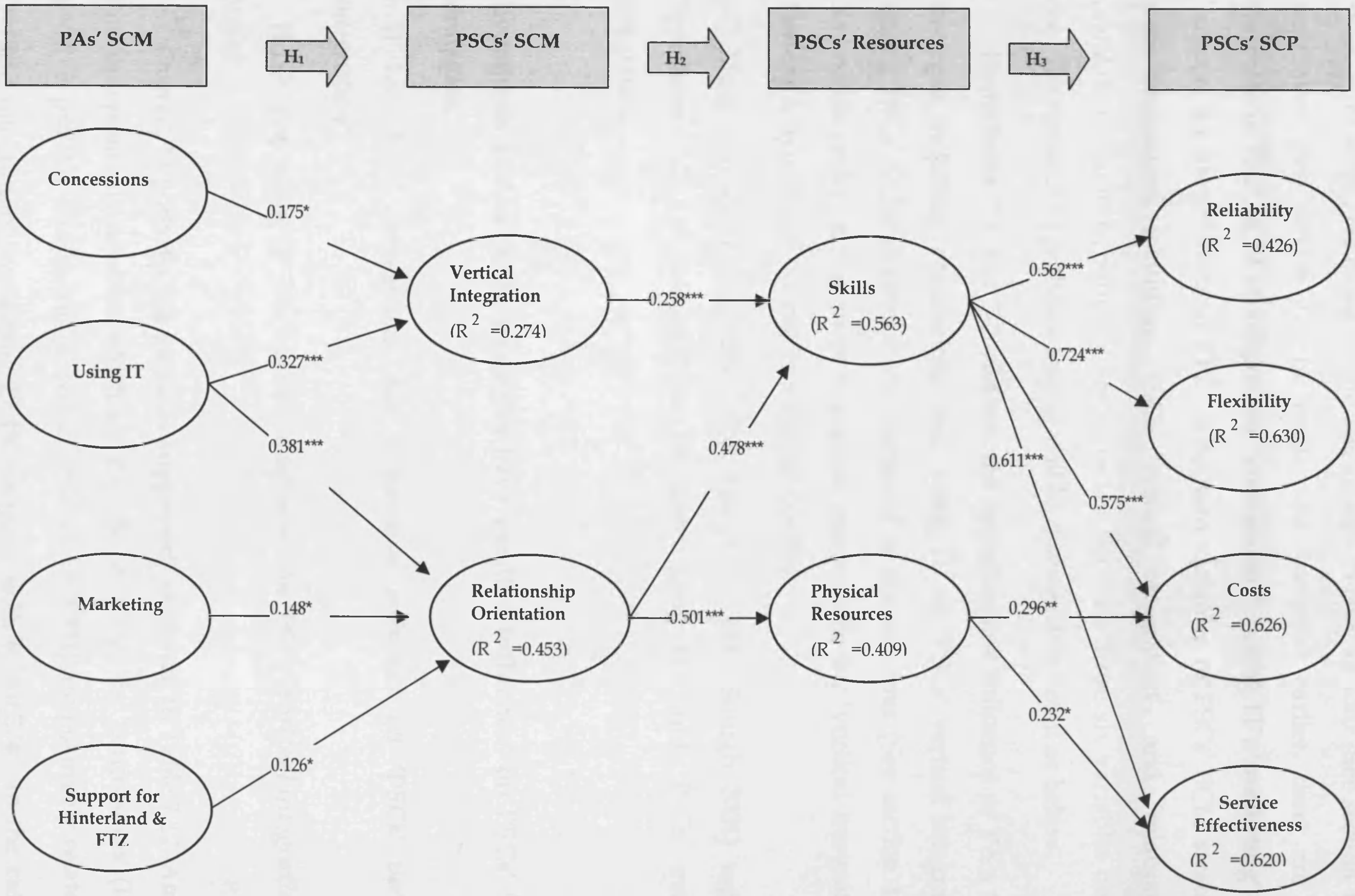

Figure 7.2 Estimates of overall structural model

(Significant relationships only)

7.5.2 PAs' SCM strategies

This section discovers the relationships between PAs' SCM strategies and PSCs' SCM strategies based on the discussions in chapter four (See section 4.3.1) and seven (See section 7.3) in detail. As discussed earlier, there are four variables in PAs' SCM strategies, i.e. 'concessions', 'using IT', 'marketing', and 'support for hinterland and FTZ'. Also, two variables of PSCs' SCM strategies were recognized including 'PSCs' vertical integration', and 'relationship orientation'. Eight hypotheses are extracted between those six variables one by one. The result of hypotheses testing will be discussed in detail as below.

Hypotheses 1-1 and 1-2 address the hypothesized influence of PA's SCM strategies including 'concessions' and 'using IT' on 'PSCs' vertical integration' among PSCs' SCM strategies. As discussed in chapter four (See section 4.3.1), concession policy, is the most important prerequisite for 'vertical integration'. Therefore, hypothesis 1-1 can be logically posited.

Many studies (Evangelista, 2005; Kia *et al.*, 2000; Stough 2001) support hypothesis 1-2, i.e. relationships between 'using IT', and 'PSCs' vertical integration'.

Hypothesis 1: PAs' SCM strategies have positive influences on PSCs' SCM strategies.

H 1-1: ***'PAs' concessions' has a positive influence on 'PSCs' vertical integration'.***

H 1-2: ***'PAs' using IT' has a positive influence on 'PSCs' vertical integration'.***

Overall, hypothesis 1 is partially supported, as shown in Table 7.12. Among four independent variables which are PAs' SCM strategies, 'concessions' (H1-1: β=0.175, $p<0.05$), and 'using IT' (H1-2: β=0.327, $p<0.001$) are positively related to 'vertical integration' explaining 27.4% variance with R^2=0.274. In the case of Busan port, many road haulage companies are operating container terminals, e.g.

Korea express and Sebang Co., Ltd in Gamman terminal and central pier (Busan regional Maritime Affairs & Port Office, 2009) are participating in Busan and Gwangyang terminal through concession. The variable 'using IT' is more influential on 'vertical integration' with standardized coefficient 0.327 than 'concessions' with coefficient 0.175. This implies that investing in information technologies is the most effective strategy which will enhance the 'vertical integration' by ratio of 0.327. As stipulated in chapter four (see section 4.3.1), IT system is one of the key integration elements (Evangelista, 2005). Having recognized the R^2 of 'vertical integration' is relatively low (0.274), it is notified that further studies are necessary to find out other PAs' SCM strategies affecting 'vertical integration' of PSCs. Furthermore, it can be posited that 'vertical integration' can be affected by PSCs' internal environments than by PAs' SCM strategies.

Hypotheses 1-3 and 1-4 describe the hypothesized relationships between PAs' SCM strategies ('marketing' and 'support for hinterland and FTZ') and 'PSCs' vertical integration'. As discussed earlier in chapter four (See section 4.3.1), marketing is one of necessary components for implementing SCM, e.g. close long-term relationships and inter-firm cooperation like 'vertical integration' (Min and Mentzer, 2000). Regarding 'support for hinterland and FTZ', a positive relationship is posited based on discussions by UNESCAP (2005) in chapter four (See section 4.3.1). According to the above discussion, 'support for hinterland and FTZ' is closely connected to the demand for SCM.

H 1-3: ***'PAs' marketing' has a positive influence on PSCs' vertical integration.***

H 1-4: ***'PAs' support for hinterland and FTZ' has a positive influence on 'PSCs' vertical integration'.***

However, it is revealed that two variables of PAs' SCM strategies, i.e. 'marketing' and 'support for hinterland and FTZ' have no significant influence on 'vertical integration'. The path coefficient of 'marketing' to 'vertical integration' is 0.085 (t-statistic = 0.850) which is insignificant at the 0.05 level. 'Support for hinterland and FTZ' is not significantly related to 'vertical integration' with path coefficient -0.005 (t-statistic = 0.045).

It should be noted that 'using IT' is the most influential variable among PAs' SCM strategies affecting PSCs' SCM strategies.

Next, the relationships between four variables of PAs' SCM strategies and 'PSCs' relationship orientation' were hypothesized. As to the relationships between 'concessions' and 'PSCs' relationship orientation', H 1-5 was hypothesized. It is supported by Hirst's view (Hirst, 2000: Cited in Everett, 2003) which insisted that corporatized ports were more responsiveness to customer needs than other ports. Regarding H 1-6, Study by Kia *et al.* (2000), Stough (2001), Banister and Stead (2004) explicate the positive relationships between 'using IT' and SCM perspective of firms (See Table 2.7). In respect of H 1-7, Min and Mentzer pointed out that 'marketing' concept was a necessary component for implementing SCM. Relationship between 'support for hinterland and FTZ' and 'PSCs' relationship orientation' is hypothesized in H 1-8. Considering port users', e.g. shipping lines' introduction of 'vertical integration' to provide total logistics service (UNESCAP, 2005), 'support for hinterland & FTZ' could be assisting port user based services by ports.

H 1-5: ***'PAs' concessions' has a positive influence on 'PSCs' relationship orientation'.***

H 1-6: ***'PAs' using IT' has a positive influence on 'PSCs' relationship orientation'.***

H 1-7: ***'PAs' marketing' has a positive influence on 'PSCs' relationship orientation'.***

H 1-8: ***'PAs' support for hinterland and FTZ' has a positive influence on 'PSCs' relationship orientation'.***

'PSCs' relationship orientation' is significantly predicted by three PAs' SCM strategies, i.e. 'using IT', 'marketing', and 'support for hinterland & FTZ'. These three variables can explain 45.3% of variance. 'PAs' concessions' is not significantly related to 'relationship orientation' at p=0.05 level with standard coefficient 0.145 (t=1.550). As some studies find that 'privatisation' is only a partial factor regarding improvement in ports' performance (Cullinane and Song, 2002; Cullinane *et al.*, 2005b), it can be posited that 'concessions' itself did not affect PSCs' SCM strategies without relevant other strategies according to the PLS analysis result.

The path coefficient from 'using IT' to 'relationship orientation' is 0.381 (t-statistic=5.075) which is significant at 0.001 level. This result suggests that 'using IT' has a strong impact on 'PSCs' relationship orientation' as suggested by many studies (Lee *et al.*, 2003; Banister and Stead, 2004).

'Relationship orientation' is significantly predicted by 'PAs' marketing' with a path coefficient 0.148 which is significant at 0.05 level (t-statistic=1.766).

'Support for hinterland and FTZ' significantly affect 'relationship orientation' with a path coefficient 0.126 which is significant at 0.05 level (t-statistic=1.855).

It is recognized that 'using IT' is the most influential variable predicting 'relationship orientation'.

7.5.3 PSCs' SCM strategies

This section discovers the influence of PSCs' SCM strategies on PSCs' resources. As discussed earlier, there are two variables of PSCs' SCM strategies, i.e. 'vertical integration' and 'relationship orientation'. Two resources variables including 'physical resources' and 'skills (technologies)' were used for statistical analysis based on the discussions in section 7.3.2. As below, hypothesis two is posited with regard to positive relationships between PSCs' SCM strategies and PSCs' resources.

Hypothesis 2: PSCs' SCM strategies have positive influences on 'PSCs' resources'.

As Araujo *et al.* (2005) insisted, there is a positive relationship between 'vertical integration' and optimizing the terminal and port function within logistics networks. Based on this discussion, H 2-1 was hypothesized. Jensen's (2003) point that stipulates co-operation with customers enable to create tailored services that are more difficult to imitate, can support H 2-2.

H 2-1: ***'PSCs' vertical integration' has a positive influence on 'PSCs' skills'.***

H 2-2: ***'PSCs' relationship orientation' has a positive influence on 'PSCs' skills (or technologies)'.***

'PSCs' skills' (or technologies) is significantly predicted by both 'vertical integration' and 'relationship orientation'. The 53.4% of variance associated is explained by two variables.

The path coefficient from 'vertical integration' to 'PSCs' skills' is 0.258 which is significant at 0.001 level (t-statistic= 3.323). This indicates that PSCs using strong 'vertical integration' can increase the level of 'skills' compared to other PSCs which adopt less level of 'vertical integration' strategy.

The path coefficient of 'relationship orientation' is 0.478, thus the relationship is significant at 0.001 level (t-statistic=7.121). The result shows that 'relationship orientation' is a very important factor predicting 'PSCs' skills'.

A combined view based on general RBT (Resource Based Theory) and SCMT (Supply Chain Management Theory) posits that PSCs' SCM strategies have positive relationships with PSCs' resources. As discussed by Marlow and Paixão (2003), physical resources of container ports are information systems, cargo handling equipment, quays, berths, aprons, storage or yard capacity, and dredged channels and quays. Considering SCM's definition of SCM which is *"the systemic, strategic coordination of the traditional business functions and the tactics* *across these functions within a particular company and across business within the supply chain, for the purpose of improving the long-term performance of the individual companies and the supply chain as a whole"* (Mentzer et al., 2000: 18p), PSCs' intention to coordinate entities in PSCs requires a certain level of improvement of 'physical resources'.

Regarding H 2-3, it can be pointed out that vertical integration requires resources for road haulage, inland terminals, and rail transport (See section 2.7.2.2). As to H 2-4, it is posited that PSCs trying to implement SCM strategies will improve physical resources to meet users' demand.

H 2-3: ***'PSCs' vertical integration' has a positive influence on 'physical resources'.***

H 2-4: ***'PSCs' relationship orientation' has a positive influence on 'physical resources'.***

40.9% of variance is explained by two variables, i.e. 'vertical integration', and 'relationship orientation'.

'Physical resources' is significantly related to 'relationship orientation'. The path coefficient of 'relationship orientation' to 'physical resources' is 0.126 which results in significant association with t-statistic 6.492 at 0.001 levels. However, the relationship between 'vertical integration' and 'physical resources' is insignificant with the path coefficient 0.126 (t-statistic = 1.368).

7.5.4 PSCs' resources

This section discovers the influence of PSCs' resources on PSCs' SCP. As discussed earlier, there are two variables of PSCs' resources that can be used for statistical analysis based on the result of EFA (Exploratory Factor Analysis) in section 7.3.2, i.e. 'skills' and 'physical resources'. Four variables including 'reliability', 'costs', 'service effectiveness', and 'flexibility' were adopted for statistical analysis. Hypotheses among those 6 variables are presented below as from hypothesis 3-1 to hypothesis 3-8.

Hypothesis 3: 'PSCs' resources' has a positive influence on PSCs' SCP.

Hypotheses addressing relationships between 'skills' and PSCs' SCP are H 3-1 (reliability), H 3-3 (costs), H 3-5 (service effectiveness), and H 3-7 (flexibility). It is stressed that skills can help a firm create competitive advantage by some studies (Wright *et al.*, 2001; Mentzer *et al.*, 2004). As mentioned earlier in section 4.2, this study assumes that competitive advantage and SCP shared same measurements.

On the basis of general RBT, the positive relationships between 'physical resources' and PSCs' SCP were posited, e.g. H 3-2 (reliability), H 3-4 (costs), H 3-6 (service effectiveness), and H 3-8 (flexibility). However, it was expected that the influence of 'physical resources' on PSCs' SCP was not as strong as that of 'skills' in the context of SCM. The result of hypotheses testing will be discussed in detail as below.

H 3-1: ***'PSCs' skills' has a positive influence on 'PSCs' reliability'.***

H3-2: ***'PSCs' physical resources' has a positive influence on PSCs' reliability.***

42.6% of variance of 'reliability' is explained by 'PSCs' resources', i.e. 'skills' and 'physical resources'.

'Skills' are positively related to reliability with the path coefficient of 0.562, thus H 3-1 is supported at 0.001 level (t-statistic = 3.958). The result indicates that PSCs which have more skills can increase the level of 'reliability' in their services.

The path coefficient from 'physical resources' to 'reliability' is 0.165, which is lower than that of skills and insignificant at 0.05 level (t-statistic = 1.162).

Considering 'reliability' as one of the important factors to choose a port or a PSC, it is proved that 'skills' is influential on 'PSCs' reliability'.

H 3-3: ***'PSCs' skills' has a positive influence on PSCs' cost.***

H 3-4: ***'PSCs' physical resources' has a positive influence on PSCs' cost.***

62.6% of variance is explained by both variables of PSCs' resources. 'PSCs' costs' is significantly predicted by 'skills'. The path coefficient from 'skills' to 'costs' is 0.575, which results in a significant relationship at 0.001 levels with t-statistic 4.651. 'PSCs' physical resources' has a direct influence on 'PSCs' costs' as well.

The path coefficient is 0.296 which is significant at 0.01 level (t-statistic = 2.470).

It is stipulated that 'skills' is stronger than 'physical resources' in influencing on 'costs'.

H 3-5: ***'PSCs' skills' has a positive influence on 'PSCs' service effectiveness'.***

H 3-6: ***'PSCs' physical resources' has a positive influence on 'PSCs' service effectiveness'.***

'Service effectiveness' is significantly predicted by 'skills' and 'physical resources'. 62% of variance is laid out by two variables.

H 3-5 is supported with the high path coefficient of 0.611 which is significant at 0.001 level (t-statistic = 3.727). This result suggests that 'skills' is a strong predictor of 'service effectiveness'.

In H 3-6, the path coefficient of 'physical resources' to 'service effectiveness' is 0.232 which is significant at 0.01 level (t-statistic = 2.098). This shows that 'physical resources' is not as strong as 'skills' in predicting 'service effectiveness'.

H 3-7: *'PSCs' skills' has a positive influence on 'PSCs' flexibility'.*

H 3-8: *'PSCs' physical resources' has a positive influence on 'PSCs' flexibility'.*

63% of variance of 'flexibility' is explained by two variables of 'PSCs' resources'.

'Flexibility' is significantly predicted by 'skills' with the high path coefficient 0.724, thereby resulting in significant relationship between 'skills' and 'flexibility' at 0.001 level (t-statistic = 6.497).

Hypothesized relationship of H 3-8 is not supported by t-statistic 1.367. The path coefficient of 'physical resources' to 'flexibility' is 0.155.

The result implies that 'skills' is affecting 'flexibility' more strongly than 'physical resources'. It is recognized that 'skills' is affecting all the four PSCs' SCP variables, i.e. 'reliability', 'cost', 'service effectiveness', and 'flexibility'. Meanwhile, 'physical resources' is influencing only two variables, i.e. 'cost' and 'service effectiveness'.

7.6 Concluding Remarks

As illustrated in figure 7.1 (see section 7.1), this chapter is designed to have four sections; 1) data preparation and screening; 2) exploratory factor analysis (EFA); 3) measurement model; 4) testing PLS model. To satisfy statistical premises, missing data, outliers, and non-normality data were carefully treated and remedied. The two items (PA6: management contract; PA7: sale of port land) were dropped because of more than 10% of missing data; then, imputed data set for further analysis was provided using regression imputation method. Then, the treating outlier and non-normality were discussed. Outlier was decided to be kept for generalizability. Then, bootstrapping method was employed to remedy non-normality.

EFA is implemented to clarify the validity issues of formative measures. The variable 'privatisation' is simplified to 'concessions' through the theoretical considerations. Then, the variable, 'relational resources', is deleted because of the non-clarity with the concept 'skills'.

After the EFA, twelve variables ('concession', 'using IT', 'marketing', 'support for hinterland and FTZ', 'vertical integration', 'relationship orientation', 'skills', 'physical resources', 'reliability', 'cost', 'service effectiveness', and 'flexibility') are finally selected for PLS analysis.

Among twenty hypothesized relationships, thirteen, i.e. H 1-1, H 1-2, H 1-6, H 1-7, H 1-8, H 2-1, H 2-2, H 2-4, H 3-1, H 3-3, , H3-5, H3-6, and H 3-7, are shown to be significant (See Table 7.12). 'Using IT' is recognized as the most influential PAs' SCM strategy with two significant relationships with 'vertical integration' and 'relationship orientation'. 'Relationship orientation' is affecting two variables of PSCs' resources. Then, 'skills' is stronger than 'physical resources' in terms of affecting PSCs' SCP.

In summary, the data analysis results suggest that the combination of RBT and SCMT, which has been adopted in this research, were presumably supported in the context of Korean and Chinese port users' perspectives and the 'using IT' of the Port Authority was spotted as a crucial factor as to PSCs' SCP or competitive advantage.

The implications of these findings and general contributions of the research, as well as suggestions for future research, are presented in the final chapter below.

Chapter 8
Discussions and Conclusions

This research started with the key research question, i.e. *"what are the key strategies of PAs' to enhance Port focused Supply Chains' (PSCs') performance, and how do these PAs' measures affect PSCs' performance in the context of supply chain management (SCM)?"* In the context of supply chain management (SCM), port users are taken as: users of port operators, inland transport service providers including depot operators. Bearing the question in mind, four main objectives have been developed; 1) To define PAs' key strategies enhancing PSCs' performance in terms of SCM and related factors; 2) To investigate the relationships among PAs' SCM strategies, PSCs' SCM strategies, PSCs' resources, and PSCs' SCP, and 3) To provide a conceptual model designed to explain and predict port users' selection of Port focused Supply Chains (PSCs), and 4) To measure Supply Chain Performance (SCP) of five major ports in Asia (Busan, Gwangyang, Shanghai, Hong Kong, Singapore) and compare it to each other,

To acquire the theoretical background for these objectives, literature regarding firms' (or ports') governance was reviewed. Transaction Cost Theory (TCT), Porter's Competitive Strategy Framework, Port Selection Theory, and theory on Port Performance were covered as traditional theories. Then, chapter two addresses RBT (Resource Based theory), and SCMT (Supply Chain Management Theory) as new views. Adopting the comprehensive view of SCMT and RBT as the alternative theoretical basis, four basic constructs and sub-constructs are defined.

Considering the fierce competition between Busan and Shanghai port, characteristics of two ports including container routes, physical resources, and SCM strategies are compared in chapter three.

Four constructs (i.e. PAs' SCM strategies, PSCs' SCM strategies, PSCs' resources, and PSCs' Supply Chain Performance (SCP)) and three main hypotheses were stipulated in chapter four.

In order to clarify the relationships between four constructs, in chapter five, the research was designed in terms of research process; data collection method, questionnaire design, sampling design, validity and reliability issues, and data analysis method. Thus, a postal questionnaire in Korea and China was employed initially and an on-line questionnaire was prepared for supplementary purpose. The 1,208 sample frame was adopted.

After 3 months data collection using on-line questionnaire, descriptive statistics have been presented and analysed in chapter six. It was revealed that 59% of respondents belonged to shipping liner companies. Main respondents (65%) used Busan port as a base port for questionnaire among five major container ports in Asia (See section 6.5).

Using 124 responses (response rates: 16%), Partial Least Square (PLS) was performed to statistically test 20 hypotheses under the three main hypotheses in the context of port users of Korean and Chinese container ports in chapter seven. Thirteen causal paths were diagnosed as statistically significant.

In this chapter, findings from statistical tests and Supply Chain Performance of five Asian container ports are summarized and their implications for the theory and practice are discussed. Then, the contribution of this research is presented. Finally, the limitations of this research are highlighted, and suggestions for future studies are proposed in this chapter.

8.1 Research Findings and Implications

The main statistical findings and their implications are discussed in detail in sequence of the four constructs. Overall, the combined view of RBT and SCMT was proved to be theoretically pertinent.

8.1.1 PAs' SCM strategies

The final model suggests that hypothesis one is partially supported. Among PAs' SCM strategies, 'using IT' is the strongest variable affecting both 'vertical integration' and 'relationship orientation'. As recognized in considerable studies (Evangelista, 2005; Heaver, 2001; Kia *et al.*, 2000), 'using IT' can enhance 'vertical integration' with coefficient 0.327, and 'relationship orientation' with coefficient 0.381. 'Concessions' affects only 'vertical integration' with coefficient 0.175. 'Marketing' positively influences 'relationship orientation' only with coefficient 0.148. 'Support for hinterland and FTZ 'is significantly related only to 'relationship orientation' with coefficient of 0.126.

In summary, the results imply that PAs should design their SCM strategies concentrating on 'using IT' strategy. For enhancing 'vertical integration', 'concessions' is another useful strategy can be taken. To improve 'PSCs' relationship orientation', a PA can support hinterland and FTZ. Therefore, it can be proposed that PAs' strategic choice of SCM strategies can affect PSCs' SCM strategies.

In doing so, it should be stressed that PAs' SCM strategies should be in line with national economic policies. As UNESCAP (2005) stipulated, establishing a FTZ is not a guaranteed method of obtaining higher growth rates or attracting FDI (Foreign Direct Investment). Furthermore, it is suggested that the strategic goals of FTZ should be consistent with national development goals, and set out the objectives of the zone, and how those objectives will be achieved, and the responsibilities of various stakeholders in making the investment a success. Therefore, to ensure the success of PAs' SCM strategies, PAs' (or governments) strategic role should be considered as well. The necessity of PAs' (or governments') strategic role is advocated by the example of the British government's inquiry procedure regarding the UK private port development case, e.g. Dibden Bay in Southampton and London Gateway at Shellhaven on the north bank of the Thames (Gilman, 2003; 288p). Government involvement even in private port development via planning system is clearly declared by the British government in the document (17 DETR 2000b 1.1.14[1]) (Ibid.). As will be

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1) DETR : Department of the Environment, Transport and the Regions (up to 2001). According to the re-organization, it is Department for Transport in 2007 (http://www.dft.gov.uk).

discussed further in the 'SCP of five main container ports (7.1.2)', port of Singapore achieved the highest score in almost all SCP criteria; thus, it can be proposed that the SCM strategies of Singapore port are most efficient and effective. Some evidence is provided, e.g. in the inland transport decision-making system, Singapore's transport policy-making system can be characterized as having attributes, e.g. development of long-term vision and strategy, and adherence to it over 30 years, with a single tier of government, enabling much more rapid decision-making, and high-quality tools for planning and evaluation of policy measures (May, 2004).

'Concessions' was expected to be one of the important PAs' SCM Strategies as can be seen in the competition case between Shanghai and Ningbo (Cullinane *et al.*, 2005). In mainland China, with the exception of Shenzhen port, PAs or central government possess the majority shares of port joint ventures (Shanghai: 51%, Ningbo: 80-100%, Dalian: 51%, Qingdao: 51%, Tianjin: 55%). In addition, JV (Joint Venture) partners are mainly restricted to Chinese ethnic terminal operator, e.g. HPH (Hutchison Port Holdings) and Chinese state owned shipping companies, i.e. COSCO (Wang *et al.*, 2004). Owning terminals in 11 ports (Hong Kong, Jiangmen, Nanhahi, Ningbo, Shanghai, Shantou, Xiamen, Yantian, Zhuhai, Busan, and Gwangyang), HPH (Hutchison Port Holdings) was the No.1 terminal owning company with 12.85% of total regional throughput (32,368,000 TEUs) in Northeast Asia in 2005 (Drewry, 2006)[1]. The company recorded also No. 1 earnings (HPH: 1318.2 mil US$, PSA: 722.8 mil US$, P&O ports: 148.1 mil US$, OOCL: 56.4 mil US$, NYK line: 34.8 mil US$) in Northeast Asia in 2005 (Ibid.). Practically owned by the government of Singapore, the form of privatisation of PSA also reflects that port of Singapore favours a common user system, rather than dedicated berths, for its terminal (Cullinane and Song, 2001). These two financial shareholding strategies are totally different from South Korea's recent privatisation of terminals in Busan. This kind of different approach may affect the differences of SCP. It should be stated that the strategic

[1] Top ten terminal owning companies in 2005 were as follows: 1) HPH, 2) COSCO, 3) China Merchants Holdings, 4) APM Terminals, 5) SIPG, 6) PSA, 7) P&O Ports, 8) Wharf Holdings, 9) Evergreen, 10) Hanjin. DP World purchased P&O Ports in the first half of 2006.

choice between global container terminal operators and shipping liner companies may affect SCP. The results of this study have an implication, for 'PAs, 'using IT' to connect various players in the supply chain can be advocated as a key measure to maintain the success of a port. It should be noted that 'concessions' has a positive relationship with 'vertical integration'. 'marketing' and 'support for hinterland & FTZ' affect only 'relationship orientation'.

8.1.2 PSCs' SCM strategies

In detailing the statistical analysis results about PSCs' SCM Strategies, it is highlighted that 'relationship orientation' is a major strategy of PSCs for enhancing 'skills' (or technology) and 'physical resources'. 'Relationship orientation' had positive influences on 'skills' with coefficient 0.478 and 'physical resources' with coefficient 0.501. In addition, the empirical research findings showed that 'vertical integration' influences on 'skills' with coefficient 0.258. Different from the expectation that was stipulated by hypothesis 2-3, vertical integration had no significant influence on 'physical resources' with t-statistics 1.368.

According to the result of hypotheses testing, 'relationship orientation' is more influential than 'vertical integration'. Especially, its positive relationship with 'physical resources' implies that 'relationship orientation' is proved to be one of key elements of SCM which is dependent on partnership and cooperation in port and shipping industries. This can be interpreted as PSCs' investments on 'physical resources' can be strongly influenced by 'relationship orientation'. As discussed in section 2.7.2.4, many authors, e.g. Lee *et al.* (2003), Paixão and Marlow (2005), Panayides and So (2005), and Panayides and Song (2007) explicitly acknowledged that 'relationship orientation' has positive relationships with 'logistics service quality (LSQ)' and performance. This research proved that 'PSCs' resources' is affected by 'relationship orientation' and has a positive relationship with 'PSCs' SCP' in the context of RBT. Furthermore, it supported SCMT's view that 'relationship orientation' can enhance 'resources' and 'SCP' as many authors, e.g. Mentzer *et al.* (2000), Min and Mentzer (2000), Lee *et al.* (2003), Hult *et al.* (2005), Panayides and So (2005), Panayides (2007), and De Martino and Morvillo (2008) insisted.

8.1.3 PSCs' resources

'Skills' significantly influenced on all variables of PSCs' SCP, i.e. 'reliability', 'flexibility', 'costs', and 'service effectiveness'. 'Skills' was the single most important factor from 'PSCs' resources' to decide SCP. It had the highest direct effect on 'reliability' (coefficient: 0.562), 'flexibility' (0.724), 'costs' (0.575), and 'service effectiveness' (0.611). 'Physical resources' has positive influences only on 'costs' (0.296) and 'service effectiveness' (0.611). This result clearly suggests the importance of intangible resources as explicated by Mentzer *et al.*, (2004), e.g. relationships, culture, skills, and loyalty (See section 2.7.3).

It is clearly evident that intangible resources should be given more emphasis when a researcher measures a port industry's competitiveness. According to the study by Lirn *et al.* (2004), weight given by global carriers on major criteria for transhipment port selection followed in sequence of 1) carrier's port cost (38.12%), 2) geographical location (35.12%), 3) physical and technical infrastructure (16.38%), and 4) port management and administration (10.38%). It is recognized that intangible resources has not been given much emphasis.

Some meaningful implications can be found in other studies. In the aspect of Greek ocean transportation industry, Lagoudis *et al.* (2006; 356p) found the 'quality' as the most important contributor to higher performance, *inter alia*, 'service', 'cost', and 'time'. According to their definitions, some resources, e.g. 'skills' and 'the knowledge of operating personnel', 'reputation' and 'reliability', and 'financial stability' belong to quality category. 'Flexibility', 'responsiveness', and 'reliable and efficient services' are included in service category. Along with other studies (Martin *et al.*, 1997; Murphy *et al.*, 1997), this result also highlights the importance of resources in the maritime sector.

Having recognized the influence of PSCs' Resources on PSCs' SCP, some implications for practice stem from this fact. First of all, PAs' role to support

PSCs' resources whereby enhancing SCP is crucial. Therefore, PAs must understand their roles, develop effective guidelines and support essential resources with partners in PSCs (Port focused Supply Chains) in order to compete with other PSCs.

In the meantime, coordination at national level should be retained and well organized when privatisation of PAs' function and concession take place. Terada's study (2002) points out Japanese overcapacity problem under the decentralized management system of container ports. In addition, there is increasing awareness of the importance of measuring SCP in logistics (Lai *et al.* 2002) or port industry (Panayides and Song, 2007), thereby recalling the necessity of the PAs or PSCs' top managers' careful attention on SCP.

Furthermore, considering the recent recession all over the world (IMF, 2009), the importance of SCM strategies is recognized as well in terms of PSCs' competition and survival.

8.1.4 SCP of five major container ports in Asia

To gain an insight into real port industry, SCPs of five major container ports in Asia were measured in this research. The implication discussed about empirical findings earlier should be feasible with SCPs of 5 major ports in Asia in terms of theoretical and practical implications. The result shows that the author's assumption on positive relationships between PAs' SCM strategies, PSCs' SCM strategies, PSCs' resources, and PSCs' SCP are supported.

According to the results of 24 SCP measures in chapter six (See section 6.4), Singapore port was the most competitive port (Total: 95.08, mean: 3.96); then Hong Kong (91.30, 3.80), Busan (87.93, 3.66), Gwangyang (84.90, 3.54) and Shanghai (82.51, 3.44) followed.

Singapore was ranked as the No. 1 SCP port, except in terms of 'reduction of warehousing cost' (3rd: 3.72) and 'expansion flexibility' (3rd: 3.74). It is specified the value for money of Singapore score was the highest, despite having high terminal handling charges (Lee *et al.*, 2006). Therefore, Singapore port's resources and SCM strategies are assumed to be better than those of other ports, despite PSA's physical resources and financial performance being less than that of HPH in 2005 (Drewry, 2006).

Hong Kong's position was the second place based on its overall SCP. Some exception cases were found, i.e. 1) 'level of damages' (3rd: 3.82); 2) 'level of overall transport costs' (3rd: 3.53); 3) 'reduction of warehousing cost' (4th: 3.39); 4) 'lower port time' (3rd: 3.80); 5) 'expansion flexibility' (5th: 3.59). Identifying HPH's strong status within a PSC in Shanghai port, PAs' role regarding 'concessions' should be considered as an important factor. This maybe occurred from the Chinese governments 're-allocation of port activities concentrating on Shanghai port as the international gateway and regional gateway of YRD (Yangtze River Delta) (Wang and Slack, 2004).

It seems that Busan port is on the verge of serious challenges concerning its hub port status with disappointing the third score of SCPs. Contrary to a body of research demonstrating Busan port's low-logistics cost (Yeo, 2006), it is recognized that the cost competitiveness of Busan port is relatively low, i.e. 'value for money' (4th: 3.55) and 'level of overall transport costs' (5th: 3.46) as well as 'low expansion flexibility' (4th: 3. 61) and 'process flexibility' (4th: 3.48). Busan port failed to acquire a highest score in any SCP measures. This aspect casts huge challenge to Busan Port Authority. The only two SCP items above 2nd place were 'level of damages' (2nd: 3.94) and 'lower port time' (2nd: 3.81). PAs' strategic role should be reconsidered carefully after the introduction of BPA (Busan Port Authority) in 2004. Using the Multicommodity network flow model, Lee *et al.* (2006) insist that Busan port could boost the container throughput in the north-eastern part of China, e.g. Dalian, Shenzhen (Yantian), Hong Kong, and Shanghai by improving its service quality (reducing turnaround time). Considering Busan ports' poor competitiveness and flexibility rankings, Port Authority of Busan port should support its SCM strategies, PSCs' SCM strategies, and PSCs' resources to enhance PSCs' SCP.

Gwangyang port was ranked in 4th place regarding SCP scores. Its' strong advantages were about 'low warehousing cost' (1st: 3.60), 'expansion flexibility'

(2nd: 3.83), 'process flexibility' (speed of decision making, 3rd: 3.53), and 'level of conflict with other multimodal processes' (3rd: 3.50). Its' weak point were 'value for money' (5th: 3.38), 'reduction of facilities/equipment cost' (5th: 3.50), 'transportation cost' (5th: 3.43), 'access/distribution flexibility' (5th: 3.49), 'product flexibility' (5th: 3.36), 'routing flexibility' (5th: 3.14), 'target flexibility' (5th: 3.27), and 'volume flexibility' (5th: 3.33). It can be summarized that Gwangyang port, as a newly developed port, suffered from low level of networking in terms of number of shipping lines and road/rail accesses. Furthermore, there are not enough strategic guidelines between Busan and Gwangyang port yet, as there are with Shanghai and other ports in China.

Shanghai port recorded the lowest level of SCPs overall. However, this port scores well in 'costs', i.e. 'value for money' (3rd: 3.60), 'level of overall transport cost' (2nd: 3.72), 'reduction of facilities/equipment costs' (3rd: 3.54), 'reduction of transportation costs' (3rd: 3.52). The port scored top in 'expansion flexibility' among five ports.

To Busan and Gwangyang port, several recommendations can be provided. The level of SCP including 'flexibility' and 'costs' should be raised through relevant PAs' SCM strategies, which should embrace: 'using IT', 'support for hinterland and FTZ', 'marketing', and 'concessions'. At the same time, it is important to encourage PSCs to have a particular level of integration and 'relationship orientation'.

8.2 Limitations of the current study

Several limitations of this study are detailed below.

First of all, in PLS, at least one reflective measure should be used. However, this study adopts 12 variables with formative indicators owing to the difficulties of finding existing studies using reflective measures. As discussed in the section 5.6.2, using only formative measures caused the validity and reliability problems (Chin, 1998a). However, supplementary measures were taken by an EFA

(Exploratory Factor Analysis) and pilot survey involving experts in port and shipping industries at certain level.

Next, owing to the failure to acquire a large number of responses (more than 100) for moderator analysis, the moderating effect between shipping lines and freight forwarders could not be analyzed. However, a sample of 124 is good enough for general PLS analysis.

Then, an interesting variable, 'privatisation', is dropped because of missing data problem. Thus the relationships between privatisation and the other 3 main variables could not be analysed. After EFA, 'relational resources' was discarded owing to its correlation with 'skills'. This can be interpreted that greater efforts should be taken in choosing variables in the model.

Finally, it may be difficult to generalize the result of this study owing to the concentration of respondents from Busan port. 65.3% (81 out of 124) of respondents designated Busan port as a base-port for the questionnaire answer. Respondents mainly using Chinese ports, e.g. Shanghai, Qingdao, and Ningbo, were only 6.4% (8 out of 124).

8.3 Contribution of the Research

Despite its' limitations, the author believes that this study makes several important contributions both to theory and practice as follows:

Firstly, this study proves that Resource-based Theory (RBT) and Supply Chain Management Theory (SCMT) add a new perspective in understanding the modern port industry's turbulent atmosphere of competition. It is recognized that PAs' SCM strategies affect PSCs' SCP through PSCs' SCM strategies and PSCs' resources.

Secondly, this research, for the first time, diagnoses the limitation of the formative measures in SEM analysis in the field of port logistics as discussed earlier (See section 5.5.2). Furthermore, the relevance of PLS is stressed in the current study in the case of formative measures. Based on a sound theoretical basis, it would provide the important turning point of studies using PLS in logistics and port studies as one of the options of SCM methods. As Lirn (2005) suggests the necessity of employing SEM to implement a study focusing on shippers' port selection decision criteria as a future research area, it is recognized that SEM is seldom employed except few case (Bennett and Gabriel, 2001; Panayides and Song, 2007) owing to the characteristics of maritime sector whereby the number of surveyees in a population is small (Lirn, 2005).

Thirdly, to the author's best knowledge, for the first time, this study has been implemented an empirical study testing the relationships between variables including Ports' SCM strategies, Resources, and SCP, within the field of maritime logistics. Recently, a body of research addressed its interest in SCP; however, it was restricted to developing measurement tools of SCP in the logistics or maritime sectors (Lai *et al.* 2002; Panayides and Song, 2007). This research was, notwithstanding, successful in establishing the conceptual model involving 12 variables, i.e. 'PAs' concessions', 'PAs' using IT', 'PAs' marketing', 'PAs' support for hinterland and FTZ', 'PSCs' vertical integration', 'PSCs' relationship orientation', 'PSCs' skills', 'PSCs' physical resources', 'PSCs' reliability', 'PSCs' flexibility', 'PSCs' cost', and 'PSCs' service effectiveness'.

Fourthly, this study has provided strong empirical evidence which highlights the necessity for further research on PAs' SCM Strategies including the potential influences of: 'concessions', 'using IT', 'marketing', and 'support for hinterland and FTZ'. All enable a port to adapt against the external changes which surround the port. As Notteboom and Winkelmans (2001) insist, Port Authorities can play an important role in the creation of core competencies and economies of scope in areas, e.g. value-added logistics and logistics polarization, the development of information systems, an active participation in the planning and/or implementation of new transport services, and port networkings with inland/overseas/ neighbouring ports.

Fifthly, this research clarified the concept of Port-focused Supply Chains (PSCs). It is hoped that theoretical division of port authorities and PSC in Port Supply Chains can provide more vivid insight into port and shipping industries.

Finally, this research suggests practical solution for actual policy makers in the field of port authorities and port operators to compete with other ports. The solution can be implementing SCM strategies like 'using IT', 'support for hinterland & FTZ' to enhance PSCs' SCP, i.e. reliability, cost, service effectiveness, and flexibility.

8.4 Suggestions for Future Research

To provide some insights into future studies in port and shipping industries based on the author's experience throughout this study, several proposals for researchers are advocated and detailed as follows:

First of all, recognizing the explanation of the small amount of variance of 'vertical integration' (27.4%), 'relationship orientation' (45.3%), 'physical resources' (40.9%), and 'reliability' (42.6%) by the model, it would be important to consider the inclusion of new variables in the model to clarify hitherto unexplained variance.

Secondly, noticing the importance of PAs' SCM strategies, PAs' strategic policy making should be investigated. There is increasing awareness to the importance of studies on PAs' Strategic Planning (Panayides, 2006) and Cultural and institutional approach to Port Authorities' development strategies and financial stake in stevedoring companies (Wang *et al.*, 2004). These arguments strongly support PAs' active role in enhancing PSCs' SCP. The challenging characteristics of this area may require a qualitative approach.

Thirdly, it is stressed that researchers who intend to use SEM should employ reflective measures. With formative measures, PLS should be considered as a data analysis technique as discussed earlier in chapter five.

Fourthly, Northeast Asia is regarded as holding a central position in container ports. Moreover, some new policy measures have been taken, e.g. introduction of semi-public independent port authorities like BPA (Song, 2008), and Chinese ports' efforts to integrate Chinese stevedoring companies (Olivier, 2005). Further investigations as to the impacts of these efforts are recommended.

Fifthly, this study inspires a noticeable insight into the shift of the paradigm from cost perspective to quality in the field of port and shipping industries. As Lagoudis *et al.* (2006) insisted, this research adopts variables focused on quality and service factors (reputation and reliability, sills and knowledge of operating personnel, development and maintenance of good relationships with customers and suppliers, flexibility to meet customer demand and market changes, responsiveness to unforeseen problems, willingness to negotiate constant service changes with customers and suppliers, provision or reliable and efficient services by ports), rather than cost factors (administration, quality assurance of services, spares and supplies inventory, insurance, company restructuring, and operating costs) which was recognized as the salient factor (Lirn *et al.*, 2004). Using quality and service related variables, e.g. vertical integration, relationship orientation, and skills, which are stressed in SCMT, Empirical test result of this study shows that these factors are influential on PSCs' SCP. Therefore, it is suggested that future researchers should be keen on quality and service related factors rather than just cost factors when they plan to design a model.

Next, it is advocated by this research that performing questionnaire survey in China is difficult (in terms of postal delivery with English Address in China and response rate). However, as a very rapidly growing market, China 's container ports are an interesting target to be studied; hence, further research based on questionnaire focused on Chinese port users is suggested for future research. Researchers should be careful to avoid implementing postal survey in China (especially in Beijing) with address in English.

Finally, Resource Based Theory (RBT) and Supply Chain Management Theory (SCMT) were shown to be useful theoretical tools to understand port competition in the real world. Thus, this combined perspective is recommended to be used by future researchers.

8.5 Conclusions

Considering the recent global economic recessions, SCM strategies can be one of key strategies to enhance PSCs' performance.

Four main objectives of this study were 1) To define PAs' key strategies enhancing PSCs' performance in terms of SCM and related factors; 2) To investigate the relationships among PAs' SCM strategies, PSCs' SCM strategies, PSCs' resources, and PSCs' SCP, and 3) To provide a conceptual model designed to explain and predict port users' selection of Port focused Supply Chains (PSCs), and 4) To measure Supply Chain Performance (SCP) of five major ports in Asia (Busan, Gwangyang, Shanghai, Hong Kong, Singapore) and compare it to each other,

The empirical results suggest that 1) 'Using IT' is the most important among PAs' SCM strategies; 2) 'relationship orientation' is the salient factor in PSCs' SCM strategies. This supports some theoretical suggestions by Mentzer *et al.* (2001, 2004) in the context of SCM. 3) 'Skills' is more influential on PSCs' SCP than 'physical resources'.

SCPs of five major container ports in Asia suggest that Singapore is the clear No.1 port in terms of SCP. Busan and Gwangyang port suffer from its low flexibility, and poor cost competitiveness, therefore, their SCM strategies should be reconsidered in the light of PAs' SCM strategies. Recently, the growth rate of Busan port's container volumes has slowed from 10.2% (06/07) to 1.2% (07/08). Shanghai port has also recorded a sharp downturn of cargo handling from 20.4% (06/07) to 6.9% (07/08). This may implies that the different SCM approach can affect the likelihood of attracting port users' cargo.

Notwithstanding its' limitations, this study has addressed important issues concerning the future development of port and shipping industries studies based on combined framework of RBT and SCMT. Furthermore, this study does highlight new perspectives on soft variables, e.g. 'using IT', 'relationship orientation', and 'skills' similar to Lagoudis *et al.*'s study (2006) which is also emphasized the role of business relationships rather than cost-based perspectives seen in traditional work (Song and Yeo, 2004).

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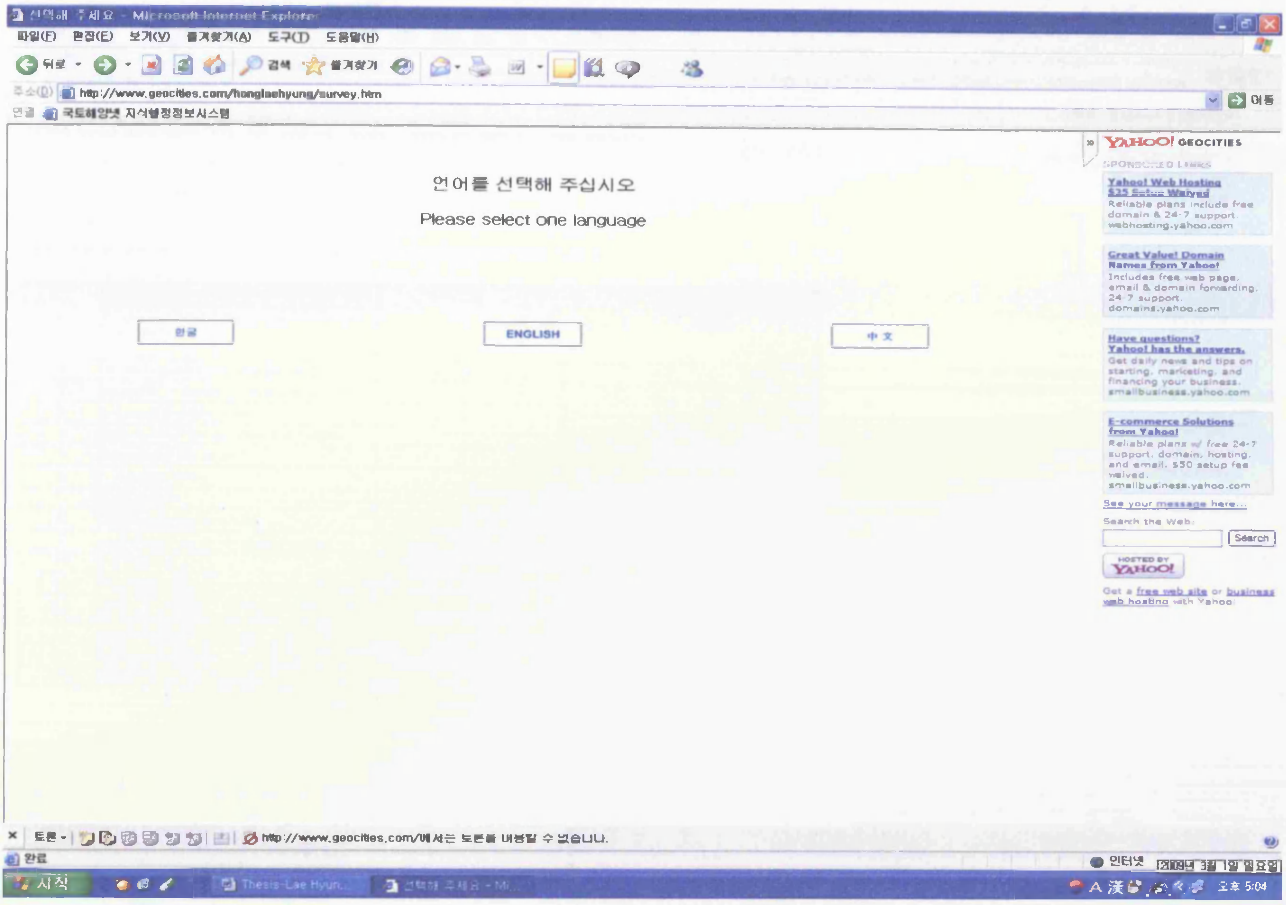
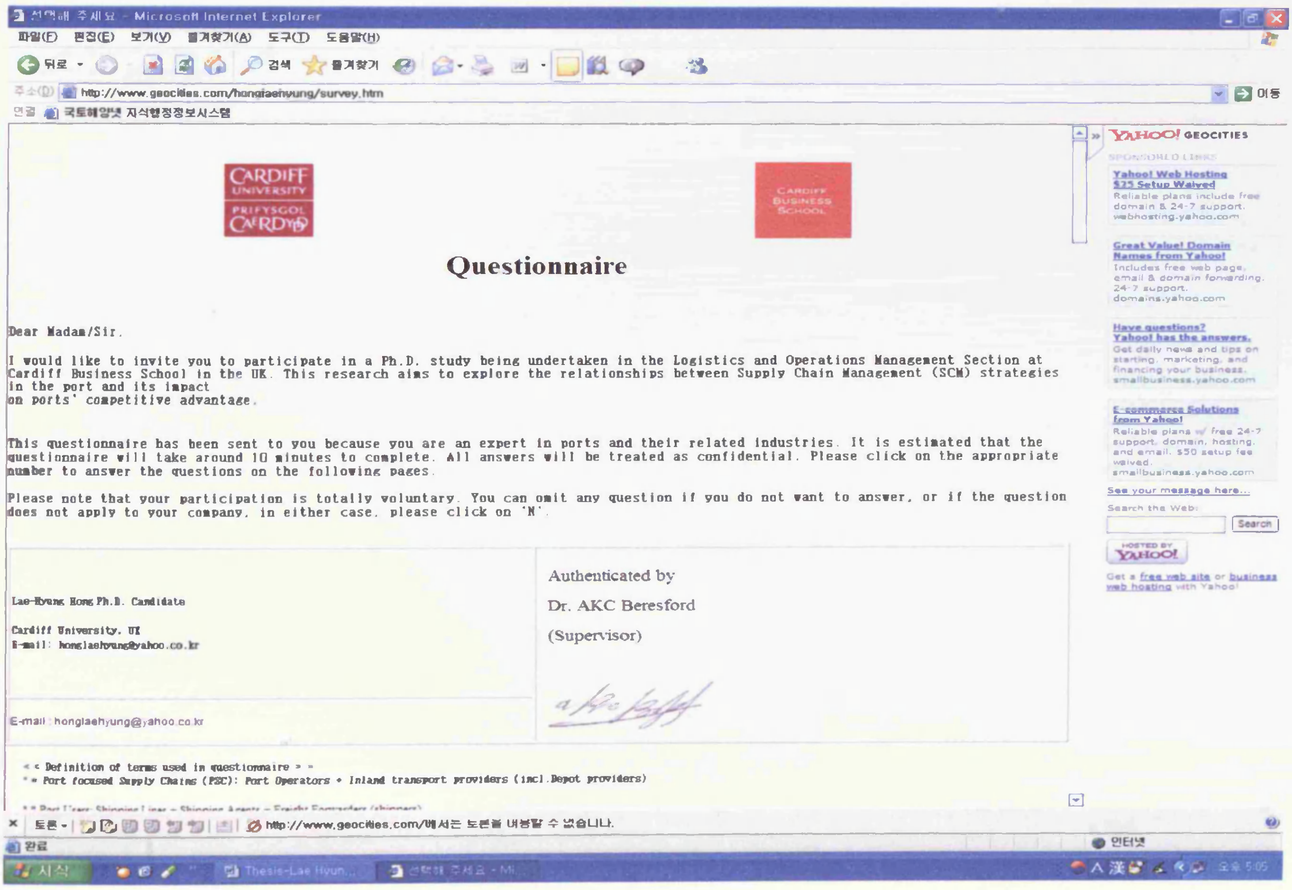
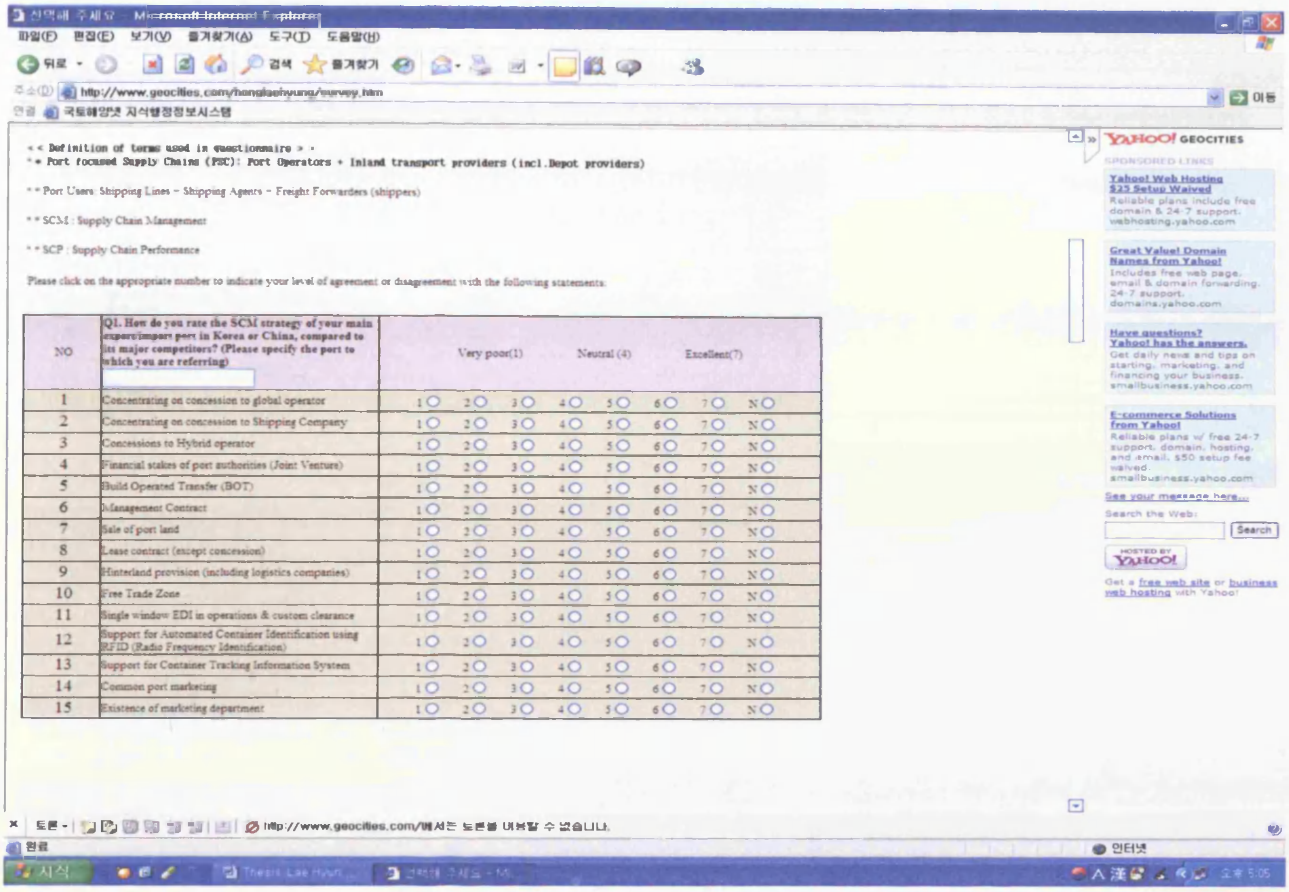
Appendix 1: Online English Questionnaire


언어를 선택해 주십시오
Please select one language
ENGLISH
中文


Questionnaire
Dear Madam/Sir.
I would like to invite you to participate in a Ph.D. study being undertaken in the Logistics and Operations Management Section at Cardiff Business School in the UK. This research aims to explore the relationships between Supply Chain Management (SCM) strategies in the port and its impact on ports' competitive advantage.
This questionnaire has been sent to you because you are an expert in ports and their related industries. It is estimated that the questionnaire will take around 10 minutes to complete. All answers will be treated as confidential. Please click on the appropriate number to answer the questions on the following pages.
Please note that your participation is totally voluntary. You can omit any question if you do not want to answer, or if the question does not apply to your company, in either case, please click on 'N'.
Lae-Hyung Hong Ph.D. Candidate
Cardiff University, UK
E-mail: honglaehyung@yahoo.co.kr
E-mail : honglaehyung@yahoo.co.kr
Authenticated by
Dr. AKC Beresford
(Supervisor)
« Definition of terms used in questionnaire »
* Port focused Supply Chains (PSC): Port Operators + Inland transport providers (incl.Depot providers)



< < Definition of terms used in questionnaire > >
* * Port focused Supply Chains (PSC): Port Operators + Inland transport providers (incl. Depot providers)

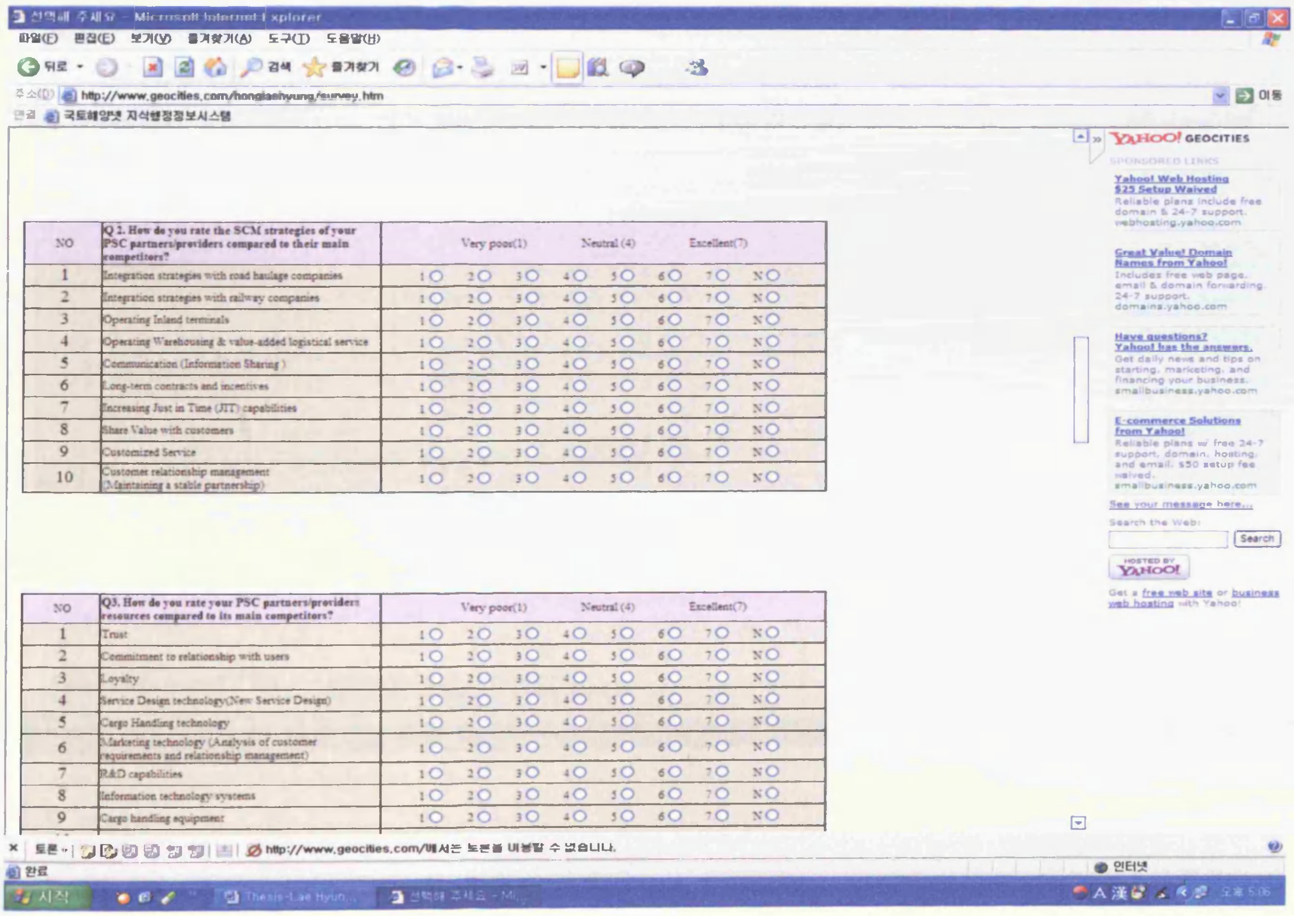
* * Port Users: Shipping Lines – Shipping Agents – Freight Forwarders (shippers)

* * SCM : Supply Chain Management

* * SCP : Supply Chain Performance

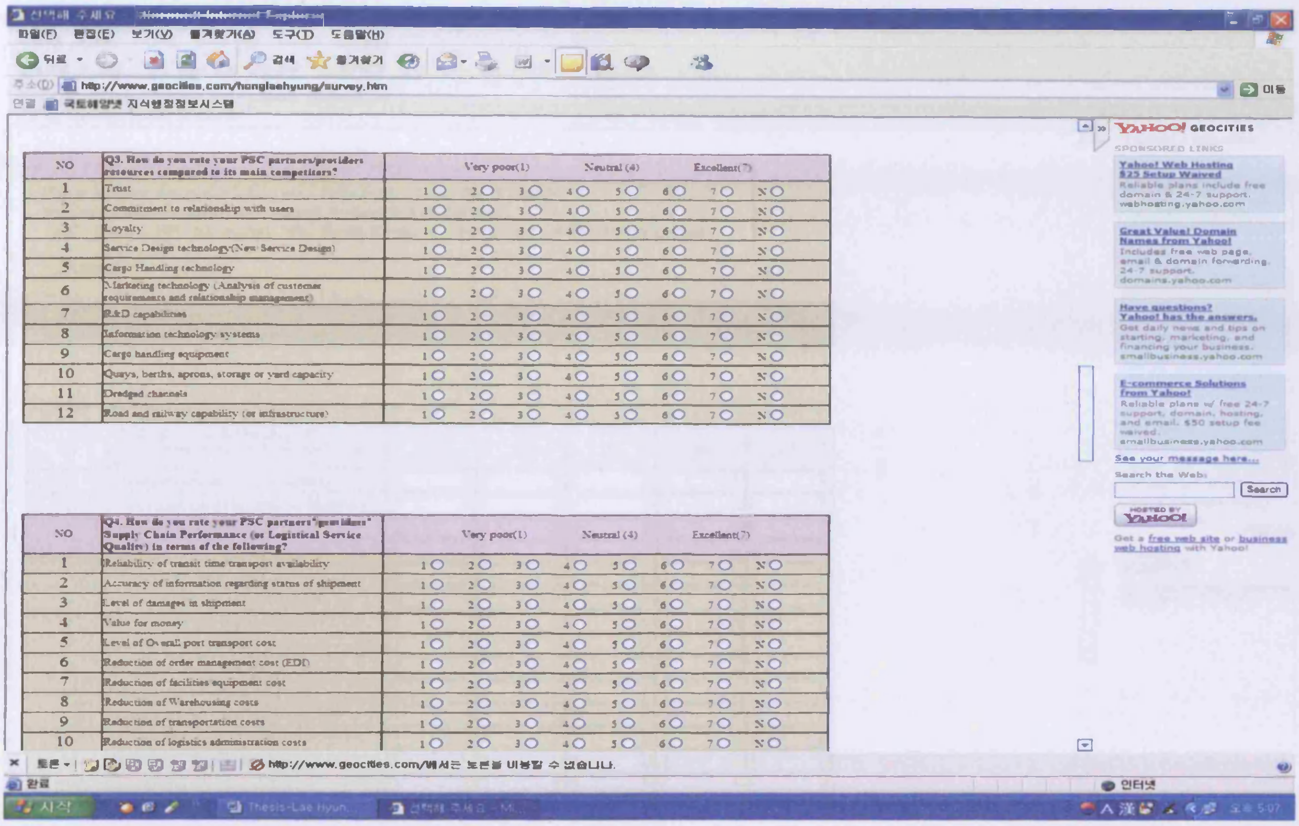
Please click on the appropriate number to indicate your level of agreement or disagreement with the following statements.

NO	Q1. How do you rate the SCM strategy of your main export/import port in Korea or China, compared to its major competitors? (Please specify the port to which you are referring)	Very poor(1)			Neutral (4)			Excellent(7)	
1	Concentrating on concession to global operator	1○	2○	3○	4○	5○	6○	7○	N○
2	Concentrating on concession to Shipping Company	1○	2○	3○	4○	5○	6○	7○	N○
3	Concessions to Hybrid operator	1○	2○	3○	4○	5○	6○	7○	N○
4	Financial stakes of port authorities (Joint Venture)	1○	2○	3○	4○	5○	6○	7○	N○
5	Build Operated Transfer (BOT)	1○	2○	3○	4○	5○	6○	7○	N○
6	Management Contract	1○	2○	3○	4○	5○	6○	7○	N○
7	Sale of port land	1○	2○	3○	4○	5○	6○	7○	N○
8	Lease contract (except concession)	1○	2○	3○	4○	5○	6○	7○	N○
9	Hinterland provision (including logistics companies)	1○	2○	3○	4○	5○	6○	7○	N○
10	Free Trade Zone	1○	2○	3○	4○	5○	6○	7○	N○
11	Single window EDI in operations & custom clearance	1○	2○	3○	4○	5○	6○	7○	N○
12	Support for Automated Container Identification using RFID (Radio Frequency Identification)	1○	2○	3○	4○	5○	6○	7○	N○
13	Support for Container Tracking Information System	1○	2○	3○	4○	5○	6○	7○	N○
14	Common port marketing	1○	2○	3○	4○	5○	6○	7○	N○
15	Existence of marketing department	1○	2○	3○	4○	5○	6○	7○	N○



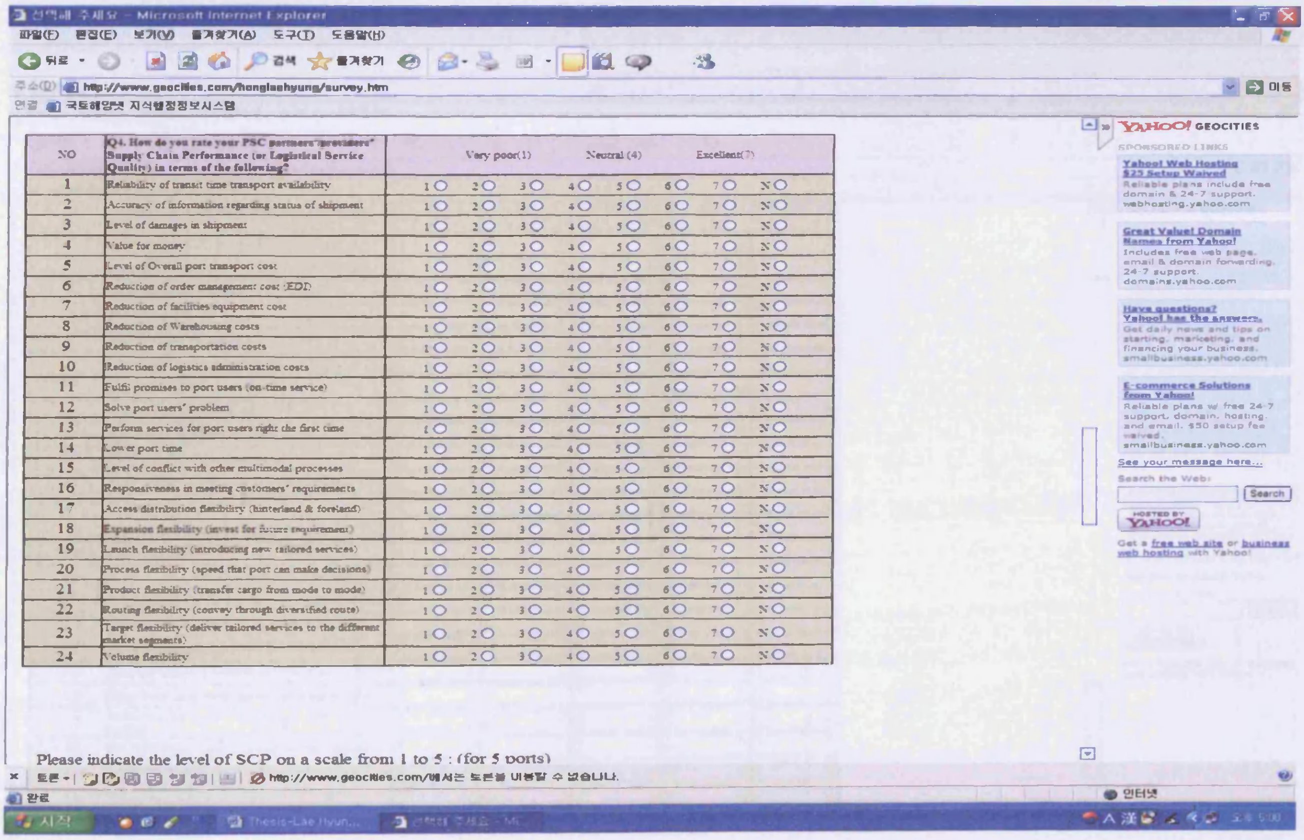
NO	Q 2. How do you rate the SCM strategies of your PSC partners/providers compared to their main competitors?	Very poor(1)			Neutral (4)			Excellent(7)	
1	Integration strategies with road haulage companies	1○	2○	3○	4○	5○	6○	7○	N○
2	Integration strategies with railway companies	1○	2○	3○	4○	5○	6○	7○	N○
3	Operating Inland terminals	1○	2○	3○	4○	5○	6○	7○	N○
4	Operating Warehousing & value-added logistical service	1○	2○	3○	4○	5○	6○	7○	N○
5	Communication (Information Sharing)	1○	2○	3○	4○	5○	6○	7○	N○
6	Long-term contracts and incentives	1○	2○	3○	4○	5○	6○	7○	N○
7	Increasing Just in Time (JIT) capabilities	1○	2○	3○	4○	5○	6○	7○	N○
8	Share Value with customers	1○	2○	3○	4○	5○	6○	7○	N○
9	Customized Service	1○	2○	3○	4○	5○	6○	7○	N○
10	Customer relationship management (Maintaining a stable partnership)	1○	2○	3○	4○	5○	6○	7○	N○

NO	Q3. How do you rate your PSC partners/providers resources compared to its main competitors?	Very poor(1)			Neutral (4)			Excellent(7)	
1	Trust	1○	2○	3○	4○	5○	6○	7○	N○
2	Commitment to relationship with users	1○	2○	3○	4○	5○	6○	7○	N○
3	Loyalty	1○	2○	3○	4○	5○	6○	7○	N○
4	Service Design technology(New Service Design)	1○	2○	3○	4○	5○	6○	7○	N○
5	Cargo Handling technology	1○	2○	3○	4○	5○	6○	7○	N○
6	Marketing technology (Analysis of customer requirements and relationship management)	1○	2○	3○	4○	5○	6○	7○	N○
7	R&D capabilities	1○	2○	3○	4○	5○	6○	7○	N○
8	Information technology systems	1○	2○	3○	4○	5○	6○	7○	N○
9	Cargo handling equipment	1○	2○	3○	4○	5○	6○	7○	N○



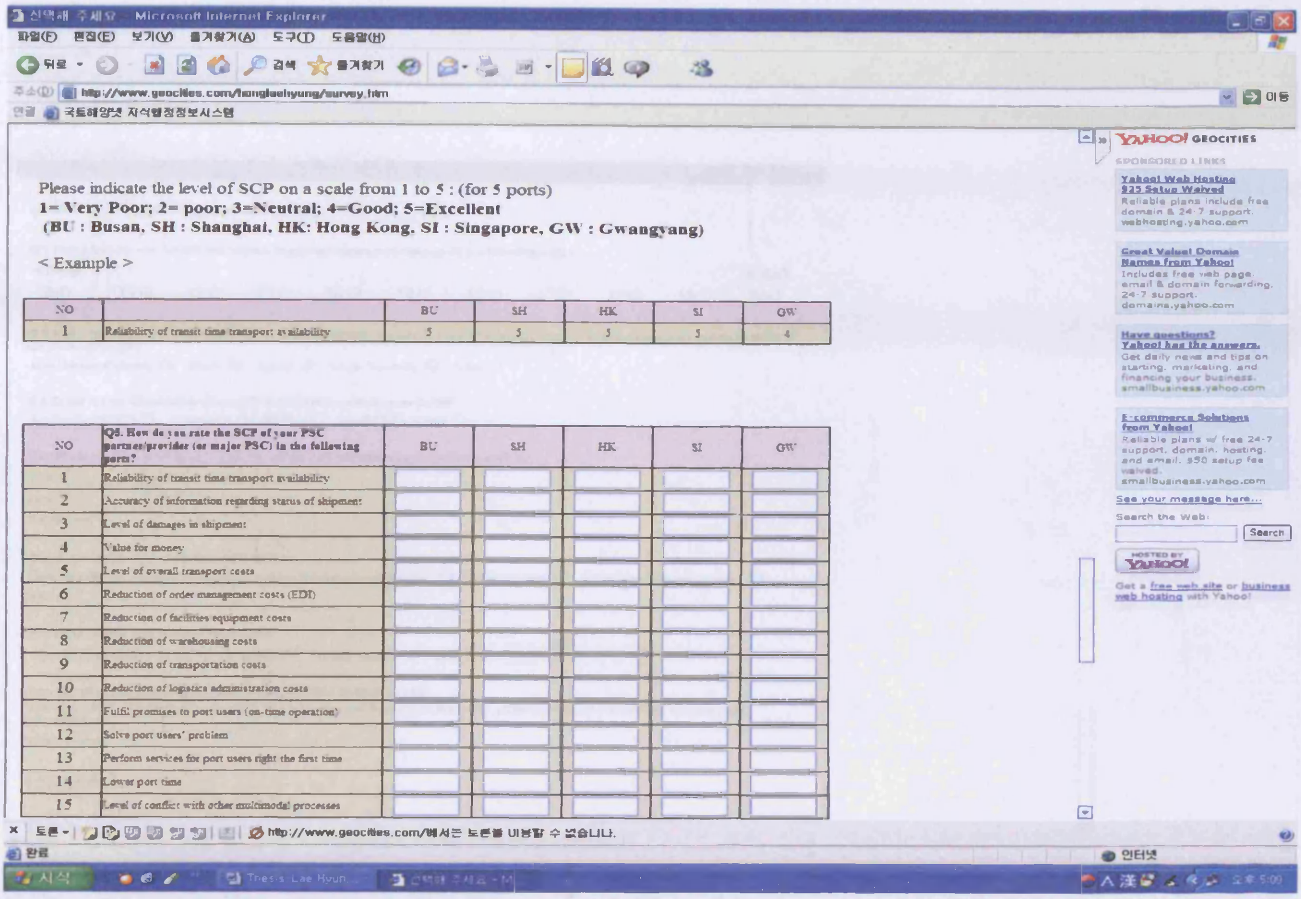
NO	Q3. How do you rate your PSC partners/providers resources compared to its main competitors?	Very poor(1)			Neutral (4)			Excellent(7)	
		1	2	3	4	5	6	7	N
1	Trust	○	○	○	○	○	○	○	○
2	Commitment to relationship with users	○	○	○	○	○	○	○	○
3	Loyalty	○	○	○	○	○	○	○	○
4	Service Design technology(New Service Design)	○	○	○	○	○	○	○	○
5	Cargo Handling technology	○	○	○	○	○	○	○	○
6	Marketing technology (Analysis of customer requirements and relationship management)	○	○	○	○	○	○	○	○
7	R&D capabilities	○	○	○	○	○	○	○	○
8	Information technology systems	○	○	○	○	○	○	○	○
9	Cargo handling equipment	○	○	○	○	○	○	○	○
10	Quays, berths, aprons, storage or yard capacity	○	○	○	○	○	○	○	○
11	Dredged channels	○	○	○	○	○	○	○	○
12	Road and railway capability (or infrastructure)	○	○	○	○	○	○	○	○

NO	Q4. How do you rate your PSC partners'/providers' Supply Chain Performance (or Logistical Service Quality) in terms of the following?	Very poor(1)			Neutral (4)			Excellent(7)	
		1	2	3	4	5	6	7	N
1	Reliability of transit time transport availability	○	○	○	○	○	○	○	○
2	Accuracy of information regarding status of shipment	○	○	○	○	○	○	○	○
3	Level of damages in shipment	○	○	○	○	○	○	○	○
4	Value for money	○	○	○	○	○	○	○	○
5	Level of Overall port transport cost	○	○	○	○	○	○	○	○
6	Reduction of order management cost (EDI)	○	○	○	○	○	○	○	○
7	Reduction of facilities equipment cost	○	○	○	○	○	○	○	○
8	Reduction of Warehousing costs	○	○	○	○	○	○	○	○
9	Reduction of transportation costs	○	○	○	○	○	○	○	○
10	Reduction of logistics administration costs	○	○	○	○	○	○	○	○



NO	Q4. How do you rate your PSC partners'/providers' Supply Chain Performance (or Logistical Service Quality) in terms of the following?	Very poor(1)			Neutral (4)			Excellent(7)	
		1	2	3	4	5	6	7	N
1	Reliability of transit time transport availability	○	○	○	○	○	○	○	○
2	Accuracy of information regarding status of shipment	○	○	○	○	○	○	○	○
3	Level of damages in shipment	○	○	○	○	○	○	○	○
4	Value for money	○	○	○	○	○	○	○	○
5	Level of Overall port transport cost	○	○	○	○	○	○	○	○
6	Reduction of order management cost (EDI)	○	○	○	○	○	○	○	○
7	Reduction of facilities equipment cost	○	○	○	○	○	○	○	○
8	Reduction of Warehousing costs	○	○	○	○	○	○	○	○
9	Reduction of transportation costs	○	○	○	○	○	○	○	○
10	Reduction of logistics administration costs	○	○	○	○	○	○	○	○
11	Fulfil promises to port users (on-time service)	○	○	○	○	○	○	○	○
12	Solve port users' problem	○	○	○	○	○	○	○	○
13	Perform services for port users right the first time	○	○	○	○	○	○	○	○
14	Lower port time	○	○	○	○	○	○	○	○
15	Level of conflict with other multimodal processes	○	○	○	○	○	○	○	○
16	Responsiveness in meeting customers' requirements	○	○	○	○	○	○	○	○
17	Access distribution flexibility (hinterland & foreland)	○	○	○	○	○	○	○	○
18	Expansion flexibility (invest for future requirement)	○	○	○	○	○	○	○	○
19	Launch flexibility (introducing new tailored services)	○	○	○	○	○	○	○	○
20	Process flexibility (speed that port can make decisions)	○	○	○	○	○	○	○	○
21	Product flexibility (transfer cargo from mode to mode)	○	○	○	○	○	○	○	○
22	Routing flexibility (convey through diversified route)	○	○	○	○	○	○	○	○
23	Target flexibility (deliver tailored services to the different market segments)	○	○	○	○	○	○	○	○
24	Volume flexibility	○	○	○	○	○	○	○	○

Please indicate the level of SCP on a scale from 1 to 5 : (for 5 ports)

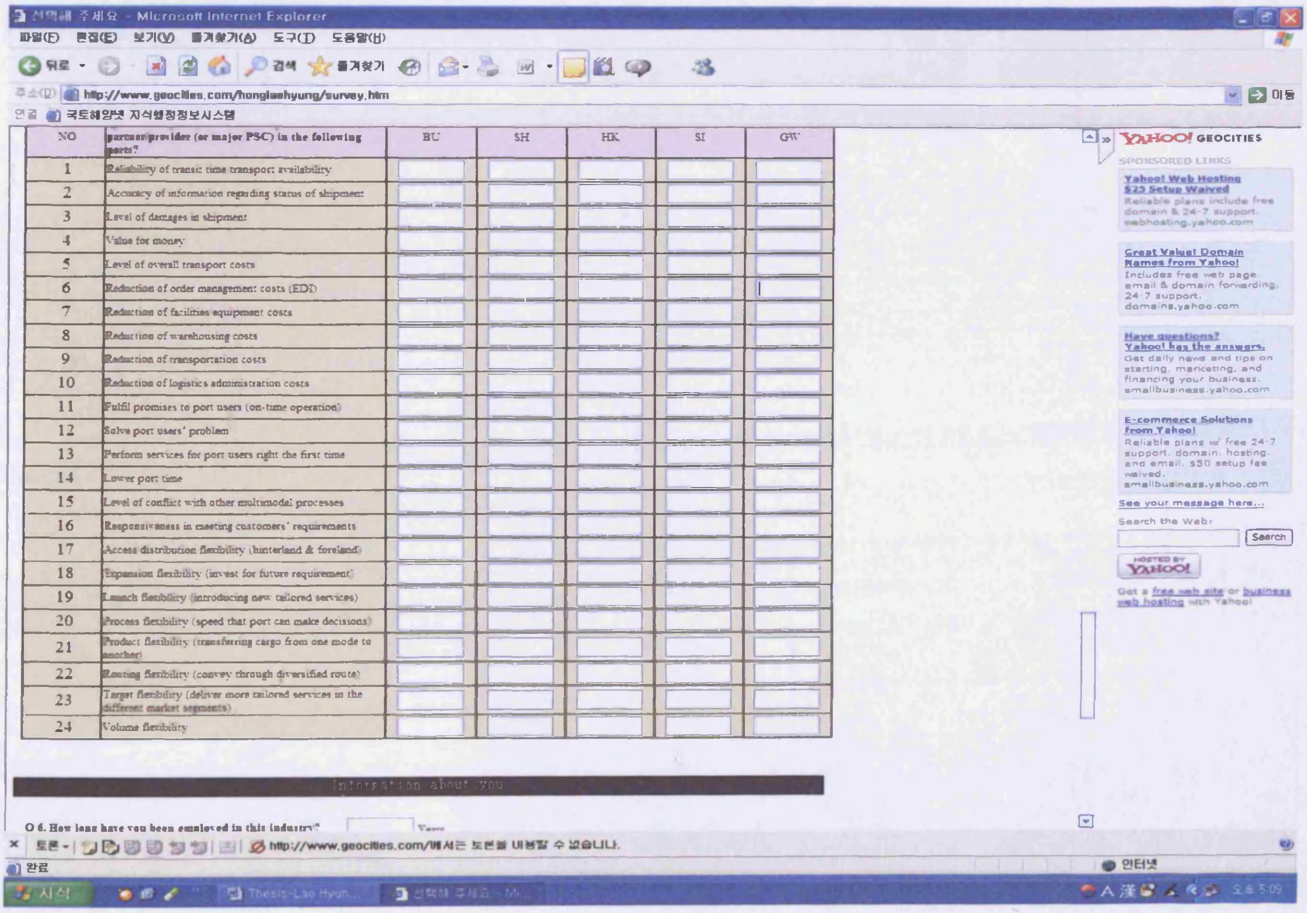


Please indicate the level of SCP on a scale from 1 to 5 : (for 5 ports)
1= Very Poor; 2= poor; 3=Neutral; 4=Good; 5=Excellent
(BU : Busan, SH : Shanghai, HK: Hong Kong, SI : Singapore, GW : Gwangyang)

< Example >

NO		BU	SH	HK	SI	GW
1	Reliability of transit time transport availability	5	5	5	5	4

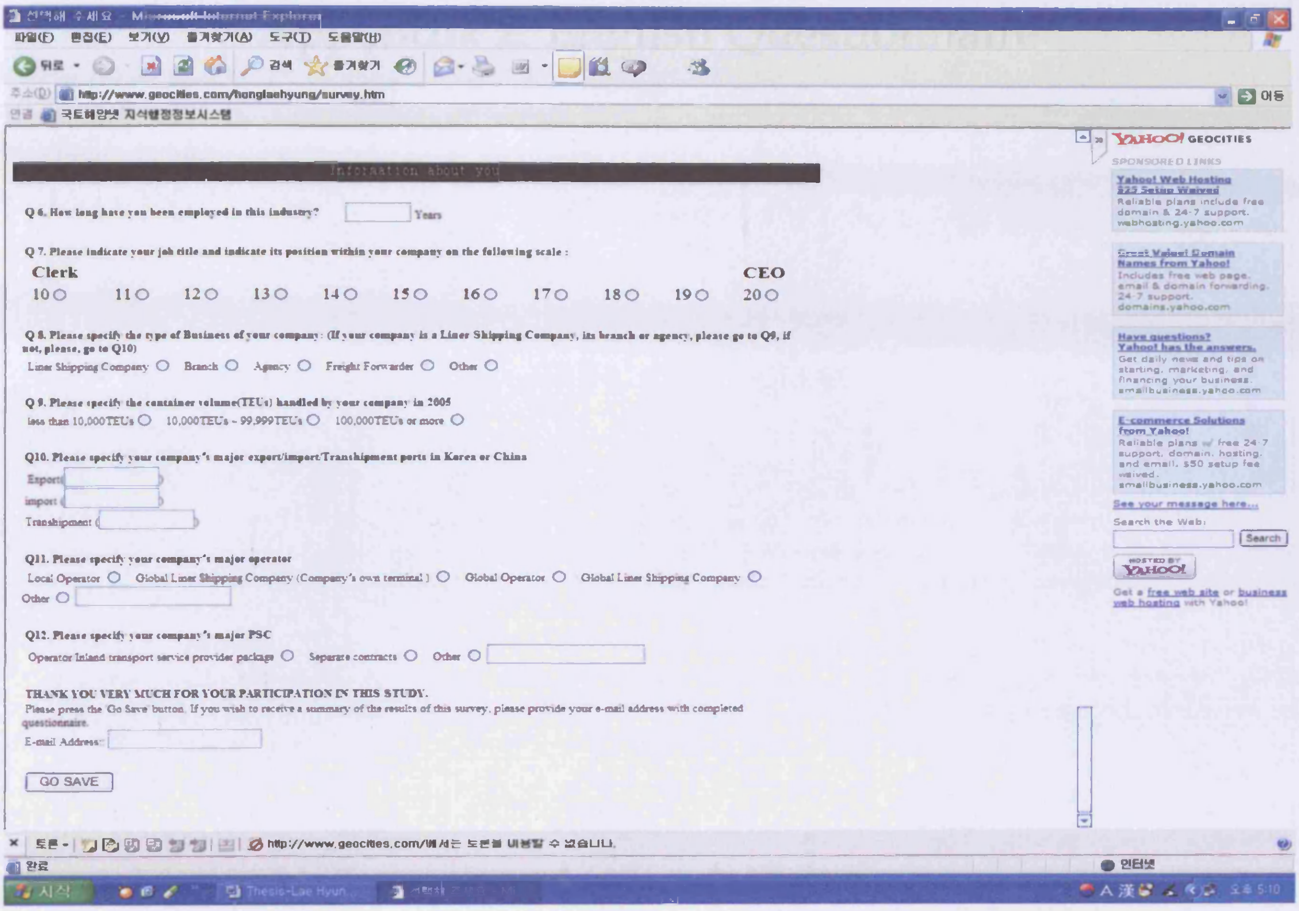
NO	Q5. How do you rate the SCP of your PSC partner/provider (or major PSC) in the following ports?	BU	SH	HK	SI	GW
1	Reliability of transit time transport availability					
2	Accuracy of information regarding status of shipment					
3	Level of damages in shipment					
4	Value for money					
5	Level of overall transport costs					
6	Reduction of order management costs (EDI)					
7	Reduction of facilities equipment costs					
8	Reduction of warehousing costs					
9	Reduction of transportation costs					
10	Reduction of logistics administration costs					
11	Fulfil promises to port users (on-time operation)					
12	Solve port users' problem					
13	Perform services for port users right the first time					
14	Lower port time					
15	Level of conflict with other multimodal processes					



NO	partner/provider (or major PSC) in the following ports?	BU	SH	HK	SI	GW
1	Reliability of transit time transport availability					
2	Accuracy of information regarding status of shipment					
3	Level of damages in shipment					
4	Value for money					
5	Level of overall transport costs					
6	Reduction of order management costs (EDI)					
7	Reduction of facilities equipment costs					
8	Reduction of warehousing costs					
9	Reduction of transportation costs					
10	Reduction of logistics administration costs					
11	Fulfil promises to port users (on-time operation)					
12	Solve port users' problem					
13	Perform services for port users right the first time					
14	Lower port time					
15	Level of conflict with other multimodal processes					
16	Responsiveness in meeting customers' requirements					
17	Access distribution flexibility (hinterland & foreland)					
18	Expansion flexibility (invest for future requirement)					
19	Launch flexibility (introducing new tailored services)					
20	Process flexibility (speed that port can make decisions)					
21	Product flexibility (transferring cargo from one mode to another)					
22	Routing flexibility (convey through diversified route)					
23	Target flexibility (deliver more tailored services in the different market segments)					
24	Volume flexibility					

Information about you

Q 6. How long have you been employed in this industry? Years



http://www.geocities.com/honglaehyung/survey.htm

Information about you

Q 6. How long have you been employed in this industry? ☐ Years

Q 7. Please indicate your job title and indicate its position within your company on the following scale :

Clerk										CEO
10 ○	11 ○	12 ○	13 ○	14 ○	15 ○	16 ○	17 ○	18 ○	19 ○	20 ○

Q 8. Please specify the type of Business of your company: (If your company is a Liner Shipping Company, its branch or agency, please go to Q9, if not, please, go to Q10)

Liner Shipping Company ○ Branch ○ Agency ○ Freight Forwarder ○ Other ○

Q 9. Please specify the container volume(TEUs) handled by your company in 2005

less than 10,000TEUs ○ 10,000TEUs ~ 99,999TEUs ○ 100,000TEUs or more ○

Q10. Please specify your company's major export/import/Transhipment ports in Korea or China

Export( )
import ( )
Transhipment ( )

Q11. Please specify your company's major operator

Local Operator ○ Global Liner Shipping Company (Company's own terminal) ○ Global Operator ○ Global Liner Shipping Company ○
Other ○

Q12. Please specify your company's major PSC

Operator Inland transport service provider package ○ Separate contracts ○ Other ○

THANK YOU VERY MUCH FOR YOUR PARTICIPATION IN THIS STUDY.

Please press the 'Go Save' button. If you wish to receive a summary of the results of this survey, please provide your e-mail address with completed questionnaire.

E-mail Address:

GO SAVE

Appendix 2: English Questionnaire

CARDIFF
UNIVERSITY
PRIFYSGOL
CAERDYDD

CARDIFF
BUSINESS
SCHOOL

Questionnaire

Dear Madam/Sir,

I would like to invite you to participate in a Ph.D. study being undertaken in the Logistics and Operations Management Section at Cardiff Business School in the UK. This research aims to explore the relationships between Supply Chain Management (SCM) strategies in the port and its impact on ports' competitive advantage.

This Questionnaire has been sent to you because you are an expert in ports and their related industries. It is estimated that the questionnaire will take around 10 minutes to complete. All answers will be treated as confidential. Please choose appropriate number using brackets ( ) on the following pages.

Please note that your participation is totally voluntary. You can omit any question if you do not want to answer, or if the question does not apply to your company, in either case, please circle or tick 'N'.

If you would prefer to complete an on-line version of questionnaire, please visit 'www.geocities.com/honglaehyung/survey.htm', and follow the instructions.

Authenticated by
Dr. AKC Beresford
(Supervisor)

< Definition of terms used in questionnaire >

* **Port focused Supply Chains (PSC): Port Operators + Inland transport providers (incl.Depot providers)**
* Port Users: Shipping Lines + Shipping Agents + Freight Forwarders (shippers)
* SCM : Supply Chain Management
* SCP : Supply Chain Performance

Please choose appropriate number using brackets ( ):.

Q1. How do you rate the SCM strategy of your main export/import port in Korea or China, compared to its major competitors?(Please Specify the port to which you are referring..)	Very poor			Neutral			Excellent	
Concentrating on concession to global operator	1	2	3	4	5	6	7	N
Concentrating on concession to Shipping Company	1	2	3	4	5	6	7	N
Concessions to Hybrid operator	1	2	3	4	5	6	7	N
Financial stakes of port authorities (Joint Venture)	1	2	3	4	5	6	7	N
Build Operated Transfer (BOT)	1	2	3	4	5	6	7	N
Management Contract	1	2	3	4	5	6	7	N
Sale of port land	1	2	3	4	5	6	7	N
Lease contract (except concession)	1	2	3	4	5	6	7	N

Hinterland provision (including logistics companies)	1	2	3	4	5	6	7	N
Free Trade Zone	1	2	3	4	5	6	7	N

Single window EDI in operations & custom clearance	1	2	3	4	5	6	7	N
Support for Automated Container Identification using RFID (Radio Frequency Identification)	1	2	3	4	5	6	7	N
Support for Container Tracking Information System	1	2	3	4	5	6	7	N

Common port marketing	1	2	3	4	5	6	7	N
Existence of marketing department	1	2	3	4	5	6	7	N

Q 2. How do you rate the SCM strategies of your PSC partners/providers compared to their main competitors?	Very poor			Neutral			Excellent	
Integration strategies with road haulage companies	1	2	3	4	5	6	7	N
Integration strategies with railway companies	1	2	3	4	5	6	7	N
Operating Inland terminals	1	2	3	4	5	6	7	N
Operating Warehousing & value-added logistical service	1	2	3	4	5	6	7	N

Communication (Information Sharing)	1	2	3	4	5	6	7	N
Long-term contracts and incentives	1	2	3	4	5	6	7	N
Increasing Just in Time (JIT) capabilities	1	2	3	4	5	6	7	N

Share Value with customers	1	2	3	4	5	6	7	N
Customized Service	1	2	3	4	5	6	7	N
Customer relationship management (Maintaining a stable partnership)	1	2	3	4	5	6	7	N

Q3. How do you rate your PSC partners/providers resources compared to its main competitors?	Very poor ←			Neutral			Excellent →	
Trust	1	2	3	4	5	6	7	N
Commitment to relationship with users	1	2	3	4	5	6	7	N
Loyalty (Relationship specific assets: CY etc.)	1	2	3	4	5	6	7	N
Service Design technology(New Service Design)	1	2	3	4	5	6	7	N
Cargo Handling technology	1	2	3	4	5	6	7	N
Marketing technology (Analysis of customer requirements and relationship management)	1	2	3	4	5	6	7	N
R&D capabilities	1	2	3	4	5	6	7	N
Information technology/systems	1	2	3	4	5	6	7	N
Cargo handling equipment	1	2	3	4	5	6	7	N
Quays, berths, aprons, storage or yard capacity	1	2	3	4	5	6	7	N
Dredged channels	1	2	3	4	5	6	7	N
Road and railway capability (or infrastructure)	1	2	3	4	5	6	7	N

Q4. How do you rate your PSC partners'/providers' Supply Chain Performance (or Logistical Service Quality) in terms of the following?	Very poor			Neutral		Excellent		
Reliability of transit time/transport availability	1	2	3	4	5	6	7	N
Accuracy of information regarding status of shipment	1	2	3	4	5	6	7	N
Level of damages in shipment	1	2	3	4	5	6	7	N

Value for money	1	2	3	4	5	6	7	N
Level of Overall port transport cost	1	2	3	4	5	6	7	N
Reduction of order management cost (EDI)	1	2	3	4	5	6	7	N
Reduction of facilities/equipment cost	1	2	3	4	5	6	7	N
Reduction of Warehousing costs	1	2	3	4	5	6	7	N
Reduction of transportation costs	1	2	3	4	5	6	7	N
Reduction of logistics administration costs	1	2	3	4	5	6	7	N

Fulfill promises to port users (on-time service)	1	2	3	4	5	6	7	N
Solve port users' problem	1	2	3	4	5	6	7	N
Perform services for port users right the first time	1	2	3	4	5	6	7	N
Lower port time	1	2	3	4	5	6	7	N
Level of conflict with other multimodal processes	1	2	3	4	5	6	7	N
Responsiveness in meeting customers' requirements	1	2	3	4	5	6	7	N

Access/distribution Flexibility (hinterland & foreland)	1	2	3	4	5	6	7	N
Expansion flexibility (invest for future requirement)	1	2	3	4	5	6	7	N
Launch flexibility (introducing new tailored services)	1	2	3	4	5	6	7	N
Process flexibility (speed that port can make decisions)	1	2	3	4	5	6	7	N
Product flexibility (transfer cargo from mode to mode)	1	2	3	4	5	6	7	N
Routing flexibility (convey through diversified route)	1	2	3	4	5	6	7	N
Target flexibility (deliver tailored services to the different market segments)	1	2	3	4	5	6	7	N
Volume flexibility	1	2	3	4	5	6	7	N

Please indicate the level of SCP on a scale from 1 to 5 : (for 5 ports)
1= Very Poor; 2= poor; 3=Neutral; 4=Good; 5=Excellent
(BU : Busan, SH : Shanghai, HK: Hong Kong, SI : Singapore, GW : Gwangyang)

< Example >	***BU***	***SH***	***HK***	***SI***	***GW***
Reliability of transit time/transport availability	***5***	***5***	***5***	***5***	***4***

Q5. How do you rate the SCP of your PSC partner/provider (or major PSC) in the following ports?	BU	SH	HK	SI	GW
Reliability of transit time/transport availability					
Accuracy of information regarding status of shipment					
Level of damages in shipment					

Value for money					
Level of overall transport costs					
Reduction of order management costs (EDI)					
Reduction of facilities/equipment costs					
Reduction of warehousing costs					
Reduction of transportation costs					
Reduction of logistics administration costs					

Fulfill promises to port users (on-time operation)					
Solve port users' problem					
Perform services for port users right the first time					
Lower port time					
Level of conflict with other multimodal processes					
Responsiveness in meeting customers' requirements					

Access/distribution Flexibility (hinterland & foreland)					
Expansion flexibility (invest for future requirement)					
Launch flexibility (introducing new tailored services)					
Process flexibility (speed that port can make decisions)					
Product flexibility (transferring cargo from one mode to another)					
Routing flexibility (convey through diversified route)					
Target flexibility (deliver more tailored services in the different market segments)					
Volume flexibility					

Information about you

Q 6. **How long** have you been **employed** in this industry? ____________Years

Q 7. Please indicate your job title and indicate its position within your company on the following scale:
Job title:

Clerk										CEO
10	11	12	13	14	15	16	17	18	19	20

Q 8. Please specify the **type of Business** of your company:
(If your company is a Liner Shipping Company, its branch or agency, please go to Q9, if not, please, go to Q10)

❑ Liner Shipping Company ❑ Branch ❑ Agency / ❑ Freight Forwarder **(go to Q10)**

❑ Other (Please specify.....................................)

Q9 Please specify the **container volume** (TEUs) handled by your company in 2005:

❑ less than 10,000TEUs ❑ 10,000TEUs ~ 99,999TEUs ❑ 100,000TEUs or more

Q10. Please specify your company's **major export/import/Transhipment ports** in Korea or China:
Export ( ) / import ( ) / Transhipment ( )

Q11. Please specify your company's major operator:

❑ Local Operator ❑ Global Liner Shipping Company (Company's own terminal) ❑ Global Operator

❑ Global Liner Shipping Company ❑ Other (Please specify.......................................)

Q12. Please specify your company's major PSC:

❑ Operator/Inland transport service provider package ❑ Separate contracts

❑ Other (Please specify.......................................)

THANK YOU VERY MUCH FOR YOUR PARTICIPATION IN THIS STUDY.
After the completion of the questionnaire, please save and send it back to the following e-mail address <honglaehyung@yahoo.co.kr>. If you wish to receive a summary of the results of this survey, please provide your e-mail address with completed questionnaire.
(A) E-mail Address:

Lae Hyung Hong, Doctoral Candidate , Cardiff University, UK
Email: honglaehyung@yahoo.c.kr Tel : +44(0)29 2087 6449 Fax : +44(0)29 2087 4419

Appendix 3: Korean Questionnaire

설 문 서

안녕하십니까?
귀사의 무궁한 발전을 기원합니다.

저는 해양수산부에 근무하고 있는 홍래형 서기관입니다. 현재 영국 카디프 경영대학에서 해운항만물류 박사과정을 이수 중에 있습니다. 제 연구논문 주제는 항만당국 및 하역/내륙운송업체들이 실행하고 있는 항만 이용자들을 고려한 공급사슬관리 전략이 항만의 경쟁 우위(Competitive Advantage)에 어떻게 그리고 얼마나 영향을 미치는지에 대한 것입니다.

위 주제에 대한 실증적 연구를 위하여 해운항만 분야 전문가인 귀하께 설문을 의뢰하게 되었습니다. 본 설문 응답에는 약 10 분이 소요될 것으로 예상됩니다. 귀하께서 제공하신 모든 정보는 기밀로 취급될 것이며, 연구목적으로만 활용될 것임을 약속 드립니다.

동 설문조사에 대한 참여는 전적으로 귀하의 자발적인 동의에 기초한 것임을 알려드리며, 원하지 않으시는 경우 특정 질문에 언제든지 응답하지 않으실 수 있으며, 이 경우 N 항목에 괄호( )로 표시하여 주시면 되겠습니다.

인터넷 웹 설문조사에 응답하시는 것이 더 용이하실 경우 아래의 인터넷 사이트를 방문하여 설문조사에 응하여 주시기 바랍니다.
(www.geocities.com/honglaehyung/survey.htm)

Authenticated by
Dr. AKC Beresford
(Supervisor)

영국 카디프 대학
해운항만물류 박사과정
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< 설문조사 용어 설명 >
* 항만 중심 공급사슬 (Port focused Supply Chain: PSC) : 하역업체 + 내륙운송업자(철송, 트럭킹 업체, Depot provider 포함)
* 항만이용자 : 선사 + 선사대리점 + 복합운송업자(화주)

다음 설문항목에 대하여 적절한 선택지에 괄호 표시(   )를 해 주시기 바랍니다.

Q1. 귀사의 한국 및 중국 내 주요 수출입 항만 당국이 취하고 있는 다음의 공급사슬관리 관련전략을 경쟁항만의 전략과 비교하여 어떻게 평가하십니까? (해당항만을 1 개만 표기하여 주십시오......................)	매우 미흡			중립			매우 우수	
글로벌 하역사 위주의 전용 터미널 제공 정책	1	2	3	4	5	6	7	N
선사 위주의 전용 터미널 제공 정책	1	2	3	4	5	6	7	N
항만운영-선사 복합운영사(Hybrid operator) 위주 전용터미널 제공정책	1	2	3	4	5	6	7	N
항만당국의 항만운영사 지분 참여 (Joint Venture)	1	2	3	4	5	6	7	N
민자유치사업 (Build Operated Transfer : BOT)	1	2	3	4	5	6	7	N
관리계약 (Management Contract)	1	2	3	4	5	6	7	N
항만부지 매각	1	2	3	4	5	6	7	N
전용 터미널 제공 외의 임대계약 (Lease contract)	1	2	3	4	5	6	7	N

물류기업 등에 대한 항만배후부지 제공	1	2	3	4	5	6	7	N
자유무역지대 (Free Trade Zone) 지정•운영	1	2	3	4	5	6	7	N

항만운영, 관세 등에 대한 단일창구 EDI 서비스	1	2	3	4	5	6	7	N
RFID (Radio Frequency Identification)를 이용한 컨테이너 자동인식 지원 (GATE 통과시)	1	2	3	4	5	6	7	N
컨테이너 위치추적 정보시스템 지원	1	2	3	4	5	6	7	N

항만당국과 항만운영사의 공동 마케팅	1	2	3	4	5	6	7	N
항만당국의 마케팅 부서 설치운영	1	2	3	4	5	6	7	N

Q 2. 귀사가 거래하고 있는 항만 하역/내륙운송업체 사슬 (항만중심 공급사슬 파트너/서비스 제공자)의 다음 공급사슬 전략 (Supply Chain Management)을 주요 경쟁자 전략과 비교하여 어떻게 평가하십니까?	매우 미흡			중립			매우 우수	
운송업체(Trucking company)와의 통합전략	1	2	3	4	5	6	7	N
철송업체(Railway company)와의 통합전략	1	2	3	4	5	6	7	N
내륙터미널(Inland Container Depot) 운영 또는 지분참여	1	2	3	4	5	6	7	N
창고보관업 및 부가물류서비스	1	2	3	4	5	6	7	N

정보교환 (정보공유)	1	2	3	4	5	6	7	N
장기계약 및 인센티브 제공	1	2	3	4	5	6	7	N
Just in Time (JIT) 서비스 제공	1	2	3	4	5	6	7	N
고객과 가치공유 및 공동발전 노력	1	2	3	4	5	6	7	N
고객 맞춤서비스 제공	1	2	3	4	5	6	7	N
고객 관리(안정적 파트너쉽 유지노력)	1	2	3	4	5	6	7	N

Q3. 귀사가 거래하고 있는 항만 하역/내륙운송업체 사슬 (항만중심 공급사슬)의 자원(resources)을 주요 경쟁사 자원과 비교하여 어떻게 평가하십니까?	매우 미흡			중립			매우 우수	

신뢰 (Trust)	1	2	3	4	5	6	7	N
항만이용자와의 관계에 대한 의지 (Commitment to relationship-장기계약 등)	1	2	3	4	5	6	7	N
충성도 (고객전용 CY 제공 등)	1	2	3	4	5	6	7	N

서비스 기술 (새로운 서비스 디자인 능력 등)	1	2	3	4	5	6	7	N
화물처리기술 (Cargo handling technology)	1	2	3	4	5	6	7	N
마케팅 기술(수요분석 및 고객관리 기술)	1	2	3	4	5	6	7	N
연구개발 역량	1	2	3	4	5	6	7	N

정보 기술/시스템	1	2	3	4	5	6	7	N
화물처리 시설 (컨테이너 크레인 등)	1	2	3	4	5	6	7	N
접안능력, 장치능력	1	2	3	4	5	6	7	N
준설된 항로	1	2	3	4	5	6	7	N
도로 및 철송능력 (인프라)	1	2	3	4	5	6	7	N

Q4. 귀사가 거래하고 있는 항만 하역/내륙운송업체 사슬 (항만중심 공급사슬 파트너/서비스 제공자)의 다음 공급사슬성과(또는 물류서비스 품질)를 주요 경쟁자와 비교하여 어떻게 평가하십니까?	매우 미흡			중립			매우 우수	
하역-운송의 신뢰성/이용 가능성(availability)	1	2	3	4	5	6	7	N
선적 등 관련정보의 정확성	1	2	3	4	5	6	7	N
화물의 파손정도	1	2	3	4	5	6	7	N

비용대비 서비스 가치	1	2	3	4	5	6	7	N
전체 항만물류비용 (하역, 육상운송비용, 행정비용) 수준	1	2	3	4	5	6	7	N
주문관련 관리비용 절감(EDI 이용)	1	2	3	4	5	6	7	N
시설/장비 이용비용 절감	1	2	3	4	5	6	7	N
보관비용 절감	1	2	3	4	5	6	7	N
운송비용 (Transportation cost) 절감	1	2	3	4	5	6	7	N
대행정 비용 절감 (logistics administration costs)	1	2	3	4	5	6	7	N

항만고객에 대한 약속 준수 (On-time service)	1	2	3	4	5	6	7	N
항만이용자의 문제 해결	1	2	3	4	5	6	7	N
고객의 첫번째 요청시 충분한 서비스 제공	1	2	3	4	5	6	7	N
낮은 재항 시간(Lower port time)	1	2	3	4	5	6	7	N
다른 복합운송 절차와의 갈등정도	1	2	3	4	5	6	7	N
고객요구에 대한 신속한 대응(Responsiveness)	1	2	3	4	5	6	7	N

접근 유연성(Flexibility) (배후부지 등 제공관련)	1	2	3	4	5	6	7	N
확장 유연성 (미래 요구사항에 대한 적절한 투자)	1	2	3	4	5	6	7	N
서비스 출시 (Launch) 유연성 (맞춤 서비스 제공)	1	2	3	4	5	6	7	N
절차 유연성 (항만 또는 업체의 의사결정 속도)	1	2	3	4	5	6	7	N
항만서비스 유연성(타 운송모드간 화물운송 유연성)	1	2	3	4	5	6	7	N
항로 유연성 (다양한 루트로 화물 운송가능 여부)	1	2	3	4	5	6	7	N
목표 유연성(맞춤서비스를 보다 다양한 시장에 제공)	1	2	3	4	5	6	7	N
선박 및 물동량 변화 대응 (Volume) 유연성	1	2	3	4	5	6	7	N

1 부터 5 까지 숫자로 직접 평가•기입하여 주시기 바랍니다. (5 개 항만 모두)
1= 매우 미흡r; 2= 미흡; 3=중립; 4=우수; 5=매우 우수
(BU: Busan, SH: Shanghai, HK: Hong Kong, SI: Singapore, GW: Gwangyang)

<□ □>	BU	SH	HK	SI	GW
하역-운송의 신뢰성/하역-운송 이용가능성(transport availability)	5	5	5	5	4

Q5. 다음 5 개 항만에서의 귀사가 거래하고 있는 (또는 주요) 항만 하역/내륙운송업체 사슬 (항만중심 공급사슬 파트너/서비스 제공자)의 공급사슬성과(또는 물류서비스 품질)를 어떻게 평가하십니까?	BU	SH	HK	SI	GW
하역-운송의 신뢰성/하역-운송 이용가능성(transport availability)					
선적 등 관련정보의 정확성					
화물의 파손정도					

비용대비 서비스 가치					
전체 항만 물류비용 (하역, 육상운송비용, 행정비용) 수준					
주문관련 관리비용 절감(EDI 이용)					
시설/장비 이용비용 절감					
보관비용 절감					
운송비용 (Transportation cost) 절감					
대행정 비용 절감 (logistics administration costs)					

항만고객에 대한 약속 준수 (On-time service 등)					
항만이용자의 문제 해결					
고객의 첫번째 요청시 충분한 서비스 제공					
낮은 재항 시간(Lower port time)					
다른 복합운송 절차와의 마찰 정도					
고객요구에 대한 신속한 대응(Responsiveness)					

접근 유연성 (배후부지 제공 등 관련)					
확장 유연성 (미래 요구사항에 대한 적절한 투자)					
서비스 출시 (Launch) 유연성 (맞춤 서비스 제공)					
절차 유연성 (의사결정 속도)					
항만서비스 유연성(다른 운송모드간 화물운송 유연성)					
항로 유연성 (다양한 루트로 화물 운송 가능여부)					
목표 유연성(맞춤형 서비스를 보다 다양한 시장에 제공)					
선박 및 물동량 변화 대응 (Volume) 유연성					

응답자 정보

Q 6. 귀하는 본 산업분야에 몇 년간 종사하셨습니까? __________년

Q 7. 귀하의 사내 직위를 다음 선택지에 표시해 주십시오.
직위 (표기하여 주십시오..............................)

사원										CEO
10	11	12	13	14	15	16	17	18	19	20

Q 8. 귀하가 근무하고 계신 회사의 사업유형을 선택하여 주십시오.
(선사, 선사지점 및 선사대리점인 경우 Q9로, 그 외의 경우는 Q10로 이동해 주시기 바랍니다.)

❑ 선사본부 ❑ 선사 해외지점 ❑ 선사대리점 / ❑ 복합운송사업자 → **(Q10 로)**
❑ 기타 (표기하여 주십시오...............................)

Q9. 귀사가 2005 년에 처리한 컨테이너 화물량을 아래 보기 중 선택하여 주십시오.

❑ 10,000TEUs 이하 ❑ 10,000TEUs ~ 99,999TEUs ❑ 100,000TEUs 또는 그 이상

Q10. 귀사가 이용하고 있는 가장 주된 한국 또는 중국내 수출/수입/환적 항만을 각각 1개씩 기입해 주십시오.
수출항(　　　) / 수입항 (　　　) / 환적항 (　　　)

Q11. 귀사가 이용하는 주된 항만중심 공급사슬 중 하역업체의 유형을 선택하여 주시기 바랍니다.

❑ 지역 하역업체 ❑ 글로벌 선사 (자사 터미널) ❑ 글로벌 하역업자 ❑ 글로벌 선사

❑ 기타 (표기하여 주십시오....................................)

Q12. 귀사의 항만중심 공급사슬 선택 유형을 아래 보기 중 선택하여 주시기 바랍니다.
❑ 하역업체/내륙 운송업체 패키지 선택 ❑ 하역업체/내륙 운송업체 별도 선택/계약
❑ 기타 (표기하여 주십시오...................)

<u>설문응답에 진심으로 감사드립니다.</u> 설문응답을 완료하셨으면 파일을 저장하신 후 아래 이메일 주소 <honglaehyung@yahoo.co.kr>로 송부하여 주시기 바랍니다. 본 설문조사 결과를 받고 싶으신 경우 아래 양식에 귀하의 이메일 주소를 기입하여 주시기 바랍니다.

(A) E -mail 주소: ____________________________

홍래형 드림
Email: honglaehyung@yahoo.co.kr Phone: +44(0)29 2087 6449 Fax : +44(0)29 2087 4419

Appendix 4: Chinese Questionnaire

问卷调查

亲爱的女士/先生,

我想邀请您参与一项由英国卡地夫大学（Cardiff University）物流与操作管理研究所（Logistics and Operations Management Section）负责的博士生研究项目。该项研究的目的是探讨供应链管理战略在港口的发展及其对港口竞争优势的影响。

这份问卷发给您是因为您是一位在港口及其相关产业方面的专家。 填写该问卷大约需要占用您 10 分钟左右的时间。您所提供的所有信息将会严格保密。在接下来的问题中， 请用括号( )在您所认为合适的数字上标出.

这份问卷将会采取完全自愿形式填写。在填写中，您可以忽略任何不愿意回答的问题，或者在该问卷中出现的某些情况不曾在您公司应用，请您都在‘N’上用括号(　)标明.

如果您更愿意在网上完成该调查问卷， 请访问以下链接，然后根据提示填写。
‘www.geocities.com/honglaehyung/survey.htm’

此致

Lae-Hyung Hong
博士研究生
Cardiff University, 英国
电子邮箱 : honglaehyung@yahoo.co.kr

由 Dr. AKC Beresford (指导) 鉴定：

问卷中相关术语的定义：
* **港口集中供应渠道（PSC）：港口经营商 + 内陆运输提供商 (包括货物储藏库提供商)**
* **港口使用者：航运公司 + 航运代理 + 货运代理 (托运人)**
* **SCM (Supply Chain Management) ：** 供应链管理
* **SCP (Supply Chain Performance)：** 供应链绩效

请用括号( )在您所认为合适的数字上标出:

Q1.与主要竞争对手相比，您认为您公司在韩国或中国的主要出口/进口港口的 SCM 战略如何？（请填写其中一个您所提及港口的名.............................）	差			中			优	
致力于给予全球经营商的特惠(提供专用码头)	1	2	3	4	5	6	7	N
致力于给予航运公司的特惠(提供专用码头)	1	2	3	4	5	6	7	N
对各类型的经营商的特惠(提供专用码头)	1	2	3	4	5	6	7	N
港务局的股份参与（合资企业）	1	2	3	4	5	6	7	N
BOT（建造，经营和移交）	1	2	3	4	5	6	7	N
管理契约 （Management Contract）	1	2	3	4	5	6	7	N
港口土地出售	1	2	3	4	5	6	7	N
租赁契约(特惠除外)	1	2	3	4	5	6	7	N

腹地供应（提供给众多物流公司）	1	2	3	4	5	6	7	N
自由贸易区	1	2	3	4	5	6	7	N

港口经营与清关采用单一窗口 EDI 交换系统	1	2	3	4	5	6	7	N
使用 RFID 以支持自动集装箱识别（ACI）	1	2	3	4	5	6	7	N
支持集装箱跟踪信息系统	1	2	3	4	5	6	7	N

联合港口营销	1	2	3	4	5	6	7	N
设立市场营销部门	1	2	3	4	5	6	7	N

Q 2. 与主要竞争对手相比，您认为您公司的 PSC 合作者/提供者的 SCM 战略如何：	差			中			优	
对公路运输公司的整合战略	1	2	3	4	5	6	7	N
对铁路公司的整合战略	1	2	3	4	5	6	7	N
经营内陆枢纽	1	2	3	4	5	6	7	N
经营仓储&物流增值服务	1	2	3	4	5	6	7	N

交流（信息共享）	1	2	3	4	5	6	7	N
长期合同和提供鼓励机制	1	2	3	4	5	6	7	N
提高准时（JIT）能力	1	2	3	4	5	6	7	N
与顾客价值共有并共同发展	1	2	3	4	5	6	7	N
按需服务	1	2	3	4	5	6	7	N
客户关系管理(保持稳定的合作)	1	2	3	4	5	6	7	N
关系特殊性资产（客户指定资产）	1	2	3	4	5	6	7	N

Q3. 与主要竞争对手相比，您认为您公司的 PSC 合作商/提供商的资源：	差			中			优	
诚信	1	2	3	4	5	6	7	N
对客户关系的承诺	1	2	3	4	5	6	7	N
忠誠度（客户专用资产）	1	2	3	4	5	6	7	N

服务设计技术（新服务的设计能力）	1	2	3	4	5	6	7	N
货物处理技术	1	2	3	4	5	6	7	N
市场营销技术（对顾客需求和关系管理的分析能力）	1	2	3	4	5	6	7	N
研究与开发（R&D） 能力	1	2	3	4	5	6	7	N

信息技术/系统	1	2	3	4	5	6	7	N
货物处理设备	1	2	3	4	5	6	7	N
船坞容量（接岸能力，装卸能力）	1	2	3	4	5	6	7	N
疏浚通道	1	2	3	4	5	6	7	N
公路/铁路基础设施	1	2	3	4	5	6	7	N

Q4. 您认为您公司的 PSC 合作商/提供商的 SCP（供应链绩效）或物流服务质量如何：	差			中			优	
全程运输时间的保证/运输的有效性（Transport availability）	1	2	3	4	5	6	7	N
关于发货状况信息（包括装船）的精准性	1	2	3	4	5	6	7	N
运输中货物的破损程度	1	2	3	4	5	6	7	N

物有所值	1	2	3	4	5	6	7	N
总运输费用水平	1	2	3	4	5	6	7	N
订单管理成本（使用 EDI）的降低	1	2	3	4	5	6	7	N
设备成本 的降低	1	2	3	4	5	6	7	N
仓储成本的降低	1	2	3	4	5	6	7	N
运输成本的降低	1	2	3	4	5	6	7	N
物流行政成本的降低	1	2	3	4	5	6	7	N

履行对港口使用者的承诺（准时到港）	1	2	3	4	5	6	7	N
解决港口使用者的困难	1	2	3	4	5	6	7	N
为港口使用者提供一步到位的服务	1	2	3	4	5	6	7	N
降低在港时间	1	2	3	4	5	6	7	N
与多式联运中其他运输方式的冲突程度	1	2	3	4	5	6	7	N
积极相应客户需求	1	2	3	4	5	6	7	N

进入/发配的机动性 (腹地&前沿)	1	2	3	4	5	6	7	N
扩充的灵活性 (对未来需求进行可行性投资)	1	2	3	4	5	6	7	N
投放市场的机动性 (推出新的特定的服务)	1	2	3	4	5	6	7	N
过程的灵活性 (促使港口快速做决定)	1	2	3	4	5	6	7	N
服务的变通性 (多种方式运送货物)	1	2	3	4	5	6	7	N
路线的变通性 (多种路线运送货物)	1	2	3	4	5	6	7	N
目标的灵活性 (给不同市场部门提供特定的服务)	1	2	3	4	5	6	7	N
货运量的变通性	1	2	3	4	5	6	7	N

请您从级别 1 到级别 5 分别给以下五个港口的 SCP（供应链绩效）水平评分：
（1 = 非常不好; 2 = 不好; 3 = 一般; 4 = 好; 5 = 非常好）
BU—釜山港（Busan）；*SH*—上海港(Shanghai)；*HK*—香港港（Hong Kong）；*SI*—新加坡港（Singapore）；*GW*—光阳港（Gwangyang）

< 举例 >	*BU*	*SH*	*HK*	*SI*	*GW*
全程运输时间的保证/运输的有效性（Transport availability）	*5*	*5*	*5*	*5*	*4*

Q5.您认为您公司的 PSC 合作商/提供商（或主要 PSC）在这五个港口的 SCP 如何：	BU	SH	HK	SI	GW
全程运输时间的保证/运输的有效性（Transport availability）					
关于发货状况信息（包括装船）的精准性					
运输中货物的破损程度					

物有所值					
总运输费用水平					
订单管理成本（使用 EDI）的降低					
设备成本 的降低					
仓储成本的降低					
运输成本的降低					
物有所值					

履行对港口使用者的承诺（准时到港）					
解决港口使用者的困难					
为港口使用者提供一步到位的服务					
降低在港时间					
与多式联运中其他运输方式的冲突程度					
积极相应客户需求					

进入/发配的机动性 (腹地&前沿)					
扩充的灵活性 (对未来需求进行可行性投资)					
投放市场的机动性 (推出新的特定的服务)					
过程的灵活性 (促使港口快速做决定)					
服务的变通性 (多种方式运送货物)					
路线的变通性 (多种路线运送货物)					
目标的灵活性 (给不同市场部门提供特定的服务)					
货运量的变通性					