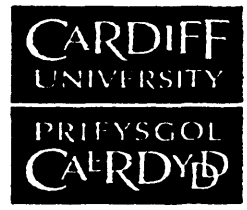

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A Study of Competitive Transport Policies and ICT Development Strategies in the Global Logistics Service: The Case of Taiwan

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Abstract

The world has seen changes in economies, trade, business and international transport in the past two decades. The forces behind the changes are the growth of the world economy, the maturation of supply chain and logistics management, deregulation of transport and rapid developing technologies. At present, more and more manufacturing firms conduct global sourcing, marketing and/or production. However, the scope of globalisation of business encompasses a great number of different and complicated processes and information. International transport is becoming increasingly complex and is imposing pressure on carriers and governments to respond with appropriate policies and strategies. The Win-Win strategy international carriers have adopted is to provide seamless global logistics services to global enterprises.

Taiwan, a small island nation, is more dependent on foreign trade than most other nations. 99% of its international trade cargo is carried via sea transport in terms of cargo volume, and the rest, 1%, by air. After accomplishing the transition to an international trade oriented economy, Taiwan has been an important pivot for cross-continent international routes. The Port of Kaohsiung was one of the leading container hubs in the world and CKS airport was one of leading air cargo hubs in East Asia. However, Taiwan is losing its attractive position for foreign investors because of the high production cost in Taiwan and the huge market and low cost of labour in China. In coping with changing economic environment, Taiwan's policies and strategies reveal the intention to develop itself as an operations centre for Asia-Pacific region through a number of governmental plans, including the transformation of seaports/airports into global logistics hubs and the enhancement of ICT uses in international trade and transport.

This research is based on the methodology of literature review, case study, questionnaire survey and interview to answer the research question, *whether Taiwan government's transport policies incorporating ICT development strategies are suitable for international carriers to provide global logistics services.* It has examined six research objectives; three of them, namely, (1) four forces, *market, cost, government and competition*, are driving the evolution of global logistics services, (2) five factors, *ICT implementation, logistics integration, investment and alliance, customer service and business re-engineering*, are critical for international carriers gaining competitive advantages in providing global logistics services, and (3) seven factors, *operations, facilities, service, market, cost, government and political stability*, are relevant to the success of a global logistics hub. The findings of this research also show strongly support for three hypotheses: (1) international trade is influencing global logistics services, (2) ICT implementation is a key factor in providing global logistics services, and (3) suitable government transport policies can successfully establish global logistics hubs.

The research also reveals that, most other countries in Asia, in the same way as Taiwan, have adopted numbers of transport polices to modernise their seaports/airports. However, two barriers, *the ban on transport links between China and Taiwan and political instability*, must be removed as soon as possible if Taiwan intends to transform its seaports/airports into competitive global logistics hubs. In addition, ICT integration of and collaboration among related trade and transport information systems is key to attaining a paperless trade and transport environment and to ensuring the success of seamless global logistics services; and suitable government transport policies must enhance seaports/airports with logistics functions instead of establishing them as large hubs as there is no guarantee of cargo to and from regions via these seaports/airports.

Finally, this research used a structured approach to analyse government transport policies and strategies as seen in the case of Taiwan. The model used in this research could be used by others, including researchers, governments and carriers, to examine whether their transport policies incorporating ICT development strategies are suitable for international carriers to provide global logistics services.

Acknowledgements

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Abbreviations

APEC	Asia-Pacific Economic Cooperation - the premier forum for facilitating economic growth, cooperation, trade and investment in the Asia-Pacific region
APROC	Asia-Pacific Regional Operations Centre - a Taiwanese national development plan
ANSI	American National Standards Institute - a general standards organisation in the US
ASEAN	Association of Southeast Asian Nations
B2B	Business to Business
B2C	Business to Customer
B2G	Business to Government
CEFACT	The United Nations Centre for Trade Facilitation and Electronic Business
CHIEF	Customs Handling of Import and Export Freight - a UK Customs system
COFC	Container on Flatcar
CPFR	Collaborative Planning, Forecasting, and Replenishment
D2D	Door to Door
DTI	Direct Trade Input - procedure for UK Customs entry clearance
EC	Electronic Commerce
ECR	Efficient Consumer Response
EDI	Electronic Data Interchange - the transfer of structured data from one computer system to another
EDIFACT	EDI for Administration, Commerce and Transport - organization responsible to UNECE for the development of Standard EDI messages for administration, commerce and transport
EPZ	Export Processing Zone
ERP	Enterprise Resource Planning
FDI	Foreign Direct Investment
FTK	Freight Ton Kilometres
GDP	Gross Domestic Product
GII	Global Information Infrastructure
GNP	Gross National Product
IATA	International Air Transport Association
ICT	Information and Communication Technology
LAN	Local Area Network
MNEs	Multinational Enterprises
MRP I	Materials Requirements Planning - using computers to manage production inventory
MRP II	Manufacturing Resource Planning - the use of computerised systems
NAFTA	North American Free Trade Agreement
NICs	Newly Industrialised Countries
NII	National Information Infrastructure
NVOCC	Non Vessel Operating Common Carrier
ODM	Original Design Manufacturing
OECD	Organisation for European Cooperation and Development
OEM	Original Equipment Manufacturing
OLAP	Online Analytical Processing
OLTP	Online Transaction Processing
RFID	Radio Frequency Identification
RTK	Revenue Ton Kilometres
SCM	Supply Chain Management
SITPRO	Simpler Trade Procedures Board - a UK government body responsible for simplifying trade procedures
TEU	Twenty-foot Equivalent Unit
TOFC	Trailer on Flatcar
UNCTAD	United Nations Conference on Trade and Development
VMI	Vendor-Managed Inventory
WAN	Wide Area Network
WTO	World Trade Organisation

Country Code List

Code	Country	Code	Country
AE	United Arab Emirates	JP	Japan
AU	Australia	KR	Korea, Republic Of
CA	Canada	LK	Sri Lanka
CH	Switzerland	MO	Macao, China
CL	Chile	MY	Malaysia
CN	China	NL	Netherlands
DE	Germany	NO	Norway
DK	Denmark	PA	Panama
ES	Spain	PH	Philippines
FI	Finland	SE	Sweden
FR	France	SG	Singapore
GB	United Kingdom	TH	Thailand
HK	Hong Kong	TW	Taiwan
IL	Israel	US	United States
IN	India	VN	Vietnam
IT	Italy		

Abbreviations for International Carriers

Abbreviation	Ocean carriers
Alianca	Aliança Navegação E Logística Ltda, Brazil
ANL	ANL Container Line Pty Limited, Australia. A subsidiaries of CMA CGM
ANZDL	Australia New Zealand Direct Line, Australia
APL	American President Line
CMA CGM	CMA CGM container shipping line, France
COSCO	COSCO Container Lines Co Ltd, China
CSAV	Compañía Sud Americana de Vapores S.A., Chile
HMM	Hyundai Merchant Marine, Korea
K Line	Kawasaki Kisen Kaisha, Ltd, Japan
MCC	MCC Transport Pte Ltd, Singapore
MISC	Malaysia International Shipping Corporation Berhad, Malaysia
MOL	Mitsui O.S.K. Lines, Ltd, Japan
MSC	Mediterranean Shipping Company, S.A., Switzerland
NOL	Neptune Orient Lines, Singapore
NYK	Nippon Yusen Kaisha, Japan
OOCL	Orient Overseas Container Line Limited, Hong Kong
TMM	Transportación Maritima Mexicana, Mexico
UASC	United Arab Shipping Company, Kuwait

Abbreviation	Air Carriers
FedEx	FedEx Corporation, US
DHL	DHL International, Ltd. US
UPS	United Parcel Service Inc. US

Chapter 1 Introduction

Chapter Aims:
- Explain the research background
- Define research initiatives, areas, and objectives
- Outline the structure of the thesis

1.1 Changes in World Trade

A great number of remarkable changes have been seen in the world economy and international freight transport since the 1970s, and they are expected to continuously impact on business practices in the future. These changes include:

- Globalisation of business
- The global supply chain and logistics management
- Deregulation of transport and changing government infrastructure
- Rapidly developing technology
- Business process restructuring and corporate resource management

World trade has continually grown in the past years. The merchandise exports accounted for US$5.3 trillion in 1997 and reached US$ 8.9 trillion in 2004 (WTO, 2005). The main driving forces behind this growth are the prosperity of the world economy, the relaxation of trade barriers, and the development of international freight transport (Tavasszy, et al., 2003). By employing global sourcing, firms are able to reduce costs, to improve quality, to become more flexible and innovative, and to diminish lead times for delivery. With global marketing, firms are able to expose products to the world, to expand sales to other countries, to become more dynamic and competitive, and to gain profits. In addition, by conducting global production, firms based in the developed countries are able to compete in the world markets.

The scope of globalisation of business, running from foreign sourcing, production and marketing encompasses multinational distribution, multiple staging of inventory, manufacturing and marketing strategies. The cost of transport and logistics as a percentage of total cost is greater for international ventures, and complexity of logistics operations usually increases at a geometric rate. Managing global supply chain becomes a vogue of global enterprises.

Transport is a vital activity for a successful international venture. The management of transport is concerned with the overall purchase and control of this movement service in achieving the objectives of a global enterprise's logistics process. Numbers of changes in the transport marketplace were accelerated by the advent of deregulation of transport in the1980s. Since then, the cost and quality of transport services have improved in general, and the declined transport cost has helped in lowering overall logistics costs on a relative basis (Hoyle and Knowles, 1996). Other changes in governmental infrastructure, such as the deregulation of the banking system, liberalisation of telecommunications, privatisation of the public transport sector, and the formation of economic communities, have also accelerated the growth of international freight transport and world trade.

International carriers have followed the path to globalisation of business; specialisation becomes the drive for their development (Harlaftis and Theotokas, 2002). The first technological change in international freight transport was the use of containers in sea transport. This evolutional method of sea transport has changed the world's freight movement in both sea and air transport, and has led to the innovative cargo handling systems used on the shore/apron and the jumbo size of transport vehicles. The development of Information and Communication Technology (ICT) was the second wave of innovation in international freight transport. Currently, computers, intra-organisational

systems, inter-organisational systems, Electronic Data Interchange (EDI), Electronic Commerce (EC) and the Internet are widely used in the transport industries, and they are also successfully used in domestic and multinational supply chain management.

These changes stated above have led global enterprises to severe competition in global business. Global enterprises are compelled to re-evaluate their approach to doing business, to restructure their business organisations, to integrate logistics management, to reduce operational costs, and to add efficiency by focusing upon core competencies and outsourcing those that are not (Hoyle and Knowles, 1996; Coyle, et al., 2000). The focus of attention on core competencies and logistics outsourcing is a source of potential contributions to revitalising the organisations and making them more competitive. In particular, a growing number of companies have recognised the role that an efficient transport logistics system is capable of playing at the margin in their strategic efforts to gain or regain a sustainable competitive edge. These have also led to the growth of global logistics services providers.

1.2 Changes in Taiwan's Economy

Taiwan has experienced frustrations in political relationships with international organisations and foreign countries since its government moved in from Mainland China in 1949. It had a population of five million and the economy relied on aid and assistance from the United States in the early 1950s. Coping with the setbacks in foreign relations, the government took action to improve the domestic economy and international trade as its top priority (Tsai, 1992).

The growth of Taiwan's economy is remarkable during 1951 to 2004. The gross national product (GNP) per capita increased from US$ 145 in 1951 to US$ 14,032 in 2004. The

economic development can be categorised into four phases to address. **The first phase** was that of import substitution, lasting from 1950 through to 1962; nearly 90% of Taiwan's goods were of agricultural or related origin. **The second phase** was that of the external orientation, lasting from 1962 to 1980, the government made changes in foreign exchange policy, interest rates and tariffs to facilitate international trade. Three export processing zones (EPZs), Kaohsiung, Nanze and Taichung, were established in the island. Textiles and electrical goods were the main products for export. **The third phase** was a second stage of external orientation, lasting from 1980 to 1995. This period saw the island's economy move into the production of more sophisticated consumer goods. By 1995, mechanical appliances and electronic machinery made up 43.7 percent of Taiwanese exports. However, with GNP per capita increasing to US$ 12,439, Taiwan's economy began to face a number of challenges in 1995. The high production costs caused much manufacturing to move out of the country. This led to the fourth phase of economic development; the government planed to make Taiwan into an Asia-Pacific Regional Operations Centre (APROC), aiming to build an even greater national competitive advantage through establishing an environment favourable to helping businesses conduct global operations businesses as well as through transforming the seaports and airports as logistics hubs to facilitate global operations (Maguire, 1999).

1.3 The Role of Taiwanese Government

During the past 50 years, the pragmatic and flexible government policies have been the important factors in Taiwan's economic success. In particular, the promotion of social and political stability and the adoption of an outward-looking development strategy. Whenever new problems have arisen, timely and market-friendly policy initiatives are undertaken to cope with them (CEPD, 2003a). Two agencies of the government in Taiwan have played a critical role in promoting economic growth. The first of these is

the Council for Economic Planning and Development (CEPD), responsible for long-term development of the economy. The second agency is the Ministry of Economic Affairs (MOEA), dealing with the implementation of domestic economic development and with issues of international trade. Some other agencies of the government, such as the Ministry of Transportation and Communications (MOTC), responsible for transport infrastructure, the Ministry of Finance (MOF), responsible for banking systems, and the National Council of Science (NCS), responsible for research and development, also contributed to the national economic development.

In general, all the agencies and departments of the government worked hand in hand to develop the national economy. Through the coordination of CEPD, a series of medium-term economic plans have been completed. One of the foremost achievements of state planning was the development of the Hsinchu Science Based Industrial Park, a science park built on the concept of California's Silicon Valley. It still remains as the hub of Taiwan's computer industry. In addition, the government's desire to move from director or central player to facilitator in economic development has also achieved remarkable changes. Private enterprises have been encouraged to participate in economic development, deregulated financial markets, and transport infrastructure and operations.

1.4 Taiwan's International trade

The total value of Taiwan's foreign trade has increased in the past years. It accounted for US$ 43.8 billion (1 US$=37.8 NTD) in 1981, amounted to US$ 215.2 billion (1US$=27.3NTD) in 1995 and increased to US$341.9 billion in 2004 (1US$=33.5NTD). The top three trade countries of Taiwan were the United States (28.2%), Japan (20.0%) and Hong Kong (8.2%) in 1990, and Japan (16.6%), China (14.8%) and the United States (14.6%) in 2004. Hong Kong was Taiwan's fourth largest trade partner in 2004,

accounting for 9.3% of Taiwan's trade value (MOEA, 2004).

Table 1-1 shows Taiwan's main export commodities from the years 1981 to 2004. In 2004, the value of exports accounted for US$174.0 billion; the top three export commodities were electronic products, basic metals and articles, and information and communication products.

Table 1- 1: Taiwan's Main Export Commodities 1981 to 2004

Unit: US$ Million

Items/ year	1981	1985	1990	1995	2000	2002	2004
Chemicals	295	425	1,282	3,238	4,050	4,667	7,716
Plastic Products	770	1,316	3,918	7,101	9,058	8,802	12,538
Textile Products	2,220	2,852	7,094	13,272	15,219	12,151	12,539
Basic Metals & Articles	1,533	2,354	5,215	10,027	13,523	12,547	18,324
Electronic Products	2,940	3,038	7,725	16,250	31,699	25,850	40,533
Machinery	1,367	2,850	11,351	24,894	9,676	9,078	11,973
Electrical Machinery Products	422	797	2,208	3,999	5,394	5,902	8,062
Information & Communications Products	160	1,318	5,024	9,907	19,556	16,040	12,759
Transportation Equipment	841	1,241	3,449	5,362	5,756	4,832	6,484
Precision Instruments			799	2,588	4,058	4,566	11,512
Toys, Games & Sports Parts etc.	1,331	1,784	2,906	2,746	2,209	1,730	1,839
Others	10,732	12,751	16,243	12,275	28,122	24,476	29,735
Total	22,611	30,726	67,214	111,659	148,320	130,641	174,014

Source: Customs Statistics Report, MOF, 2004

Table 1-2 shows Taiwan's main import commodities from the years 1981 to 2004. In 2004, the value of imports accounted for US$ 167.9 billion, and the top three import commodities were electronic products, machinery, and chemicals.

Table 1- 2: Taiwan's Main Import Commodities 1981 to 2004

Unit: US$ Million

Product/Year	1981	1985	1990	1995	2000	2002	2004
Wheat, Maize & Soybean	1,076	993	1,425	1,880	2,040	2,082	2,667
Crude Petroleum	4,454	3,338	3,180	3,782	8,088	6,752	13,108
Chemicals	1,679	2,132	5,838	11,623	13,085	11,340	17,579
Textile Products	879	970	1,924	3,521	2,897	2,470	2,689
Basic Metals & Articles	1,882	1,641	5,998	12,938	11,045	9,187	18,413
Electronic Products	1,274	1,485	5,756	16,822	27,283	23,121	30,592
Machinery	2,277	2,038	7,376	13,286	17,065	9,763	17,597
Electrical Machinery Products	841	636	1,915	3,558	5,355	4,616	6,217
Information & Communications Products			1,742	2,274	11,282	8,246	5,479
Transportation Equipment	1,331	1,146	3,883	6,038	4,706	3,471	5,307
Precision Instruments	512	483	1,545	4,085	9,116	6,615	12,545
Others	4,995	5,240	14,134	23,743	28,052	24,928	35,696
Total	21,200	20,102	54,716	103,550	140,014	112,591	167,889

Source: Customs Statistics Report, MOF, 2004

As a consequence of the development of international trade, the volume of international trade cargo handled at Taiwan's seaports increased from 59,897,263 metric tons in 1970 to 235,824,445 metric tons in 2004 (MOTC, 2004). Container handling in Taiwan started in the early 1970s. Table 1-3 shows the containers handled in Taiwan's seaports from the years 1975 to 2004. The amount increased from 473,354 TEUs in 1975 to 13,034,362 TEUs in 2004.

Table 1- 3: Containers Handled in Taiwan's Seaports

Unit: TEU

	Gateway and Hub Flow				Hub Flow (Transhipment)			
Year	Total	Keelung	Kaohsiung	Taichung	Sub-total	Keelung	Kaohsiung	Taichung
1975	473,354	246,016	227,338		2,302		2,302	
1980	1,644,341	659,644	979,015	5,682	76,372		76,372	
1985	3,075,150	1,157,839	1,900,853	16,458	571,664	37,651	534,013	
1990	5,463,563	1,840,794	3,494,631	128,138	1,449,489	107,920	1,341,569	
1995	7,665,178	2,165,193	5,053,183	446,802	2,370,380	188,763	2,177,264	4,353
2000	10,510,762	1,945,574	7,425,832	1,130,357	4,339,707	94,901	3,965,614	279,192
2001	10,427,714	1,815,855	7,540,525	1,069,354	4,513,027	122,855	4,120,621	269,551
2002	11,608,634	1,918,598	8,493,052	1,193,657	4,949,782	104,451	4,518,719	326,612
2003	12,094,753	2,000,707	8,843,365	1,246,027	5,069,178	116,463	4,596,524	356,191
2004	13,034,362	2,070,192	9,714,115	1,245,186	5,456,221	94,351	5,034,680	327,190

Source: Statistics of Transportation and Communications, MOTC

Port of Keelung used to be the main entrance for valuable containerised cargo in the north of Taiwan. With good natural conditions and infrastructure, Port of Kaohsiung has become the leading container seaport in Taiwan and a hub seaport in the region. In 2004, its transhipped containers accounted for 51.8% of total containers handled in the port.

Taiwan's international airports, CKS and Kaohsiung, have also experienced a growth of air cargo traffic in the past years. Table 1-4 shows the volume of international trade cargo handled in Taiwan's airports during the years 1985 to 2004. This amount increased from 302,158 tons in 1985 to 1,782,513 tons in 2004. CKS airport is the leading airport in Taiwan, handling 95% of Taiwan's international air cargo.

Table 1- 4: Volume of Cargo Handled in Taiwan's Airports

Unit: metric ton

Airport	CKS				Kaohsiung				Total
Year	Import	Export	Tranship	Sub-total	Import	Export	Tranship	Sub-total	
1985	92,479	192,124		284,603				17,555	302,158
1990	237,337	357,306		594,643				30,787	625,430
1995	297,471	396,860	60,158	754,489	23,644	26,423	973	51,040	805,529
2000	428,807	636,831	89,200	1,208,838	38,788	56,433	269	95,490	1,250,328
2001	400,192	552,675	237,006	1,189,873	31,703	50,983	260	82,946	1,272,819
2002	425,107	623,889	331,752	1,380,748	33,342	55,265	233	88,840	1,469,588
2003	437,538	671,366	391,167	1,500,071	26,155	50,973	1826	78,954	1,579,025
2004	498,623	677,472	524,925	1,701,020	25,589	53,204	2,700	81,493	1,782,513

Source: Annual Statistical Report, CAA, Taiwan

1.5 Taiwan's International Transport

Taiwan has three major seaports and two airports providing service for international trade and transport. Numbers of shipping companies and airlines are also involved in moving cargo from and to Taiwan.

1.5.1 Seaports

Currently, five international ports, Keelung, Kaohsiung, Taichung, Hualien and Suao, are dedicated for Taiwan's international trade; two private industrial ports, Yung-An and Mai-Laou, are mainly for import and export of industrial materials and products; and some small ports are for domestic trade. The government owns and operates these international and small ports; Harbour Bureaus are given responsibility to manage them.

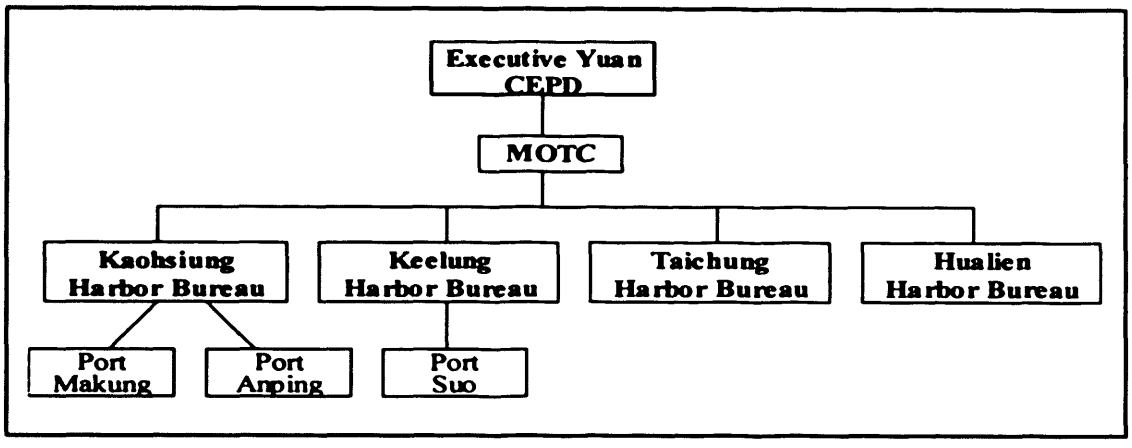
According to Taiwan's Commercial Port Law, the Ministry of Transportation and Communications (MOTC) administrates and operates international ports. Fig 1-1 shows the current seaport administrative system in Taiwan. Many government departments are also related to the administration of Taiwan's seaports:

- The Ministry of Transportation and Communications (MOTC), responsible for port administration, dealing with port policies, investment projects and port prices.
- The Council for Economic Planning and Development (CEPD) of the Executive

Yuan is concerned with port policies and port investment. The Directorate-General of Budget, Accounting and Statistics (Audit Department) is concerned with port statistics and port performance. The Council of Labour Affairs (CLA) is concerned with port labour. And the Central Personnel Administration (CPA) is concerned with port employees.

- The Ministry of Finance (MOF), the Directorate General of Customs (DGOC), the National Police Agency (NPA), and the Department of Health (DOH) are also involved in port operations.

Fig 1- 1: Port Administrative System in Taiwan



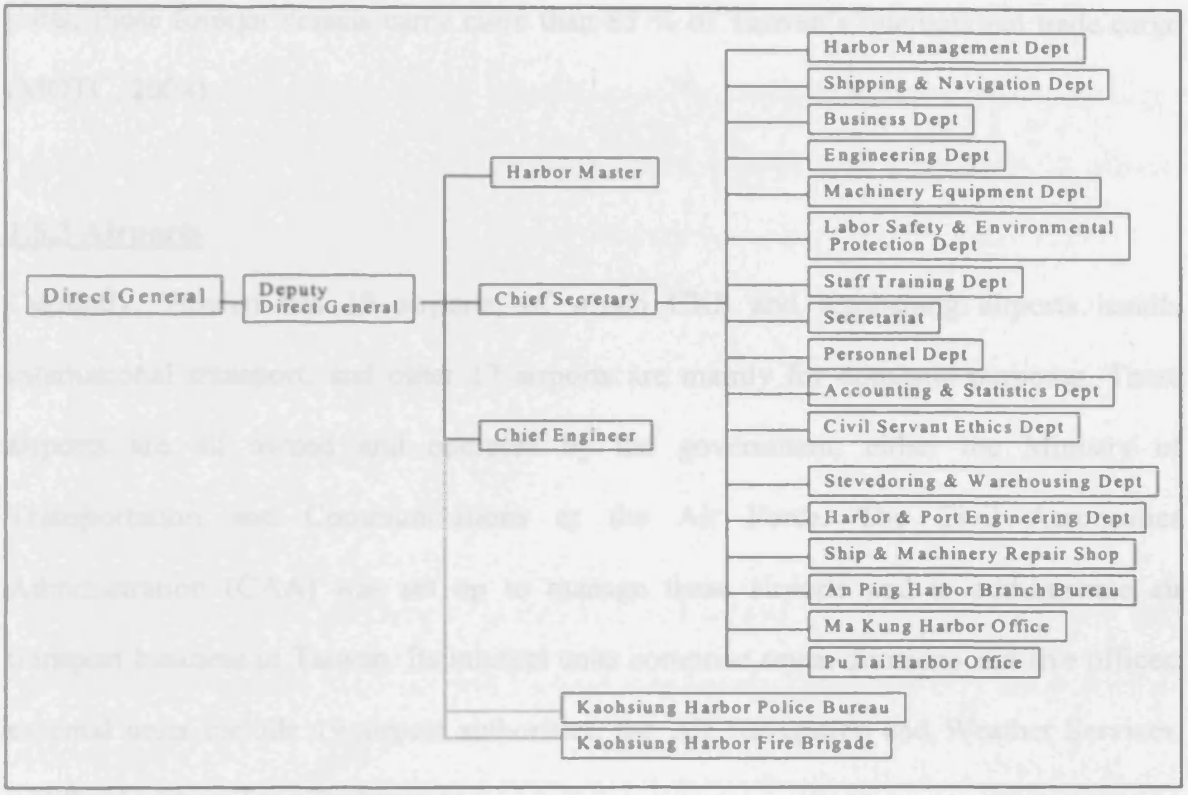
Source: Author

Harbour bureaus are set up at the four international ports except for the Port of Suao. The harbor bureau administrates and carries out most of the activities in the port. In order to carry out day-to-day port operations, it fulfils four main functions: the administration of shipping and navigation, the management of the harbour, the operations of stevedoring and warehousing services, and the construction and maintenance work. Under the director, there are a deputy director, a chief secretary, a harbor master, and a chief engineer to conduct their work separately. Its internal units comprise a number of departments and offices; external units include affiliated port branches and other departments. Fig 1-2 presents the organisation chart of Kaohsiung harbor bureau.

Apart from the port authority, numerous private enterprises, such as stevedores, shipping

companies and agents, ships' stores suppliers, tally companies, cargo forwarders, truck companies or terminal operators, also engage in seaport operations and services.

Fig 1- 2 The Organisation Chart of Kaohsiung Harbour Bureau



Source: Port of Kaohsiung

1.5.2 Shipping Industry

Taiwan has endeavoured to develop its shipping fleet to coping with the economic development and the demand of sea transport for its import and export cargo. By the end of 2004, Taiwan had a shipping fleet totalling 200 national-flagged ships (over 100 gross tonnage) with a gross tonnage of 3.66 million tons and a dead weight tonnage of 5.89 million tons, of these, more than half of the fleet are designated for international freight transport. Besides, there were 116 Taiwan-registered shipping companies, 453 shipping agents, 510 sea freight forwarders and 33 container terminal operators in Taiwan. Taiwan-based **Evergreen and Yangming** lines are listed among the world top 20

container carriers, providing cross-continents scheduled container services.

Taiwan offers free access for shipping enterprises, except domestic coastal shipping. Many leading global shipping companies have deployed their fleet to call at Taiwan's ports; these foreign vessels carry more than 85 % of Taiwan's international trade cargo (MOTC, 2004).

1.5.3 Airports

Currently, Taiwan has 19 airports, of which CKS and Kaohsiung airports handle international transport, and other 17 airports are mainly for domestic purposes. These airports are all owned and operated by the government, either the Ministry of Transportation and Communications or the Air Force. The Civil Aeronautics Administration (CAA) was set up to manage these airports and to administrate air transport business in Taiwan. Its internal units comprise seven divisions and five offices; external units include 19 airport authorities, the Air Navigation and Weather Services, and the Aviation Training Institute.

Many enterprises provide aviation-related services, e.g. civil air transport enterprises, general aviation, airfreight forwarders, airport ground handling services, air cargo distribution centres, and catering services. All of them must be granted authorisation before they conduct their business.

1.5.4 Airlines

Taiwan's air transport market is small. With the government's implementation of an "Open Sky" policy in 1987, subsequent changes to the air transport environment and the mergers of some companies, only six airlines were left by 2004, with 181 aircrafts

servicing the international and domestic air routes. China Air and EVA Air dedicatedly operate international transport; the others operate domestic air routes (CAA, 2005).

Taiwan's six airlines operate 31 domestic and 53 international air routes, connecting 82 cities in 45 countries and areas around the world. Other than Taiwan-based airlines, 38 foreign airlines currently conduct scheduled and non-scheduled passenger and cargo flights to and from Taiwan. These national and foreign airlines handle 23 million passengers and 1.78 million metric tons of air cargo a year in Taiwan's international air routes, and national flagged airlines handle 21 million passengers and 40 thousand tons of air cargo in Taiwan's domestic air routes.

1.6 Definitions

Throughout the thesis, the terms "global logistics service", "global logistics hub" and "government transport policies" will be used frequently. Therefore, they are defined to ensure clarity.

1.6.1 Global Logistics Service

Logistics defined by the Council of Logistics Management is the process of planning, implementing, and controlling the efficient, effective flow and storage of goods, services, and related information from point or origin to point of consumption for the purpose of conforming to customer requirements. Logistics activities include but are not limited to warehousing, transportation, private fleet, inventory control, purchasing, production scheduling, customer service, and long range planning (Coyle, et al., 2003). Firms could have their own logistics capacities, or they can buy in logistics from logistics service providers. Global logistics service in this thesis means the logistics service provided by international carriers, their service is crossing from a country to other countries. In

addition, international carrier in this thesis refers to a container shipping company or an airline that provides service to global shippers.

1.6.2 Global Logistics Hub

Global logistics hub in the thesis refers to a seaport/airport, which is areas made up of infra- and superstructures capable of receiving ships/aircrafts and other modes of transport, handling international trade cargo from ships/aircrafts to the seaport/airport and vice versa and capable of providing value-added logistics functions. Therefore, a global logistics hub is a four-modal node where water, road, railroad and air modes exist. The cargo transported include local, gateway and hub traffic; numbers of logistics functions may perform in it, such as warehousing, re-consolidation, re-configuration, distribution and other value-added activities.

1.6.3 Government Transport Policies

The word "policy" is a definite course or method of action selected by government, institution, group or individual from among alternatives and in the light of given conditions to guide and, usually, to determine present and future decisions. Government policies are often supported by special legislation, usually national policies (not district or provincial), and not normally limited in time. Government transport policies in the thesis refer to the policies made by a government to implement regarding the development of international sea/air transport and seaports/airports in the country.

1.7 Research Question and Objectives

Taiwan is a small island, with a population of 23 million and a size of 36,000 square-kilometres. It is not richly endowed by nature but more dependent on foreign trade than most other nations. The export goods and services account for approximate 61.4 % of

Taiwan's gross national product (GNP) (MOEA, 2004). Sea transport is the dominant mode by volume (tonnes) of Taiwan's international trade, accounting for 99%; the rest, 1%, is transported by air. In 2004, Taiwan ranked as the world's 15th biggest exporter and importer respectively (WTO, 2005).

China, adjacent to Taiwan and capable of huge market capacity and human resources, has been the fastest growing economy in the world since it adopted an "open door" policy in 1978. The total value of its GDP increased from US$44 billion in 1978 to US$1,154.8 billion in 2004, and China became the world's third biggest trading nation (WTO, 2005). Therefore, its seaports and airports have been enjoying double-digit expansion in cargo traffic in recent years.

The changing economic environment in the world and the region, including the changes in the country, compelled Taiwan to seek new opportunity to gain competitive advantages in this changing environment. Envisaging the competitive geographic location of its pivotal position, and advantageous niches in technical and commercial development, communication infrastructure and hi-tech industries, the government plans to establish Taiwan as a regional operations base for the operations of multi-national enterprises and to transform its seaports/airports to become logistics hubs in the Asia-Pacific region since the year 1995. A number of governmental development plans have been initiated and carried out by the government. It is worth to study government transport policies and development strategies and to ascertain whether they are suitable for international carriers to gain competitive advantages in conducting global logistics services in Taiwan. Therefore, the research is intended to answer the question,

"Whether Taiwan government's transport policies incorporating ICT development strategies are suitable for international carriers to provide global logistics services."

The research is also intended to achieve the following objectives:

O1: To identify the driving forces for the evolution of global logistics services

O2: To examine the network strategies adopted by international carriers to managing global logistics services

O3: To analyse the critical factors relevant to international carriers gaining competitive advantages in providing global logistics services

O4: To examine transport policies that most governments adopted to modernise their seaports/airports

O5: To study the unique position of Taiwan's seaports/airports in performing as global logistics hubs

O6: To analyse the factors relevant to the success of a global logistics hub

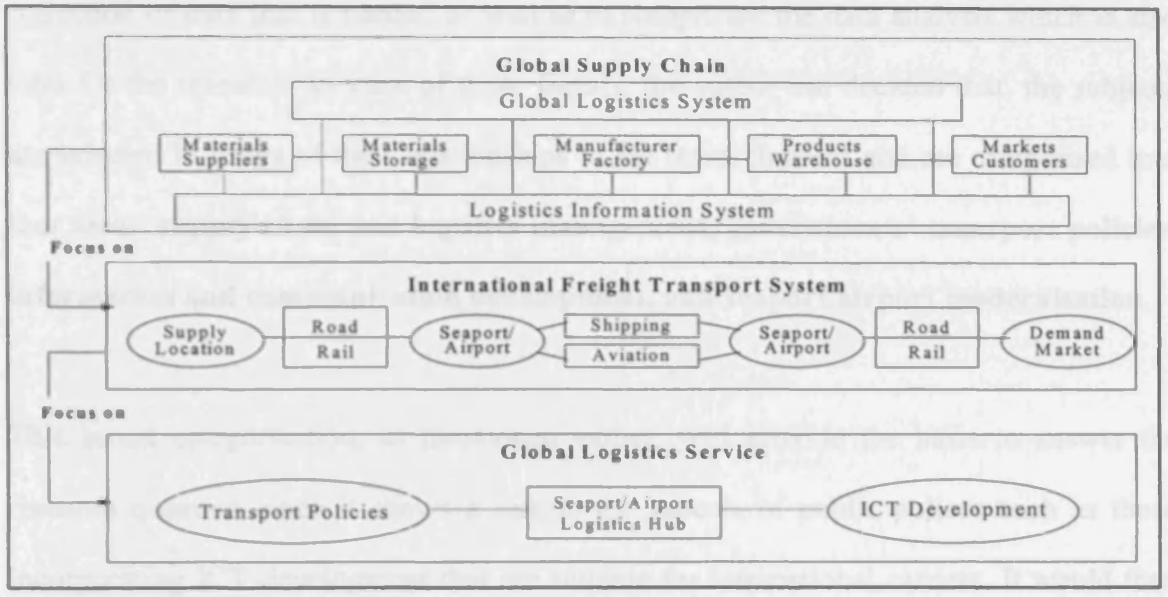
1.8 Identification of Research Areas

In order to answer the research question and examine the research objectives, it is necessary to define the framework of the research, the areas needed to study and then, to give the initial model of the research and the structure of the thesis.

1.8.1 Research Framework

International carriers provide global logistics service to fulfil a firm's global supply chain. Therefore, the research will necessarily progress through the study of supply chain management, to identify the role of international freight transport system in the supply chain, and to discover the development of global logistics service. As international freight transport system is important to managing global supply chain for an international business, the role of global logistics service and seaport/airport logistics playing in international freight transport system and government transport policies incorporating ICT development strategies involved therein must be investigated. Figure 1-3 presents the framework of the research. It indicates that the research is focused on government transport policies and ICT development strategies in the global logistics service.

Fig 1- 3: The Framework of the Research



Source: Author

1.8.2 Research Areas

This research is intended to answer the question, *whether Taiwan government's transport policies incorporating ICT development strategies are suitable for international carriers to provide global logistics services*, through the examination of six research objectives. In carrying out initial work to identify the broad areas of research, it is seen that a broad framework could be formulated as shown in Fig 1-3. This framework shows that the areas of the research although specific contain a number of subjects that are linked to the research question. These subjects include, among others, international trade, global supply chain management, multi-national logistics and distribution, international transport, global logistics service providers, government policies, seaports/airports, and information and communication technology.

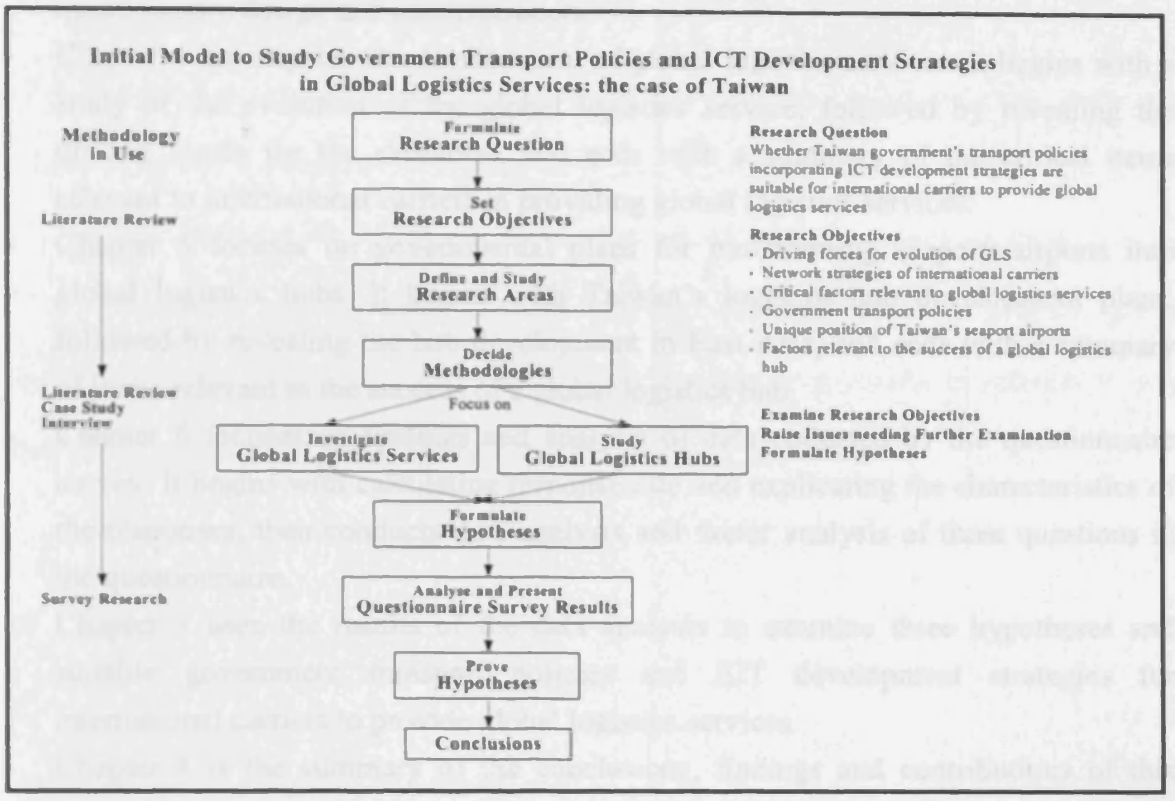
Since this is a wide list, it would facilitate the research if they are categorised in a more coherent way to reflect directly upon the search question and to place a more direct basis to examining the research question and to select the methodology that is adopted. It must

be recognised that if the subject areas are drawn too widely they may not facilitate the collection of data that is needed as well as to complicate the data analysis which is also vital for the research. In view of these factors, the author has decided that, the subjects are selected in terms of their relationships to the research areas and are categorised into four areas: **supply chain and logistics management, governments' transport policies, information and communication development, and seaport/airport modernisation**.

This broad categorisation, as mentioned earlier, will provide the basis to answer the research question since it shows a link to the aspects of public polices such as those incorporating ICT development that are suitable for international carriers. It would then be possible to place a proper perspective on the literature review for this research since the material examined can be looked at from the point of the research question. It is believed that this format of subject categories will provide a research framework, which is structured for the subsequent task of exploring the main theme, which is identified in the research question.

In order to explore the research question, which will examine data from the perspective identified, this research will investigate the importance and the development of global logistics services and global logistics hubs in the global supply chain. Thus, the literature review, case study and interview will be carried out on these two areas. Following upon the literature review and identification of the research question guided by the four categories, the appropriate methodology for this research will then be explored and it is seen that an appropriate method would be through a questionnaire survey, which will enable the research question and objectives to be examined. Fig 1-4 presents the initial model for this research which brings these ideas together and which will form the framework for this research.

Fig 1- 4: Initial Model for this Research



Source: Author

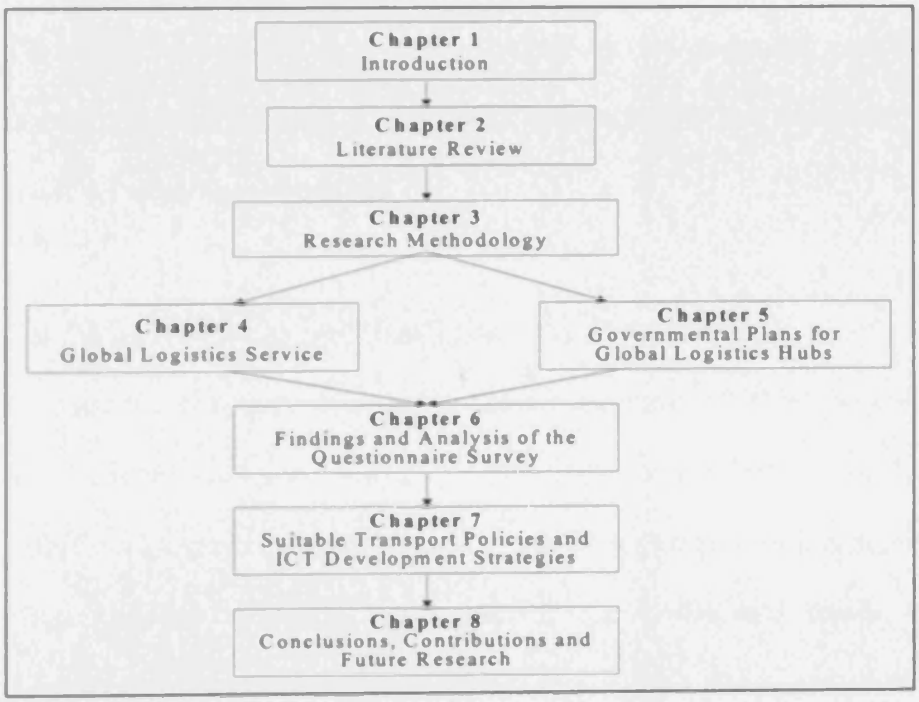
1.8.3 The Structure of the Thesis

The research begins with an introduction, followed by a literature review, methodologies used, an investigation of the global logistics service, a study of governmental logistics hub development plans, and a questionnaire survey, to examine the research objectives and formulate research hypotheses. It then uses the results of the questionnaire survey to examine hypotheses formulated, and provides conclusions, findings and contributions in the end. Fig 1-5 presents the structure of the thesis. It is divided into eight chapters.

- Chapter 1 begins with an introduction to describe changes in world trade, Taiwan's international trade and transport and then, defines the research question, objectives, areas and the structure of the thesis.
- Chapter 2 describes the results of the literature review. The literature review is focused on four areas: supply chain and logistics management, governments' international transport policies, information and communication development, and seaport/airport modernisation. It also defines the areas for further investigation.

- Chapter 3 is research methodology. It begins with the explanation of the methodology used for the research and then, describes research strategy, questionnaire design and administration.
- Chapter 4 investigates the development of global logistics services. It begins with a study of the evolution of the global logistics service, followed by revealing the driving forces for the evolution, and ends with a summary of the critical items relevant to international carriers in providing global logistics services.
- Chapter 5 focuses on governmental plans for transforming seaports/airports into global logistics hubs. It begins with Taiwan's logistics hub development plans, followed by revealing the hub development in East Asia, and ends with a summary of items relevant to the success of a global logistics hub.
- Chapter 6 focuses on findings and analysis of data collected by the questionnaire survey. It begins with calculating response rate and explicating the characteristics of the responses, then conducts data analysis and factor analysis of three questions in the questionnaire.
- Chapter 7 uses the results of the data analysis to examine three hypotheses and suitable government transport policies and ICT development strategies for international carriers to provide global logistics services.
- Chapter 8 is the summary of the conclusions, findings and contributions of this research.

Fig 1- 5: The Structure of this Thesis



Source: Author

1.9 Summary

This chapter has described changes in world trade, Taiwan's international trade and transport, research question and objectives, research areas, and the structure of this thesis. It is intended to examine whether Taiwan government's transport policies incorporating ICT development strategies are suitable for international carriers to provide global logistics services. The next chapter will provide a literature review in relation to this research.

Chapter 2 Literature Review

Chapter Aims:

- Search and study research topic-related published literature
- Discover the current development and trends in research topic-related subjects
- Formulate research areas for detailed investigation

2.1 Introduction

This research is intended to examine the research question, "Whether Taiwan government's transport policies incorporating ICT development strategies are suitable for international carriers to provide global logistics services"; the subjects relating to the research question have been categorised into four areas: supply chain and logistics management, governments' international transport policies, information and communication technology, and seaport/airport modernisation. Therefore, the literature review for this chapter is focused on these four areas.

This chapter is intended to study the historic development and the trends in research question related subjects, to develop a foundation for the thesis and to identify areas that require further investigation.

2.2 Supply Chain and Logistics Management

In general, the framework of business consists of three major processes: product development, customer relations and the supply chain (Schary and Skjoett-Larsen, 2002). These major processes are normally treated separately within an organisation, but they come together to serve customers. In the 1950s and 1960s, most manufacturers emphasized mass production to minimize unit production cost as the primary operations strategy, with little product or process flexibility. In the 1980s, intense global

competition forced world-class organisations to offer low-cost, high-quality, and reliable products with greater design flexibility. Manufacturers utilised Just-In-Time (JIT) and other management programmes to improve manufacturing efficiency and cycle time. In the 1990s, business organisations further extended best practices in managing corporate resources to include strategic suppliers and logistics functions, seamlessly integrated with their logistics providers to achieve direct store delivery (Tan, 2002).

Coyle, et al. (2003) described supply chain management as representing the third phase of an evolution that started in the 1960s with the development of the physical distribution concept and that focused upon the outbound side of the firm's logistics system during 1980s. It came into vogue during the 1990s and continues to make organisations more competitive in the global marketplace since deregulation of transport has provided an opportunity to coordinate the inbound and outbound transport movements of large shippers (manufactures). Nowadays, reverse logistics, leanness and agility are added to supply chain management (Mangan and Hanningan, 2000; Schary and Skjoett-Larsen, 2002; Gattorna, 2003); the advent of third-party logistics/fourth-party logistics (3PL/4PL) and ICT has dramatically involved in supply chain management. The new challenge is to manage the global supply chain as more enterprises trade globally (Gattorna, 2003).

2.2.1 The Purposes of Supply Chain Management

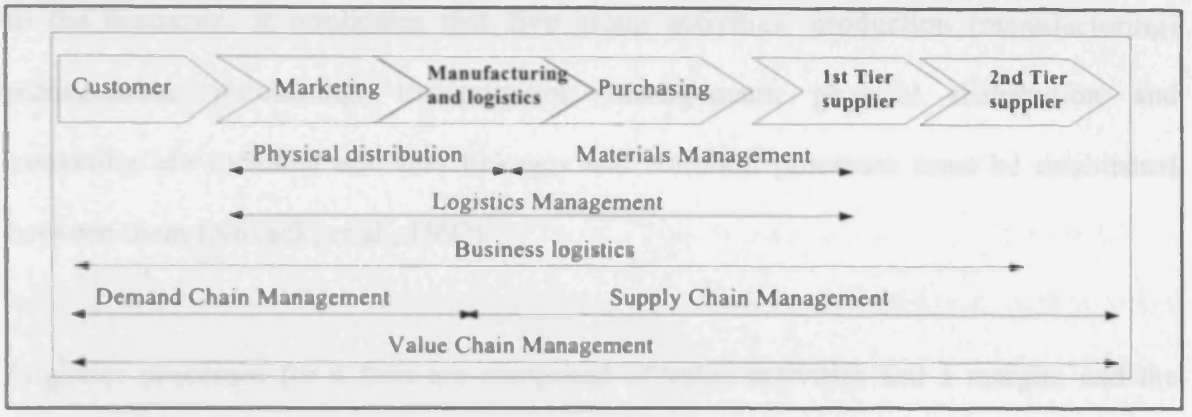
Supply chain management has been defined as "the management of products and services from their origination to their final use, beginning with the supply of raw materials, and proceeding through manufacturing, warehousing, distribution, wholesaling and retailing" (Stock and Lambert, 2001; Schary and Skjoett-Larsen, 2002). The definition suggests that the supply chain consists of five components, e.g. sourcing, inbound storage/ transportation, operations, outbound storage/transportation, and consumer distribution;

and it implies three two-way flows, e.g. goods, information and finance (especially cash) from vendors to customers (Coyle, et al., 2003).

For a firm, the goals of organisation management are: lower costs, higher quality, greater variety, more flexibility and faster response-times (Christopher, 1994). Its essential achievement is to acquire the maximum and most prolonged profits through customer satisfaction. Therefore, the concept of supply chain management is a reverse of prior practices where manufacturers supplied product to customers. Now customers tell suppliers how and when they want their inventory delivered. By having the programme driven by the customer, it is hoped that inventories, caused by uncertainties and slow response, will be significantly eliminated. Thus, supply chain management is to managing the provision of the right product, in the right place, at the right time so as to maximize the value received by the purchaser or user while minimizing the overall cost of the complete process.

Numbers of terms, as shown in Fig 2-1, are related to business chain, such as value chain, logistics chain, supply chain, demand chain and logistics supply chain (Van Weele, 2002). The value chain is composed of the demand chain and the supply chain, and the logistics management can be divided into the physical distribution and materials management. However, other authors might broadly define supply chain as value chain and the total integration of inbound logistics and outbound logistics as logistics supply chain (Coyle, et al., 2003; Larson and Halldorsson, 2004).

Fig 2- 1: The Business Chain and Some Related Terms



Source: Van Weele (2002)

Note: a First Tier supplier is a supplier that invoices the manufacturer for goods and services rendered directly by that supplier. A Second Tier supplier is a supplier that invoices the First Tier supplier for goods and services rendered.

2.2.2 Logistics in the Supply Chain

Logistics management differs from supply chain management. "Supply Chain Management" includes managing supply and demand, sourcing raw materials and parts, manufacturing and assembly, warehousing and inventory tracking, order entry and order management, distribution across channels and delivery to customer. On the other hand, "Logistics" is the part of the supply chain process that plans, implements and controls the efficient flow and storage of goods, services and related information from the point of origin to the point of consumption (Huddleston, 2002).

The definition of logistics management by the Council of Logistics Management is generally accepted: *"Logistics management in a company includes many activities, such as transportation, storage, packaging, materials handling, order fulfilment, demand forecasting, production planning, purchasing, customer service, inventory control, plant and warehouse site location, return goods handling, parts and service support, and salvage and scrap disposal"* (Lynch, 2000; Stock and Lambert, 2001; Coyle, et al., 2003). From this definition, the logistics management encompasses all material flows, from the

flows of purchased materials into a facility, through the manufacturing process, and out to the customer. It implicates that five group activities, production (manufacturing) management, purchasing, transportation management, physical distribution and marketing are included and that linkages and common processes must be established between them (Novack, et al., 1992).

Logistics processes for a firm are composed of value activities and a margin; and the value activities can be divided into primary activities and support activities, as shown in Table 2-1. Logistics function is necessary to a business. The question is whether logistics is more representative of a value-adding operation or merely a cost.

Table 2- 1: Value Activities in the Value Chain

Primary Activities	Support Activities
• Inbound Logistics	• Procurement
• Operations	• Technology Development
• Outbound Logistics	• Human Resources Management
• Marketing and Sales	• Firm Infrastructure
• Services	

Source: Van Weele (2002)

Porter (1985) noted that a series of primary processes could add value to the output through its inbound logistics, operations/production, outbound logistics, sales, and services. Firms depend on the logistics channel for such functions as sourcing, transportation, warehousing, selling, and physical handling. The channel is a network of intermediaries to create an efficient flow of materials and products from the supplier to the manufacturer and then to the consumer. To obtain optimum performance of these flows or processes at minimum total cost becomes a goal of logistics management to a firm. Logistics manager must monitor and evaluate the performance of logistics channels regularly and frequently. When the performance of the logistics goals is not met, the manager must evaluate possible channel alternatives and consider important changes.

Increasing numbers of firms have adopted globalisation strategies to conduct global sourcing, marketing and/or production, highlighting the need for efficient logistics systems and networks throughout the world. There are similarities and differences between domestic and global supply chain. The conceptual logistics framework of linking supply sources, plants, warehouses, and customers is the same; both systems involve managing the movement and storage of materials and products; and information is critical to effective provision of customer service, management of inventory, vendor product and service quality monitoring, and costs control. But managing global logistics encounters many difficulties, such as distance, language, the meaning of words, cultural differences, currency exchange, political stability, transport infrastructure, customs clearance and other transport, trade, environment and safety laws and regulations (Cho and Kang, 2001; Coyle, et al., 2003)

2.2.3 Trends in Supply Chain Management

A number of trends have been found in supply chain management. These include outsourcing and virtual integration, the use of information and communication technology, and the enhancement of ECR, JIT delivery and collaboration.

2.2.3.1 Outsourcing and Virtual Integration

Since the mid-1980s, numbers of firms have adopted Porter's three generic strategies, *cost, differentiation and focus*, to conduct their business. This management approach, do what you do best and outsource the rest, defines activities that a firm should retain for competitive advantage and other activities would be outsourced (Porter, 1980). For example, the international segmentation of personal computer (PC) manufacturing has led to the production of parts or semi-finished products in one country, the assembly of

them in other countries and the sale of products in the world markets. Another example is that manufacturing firms outsource their logistics activities to third-party logistics service providers.

Supply chains are networks, formed by varieties of organisations. It is essential for the supply chain that separate organisation not only works together as a virtual enterprise but also seeks for long-term relationships where partners can operate with stability continually. This kind of effective supply chain management require firms to integrate both logistics and manufacturing activities as a single unit.

2.2.3.2 The Use of Information and Communication Technology

The evolution of the supply chain could be divided into four stages: traditional, lean, integrated leagile and customised leagile (Childerhouse and Towill, 2000) or the stages of optimisation, integration, collaboration and synchronization (Anderson and Lee, 2000). However, the development of the supply chain could explain the use of e-commerce in enhancing the supply chain and logistics management, and how information systems have been used to support them (Towill, 1997; Behnezhad, 2000; Chaffey, 2002).

Information and communication technology is affecting both a firm and its supply chains in many ways. Firstly, it can automate processes such as documentation, order processes, and other internal and external operations. Secondly, it enlarges the scope of management and allows managers to make informed operational decisions in a variety of areas where information was previously lacking; the managers could monitor and control operations without regard to geographic location. And thirdly, supply chain partners could coordinate operations, using common data. Currently, the supply chain information system is able to bind the entire chain together as a single integrated unit, allowing for

the integrated management and control of goods, information and finance flows for developing a seamless supply chain (Lee and Whang, 2001; Hill and Scudder, 2002; Hesse, 2002). Furthermore, the use of standard data formats to exchange information and data electronically between organisations enables instructions to be sent in a form that can be processed automatically, with no manual intervention. Partners in the supply chain can view status information for inventory, orders, and deliveries within the framework of the production process (Stefansson, 2002; Schary and Skjoett-Larsen, 2002). Thus, the most important contribution of ICT is to bring visibility (information sharing) to the entire supply chain (Swaminathan and Tayur, 2003; Gattorna, 2003).

2.2.3.3 The Enhancement of ECR, JIT Delivery and Collaboration

Traditionally, manufacturing firms retained high levels of inventory, in part to protect against poor product quality, supplier delinquencies or material inefficiency. They even planned to build inventories of component parts prior to assembling the complete products, or stock products in distribution or retail inventory for the purpose of quick delivery. Maintaining a large inventory requires excessive storage capacity and excessive handling of stored products, and it also ties up large quantities of capacity.

In response to the competitive era, manufacturing firms begin to arrange each operation to produce what is necessary to satisfy the demands of the subsequent operations; conversely, consumers put increased pressure on their suppliers to support the demands of product quality and delivery schedules (Christensen, 1996; Vokurka and Lummus, 2000; Van Weele, 2002). A number of business initiatives, such as quick response, EDI, vendor-managed inventory (VMI), continuous-replenishment planning (CRP), efficient customer response (ECR), and just-in-time (JIT) delivery, have attempted to create efficiency and effectiveness through integration of supply chain activities and processes.

However, each initiative mentioned above fell short in its ability to integrate supply chain activities among the many participants (Coyle, et al., 2003).

The principle of JIT delivery or ECR means that all materials and products become available at the very moment when they are needed, exactly on time and in the right quantity. Complemented by the ICT development, one of the recent initiatives, Collaborative, Planning, Forecasting, and Replenishment (CPFR), is an Internet-based solution, which emphasises a sharing of consumer purchase data among and between trading partners for the purpose of helping to govern supply chain activities from operational planning through execution (Coyle, et al., 2003). The other initiative is the Radio Frequency Identification (RFID), which is an automatic identification method, relying on storing and remotely retrieving data using devices called RFID tags or transponders. RFID is expected to replace bar codes and will broadly be used in supply chain management.

2.3 Governments' International Transport Policies

Transport moves a firm's materials to factories and products to markets that are often geographically separated by distances. It creates place utility and contributes to time utility. In an industrialised society, we often assume that materials and products will move from where they are produced to where they are consumed with minimum difficulty in terms of both time and cost.

Most governments endeavour to create prosperity by strengthening their industry competitiveness and promoting international trade and transport. They adopt a number of international transport policies to facilitating international transport activities conducted in the countries.

2.3.1 Developments in International Freight Transport

Transport modes, including road, rail, water, air, and pipeline, are used for fulfilling the transportation, warehousing and distribution of cargoes (Faulks, 1990). In the past two decades, the world experienced the growth of international trade and transport. In particular, manufacturing firms based in the developed countries have found difficulty competing with operations located in the emerging markets. By employing global sourcing and/or marketing, firms are able to reduce costs, to improve quality, to become more flexible and innovative, to diminish lead times for delivery, to expose products to world markets, and to gain profits. On the other hand, many countries have highly relied on international trade and transport to expand their national economies. However, dispatching international freight is mostly completed by air or surface transport modes.

The growth of international freight transport reflects many developments. These include technological developments in transport and logistics, the growth of global business strategies, and evolution of supply chain management (Heaver, 2001). Containerisation is a technological improvement in both sea and air transport. It has revolutionised the international transport of general cargo and led to concentrated load centres by international carriers' calling at only one or two ports on a ranges (Talley, 2000). Another technological improvement is the advent of information and communication technology. The advances in information and communication technology have helped international carriers managing their intra-/inter-organisational operations and transactions. In the 1990s, a number of trade barriers were removed due to the formation of the European Economic Community, the opening up of East Europe, the dissolution of the USSR and the promotion of free trade agreement. The growth of global business has increased the demand for door-to-door services since then. International carriers are

likely to evolve as integrated carriers, fulfilling all the transport partner roles from pickup, forwarding, carrier or airline, customs broker, and delivery. They even become logistics service providers adjusting to the changing environment for multinational enterprises' global logistics demands (Wang, 2001).

Conducting international container transport, international carriers encounter at least three challenges. **First**, to meet the increasingly global needs of shippers for access to suppliers and markets, international carriers are under pressure to increase the geographical span of their services. **Second**, as shippers seek to integrate and improve the performance of their supply chains, international carriers face issues about the range of logistics services to provide and the level of organisational restructure. And **third**, international carriers need to find ways to hold or reduce their cost levels through achieving economies of operational scale and scope (Heaver, 2001). To cope with these challenges, international carriers have adopted the following approaches: (1) the development of hub and spoke network, (2) the use of information and communication technology, (3) the integration with global enterprises' supply chain, (4) the increase of operational scale and scope, and (5) the investment on inter-modal transport and terminal operations (Bajaj and Nag, 2000; Forsyth, et al., 2002).

2.3.2 Government Intervention on Transport

The intervention of national governments in the transport sector has been a long tradition and has evolved from direct control to free market-led policies. The intervention by governments includes investment in infrastructure, coordination of services, enforcement of operating and employment conditions, and implementation of environmental, safety and energy policies. The degree of intervention varies from slight intervention to considerable intervention depending on government objectives and actions (Faulks,

1990). Some governments place the transport sector almost exclusively under public control; others may control transport companies, for examples, bus, railroad, airline and shipping companies, so that the activities of the transport sector can be influenced by the government through such publicly owned companies (White, 1995). Government intervention in the transport sector are through policies that usually aim to protect customers and employees by introducing quality and safety controls, controlling the quantity of services to ensure a comprehensive transport network, controlling the price of services, and regulating the entry of new transport operators. In this protected system, operators are expected to provide some services for social rather than for commercial reasons (Hoyle and Knowles, 1996).

Most countries are dependent on trade and transport for their prosperity, but transport problems can create frictions within the economic system and have adverse effects on efficiency and competitiveness. Congestion, urban sprawl, pollution, and land-take are all subjects that have to be addressed within the transport economics discipline. Thus the areas of transport intervention by governments are not only at the national level but also have international dimensions. Many international organisations, such as the IMO and the ICAO, were established to develop international conventions and regulations in line with the growing globalisation of economic activities. These conventions and regulations are both at government level and at the commercial level, regarding transport safety or environmental protection (DETR, 1998).

2.3.3 Transport Policies and Competitiveness

Healthy transport systems have brought the development of a nation and the world. For many years, transport was closely regulated industry in many countries. Governments had a number of reasons why they were not prepared to leave the industry entirely to

forces of free and unfettered competition. The deregulation measures began in response to the requirements of individual modes of transport in the 1960s. In the late 1970s, "Contestability Theory" suggested that the free entry of new operators into the transport market was the key mechanism to ensure efficiency and welfare maximization. This move to deregulate and privatise transport started in the UK, followed by the US, and then spread rapidly throughout the world (Hoyle and Knowles, 1996).

Not all governments have approached the issue in the same way as the UK, although all have had similar aims: to try to increase the efficiency with which public money is spent while maintaining political support (Baird, 1995; Flynn, 2002). However, "Contestability Theory" has been increasingly challenged, as the outcome of deregulation and privatisation has often been oligopolistic control of particular transport markets instead of competition, as seen in the mid-1980s (Hoyle and Knowles, 1996).

Nowadays, the public accept that markets are an efficient way of allocating resources, reducing costs and improving efficiency. The implications of competitive policies on national legislations become ever more than before as the trading environment becomes increasingly competitive. However, It is seen that there are different points of view on this as the markets fail in some instances. It is necessary for governments to intervene to provide the services or else to regulate the industry. What a government has to do is to provide maximum consumer benefits through the preservation and extension of competition between industries in a fair marketplace. For example, the Competition Act in the UK asks for the removal of many restraints which impact on the allocation of resources in the service sectors of the economy. The Competition (Amendment) Act 1996 even introduced the criminalisation of breaches of competition law (Pallis, 1997; Lyons, 2000; Chlomoudis and Pallis, 2002).

2.3.4 Trends in International Freight Transport

A number of trends have been found in international freight transport. These include encouraging private investment on transport, ICT implementation, and transport inter-modality and logistics.

2.3.4.1 Encouraging Private Investment on Transport

Contestability theory is commonly accepted as a basis for government policy in many countries, even though some argue that the outcome of deregulation and privatisation has often been oligopolistic control of particular transport markets instead of competition (Charlton and Gibb, 1998). However, many examples have for the most part shown increases in productivity following governmental deregulation and privatisation policy, which means that the government does not have to engage in every kind of business operation.

The purpose of transport deregulation and privatisation is to reduce the role of government or to increase the role of the private sector in the ownership of national transport assets or in transport activities. The new entity gains a legal status that enables it to act as a private company (Marsh, 1991, White, 1995; Humphreys, 1999). The programme of transport deregulation and privatisation is mainly for new operators free entry into transport market and to transfer virtually nationalised industries into private ownership, along with public utilities. In other areas, the activities of the public sector are contracted out to companies, but remain under public control. Currently, more and more national carriers are privatised; new operators are free to enter international transport market; seaports/airports are commercialised; seaport/airport organisations are restructured; and air routes are deregulated. These kinds of arrangement, whether

privatisation or contracting out, primarily derive from the consideration of government expenditure, improvement of efficiency through competition, and the rising demand for services from the public.

2.3.4.2 ICT Implementation

Information and communication technology has been widely used by international carriers to effect the timely and accurate JIT shipment of goods. On the other hand, manufacturers and other large customer organisations require their suppliers to support technologies with which they can supplement their supply process.

Indeed, the prevalent trend in business today is a trend toward quality: quality of product, quality of service and quality of information. If a company promises quality, it implies more staff and considerably more time being required to process it. The solution to make the handling of transactions less labour-intensive is developing computer applications to automate the tasks previously performed by people and to pass data from one computer to the next with no editing and key entry in between. Currently, the information and communication technology has become important in improving intra-organisational operations, inter-organisational transactions, and global supply chains (Bajaj and Nag, 2000).

2.3.4.3 Transport Inter-modality and Logistics

Government-owned transport enterprises, which could be commercialised, privatised or participated in by the private sector, include road, railroad, national carriers, and seaport/airport operators. Road carriage, for example, has replaced rail carriage as the dominant form of inland freight transport in the United States and other countries since the 1960s (Stock and Lambert, 2001). The deregulation and privatisation of transport has

led to the combination of large railroad companies with national truckload (TL) road carriers for providing shippers with door-to-door inter-modal services. The combination of shipping companies and railroad companies has provided Trans-America or Trans-Siberia double-stacked railroad container transportation. Many logistics service providers even provide sea-air inter-modal transport services.

The deregulation and privatisation of transport has also led to the severe competition in international freight transport. In this competitive environment, there are many ways that international carriers can gain competitive advantages. The expansion of geographic span of transport services is one; the reduction of cost levels through achieving economies of operational scale and scope is the other; and the increase of logistics services range is the third. It has been seen that more and more international carriers involve in providing global logistics services.

2.4 Information and Communication Development

As addressed in above sections, business enterprises in manufacturing or international freight transport, nowadays, have a number of computer systems dispersed in organisational units both within and outside countries, depending on the business scenario. Indeed, the advent of the personal computer (PC), available as both standard desktop models and net PCs (NC), has given a new meaning to the word network and to the concept of a server computer and a client computer. With the increase in processing power and decrease in costs, more and more powerful operating systems (OS) are set up in interconnected computers and form a computer network.

2.4.1 ICT Use in Business Networks

At present, personal computers or network computers can easily boot to the

organisational networks, query/update databases, browse the Internet, send e-mail, or compose documents (including graphics or images). The networks formed are the so-called Local Area Networks (LANs) or Wide Area Networks (WANs). With the vast amount of information stored on the systems, these computer systems allow access to the right kind of information at the right time through the interconnection of computing resources both at the intra-organisational (Intranet) and inter-organisational (Extranet) levels (Angeles, 2001). In order to facilitate every business organisation communicating with suppliers, customers, carriers, banks, and other business partners, Electronic Data Interchange (EDI) has been developed to exchange structured data through agreed message and communication standards between the computer systems of trade partners (Parfett, 1992; EDIA, 1993; Connection, 1993).

The progression of international EDI standards has had a long history since the establishment of a working party on the simplification and standardization of external trade documents by the United Nations Economic Commission for Europe (UN/ECE) in 1963. In 1985, North American and European EDI interests began to discuss the establishment of a joint syntax for an international standard format to be used in international trade (Sokol, 1995). In 1990, the UN Electronic Data Interchange for Administration, Commerce and Transport (UN/EDIFACT) was formed to harmonise international EDI standards, and regional EDIFACT boards were also established to promote EDI implementation in the regions of Africa, Asia, Australia/New Zealand, East Europe, Pan America and Western Europe. With the advent of Internet technology, EDIFACT was re-structured into CEFACT (the United Nations Centre for Trade Facilitation and Electronic Business) in 1996. However, EDIFACT EDI standards have not been fully implemented throughout the world. The implementation of EDI normally forms a Value Added Network (VAN) to provide services among the same trade

community. The VAN is a third-party link in the EDI communication system that provides the EDI translation software service, EDI mail boxing and trading partner validation services among others (Bajaj and Nag, 2000).

Since the 1970s, the prevailing use of the Internet has given another boost to EC because it is a low-cost alternative to the proprietary networks. There are two ways in which EC is conducted over the Internet. The first is EDI in its present form over the Internet; the other is the World Wide Web (WWW) as a marketplace where vendors can offer goods, information and services for sale and where purchasers can browse, see and feel the goods through browsing tools. Many tools have been developed to help find, send and receive information across the Internet, and many computer languages have also been developed for use in the Internet EC, such as Extensible Markup Language (XML), XML/EDI, and Electronic Business using eXtensible Markup Language (ebXML) (Peat and Webber, 1997; Angeles, 2000; Chaffey, 2002; Liang, et al., 2000/2002).

An information system is limited by the bandwidth it has available to handle multimedia messaging with the high-speed transfer of data. There is a large variety of communication media, varying in its needs for capacity, bandwidth and speed in information transmission; even the telephone system (telecom) has progressed to direct data communication via electronic data interchange and now to the Web (Schary and Skjoett-Larsen, 2002). In the main, telecom companies provide a variety of solutions to different users; these include personal/family users, businesses and global enterprises. Other telecommunication providers are third parties, such as IBM, GE, SITA, and SWIFT, providing international value-added networks (Jussawalla, 1999).

The computer systems are a medium for transferring information and data. The medium

should be trustworthy for the guaranteed and secure delivery of transactions. The information infrastructure is just the latest to be added to the repertory of infrastructure within countries and at the global level. Many countries have National Information Infrastructure (NII) plans to strengthen national backbones for telecommunication and bring the networking and applications thereby developed to the general public (Wang, 1999; Jussawalla, 1999). The US Government has also promoted the Global Information Infrastructure (GII) in the past few years, and many countries have responded to this by coming up with their own national plans.

In addition, a wide range of personal, wireless, Internet-enabled computing devices have recently become available. These include GPRS (General Packet Radio Service) phones, WAP (Wireless Application Protocol) phones, wireless PDAs (personal digital assistants) and wireless pagers. The European Community and many other countries have benefited from the worldwide mobile phone GSM (Global System for Mobile Communications) standard and roaming. Mobile phones offer customers wireless tracking with real-time responses, with the customers not having to be dependent on a landline or PC. With the evolution of faster and more advanced mobile offerings, distribution and express companies can provide a faster and more reliable service allowing the whole supply chain to benefit (IBM, 2002; Giannopoulos, 2004).

2.4.2 ICT Use in Container Shipping

The organisational structure of a container shipping company varies according to a number of factors: (1) fleet size and overall financial turnover, (2) the trade(s) in which the company is engaged, and (3) the scale of the business involved. The shipping companies conduct their business abroad by means of branch offices or agents; they act as the owners' local representatives in the clearance and discharge of the owners' vessels,

and they secure cargo for shipment. Many modern computer and advanced communication systems are found in many global container shipping companies (Drewry, 1998). They are created for the highest possible accuracy and speed of data collection and information processing and provide fast documentation and up-to-the-minute cargo status reports. Some shipping companies have dedicated satellite bases and communication networks with computer centres in their headquarters or in outside hub ports, thereby providing a global data resource, which is continuously available. This enables the shippers/manufacturers to track the cargo/container movements on a 24-hour basis and to apply the materials management, Just-In-Time production, and product delivery (Stopford, 2002; Giannopoulos, 2004).

Liner services provided by a container shipping company are also involved with container (cargo) processing and vessel operations to provide a door to door global service via a container fleet, feeders, container trains, truck/road vehicles, exclusive terminals, container yards and container freight stations. Many container shipping companies have developed an integrated VAN service for all of their clients covering all aspects of the shipping business such as vessel operation, schedules, booking, shipping instructions, bill of lading data, cargo tracing, freight rate details and so on, together with details for other transport modes. The VAN will be linked with the major important international VAN services of other countries, thereby providing data and information on a global basis to all the customers worldwide, or it will connect with external systems such as port terminals, truck/rail companies, customs, and shippers/consignees, for companies' business operations. These information systems enable shipping companies and shippers to reduce costs by eliminating transcription errors and simplifying the transfer of information. Shippers can track the movement of their shipment from the time a shipping company accepts the cargo until the cargo reaches the destination. These

systems also offer shippers the opportunity of participation in numerous EDI systems in local seaports for the purpose of port operations and Customs clearance.

The container shipping industry has joined the development of international EDI standards in the past few years, such as SMDG in Europe or EDIFACT/CEFACT in the United Nations. The experts meet periodically for the formulation of international standards. Table 2-2 shows the messages of both UN/EDIFACT and ANSI X12, commonly implemented by the shipping industry.

Table 2- 2: EDI Messages Implemented by Shipping Companies

Business process	EDIFACT	ANSI X12	Business process	EDIFACT	ANSI X12
Booking Request	IFMBF	300	Loading list/loading report	COLOIN COLORE	319
Booking confirmation	IFTMIN	301	Vessel loading/unloading	COARRI	322
Import release information	COREOR	301	Vessel schedule	IFTSAI	323
Booking cancellation		303	Stowage plan	BAPLIE	324
Shipping instruction	IFTMIN	304	Gate in gate out operations	CODECO	622
Bill of lading	IFTMCS	310	Hazardous Manifest	IFTDGN IFTIAG	
Arrival notice		312	Remittance advice	REMADV	820
Customs inbound manifest	CUSCAR		Acknowledgment Application level	APERAK	824
			Translator level	CONTRL	997
Status information	IFTSTA	315			

Source: Author, collected from Yangming line

The advent of Internet has helped container shipping companies provide web services to global shippers; the services include schedules, container tracking, rate inquiry, booking, shipping instruction, bill of lading processing, customized report, shipment summary, cargo tracing, shipment detail, exception reporting, event notification, and cut-off/availability (Stopford, 2002). The use of Internet has also helped many container shipping companies to provide logistics services to global shippers. They even help their shippers managing supply chain processes from origin to destination by integrating the services of consolidating, inventory monitoring, export forwarding, customs brokerage at the original place, sea transport, and import forwarding, customs brokerage,

deconsolidation and delivery to customers at the destination.

2.4.3 ICT Use in Seaport Operations

A seaport provides a variety of services and operations, from a vessel's pre-arrival to its departure. In order to efficiently handle cargo or passenger in the seaport, information systems and communication technology have played an important role in seaport operation, management, and planning. The use of ICT means the port community has come closer to taking advantage of the sharing of information to plan the individual operational functions in synchronization with the rest of the community members. Some of the data even transfers between seaports to facilitate cargo handling: the stowage plan of a container vessel, called Bayplan, for example, is always the most up-to-date and the latest available if it is passed by computer.

Port Management Information Systems (PMISs) and port community networks are prevailingly developed to facilitate port operations and services. The systems vary from port to port. Their scale and scope rely on the services that they provide to users. Briefly, a port includes at least the following systems:

- A network system providing inter-organisational information sharing. Many leading port community network systems, such as DAKOSY in Hamburg, ADEMAR in Le Havre, FCPS in the Port of Felixstowe, INTIS in Rotterdam, PORNET in Singapore, SEAGHA in Antwerp, SHIPNET in Japan, TRADENET in the Singaporean maritime community and KL-NET in the Korean maritime community, are connecting to relevant organisations or port users, providing EDI or EC services (Lee, et al., 2000).
- A port in-house management information system, consisting of many subsystems, which facilitate processes within the port authority or port operator.
- Terminal operation systems, which may consist of different subsystems, depending on the business engaged in, either container terminal or conventional terminal.
- Customs clearance system for automatic cargo clearance (Lee-Partridge, et al., 2000).

Port information systems have to be continuously reengineered to cope with the changing communication technologies and international standards. EDI messages used in port data interchange have three formats: proprietary messages, UN/EDIFACT messages, or a combination of both. Currently, UN/EDIFACT messages, such as Customs Cargo Report - CUSCAB, In Gates and Out Gates - COPECO, Discharge and Loading - COARRI, Bay Plan - BAPLIE, Dangerous Goods Notification - IFTDGN, Customs Declarations - CUSDEC, Customs Response - CUSRES, Container Pre-Arrival Notification - COPARN etc., are available for implementing in the port for cargo handling (UN/EDIFACT, website). The use of EDI messages may vary from port to port. Some ports may still use their own proprietary messages or regional standards. For example, ANSI standards are commonly used in the US (Garstone, 1995).

The Internet has also become a powerful medium for a seaport to interact with its users. The online networks have been accelerated to increase a port's level of quality service by making the current paper-driven or counter-based services more convenient and accessible to all the port users. Typically, port electronic commerce can be categorised into three levels, as presented in Table 2-3.

Table 2- 3: Typical Functions of Port Electronic Commerce

Port information	Port EDI	Port e-business
• Shipping directory	• Customs clearance	• e-application
• Vessel status: vessel schedules, berth alongside, ships' data	• Container handling	• e-service
	• Stowage plan	• e-order
• Cargo/container track and trace	• Dangerous goods	• e-billing and e-payment
• Port statistics reports		

Source: collected by Author

2.4.4 ICT Use in Airfreight Transport

A shipper might select the air mode instead of surface movement because the speed of air transport, especially over long distances, is critical for goods requiring a short delivery

time. Air transport's low risk of losing or damaging shipments is another advantage for goods with a high ratio of value to size. Adapting to logistics needs and procedures for moving cargo, the international market has led to an increasing reliance on the air transport industry. The air cargo carriers, similar to container shipping companies, scatter their agents and customers worldwide. ICT is also widely used in managing intra- and inter-organisational processes and transactions. Its applications for a carrier have focused on three areas: freight resource management, terminal and warehouse information and communication, and freight and vehicle tracking and tracing (Pao, 2004).

Some air cargo community network systems have been set up to simplify the processes and information exchange between airlines, forwarders and shippers. For example, Cargo 2000, set up in 1997, is an IATA special interest group of airlines and forwarders (BA website). TRAXON, set up in 1990, is a joint force of Cathay Pacific, Air France, Japan Airlines and Lufthansa (Cathay Pacific website). Other express carriers, such as UPS, FedEx, and DHL, have their own exclusive network systems.

Most airlines and airports have widely implemented information systems in cargo operations; they recognise that EDI and EC are an integral part of the air cargo automation effort to reduce the need to process paper documentation (MOTC, 1992). With the ultimate objective of moving goods from shippers to consignees as quickly as possible, cargo information should be transferred among airlines, forwarders, brokers, ground handlers, customs and airport authorities directly or over a network of cargo community systems. IATA and EDIFACT have worked closely to develop and maintain EDI standards on behalf of the air cargo industry. Currently, EDI messages are available for the applications of booking, air waybill, flight manifest, consignment status, customs, cargo account settlement systems (CASS), and surface transportation. Some international

carriers even provide a Web service for schedule queries and availability information requests, reservations and space allocation requests, and freight status information (Li and Shue, 2003).

2.5 Seaport/Airport Modernisation

Following the trend of transport deregulation in the 1970s, many governments began to deregulate their seaports/airports for the purpose of modernising them through eliminating the government's role in seaport/airport activities as well as introducing the private sector into seaport/airport operations.

2.5.1 Deregulation to Modernise Seaport/Airport

Deregulation is aimed at reducing the government's controls over the way an industry operates. The methods of deregulation include the removal of bureaucratic regulations, the abolition of unnecessary obstacles and constraints, and the increase of market forces in seaport/airport activities. The reasons behind deregulation may be one or more of the following: (1) the reduction of a government's involvement in seaport/airport operations, (2) the removal of government subsidies, (3) the removal of employment monopolies, (4) the removal of obstacles to the seaport/airport's operation of market forces, (5) the wider participation of the private sector in the provision of seaport/airport services, (6) the inducement of private investment to cope with technological changes, and (7) the increase of seaport/airport productivity through competition (Thomas, 1996; Carney and Mew, 2003).

The extent of deregulation of seaports/airports may include changes in government control, institutional structure, and employment. Government controls and regulations on seaports/airports and their activities could be characterised as the following categories: (1)

control over development schemes, (2) regulate competition, (3) set financial objectives, (4) establish procedures for the preparation and execution of capital and revenue budgets, (5) supervise fiscal management and tariff policies, (6) control seaport/airport charges, (7) lay down procurement procedures, (8) license seaport/airport operators, and (9) establish employment schemes (Faulks, 1990; Thomas, 1996). Changes in government control are designed to give the seaport/airport more commercial freedom. Seaport/airport authorities or corporations act as normal private enterprises and are free to manage their own businesses. Changes in institutional structure are designed to change the ownership structure of seaports/airports and the institutional framework for the provision of services. Many governments transformed seaport/airport authorities into state-owned landlord entities or even private companies (Forsyth, 2002; Carney and Mew, 2003); they would rather not take the responsibility of day-to-day port operation. For examples, UK government privatised its nationalised seaports/airport in the 1970s; Italian and French governments encouraged the private sector to lease terminals and operate in the ports; Dutch and German port authorities act as landlords and a majority of operations are performed by the private sector); Australian and New Zealand governments sold off their major airports in the 1990s (Thomas, 1996; Forsyth, 2002). Changes in employment are aimed at reducing the size of the labour force and the removal of restrictive and archaic employment practices as a prerequisite for the greater involvement of the private sector in the seaport/airport industry. In the past two decades, the technological changes in cargo handling and the introduction of inter-modal container transport have reduced the manpower requirements of seaports/airport. The excessive manpower, job for life employment schemes and strong unions will hinder the involvement of the private sector in seaport/airport development. Therefore, the institutional restructure of the seaports/airports must be supported by employment reform.

2.5.2 Privatisation to Modernise Seaport/airport

Seaport/airport privatisation is the act of reducing the role of government, or increasing the role of the private sector in seaport/airport activities, or in the ownership of national seaport/airport assets. It includes the transfer of government services or the ownership of assets from the public to the private sector, or actual application of private capital to fund investments in the facilities, equipment and systems of the seaport/airport.

The introduction of the private sector into seaport/airport management or activities is based on the belief that private management is more efficient than a public entity. The tendency is clearly obvious, but many governments are reluctant to hand over seaports/airports completely to the private sector (Baird, 2002). It is a question of whether such seaports/airports can develop successfully without government involvement, even though the seaports/airports of the UK have been fully privatised. In fact, almost all the governments are still involved in one form or another in the seaport/airport industry.

Seaport/airport privatisation is prevalent and publicly accepted. One of the incentives for a government to impose port privatisation is to rely on competition to promote efficiency. Many seaports/airports have thus enjoyed benefit from their privatisation (Baird, 2002). However, it is still too simplistic and too optimistic to conclude that privatisation alone results in seaport/airport modernisation and productivity (Thomas, 1996). The methods by which seaport/airport privatisation takes place are those of:

- Commercialisation. A seaport/airport authority's principal activities are divided into separate operating units, each thereafter functioning as an independent, commercial company.
- Liberalisation. The government lessens the public seaport/airport's organisational monopoly power by allowing the private sector to provide the same services.
- The sale of assets. The government sells seaport/airport assets through a full or partial

sale of assets to any company or consortia to bid or to negotiate, or through the sale of shares on the Stock Exchange. This includes management buy-out (MBO), management buy-in (MBI), and management /employee buy-out (MEBO).

- Corporatisation. The government establishes a public sector landlord (the seaport/airport corporation) and at the same time gives more freedom and full autonomy in seaport/airport operations; but the government retains some powers.
- Concessions (BOT or lease). The government grants specific privileges to private companies or terminal operators based on an agreement conveying the right to use the seaport/airport asset for an agreed period of time in return for a payment or series of payments by the private company or terminal operator. This includes Build-Operate-Transfer (BOT) schemes and lease. However, strictly speaking, concession is not privatisation.
- Joint ventures. One or more than one independent organisation joins with the seaport/airport authority to share the costs of seaport/airport construction and the rewards of seaport/airport operations. The common case is Build-Operate-Own (BOO).
- Management (or technical) contract. The seaport/airport authority retains ownership of the assets and is responsible for provision of further capital and the management company offers a package of expertise to build a profitable business. The management contract is very similar to the lease of seaport/airport premises equipped with seaport/airport-owned equipment. (Cass, 1996/1998; Hooper, 2002; Carney and Mew, 2003)

2.5.3 Trends in Seaport/Airport Modernisation

A number of trends have been found in seaport/airport modernisation. These include the changing role of a seaport/airport, changes in seaport/airport administration, the changing role of a seaport/airport authority, and the transformation of seaports/airports into global logistics hubs.

2.5.3.1 The Changing Role of a Seaport/Airport

A seaport/airport consists of a variety of works, from the construction of infrastructure and superstructure to the provision of different services. Most governments in the world are concerned that their seaports/airports are sufficient to facilitate their domestic and

international trade and transport.

The modernisation of a seaport/airport includes many aspects. As discussed in above sections, efforts on institutional, administrative and management reforms are essential to their modernisation. Having sufficient infrastructure and facilities, efficient operations and productive functions are also important to the modernisation of a seaport/airport. To increase seaport/airport sufficiency, the seaport/airport would need new investments on both infrastructure and facilities to ensure that it is adequate to accommodate the ships or aircraft that call at the seaport/airport. Efficient seaports/airports need to increase their competitive position and promote their productivity. Encouragement of the private sector could help to change the seaport/airport a more sensible position in the market place (Baird, 1995; Humphreys, 1999; Doganis, 2002). The role a seaport/airport plays in a global supply chain is also changed. It used to be a site for transferring goods from one mode of transport to another and now, plays the role of a pivot to collect or distribute cargo from and to different places or an interface to handle cargo from one mode to the other in an integrated logistics chain system. A modern seaport/airport becomes a logistic and industrial centre, directly and indirectly involved in seamless transportation and information processes in the supply chain (Slack, 1993; Mangan and Cunningham, 2000; Winkelmans, et al., 2002; Robinson, 2002; Carbone and De Martino, 2003; Carney and Mew, 2003; Moglia and Sanguineri, 2003; Bichou and Gray, 2005).

2.5.3.2 Changes in Seaport/Airport Administration

There is no uniform form of a seaport/airport organisation. Ownership of port facilities, the attitude of central and local governments and the functions of a seaport/airport are the factors that have led to the great variety of seaport/airport organisations. Thus, a seaport/airport may be state controlled, municipal, autonomous or private (Ircha, 2001a;

Juhel, 2001; Baird; 2002; Hooper and White, 2000; Hooper, 2002; Forsyth, 2002).

Does a seaport/airport need a port authority? Currently, only few seaports throughout the world are without a port authority, Hong Kong being an example. The question is what kind of port authority is needed, and the trend in port administration is that the government's involvement in the port industry is reduced. Smaller port organisations might well be better than bigger ones, and this might be achieved by avoiding multi-port bodies or, if necessary, by moving towards the landlord model (Goss, 1990c). It implicates that the direct management by the state or by the central government departments have given a seaport/airport less than satisfactory results. Therefore, many governments have abandoned responsibility for their seaports/airports in favour of independent public bodies, based on the following essential principles: autonomy, authority over the whole seaport/airport area and the main seaport/airport functions, financial self-sufficiency and commercial management methods (Nagorski, 1972; Notteboom and Winkelmans, 2001b; Carney and Mew, 2003).

2.5.3.3 The Changing Role of a Seaport/Airport Authority

A seaport/airport authority may or may not engage in every port activity. It can provide all, or almost all, of the seaport/airport services, but it may rent or lease berths or terminals to private sector firms, relying on them for these activities. However, there are few fully private seaports/airports or even fully public ones, and there are a wide variety of seaport/airport authorities.

Table 2-4 helps to identify the four main forms in which a port authority is organised. A seaport/airport, irrespective of whether it is in private or public ownership, must fulfil three essential functions: the regulatory function, the landlord function and the utility

function (Case, 1996/1998). In this regard, a seaport/airport authority can play an important role in the creation of core competencies and economies of scope in the following areas: (1) value-added logistics and logistics polarisation, (2) the development of information systems, (3) an active participation in the planning and/or implementation of new (inter-modal) transport service, and (4) seaport/airport networking (Notteboom and Winkelmans, 2001a).

Table 2- 4: The Port Function Matrix

Port models	Regulatory functions	Landlord functions	Utility functions
Comprehensive (Public)	Public	Public	Public
Tool (Public/private)	Public	Public	Private
Landlord (Private / Public)	Public	Private	Private
Private	Private	Private	Private

Source: Port Privatisation, Case, 1996/1998

2.5.3.4 The Transformation of Seaports/Airports into Global Logistics Hubs

Seaports and airports have evolved from cargo handling points to crucial hubs in the transport chain and now, to logistics platforms, acting as interfaces between production and consumption centres. A major seaport/airport is always facing a number of impacts from both the internal and external environment. The technological changes in ship/aircraft design and cargo handling, as well as the competition from neighbouring seaports/airports outside the country, have already caused effects on seaport/airport operations (Hoyle, 1999; Ircha, 2001c; Paixao and Marlorw, 2003; Park, 2003). In addition, the diversity of operations that take place in a seaport/airport and the bureaucratic management of a seaport/airport authority may cause the seaport/airport to be unable to provide sufficient services. The prevalent is a trend that many governments endeavour to transform their seaports/airports into global logistics hubs.

2.6 Summary

This chapter described the conduct of academic survey/literature review in four areas: supply chain and logistics management, governments' international transport policies, information and communication technology, and seaport/airport modernisation. It has been found that the business supply chain has formed a virtual network and a business does count on logistics to fulfil its whole supply chain. It has also found that ICT has been used in improving efficiency and effectiveness of the supply chain management to provide JIT delivery and ECR service and that manufacturing firms' logistics outsourcing has led to the expertise and professional of global logistics service providers.

ICT has been widely used not only by business enterprises but also by international freight transport operators in their organisational units within and outside countries, helping them in managing both intra-organisational operations and inter-organisational transactions. However, an information system may have bandwidth constraints, preventing it from transferring larger multimedia and data. Many countries strengthen their national telecom networks through NII plans and the GII plan at the global level.

Transport plays an important role in moving a firm's materials to its factories and products to markets. The intervention of national governments in the transport sector has been a long tradition. In the 1970s, "Contestability Theory" suggested that the free entry of new operators into transport market was the key mechanism to ensure efficiency and welfare maximization. This move to deregulate and privatise transport started in the UK, followed by the US, and then spread rapidly throughout the world. The application of this theory in government transport policies includes **deregulation of the government transport sector, privatisation of transport operations, reformation of transport organisational structures, and reform of labour employment.**

The deregulation and privatisation of a seaport/airport is based on the belief that private management is more efficient than public seaport/airport agencies. The role of a seaport/airport is also changed. It has been a site for transferring goods from one mode of transport to another. Currently, a modern seaport/airport plays as a pivot or interface in an integrated logistics chain system, directly and indirectly involving in seamless transport and information processes.

This research is intended to answer the question, *whether Taiwan government's transport policies incorporating ICT development strategies are suitable for international carriers to provide global logistics services",* through the examination of six research objectives, which are stated in the section 1.7 of Chapter 1. The former three objectives are related to global logistics services and the latter three are related to global logistics hubs. Therefore, these two areas will be further investigated in Chapter 4 and Chapter 5 respectively. The next chapter, Chapter 3, will define the methodology used for the research; this can help to determine the steps that need to be followed during the research process.

Chapter 3 Research Methodology

Chapter Aims:

- Explain the methodology used for this research
- Design a questionnaire to examine research objectives and prove hypotheses
- Define the administration of the questionnaire and statistics techniques

3.1 Introduction

This chapter is intended to describe the methodology used for this research, including the questionnaire survey used to examine research objectives and hypotheses formulated in this research. The main issues addressed include: research methodology, survey research strategy, the design of the questionnaire, the conduct of the questionnaire survey, and the administration of the questionnaire and statistics techniques.

3.2 Methodology Used for This Research

A methodology is the framework within which a study takes place. The methodology used will determine the steps that need to be followed during the research process for the final goal to be achieved. There are a number of methodologies with which research can be conducted, such as academic research, survey research, modelling and simulation, action research and case research (Lagoudis, 2003).

The aim of the research is to find out the link between government transport policies and the impact on global logistics services taking into account the role of ICT. This led to statement of the research question, the formulation of objectives and the identification of the hypotheses. Following this it is possible to look at the nature of data that is required

for the analysis of the research and to answer the hypotheses stated. Only after this is an idea seen on the nature of data that is required and since this involves research into policy aspects including operations there are elements of both qualitative and quantitative data. The methodology thus reflects the nature of data that is required in this thesis. As such the methodology chosen is about the survey, the interview and case study approach, all of which will answer both the quantitative and qualitative aspect of the research (Mangan, et. al., 2004). Therefore, methods used for this research are (1) survey using questionnaire, (2) interview and (3) case study. Literature review is the basis of the whole research.

3.2.1 Literature Review

Generally, a researcher starts a piece of research with an interest in solving a particular problem through being better acquainted with the facts surrounding the problem. A research has to address the question is the research exploring and research objectives are the research identifying, and then need to test certain specified hypotheses. Following these, the researcher has an idea of nature of data and how the data have to be collected. Literature review is one of the best strategies, complemented with survey research, which can examine and support the solutions to the problems.

Literature review is a kind of academic research. Literature review is used to collect and carry out studies from academic books, theses, journals and periodicals in libraries or elsewhere. Other than the above-mentioned sources, the materials searched for the review will go further, specifically to websites. There are a large number of books and articles related to the areas of supply chain, global logistics, transport policy, international transport, seaport/airport management, and information and communication technology. As the author has defined the research topic as "A Study of Competitive Transport

Policies and ICT Development Strategies in the Global Logistics Services: The Case of Taiwan", the literature review is focused on the research topic related subjects. The research topic related subjects had been reviewed in Chapter 2 and summarised as the following areas:

- Supply chain and logistics management
- Governments' international transport policies
- Information and communication development
- Seaport/airport modernisation

In addition, literature review will further conduct in Chapter 4 and Chapter 5 in order to better understand the following two areas:

- Global logistics services
- Global logistics hubs

3.2.2 Research Survey

A survey is one of the methods available for obtaining information. It is the method used for collecting information directly from people about their ideas, feelings, plans and other such topics. It can be a self-administered questionnaire that someone fills in or an interview that is conducted in person, on the telephone, through e-mail or a website. A survey consists of questions and instructions, and it makes sense only in the context of sampling and design, data processing and analysis, the pilot test, response rate, and the reporting of results (Fink and Kosecoff, 1998). Thus, a survey could be descriptive or analytical.

There are no iron guarantees that following a set of practical guidelines will lead to the production of a good questionnaire. The types of questionnaire can vary enormously in terms of their purpose, their size and their appearance. To qualify as a research questionnaire, they should: (1) be designed to collect information which can be used subsequently as data for analysis; (2) consist of a written list of questions; and (3) gather

information by asking people directly about the points concerned with the research (Denscombe, 2003). The researchers also have to carefully consider whether it is appropriate to use a questionnaire and what kinds of data will be collected by the questionnaire before planning the use of a questionnaire. In addition, a questionnaire is to obtain information by asking questions; the questions may have forced response choices or open-ended answers. Therefore, the selection, wording, and ordering of questions and answers requires careful thought and a reasonable command of the language.

There are many ways to administrate the questionnaire, one of which is by post depending upon the size of sample selected for the study. Questionnaire administered by post have advantages and disadvantages: a low response rate is one of their disadvantages. In order to increase the response rate for the research, self-administered methods can be used for some respondents; face-to-face meetings, telephone calls and e-mails are usually used to explain the purpose of questionnaire, to find out if there are problems in answering questions, and to remind them to send back the questionnaire.

3.2.3 Interview

An interview is used to collect qualitative data through direct verbal interaction with individuals in the surveyed organisations. It could be a structured, semi-structured, unstructured, one-to-one, group or focus group interview (Denscombe, 2003). This method can be used on its own or in combination with other survey methods, providing data that give a fuller expression of the informant's view. The data gathered from interviews can be used to design a questionnaire. In addition, in-depth interviews may also be used as a means to validate findings from the use of a questionnaire. Before conducting an interview, the researcher must carefully consider when it is appropriate to use an interview and what kinds of data are to be collected by the interview.

In this research, interviews were used: (1) to obtain a comprehensive picture of global logistics services, (2) to discover the transformation of seaports/airports into global logistics hubs, and (3) to gather more detailed information for the design of questionnaire survey. These interviews were undertaken during the years 2003 and 2004. Some interviews were conducted as part of a pilot study that tested the questions that were used in the questionnaire survey. However, the most important concern was not to interfere with their decisions in filling out the answers. Data collected by in-depth interviews were also used to assist the evaluation of results and to increase the validity of the findings derived from the questionnaire survey.

3.2.4 Case research

Case research is based on case studies. It is the systematic examination of a single case by dealing with a variety of evidence through documents, artefacts, interviews and observations, from which useful findings can be derived (Denscombe, 2003). This enables the in-depth understanding of the problem that a case study aims to address and the generation of a meaningful theory. It is an appropriate methodology when focusing on one organisation or entity. It enables the researcher to develop a better insight into a complex and relatively unexplored phenomenon.

A case study may be defined as research in which the researcher has direct contact with the participants and the participants are the primary source of data. The primary methods used in a case study are interviews and direct observations; other methods include experiments and surveys. Therefore, the method of case study is used in Chapter 4 and 5 for more detailed understanding current developments in the fields of global logistics services and global logistics hubs.

3.3 Survey Research Strategy

It is expecting that the results obtained and information collected in the research should sufficiently answer the research question and examine research objectives. These results and information are also expected to be useful for international carriers to identify areas or topics that need to be focused on to increase the efficiency of the global logistics service provided by them, and for policy makers in the government departments to make the right decisions in facilitating the conduct of global logistics services in the country. In order to achieve these goals, a questionnaire survey will be used for collecting primary data and hypotheses are also formulated to examine.

3.3.1 The Initiatives of Questionnaire Survey

This research aims to examine the research question, *whether Taiwan government's transport policies incorporating ICT development strategies are suitable for international carriers to provide global logistics services*, and the following six research objectives:

O1: To identify the driving forces for the evolution of global logistics services

O2: To examine the network strategies adopted by international carriers to managing global logistics services

O3: To analyse the critical factors relevant to international carriers gaining competitive advantages in providing global logistics services

O4: To examine transport policies that most governments adopted to modernise their seaports/airports

O5: To study the unique position of Taiwan's seaports/airports in performing as global logistics hubs

O6: To analyse the factors relevant to the success of a global logistics hub

The former three research objectives are related to global logistics services and the latter

three research objectives are related to global logistics hubs. In order to understand the role of the global logistics service in global supply chain, the use of ICT in global logistics service, the role of a seaport/airport in global logistics service, and the impact of government transport policies on global logistics service and global logistics hub, a literature review conducted in Chapter 2 has been focused on research question related four areas: supply chain and logistics management, governments' international transport policies, information and communication technology, and seaport/airport modernisation. Then, detailed investigation and study on global logistics services and global logistics hubs will be conducted in Chapter 4 and Chapter 5 respectively. After studying these two areas, a questionnaire survey will be used to examine the research objectives, which could not be examined through literature review. Therefore, items related to research objectives will be collected through literature review and interview, and these items will be used for preparing the questionnaire to examine these research objectives.

3.3.2 Research Hypotheses

Hypotheses will also be formulated in Chapters 4 and 5. Each of them will be examined in turn so as to verify they are acceptable.

3.4 Questionnaire Design

The details of the questionnaire survey approach taken in this research are addressed in the section that follows.

3.4.1 Defining the Population

All surveys consist of (1) questions and (2) instructions, and they make sense only in the context of (3) sampling and design, (4) data processing and analysis, (5) pilot testing, (6) response rate, and (7) reporting results (Fink and Kosecoff, 1998). Before designing questionnaires, it is essential for the researcher to clearly determine who will be surveyed and what information is required in order to fulfil the objectives of the survey.

3.4.2 Sampling Techniques

A survey is frequently faced with the fact that data cannot be collected from everyone who is in the category being researched. As a result, it relies on getting evidence from a portion of the whole in the expectation and hope that what is found in that portion applies equally to the rest of the population (Denscombe, 2003). Therefore, the sampling in the first place needs to be carefully selected if there is to be confidence that the findings from the sample will be similar to those found among the rest of the category under investigation. There are two kinds of sampling technique that can be used: probability sampling and non-probability sampling.

Probability sampling is based on the idea that the people or events that are chosen as the samples are chosen because they will be a representative cross-section of people or events in the whole population being studied. Non-probability sampling is conducted without such knowledge about whether those included in the sample are representative of

the overall population (Denscombe, 2003).

3.4.3 Sampling Frame and Size

The sampling frame is an objective list of the population from which the researcher can make his or her selection. It should ideally contain a complete, up-to-date list of all those that comprise the population for research. In order to generalise from the findings of a survey, the sample size must be carefully selected to be representative of the population and include a sufficient number.

As the survey is focused on opinions of the conduct of global logistics services in Taiwan, the population of the survey is defined as scholars and experts who are concerned with global logistics services and who work in academia, government departments and international transport industries. The sampling frame of the survey is collected from different sources; these include the Ministry of Education, the Ministry of the Economic Affairs, and the Ministry of Transportation and Communications. As all companies engaged in international transport in Taiwan must be registered with the Ministries, a list of private companies related to international freight transport for the survey can be collected from the Ministries concerned. The background of these scholars and experts can also be categorised into the following five groups: (1) departments in universities/institutes related to international transport, (2) government departments and authorities, (3) international ocean carriers - foreign and domestic, (4) international air cargo carriers - foreign and domestic, and (5) container terminal operators in the seaports, warehouse/terminal operators in the airports, and logistics service providers.

It is estimated that around 560 persons qualified to be included in the survey. For a small-scale research project, the survey and sampling frequently involve between 30 and

250 cases. In order to have around 100 cases for analysis, 30% (168 persons) of those eligible are selected to participate in the survey: this is based on estimating that the response rate would reach more than 50% for the mail survey. Table 3-1 shows the total survey sample. It can be seen that 168 questionnaires will be distributed to 72 organisations and companies. These include:

- 10 professors/researchers in 7 universities and maritime institutes,
- 24 government officials in 10 transport departments and seaport/airport authorities,
- 61 managers in 27 leading international ocean carriers,
- 23 managers in 12 leading air cargo carriers, and
- 50 managers in 16 logistics service providers and terminal operators.

Table 3- 1: Total Survey Sample

Categories	Number of Organisations/ Companies related	Estimated Number of Survey Population	Number of Questionnaires Distributed
Academia	7	30	10
Government	10	60	24
Ocean Carriers	27	250	61
Air Carriers	12	70	23
Logistics/Terminal Operators	16	150	50
Total	72	560	168

Source: author

Table 3-2 shows the survey list of leading international carriers conducting global logistics service business in Taiwan. It consists of 27 international ocean carriers and 12 international air carriers. The former include the world's top 20 leading container shipping companies; the latter are the top 12 air cargo carriers, which carried 90% of Taiwan's import/export cargo volume.

Table 3- 2: Leading International Carriers conducting Business in Taiwan

Ocean carrier	Flag	R*	Air Carrier	Flag	R**	R***
Maersk Line	DK	1	EVA Air	TW	1	9
Mediterranean Shipping (MSC)	CH	2	China Airlines	TW	2	8
Evergreen Group	TW	3	Cathay Pacific	HK	3	7
P&O Nedlloyd	UK	4	Japan Airlines	JP	4	10
CMA CGM & ANL	FR	5	HK Dragon Air	HK	5	
NOL/APL	SG	6	Northwest Airlines	US	6	13
Hanjin Shipping	KR	7	United Parcel Service (UPS)	US	7	6
Nippon Yusen Kaisha (NYK)	JP	8	Thai Airways	TH	8	28
COSCO Container Lines (COSCO)	CN	9	Cargolux Airlines	LU	9	11
China Shipping Container Lines	CN	10	Singapore Airlines	SG	10	5
Orient Overseas Container Line (OOCL)	HK	11	Polar Air Cargo	US	11	16
Mitsui O.S.K. Lines (MOL)	JP	12	Federal Express Airways (FedEx)	US	12	1
ZIM	IL	13				
CP Ship /Lykes Lines /TMM Lines	CA	14				
K Lines	JP	15				
Compania Sud American de Vapors (CSAV)	CL	16				
Hapag-Lloyd	DE	17				
Yang Ming Marine Transport (YML)	TW	18				
Hyundai Merchant Marine (HMM)	KR	19				
Hamburg Sud	DE	20				
Pacific International Line (PIL)	SG					
United Arab Lines (UASC)	KW					
Wan Hai Lines	TW					
MISC	MY					
Regional Container Lines	TH					
Cheng Lie Navigation	TW					

Source: Review of Maritime Transport, 2005 and Airline Business, Nov, 2005
Note: R*: rankings in the world, 2004; R**: rankings in Taiwan, 2004; R***: rankings in the world, 2004

3.4.4 Design of Questionnaire

It is important to provide sufficient background information about the research and the questionnaire, such as the sponsor, the purpose, the return address, confidentiality, that responses are voluntary, and to include thanks (Denscombe, 2003). It is also very important that respondents are instructed on how to go about answering the questions, with examples or instructions if necessary. Normally, a questionnaire is divided into three parts:

- The first part is a letter describing the purpose of the questionnaire.
- The second part is the main part of the questionnaire.
- The third part is to ask about the background of respondents.

The items in the second part of the questionnaire will be obtained from literature reviews

and personal interviews with scholars and experts working for the academia, government, international carriers, and logistics/terminal operators. Respondents will be asked to indicate the importance levels of and their satisfaction levels with each item in three questions of the questionnaire. At the bottom of each question, respondents are also asked to add items they think important and suggestions they would like to provide. A 5-point scale is used, with values ranging from "1 = very unimportant" to "5 = very important" and from "1 = very unsatisfied" to "5 = very satisfied", to indicate the importance of and their satisfaction with each item respectively.

3.5 Questionnaire Administration

A research survey needs to be reliable and valid in its results. To determine the adequacy of a measure, evidence of its reliability and validity must be offered.

3.5.1 Assessing Validity

There are many methods to examine the survey is valid and reliable. The adoption and adaptation of questions in the literature (if they exist) is one of the best methods in helping to assess reliability and validity and in assisting comparison with the findings of other studies (Saunders, et al., 1997). This approach can also be effective because the questions and instructions have already undergone development and testing. However, some specific measures need to be developed for the purpose of the research and these measures (where no related literature exists) will be tested for both reliability and validity.

The reliability of the questionnaire is concerned with the consistency of the responses to questions, and the validity is the degree to which a measuring instrument measures what is supposed to be measured (Oppenheim, 2001; Chen, 2003). The issues of the reliability

and validity of the questionnaire should be considered at the design stage; the reliability and validity of the data collected and the response rate can then be achieved in the research through the design of the questions, the structure of questionnaires and the rigour of the pilot testing (Saunders, et al., 1997). In this research, a number of efforts have been made to improve the reliability and validity of the questionnaires during the design process by careful construction of measuring devices and by pilot testing.

3.5.2 Pilot Test

A pilot test is a try out. The purpose of a pilot test is to help produce a questionnaire form that is usable and that will provide the information needed. Other than self-administered questionnaires, a pilot test of a face-to-face interview can reveal whether the respondents understand the directions for the questionnaire and can answer the questions easily. If necessary, the questionnaires must be refined before they are sent out. Consequently, the reliability of the questionnaire and the validity of the data collected will be increased (Fink and Kosecoff, 1998; Chen, 2003).

3.5.3 Statistical Techniques

The Statistical Package for the Social Science, SPSS, is used to process and analyse the data obtained from the questionnaire survey. Descriptive statistics are used to explore data, to present results and to assess whether the expected outcomes of the research survey are achieved. A number of statistics analysis tools, such as frequency analysis, quadrant scatter plots, factor analysis, and independent-samples T test, have been used to analyse the data. In which, the independent-samples T test is used to determine any difference between the views of respondent groups concerning the items measured in the questionnaires (Mitler, et al., 2002; Chen, 2004).

3.6 Summary

This chapter described the research methodology, questionnaire design, and the administration of questionnaire survey. The methods used for this research include literature review, questionnaire survey, case study, and interview.

In order to obtain useful results and findings from the questionnaire data returned by the respondents with a high degree of accuracy, this chapter has also defined the population, the structure, and the methods used to assess the reliability and validity of the questionnaire. A pilot test will be conducted and some changes should be made to the questionnaire before the questionnaires are sent out.

168 scholars and experts from five groups of international transport-related organisations and companies are invited to participate in the questionnaire survey. Their views regarding the global logistics service and global logistics hub are essential to this research. The results of the survey will be used to examine three hypotheses formulated for this research and to ascertain whether Taiwan government's transport policies incorporating ICT development strategies are suitable for international carriers to provide global logistics services.

Chapter 4 Global Logistics Service

Chapter Aims:

- In-depth review the development of global logistics services
- Identify and examine global logistics services related research objectives
- Collect global logistics service items for questionnaire survey and raise hypotheses

4.1 Introduction

Three research objectives stated in Chapter 1 are related to global logistics service; these are: **O1:** To identify the driving forces for the evolution of global logistics services, **O2:** To examine the network strategies adopted by international carriers to managing global logistics services, and **O3:** To analyse the critical factors relevant to international carriers gaining competitive advantages in providing global logistics services.

This chapter is intended to study the development of global logistics service, aiming to examine these three objectives. The main issues addressed include: the evolution of global logistics services, global logistics service providers, drivers of global logistics services and critical factors for global logistics services. From a detailed understanding the development of global logistics services, items relating to global logistics services are obtained for preparing the questionnaire survey and to formulate the hypotheses.

4.2 The Evolution of International Transport

International trade has had a long history. In the ancient world, classical Athens was known for its trading activities as early as the fifth or fourth centuries BC; Rome attracted extensive trade and commerce from many parts of the globe; and the Silk Road referred to a route of trade in the northwest of China linking China with central Asia, the Middle East and Europe, and in particular with Iran. However, ancient international trade was constrained by transport volume of vehicles via land or sea routes.

The industrialisation of the West and its dominance over the rest of the world led to the world witnessing an unprecedented boom in the worldwide exchange of goods and services in the 19th century; the steamships were dominant in international sea trade for bulk and general cargo. The 1970s marked a new era of international freight transport; containerships and air freighters were developed to carry general cargo, finished or semi-finished manufactured goods.

4.2.1 Development of International Freight Transport

World trade has continually grown in the past years. The merchandise exports accounted for US$5.3 trillion in 1997 and reached US$ 8.9 trillion in 2004 (WTO, 2005). Sea transport is the dominant mode of transport, accounting for almost two thirds (65.43%) of world trade in terms of weight, in which tanker transport accounts for 29.01%, dry bulk 25.21%, containerised cargo 6.61% and other general cargo 4.60%; international freight transport by air is still limited, accounting for 0.2%; others are transported by land (Kumar and Hoffmann, 2002). Table 4-1 shows the development of international sea-borne transport. It increased from 2,504 million tons in 1970 to 6,758 million tons in 2004. On the other hand, international freight carried by air accounted for 22.7 million tons in 2004, with average annual changes 6% from 1994 to 2004 according to IATA's statistics (WATS, 2005).

Table 4- 1: Development of International Sea-borne Trade

million metric tons

	Tanker cargo			Dry cargo			
Year	Subtotal	Crude oil	Product	Subtotal	Dry bulk	General cargo	Total
1970	1,440	1,109	232	1,162	447	715	2,504
1980	1,871	1,527	344	1,833	796	1,037	3,704
1990	1,755	1,287	468	2,253	968	1,285	4,008
2000	2,163	1,665	498	3,821			5,983
2004	2,316	1,770	546	4,442			6,758

Source: Review of Maritime Transport, 2005, UNCTAD
Note: Goods loaded for international trade

4.2.2 Global Approach of International Carriers

Containerisation has been a major and increasingly important element not only of maritime activity but also of world trade and of the entire global industrial structure (Peters, 2001). The services of container shipping companies cover Asia, Oceania, North America, India, the Middle East, the Mediterranean, and Europe. Table 4-2 shows the top 20 container shipping companies from 2002 to 2004. Their container carrying capacity increased from 4,763,013 TEUs in 2002 to 5,924,572TEUs in 2004, representing 61.75% and 67.06% of the world total container carrying capacity respectively.

Table 4- 2: Top 20 Container Shipping Companies 2002-2004

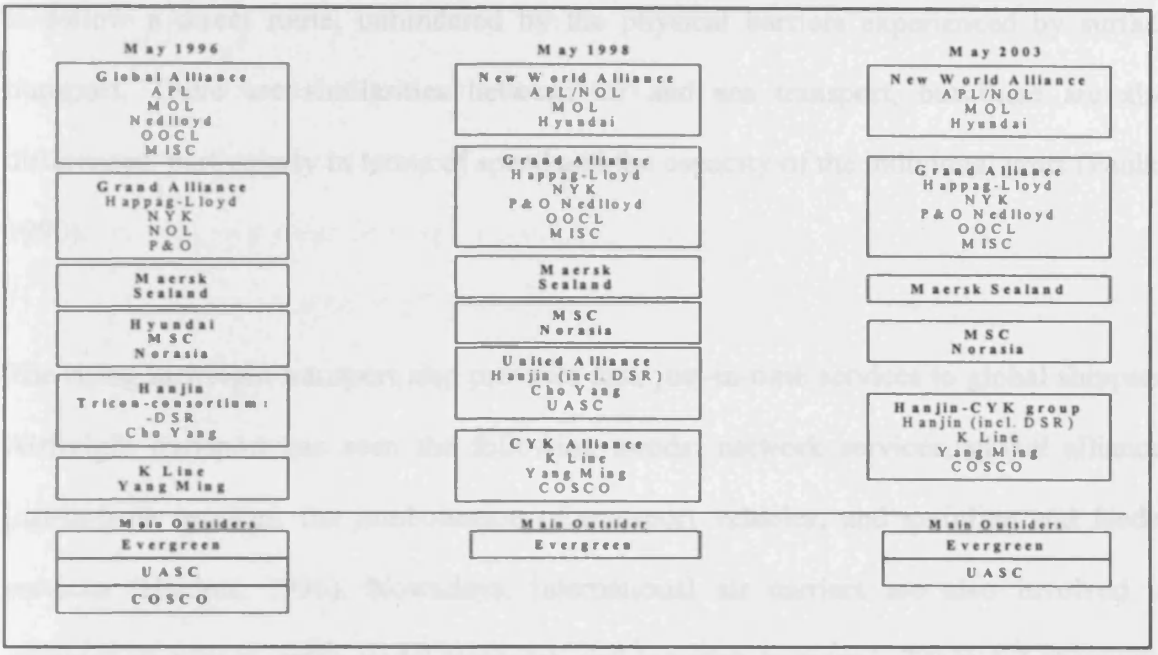
Ranking 04	Ranking 03	Ranking 02	Operator	Country	Ship 2004	Capacity TEU/2004	Ship 2003	Capacity TEU/2003	Ship 2002	Capacity TEU/2002
1	1	1	Maersk-Sealnad	DK	346	900,509	328	844,626	312	773,931
2	2	2	MSC	CH	237	618,025	217	516,876	183	413,814
3	3	4	Evergreen Group	TW	151	437,618	152	442,310	143	403,932
4	4	3	P&O/Nedlloyd	UK/NL	158	426,996	157	419,527	160	406,654
5	5	8	CMA/CGM Group	FR	178	373,191	150	299,174	107	225,436
6	8	7	NOL/APL	SG	91	295,321	82	273,573	71	227,749
7	6	5	Hanjin/DSR-sentor	KR/DE	75	284,710	76	290,677	81	304,409
8	9	11	NYK	JP	96	265,192	91	233,934	73	177,700
9	7	6	COSCO	CN	125	253,007	148	274,128	140	255,937
10	17	15	China Shipping	CN	106	236,079	94	143,655	88	148,212
11	13	14	OOCL	HK	63	216,527	55	185,502	50	157,493
12	10	9	MOL	JP	68	213,195	72	222,533	68	188,326
13	14	13	Zim	IL	85	196,420	79	174,480	77	164,350
14	11	10	CP Ships Group	CA	83	196,317	85	201,706	92	187,890
15	12	12	K Line	JP	66	195,750	63	186,017	56	168,413
16	19	20	CSAV	CL	74	190,143	55	123,378	39	90,623
17	15	16	Hapag-Lloyd	DE	48	186,610	41	154,850	38	135,953
18	16	18	Yangming	TW	59	168,006	55	153,783	40	120,319
19	18	17	Hyundai	KR	36	139,243	35	136,548	32	122,713
20			Hamburg Sud	DE	68	131,713				
	20	19	PIL Group	SG			92	106,508	83	97,829
			Total 1-10		1,563	4,090,648	1,473	3,817,358	1,357	3,388,078
			Total 1-20		2,213	5,924,572	2,121	5,383,785	1,933	4,763,013
			World Total			8,835,000		8,354,000		7,713,000

Source: Review of Maritime Transport, 2003, 2004, 2005, UNCTAD; CI, 2004
Note: 1. MSC: Mediterranean Shipping, Evergreen group: Evergreen/Lloyd Triestino
2. Country code: International Organisation for Standardization (ISO)

Just in time (JIT) techniques have been introduced into global network services by container shipping companies, offering shippers fixed day departures. In order to respond to increasing JIT global transport requirements and to rationalize the use of existing

assets and new investment, these companies have been compelled to enter mergers, acquisitions, groupings or alliances (Notteboom, 2004). These formations could reduce operation costs and promote their market strength by integrating service structures. Fig 4-1 shows the evolution of typical container shipping alliances.

Fig 4- 1: The Evolution of Typical Container Shipping Alliances



Source: Notteboom, 2004

The competition of container shipping is tremendously serious. New container ships with larger capacities are launched every year. Right now, some Jumbo container ships deployed in main-haul services have capacities of 6,000 to 9,000 TEUs and over, and container ships with a loading capacity of somewhere between 10,000 and 15,000 TEUs are expected to enter service before 2010 (Grammenos, 2002; Baird, 2005). In addition, many container shipping companies are more involved in terminal operations, inter-modal transport and logistics services than before. Almost all of the top 20 container shipping companies have operated dedicated terminals worldwide. They seek long-term dedicated terminals for cargo operations and container handling in order to

improve transport service quality and to seek value-added activities (Heaver, 2001; Notteboom, 2004).

In the airfreight transport, more than 1200 scheduled airlines are providing transport services to passengers and cargo in the world, of which around 300 operate on international routes. The outstanding characteristic of air transport is speed. It is also able to follow a direct route, unhindered by the physical barriers experienced by surface transport. There are similarities between air and sea transport, but there are also differences, particularly in terms of speed and the capacity of the individual units (Faulks, 1990).

The rising airfreight transport also provides fast, just-in-time services to global shippers. Airfreight transport has seen the following trends: network services, global alliance, just-in-time services, the jumboisation of transport vehicles, and mainline and feeder services (Hanlon, 1996). Nowadays, international air carriers are also involved in terminal operations, inter-modal transport, and logistics services. Table 4-3 shows the world's top 25 airlines by freight in 2004.

Table 4- 3: The World's Top 25 Airlines by Freight, 2004

Rank	Airline	Country	Million RTKs	Rank	Airline	Country	Million FTKs
1	**FedEx**	US	14,586	14	**Emirates**	AE	3,671
2	**Air France-KLM**	FR	10,078	15	**Martinair**	NL	3,363
3	**Korean**	KR	8,345	16	**Polar Air**	US	3,286
4	**Lufthansa**	DE	7,961	17	**American**	US	3,216
5	**Singapore**	SG	7,333	18	**Asiana**	KR	3,001
6	**UPS**	US	7,305	19	**United**	US	2,906
7	**Cathay Pacific**	HK	6,007	20	**Malaysia**	MY	2,690
8	**China Airlines**	TW	5,769	21	**Air China**	CN	2,581
9	**EVA**	TW	5,481	22	**Nippon Cargo**	JP	2,504
10	**JAL Group**	JP	5,303	23	**LAN Airlines**	CL	2,259
11	**Cargolux**	LU	5,115	24	**Qantas**	AU	2,095
12	**British Airways**	UK	4,951	25	**Delta**	US	2,081
13	**Northwest**	US	3,765				

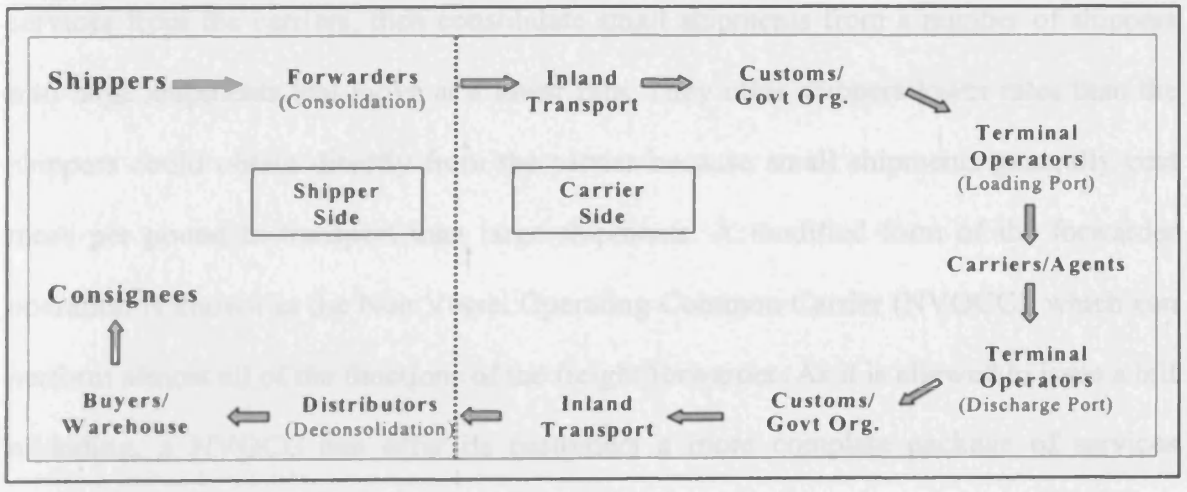
Source: Airline Business, Nov. 2005
Note: 1. RTK: Revenue Ton Kilometre; 2. Country Code: ISO code

4.2.3 International Freight Transport Chain

The movements of international freight by international carriers include a number of processes and information, such as the documentation, data of trading, cargo handling, customs clearance, inland transport, terminal operation, and international transport from the exporting country to the importing country.

Figure 4-2 shows a basic general structure for international freight transport, starting from shippers who want their goods to be shipped via sea/air to consignees who accept the goods. Cargoes/containers are moved from the domestic seller's inventory, through an inland transport carrier's ICD/warehouse or directly to the domestic terminal for loading onto the ship or aeroplane; as the ship/aeroplane arrives at the foreign port/terminal, the cargo/containers move to a foreign ICD/warehouse or directly to the buyer's warehouse/distribution centre. A variety of transport modes are used, including road, rail, air, water or a combination of these, subject to the selection of the buyer and the provision of transport services (Stock and Lambert, 2001).

Fig 4- 2: International Freight Transport Chain



Source: Author

A number of enterprises participate in the international freight transport chain. These include traders/shippers, brokers, freight forwarders, hauliers/inland transport operators, carriers/agents, terminal operators, banks, consignees, logistics service providers and insurance companies; and most of which are licensed and administrated by the governments (Branch, 1994/1996). In addition, government bodies and trading organisations are also involved in the whole international freight transport chain. The participation of all of these in the chain makes it quite complex. A successful international freight transport requires an average of twenty-seven players (Fiona, 2001).

4.2.4 Increasing role of Freight Forwarders

Other than international sea/air carriers, trade intermediaries are playing a more and more important role for the less-trailer-load (LTL) or less-container-load (LCL) cargo in international freight transport. One of these intermediaries is the freight forwarder, which perform the functions of advising on the acceptance of letters of credit, booking space on carriers, preparing export declarations, preparing air waybills or bills of lading, obtaining consular documents, arranging for insurance, preparing and sending shipping notices and documents, and serving as a general consultant. Freight forwarders purchase transport services from the carriers, then consolidate small shipments from a number of shippers into large shipments that move at a lower rate. They offer shippers lower rates than the shippers could obtain directly from the carrier because small shipments generally cost more per pound to transport than large shipments. A modified form of the forwarder operation is known as the Non Vessel Operating Common Carrier (NVOCC), which can perform almost all of the functions of the freight forwarder. As it is allowed to issue a bill of lading, a NVOCC can offer its customers a more complete package of services (Johnson and Wood, 1996).

4.3 The Advent of Global Logistics Service

The advent of global logistics service is due to demand from two sides, one from the demand side and the other from the supply side (Lynch, 2000). The reasons for these demands are the globalisation approach of multinational enterprises (MNEs), logistics outsourcing of multinational enterprises, and gaining competitive advantages of international transport operators. It has also found that some international transport operators provide third-party/fourth party logistics services to multinational enterprises and some of them evolve to an integrated carrier providing integrated logistics services to small package shippers.

4.3.1 Globalisation Approach of Multinational Enterprises

There are a number of reasons for manufacturing firms wanting to expand their markets worldwide and to source their materials abroad. Firstly, they can expose their products in the global market; secondly, global sourcing can achieve material cost savings, estimated at 15 to 30 per cent, compared with local or regional sourcing; thirdly, improvements are also available in areas such as quality, supplier responsiveness and supplier technology contribution (Zeng, 2003; Trent and Monczka, 2003).

Some manufacturing firms even adopt an international segmentation policy, separating their production into the following processes: research and design, manufacturing, assembling, marking and labelling. These processes can be finished in different plants at different countries. In order to gain the benefits of global markets, the manufacturers are able to integrate and control international operations by centralizing and coordinating marketing, manufacturing and distribution. This global localisation approach enables firms to increase their competitiveness in world markets (Cooper, et al., 1994).

Other than global localisation, some firms pursue a strategy of concentrating production. They concentrate production at fewer sites or go one step further to single-product production lines, where specific factories are devoted to the manufacture of a single product type. There are a number of prerequisites in order for this concentration strategy to work: (1) products must have a significant degree of commonality; (2) transport costs must be low relative to other resource costs; (3) transport must be reliable; (4) the firms must have centralised marketing control.

4.3.2 Logistics Outsourcing of Multinational Enterprises

Logistics services comprise a variety of activities, such as storage and handling, transportation, consolidation, cross docking, consulting/solutions, pick and pack, light assembly, package and kitting, reverse logistics/return and repair, order processing and fulfilment, information processing, and inventory management (Lynch, 2000). Not all logistics firms provide all of these services: it varies from one firm to another, depending on the firm's functions and the business it is engaged in.

The users of global logistics services have two choices: either they can service their own logistics requirement by having an in-house capacity, or they can buy in specialist suppliers of logistics services. There are a number of reasons for the users to buy in logistics services. Firstly, global logistics is more complicated and dynamic for a firm than is local logistics as the multi-national freight trade includes a variety of trade processes, such as import/export procedures, customs clearance, and taxation. Secondly, transport and ICT are crucial services in global logistics. Global firms demand international transport to carry freight from one country to other countries. Many transport modes are needed to complete the transport service. As this process involves

trading with different countries in different languages and dealing with different practices, there is a need for continual monitoring and for being informed all of the time. Thirdly, the global logistics service, which a global firm demands, is more than a transport service. As the transport service is a part of the logistics service, the characteristics of transport service, i.e., transit time, reliability, accessibility, capability, and security, are the basic elements of a global logistics service.

4.3.3 Gaining Competitive Advantages of Global Logistics Service

Manufacturing firms began to expand their markets worldwide in the 1980s. Intensive competition compelled them to outsource some of their non-core activities to other firms possessing professionals in these activities. The lowering of trade barriers has also encouraged firms to engage global sourcing and/or marketing. They are aware of the importance of logistics in business strategy and consider the international transport operators as partners. They want to work with a few of them and delegate responsibility of transport management to them as a third party. On the other hand, the international transport operators have found that the concepts used among manufacturing firms such as outsourcing, just-in-time, the reducing cycle/lead time, and the new global view on storage and distribution within manufacturing are useful for them to gain competitive advantages. They may provide not only transport services for multinational enterprises but also logistics management for them. This is a Win-Win strategy of a global logistics service provider.

4.3.4 Third-/Forth-Party Logistics Providers

As small business transactions of buying and selling are conducted in the same location, they may involve single or continuing purchases of logistics services. The relationship is typically weak and the agreements are short or informal. This stage of logistics is defined

as First-Party Logistics (1PL). As the business expands geographically, the outsourcing of logistics activities usually includes transportation and warehousing, which is defined as Second-Party Logistics (2PL). Third-Party Logistics (3PL) is the third stage in the development of the relationship and demonstrates commitment by both shipper and service provider. The operations of both parties are integrated and cooperative, making a 3PL provider more of a partner than a supplier. The continuing growth of supply chain management, outsourcing and globalisation plus the dynamic effects of e-commerce are driving a 3PL provider to expand its services more than transportation, warehousing, and distribution (Schary and Skjoett-Larsen, 2002).

Fourth-Party Logistics (4PL) is another new form of strategic partnership between a shipper and a logistics service provider. It plays the role of a supply chain integrator that assembles and manages the resources, capabilities, and technology of its own organisation along with those of complementary service providers to deliver a comprehensive supply chain solution, focusing on all elements of supply chain management and tailoring to specific client needs (Schary and Skjott-Larsen, 2002).

4.3.5 Integrated Carriers

Integrated carriers are the small package shipping companies that specialize in letter documents and small packages up to 500 lbs. In recent years, the function of integrated carriers has evolved into something more like a 3PL provider and subsequently a 4PL provider as well. The major integrated carriers include UPS, FedEx, Airborne, DHL, BAX, USPS, Emory and other emerging carriers. The success of the Integrated Carrier is dependent upon their ability to take small shipments to multiple points around the world and provide multi-tiered delivery options with extremely high levels of visibility (Huddleston, 2002).

4.4 Categories of Global Logistics Service Providers

Logistics service providers, categorised by the area they service, can be local, regional, national, international or global. They, as to whether or not they own or lease trucks, warehouses and other property that are used in offering their services, can be asset based or non-asset based. Finally, if characterised by their basic orientation, they can be carrier-based, warehouse/distribution-based, brokerage/forwarder-based, or information-based (Cooper, et al., 1994; Coyle, et al., 2003).

4.4.1 Carrier-based Global Logistics Service Providers

This service provider refers to a container shipping company or airline that offers the global logistics service. In the 1990s, some major carriers, denoted as 'mega-carriers', began to offer total logistics solutions - one-stop shopping, as shown in Table 4-4.

Table 4- 4: Selected Mega-Carriers' One-Stop Shopping Services

Category	Carriers	Categories of Services
Ocean Shipping companies which depend on their ocean going vessels for overseas delivery	APL Evergreen Hapag-Lloyd MOL Maersk Sealand NYK P&O Nedlloyd	• Connecting transport modes to achieve global movement of goods - air/motor/ocean/rail • Supporting services to make inter-modal transportation run smoothly - tracking and tracing/EDI/customs link/forwarding • Distribution related service - warehousing/repackaging/re-labelling/order picking/inventory management • Tailored logistics services - contract logistics or third party logistics
Air Dedicated air cargo carriers offering complete international air service for general freight	FedEx, UPS, DHL American Airlines KLM Lufthansa Japan Airlines	

Source: Author, based on Semeijn and Vellenga (1995)

The concept of one-stop shopping is that the multi-modal carrier plays the role of a transport supermarket, providing the most efficient mode or modes of transport and other types of logistics services, and satisfying all of the needs of the shipper. The other types of logistics services offered by a mega-carrier include pick-up, insurance, inventory management, proper documentation, and delivery (Semeijn and Vellenga, 1995). Some

carriers, such as FedEx, UPS and DHL in the table, are designated to provide a worldwide parcels service.

4.4.2 The Warehouse/Distribution-based Global Logistics Service Provider

This service provider refers to warehousing operators or haulage providers offering cross-border or multi-national logistics services. They can also offer one-stop shopping opportunities to customers not only for national markets but also for international distribution.

4.4.3 Brokerage/Forwarder-based Global Logistics Service Providers

This service provider refers to shipper's brokers or forwarders offering global logistics services. As shipper's brokers or freight forwarders consolidate small shipments to a large one, they are eligible to bargain or purchase transport services from the carriers and offer shippers lower rates than the shippers could obtain directly from the carrier. Some of them even go far beyond this role to offer logistics services, working as the Non Vessel Operating Common Carrier (NVOCC).

4.4.4 Information-based Global Logistics Service Providers

This service provider emerges from the development of ICT and the support of larger carriers. There are at least two types: one is information consultant who helps large shippers establishing a logistics information system linking with the carriers' systems and providing logistics management; the other is the establishment of a Web-portal, supported by major carriers, as shown in Table 4-5.

Table 4- 5: Active Web-portals and their Member Carriers

PORTALS	INTTRA	GT-NEXUS		CARGO SMART
CARRIERS	Alianca	APL	Montemar	OOCL
	ANL	CP Ships Group	NYK	COSCO
	CMA CGM	ANZDL	Senator Lines	MISC
	DAL	Canada Maritime	Wan Hai	
	Hamburg-Sud	Contship Container	Yangming	
	Hapaq-Lloyd	Italia Line	Zim	
	"K" Line	Lykes Lines		
	Maersk Sealand	TMM		
	MCC Transport	Crowley Maritime		
	MOL	CSAV		
	MSC	Gold Star		
	NYK	HMM		
	P&O Nedlloyd	Hanjin		
	Safmarine	"K" Line		
	Senator Line	Libra		
	UASC	MOL		

Source: Author, based on Web-portals' website, by July 2005

4.5 Drivers of Global Logistics Services

Yip (1989) groups industry globalisation drivers into four categories: market, cost, government, and competition. Some researchers describe global customers (market drivers), economies of scale and scope (cost drivers), trade policies and labour regulations (government drivers), and the threat of global competitors (competition drivers) as the forces driving the physical transport of goods into global supply chains (De Souza Junior, et al., 2003). Therefore, the drivers for the evolution of global logistics services are presented in the section that follows.

4.5.1 Market Drivers

The evolution of global logistics services is addressed in terms of market drivers, such as the growth of international trade, global production, and logistics outsourcing.

4.5.1.1 The Growth of International Trade

The growth of international trade in the past years as previous sections addressed was mainly derived from the firms' increasing demands of global marketing, sourcing and/or

production. These globalisation approaches of businesses primarily exploit labour cost differences, global product differentiation opportunities, and availability of materials in particular countries (Tavasszy, et al., 2003). However, there are many differences between the trading nations' transport and customs regulations, infrastructure, exchange rates, culture, and language. International carriers have expertise in providing services to these global shipments. Helped by international carriers, materials and products are moved from exporting nations to importing nations.

4.5.1.2 Global Production

A global business does more than simply export and import and has the following features: source its materials and supplies in more than one country, often has widely spread production and assembly facilities, and market its products worldwide (Christopher, 1998). In recent years, firms based in the developed countries have found it difficult to compete with operations located in the emerging markets. Manufacturing firms in developing countries such as Malaysia, Korea, Taiwan, India, and China are capable of producing high quality products at low cost. Large manufacturing firms often develop their products in one country, relocate operations/productions to other low wage countries and source from them, and sell products locally or worldwide (Fraering and Prasad, 1999; Notteboom and Winkelmans, 2001a; Zeng, 2003).

Adopting the strategy of international segmentation of manufacturing, multi-national enterprises tend to outsource some of their non-core activities to other firms, which possess the relevant professionals and expertise. Outsourcing allows firms to focus on their core competencies, to provide a differentiated level of customer service, and to take advantage of greater operational flexibility. The move to business outsourcing has increased the demand for transport and logistics from specialist logistics firms.

4.5.1.3 Logistics Outsourcing

There are many reasons for a firm to outsource its logistics. Firstly, outsourcing allows a firm to improve its return on assets. By reducing investment in logistics facilities, the firm can invest in its core competencies or best businesses. Secondly, flexibility is another reason for outsourcing. Firms often find it impossible to predict logistics needs accurately. As the market changes, the logistics needs change as well. Contracting with logistics firms may be one of the solutions to this problem. Thirdly, operating cost is reduced. Comparing the cost of operating a logistics function to that of the logistics outsourcing, a firm will achieve a cost saving. Fourthly, logistics firms, denoting as mega carriers, are mature, dynamic, professional and reliable in providing integrated logistics services. Other reasons for outsourcing logistics include labour considerations, management and political considerations, customer service and specialized services (Lynch, 2000).

4.5.2 Cost Drivers

The evolution of global logistics services is addressed in terms of cost drivers, such as economics of scale and scope, learning and experience, new technologies, decrease of cargo/product inventory, and simplification of process flow and documentation.

4.5.2.1 Economies of Scale and Scope

A single country market may not be large enough for local transport enterprises to achieve all possible economies of scale or scope. Global enterprises are concerned the market coverage and the level and the flexibility of transport service could meet the changing requirements they encounter. International carriers provide transport service to global enterprises; they can gain economic advantage through global networks and/or

global experience to increase both their operating scale and their global coverage (Lemoine and Dagnæs, 2003; Panayides and Cullinane, 2002; Notteboom, 2004).

4.5.2.2 Learning and Experience

A global strategy of network service can help international carriers develop as global logistics experts and provide seamless global logistics services (Lemoine and Dagnæs, 2003). International carriers can learn from the expanded market participation and activity concentration and accelerate the accumulation of learning and experience. The steeper the learning and experience curves, the greater the potential benefit will be (Yip, 1989; Lorange, 2001).

4.5.2.3 New Technologies

The use of standardised container handling in international freight transport and the subsequent intermodalism of international trade, which moves cargo from an origin in one country to a destination in another by more than one transport mode, is a good example to explain the use of new technology in the reduction of cost and commercial feasibility. This practice has made the international transport of cargo a quick, labour and damage-reduced, and more economic process (Talley, 2000).

The use of information and communication technology (ICT) is another example of new technology used in international freight transport. ICT enables the rapid and accurate sharing of information among supply chain partners. It not only speeds transport processes and transactions but also enables new approaches to supply chain management, reducing order cycle times, cutting inventories and making the systems more flexible (Heaver, 2001).

4.5.2.4 Decrease of Cargo/Product Inventory

Transit time for transporting international trade cargo and products is longer than that within a nation by a couple of days to a few weeks. Currently, shippers have shifted to reduced inventories in more responsive supply chains (Heaver, 2001). JIT networks provided by the international carriers can keep inventories to a minimum even for a supply line that stretches from one nation to another far away nation. Global enterprises can treat shipments in transit as floating inventory. The tight communication between carriers and global enterprises on a constant basis may help global enterprises reduce their cargo/product inventory.

4.5.2.5 Simplification of Process Flow and Documentation

An international freight transport chain, performed by many participants, comprises a number of processes and entails much documentation between them. The integration of the participants of an international freight transport chain can not only simplify the process and documentation but also cut down the operating cost and time. This can benefit both international carriers and shippers.

4.5.3 Government Drivers

The evolution of global logistics services is addressed in terms of government drivers, such as the deregulation of transport and government infrastructure, trade liberalisation, and the relaxation of trade barriers.

4.5.3.1 Deregulation of Transport and Government Infrastructure

The management of transport is concerned with the overall purchase and control of the movement service used by a firm in achieving the objectives of its logistics process. The deregulation and privatisation of the transport industry in the 1980s has brought new carriers and competition into the transport marketplace, encouraging network

organisation of the transport chain (Lemoine and Dagnæs, 2003). The cost of transport has been reduced and the quality of transport services has improved in general. The reduction of transport cost can help to lower overall logistics costs on a relative basis. Deregulation in other governmental infrastructure, such as the banking system, telecommunications, and the seaport/airport industry, are also accelerating the growth of global business.

4.5.3.2 Trade Liberalisation

The lowering of trade barriers has encouraged global sourcing, marketing, and/or production. The formation of the European Economic Community, the opening up of Eastern Europe and the dissolution of the USSR have facilitated firms expanding their business in these areas (Tavasszy, et al., 2003). Other formations, such as the North American Free Trade Agreement (NAFTA), ASEAN, and the World Trade Organisation (WTO), promote free trade among their member states. These mechanisms accelerate the growth of international transport and global trade.

4.5.3.3 Relaxation of Trade Barriers

Barriers to trade are divided into two areas: tariff and non-tariff. Tariff barriers, such as tariffs, quotas and export controls, are official constraints on the importation of certain goods and services in the form of a total or a partial limitation or in the form of a special levy. Non-tariff barriers, including administrative barriers, production subsidies, emergency import protection, embargoes and boycotts, technical standards and corruption, are indirect measures that discriminate against foreign manufacturing firms in the domestic market or otherwise distort and constrain trade.

The Single European Market (SEM) is a good example of free trade. In order to create the opportunity for free movement of goods among EU member states, various physical,

technical, and fiscal barriers to trade between member states are being removed; these measures are helping to create European companies with the critical mass to compete in the global marketplace (Cooper, et al., 1994).

4.5.4 Competition Drivers

The international freight transport industry is operating in a highly competitive international market environment. The environment includes service providers coming from different nationalities and operating across borders that are virtually minimal in the current world trade scene. Global logistics service providers would be aware of these challenges as well as threats in the market, costs and transport policies of governments that would have to be taken into account.

In order to cope with competition from the entry of new carriers, the threat of substitution, the bargaining power of customers, and rivalry among current competitors, international carriers need to adopt Porter's three generic competitive strategies, i.e., *cost, differentiation and focus*, to gain competitive advantages. The evolution of global logistics services is addressed in terms of competition drivers, such as increasing the range of services, JIT seamless delivery and integrated D2D services, expansion of geographic span, and process visibility.

4.5.4.1 Increasing the Range of Services

Global enterprises gradually demand a full logistics service rather than just physical transport. They also seek to integrate and improve the performance of their supply chains. International carriers face issues about the range of logistics services to provide and the level of organisational integration to establish among their various services (Heaver, 2001). In order to meet these demands, international carriers have expanded their range of service provision through mergers, acquisitions, joint ventures, alliances or

partnerships with other carriers. Some of them have evolved into "mega-carriers", providing "one-stop shopping" transport and logistics services (Semeijn and Vellenga, 1995; Stone, 2001).

4.5.4.2 JIT Seamless Delivery and Integrated D2D Services

A quick response service for customers implies smaller deliveries, frequent transportation and the demand for door-to-door (D2D) service. The door-to-door service of global transport includes complicated processes, such as trade procedures, customs clearance, warehousing and distribution. Some logistics service providers, known as integrated carriers in the aviation industry, are capable of fulfilling all of the transport partner roles, from pickup, forwarding, carrier or airline, customs broker, and delivery. Most leading container shipping companies also set up logistics departments or companies to provide JIT seamless delivery and D2D services for global shippers.

4.5.4.3 Expansion of Geographical Span

One of the challenges to international carriers is the increasingly global need of shippers for access to suppliers and markets while using a reduced number of carriers. International carriers may increase their geographical coverage by deploying more transport vehicles or by mergers, acquisitions, joint venture or alliances with other carriers to expand service routes (Panayides and Cullinane, 2002).

4.5.4.4 Process Visibility

Process visibility is critical to a successful global supply chain. It allows a business to focus on how much inventory is readily available in a warehouse, where it is stored, and when it has fulfilled an order.

The global supply chain encompasses transportation, distribution, order and inventory

management, customs brokerage, returns management, parts distribution and warranty services. To gain competitive advantages, international carriers should be able to integrate these independent processes by their information systems, providing correct and timely information to global shippers. This information must be transmitted and shared in real-time, as goods get handed-off from one process to another (Huddleston, 2002).

As shown in Table 4-6, this section has discovered that four factors, including 15 items, are driving the evolution of global logistics services. The selection of these 15 items is based on the literature review and the discussions carried out during the pilot stages of questionnaire design. They will be used for preparing the first question of the questionnaire survey and examined through it for this research.

Table 4- 6: Driving Force Items for the Evolution of Global Logistics Services

Factors	Items
Market	1.Growth of international trade 2.Global production and demand for transhipment 3.Shippers' logistics outsourcing
Cost	4.Gaining economies of scale and scope 5.Learning and experience from logistics service 6.New technologies in transport and ICT 7.Simplification of process flow and documentation 8.Decrease of cargo/product inventory
Government	9.Deregulation of transport and infrastructure 10.Trade liberalisation 11.Relaxation of trade barriers
Competition	12.Expansion of services/one-stop shopping service 13.Provision of JIT delivery/D2D services 14.Increasing geographical span of logistics service 15.Visibility of logistics chain

Source: collected by author

It has also found that the growing international trade has led international carriers to evolve to provide global logistics services. Therefore, the first hypothesis is formulated on basis of the literature review on global logistics service and will be examined through questionnaire survey. The hypothesis is as follows:

Hypothesis:
H1: International trade is influencing global logistics services

4.6 Critical Factors for Global Logistics Services

In order to find out the critical factors relevant to international carriers in providing global logistics services, the research will firstly study global shippers' demand for logistics services and then, the strategic networks of international carriers and business reengineering for logistics service providers.

4.6.1 Shippers' Demand for Logistics Services

Business logistics for a firm can simply be divided into two functions: materials management and products distribution. Transport is to move cargo from a place to the other and traffic is the passage or business of transport. Thus, transport and traffic activities are conducted in both inbound and outbound physical movement. In general, the users of transport service would require five elements from logistics service providers, i.e., transit time, reliability, accessibility, capability, and security (Coyle, et al., 2000). Transit time affects the level of inventory held and the cost of holding inventory; the longer the transit time, the greater the inventory levels and the higher the inventory carrying cost. Reliability refers to the consistency of transit time. Meeting pickup and delivery schedules enables the shippers and receivers to optimise inventory levels and minimize stock-out cost. Accessibility is the ability of the transport provider to move the freight between a specific origin and destination. Capacity is the ability of the carrier to provide unique demands for equipment, facilities, and communication, based on the physical and marketing characteristics of the freight. Security is concerned with the safety of the goods in transit. Shipments that are damaged or lost in transit would cause increased costs in the inventory and/or stock-outs.

In the era of business outsourcing, a number of logistics functions, as Table 4-7 shows, can be outsourced to a service provider (Lynch, 2000). Global enterprises may further

demand a full logistics service rather than just physical transport. Their demands include market coverage, distribution strategy, materials handling, inventory control, purchasing, transportation planning, information systems, and the ability to manage change, especially within multinational organisations with several different subsidiaries (Lobo and Zairi, 1999a/1999b; Lieb and Miller, 2002). They also demand a logistics service that can integrate with their supply chains or work with global logistics service providers as partners, delegating responsibility of transport management to them as a third party. If one or more of these areas are not operating correctly, it has a negative impact on the effectiveness and efficiency of the total logistics system. Logistics outsourcing to third-party operators is often a way of dealing with these problems (Makukha and Gray, 2004; Abrahamsson and Wandel, 1998).

Table 4- 7: Logistics Services Outsourced

	Logistics Service Functions can be Outsourced	
Basic services	• Outbound transport • Freight bill auditing/payment • Warehousing • Inbound transport • Freight consolidation/distribution • Cross-docking • Selected manufacturing activities • Product marking, labelling, packaging	• Product returns and repair • Traffic management/fleet operations • Information technology • Product assembly/installation • Inventory management • Order fulfilment • Customer service • Order entry/order processing
Other services	• Solutions/network design • Customs processing and brokerage	• Tracking systems

Source: Lynch (2000), based on study by the University of Tennessee

4.6.2 Network Strategies Adopted by International Carriers

Heaver (2001) pointed out that conducting international container transport, international carriers encountered at least three challenges: (1) they were under pressure to increase the geographical span of their services to meet the increasingly global needs of shippers for access to suppliers and markets, (2) they faced issues about the range of logistics services to provide and the level of organisational restructure as shippers seek to integrate and improve the performance of their supply chains, and (3) they needed to find ways to hold

or reduce their cost levels through achieving economies of operational scale and scope. It has been found that international carriers adopt the following three network strategies: vertical integration, horizontal integration and ICT integration.

4.6.2.1 Vertical Integration

An international freight transport network is a combination of international carriers, inland transport operators, terminal operators, and warehouse/distribution owners. It is too complicated to be conducted by a shipper. A shipper would rather select a good international transport operator than be involved in its operation.

The advent of supply chain management has also contributed to the changing nature of the way international carriers conduct their businesses. The international carrier has been transformed from a product dispenser or distributor to a critical element in the supply chain. It has been involved in the operations of inland transport, terminals and warehouse/distribution centres to provide door-to-door transport services and value-added logistics packages for their customers (Frankel, 1999; Heaver, et al., 2000; Panayides and Cullinane, 2002; De Souza Junior, et al., 2003).

The adoption of this vertical integration by international carriers was initiated by the need for greater efficiency and effectiveness. By vertically enhancing transport networks, international carriers can reduce cost through the use of shared resources, add value through other type of logistics service, and generate additional revenue, particularly with the low level of freight rates in recent years (Heaver, 2001).

4.6.2.2 Horizontal Integration

Horizontal integration has also been found in global logistics service providers. Stone

(2001) examined the expansion of UK logistics service providers in European countries, and concluded that joint ventures as a method of European expansion will increase considerably in the future. Lieb and Miller (2002) annually surveyed the use of third-party logistics services by large US manufacturers and found that US manufacturers expected 3PL providers to provide broader international coverage. Many large service providers had also broadened their service offerings, not only in terms of the specific service offered, but also in terms of the geographies they served and the leading-edge information services they provided.

As described in Section 4.2.2 of this Chapter, horizontal integration strategies adopted by international carriers include mergers, acquisitions, strategic alliances, joint ventures and partnerships with other international carriers. The main reason for international carriers adopt horizontal integration strategies is to gain economies of scale and scope. These not only can help international carriers to expand the geographic coverage of their global networks but also can give global firms advantages and opportunities for growth through finding new markets and reacting quickly to business changes at a low cost. It can be sure that the capacity a global network creates is one of the critical success factors for global enterprises' survival in the new economy (Lemoine and Dagnæs, 2003).

4.6.2.3 ICT Integration

Advances in ICT have allowed companies to manage the physical movement of products over the long term. As described in Section 2.4 of Chapter 2, international carriers have widely used ICT in intra-/inter-organisational business, terminal operations, customer service and others. Their track and trace systems establish the location of any consignment at any time, improving the visibility of the whole global supply chain to shippers and their customers. The information systems also enable the move from

distribution based on "production to stock" towards "production to order", where delivery takes place directly or through cross docking.

The various ICT applications in the field of freight transport have, nowadays, focused on the solutions for online analytical processing (OLAP) and online transaction processing (OLTP) among business partners to support integration and inter-modality in four key areas: freight resource management, terminal operations, freight and vehicle tracking and tracing, and back-office logistics (Giannopoulos, 2004).

4.6.3 Business Reengineering for Logistics Service Providers

International carriers commonly adopt three levels of strategic integration, e.g. vertical, horizontal and ICT, in forming international freight transport chains to offer global logistics services. Logistics services, as a business competence, deals with the achievement of customer satisfaction at the minimum level of logistics costs. In logistics management, emphasis is normally placed on the possibility of simultaneously achieving efficiency and effectiveness to which customer satisfaction is reached (Talley, 2000; Tavasszy, et al., 2003). The business reengineering conducted by International carriers includes business process reengineering (BPR) and Enterprise resource planning (ERP).

4.6.3.1 Business Process Reengineering

Business Process Re-engineering is the strategic analysis of business processes and the planning and implementation of improved business processes to achieve breakthrough improvements in performance measures (Choi and Chan, 1997). The analysis and design of workflows and processes is within and between organisations and is often customer centred and holistic in approach. Information technology (IT) can support BPR in many ways. Software can be used to help with gathering information about the current business

organisation. Other packages, such as workflow and process analysis tools, business modelling and simulation, on-line analytic processing (OLAP) and data mining, also have a role to play in international carriers' business process re-engineering.

4.6.3.2 Enterprise Resource Planning

Information and communication technology enable firms to communicate with each other and exchange data instantly, deeply changing the relationship between firms as well as production processes management and delivery procedures. In this way, all the logistics processes associated with manufacturing production have seen their relative importance in corporate management increase significantly during the last few years. The use of ICT has also enabled international carriers effectively to provide transport services to global enterprises, to respond to lower-cost and overseas competition, and to deliver goods more quickly.

The concept of enterprise resource planning (ERP) is being extended to linking information throughout an organisation so that it can be accessed at unlimited points. There are many reasons that international carriers will find it necessary to implement this concept used by manufacturers; firstly, demand from global enterprises is changing, as they need transport information concerning transported goods; secondly, the concept is useful for international carriers, as they can save time and reduce cost; thirdly, international carriers have to provide more than transport information to global enterprises, as they provide logistics service to global enterprises, including information concerning inventory, sales and orders; fourthly, ERP solutions are appealing to cost-conscious customers, not only because they enable operative effectiveness, but also because they have lower implementation costs (Stopford, 2002; Choi, et. al., 2003; Giannopoulos, 2004).

It has been discovered in Section 4.6.2 of this Chapter that international carriers adopt three network strategies, i.e., *vertical integration, horizontal integration and ICT integration*, to managing global logistics services. This has already examined the second research objective (O2). It also found that numbers of factors are critical for international carriers gaining competitive advantages in providing global logistics services. These may be customer service, strategic networks, logistics function, and business reengineering. But they are not exact to examine the third research objective. Therefore, 26 items collected in this section (4.6), as shown in Table 4-8, will be used for preparing the second question of the questionnaire survey to examine the factors relevant to international carriers gaining competitive advantages in providing global logistics services. These 26 items obtained from seven papers shown in the table have also been re-evaluated through the discussions carried out during the pilot stages of questionnaire design.

Table 4- 8: Critical Items of Global Logistics Services

Factors/ Authors	Semeijn& Vellenga 1995	Lynch, 2000	Lobo & Zairi, 1999	Panayides & Cullinane, 2002	Lieb & Miller 2002	De Souza J. et al., 2003	Lemoine & Dagnae 2003
1.Cargo consolidation and distribution service	v	v	v	v	v		v
2. Enhancing transport network to reduce delivery time		v	v	v			v
3. Provision of land/air/sea transport		v	v				
4. Provision of freight bill audit/payment		v	v				
5. Large or simplified transport fleet			v				
6. Investing in dedicated terminal operations			v				
7. Investing in warehouse/distribution centre operations	v	v	v		v		v
8. Provision of inventory control	v	v			v		
9. Cargo value added service (product marking etc.)	v	v	v		v		
10.Specialised cargo services			v				
11.Product returns and repair		v			v		
12.Transport/logistics planning for shippers	v	v			v		
13.Call free customer service/feedback/consultant			v		v		
14 Provision of customs clearance service		v			v		
15.Business alliances with global shippers							
16.Order entry, processing and fulfilment		v			v		
17.Slot exchange/code sharing/strategic alliance with other carriers			v	v		v	v
18.Partnership or joint venture with other carriers						v	v
19.Merger or acquisition of other carriers	v		v	v		v	v
20.Business process re-engineering /BPR							
21.Enterprise resource planning							
22.Intra-organisational information networking			v				
23.Inter-organisational information networking	v		v				v
24.Information links with business partners	v	v	v		v		v
25.Providing web service	v	v	v		v		v
26.Joining shippers' portals							

Source: collected by Author

Note: These 26 items are taken from seven sources shown in the Table and from interviews

As described in Section 2.4 of Chapter 2 and Section 4.6.2 of this chapter, information and communication technology has been widely used in international transport industry and international carriers have also used ICT in managing transport operations and conducting business transactions with trade partners. Based on the literature review of ICT implementation in transport industry, the second hypothesis is formulated to further examine through questionnaire survey. The hypothesis is as follows,

Hypothesis: **H2: ICT implementation is a key factor in providing global logistics services**

4.7 Summary

This chapter has studied the evolution of global logistics services, the categories of global logistics service providers, drivers of global logistics services, and critical factors for global logistics services. It has been found that more and more firms expand their markets worldwide and source their materials abroad; they even conduct global production to gain the benefits of global marketing and sourcing. They are aware of the importance of logistics in business strategy and demand global logistics services. On the other hand, carriers, warehouse/distribution operators, brokerage/forwarders and information consultants have evolved to provide global logistics services. However, the movements of international freight by international carriers comprise a number of processes and information, such as the documentation, data of trading, cargo handling, customs clearance, inland transport, terminal operation, and international transport. Therefore, numbers of enterprises are participating in the international freight transport chain; these include traders/shippers, brokers, freight forwarders, hauliers/inland

transport operators, carriers/agents, terminal operators, banks, consignees, logistics service providers, insurance companies, and other government bodies and trading organisations.

This chapter has also discovered that four factors, *market, cost, government and competition*, are driving the evolution of global logistics services. It has examined the second research objective (O2); **three network strategies, *vertical integration, horizontal integration and ICT integration*, are adopted by international carriers to managing global logistics services.** However, it has not exactly found the critical factors relevant to international carriers gaining competitive advantages in providing global logistics services. Therefore, 26 items collected in this chapter will be used for preparing the questionnaire survey for this research to examine the third research objective (O3), **the critical factors relevant to international carriers gaining competitive advantages in providing global logistics services.** In addition, 15 items collected in this chapter will also be used for preparing the questionnaire survey to examine the first research objective (O1), **the driving forces for the evolution of global logistics services**; and two hypotheses, **H1: International trade is influencing global logistics services and H2: ICT implementation is a key factor in providing global logistics services,** are also formulated.

Chapter 5 Governmental Plans for Global Logistics Hubs

Chapter Aims:

- In-depth review global logistics hub related government development plans
- Conduct competitiveness analysis of development plans
- Identify and examine global logistics hub related research objectives
- Collect global logistics hub items for questionnaire survey and raise hypotheses

5.1 Introduction

Three research objectives stated in Chapter 1 are related to global logistics hubs; these are: O4: To examine transport policies that most governments adopted to modernise their seaports/airports, O5: To study the unique position of Taiwan's seaports/airports in performing as global logistics hubs, and O6: To analyse the factors relevant to the success of a global logistics hub.

The seaport/airport plays an essential role in a seamless global logistics chain. This chapter is intended to review governmental plans for developing seaports/airports into global logistics hubs, aiming to examine global logistics hub related research objectives. The main issues addressed include: Taiwan's global logistics hub development plans, logistics hub development in Asia, and competitiveness analysis of the development plan. From a detailed understanding the global logistics hub plans, items relating to the success of global logistics hubs are obtained for preparing questionnaire survey and to formulate hypothesis.

5.2 Taiwan's Global Logistics Hub Development Plans

Taiwan's government has initiated a number of global logistics hub development plans

since 1995. It intended to transform Taiwan's seaports/airports into global logistics hubs and to facilitate the conduct of global logistics services in Taiwan.

5.2.1 The Background of the Development Plans

Taiwan has experienced enormous economic changes since the government moved into Taiwan in 1945. Its gross national product (GNP) per capita rose from US$ 145 in 1951 to US$ 14,032 in 2004. The history of Taiwan's economic development since 1950 has been addressed in Session 1.2 of Chapter 1. Since the 1980s, Taiwan became one of four Newly Industrialised Countries (NICs) in Asia and a leading manufacturing country in high-tech products, such as consumer electronics and computers. However, high production costs have compelled many Taiwanese manufacturing firms to adopt global approaches in order to gain competitive advantages since the 1990s. As a result, Taiwan has become one of the major Foreign Direct Investment (FDI) exporters to ASEAN and China (Wong, et al., 2001); more and more manufacturing firms set up off-shore plants to conduct global production. Therefore, the government has to seek new opportunity to meet economic changes in Taiwan. One of the governmental plans is the Asia-Pacific Regional Operations Centre (APROC) plan, aiming to establish Taiwan as operation bases for global enterprises conducting business in Taiwan. Two other governmental plans, Global Logistics Development Plan and Trade Facilitation e-business Plan, have also been initiated to develop Taiwan as business and logistics hubs for the region and the world.

The idea behind the APROC plan is that Taiwan will need to adapt in line with changes to its comparative advantage. The plan initiated by the government was based on the changes in Taiwan and the world economic environment. Taiwan has moved from labour-intensive to capital-intensive manufacturing since the years of the 1980s. In 1993,

high tech products accounted for more than 41% of total export volume; the service industry also increased to 56% of Taiwan's GDP (CEPD, 1995). As domestic labour costs have increased, low skilled work moves out of the island to locations where labour costs are lowers.

With its advantageous geographic location and considerable economic strength, the government believed that Taiwan could operate as a base for local and foreign enterprises to conduct business in East Asia as well as the window through which East Asian countries could expand their foreign trade. It intended to transform Taiwan into hubs for manufacturing, transportation, financial and media interests in the Asia-Pacific region.

5.2.2 The Key Plans For Global Logistics Hub Development

The key plans for global logistics hub development initiated by Taiwan's government comprise APROC's Transport Centre Sub-plans, Global Logistics Development Plan, and Trade Facilitation e-business Plan.

5.2.2.1 APROC's Transport Centre Sub-plans

Taiwan's APROC plan, initiated in 1995, consists of six operation centre sub-plans. Three of them are related to transport development; these are sub-plans for developing a sea transhipment centre, an air transhipment centre, and a telecommunications centre.

The purpose of the sea transhipment centre sub-plan is to develop Taiwan's seaports as East Asian hubs for container transhipment and related cargo processing, as the trend in global container shipping is the formation of regional hub-and-spoke operations concentrated in good geographic locations and with well-equipped deep-water seaports. Taiwan's seaports, capable of a number of competitive advantages, are eligible to be

container hubs for the region. The sub-plan consists of four major projects: offshore shipping, maritime information and telecommunications, port integration and coastal shipping, and the reform of the shipping and seaport administrative system (MOTC, 1996a).

The purpose of the air transhipment centre sub-plan is to develop Taiwan's airports as East Asian hubs for cargo and passenger transhipment and related cargo processing. As the trend in airfreight transport is also the formation of hub-and-spoke operations in the same way as for container shipping, Taiwan's airports could be hubs for regional air cargo and passengers. The sub-plan consists of four major sub-plans: the development of air cargo express, air cargo information and telecommunications integration, passenger transhipment, and an airport city (IOT, 1993; MOTC, 1996b).

The purpose of the telecommunications centre sub-plan is to develop Taiwan as a base for the provision of region-wide telecommunications services. It also entails providing reasonably priced and high quality telecom services, thereby making it more favourable for local and foreign enterprises to set up regional communications networks. The sub-plan consists of five major sub-plans: the liberalisation of telecom services, the provision of a new regulatory authority for telecom services, the corporatisation of the existing Directorate General of Telecommunications, expanding connections with cable networks in the Asia-Pacific region, and the speeding up the building of a National Information Infrastructure (NII) (MOTC, 1996c).

5.2.2.2 Global Logistics Development Plan

The Global Logistics Development Plan is a sub-plan of the Challenge 2008 National Development Plan. Since the year 2000, Taiwan has faced three problems: global

competition, China's magnetic effect, and a historical burden. In particular, the cheap labour and land, the vast market and preferential measures in China have been luring global capital and technology. Thus, in 2002, Taiwan launched a new project, the Challenge 2008 National Development Plan. The plan is intended to call for all-out investment in manpower, research and innovation, logistics channels, and the living environment so as to meld a new international competitiveness for Taiwan, as well as initiating the Global Logistics Development Plan and implementing the concept of Free Ports to develop Taiwan as a global logistics centre.

Taiwan's economy almost completely relies on foreign trade. The APROC plan led to the finding that the expansion of seaports/airports' functions for cargo transhipment could not meet the logistics demands from international carriers and shippers. The government published the Global Logistics Development Plan in 2000 in order to create value-added logistics activities in the seaports/airports. The key measures of the plan included:

- Enact the Act for the Establishment and Development of Free Ports
- Promote B2G, B2B and B2C in transport and trade industries
- Facilitate goods distribution
    - Introduce private enterprises to invest in the new Taipei port
    - Set up a Cargo Distribution Zone in CKS airport
    - Continuously improve the customs clearance environment
- Improve transport infrastructure (CEPD, 2000)

5.2.2.3 Trade Facilitation e-Business Plan

In coping with the trend for e-commerce in trade business and to reach the goal of APEC's paperless trade process, Taiwan's government also announced the "Trade Facilitation e-business Plan" in 2002 to continually promote e-business in trade and transport industries. The plan is focused on the promotion of ICT in three areas, the trade process, customs clearance, and port and shipping businesses, intending to re-engineer

current existing systems and develop new systems for facilitating trade and transport. There are three sub-plans in the plan, i.e., the Paperless Trade Sub-plan, the Customs Clearance System Reengineering Sub-plan, and the Port and Shipping Automation Sub-plan.

Taiwan began to promote ICT uses in industries through government agencies in the early 1980s. The Ministry of Economic Affairs (MOEA), responsible for the use of information technologies in trade and manufacturing, implemented the Nationwide Commercial EDI/VAN System in 1992 to build a standardized, open and automated commercial transaction environment. In 1994, the Ministry of Finance (MOF) began to promote EDI application in the finance industry, establish financial EDI standards and implement a financial EDI common system. A Financial Information System Company (FISC) was formed for inter-bank withdrawals. The Ministry also initiated a cargo clearance automation planning and promotion (CCAPP) task force in 1990. Tradevan was formed in 1996 and has developed a range of web-based front-end systems to enhance customs clearance. Table 5-1 shows the current functions and services provided by Tradevan in Taiwan.

Table 5- 1: Current Functions and Services provided by Tradevan

Cargo Clearance	E-Commerce
• Sea cargo clearance	• E-supply chain
• Air cargo clearance	• E-procurement
• Duty payments	• E-marketplaces
• Bonded factory document exchange	• Global logistics service

Source: Tradevan (http://www.tradevan.com.tw)

Envisaging ICT development and its importance to global supply chains, the Ministry of Transportation and Communications (MOTC) launched the "Port and Maritime Operations Automation Project" (PMOAP) in 1996. It aimed to integrate the information

systems used for maritime operations, custom clearance and port operations to a unified, paperless and rational network, which could enhance the use of electronic data interchange (EDI) and electronic commerce (EC) in seaport and shipping industries. The project, in the same way as the air cargo information and telecommunication system, was based on the NII improvements of the telecommunications centre sub-plan to establish information platforms and infrastructure for the industries. It included the following tasks: (1) to overhaul existing port management information systems, (2) to develop port information networks, (3) to establish a maritime database, (4) to establish a maritime information network, (5) to promote port and shipping EDI, and (6) to coordinate the establishment of a telecommunication network (MOTC, 1996d).

In order to raise interest in the maritime industry in the use of EDI and EC, the MOTC has, since 1996, contracted the Institute for Information Industry (III) to promote EDI/EC uses in the seaport and shipping industries. In addition, the MOTC has delegated the state-owned Chunghwa Telecom Company to develop the Maritime Transport Network (MTNet) to speed up the information integration of seaport and shipping operations. The MTNet, a web-based platform, includes Intranets for internal use by seaports and maritime transport operators, Extranets for external use among maritime transport operators, and a central website for providing Internet services for seaport and shipping users (MOTC, 1996d). Internet services provided by the MTNet website will include:

- Port and shipping community directory
- Shipping services
- Seaport services
- Network services
- Telecommunication Infrastructure
- Maritime Database
- Portnet Integration (DCBG, 1997, 2003)

5.2.3 The Essentials of the Global Logistics Hub Development Plans

The essentials of the global logistics hub development plans initiated by Taiwan's government can be characterised in terms of the integrated development of logistics hub infrastructures, the encouragement of private participation, the reform of seaport/airport administrative system, the reform of dock labour system, and the enhancement of ICT use in trade and transport. These are addressed in the section that follows.

5.2.3.1 The Integrated Development of Logistics Hub Infrastructures

As mentioned in the above section, 5.2.2, three plans initiated by the government in recent years are related to the development of global logistics hubs in Taiwan. These are:

- Asia-Pacific Regional Operations Centre (APROC) Plan, 1995
- Global Logistics Development Plan, 2000
- Trade Facilitation e-business Plan, 2002

The APROC plan consists of sub-plans to create six centres: sea transhipment, air transhipment, telecommunications, media, manufacturing, and finance. It is divided into three phases for implementation and is expected to last for 20 years. Phase I, from 1995 to 1997, is to speed up improvements in Taiwan's economic infrastructure and to develop small-scale operation centres for each centre; Phase II, from 1997 to 2000, is to expand the scale of the six operation centres and to make further adjustments to the structure of the economy; Phase III, from 2000 to 2005, is to fully liberalise the economic system and to complete major infrastructure projects (CEPD, 1995/1997).

The six APROC sub-plans are for a network of connections intended to operate to their mutual advantage. It is believed that a telecommunications system is fundamental to the satisfactory development of the concept of APROC. The telecommunications centre sub-plan is expected to make the most important contribution to manufacturing,

transportation, media and finance for the country and its international connections. Its telecommunications system will provide a NII for other centres and the whole country. The manufacturing centre will encourage enterprises to use Taiwan as an East Asian base for the production and distribution of high-value-added goods to turn Taiwan into an island of technology, and the sea and air transhipment centres will provide efficient and economic transport networks for transferring passengers and cargoes in the region.

In 1999, the government went further to develop Taiwan as a logistics hub for the region after it was found that the APROC plan was not in line with the trend for logistics development. The "Global Logistics Development Plan" was subsequently initiated in 2000, clearly defining its objective to develop Taiwan's seaports/airports as global logistics hubs. It aimed to build an even greater national competitive advantage through establishing an environment favourable to conduct global logistics operations in Taiwan. In addition, the government recognised that ICT plays a key role in facilitating the conduct of global logistics operations by global enterprises in Taiwan. The plan has set the promotion of e-business and e-commerce as one of its principal tasks. The promotion of ICT use will be focused on inter-organisational processes between business and government. In 2002, the government drafted the "Trade Facilitation e-Business Plan", aiming to achieve paperless processes in trade, customs clearance and international freight transport in line with APEC's project therefor, which is anticipated to be completed by 2005 among the developed countries of the APEC member states and by 2010 among developing countries.

5.2.3.2 The Encouragement of Private Participation

It is believed that business privatisation and competition can bring productivity in business operation. Taiwan's government began to privatise state-owned enterprises in

the 1980s to cope with the trend for transport deregulation. Private enterprises are further encouraged to participate in international freight transport operations since the amendment of transport-related laws and regulations in the 1990s. Foreign enterprises are also free to conduct operations in international freight transport, terminals, warehouses, cargo forwarding and others. Port of Kaohsiung, for example, 23 of its 26 container terminals were contracted out to private shipping companies, as shown in Table 5-2.

Table 5- 2: Current Container Terminals contracted out in the Port of Kaohsiung

Carriers	Terminal No.	Length (m)	Depth (m)	Location
APL	68- 69	432/320	14	Third Container Centre
Evergreen	79-81	355/340/120	14/15	Fifth Container Centre
	115-117	277/320/320		Fourth Container Centre
Hyundai	75	320	14	Fifth Container Centre
Maersk	76-77	320/356	14/15	Fifth Container Centre
	118-119	320/320	14	Fourth Container Centre
NYK	121	320	14	Fourth Container Centre
OOCL	65-66	244/440	12/14	Second Container Centre
Yangming	70	321	14	Third Container Centre
	120	320		Fourth Container Centre
United	42-43	243/188	10.5	First Container Centre
Great Ocean	78	320	15	Fifth Container Centre
Wan-Hai	63-64	275/245	12	Second Container Centre

Source: Port of Kaohsiung, Taiwan, 2004

5.2.3.3 The Reform of Seaport/Airport Administrative System

Currently, Taiwan's international seaports/airports are state-owned. Their authorities conduct almost all of the operations in them and play the roles of regulator and operator. The government began to study on the reforms of port administration system in the 1990s. In July 1995, the Kaohsiung Harbour Administration Committee was set up within the Ministry of Transportation and Communications to examine current fundamental problems in the Port of Kaohsiung. Port reforms include:

- To set up a Maritime Administration under the MOTC.
- To restructure the Kaohsiung Harbour Bureau, then the other harbour bureaus.
- To privatise the port and to encourage private enterprises to engage in port and terminal operations.
- To set up a compensation fund for dock labour reform.
- To set up free port zones in each port.

The government has also completed studies on the reforms of airport administration and operations since the instigation of the APROC plan. These include:

- To restructure the civil aviation authority.
- To corporatise CKS airport and restructure the airport authority to become commercially operated.
- To privatise the airport operations and encourage private enterprises to engage in terminal operations.
- To set up a cargo consolidation distribution park capable of functioning as a free trade zone in CKS airport.

5.2.3.4 The Reform of Dock Labour System

Dock labour reform in Taiwan was initiated by the government in 1995 and completed in 2000. Before the reform was completed, dock labourers in the ports of Keelung, Kaohsiung, Hualien and Suao were not employed by stevedoring companies or by port authorities; the exception was the Port of Taichung. The dock labourers in each of these ports participated in the dock labour union, which acted as an independent third party and engaged in cargo handling.

The MOTC began to draft Taiwan's Dock Labour Reform Plan in 1995. Through continual negotiation with the union, the reforms were completed in the year 2000 and new stevedoring companies were set up at each port. Totally, around NT$ 20.5 billion (NT$50=£1) was compensated to the dock labourers, as shown in Table 5-3. It was estimated that Port of Kaohsiung experienced a growth in gross productivity of 37.5% and 29.3% for container ships and other ships respectively between 1997 and 2001; Port of Keelung experienced a growth of 18.4% and 19.7% for container ships and other ships respectively between 1998 and 2001; Ports of Suao and Hualien experienced a growth of 7.8% and 18.6% for other ships respectively between 1998 and 2001 (Chen, 2003).

Table 5- 3: The Result of Redundancy at Ports in Taiwan

Port	Kaohsiung	Keelung	Suao	Hualien	Total
Number of dock workers	3,781	2,733	187	178	6,879
Total payment	11,033,634,312	8,281,085,374	590,994,673	620,186,058	20,525,900,417
Payment per worker	2,918,179	2,986,327	3,078,097	3,370,576	2,961,890
Number of Re-employed	2,530	1,764	166	144	4,604

Note: Payment based on NT$. Exchange rate: £1=NT$50
Source: MOTC and Chen (2003)

5.2.3.5 The Enhancement of ICT Use in Trade and Transport

Business information systems are prevalent in a variety of industries. Connections and linkages of information systems could be in-house, local, domestic, national or international. Telecommunications play, without doubt, an important role in the success of information systems. A great number of countries have introduced initiatives in launching a national information infrastructure (NII) aimed at improving the information society through increasing IT diffusion and encouraging IT production.

In Taiwan, a 10-year NII project was introduced in 1994 and formulated to APROC's National Information and Communications Infrastructure Action Plan in 1997, aiming to upgrade Taiwan to become a telecommunications hub in the Asia-Pacific region (Wang, 1999). The deregulation of the telecommunications sectors has rapidly made Taiwan globally viable, introducing competition first in the consumer equipment sector and subsequently in domestic value-added networks. This will help Taiwan continually reap the further benefits of converging infrastructure and other IT products (Jussawalla, 1999). Taiwan has also participated in UN/EDIFACT message development and implementation. EDI/VANs have been set up in trade, customs, manufacturing, and transport industries, facilitating transactions between them. These VANs are proprietary and cost a lot to operate. The advent of the Internet has compelled government agencies

and private enterprises to work together to reengineer these systems and develop new systems for inter-organisational transactions.

5.3 Logistics Hub Development in East Asia

The economy of most Asian countries has continually grown in recent years. Among the countries of East Asia, Japan, Korea and Taiwan are world leading manufacturing nations. International trade and container traffic has increased year by year. China's economy has been developing since it adopted an "open door" policy in 1978. The throughput of foreign trade cargo increased from 0.34 billion tons in 1996 to 1.16 billion tons in 2004. Its 14 main container ports handled 7.714 million TEUs in 1996 and reached 56.62 million TEUs in 2004 (MOC, 2005). In 2003, China became the world's largest exporter of containerised cargo, with 14.4 million TEUs, followed by Japan, the second largest Asian exporter. In Southeast Asia, Singapore is already a developed country. Malaysia, the Philippines, Indonesia, Thailand and Vietnam have also successfully developed their national economies. With their strong bases of natural resources and labour and continuing reductions in bureaucracy, these countries have attracted foreign investment and have become key locations for strategic investors.

Table 5-4 shows that container traffic of world's major trade routes reached 34.88 million TEUs in 2004. The traffic from and to Asia is still the largest among the major trade routes, accounting for 86.2%. Asian containerised export reached to more than 35 million TEUs in 2004. Around one-third of them went to other Asian countries, indicating that intra-Asian containerised trade was important for most Asian countries (UNCTAD, 2004).

Table 5- 4: Estimated Cargo Flows Along Major Trades Routes

Unit: million TEU

Year	Trans-Pacific		Europe-Asia		Trans-Atlantic	
	Asia-USA	USA-Asia	Europe-Asia	Asia-Europe	USA-Europe	Europe-USA
1997	4.66	3.61	2.73	3.29	1.27	1.56
1998	5.22	3.33	2.71	3.49	1.33	1.70
1999	5.84	3.37	2.85	3.95	1.34	1.71
2000	6.15	3.54	3.05	4.15	1.41	1.80
2002	8.81	3.9	3.94	6.13	1.50	2.59
2003	10.19	4.05	7.26	4.92	1.72	2.9
2004	11.78 (15.6%)	4.3 (6.2%)	8.4 (15.7%)	5.6 (13.8%)	1.8 (4.6%)	3 (3.4%)

Source: Review of Maritime Transport, 2000, 2004, 2005

Note: ( ) percentage of change, comparing to previous year

The Pacific Basin, as with container shipping, also dominates the geography of air services. The intra-Asia, Asia-North America, and Asia-Europe air cargo markets accounted for 43% of the world's freight ton-kilometres (FTKs) and just fewer than 30% of the world's freight tons in 2002 (Boeing, website). It is expected to grow from 4.6% to 7.0% during 2004-2008 in terms of freight tons (IATA, 2004). The expansion of airfreight is the product of several factors; firstly, the rapid growth of trade in Asia and the world has driven airfreight volumes upwards; secondly, knowledge-intensive goods with high value-to-weight ratios, such as semiconductors and other electronic components, comprise a growing share of global trade; thirdly, airfreight rates exhibit a long-term downward trend, falling on average by more than 3% annually; and fourthly, the expansion of air cargo flow has been fuelled by the adoption by a growing number of manufacturers of supply chain management practices that place a premium on the speed and reliability of transport (Bowen, 2004).

5.3.1 Main and Hub Seaports in East Asia

In Northeast Asia, **Japan** has five main container ports: Tokyo, Yokohama, Kobe, Nagoya, and Osaka. Other ports handle containers on a small scale. The Port of Tokyo ranks at the top of Japan's container ports in terms of container volume since 1998. Japan

has a number of berths with a depth of more than 14 metres, which can accommodate the new generation of container ships. Tokyo, Kobe and Yokohama are already transhipment centres in the region. **South Korea** is ambitiously expanding its container port facilities; Pusan, Inchon and Kwangyang are leading container ports in South Korea. Pusan has four container terminals, handling 11.43 million TEUs in 2004 (Cargo Systems, 2005). To cope with its booming market, **China** has strongly introduced private enterprises into port development. Among the 14 container ports in China, Qingdao in the northeast, Shanghai in the east and Shenzhen in the southeast have become its three leading transhipment ports (Cargo System, 2004). Adjacent to the booming market of the Pearl River Delta (PRD) in China, the Port of **Hong Kong** achieved a container throughput of 21.93 million TEUs in 2004. The port retains its position as the world's leading container port. **Taiwan**, with a strong manufacturing market, has three main container ports, Kaohsiung, Keelung and Taichung, which provide facilities for Taiwan's import and export of cargo. The Port of Kaohsiung was ranked as the world's sixth largest container port in 2004.

In Southeast Asia, **the Philippines** has seen a big change in its government's trade policy and reforms have been made in many areas of the port and shipping industry since 1992. It has five primary container ports: Manila, Cebu, Davao, Iloilo and Zamboanga. The container traffic accounted for 3.83 million TEUs in 2004, of which 2.6 million TEUs were handled in the Port of Manila (Cargo System, 2005). **Indonesia** has four main container ports: Tanjung Priok, Tanjung Perak, Belawan and Ujung Pandang. The shortcomings of the shore-side infrastructure have hindered containerised export growth. The government has called for the development of a large new port in Serang (western Java), west of Jakarta, in addition to the construction of a third terminal in Tanjung Priok. **Malaysia's** economic development has been very successful. Manufactured goods have

overtaken its traditional export base of primary products. GDP per head reached US$ 9,700 in 2004, second only to Singapore in Southeast Asia. Malaysia has eight main container ports. Port Klang serves the Kuala Lumpur area, and has been the main Malaysian gateway to the world. Penang is localised as the outlet for Northwestern Malaysia. Tanjung Pelepas is located at the southern tip of Malaysia, opposite Singapore. **Vietnam** began to open its market to the outside world in 1985. Potential investors have been lured to Vietnam by its low labour costs. It has become one of the key places for strategic investors in Southeast Asia. Vietnam has three primary economic zones: Hanoi, Da Nang and Ho Chi Minh City (HCMC). At present, Vietnam has four container ports: HCMC in the south, Hauphong and Cai Lan in the north, and Da Nang in the central region. **Thailand's** economic growth rose very quickly during the 80s and early 90s. Thailand has three primary container ports: Bangkok (Klong Toey), Laem Chabang and Sattahip. The new deep sea Port of Laem Chabang (LCP) opened in 1991: it has a mix of state-run and private terminals, around 110 km south of Bangkok. LCP has already fulfilled the aims of the Port Authority of Thailand (PAT). It handled 3.62 million TEUs in 2004 (Cargo System, 2005). With its geographic location on the mainline of Asian and European ocean trade, **Singapore** is a success, both as a port and a trading state. From 1985 to 1995, container shipments through Singapore increased at a compound rate of 20%. It continues to dominate the Southeast Asian transhipment sector until now; container transhipped at Port of Singapore is estimated at 70-85% of its container volume (UNESCAP, 2001).

Table 5-5 presents the East Asian nations' containerised exports (in million TEUs), their main container ports, and container throughput of leading ports in these nations. Fig 5-1 shows the container traffic among selected Asian ports from 1980 to 2004, presenting the growth of container traffic during this period.

Table 5-5: Leading Seaports in East Asia and Their Container Throughput

Unit: million TEUs

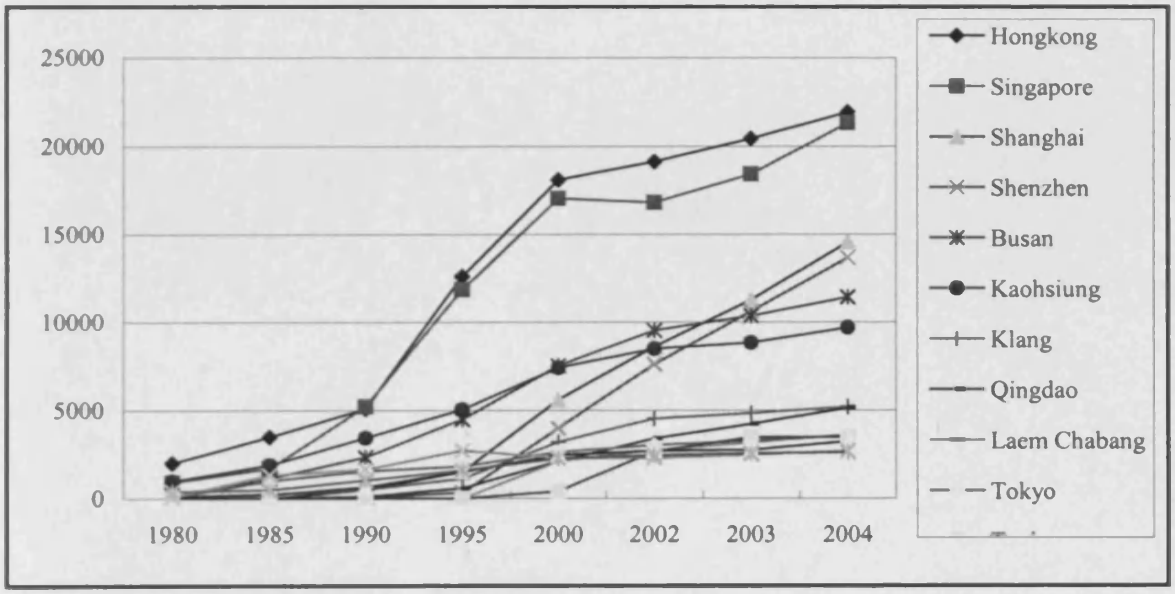
Nations	Export (TEU)	Main container ports	Leading ports	Container Throughput 2001	2002	2003	2004
Japan	3.95	Tokyo, Yokohama, Kobe, Nagoya, Osaka	Tokyo	2.7	3.0	3.3	3.58
Korea	2.76	Pusan, Inchon, Kwangyang	Pusan	8.0	9.4	10.3	11.43
Hong Kong	0.59	Hong Kong	Hong Kong	17.9	19.1	20.4	21.93
China	13.39	Tianjin, Dalian, Qingdao, Shanghai,	Shanghai	6.3	8.6	11.3	14.55
		Xiamen, Ningbo, Shenzhen, Guangzhou	Shenzhen	5.0	7.6	10.6	13.66
Taiwan	2.68	Kaohsiung, Keelung, Taichung	Kaohsiung	7.5	8.4	8.8	9.71
Philippines	0.52	Manila, Cebu, Davao, Iloilo, Zamboanga	Manila	2.3	2.4	2.5	2.62
Thailand	1.79	Bangkok, Laem Chabang, Sattahip	Laem Chabang	2.3	2.7	3.1	3.62
Indonesia	2.20	Tanjung Priok, Tanjung Perak, Belawan,	Tanjung Priok	2.2	2.3	2.7	3.25
		Ujung Pandang	(Jakarta)				
Vietnam	0.37	HCMC, Hauphong, Cai Lan, Da Nang					
Malaysia	1.67	Port Klang, Penang, Johor, Kuantan, Kota	Port Klang	3.7	4.5	4.8	5.20
		Kinabalu, Kuching, Sandakan, Sibu	Tanjung Pelepas			3.4	3.48
Singapore	0.96	Singapore	Singapore	15.5	16.9	18.1	21.33

Source: UNESCAP, 2001; UNCTAD, 2004; Cargo Systems, 2005; and author

Note: Figures of Asian nations' containerised exports were the data of 2003

Fig 5- 1: Container Traffic Development among selected Asian Ports

Unit: thousand TEUs



Source: Cargo Systems, and Author

These seaports are gateways to their own countries for cargo exports and imports; some seaports play a greater role than that as hubs servicing their neighbouring countries. In addition, according to the statistics of Cargo Systems, the rankings of the top 6 world

container ports in 2000 were Hong Kong, Singapore, Pusan, **Kaohsiung**, Rotterdam and Shanghai: five of these ports are located in East Asia. In 2004, the world's top 6 container ports, Hong Kong, Singapore, Shanghai, Shenzhen, Pusan, and **Kaohsiung**, were all located in East Asia.

5.3.2 Challenges to East Asian Hub Ports

Containerised cargo transport in Japan has been developed. However, the high terminal handling charges, port land price and tight control over port business prevent Japan's container ports from competing with neighbouring ports. These even lead to the overcapacity problem in Japan's container ports (Terada, 2002)

The economic development in China has led the ports of Hong Kong, Shanghai and Shenzhen to continue to grow. **Shanghai** and **Shenzhen** have many development projects taking place in the ports to meet the increasing demand for container handling. The increasing cargo flow has led to these two ports ranking as the world's third and fourth leading container ports respectively since 2003. In contrast, 66% of **Hong Kong**'s container traffic is handled through terminals, 23% at mid-stream buoys and anchorages and the remaining 11% by river trade vessels (Ko, 1997). The increased direct calls to the mainland east coast ports Yantian and Shekou (these two ports included in Shenzhen), and cheaper transhipment alternatives such as Kaohsiung, have led to transhipment through the Port of Hong Kong declining rapidly, significantly impacting its mid-stream operations, which are estimated to account for around one-third of Hong Kong's port container traffic. Port throughput growth of Hong Kong has dropped year-on-year in the past decade from 14.2% to 4.7% in 2001 and it is estimated to slow to approximately 2.5% to 3% in the coming years (Maritime Asia, 2002; PMB, 2002).

The absence of direct sailing between Taiwan and China has hindered the growth of Taiwan's container traffic. Port of **Kaohsiung** in Taiwan has seen a low growth rate of container traffic in the past years; its rankings dropped from the third of world leading container port in 1999 to the sixth in 2003. However, the value of annual cross-strait trade has increased very sharply in the past decade to $50.7 billion in 2004; China and Hong Kong have together become Taiwan's largest trading partner (MOEA, 2004). In contrast, the ports of Pusan, Manila, Klang, Tanjung Pelepas, and Laem Chabang are enjoying significant growth rates for container traffic. **Pusan** in Korea, located in Northeast Asia, is a hub port for Japan and Northern China, and has had a 16% annual growth rate since 1995. The ports of **Klang** and **Tanjung Pelepas** in Malaysia and **Laem Chabang** in Thailand also continue to grow due to the booming market and their governments' development programmes. The growth of these ports has, however, impacted on the growth of Singapore's container traffic (Mak and Tai, 2001).

Hong Kong and Singapore are the leading hub ports in Asia and indeed the world. Hong Kong has around 380 weekly container services at present. However, **Hong Kong** faces increasing challenges, such as (1) the world's highest terminal handling charges (THCs), $265 per 20ft box and $350 per 40ft box, (2) high road haulage costs to and from China, (3) cheaper and convenient port handling in the PRD's ports, and (4) a direct link between Taiwan and China. To cope with these challenges, the Port of Hong Kong has increased its efforts to establish itself as a major international logistics hub through its advantages, such as a higher frequency of calling, superior port productivity, enhanced transport link to hinterland, efficient logistics services, straightforward and transparent customs, world-class banking and financial institutions, and experience in international trade practices (Wang, 1998; Wang and Slack, 2000; PMB, 2001; CI, 2002; Cheung, et al., 2003; Song, 2003). The **Port of Singapore** has also encountered its challenges. The

port built the Pasir Panjang Container Terminal in the 1990s to accommodate the new generation of container ships in coping with its increasing container traffic. The high investment on terminals and ICT solutions has caused higher terminal handling costs that need to be levied on the users. Other competition also comes from neighbouring ports, such as the Port of Tanjung Pelepas (PTP) in Malaysia, located opposite Singapore. The move-out of Maersk Sealand and Evergreen from the Port of Singapore has caused its container traffic to surge in recent years. The port has undertaken port development strategies to cope with the increasing challenges from the neighbouring ports, one of which is the "Singport" concept, which links the port with other ports in the world within one system to provide integrated supply chain services to its customers on the basis of its highly advanced IT solutions. PSA Corporation, the owner of the Port of Singapore, became one of inter-port consortium and has participated in 14 port projects in eight countries (PSA, website). In addition, in response to the loss of Maersk Sealand and Evergreen, PSA dropped the handling charge for empty containers by 50% and cut fees for ships accommodating in the port. In 2003, PSA recovered the loss of the roughly 3 million TEUs from these two carriers the year before (Gordon, et al., 2005).

5.3.3 Air Freight Hubs in East Asia

Table 5-6 presents the world top 30 airports by cargo tonnage in 2004, 12 of which are located in East Asia: Tokyo (Narita and Haneda), Osaka, Beijing, Seoul, Shanghai, Guangzhou, Hong Kong and Taipei are located in Northeast Asia, while Singapore, Kuala Lumpur, and Bangkok are in Southeast Asia. These cities are home not only to major airfreight hubs, but also to major sea freight hubs. These two transport modes complement each other to some extent, particularly as the movement of goods is increasingly an adjunct to value-added third-party logistics services. The success of a hub is also interactively driven by its principal airline. For instance, Singapore's prominence

is to an important degree driven by the success of Singapore Airlines, whose network serves to amplify the intermediary status of the city. Other leading Asian hubs are also found each home to at least one major air cargo carrier.

Table 5-6: World Top 30 Airports by Cargo Tonnage, 2004

Unit: thousand Freight Tons

Rank	Airport (country)	Total Cargo	% Change	Rank	Airport (country)	Total Cargo	% Change
1	Memphis (US)	3,555	4.8	16	London (UK)	1,412	8.6
2	**Hong Kong (CN)**	3,119	16.9	17	Dubai (AE)	1,169	22.2
3	**Narita (JP)**	2,373	10.1	18	**Bangkok (TL)**	1,058	11.3
4	**Seoul (KR)**	2,155	15.8	19	Newark (US)	985	2.4
5	Los Angeles (US)	1,914	4.3	20	Indianapolis (US)	932	5.9
6	Paris (FR)	1,877	8.9	21	**Osaka (JP)**	888	11.9
7	Frankfurt/Main (GM)	1,839	11.4	22	Atlanta (US)	862	7.5
8	**Singapore (SQ)**	1,796	10.0	23	**Haneda (JP)**	774	7.1
9	Miami (US)	1,779	8.6	24	Dallas/Fort Worth (US)	742	11.4
10	Louisville (US)	1,739	7.5	25	Luxembourg (Lux)	713	8.5
11	New York (US)	1,706	3.1	26	**Beijing (CN)**	669	1.0
12	**Taipei (TW)**	1,701	13.4	27	**Kuala Lumpur (MY)**	655	11.1
13	**Shanghai (CN)**	1,642	38.1	28	Oakland (US)	645	7.9
14	Chicago (US)	1,475	-2.4	29	**Guangzhou (CN)**	632	16.2
15	Amsterdam (ND)	1,467	8.4	30	Brussels (BG)	628	7.2

Source: ACI Statistics, 2005, website

Note: (1) Anchorage (US) would rank fourth at 2.25 million tons but the bulk of this is transit traffic.
(2) % Change is compared with the previous year

5.3.4 Challenges to East Asian Airport Hubs

The cargo flow of an airport can be divided into three types: local flow, gateway flow and hub flow (Zhang, 2003). Most airports mainly provide cargo import and export services for their adjacent cities and industrial complexes. **Hong Kong**, with its excellent geo-political location, has become a key airfreight hub in recent decades. It serves as a gateway and a hub for China and Taiwan. Air cargo traffic in Singapore grew rapidly in the 1980s and 1990s. A large share of **Singapore**'s air cargo business is transhipment business, based to a significant degree on the integration of high-tech manufacturing activity around the Southern Asian region. The opening of **Incheon** International Airport (IIA) in Korea has provided new opportunities for Korea and China. Other airports in East Asia are the most significant airfreight hubs for their countries (Bowen, 2004).

It is believed that taking care of their own origin/destination (O/D) freight is a top priority for most airports. Some airports, for examples, Narita and Kansai in Japan, have capacity shortage problems. Taiwan's airports suffer from a lack of hub flow due to the ban on direct flights between Taiwan and China. Therefore, a leading airport would probably need to create sufficient O/D and transhipment freight by positioning themselves as a global trade centre as well as a hub for international logistics if it wants to compete with other neighbouring airports (Lee and Yang, 2003).

5.3.5 Trends in Asian Government Transport Policies

Most East Asian countries are feeling the demanding pressure for an efficient and effective transport service. They must respond to market conditions quickly and competently as the global transport industry becomes increasingly competitive. The transport policies that Asian countries have adopted can be categorised into institutional restructuring, commercial management, deregulation and privatisation, and expansion of infrastructure and facilities.

5.3.5.1 Institutional Restructuring

Most major seaport/airport organisations in East Asia used to be a government department or administrative authority. The prevailing organisation for seaport/airport ownership and management is the government-owned autonomous entity, followed by a directorate of administrative authority, a ministry or other government department, a concession or leasing arrangement and, lastly, a private entity. East Asian countries have essentially reflected this trend. The Port of Hong Kong is an exception. The port has no administrative authority. The government is the lesser of land sites to private terminal operators, and its Marine Department acts as port authority dealing with all navigational matters of the port. In Singapore, the Maritime and Port Authority (MPA) was formed in

1996, acting as the sole regulatory body for Singaporean port and maritime affairs. The Port of Singapore was incorporated in 1997. The PSA Corporation was transformed from the former Port of Singapore Authority and became an independent and private entity. Other examples are the corporatisation in Pusan port, Incheon airport, Penang port and Shanghai port. (Cullinane and Song, 2001)

5.3.5.2 Commercial Management

The transformation of a seaport/airport organisation involves changing its status from a government body to an independent or private entity. It is believed that this transformation can bring market-driven management and customer-focused service into seaport/airport operations. Most Asian seaports/airports introduce commercial management by the way of contracting out their terminals to private enterprises or bringing private enterprises into seaport/airport operations. The turnover of ownerships of national sea/air carriers is another example to show Asian governments' intention to keep in line with the world trend of commercial management of transport services.

5.3.5.3 Deregulation and Privatisation

Following global trends towards the deregulation and privatisation of the transport industry, many seaports/airports and national carriers in Asian countries have been privatised and deregulated. The private sector are introduced into terminal operations in the seaports/airports without regards to the ownership of seaports/airports, government or privately owned. Most East Asian countries, such as Japan, China, Malaysia, the Philippines, Indonesia and Taiwan, have published related deregulation or privatisation schemes, and the private sector become the main source of finance for transport infrastructure (Li, 1998; Cullinane and Song, 2001; Hooper, 2002; Wang, et al., 2004).

5.3.5.4 Expansion of Infrastructure and Facilities

In Asia, a number of mega seaport/airport developments have also been finished in recent years, such as Kwangyang Port and Incheon International Airport in Korea, Kansai International Airport in Japan, Kuala Lumpur International Airport in Malaysia, and Hong Kong International Airport in Hong Kong. The New Bangkok International Airport is expected to inaugurate in 2005. Other major new seaport and airport developments, such as runways and terminal facilities, have been seen in China and other countries.

Shanghai, for example, is in the stages of an expansion and upgrade programme, including the deepening of the mouth of the Yangtse River from its current depth of 7m to 12.5m, the expansion of facilities in the outer Waigaoqiao harbour area, the improvement of the efficiency of the Huangpu (inner harbour) facilities, and the new Yangshan port project in Shengshi, Zhejiang province, 40 km from Shanghai. The new port project, including a 52-berth container terminal on islands in Hangzhou Bay, is estimated to take 20 years to complete (Cargo System, 2004). A BOT project for the development of Taipei Port was, another example, signed in 2003 by the government with a consortium formed of local shipping companies, Evergreen, Wan Hai and Yang Ming. The first container berth is scheduled to complete before the end of March 2008.

It has been found in this section, 5.3, that most Asian governments followed the governments in Europe and North America to turn their leading seaports/airports into global logistics hubs. It has also examined the fourth research objective, O4: the transport policies adopted by most governments to modernise their seaports/airports are: institutional restructuring, commercial management, deregulation and privatisation, and expansion of infrastructures and facilities.

5.4 Benchmarking Logistics Hub Development

Some countries or economies are selected for further study to understand their governments' logistics development strategies. These include Singapore, Netherlands, Japan and Hong Kong.

5.4.1 Singapore

The seaport and airport in Singapore have successfully transformed from a transhipment hub for the Southeast Asian countries into a logistics hub for both the region and the world. Its development strategy could be divided into three stages; the first stage was the "Singapore: New Direction" development plan initiated by the government as it faced economic crisis in 1986; the second stage was "The Next Lap" development plan initiated in 1991. It aimed to transform Singapore into a "Global Business Centre" for exhibitions, conferences, tourism, trade, finance and regional operations; and the third stage was to develop Singapore into a global integrated logistics hub in 2002 (MTI, 2002). Their development strategies can be summarised as follows:

- Proclaim an open and free trade system to enhance international business competitiveness.
- Set up free trade zones to increase global resources
- Encourage MNEs to set up regional operation headquarters in Singapore
- Provide tax exemption for MNEs
- Strengthen regional strategic alliances

The Singaporean government foresees a role for logistics infrastructure in its economic development and is continuously strengthening its shipping and logistics infrastructures to gain competitive advantages for trade and transport business in the region. The government has carried out a number of measures. The first measure is the improvement of shipping services: the concept of a "One Stop Shipping Centre" has led to the provision of an integrated service to ships calling at the port. The second measure is the

commercial management of the port. The Port of Singapore Authority (PSA) was transformed into the PSA Corporation in 1997 and private enterprises have also been introduced into port services. The third measure is the investment in logistics hubs to provide good service in the transhipment of cargo. Several distribution parks have been set up in the Pasir Panjang, Alexandara, Tanjong and Keppel contaier terminals and Changi airport areas, which facilitate the transhipment of cargo in and out of Singapore for neighbouring countries (Gordon, et al., 2005).

The promotion of ICT use in business industries has had a long history in Singapore. In 1999, the government set up the Committee of the Logistics Enhancement and Applications Programme to enhance Singapore's logistics capacity and to promote ICT use in business industries. The network service systems have been well developed in the trade and transport industries. A number of systems are incorporated in the PSA IT set-up (Airriess, 2001). In addition, PORTNET is used as a community system, which allows the port users/customers access to data relevant to ship arrival, departure, vessel berthing schedules, container or cargo inquiries and access to the dangerous goods information system (portnet.com, PSA).

5.4.2 Netherlands

The Netherlands has been an active geographic hub for Europe. More than 70% of its GDP comes from service industries. A special organisation, Netherlands Foreign Invest Agency (NFIA), is dedicated to the service of multinational enterprises setting up headquarters or distribution centres in the country. There are a number of reasons for multinational enterprises to set up regional headquarters or distribution centres in the Netherlands. These include:

- The country has a good geographic position in Europe. Within a distance of 600 miles

from Amsterdam, it can service an area with a population of 244 million. Commodities can be transported to customers in not more than two days.

- The country has good transport infrastructure and European networks. Currently, Rotterdam and Schiphol (Amsterdam) have become a world-leading seaport and airport respectively. Telecom infrastructure is also well constructed to provide information and communication platforms for business transactions.
- Numbers of logistics service providers with professionals and expertise provide logistics services in the Netherlands; their services reach almost all of Europe.
- Highly qualified manpower with multi-language ability is another competitive advantage for enterprises and logistics service providers doing business in the country.
- The government provides tax deductions to encourage MNEs to invest.
- The establishment of dedicated organisations to manage and service foreign investments. (NFIA, Website; CEPD, 2003b)

5.4.3 Japan

Another world example of logistics development is that which has occurred in Japan. With limited natural resources, Japan endeavoured to develop its economy and has become one of the leading economies since World War II. International trade fully relies on sea, air and land transport. Since the years of the 1980s and 1990s, Japan's manufacturing industry has faced high labour costs and has sought productions in countries with low labour costs. This increasing demand for international freight transport has led to the transition from international carriers to transport logistics service providers. Currently, many large Japanese carriers, such as NYK and MOL, have logistics service departments or independent logistics companies providing third party logistics services for multinational enterprises. The measures taken to promote global logistics development in Japan can be summarised as follows:

- Improve port facilities to accommodate larger container ships. Many seaports, such as Tokyo, Yokohama, Osaka and Kobe, are capable of operating as deep-water terminals. The port management system has also been re-structured recently and private enterprises are encouraged to undertake port and terminal operations.
- Set up the free trade zones and provide tax deductions or exemption for enterprises

doing business in the zone. Currently, Japan has 22 foreign access zones set up by Japan External Trade Organisation (JETRO, Website).

- Improve customs clearance automation system
- Tax deductions to Logistics Service Providers
- Stipulate related laws and regulations
- The foreign access zones in Japan are divided into six categories: general logistics, distribution centre, cargo transit zone, seaport logistics park, airport logistics park, and warehouse and cargo station. (CEPD, 2003b)

5.4.4 Hong Kong

Hong Kong has maintained the position of being the busiest container port and international air cargo handling centre in the world for many years. The government, envisaging Hong Kong's excellent transportation facilities and the PRD's high productivity, initiated a plan in 2001 to develop Hong Kong into a logistics hub to link the Mainland with the world (HKPMB, 2001). The plan included the development of an inter-modal system and other supporting facilities to speed up the flow of goods and information and the provision of integrated services to strengthen Hong Kong's competitive advantage as a supply-chain base.

As logistics services span over sea, air and land transport, and involve various policy areas and services areas, including distribution, supply chain management and information technology, the measures taken by Hong Kong government include:

- The initiation of a "Logistics Hong Kong" plan in 2001, followed by other information system and logistics hub development plans, aiming to build on the solid foundation provided by Hong Kong's infrastructure to create an even more conducive environment (HKEDLB, 2002; HKLDC, 2002).
- Two new institutions, the Steering Committee on Logistics Development (LOGSCOM) and the Logistics Development Council (LOGSCOUNCIL), were set up to support the "Logistics Hong Kong" initiative.
- The LOGSCOUNCIL co-ordinates and carries out matters concerning "Logistics Hong Kong". Five project groups were set up under LOGSCOUNCIL: P-logistics Project Group for physical and regulatory infrastructure, E-logistics Project Group for

cyber and IT infrastructure, H-logistics Project Group for human resources, M-logistics Project Group for marketing and promotion, and S-logistics Project Group for small and medium sized enterprises' support.

- Other than the set-up of HK Airport Authority to managing Hong Kong International Airport in 1995, the HK Port Development Council, replacing former Port and Maritime Board, was set up to dedicate to port development in 2003 (HK Government, Website).

5.5 SWOT Analysis of Taiwan's Seaports/Airports

SWOT, standing for strengths, weaknesses, opportunities and threats, is a methodology used to aid strategic planning. SWOT analysis is to take the information from the environmental analysis and separate it into internal issues (strengths and weaknesses) and external issues (opportunities and threats). This can help to determine if the issues will assist a business in accomplishing its objectives or if they are obstacles that must be overcome or minimise to achieve desired results.

The government conducted a SWOT analysis to identify the strategic position of Taiwan's seaports/airports in 1996 (MOTC, 1996a/b). The results have been reviewed and described as follows:

5.5.1 Strengths

Taiwan's seaports/airports have several strengths, i.e., geographic location, market-oriented government policies, government-supported seaport/airport development, strong economic hinterland, modern information networks, efficient seaport/airport operations and competitive seaport/airport charges. Other strengths are good weather, adequate draught, sufficient facilities, and lease-out terminals for international carriers. These strengths have allowed Kaohsiung seaport and CKS airport to become leading international freight transport nodes in Asia.

Taiwan is located in the fast-developing Asia-Pacific region. Nearly all major liner routes, either eastbound to North America or westbound to Europe from Asia, pass through Taiwan. The government's policies are obviously to develop Taiwan as a logistics hub in the region. The support for seaport/airport development from the government will continue unabated. Taiwan also possesses an excellent telecommunications network with other countries. Advanced information technology has allowed Taiwan's seaports/airports to develop EDI/EC facilities linked with their users, as well as allowing international carriers to be connected with their branches and agents around the world.

5.5.2 Weaknesses

Some weaknesses, i.e., no direct links to China, restricted seaport/airport operation and a bureaucratic administrative system, are hindering Taiwan's seaports/airports from embracing technological changes and from developing as hub centres.

The booming market and the inadequate transport facilities in China have compelled international carriers to look for adequate seaports/airports to tranship cargo to and from China. Hong Kong has become the major cargo hub for China; Korea is the second and Japan, the third. Taiwan's policy of no direct cross-strait link is its major weakness in the logistics hub competition. Other problems in seaport/airport operations and the reforms of seaport/airport organisations are also important to Taiwan's seaport/airport modernisation.

5.5.3 Opportunities

China's booming trade and inadequate transport infrastructure give Taiwan a good opportunity to develop its seaports/airports as hub centres for cargo transport. China's

economy is expected to continue to grow, especially in Southeast provinces, such as Guangdong, Fuchien and Zhechung, where most Taiwanese investment is based. If the ban on direct transport links is abolished, the cross-strait transport between China and Taiwan, which currently goes through Hong Kong or Macao, is expected to increase very sharply. Other advantages that Taiwan has, which could lead to its seaports/airports becoming logistics centres in the region, are, for example, that around 20% of transport costs could be saved for cargo going through Taiwan's seaports/airports in place of Hong Kong, and that transit time for cross-strait trade between China and Taiwan could also be reduced significantly.

5.5.4 Threats

The external threats to Taiwan's seaports/airports are cross-strait relationships, competition from neighbouring seaports/airports, and market change in Asian countries. The political situation between China and Taiwan has been uncertain since the separation of these two countries in 1949. However, Taiwan began to trade with China in the 1970s. A policy of no transport links has compelled cargo trade between China and Taiwan to be transhipped via Hong Kong or another third place. Severe competition is also envisaged from East Asian seaports/airports in the region. Pusan and Soul in South Korea, Tokyo and Kobe in Japan and Hong Kong are current hubs for containerised cargo: these hubs are the major competitors of Taiwan's seaports/airports.

Market change will also be a threat to Taiwan's seaports/airports. Taiwan used to be a country with an abundance of import and export trade. The moving out of manufacturing industry has led to a small loss of containerised cargo. If China and Southeast Asian countries become leading market places instead, Taiwan may thus lose its attraction to mainline operators.

5.6 Competitive Advantages of Logistics Hubs

Following the study of global logistics hub development plans in Taiwan and the world, it is important to discover what are the strategies and critical factors for a logistics hub to gain competitive advantages.

5.6.1 Competitive Strategies

A seaport or airport used to be the node for cargo transfer from one mode to another. A modern seaport or airport has become one set of links in a global logistics chain, acting as a collection-distribution centre or logistics hub where many value-added activities are conducted. Hub-and-spoke networks appearing in shipping and aviation markets have proved the importance of a logistics hub in a global logistics chain. A logistics hub can be a large international load centre which dominates world trade, a medium-sized one which controls regional exchanges, or a smaller one which influences national commerce (Notteboom, 1997). At present, most Asian countries are endeavouring to transform their leading seaports/airports into global logistics hubs for both their countries and the region. Competition among these seaports or airports is intense. However, there is no guarantee for cargo to and from regions via the closest seaport or airport.

To gain advantage over its competitions, a seaport or airport needs to have business strategies dealing with its organisational cultures, institutional structures, operation systems, and facility provision (Ircha, 2001b). Strategic planning provides a vision or direction and develops specific goals, objectives and actions for achieving the desired vision. Before setting up business strategies, a clear appraisal of the seaport or airport is needed to identify its internal strengths and weaknesses and external threats and opportunities. This can help the seaport or airport to know where it is now in relation to its environment, and with strategic planning it can decide where it wants to go and how it

will get there. In addition, there are three types of corporate strategies for gaining competitive advantages. First, are internally-driven strategies, where the corporation evaluates its own assets and seeks to exploit internally-based advantages. Second, are customer-compelled strategies, in which the firms respond directly to satisfy customers' demands. Third, are market-focused strategies, in which business actions are oriented to providing superior value-delivery to target customers at a cost that provides acceptable profits (Slack, 1993). Therefore, if a seaport or airport wants to outperform other firms in an industry, it should intentionally apply Porter's three competitive strategies: overall cost leadership, differentiation, and focus (Porter, 1980).

5.6.2 Competitive Factors

What are the competitive factors that enable a seaport/airport to become a logistics hub? **In air transport,** Martin and Roman (2004) noted that the potential to generate traffic at the hub, a central geographical location in relation to the markets, good airport facilities, good weather conditions, the location of hubs, and strategic behaviour of competitors need to be considered when an airline chooses an airport in its network structure. Zhang (2003) pointed out that there are two principal reasons for a shipper to select the air mode as opposed to surface transportation. First, the speed of air transport, especially over long distances, is critical for goods requiring a short delivery time. Second, air transport's low risk of losing or damaging shipments is an advantage for goods with a high ratio of value to size. Thus, airports that are closer to shippers and have lower total costs and lower delivery times inevitably are strong candidates to become a regional air-cargo hub. This implies that geographical location, costs, and delivery time are competitive factors in the regional and global competition among airports to attract cargo traffic. Competitive factors also include infrastructure, customs, inter-modal transport, and international aviation policy. Park (2003) summarised the competitive advantage of an airport as

seeming to depend on "five core factors": **spatial factors** are the level of regional development around the airport, such as international trade zones, logistics and convention centres, aviation-related industrial complexes and other facilities; **facility factors** are the level of airport facilities and the expandability of the facilities at existing airports to increase capacity; **demand factors** are the level of origin-destination demand and that of transit and transfer traffic volumes for hub-and-spoke network development; **service factors** are the level of service to users, the types of airport operations, and the levels of charges; and **managerial factors** are economical considerations, such as airport operating cost, productivity and revenue structure.

In sea transport, Notteboom (1997) noted that the most common characteristics of a load centre port are related to its **location** (good foreland and hinterland accessibility and large hinterland), **operation** (high productivity, frequent ports of call, reasonable transportation and port-user costs, high cargo generating effect and high level of intermodality), **infrastructure** (state-of-the-art infrastructure and superstructure, large back-up-space on terminal) and **degree of integration** (EDI). Oum and Park (2004) examined the relative importance of location determinants for MNEs choosing a consolidated distribution centre. The top seven items are market size, geographic location and market accessibility, transport facilities, political stability, skilled labour, modern logistics service providers and costs, and pro-business government and offices. Lu and Fang (2002) used 29 items to evaluate the competitive advantages of international distribution centres for Kaohsiung port. These items were categorised into eight factors: efficiency, cost, location, facility, service, economies, politics, and policy.

Section 5.5 of this Chapter has examined the fifth research objective, O5: To study the unique position of Taiwan's seaports/airports. Through SWOT analysis, it has

been found that Taiwan's seaports/airports not only have their strengths and opportunities but also have weaknesses and threats. It also found that numbers of factors are relevant to the success of global logistics hubs. These could be location, market, operation, infrastructure, degree of integration, and political stability. But they are not exact to examine the sixth research objective. Therefore, 34 items collected in the section 5.6 of this Chapter, as shown in Table 5-7, will be used for preparing the third question of the questionnaire survey to examine the factors relevant the success of global logistics hubs. These 34 items obtained from six papers shown in the table have also been re-evaluated through the discussions carried out during the pilot stages of questionnaire design.

Table 5- 7: Summary of Successful Factors Related to the Global Logistics Hub

Items	Martin & Roman (2004)	Zhang (2003)	Park (2003)	Notteboom (1997)	Oum & Park (2004)	Lu & Fang (2002)
1. Efficiency of seaport/airport operations			v	v		v
2. Efficiency of terminal operations	v		v	v		v
3. Labour quality and skilled labour			v		v	v
4. Simplified seaport/airport process and documentations		v				v
5. Simplified Customs procedures		v				v
6. Seaport/airport management information system				v		v
7. e-business and community network integration				v	v	v
8. Reasonable seaport/airport charges		v	v	v	v	v
9. Seaport/airport operating costs		v	v	v	v	v
10.High cargo generating/value-added activities	v			v		v
11.Market size/large hinterland/Origin-Destination demand			v		v	v
12.International trade-related industrial complexes			v			v
13.Regional development around seaport/airport	v		v	v		v
14.Level of inland transport and inter-modality		v		v	v	v
15.Natural conditions of seaport/airport (e.g. weather)	v					
16.Geographic location/market accessibility	v	v	v	v	v	v
17.Seaport/airport infrastructure		v		v		v
18.Seaport/airport facilities and expandability			v	v	v	v
19.Free trade zone			v		v	
20.Logistics and trade centres			v			
21.ICT infrastructure						
22.Seaport/airport services to users			v			v
23.Introduction of modern logistics services providers					v	
24.Frequent sailings/flights				v		v
25.Pro-logistics business government and office					v	v
26.Government transport policy and actions		v				v
27.Privatisation of seaport/airport						v
28.Organisational restructure of seaport/airport			v			v
29.Direct transport link to China						v
30.Guarantee of foreign investment						v
31.Openness of foreign labour					v	v
32.Political Stability					v	v
33.Security of seaport/airport						v
34.Simplification of trade process						v

Source: Author

Note: These 34 items are taken from six sources shown in the Table and from interviews

As described in Section 2.5 of Chapter 2 and Section 5.3 of this chapter, most governments have adopted numbers of government transport policies to improve the efficiency and effectiveness of their seaports and airports and to facilitate the conduct of global logistics services in their countries. These governments also want to transform their seaports/airports into global logistics hubs. Therefore, based on the literature review of government transport policies on the development of a global logistics hub, the third hypothesis is formulated to further examine through questionnaire survey. The hypothesis is as follows,

Hypothesis:
H3: Suitable government transport policies can successfully establish global logistics hubs

5.7 Summary

This chapter has studied Taiwan's logistics hub development plans, the logistics hubs development in East Asia, and competitiveness analysis of logistics hubs. It has been found that many other East Asian countries, in the same way as Taiwan, endeavoured to transform their seaports/airports into global logistics hubs for the region. In order to transform the seaports/airports into global logistics hubs, Taiwan has initiated three government development plans in recent years, namely, Asia-Pacific Regional Operations Centre (APROC) Plan 1995, Global Logistics Development Plan 2000 and Trade Facilitation e-Business Plan 2002. The essential tasks of these development plans include the integrated development of logistics hub infrastructures, the encouragement of private participation, the reform of seaport/airport administrative system, the reform of dock labour system, and the enhancement of ICT use in trade and transport.

This chapter has also discovered that most governments in Asia, in the same ways as those in Europe and North America, adopted relevant transport policies to transform their leading seaports/airports into global logistics hubs. The transport policies they adopted include: **institutional restructuring, commercial management, deregulation and privatisation, and expansion of infrastructures and facilities.** It also found that Taiwan's seaports/airports have numbers of strengths and opportunities to turn into global logistics hubs, but they also have numbers of weaknesses and threats. These have already examined the fourth and fifth research objectives (**O4/O5**).

This chapter has also discovered that numbers of factors are relevant to the success of a global logistics hub. 34 items collected in this chapter will be used for preparing the questionnaire survey to examine the sixth research objective (**O6**), **the factors relevant to the success of global logistics hubs**. In this chapter, a hypothesis, **H3: Suitable government transport policies can successfully establish global logistics hubs**, is also formulated.

Chapter 6 Findings and Analysis of the Questionnaire Survey

Chapter Aims:

- Explain the conduct and the results of questionnaire survey
- Analyse the importance and satisfaction ratings of each survey question
- Extract factors of each survey question through factor analysis

6.1 Introduction

This chapter is intended to describe the conduct of questionnaire survey and to analyse the data obtained from the questionnaire survey. It will explain the questionnaire responses, conduct data analysis, obtain the findings, and subsequently compare the survey results by different groups.

Frequency analysis, quadrant scatter plots and factor analysis are used to analyse the data obtained from the questionnaire survey. Frequency analysis is used to rate the importance of and satisfaction with each item in three questions of the questionnaire; quadrant scatter-plots are used to compare the level of importance of and satisfaction with each item in terms of different groups; and factor analysis is used to extract smaller set of factors presenting meaningful patterns among the original variables. Principal components analysis with *VARIMAX rotation,* factor scree plot and reliability analysis will also be employed for factor analysis. The tools used and the tables and figures showing the results are as follows.

Tools used/Items	Driving Force	Global Logistics Services	Global Logistics Hubs
Frequency Analysis			
Non-Response Bias	Table 6-5	Table 6-6	Table 6-7
Relative Importance	Table 6-8	Table 6-10	Table 6-12
Relative Satisfaction	Table 6-9	Table 6-11	Table 6-13
Quadrant Scatter-plots	Fig 6-1, 6-2, 6-3	Fig 6-4, 6-5, 6-6	Fig 6-7, 6-8, 6-9
Factor Analysis	Table 6-14	Table 6-16	Table 6-18
Factor Scree Plot	Fig 6-10	Fig 6-11	Fig 6-12
Reliability Analysis	Table 6-15	Table 6-17	Table 6-19

6.2 The Conduct of Questionnaire Survey

In order to ensure the reliability and validity of the questionnaire survey, it had to follow the procedures to prepare the questionnaire survey before questionnaires are sent out for survey. Other than the preparation for the questionnaire, this section generally describes the results of the questionnaire, i.e., the distribution of questionnaire, the response rate, characteristics of responses, and non-response bias. Non-response bias is to test whether the survey responses could be generalised to the target population.

6.2.1 Preparation for the Questionnaire

After conducting in-depth investigation on global logistics service in Chapter 4 and global logistics hub in Chapter 5, it has been found that three research objectives, O1, O3 and O6, needed to be further examined through questionnaire survey. Therefore, the second part of the questionnaire consists of three questions; these are

- Q1 asks for driving forces for evolution of global logistics services
- Q2 asks for critical factors in providing global logistics services
- Q3 asks for factors relevant to the success of a global logistics hub

The first question (Q1) consists of 15 items; the second question (Q2), 26 items; and the third question (Q3), 34 items. These items were obtained through literature reviews and further examined by personal interviews with scholars and experts working for the academia, government, international carriers, and logistics/terminal operators.

In order to improve the reliability and validity of the questionnaire, the pilot test of the questionnaire was conducted to examine the views of scholars and experts in the field. After the questionnaire was developed in July 2004, the author's supervisor at the Cardiff University and Dr. Childerhouse of Auckland University, New Zealand, were asked for

their comments to the questionnaire. The questionnaire was also re-reviewed by other four experts in the field. Below are the names of the scholars who participated in helping the author to draft the questionnaire.

Dr. C. S. Lalwani, the author's supervisor, Business School, Cardiff University
Dr. Mee Lee, Air Transport Department, Kai-Nan University, Taiwan
Dr. Mariner Wang, Ritsumeikan Asia Pacific University, Japan
Dr. Chin-Shan Lu, Transport Management Department, National Cheng Kung University, Taiwan
Dr. Gordon K.C. Shang, Shipping and Transportation Management Department, National Kaohsiung Marine University, Taiwan

In addition, ten questionnaires were sent to vice presidents of international carriers, senior managers of terminal operators, and director generals of port authorities. At this stage of pilot test, the author obtained many fruitful responses and much information. Their useful feedback was used to modify the draft questionnaire.

6.2.2 The Distribution of Questionnaires

The mailings of the questionnaire survey were conducted twice. The first mailings, 168 questionnaires, were sent out in October 2004 to the surveyed organisations and companies. The questionnaires were accompanied by covering letters and stamped return envelopes in order to increase the response rate. In the covering letter, confidentiality was promised to all respondents. In order to increase the response rate, self-administered methods were used for some respondents. The author conducted face-to-face interviews, made telephone calls or sent e-mails to explain the purpose of questionnaire, to answer questions concerning responding, and to remind them to send back the questionnaire.

The second letters were planned to send out to the surveyed organisations and companies two weeks after the first mailings had been sent. Before sending them, the author made

phone calls or sent e-mails to make sure that the respondents had not yet responded or to remind them to send back the questionnaire. Through these kinds of efforts, other questionnaires were received.

6.2.3 The Response Rate

The first mailing received 79 responses. A second mailing was sent out in November after the author made phone calls or sent e-mails to remind the scholars/experts about the questionnaire survey: additional 33 responses were subsequently returned. The total response number was 112, of which 10 were from academia, 23 from government agencies, 40 from ocean carriers, 13 from air carriers and 26 from logistics and terminal operators. Two respondents, however, one from academia and the other an ocean carrier, did not finish the survey. Usable survey data were thus obtained from 110 respondents. Therefore, the overall response rate for this study is 66.7% and the usable response rate is 65.5%. A summary of the companies and organisations surveyed and the respective response rates are shown in Table 6-1.

Table 6- 1: Summary of the Surveyed Organisations and Response Rates

Categories	Surveyed Com./Org.	Number Distributed	Number of Responses	Response Rate	Usable Response	Usable Rate
Academia	7	10	10	100%	9	90%
Government	10	24	23	95.8%	23	95.8%
Ocean Carriers	27	61	40	65.6%	39	63.9%
Air Carriers	12	23	13	56.5%	13	56.5%
Logistics/Terminal Operators	16	50	26	52.0%	26	52.0%
Total	72	168	112	**66.7%**	110	**65.5%**

Source: Author

6.2.4 Characteristics of Responses

A profile of the respondents by their job titles is presented in Table 6-2. They are divided into three groups; the first group comprises vice-presidents or above in private companies, senior specialists or above in government agencies, and associate professors or above in

universities, totalling 38 respondents; the second group comprises managers, division directors and assistant professors, totalling 57 respondents; the third group comprises assistant managers, staffs and researchers, totalling 15 respondents. In general, 86.4% of the respondents are high-ranking senior persons in the field.

Table 6- 2: Profile of Respondents by Job Title

Personal information \ Job Area	Academia	Government	Ocean carriers	Air Carriers	Log./Term. Operators	Sub-Total	%
Job Title							
Vice-President/Senior Specialist/ Associate Professor or above	6	14	10	2	6	38	34.6%
Manager/Division Director/ Assistant Professor	2	7	24	9	15	57	51.8%
Assistant Manager/Senior Staff/ Researcher	1	2	5	2	5	15	13.6%
Total	9	23	39	13	26	110	100%

Source: Author

Table 6-3 shows a profile of the respondents by their job experience. Only 13 respondents, 11.8% of the total respondents, have worked in the field for less than 10 years; another 36 respondents (32.7%) have worked in the field for 10 to 20 years; 44 respondents (40%), 20 to 30 years; and 17 respondents (15.5%), more than 30 years. In total, 88.2% of the respondents have been working in the field of international freight transport for more than 10 years.

Table 6- 3: Profile of Respondents by Job Experience

Personal information \ Job Area	Academia	Government	Ocean carriers	Air Carriers	Log./Term. Operators	Sub-Total	%
Work Experience							
• Less than 10 years	3	0	4	2	4	13	11.8%
• 10 years to 20 years	4	5	16	8	3	36	32.7%
• 20 years to 30 years	2	10	15	2	15	44	40.0%
• More than 30 years	0	8	4	1	4	17	15.5%
Total	9	23	39	13	26	110	100%

Source: Author

6.2.5 Non-Response Bias

It is widely held that a response rate of 75% to 90% is sufficient to support

generalisations from the surveyed sample to the population of interest (Burkell, 2003). Though the response rate of usable data for the research is 65.5%, it is important to consider non-response bias. Survey non-response refers to the discrepancy between the group approached to complete a survey and those who eventually did not provide data. It occurs in three situations: (1) the subjects simply refuse to supply information; (2) the subjects are unable to supply answers, e.g. they do not feel qualified to complete the questionnaire; and (3) the respondents do not make the deadline for questionnaire collection. Late respondents can be assumed to be similar to non-respondents (Lu, 1997). As the survey was effectively conducted in two time periods, the data collected can be divided into two groups to ascertain if there is any difference between them. The first group, categorised as "respondent", comprises 78 replies that the author received after the survey was sent out in October, 2004; the second group, categorised as "non-respondent", comprises 32 replies that the author received after the follow-up calls to remind the respondents. The distribution of these two respondent groups is presented in Table 6-4.

Table 6- 4: Distribution of Respondents Surveyed

Responses	Academia	Government	Ocean Carriers	Air Carriers	Log./Term. Operators	Total
First response/Respondent	8	19	31	10	10	78
Late response/ Non-respondent	1	4	8	3	16	32
Total	9	23	39	13	26	110

Source: Author

6.2.5.1 Non-response Bias for Driving Force items

The major measures of non-response bias for the first question - the driving forces for the evolution of global logistics services - were based on the importance ratings of 15 driving force items as well as measures of satisfaction levels. The findings are presented in Table 6-5. There are no significant differences at the 5% level between the respondent and

non-respondent groups in the importance and satisfaction ratings of most driving force items, except for two importance ratings items, *"learning and experience from logistics service" and "simplification of process flow and documentation"*. Therefore, **it is inferred that the survey responses could be generalised to the target population.**

Table 6- 5: Comparison of Respondent and Non-Respondent Groups in Terms of the Relative Importance of and Satisfaction with Driving Force Items

Importance of Driving Force Items	Respondent Mean	SD	Non-respondent Mean	SD	F	Sig. of F
1.Growth of international trade	4.603	0.566	4.594	0.875	2.520	.115
2.Global production and demand for transhipment	4.551	0.638	4.344	0.653	.029	.865
3.Shippers' logistics outsourcing	3.91	0.856	3.844	0.767	.446	.506
4.Gaining economies of scale and scope	4.18	0.679	4.125	0.751	.404	.527
5.Learning and experience from logistics service	3.885	0.821	4.031	0.538	7.569	.007**
6.New technologies in transport and ICT	4.41	0.673	4.563	0.669	.374	.542
7.Simplification of process flow and documentation	4.462	0.733	4.625	0.554	4.289	.041**
8.Decrease of cargo/product inventory	4.09	0.825	4.219	0.659	1.425	.235
9.Deregulation of transport and infrastructure	4.487	0.639	4.438	0.619	.089	.766
10.Trade liberalisation	4.59	0.692	4.719	0.523	2.928	.090*
11.Relaxation of trade barriers	4.423	0.73	4.625	0.554	3.223	.075*
12.Expansion of services/one-stop shopping service	4.295	0.686	4.406	0.665	.002	.965
13.Provision of JIT delivery/D2D services	4.359	0.72	4.406	0.712	.023	.879
14.Increasing geographical span of logistics service	4.192	0.79	4.281	0.683	.872	.352
15.Visibility of logistics chain	4.051	0.91	4.063	0.716	3.436	.067*
Satisfaction with Driving Force Items	**Respondent Mean**	**SD**	**Non-respondent Mean**	**SD**	**F**	**Sig. of F**
1.Growth of international trade	3.103	0.656	3.313	0.644	.635	.427
2.Global production and demand for transhipment	2.897	0.815	3	0.88	.030	.862
3.Shippers' logistics outsourcing	2.949	0.719	3.094	0.689	.169	.682
4.Gaining economies of scale and scope	2.923	0.717	3.094	0.856	.531	.468
5.Learning and experience from logistics service	2.923	0.752	3.031	0.595	3.042	.084*
6.New technologies in transport and ICT	3.154	0.869	3.469	0.761	.222	.638
7.Simplification of process flow and documentation	2.859	0.833	2.813	0.859	.767	.383
8.Decrease of cargo/product inventory	3.141	0.639	3.188	0.592	.107	.744
9.Deregulation of transport and infrastructure	2.808	0.823	2.938	0.84	.005	.945
10.Trade liberalisation	2.91	0.9	3.094	0.777	.013	.909
11.Relaxation of trade barriers	2.731	0.848	2.719	0.851	.019	.890
12.Expansion of services/one-stop shopping service	3.051	0.719	3.281	0.634	.079	.779
13.Provision of JIT delivery/D2D services	3.231	0.719	3.125	0.66	2.543	.114
14.Increasing geographical span of logistics service	2.987	0.781	2.969	0.74	.150	.699
15.Visibility of logistics chain	2.923	0.66	3.063	0.504	2.713	.102

Note: ** Sig. of F <0.05, * Sig. of F <0.1

6.2.5.2 Non-response Bias for Global Logistics Service Items

The major measures of non-response bias for the second question – the critical factors in providing global logistics services - were based on the importance ratings of 26 global logistics service items as well as measures of satisfaction levels. The findings are presented in Table 6-6.

Table 6- 6: Comparison of Respondent and Non-Respondent Groups in Terms of the Relative Importance and Satisfaction of Global Logistics Service Items

Importance of Logistics Service Factors	Respondent Mean	SD	Non-respondent Mean	SD	F	Sig. of F
1. Cargo consolidation and distribution service	4.156	0.708	4.156	0.808	1.764	.187
2. Enhancing transport chain/network	4.539	0.733	4.438	0.716	.050	.824
3. Provision of transport/logistics plan for shippers	4.128	0.843	4.188	0.693	1.254	.265
4. Provision of land/air/sea-integrated transport	4.295	0.791	4.438	0.619	1.844	.177
5. Freight bill audit and payment	3.833	0.859	3.875	0.707	1.146	.287
6. Large ships/aircrafts or simplified transport fleet	3.756	0.84	3.75	0.916	.220	.640
7. Investing in terminal operations/dedicated terminal	4.039	0.813	4.094	0.818	.193	.661
8. Investing in warehouse/distribution centre	4.013	0.814	4.063	0.669	1.624	.205
9. Provision of inventory control service	3.872	0.843	4	0.718	4.032	.047**
10. Providing value-added service (e.g. marking/packaging)	3.885	0.911	3.969	0.861	.394	.531
11. Providing service for specialised cargo	3.782	0.921	3.781	0.906	.079	.779
12. Product returns and repair	3.539	0.751	3.594	0.979	5.276	.024**
13. Free customer service/consultation/complaints	4.039	0.889	4.063	0.716	1.930	.168
14. Providing customs clearance service	4.167	0.746	4.156	0.574	3.924	.050*
15. Business alliances with global shippers	3.846	0.869	3.75	0.718	.160	.690
16. Order entry, processing and fulfilment for shippers	3.897	0.749	3.813	0.693	.551	.460
17. Slot exchange/code share with other carriers	4.18	0.936	4.156	0.723	4.314	.040**
18. Partnership or joint venture with other carriers	3.59	0.829	3.563	0.84	.014	.905
19. Merger, acquisition of other carriers	3.474	0.922	3.469	0.879	.094	.760
20. Business process re-engineering/BPR	4.115	0.702	3.813	0.78	.152	.698
21. Enterprise Resource Planning/ERP	3.962	0.813	3.688	0.896	2.130	.147
22. Intra-organisational information networking	4.397	0.671	4.313	0.859	1.589	.210
23. Inter-organisational information networking	4.256	0.797	4.438	0.619	1.695	.196
24. Information links with business partners	4.282	0.682	4.219	0.751	.672	.414
25. Providing web service (e.g. on-line booking, tracking)	4.462	0.678	4.5	0.622	.586	.446
26. Joining shippers' portals	4.064	0.888	4.188	0.998	.523	.471
Satisfaction with Logistics Service Items	**Respondent Mean**	**SD**	**Non-respondent Mean**	**SD**	**F**	**Sig. of F**
1. Cargo consolidation and distribution service	3.325	0.768	3.063	0.669	4.583	.035**
2. Enhancing transport chain/network	3.103	0.783	3.156	0.767	.490	.485
3. Provision of transport/logistics plan for shippers	3.026	0.755	2.969	0.647	.839	.362
4. Provision of land/air/sea-integrated transport	3.077	0.864	3.031	0.822	.565	.454
5. Freight bill audit and payment	3.205	0.709	3.094	0.777	.137	.712
6. Large ships/aircrafts or simplified transport fleet	3.256	0.692	3.281	0.729	.298	.586
7. Investing in terminal operations/dedicated terminal	3.269	0.848	3.531	0.621	2.367	.127
8. Investing in warehouse/distribution centre	3.205	0.812	3.156	0.92	1.262	.264
9. Provision of inventory control service	3.141	0.768	3.25	0.762	.084	.772
10. Providing value-added service (e.g. marking/packaging)	3.064	0.762	2.969	0.861	.253	.616
11. Providing service for specialised cargo	3.026	0.755	2.969	0.74	.014	.905
12. Product returns and repair	2.872	0.727	2.813	0.693	.052	.820
13. Free customer service/consultation/complaints	3.077	0.734	3.031	0.861	.534	.467
14. Providing customs clearance service	3.167	0.828	2.969	0.897	.085	.771
15. Business alliances with global shippers	3.013	0.712	2.906	0.734	.101	.751
16. Order entry, processing and fulfilment for shippers	3.141	0.751	3.063	0.759	.081	.776
17. Slot exchange/code share with other carriers	3.5	0.908	3.531	0.842	.302	.584
18. Partnership or joint venture with other carriers	3.103	0.676	3.125	0.707	.080	.777
19. Merger, acquisition of other carriers	3.039	0.673	3.031	0.695	.001	.973
20. Business process re-engineering/BPR	3	0.756	3.063	0.801	.131	.718
21. Enterprise Resource Planning/ERP	3.039	0.692	3.063	0.716	.000	.998
22. Intra-organisational information networking	3.256	0.829	3.531	0.718	.269	.605
23. Inter-organisational information networking	3.115	0.789	3.188	0.859	.595	.442
24. Information links with business partners	2.987	0.814	3.031	0.74	.033	.857
25. Providing web service (e.g. on-line booking, tracking)	3.192	0.869	3.313	0.821	.002	.962
26. Joining shippers' portals	2.936	0.795	3.063	0.801	.195	.660

Note: ** Sig. of F <0.05, * Sig. of F <0.1

There are no significant differences at the 5% level between the respondent and non-respondent groups in the importance and satisfaction ratings of most global logistics service items, except for three importance ratings items, "*provision of inventory control service*", "*products returns and repair*" and "*slot exchange/code share with other carriers*" and the satisfaction ratings item, "*cargo consolidation and distribution service*".

Therefore, **it is inferred that the survey responses could be generalised to the target population.**

6.2.5.3 Non-response Bias for Global Logistics Hub Items

The major measures of non-response bias for the third question – the factors relevant to the success of a global logistics hub - were based on the importance ratings of 34 global logistics hub items as well as measures of satisfaction levels. The findings are presented in Table 6-7. There are no significant differences at the 5% level between the respondent and non-respondent groups in the importance and satisfaction ratings of most global logistics hub items, except for five importance ratings items, "*efficiency of seaport/airport operations*", "*efficiency of terminal operations*", "*simplified customs procedures*", "*seaport/airport infrastructure*" *and* "*political stability*". Therefore, **it is inferred that the survey responses could be generalised to the target population.**

Table 6- 7: Comparison of Respondent and Non-Respondent Groups in Terms of the Relative Importance and Satisfaction of Global Logistics Hub Items

Importance of Logistics Hub Items	Respondent Mean	SD	Non-respondent Mean	SD	F	Sig. of F
1. Efficiency of seaport/airport operations	4.564	0.636	4.719	0.457	5.583	.020**
2. Efficiency of terminal operations	4.577	0.614	4.719	0.457	6.378	.013**
3. Labour quality and skilled labour	4.397	0.651	4.406	0.56	1.628	.205
4. Simplified seaport/airport process and documentation	4.449	0.677	4.531	0.567	2.103	.150
5. Simplified Customs procedures	4.603	0.61	4.719	0.457	4.825	.030**
6. Seaport/airport management information system	4.526	0.618	4.563	0.564	.624	.431
7. e-business and community network integration	4.474	0.679	4.5	0.622	.064	.801
8. Reasonable seaport/airport charges	4.372	0.74	4.344	0.602	3.844	.053*
9. Seaport/airport operating costs	4.385	0.669	4.344	0.701	.063	.803
10. High cargo generating/value-added activities	3.974	0.882	4.063	0.84	.106	.746
11. Market size/large hinterland/Origin-Destination demand	4.333	0.784	4.406	0.837	.038	.846
12. International trade-related industrial complexes	4.09	0.809	4.094	0.818	.022	.884
13. Regional development around seaport/airport	4.051	0.866	4.281	0.729	.001	.974
14. Level of inland transport and inter-modality	4.282	0.754	4.313	0.592	1.910	.170
15. Natural conditions of seaport/airport (e.g. weather)	4.167	0.828	4.125	0.833	.630	.429
16. Geographic location/market accessibility	4.308	0.811	4.281	0.683	1.713	.193
17. Seaport/airport infrastructure	4.436	0.676	4.438	0.504	5.000	.027**
18. Seaport/airport facilities and expandability	4.346	0.699	4.344	0.653	.029	.866
19. Free trade zone	4.244	0.914	4.281	0.924	.026	.873
20. Logistics and trade centres	4.167	0.859	4.375	0.66	.272	.603
21. ICT infrastructure	4.423	0.655	4.406	0.615	.114	.737
22. Seaport/airport services to users	4.295	0.758	4.281	0.634	1.333	.251
23. Introduction of modern logistics service providers	4.18	0.818	4.031	0.822	.947	.333
24. Frequent sailings/flights	4.436	0.731	4.344	0.827	.057	.812
25. Pro-logistics business government and office	4.5	0.619	4.406	0.665	.537	.465
26. Government transport policy and actions	4.397	0.631	4.438	0.716	.172	.679
27. Privatisation of seaport/airport	3.936	0.858	3.906	0.893	.005	.945
28. Organisational restructure of seaport/airport	3.922	0.839	3.938	0.801	1.063	.305
29. Direct transport link to China	4.731	0.596	4.656	0.545	.323	.571
30. Guarantee of foreign investment	4.269	0.863	4.188	0.693	2.543	.114
31. Openness of foreign labour	3.539	0.907	3.313	1.148	1.671	.199
32. Political Stability	4.615	0.688	4.781	0.42	7.538	.007**
33. Security of seaport/airport	4.308	0.872	4.375	0.66	2.490	.118
34. Simplification of trade process	4.397	0.745	4.563	0.716	1.467	.228
Satisfaction with Logistics Hub Items	**Respondent Mean**	**SD**	**Non-respondent Mean**	**SD**	**F**	**Sig. of F**
1. Efficiency of seaport/airport operations	3.372	0.899	3.313	0.738	1.238	.268
2. Efficiency of terminal operations	3.436	0.831	3.438	0.669	1.976	.163
3. Labour quality and skilled labour	3.205	0.873	3.094	0.856	1.304	.256
4. Simplified seaport/airport process and documentation	3.051	0.719	2.969	0.782	.110	.740
5. Simplified Customs procedures	2.782	0.935	2.531	0.879	.104	.748
6. Seaport/airport management information system	2.962	0.763	3	0.718	.155	.695
7. e-business and community network integration	2.962	0.78	3.125	0.66	.226	.635
8. Reasonable seaport/airport charges	2.936	0.888	3.063	0.801	.353	.554
9. Seaport/airport operating costs	2.987	0.781	3	0.762	.002	.965
10. High cargo generating/value-added activities	3.026	0.738	2.813	0.738	.423	.517
11. Market size/large hinterland/Origin-Destination demand	2.885	0.837	2.969	0.822	.034	.853
12. International trade-related industrial complexes	2.974	0.772	3.188	0.821	.073	.787
13. Regional development around seaport/airport	2.923	0.802	3.031	0.647	2.562	.112
14. Level of inland transport and inter-modality	3.051	0.771	3.063	0.716	.009	.925
15. Natural conditions of seaport/airport (e.g. weather)	3.372	0.854	3.313	0.78	.564	.454
16. Geographic location/market accessibility	3.551	0.8	3.531	0.671	1.460	.230
17. Seaport/airport infrastructure	3.256	0.889	3.469	0.671	2.435	.122
18. Seaport/airport facilities and expandability	3.039	0.797	3.219	0.941	3.488	.065*
19. Free trade zone	2.949	0.836	3	0.88	.401	.528
20. Logistics and trade centres	2.949	0.788	3.094	0.689	.003	.957
21. ICT infrastructure	3.231	0.821	3.281	0.772	.348	.557
22. Seaport/airport services to users	3.205	0.762	3.188	0.592	3.247	.074*
23. Introduction of modern logistics service providers	3.064	0.779	3.125	0.609	.373	.543
24. Frequent sailings/flights	2.603	0.888	2.719	0.958	.833	.363
25. Pro-logistics business government and office	2.731	0.848	2.594	0.875	.342	.560
26. Government transport policy and actions	2.667	0.848	2.875	0.871	.072	.790
27. Privatisation of seaport/airport	2.833	0.746	3.25	0.842	2.561	.112
28. Organisational restructure of seaport/airport	2.714	0.686	3.094	0.641	1.570	.213
29. Direct transport link to China	1.859	0.879	2.031	1	1.101	.296
30. Guarantee of foreign investment	3	0.883	3.125	0.751	.300	.585
31. Openness of foreign labour	2.833	0.796	2.75	0.916	2.067	.153
32. Political Stability	2.154	0.968	1.938	0.982	.056	.813
33. Security of seaport/airport	3.205	0.903	3.281	0.772	.756	.386
34. Simplification of trade process	2.885	0.806	3.125	0.833	.818	.368

Note: ** Sig. of F <0.05, * Sig. of F <0.1

6.3 Data Analysis and Findings

Two tools of SPSS, *frequency analysis* and *quadrant scatter-plot*, are used to analyse the data obtained from the questionnaire survey. Frequency analysis is used to statistically calculate the mean of their importance and satisfaction ratings; quadrant scatter-plot is to plot the levels of importance of and satisfaction with each survey item in each survey question. In order to examine whether there is any difference between groups, the respondents are categorised into two groups, carriers and non-carriers, to compare; the former comprises respondents from government and academia, and the latter are those from ocean carriers, air carriers, and logistics/ terminal operators.

6.3.1 Importance of and Satisfaction with Driving Force Items

Table 6-8 presents the results of frequency analysis conducted on the respondents' importance ratings of 15 driving force items. It shows that there are no statistically significant differences at the 5% level between the groups of non-carriers and carriers in the importance ratings of most driving force items, except for the item "*global production and demand for transhipment*". Therefore, it is inferred that responses from non-carriers group are not significantly different from those from carriers group. However, the rankings of driving force items differ between the total respondents, non-carriers, and carriers groups. The item "*trade liberalisation*" is the most important to the total respondents group. In contrast, the non-carriers group rates the item "*global production and demand for transhipment*" and the carriers group rates the item "*growth of international trade*" as the most important respectively, and all the groups rate the item "*shippers' logistics outsourcing*" as the least important of the driving force items for the evolution of global logistics services.

Table 6- 8: The Relative Importance of Driving Force Items

Importance Items	Total			Non-carriers (1)			Carriers (2)			Compare (1)/(2)	
	R	Mean	S. D.	R	Mean	S. D.	R	Mean	S. D.	F	Sig.
10.Trade liberalisation	1	4.627	0.648	3	4.531	0.761	2	4.667	0.596	2.985	0.087*
1.Growth of international trade	2	4.6	0.666	6	4.406	0.665	1	4.680	0.655	1.700	0.195
7.Simplification of process flow and documentation	3	4.509	0.687	2	4.594	0.665	5	4.474	0.697	0.450	0.504
2.Global production and demand for transhipment	4	4.491	0.646	1	4.625	0.554	7	4.436	0.676	4.002	0.048**
11.Relaxation of trade barriers	5	4.482	0.687	5	4.438	0.759	4	4.500	0.66	0.608	0.437
9.Deregulation of transport and infrastructure	6	4.473	0.631	8	4.344	0.701	3	4.526	0.597	1.572	0.213
6.New technologies in transport and ICT	7	4.455	0.672	4	4.469	0.621	6	4.449	0.696	0.181	0.671
13.Provision of JIT delivery/D2D services	8	4.373	0.715	7	4.375	0.707	9	4.372	0.723	0.084	0.772
12.Expansion of services/one-stop shopping service	9	4.327	0.679	9	4.188	0.693	8	4.385	0.669	0.364	0.547
14.Increasing geographical span of logistics service	10	4.218	0.759	10	4.156	0.723	10	4.244	0.776	0.862	0.355
4.Gaining economies of scale and scope	11	4.164	0.698	12	4.063	0.669	11	4.205	0.709	2.002	0.16
8.Decrease of cargo/product inventory	12	4.127	0.779	11	4.125	0.833	12	4.128	0.762	0.283	0.596
15.Visibility of logistics chain	13	4.055	0.855	13	4.000	0.842	13	4.077	0.864	0.050	0.824
5.Learning and experience from logistics service	14	3.927	0.751	14	3.906	0.588	14	3.936	0.811	2.058	0.154
3.Shippers' logistics outsourcing	15	3.891	0.828	15	3.875	0.751	15	3.897	0.862	1.282	0.26

Note: ** Sig. of F <0.05, * Sig. of F <0.1

Table 6-9 presents the results of frequency analysis conducted on the respondents' satisfaction ratings of 15 driving force items. It shows that there are no statistically significant differences at the 10% and 5% levels between the non-carriers and carriers groups in satisfaction ratings of driving force items. Therefore, it is inferred that the survey responses from non-carriers group are not significantly different from those from carriers group, and all the groups rate the item "*new technologies in transport and ICT*" as the most satisfactory and the item "*relaxation of trade barrier*" as the least satisfactory. The table also shows that the satisfaction rankings of driving force items slightly differ between the total respondents, non-carriers, and carriers groups.

Table 6- 9: The Relative Satisfaction with Driving Force Items

Satisfaction Items	Total			Non-carriers (1)			Carriers (2)			Compare (1)/(2)	
	R	Mean	S. D.	R	Mean	S. D.	R	Mean	S. D.	F	Sig.
6.New technologies in transport and ICT	1	3.245	0.848	1	3.469	0.718	1	3.154	0.884	1.808	0.182
13.Provision of JIT delivery/D2D services	2	3.2	0.701	3	3.313	0.738	2	3.154	0.685	1.632	0.204
1.Growth of international trade	3	3.164	0.657	4	3.281	0.634	3	3.115	0.664	0.75	0.388
12.Expansion of services/one-stop shopping service	5	3.118	0.7	8	3.156	0.677	4	3.103	0.713	0.002	0.962
8.Decrease of cargo/product inventory	4	3.155	0.623	2	3.375	0.492	5	3.064	0.651	0.024	0.878
3.Shippers' logistics outsourcing	6	2.991	0.71	14	2.906	0.689	6	3.026	0.72	0.283	0.596
15.Visibility of logistics chain	10	2.964	0.62	13	2.938	0.564	7	2.974	0.644	0.23	0.632
14.Increasing geographical span of logistics service	7	2.982	0.766	9	3.156	0.677	8	2.91	0.793	0.988	0.323
10.Trade liberalisation	9	2.964	0.867	7	3.156	0.884	9	2.885	0.853	0.503	0.48
5.Learning and experience from logistics service	11	2.955	0.709	11	3.125	0.609	10	2.885	0.738	1.233	0.269
4.Gaining economies of scale and scope	8	2.973	0.76	5	3.219	0.706	11	2.872	0.762	0.005	0.942
2.Global production and demand for transhipment	12	2.927	0.832	10	3.125	0.793	12	2.846	0.839	0.001	0.98
9.Deregulation of transport and infrastructure	14	2.845	0.826	12	3.094	0.818	13	2.744	0.813	0.109	0.742
7.Simplification of process flow and documentation	13	2.845	0.837	6	3.219	0.751	14	2.692	0.827	0.893	0.347
11.Relaxation of trade barriers	15	2.727	0.845	15	2.906	0.856	15	2.654	0.835	0.036	0.85

The results of quadrant scatter-plot used to compare the levels of importance of and

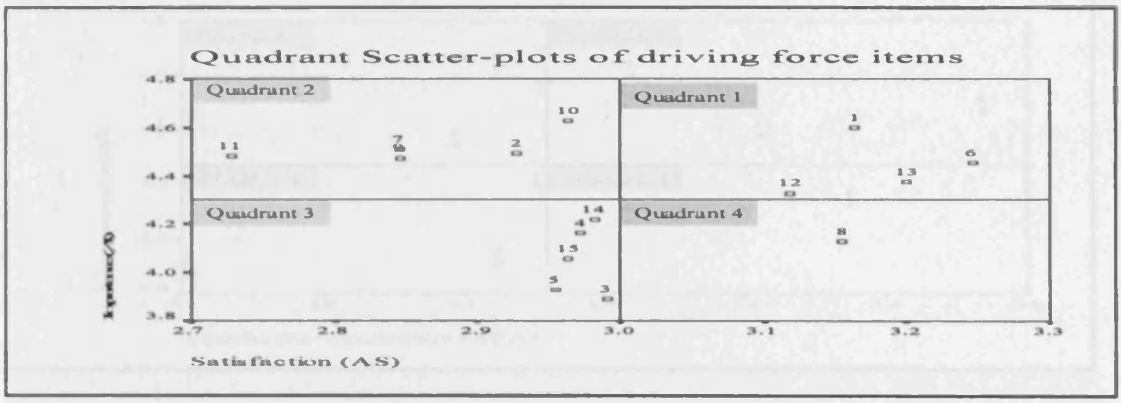
satisfaction with 15 driving force items are shown in Fig 6-1, Fig 6-2 and Fig 6-3. Quadrant 1 in these figures presents those rated as more important and satisfactory items; quadrant 2, more important and less satisfactory items; quadrant 3, less important and satisfactory items; and quadrant 4, less important and more satisfactory items. Therefore, quadrant 1 and quadrant 2 are used to further illustrate the differences between groups. As the means of importance and satisfaction ratings for the total respondents group are 4.315 and 3.004 respectively. Quadrant 1 in Fig 6-1 indicates those items rated as more important (more than 4.315) and satisfactory (more than 3.004) by the total respondents group, which are:

(1) Growth of international trade,
(2) New technologies in transport and ICT,
(3) Expansion of services/one-stop shopping service, and
(4) Provision of JIT delivery/D2D services.

Quadrant 2 indicates those items rated as more important and less satisfactory by the total respondents group, which are:

(1) Global production and demand for transhipment,
(2) Simplification of process flow and documentation,
(3) Deregulation of transport and infrastructure,
(4) Trade liberalisation, and
(5) Relaxation of trade barriers.

Fig 6- 1: Quadrant Scatter-plots of Driving Force Items



Note:
1.Growth of international trade
2.Global production and demand for transhipment
3.Shippers' logistics outsourcing
4.Gaining economies of scale and scope
5.Learning and experience from logistics service
6.New technologies in transport and ICT
7.Simplification of process flow and documentation
8.Decrease of cargo/product inventory
9.Deregulation of transport and infrastructure
10.Trade liberalisation
11.Relaxation of trade barriers
12.Expansion of services/one-stop shopping service
13.Provision of JIT delivery/D2D services
14.Increasing geographical span of logistics service
15.Visibility of logistics chain

Fig 6-2 and Fig 6-3 show the quadrant scatter-plots of 15 driving force items for the non-carriers and carriers groups respectively. Quadrant 1 in Fig 6-2 indicates those items rated as more important (more than mean importance, 4.273) and satisfactory (more than mean satisfaction, 3.163) by the non-carriers group, which are:

(1) Growth of international trade,

(2) New technologies in transport and ICT,

(3) Simplification of process flow and documentation, and

(4) Provision of JIT delivery/D2D services.

Quadrant 2 in Fig 6-2 indicates those items rated as more important (more than mean importance, 4.273) and less satisfactory (less than mean satisfaction, 3.163) by the non-carriers group, which are:

(1) Global production and demand for transhipment,

(2) Deregulation of transport and infrastructure,

(3) Trade liberalisation, and

(4) Relaxation of trade barriers.

Fig 6- 2: Quadrant Scatter-plots of Driving Force Items by Non-carriers

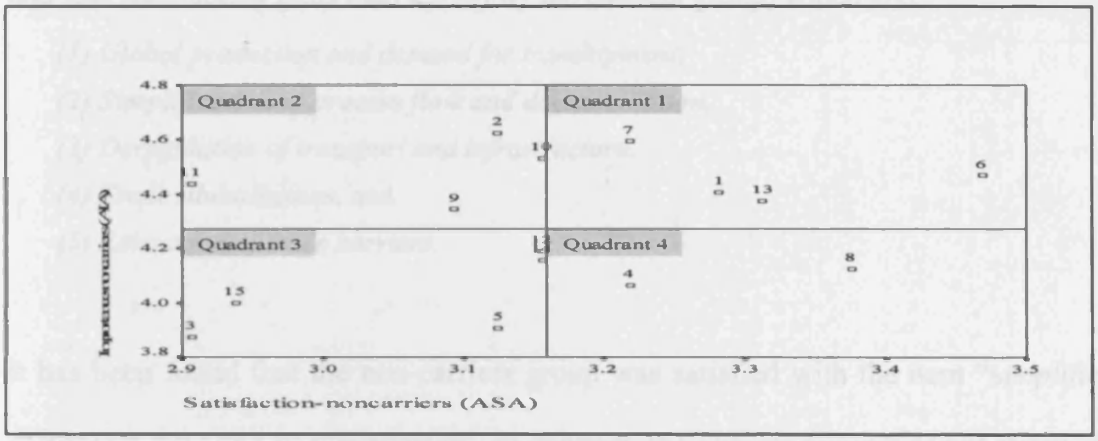
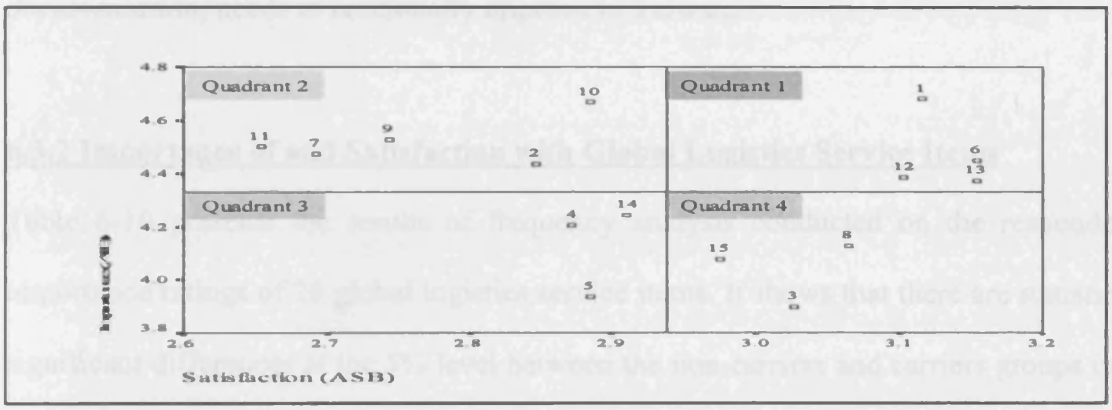


Fig 6- 3: Quadrant Scatter-plots of Driving Force Items by Carriers



Note:
1.Growth of international trade
2.Global production and demand for transhipment
3.Shippers' logistics outsourcing
4.Gaining economies of scale and scope
5.Learning and experience from logistics service
6.New technologies in transport and ICT
7.Simplification of process flow and documentation
8.Decrease of cargo/product inventory
9.Deregulation of transport and infrastructure
10.Trade liberalisation
11.Relaxation of trade barriers
12.Expansion of services/one-stop shopping service
13.Provision of JIT delivery/D2D services
14.Increasing geographical span of logistics service
15.Visibility of logistics chain

Quadrant 1 in Fig 6-3 indicates those items rated as more important (more than mean importance, 4.332) and satisfactory (more than mean satisfaction, 2.938) by the carriers group, which are:

(1) Growth of international trade,

(2) New technologies in transport and ICT,

(3) Expansion of services/one-stop shopping service, and

(4) Provision of JIT delivery/D2D services.

Quadrant 2 in Fig 6-3 indicates those items rated as more important (more than 4.332) and less satisfactory (less than 2.938) by the carriers group, which are:

(1) Global production and demand for transhipment,
(2) Simplification of process flow and documentation,
(3) Deregulation of transport and infrastructure,
(4) Trade liberalisation, and
(5) Relaxation of trade barriers.

It has been found that the non-carriers group was satisfied with the item "*simplification of process flow and documentation*"; in contrast, the carriers group was not satisfied with this item. This finding implies that the issue, *simplification of process flow and documentation*, needs to continually improve in Taiwan.

6.3.2 Importance of and Satisfaction with Global Logistics Service Items

Table 6-10 presents the results of frequency analysis conducted on the respondents' importance ratings of 26 global logistics service items. It shows that there are statistically significant differences at the 5% level between the non-carriers and carriers groups in the importance ratings of six items, namely, "*slot exchange/code share with other carriers*", "*provision of transport/logistics plan for shippers*", "*investing in warehouse/distribution centre*", "*provision of inventory control service*", "*providing value-added service*", and "*enterprise resource planning/ERP*". Another seven items are statistically significant between the 5% to 10% levels. Therefore, it is inferred that the survey responses implied the **differences** between the non-carriers and carriers groups in the importance ratings of global logistics service items. However, all the groups rate the item "*enhancing transport chain/network*" as the most important and the item "*merger, acquisition of other carriers*" as the least important.

Table 6- 10: The Relative Importance of Global Logistics Service Items

Importance	Total			Non-carriers (1)			Carriers (2)			Compare (1)/(2)	
Items	R	Mean	S. D.	R	Mean	S. D.	R	Mean	S. D.	F	Sig.
2. Enhancing transport chain/network	1	4.509	0.726	1	4.438	0.669	1	4.539	0.751	.141	0.708
25. Providing web service (e.g. on-line booking, tracking)	2	4.473	0.66	2	4.406	0.712	2	4.500	0.640	.837	0.362
22. Intra-organisational information networking	3	4.373	0.728	4	4.281	0.634	3	4.410	0.763	1.364	0.245
4. Provision of land/air/sea-integrated transport	4	4.336	0.745	3	4.281	0.634	4	4.359	0.789	2.839	0.095*
23. Inter-organisational information networking	5	4.309	0.751	7	4.219	0.751	5	4.346	0.753	.001	0.978
24. Information links with business partners	6	4.264	0.7	6	4.250	0.718	6	4.269	0.696	.131	0.718
17. Slot exchange/code share with other carriers	7	4.173	0.876	12	4.031	0.782	7	4.231	0.911	5.471	0.021**
14. Providing customs clearance service	8	4.164	0.698	11	4.031	0.695	9	4.218	0.696	3.026	0.085*
1. Cargo consolidation and distribution service	9	4.156	0.735	8	4.188	0.693	10	4.143	0.756	.552	0.459
3. Provision of transport/logistics plan for shippers	10	4.145	0.799	14	3.938	0.669	8	4.231	0.836	5.116	0.026**
26. Joining shippers' portals	11	4.1	0.918	5	4.281	0.683	14	4.026	0.993	1.881	0.173
7. Investing in terminal operations/dedicated terminal	12	4.055	0.811	17	3.875	0.707	11	4.128	0.843	.904	0.344
13. Free customer service/consultation/complaints	13	4.045	0.839	16	3.906	0.856	12	4.103	0.831	.093	0.761
8. Investing in warehouse/distribution centre	14	4.027	0.772	13	3.969	0.595	13	4.051	0.836	7.851	0.006**
20. Business process re-engineering/BPR	15	4.027	0.735	9	4.188	0.644	15	3.962	0.763	.124	0.725
9. Provision of inventory control service	16	3.909	0.808	18	3.875	0.609	16	3.923	0.879	4.571	0.035**
10. Providing value-added service (e.g. marking/packaging)	17	3.909	0.894	10	4.094	0.734	22	3.833	0.945	4.642	0.033**
21. Enterprise Resource Planning/ERP	18	3.882	0.843	15	3.938	0.619	18	3.859	0.922	8.917	0.003**
16. Order entry, processing and fulfilment for shippers	19	3.873	0.731	20	3.844	0.574	17	3.885	0.789	2.293	0.133
5. Freight bill audit and payment	20	3.845	0.815	21	3.813	0.821	19	3.859	0.817	.333	0.565
15. Business alliances with global shippers	21	3.818	0.826	19	3.875	0.707	23	3.795	0.873	3.447	0.066*
11. Providing service for specialised cargo	22	3.782	0.913	22	3.625	0.707	20	3.846	0.981	2.788	0.098*
6. Large ships/aircrafts or simplified transport fleet	23	3.755	0.859	25	3.531	0.621	21	3.846	0.927	3.171	0.078*
18. Partnership or joint venture with other carriers	24	3.582	0.828	24	3.563	0.759	24	3.590	0.859	.750	0.388
12. Product returns and repair	25	3.555	0.819	23	3.563	0.669	25	3.551	0.878	3.717	0.056*
19. Merger, acquisition of other carriers	26	3.473	0.906	26	3.438	0.759	26	3.487	0.964	3.294	0.072*

Note: ** Sig. of F <0.05, * Sig. of F <0.1, R= rank, S.D.= standard deviation

Table 6-11 presents the results of frequency analysis conducted on the respondents' satisfaction ratings of 26 global logistics service items. It shows that there are only statistically significant differences at 10% level between non-carriers and carriers groups in the satisfaction ratings of two items, namely, "*slot exchange/code share with other carriers*" and "*large ships/aircrafts or simplified transport fleet*". Therefore, it is inferred that the survey responses from the non-carriers group are not significantly different from those from the carriers group in the satisfaction ratings of global logistics service items. The total respondents group rates the item "*slot exchange/code share with other carriers*" as the most satisfactory, whereas the non-carriers group rates the item "*cargo consolidation and distribution service*" and the carriers group rates "*slot exchange/code share with other carriers*" as the most satisfactory respectively. In addition, all the groups rate the item, "*product returns and repair*", as the least satisfactory.

Table 6- 11: The Relative Satisfaction with Global Logistics Service Items

Satisfaction	Total			Non-carriers (1)			Carriers (2)			Compare (1)/(2)	
Items	R	Mean	S. D.	R	Mean	S. D.	R	Mean	S. D	F	Sig.
17. Slot exchange/code share with other carriers	1	3.509	0.886	3	3.594	.665	1	3.474	.963	3.754	.055*
7. Investing in terminal operations/dedicated terminal	2	3.345	0.795	2	3.625	.751	4	3.231	.788	.001	.980
22. Intra-organisational information networking	3	3.336	0.805	4	3.563	.669	3	3.244	.840	1.272	.262
6. Large ships/aircrafts or simplified transport fleet	4	3.264	0.7	14	3.250	.508	2	3.269	.767	4.074	.046**
1. Cargo consolidation and distribution service	5	3.248	0.747	1	3.688	.592	10	3.065	.732	.251	.617
25. Providing web service (e.g. on-line booking, tracking)	6	3.227	0.853	9	3.344	.827	5	3.180	.864	.035	.852
8. Investing in warehouse/distribution centre	7	3.191	0.84	6	3.406	.712	8	3.103	.877	.091	.764
5. Freight bill audit and payment	8	3.173	0.728	15	3.219	.751	6	3.154	.722	.559	.456
9. Provision of inventory control service	9	3.173	0.765	11	3.281	.683	7	3.128	.795	.001	.970
23. Inter-organisational information networking	10	3.136	0.807	10	3.313	.738	11	3.064	.827	.149	.700
2. Enhancing transport chain/network	11	3.118	0.775	5	3.500	.568	19	2.962	.797	.142	.707
16. Order entry, processing and fulfilment for shippers	12	3.118	0.751	8	3.344	.653	13	3.026	.772	.076	.783
14. Providing customs clearance service	13	3.109	0.85	12	3.281	.772	12	3.039	.874	.009	.923
18. Partnership or joint venture with other carriers	14	3.109	0.682	19	3.188	.644	9	3.077	.698	.002	.964
4. Provision of land/air/sea-integrated transport	15	3.064	0.849	7	3.344	.787	20	2.949	.851	.027	.870
13. Free customer service/consultation/complaints	16	3.064	0.77	16	3.219	.553	15	3.000	.837	1.835	.178
21. Enterprise Resource Planning/ERP	17	3.045	0.696	24	3.125	.609	14	3.013	.730	.163	.687
10. Providing value-added service (e.g. marking/packaging)	18	3.036	0.789	18	3.188	.693	17	2.974	.821	.028	.868
19. Merger, acquisition of other carriers	19	3.036	0.676	23	3.125	.554	16	3.000	.721	.230	.632
20. Business process re-engineering/BPR	20	3.018	0.766	17	3.219	.608	21	2.936	.811	.400	.528
3. Provision of transport/logistics plan for shippers	21	3.009	0.723	13	3.250	.568	24	2.910	.759	1.006	.318
11. Providing service for specialised cargo	22	3.009	0.748	25	3.094	.777	18	2.974	.738	.016	.899
24. Information links with business partners	23	3	0.79	21	3.156	.767	22	2.936	.795	.008	.929
15. Business alliances with global shippers	24	2.982	0.717	22	3.125	.751	23	2.923	.698	1.473	.228
26. Joining shippers' portals	25	2.973	0.795	20	3.188	.738	25	2.885	.806	.006	.939
12. Product returns and repair	26	2.855	0.715	26	2.844	.628	26	2.859	.751	.751	.388

Note: ** Sig. of F <0.05, * Sig. of F <0.1

The results of quadrant scatter-plot used to compare the level of importance of and satisfaction with 26 global logistics service items are shown in Fig 6-4, Fig 6-5 and Fig 6-6. Quadrant 1 in these figures presents those rated as more important and satisfactory items; quadrant 2, more important and less satisfactory items; quadrant 3, less important and satisfactory items; and quadrant 4, less important and more satisfactory items. Therefore, quadrant 1 and quadrant 2 are used to further illustrate the differences between groups. As the means of importance and satisfaction ratings for the total respondents group are 4.020 and 3.121 respectively. Quadrant 1 in Fig 6-4 indicates those items rated as more important (more than 4.020) and satisfactory (more than 3.121) by the total respondents group, which are:

(1) Cargo consolidation and distribution service,

(2) Investing in terminal operations/dedicated terminal,

(3) Investing in warehouse/distribution centre,

(4) Slot exchange/code share with other carriers,

(5) Intra-organisational information networking,

(6) Inter-organisational information networking, and

(7) Providing web service (e.g. on-line booking, tracking).

Quadrant 2 in Fig 6-4 indicates those items rated as more important and less satisfactory, which are:

(1) Enhancing transport chain/network, *(note: the most important item)*

(2) Provision of transport/logistics plan for shippers,

(3) Provision of land/air/sea-integrated transport,

(4) Free customer service/consultation/complaints,

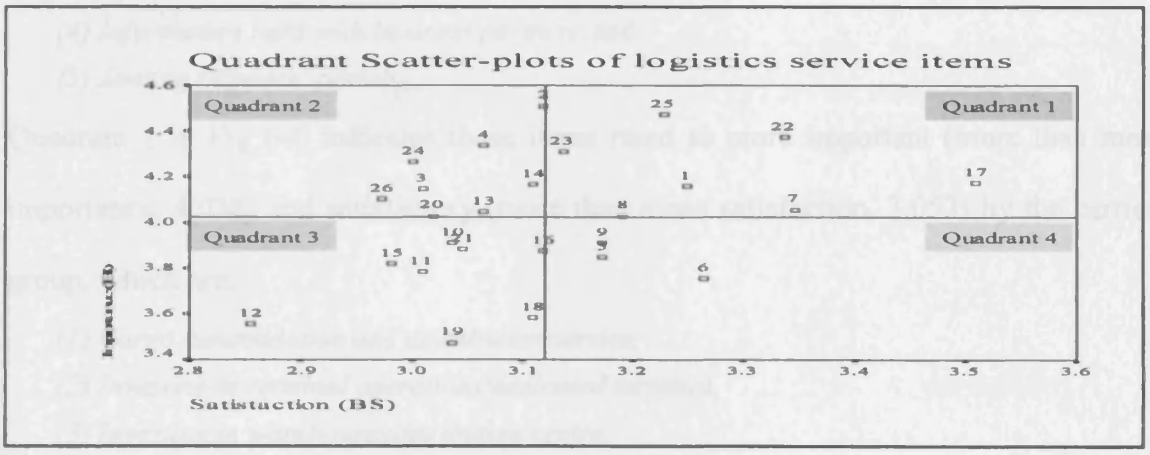
(5) Providing customs clearance service,

(6) Business process re-engineering/BPR,

(7) Information links with business partners, and

(8) Joining shippers' portals.

Fig 6- 4: Quadrant Scatter-plots of Global Logistics Service Items



Note:
1. Cargo consolidation and distribution service
2. Enhancing transport chain/network
3. Provision of transport/logistics plan for shippers
4. Provision of land/air/sea-integrated transport
5. Freight bill audit and payment
6. Large ships/aircrafts or simplified transport fleet
7. Investing in terminal operations/dedicated terminal
8. Investing in warehouse/distribution centre
9. Provision of inventory control service
10. Providing value-added service (e.g. marking/packaging)
11. Providing service for specialised cargo
12. Product returns and repair
13. Free customer service/consultation/complaints
14. Providing customs clearance service
15. Business alliances with global shippers
16. Order entry, processing and fulfilment for shippers
17. Slot exchange/code share with other carriers
18. Partnership or joint venture with other carriers
19. Merger, acquisition of other carriers
20. Business process re-engineering/BPR
21. Enterprise Resource Planning/ERP
22. Intra-organisational information networking
23. Inter-organisational information networking
24. Information links with business partners
25. Providing web service (e.g. on-line booking, tracking)
26. Joining shippers' portals

Fig 6-5 and Fig 6-6 show the quadrant scatter-plots of 26 global logistics service items for the non-carriers and carriers groups respectively. Quadrant 1 in Fig 6-5 indicates

those items rated as more important (more than mean importance, 3.978) and satisfactory (more than mean satisfaction, 3.283) by the non-carriers group, which are:

(1) Cargo consolidation and distribution service
(2) Enhancing transport chain/network
(3) Provision of land/air/sea-integrated transport
(4) Slot exchange/code share with other carriers
(5) Intra-organisational information networking
(6) Inter-organisational information networking, and
(7) Providing web service (e.g. on-line booking, tracking)

Quadrant 2 in Fig 6-5 indicates those items rated as more important (more than mean importance, 3.978) and less satisfactory (less than mean satisfaction, 3.283) by the non-carriers group, which are:

(1) Providing value-added service (e.g. marking/packaging)
(2) Providing customs clearance service
(3) Business process re-engineering/BPR
(4) Information links with business partners, and
(5) Joining shippers' portals

Quadrant 1 in Fig 6-6 indicates those items rated as more important (more than mean importance, 4.038) and satisfactory (more than mean satisfaction, 3.053) by the carriers group, which are:

(1) Cargo consolidation and distribution service,
(2) Investing in terminal operations/dedicated terminal,
(3) Investing in warehouse/distribution centre,
(4) Slot exchange/code share with other carriers,
(5) Intra-organisational information networking,
(6) Inter-organisational information networking, and
(7) Providing web service (e.g. on-line booking, tracking).

Quadrant 2 in Fig 6-6 indicates those items rated as more important (more than mean importance, 4.038) and less satisfactory (less than mean satisfaction, 3.053) by the carriers group, which are:

(1) Enhancing transport chain/network,
(2) Provision of transport/logistics plan for shippers,
(3) Provision of land/air/sea-integrated transport,

(4) Free customer service/consultation/complaints,

(5) Providing customs clearance service, and

(6) Information links with business partners.

Fig 6- 5: Quadrant Scatter-plots of Global Logistics Service Items by Non-carriers

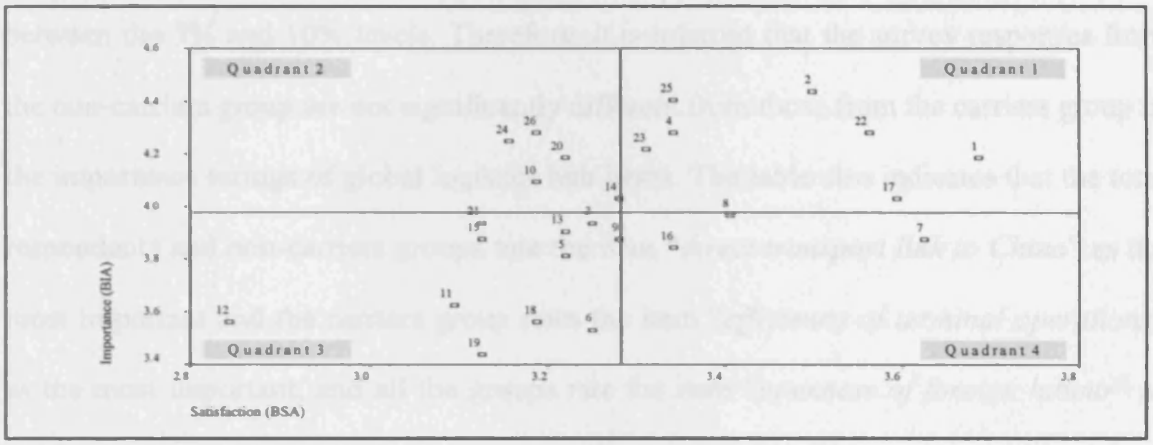
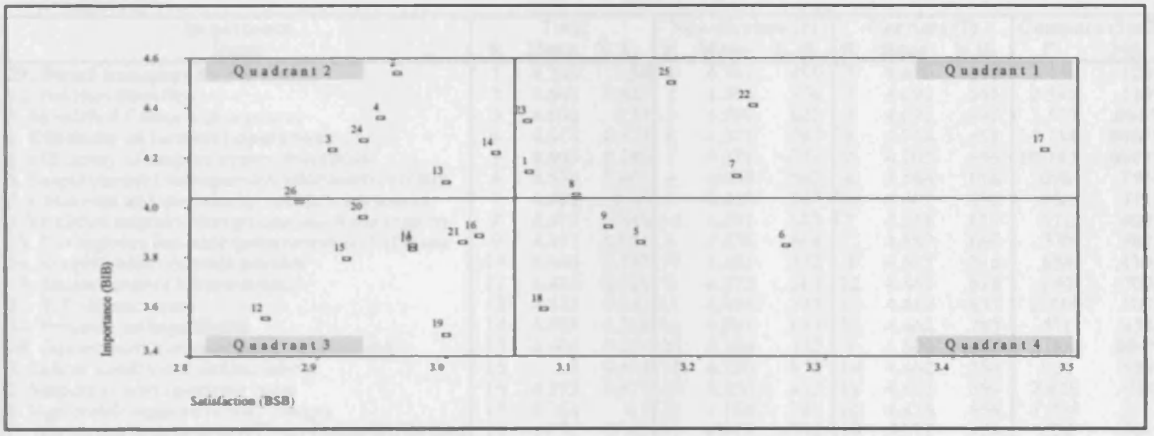


Fig 6- 6: Quadrant Scatter-plots of Global Logistics Service Items by Carriers



Note:
1. Cargo consolidation and distribution service
2. Enhancing transport chain/network
3. Provision of transport/logistics plan for shippers
4. Provision of land/air/sea-integrated transport
5. Freight bill audit and payment
6. Large ships/aircrafts or simplified transport fleet
7. Investing in terminal operations/dedicated terminal
8. Investing in warehouse/distribution centre
9. Provision of inventory control service
10. Providing value-added service (e.g. marking/packaging)
11. Providing service for specialised cargo
12. Product returns and repair
13. Free customer service/consultation/complaints
14. Providing customs clearance service
15. Business alliances with global shippers
16. Order entry, processing and fulfilment for shippers
17. Slot exchange/code share with other carriers
18. Partnership or joint venture with other carriers
19. Merger, acquisition of other carriers
20. Business process re-engineering/BPR
21. Enterprise Resource Planning/ERP
22. Intra-organisational information networking
23. Inter-organisational information networking
24. Information links with business partners
25. Providing web service (e.g. on-line booking, tracking)
26. Joining shippers' portals

6.3.3 Importance of and Satisfaction with Global Logistics Hub Items

Table 6-12 presents the results of frequency analysis conducted on the respondents'

importance ratings of 34 global logistics hub items. It shows that there are only statistically differences at the 5% level between non-carriers and carriers groups in the importance ratings of two items, namely "*efficiency of seaport/airport operation*" and "*efficiency of terminal operations*". Another three items are statistically significant between the 5% and 10% levels. Therefore, it is inferred that the survey responses from the non-carriers group are not significantly different from those from the carriers group in the importance ratings of global logistics hub items. The table also indicates that the total respondents and non-carriers groups rate the item "*direct transport link to China*" as the most important and the carriers group rates the item "*efficiency of terminal operations*" as the most important, and all the groups rate the item "*openness of foreign labour*" as the least important.

Table 6- 12: The Relative Importance of Global Logistics Hubs Items

Importance Items	Total			Non-carriers (1)			Carriers (2)			Compare (1)/(2)	
	R	Mean	S. D.	R	Mean	S. D.	R	Mean	S. D.	F	Sig.
29. Direct transport link to China	**1**	4.709	0.58	**1**	4.781	.491	5	4.680	.614	2.450	.120
32. Political Stability	2	4.664	0.625	2	4.594	.756	3	4.692	.565	2.595	.110
5. Simplified Customs procedures	3	4.636	0.57	3	4.500	.622	4	4.692	.542	3.577	.061*
2. Efficiency of terminal operations	4	4.618	0.574	8	4.375	.707	**1**	4.718	.481	14.714	.000**
1. Efficiency of seaport/airport operations	5	4.609	0.592	7	4.375	.751	2	4.705	.486	10.785	.001**
6. Seaport/airport management information system	6	4.536	0.601	4	4.469	.567	6	4.564	.616	.098	.755
7. e-business and community network integration	7	4.482	0.66	5	4.469	.567	10	4.487	.698	.806	.371
4. Simplified seaport/airport process and documentation	8	4.473	0.646	14	4.281	.683	7	4.551	.617	.272	.603
25. Pro-logistics business government and officials	9	4.473	0.631	6	4.438	.564	11	4.487	.660	.770	.382
34. Simplification of trade process	10	4.445	0.737	17	4.281	.772	8	4.513	.716	.658	.419
17. Seaport/airport infrastructure	11	4.436	0.628	9	4.375	.660	12	4.462	.618	.140	.709
21. ICT infrastructure	12	4.418	0.641	11	4.344	.545	15	4.449	.677	2.724	.102
24. Frequent sailings/flights	14	4.409	0.758	16	4.281	.683	13	4.462	.785	.571	.452
26. Government transport policy and actions	13	4.409	0.654	24	4.188	.592	9	4.500	.660	3.003	.086*
3. Labour quality and skilled labour	15	4.4	0.624	18	4.250	.672	14	4.462	.596	.034	.853
9. Seaport/airport operating costs	16	4.373	0.675	19	4.250	.622	18	4.423	.694	2.626	.108
8. Reasonable seaport/airport charges	17	4.364	0.7	22	4.188	.780	16	4.436	.656	1.034	.311
11. Market size/large hinterland/Origin-Destination demand	18	4.355	0.797	12	4.313	.738	19	4.372	.824	.028	.866
18. Seaport/airport facilities and expandability	19	4.345	0.683	10	4.344	.545	20	4.346	.736	3.069	.083*
33. Security of seaport/airport	20	4.327	0.814	28	4.063	.878	17	4.436	.766	.004	.947
16. Geographic location/market accessibility	21	4.3	0.773	20	4.250	.916	22	4.321	.712	2.266	.135
14. Level of inland transport and inter-modality	23	4.291	0.708	23	4.188	.693	21	4.333	.715	.237	.627
22. Seaport/airport services to users	22	4.291	0.721	15	4.281	.634	23	4.295	.758	1.333	.251
19. Free trade zone	24	4.255	0.913	13	4.313	.965	26	4.231	.896	.000	.995
30. Guarantee of foreign investment	25	4.245	0.815	27	4.156	.808	24	4.282	.820	.249	.619
20. Logistics and trade centres	26	4.227	0.809	21	4.219	.906	27	4.231	.772	.001	.973
15. Natural conditions of seaport/airport (e.g. weather)	27	4.155	0.826	31	3.938	.840	25	4.244	.809	.012	.913
23. Introduction of modern logistics service providers	28	4.136	0.818	26	4.156	.677	29	4.128	.873	1.737	.190
13. Regional development around seaport/airport	29	4.118	0.832	30	3.969	.861	28	4.180	.818	.153	.697
12. International trade-related industrial complexes	30	4.091	0.808	29	4.031	.898	30	4.115	.773	.482	.489
10. High cargo generating/value-added activities	31	4	0.867	25	4.156	.677	33	3.936	.931	1.635	.204
27. Privatisation of seaport/airport	32	3.927	0.864	33	3.750	.880	31	4.000	.853	.850	.359
28. Organisational restructure of seaport/airport	33	3.927	0.824	32	3.844	.920	32	3.961	.785	1.492	.225
31. Openness of foreign labour	**34**	**3.473**	**0.983**	**34**	**3.594**	**.798**	**34**	**3.423**	**1.051**	2.674	.105

Note: ** Sig. of F <0.05, * Sig. of F <0.1

Table 6-13 presents the results of frequency analysis conducted on the respondents'

satisfaction ratings of 34 global logistics hub items. The table shows that there are only statistically significant differences at the 5% level between the non-carriers and carriers groups in the satisfaction ratings of three items, namely, "*frequent sailings/flights*", "*pro-logistics business government and officials*", and "*direct transport link to China*". Another two items are statistically significant between the 5% and 10% levels. Therefore, it is inferred that the survey responses from the non-carriers group are not significantly different from those from the carriers group in the satisfaction ratings of global logistics hub items. The table also indicates that the total respondents and carriers groups rate the item "*geographic location and market accessibility*" and the non-carriers group rates the item "*the efficiency of seaport/airport operations*" as the most satisfactory respectively, and all the groups rated the item "*direct transport link to China*" as the least satisfactory.

Table 6- 13: The Relative Satisfaction with Global Logistics Hub Items

Satisfaction Items	Total			Non-carriers (1)			Carriers (2)			Compare (1)/(2)	
	R	Mean	S. D.	R	Mean	S. D.	R	Mean	S. D.	F	Sig.
16. Geographic location/market accessibility	1	3.545	0.762	3	3.813	.738	1	3.436	.749	.901	.345
2. Efficiency of terminal operations	2	3.436	0.784	2	3.813	.693	2	3.282	.771	1.785	.184
1. Efficiency of seaport/airport operations	3	3.355	0.852	1	3.844	.677	5	3.154	.839	2.759	.100
15. Natural conditions of seaport/airport (e.g. weather)	4	3.355	0.83	4	3.719	.683	3	3.205	.843	2.556	.113
17. Seaport/airport infrastructure	5	3.318	0.834	5	3.656	.787	4	3.180	.818	.001	.974
21. ICT infrastructure	6	3.245	0.804	7	3.563	.669	6	3.115	.821	.013	.910
33. Security of seaport/airport	7	3.227	0.864	11	3.500	.718	7	3.115	.897	.160	.690
22. Seaport/airport services to users	8	3.2	0.714	10	3.500	.622	8	3.077	.717	.211	.647
3. Labour quality and skilled labour	9	3.173	0.866	8	3.500	.762	9	3.039	.874	.003	.955
18. Seaport/airport facilities and expandability	10	3.091	0.841	13	3.406	.665	11	2.962	.874	.504	.479
23. Introduction of modern logistics service providers	11	3.082	0.731	14	3.344	.653	10	2.974	.738	.884	.349
14. Level of inland transport and inter-modality	12	3.055	0.752	16	3.281	.683	12	2.962	.763	.016	.899
12. International trade-related industrial complexes	13	3.036	0.789	18	3.250	.762	15	2.949	.788	.590	.444
30. Guarantee of foreign investment	14	3.036	0.845	23	3.219	.792	13	2.962	.880	.201	.655
4. Simplified seaport/airport process and documentation	15	3.027	0.735	9	3.500	.622	22	2.833	.692	.237	.627
7. e-business and community network integration	16	3.009	0.748	27	3.125	.707	14	2.962	.763	.061	.806
9. Seaport/airport operating costs	17	2.991	0.772	6	3.563	.564	28	2.756	.724	.976	.325
20. Logistics and trade centres	18	2.991	0.76	19	3.250	.762	18	2.885	.738	.203	.653
6. Seaport/airport management information system	19	2.973	0.748	25	3.156	.767	17	2.897	.731	1.018	.315
8. Reasonable seaport/airport charges	20	2.973	0.862	12	3.469	.567	27	2.769	.882	3.771	.055*
10. High cargo generating/value-added activities	21	2.964	0.741	20	3.219	.608	19	2.859	.768	.977	.325
19. Free trade zone	22	2.964	0.845	17	3.281	.851	23	2.833	.813	.940	.334
13. Regional development around seaport/airport	23	2.955	0.759	22	3.219	.659	20	2.846	.774	.398	.529
27. Privatisation of seaport/airport	24	2.955	0.794	29	3.063	.619	16	2.910	.856	3.863	.052*
34. Simplification of trade process	25	2.955	0.817	15	3.313	.780	24	2.808	.790	.043	.837
11. Market size/large hinterland/Origin-Destination demand	26	2.909	0.83	21	3.219	.751	26	2.782	.832	.968	.327
28. Organisational restructure of seaport/airport	27	2.826	0.692	32	2.781	.659	21	2.844	.708	.047	.828
31. Openness of foreign labour	28	2.809	0.829	31	2.813	.738	25	2.808	.869	1.644	.202
26. Government transport policy and actions	29	2.727	0.856	28	3.094	.777	29	2.577	.845	1.873	.174
5. Simplified Customs procedures	30	2.709	0.922	26	3.125	.871	30	2.539	.893	.341	.560
25. Pro-logistics business government and officials	31	2.691	0.854	24	3.188	.693	32	2.487	.833	5.436	.022**
24. Frequent sailings/flights	32	2.636	0.906	30	2.906	.777	31	2.526	.936	6.583	.012**
32. Political Stability	33	2.091	0.973	33	2.281	.958	33	2.013	.974	.093	.761
29. Direct transport link to China	34	1.909	0.914	34	2.000	.762	34	1.872	.972	8.299	.005**

Note: ** Sig. of F <0.05, * Sig. of F <0.1

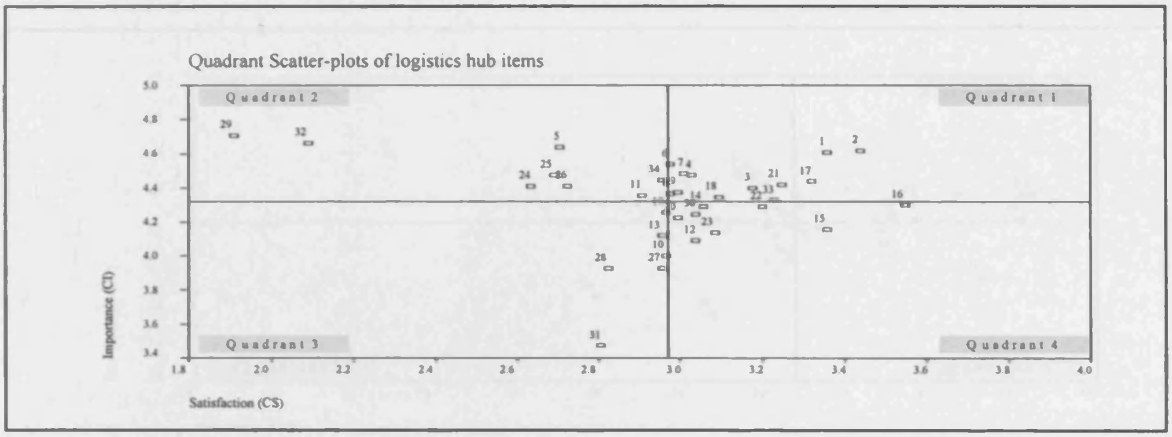
The results of quadrant scatter-plot used to compare the level of importance of and satisfaction with 34 global logistics hub items are shown in Fig 6-7, 6-8 and 6-9. Quadrant 1 in these figures presents those rated as more important and satisfactory items; quadrant 2, more important and less satisfactory items; quadrant 3, less important and satisfactory items; and quadrant 4, less important and more satisfactory items. Therefore, quadrant 1 and quadrant 2 are used to further illustrate the differences between groups. As the means of importance and satisfaction ratings for total respondents are 4.321 and 2.977 respectively. Quadrant 1 in Fig 6-7 indicates those items rated as more important (more than mean importance, 4.321) and satisfactory (more than mean satisfaction, 2.977) by the total respondents group, which are:

(1) Efficiency of seaport/airport operations,
(2) Efficiency of terminal operations,
(3) Labour quality and skilled labour,
(4) Simplified seaport/airport process and documentation
(5) e-business and community network integration,
(6) Seaport/airport operating costs,
(7) Seaport/airport infrastructure,
(8) Seaport/airport facilities and expandability,
(9) ICT infrastructure, and
(10) Security of seaport/airport.

Quadrant 2 in Fig 6-7 indicates those items rated as more important (more than mean importance, 4.321) and less satisfactory (less than mean satisfaction, 2.977) by the total respondents group, which are:

(1) Simplified Customs procedures,
(2) Seaport/airport management information system
(3) Reasonable seaport/airport charges,
(4) Market size/large hinterland/Origin-Destination demand,
(5) Frequent sailings/flights,
(6) Pro-logistics business government and officials,
(7) Government transport policy and actions,
(8) Direct transport link to China,
(9) Political Stability, and
(10) Simplification of trade process.

Fig 6- 7: Quadrant Scatter-plots of Global Logistics Hub Items



Note:
1. Efficiency of seaport/airport operations
2. Efficiency of terminal operations
3. Labour quality and skilled labour
4. Simplified seaport/airport process and documentation
5. Simplified Customs procedures
6. Seaport/airport management information system
7. e-business and community network integration
8. Reasonable seaport/airport charges
9. Seaport/airport operating costs
10. High cargo generating/value-added activities
11. Market size/large hinterland/ Origin-Destination demand
12. International trade-related industrial complexes
13. Regional development around seaport/airport
14. Level of inland transport and inter-modality
15. Natural conditions of seaport/airport (e.g. weather)
16. Geographic location/market accessibility
17. Seaport/airport infrastructure
18. Seaport/airport facilities and expandability
19. Free trade zone
20. Logistics and trade centres
21. ICT infrastructure
22. Seaport/airport services to users
23. Introduction of modern logistics services providers
24. Frequent sailings/flights
25. Pro-logistics business government and officials
26. Government transport policy and actions
27. Privatisation of seaport/airport
28. Organisational restructure of seaport/airport
29. Direct transport link to China
30. Guarantee of foreign investment
31. Openness of foreign labour
32. Political Stability
33. Security of seaport/airport
34. Simplification of trade process

Fig 6-8 and Fig 6-9 show the quadrant scatter-plots of global logistics hub items for the non-carriers and carriers groups respectively. Quadrant 1 in Fig 6-8 indicates those items rated as more important (more than mean importance, 4.235) and satisfactory (more than mean satisfaction, 3.264) by the non-carriers group, which are:

(1) Efficiency of seaport/airport operations,
(2) Efficiency of terminal operations,
(3) Labour quality and skilled labour,
(4) Simplified seaport/airport process and documentation,
(5) Seaport/airport operating costs,
(6) Geographic location/market accessibility,
(7) Seaport/airport infrastructure,
(8) Seaport/airport facilities and expandability,
(9) Free trade zone,
(10) ICT infrastructure,
(11) Seaport/airport services to users, and
(12) Simplification of trade process.

Fig 6- 8: Quadrant Scatter-plots of Global Logistics Hub Items by Non-carriers

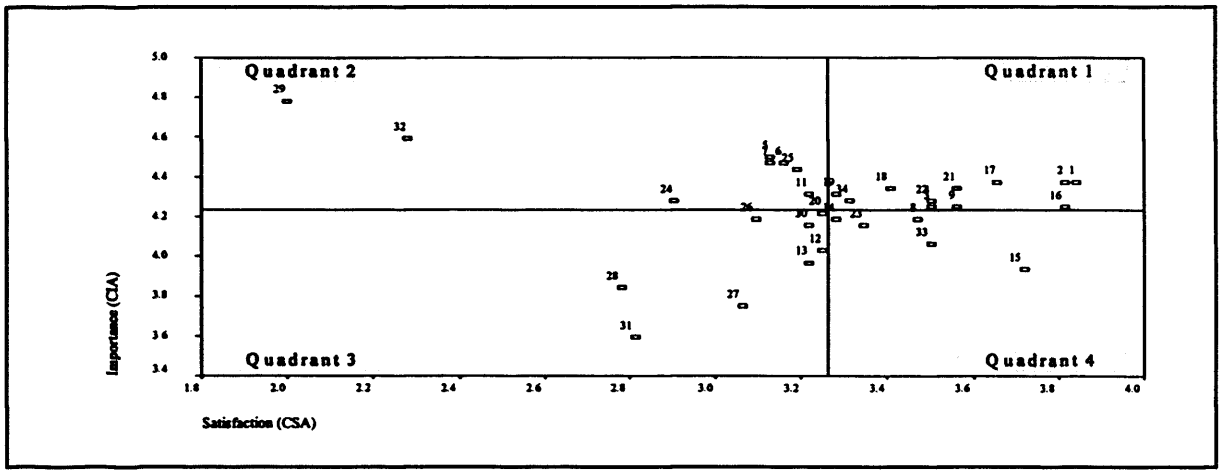
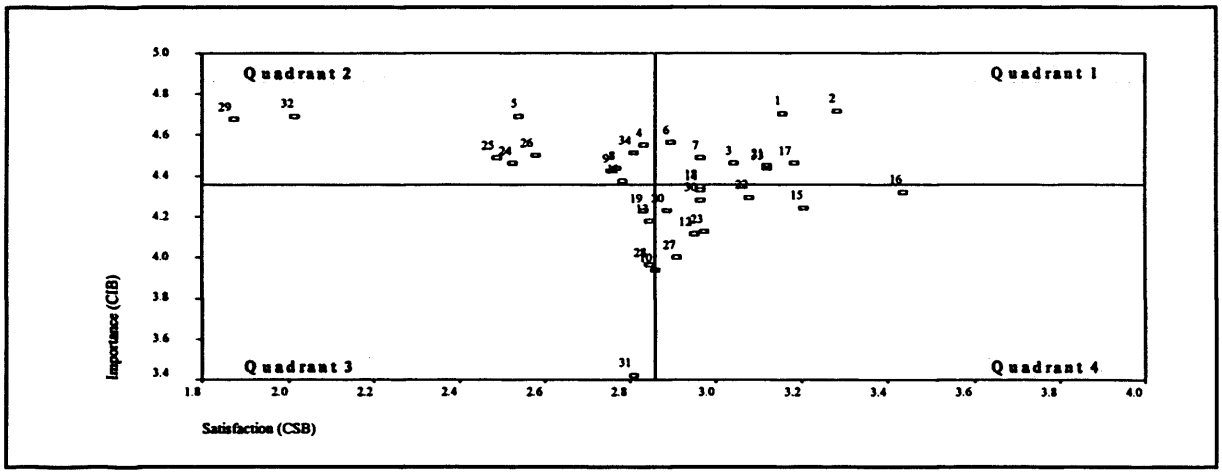


Fig 6- 9: Quadrant Scatter-plots of Global Logistics Hub Items by Carriers



Note:
1. Efficiency of seaport/airport operations
2. Efficiency of terminal operations
3. Labour quality and skilled labour
4. Simplified seaport/airport process and documentation
5. Simplified Customs procedures
6. Seaport/airport management information system
7. e-business and community network integration
8. Reasonable seaport/airport charges
9. Seaport/airport operating costs
10. High cargo generating/value-added activities
11. Market size/large hinterland/ Origin-Destination demand
12. International trade-related industrial complexes
13. Regional development around seaport/airport
14. Level of inland transport and inter-modality
15. Natural conditions of seaport/airport (e.g. weather)
16. Geographic location/market accessibility
17. Seaport/airport infrastructure
18. Seaport/airport facilities and expandability
19. Free trade zone
20. Logistics and trade centres
21. ICT infrastructure
22. Seaport/airport services to users
23. Introduction of modern logistics services providers
24. Frequent sailings/flights
25. Pro-logistics business government and officials
26. Government transport policy and actions
27. Privatisation of seaport/airport
28. Organisational restructure of seaport/airport
29. Direct transport link to China
30. Guarantee of foreign investment
31. Openness of foreign labour
32. Political Stability
33. Security of seaport/airport
34. Simplification of trade process

Quadrant 2 in Fig 6-8 indicates those items rated as more important (more than mean importance, 4.235) and less satisfactory (less than mean satisfaction, 3.264) by the

non-carriers group, which are:

(1) Simplified Customs procedures,
(2) Seaport/airport management information system,
(3) e-business and community network integration,
(4) Market size/large hinterland/Origin-Destination demand,
(5) Frequent sailings/flights,
(6) Pro-logistics business government and officials
(7) Direct transport link to China, and
(8) Political Stability.

Quadrant 1 in Fig 6-9 indicates those items rated as more important (more than mean importance, 4.356) and satisfactory (more than mean satisfaction, 2.859) by the carriers group, which are:

(1) Efficiency of seaport/airport operations,
(2) Efficiency of terminal operations,
(3) Labour quality and skilled labour,
(4) Seaport/airport management information system,
(5) e-business and community network integration,
(6) Seaport/airport infrastructure,
(7) ICT infrastructure, and
(8) Security of seaport/airport.

Quadrant 2 in Fig 6-9 indicates those items rated as more important (more than mean importance, 4.356) and less satisfactory (less than mean satisfaction, 2.859) by the carriers group, which are:

(1) Simplified seaport/airport process and documentation,
(2) Simplified Customs procedures,
(3) Reasonable seaport/airport charges,
(4) Seaport/airport operating costs,
(5) Market size/large hinterland/Origin-Destination demand,
(6) Frequent sailings/flights,
(7) Pro-logistics business government and officials,
(8) Government transport policy and actions,
(9) Direct transport link to China,
(10) Political Stability, and
(11) Simplification of trade process.

6.4 Factor Analysis

The questionnaire survey includes three questions; they have 15, 26 and 34 question items respectively. Factor analysis of SPSS is used to extract smaller set of factors presenting meaningful patterns among the original items for each question. In order to successfully obtain the factors, *eigen values greater than one criterion,* principal components analysis with *VARIMAX rotation, factor scree plot and* reliability analysis will also be employed for factor analysis.

Factor analysis includes two main analytic techniques: extraction and rotation. Extraction is the process by which we determine the factors underlying a collection of variables, and rotation is used to simplify structure when extraction technique has identified more than one factor underlying the relationships between a number of variables. Rotation can give us an idea of how the factors we initially extracted differ from each other and to provide a clear picture of which items load on which factor. Two types of criteria, eigen values and scree plot, are most commonly used to determine the number of factors to extract. SPSS software is used to calculate the potential factors and assigns each in descending order, an eigen value. Traditionally, factors with eigen values greater than one are seen as significant factors and this software will extract that number of factors. However, some statisticians prefer to use the scree plot; it can plot the eigen values in order to provide a visual assessment that allows the analyst to see which factors should be accepted. In order to clearly determine the number of factors, both eigen values and the scree plot are used for the research (Miler, et. al., 2002).

After completing the factor analysis, it is better to examine the reliability of the questionnaire. Cronbach's α is the internal consistency measure most used to determine reliability. SPSS software was used to calculate the reliability of each scale. Generally,

an acceptable Cronbach's α value for reliable scales is 0.70. Cronbach's α values as low as 0.50 are acceptable for newly developed scales (Wu, 1999).

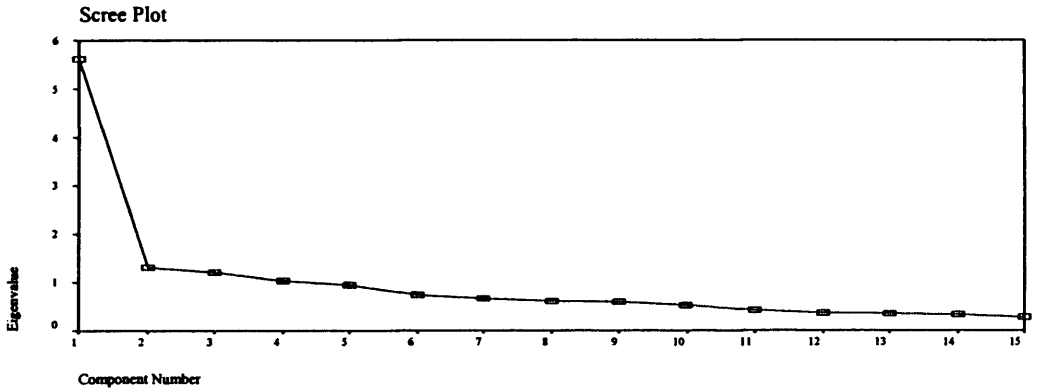
6.4.1 Factor Analysis of Driving Force Items

Factor analysis of the questionnaire data on driving force items was conducted to extract the strategic dimension, as shown in Table 6-14 and Fig 6-10. In addition, *scree plot and eigen value greater than one criterion* were used to determine the number of factors in each data set. Four factors emerged, accounting for 60.9% of the total variance, which may be adequate to represent these 15items.

Table 6- 14: Factor Analysis of Driving Force Items

	Driving Force Items	Component			
		Factor 1	Factor 2	Factor 3	Factor 4
1	13.Provision of JIT delivery/ D2D services	.792		.158	
2	15.Visibility of logistics chain	.694	.319	.179	
3	14.Increasing geographical span of logistics service	.646	.269		.199
4	3.Shippers' logistics outsourcing	.604		.210	.142
5	12.Expansion of services/one-stop shopping service	.548	.417	.194	.187
6	6.New technologies in transport and ICT		.767	.134	
7	7.Simplification of process flow and documentation		.705	.345	
8	5.Learning and experience from logistics service	.470	.644		
9	8.Decrease of cargo/product inventory	.409	.503	.147	.417
10	4.Gaining economies of scale and scope	.354	.420	.176	.366
11	10.Trade liberalisation	.167	.272	.832	
12	11.Relaxation of trade barriers	.227	.259	.791	
13	9.Deregulation of transport and infrastructure	.274		.632	.354
14	1.Growth of international trade		.115		.845
15	2.Global production and demand for transhipment	.376		.199	.585
	Eigen values	5.611	1.309	1.207	1.027
	Percentage variable (total 60.9%)	37.4	8.7	8.0	6.8

Fig 6- 10: Factor Scree Plot of Driving Force Items



Reliability analysis was conducted to examine the items of each factor; Cronbach's α values for these four factors are 0.7754, 0.7722, 0.7845 and 0.3963 respectively. The fourth value, 0.3963, is less than 0.5, showing only a little bit reliable. Therefore, based on the literature review and consultation with experts, the item "*shippers' logistics outsourcing*" in factor 1 was moved into factor 4 to re-examine their reliability. The results are shown in Table 6-15. The Alpha values for these four factors are 0.7895, 0.7722, 0.7845, and 0.4719 respectively; their values are more than 0.7 except the fourth one. As the fourth value increases to 0.4719, the factor dimensions can be assumed to be more reliable than the test conducted before.

As shown in Table 6-14 and 6-15, the first factor (F1) comprises four items: "provision of JIT delivery/D2D services", "visibility of logistics chain", "increasing geographical span of logistics service", and "expansion of services/one-stop shopping service"; the factor can be named as **Competition Driver**. The second factor (F2) comprises five items: "*new technologies in transport and ICT*", "*simplification of process flow and documentation*", "*learning and experience from logistics service*", "*decrease of cargo/product inventory*", and "*gaining economies of scale and scope*"; the factor can be named as **Cost Driver**. The third factor (F3) comprises three items: "*trade liberalisation*", "*relaxation of trade barriers*", and "*deregulation of transport and infrastructure*"; the factor can be named as **Government Driver**. And the fourth factor (F4) comprises three items: "*growth of international trade*", "*global production and demand for transhipment*", and "*shippers' logistics outsourcing*"; the factor can be named as **Market Driver**. Therefore, four factors are extracted from the data analysis of 15 driving force items; of which, **government driver** is the most important factor, with a mean of 4.5273, followed by market driver, competition driver and cost driver.

Table 6- 15: Reliability Analysis of Driving Force Factors

Factors and Items	Rank	Mean of Importance	Mean of Factor	Alpha	Rank	Mean of Satisfaction
F1: Competition Driver						
13.Provision of JIT delivery/D2D services	8	4.373			2	3.2
15.Visibility of logistics chain	13	4.055	4.2432	α=0.7895	10	2.964
14.Increasing geographical span of logistics service	10	4.218			7	2.982
12.Expansion of services/one-stop shopping service	9	4.327			5	3.118
F2: Cost Driver						
6.New technologies in transport and ICT	7	4.455			1	3.245
7.Simplification of process flow and documentation	3	4.509			13	2.845
5.Learning and experience from logistics service	14	3.927	4.2364	α=0.7722	11	2.955
8.Decrease of cargo/product inventory	12	4.127			4	3.155
4.Gaining economies of scale and scope	11	4.164			8	2.973
F3: Government Driver						
10.Trade liberalisation	1	4.627			9	2.964
11.Relaxation of trade barriers	5	4.482	**4.5273**	α=0.7845	15	2.727
9.Deregulation of transport and infrastructure	6	4.473			14	2.845
F4: Market Driver						
1.Growth of international trade	2	4.6			3	3.164
2.Global production and demand for transhipment	4	4.491	4.3273	α=0.4719	12	2.927
*3.Shippers' logistics outsourcing	15	3.891			6	2.991

Note: Mean of Importance represents the mean importance ratings of each item
Mean of Factor represents the mean importance ratings of items in each factor
Mean of Satisfaction represents the mean satisfaction ratings of each item

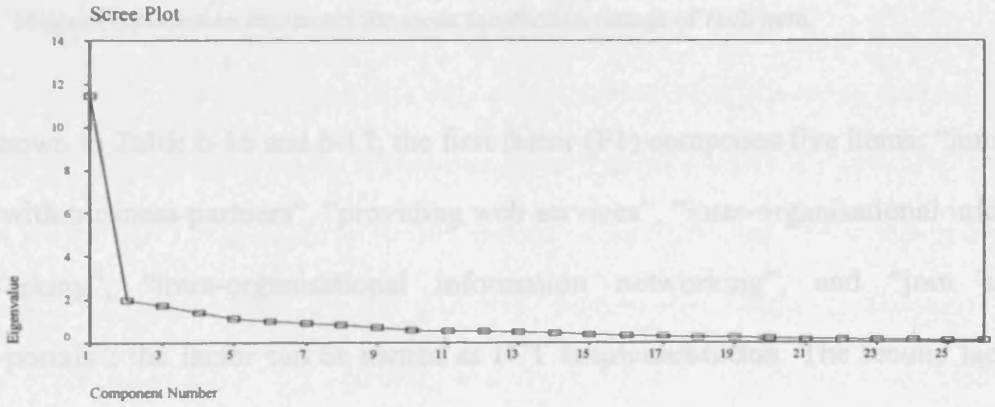
6.4.2 Factor Analysis of Global Logistics Service Items

Factor analysis of the questionnaire data on critical items for global logistics services was conducted to extract the strategic dimension, as shown in Table 6-16 and Fig 6-11. In addition, *scree plot and eigen value greater than one criterion* were used to determine the number of factors in each data set. Since there were differences between the non-carriers and carriers groups according to the t-test of these two groups' importance ratings in section 6.3.2 of this Chapter, factor analysis was conducted based on the data from the carriers group. Five factors emerged, accounting for 67.8% of the total variance, which may be adequate to represent these 26 items.

Table 6- 16: Factor Analysis of Global Logistics Service Items

	Global Logistics Service Items	Component				
		Factor 1	Factor 2	Factor 3	Factor 4	Factor 5
1	24. Information links with business partners	.803	.165		.251	.166
2	25. Providing web service (e.g. on-line booking, tracking)	.746	.220	.206		
3	23. Inter-organisational information networking	.724	.299	.138	.157	.317
4	26. Joining shippers' portals	.692		.271	.341	
5	22. Intra-organisational information networking	.674		.336		.435
6	10. Providing value-added service (e.g. marking/packaging)		.715	.199	.245	.158
7	1. Cargo consolidation and distribution service		.710		.221	.209
8	4. Provision of land/air/sea-integrated transport	.307	.676	.363		
9	3. Provision of transport/logistics plan for shippers	.477	.596	.254	.213	
10	14. Providing customs clearance service	.210	.542	-.242	.445	.124
11	2. Enhancing transport chain/network	.368	.527	.186		.463
12	9. Provision of inventory control service	.205	.504	.310	.435	.140
13	6. Large ships/aircrafts or simplified transport fleet	.231	.111	.793		
14	7. Investing in terminal operations/dedicated terminal	.173	.182	.699	.142	.223
15	18. Partnership or joint venture with other carriers	.106	.311	.589	.258	.406
16	8. Investing in warehouse/distribution centre	.159	.473	.589	.395	
17	19. Merger, acquisition of other carriers	.125	.224	.550	.345	.351
18	17. Slot exchange/code share with other carriers	.311		.548	.169	.426
19	13. Free customers service/consultation/complain	.290		.113	.752	.207
20	15. Business alliances with global shippers		.231	.345	.700	.125
21	16. Order entry, processing and fulfilment for shippers	.372	.316		.554	.275
22	12. Product returns and repair		.412	.335	.554	.339
23	5. Freight bill audit and payment		.293	.430	.506	.109
24	11. Providing service for specialised cargo	.362	.362	.345	.458	
25	20. Business process re-engineering/BPR		.123	.162	.260	.861
26	21. Enterprise Resource Planning/ERP	.338	.230	.238	.283	.715
	Eigen values	11.448	1.948	1.714	1.407	1.122
	Percentage variable (total 67.8%)	44.0	7.5	6.6	5.4	4.3

Fig 6- 11: Factor Scree Plot of Global Logistics Service Items



Reliability analysis was also conducted to examine these five factors. As shown in Table 6-17, Cronbach's α values for these five factors are 0.8628, 0.8572, 0.8718, 0.8611 and 0.8712 respectively, these α values are more than 0.7. Thus, the factor dimensions can be assumed to be reliable.

Table 6- 17: Reliability Analysis of Global Logistics Service Factors

Factors and Items	Rank	Mean of Importance	Mean of Factor	Alpha	Rank	Mean of Satisfaction
F1: ICT implementation						
24. Information links with business partners	6	4.269			21	2.936
25. Providing web service (e.g. on-line booking, tracking)	2	4.5			5	3.179
23. Inter-organisational information networking	5	4.346	**4.3103**	α=0.8628	11	3.064
22. Intra-organisational information networking	3	4.41			3	3.244
26. Joining shippers' portals	14	4.026			25	2.885
F2: Logistics Integration						
10. Providing value-added service (e.g. marking/packaging)	22	3.833			18	2.974
1. Cargo consolidation and distribution service	10	4.143			10	3.065
4. Provision of land/air/sea-integrated transport	4	4.359	4.1837	α=0.8572	20	2.949
3. Provision of transport/logistics plan for shippers	7	4.231			24	2.91
14. Providing customs clearance service	9	4.218			12	3.038
2. Enhancing transport chain/network	1	4.538			19	2.962
9. Provision of inventory control service	16	3.923			7	3.128
F3: Investment and alliance						
6. Large ships/aircrafts or simplified transport fleet	20	3.846			2	3.269
7. Investing in terminal operations/dedicated terminal	11	4.128			4	3.231
18. Partnership or joint venture with other carriers	24	3.59			9	3.077
8. Investing in warehouse/distribution centre	13	4.051	3.8889	α=0.8718	8	3.103
19. Merger, acquisition of other carriers	26	3.487			16	3
17. Slot exchange/code share with other carriers	8	4.231			1	3.474
F4: Customer Service						
13. Free customer service/consultation/complaints	12	4.103			15	3
15. Business alliances with global shippers	23	3.795			23	2.923
16. Order entry, processing and fulfilment for shippers	17	3.885	3.8397	α=0.8611	13	3.026
12. Product returns and repair	25	3.551			26	2.859
5. Freight bill audit and payment	18	3.859			6	3.154
11. Providing service for specialised cargo	21	3.846			17	2.974
F5: Business Re-engineering						
20. Business process re-engineering/BPR	15	3.962	3.9103	α=0.8712	22	2.936
21. Enterprise Resource Planning/ERP	19	3.859			14	3.013

Note: Mean of Importance represents the mean importance ratings of each item
Mean of Factor represents the mean importance ratings of items in each factor
Mean of Satisfaction represents the mean satisfaction ratings of each item

As shown in Table 6-16 and 6-17, the first factor (F1) comprises five items: "information link with business partners", "providing web services", "inter-organisational information networking", "intra-organisational information networking", and "join shippers' web-portals"; the factor can be named as **ICT Implementation**. The second factor (F2) comprises seven items: "*providing value-added service (e.g. marking/packaging)*", "*cargo consolidation and distribution service*", "*provision of land/air/sea-integrated transport*", "*provision of transport/logistics plan for shippers*", "*providing customs clearance service*", "*enhancing transport chain/network*", and "*provision of inventory control service*"; the factor can be named as **Logistics Integration**. The third factor (F3) comprises six items: "*large ships/aircrafts or simplified transport fleet*", "*investing in*

terminal operations/dedicated terminal", "*partnership or joint venture with other carriers*", "*investing in warehouse/distribution centre*", "*merger, acquisition of other carriers*", and "*slot exchange/code share with other carriers*"; the factor can be named as **Investment and Alliance**. The fourth factor (F4) comprises six items: "*free customer service/ consultation/complaints*", "*business alliances with global shippers*", "*order entry, processing and fulfilment for shippers*", "*product returns and repair*", "*freight bill audit and payment*", and "*providing service for specialised cargo*"; the factor can be named as **Customer Service**. And the fifth factor (F5) comprises two items: "*business process re-engineering/BPR*", and "*enterprise Resource Planning/ERP*"; the factor can be named as **Business Re-engineering**. Therefore, five factors are extracted from the factor analysis of 26 global logistics service items; ***ICT implementation*** is the most important factor, with a mean of 4.3103, followed by *logistics integration*, *business re-engineering*, *investment and alliance*, and *customer service*.

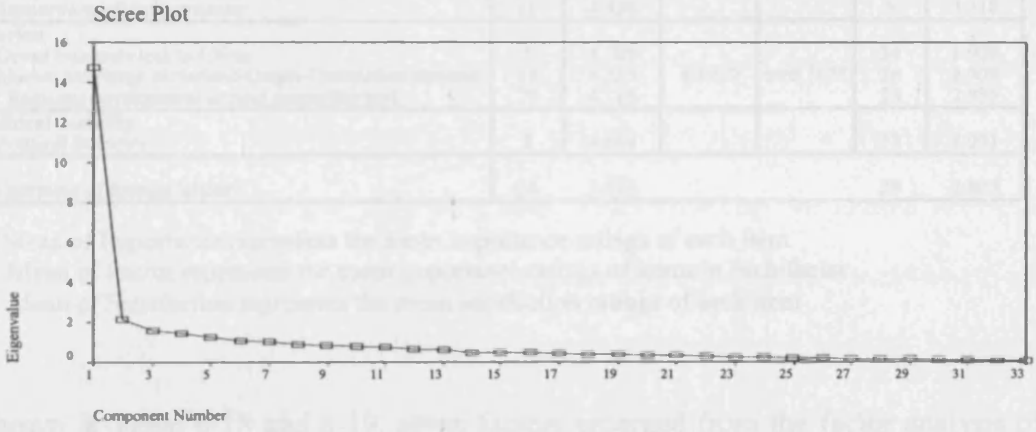
6.4.3 Factor Analysis of Global Logistics Hub Items

Factor analysis of the questionnaire data on global logistics hub items was conducted to extract the strategic dimension. The initial factor analysis used the importance data of 34 items from the questionnaire. Seven factors were extracted from the analysis and Cronbach's Alpha values for the last two factors were found to be less than 0.4. Subsequently, the item "*the openness of foreign labour*" was omitted when conducting the second factor analysis because the item was neither important nor satisfactory and not co-related to the item "*political stability*". The results of the second analysis are shown in Table 6-18 and Fig 6-12. In addition, *scree plot and eigen value greater than one criterion* were used to determine the number of factors in each data set. Seven factors emerged, accounting for 70.7% of the total variance, which may be adequate to represent these 33 items.

Table 6- 18: Factor Analysis of Global Logistics Hub Items

	Global Logistics Hub Items	Component						
		Factor 1	Factor 2	Factor 3	Factor 4	Factor 5	Factor 6	Factor 7
1	20. Logistics and trade centres	.798	.218	.131	.155		.144	-.130
2	19. Free trade zone	.796	.157	.152	.181		.283	
3	22. Seaport/airport services to users	.706	.228	.224	.235	.142		.219
4	23. Introduction of modern logistics services providers	.690	.204	.285	.308	.110	.127	.101
5	18. Seaport/airport facilities and expandability	.626	.232	.171	.229	.283	.189	.278
6	14. Level of inland transport and inter-modality	.581		.372	.155	.253		.187
7	12. International trade-related industrial complexes	.564		.111	.431	.153	.380	
8	*10. High cargo generating/value-added activities	.468	.174	.296	.422		-.116	-.245
9	*13. Regional development around seaport/airport	.432	.160		.401	.298	.382	.111
10	2. Efficiency of terminal operations		.832	.124		.272	.151	.207
11	1. Efficiency of seaport/airport operations	.211	.824	.111		.153	.119	.185
12	3. Labour quality and skilled labour	.170	.732	.277	.176	.178	.155	
13	4. Simplified seaport/airport process and documentation	.340	.697	.283	.207	.123		.152
14	5. Simplified Customs procedures	.122	.537	.463	.163	.145		
15	6. Seaport/airport management information system	.224	.209	.803		.107	.192	
16	7. e-business and community network integration	.334	.231	.722		.194		
17	25. Pro-logistics business government and office	.157	.231	.561	.434	.100	.123	.171
18	26. Government transport policy and actions		.260	.535	.347	.266	.142	.366
19	*21. ICT infrastructure	.502	.119	.511	-.185	.252	.288	.293
20	28. Organisational restructure of seaport/airport	.426		.141	.651	.316		.138
21	27. Privatisation of seaport/airport	.179	.140		.647	.219	.133	
22	30. Guarantee of foreign investment	.274	.131	.206	.595		.346	.159
23	33. Security of seaport/airport	.308	.437		.466		.225	.325
24	34. Simplification of trade process	.369	.363	.328	.420		.121	.281
25	8. Reasonable seaport/airport charges		.105	.200	.220	.836	.153	
26	9. Seaport/airport operating costs		.301	.245	.240	.680	.135	
27	16. Geographic location/market accessibility	.414	.288		.177	.625	.103	.310
28	15. Natural conditions of seaport/airport (e.g. weather)	.401	.228	.100		.586		.356
29	17. Seaport/airport infrastructure	.337	.296	.294		.515	.148	.395
30	**29. Direct transport link to China**	.116		.205	.143		.711	.174
31	11. Market size/large hinterland/Origin-Destination demand	.343	.207	.103	.116	.294	.668	-.123
32	*24. Frequent sailings/flights	.354	.190	.456	.229	.158	.458	
33	**32. Political Stability**		.256		.232	.108		.726
	Eigen values	14.743	2.175	1.599	1.437	1.256	1.081	1.038
	Percentage variable (total 70.7%)	44.7	6.6	4.8	4.4	3.8	3.3	3.1

Fig 6- 12: Factor Scree Plot of Global Logistics Hub Items



Reliability analysis was also conducted to examine these 33 items concerning the global

logistics hub, as shown in Table 6-19. Some adjustments had been made before conducting the analysis, as some factor correlation values were less than 0.5. Table 6-19 indicates that Cronbach's α for these six factors is 0.9218, 0.8951, 0.8570, 0.8327, 0.8683 and 0.7055 respectively: the seventh factor comprises only one item. As the values are more than 0.7, the factor dimensions can be assumed to be reliable.

Table 6- 19: Reliability Analysis of Global Logistics Hub Factors

Factors and Items	Rank	Imp. Mean	Factor Mean	Alpha	Rank	Sat. Mean
F1: Facilities						
20. Logistics and trade centres	26	4.227			18	2.991
19. Free trade zone	24	4.255			22	2.964
22. Seaport/airport services to users	22	4.291			8	3.2
23. Introduction of modern logistics services providers	28	4.136	4.2568	α=0.9218	11	3.082
18. Seaport/airport facilities and expandability	19	4.345			10	3.091
14. Level of inland transport and inter-modality	23	4.291			12	3.055
12. International trade-related industrial complexes	30	4.091			13	3.036
*21. ICT infrastructure	12	4.418			6	3.245
F2: Operations						
2. Efficiency of terminal operations	4	4.618			2	3.436
1. Efficiency of seaport/airport operations	5	4.609			3	3.355
3. Labour quality and skilled labour	15	4.4	4.5473	α=0.8951	9	3.173
4. Simplified seaport/airport process and documentation	8	4.473			15	3.027
5. Simplified Customs procedures	3	4.636			30	2.709
F3: Service						
6. Seaport/airport management information system	6	4.536			19	2.973
7. e-business and community network integration	7	4.482			16	3.009
25. Pro-logistics business government and officials	9	4.473	4.4618	α=0.8570	31	2.691
26. Government transport policy and actions	13	4.409			29	2.727
*24. Frequent sailings/flights	14	4.409			32	2.636
F4: Government						
28. Organisational restructure of seaport/airport	33	3.927			27	2.826
27. Privatisation of seaport/airport	32	3.927			24	2.955
30. Guarantee of foreign investment	25	4.245	4.1453	α=0.8327	14	3.036
33. Security of seaport/airport	20	4.327			7	3.227
34. Simplification of trade process	10	4.445			25	2.955
*10. High cargo generating/value-added activities	31	4			21	2.964
F5: Cost						
8. Reasonable seaport/airport charges	17	4.364			20	2.973
9. Seaport/airport operating costs	16	4.373			17	2.991
16. Geographic location/market accessibility	21	4.3	4.3255	α=0.8683	1	3.545
15. Natural conditions of seaport/airport (e.g. weather)	27	4.155			4	3.355
17. Seaport/airport infrastructure	11	4.436			5	3.318
F6: Market						
29. Direct transport link to China	1	4.709			34	1.909
11. Market size/large hinterland/Origin-Destination demand	18	4.355	4.3939	α=0.7055	26	2.909
*13. Regional development around seaport/airport	29	4.118			23	2.955
F7: Political Stability						
32. Political Stability	2	4.664			33	2.091
31. Openness of foreign labour	34	3.473			28	2.809

Note: Mean of Importance represents the mean importance ratings of each item
Mean of Factor represents the mean importance ratings of items in each factor
Mean of Satisfaction represents the mean satisfaction ratings of each item

As shown in Table 6-18 and 6-19, seven factors emerged from the factor analysis of the 33 items concerning the global logistics service hub. The first factor (F1) comprises eight items: "*logistics and trade centres*", "*Free trade zone*", "*Seaport/airport services to*

users", "*introduction of modern logistics services providers*", "*Seaport/airport facilities and expandability*", "*level of inland transport and inter-modality*", "*international trade-related industrial complexes*", and "*ICT infrastructure*"; the factor can be named as **Facilities.** The second factor (F2) comprises five items: "*efficiency of terminal operations*", "*efficiency of seaport/airport operations*", "*labour quality and skilled labour*", "*simplified seaport/airport process and documentation*", and "*simplified Customs procedures*"; the factor can be named as **Operations.** The third factor (F3) comprises five items: "*seaport/airport management information system*", "*e-business and community network integration*", "*pro-logistics business government and officials*", "*Government transport policy and actions*", and "*Frequent sailings/flights*"; the factor can named as **Service.** The fourth factor (F4) comprises six items: "*organisational restructure of seaport/airport*", "*privatisation of seaport/airport*", "*guarantee of foreign investment*", "*security of seaport/airport*", "*Simplification of trade process*", and "*high cargo generating/value-added activities*"; the factor can named as **Government.** The fifth factor (F5) comprises five items: "*reasonable seaport/airport charges*", "*seaport/airport operating costs*", "*geographic location/ market accessibility*", "*natural conditions of seaport/airport (e.g. weather)*", and "*seaport/airport infrastructure*"; the factor can named as **Cost.** The sixth factor (F6) comprises three items: "*direct transport link to China*", "*market size/large hinterland/origin-destination demand*", and "*regional development around seaport/airport*"; the factor can be named as **Market.** And the seventh factor (F7) comprises only one item; the factor can be named as **Political Stability.** Therefore, seven factors are extracted from the factor analysis of global logistics hub items: *facilities, operations, service, government, cost, market, and political stability*; in which, ***operations*** is the most important factor, with a mean of 4.5473.

6.5 Summary

The questionnaire survey has been conducted in October 2004. 168 survey mails were sent out for reply. The total number of responses and the responses containing usable data were 112 and 110 respectively; these reflected response rates of 66.7% and 65.5%. Though the response rate is considerably high, non-response bias has been tested. It has been found that the survey responses could be generalised to the target population regarding three questions. The data also showed that 86.4% of the respondents were senior persons working in the field of international freight transport and logistics, and 88.2% of them had worked therein for more than 10 years.

The respondents were categorised into two groups: non-carriers and carriers for data analysis; the former comprises respondents from government and academia, and the latter are those from ocean carriers, air carriers, and logistics/terminal operators.

Frequency analysis was conducted on the respondents' importance and satisfaction ratings of items in the three questions respectively. It has been found that there are not significantly different between non-carriers and carriers groups except the importance ratings of global logistics service items. The mean importance of and satisfaction with each questionnaire items have also been obtained in terms of different groups and survey questions.

Quadrant scatter-plots were used to compare the levels of importance and satisfaction of questionnaire items in terms of different groups. The items considered more important and satisfactory and the items considered more important and less satisfactory are obtained. The results can be regarded as the advantageous and disadvantageous items for

the three issues (questions) in the questionnaire, and they will be used for further discussions in the following chapter.

Factor analysis of the survey data has revealed that four factors, i.e., *market, cost, government* and *competition,* are the driving forces for the evolution of global logistics services; of these, the *government* factor is the most important. It also reveals that the carriers group indicates the item "*the growth of international trade*" is the most important to the evolution of global logistics services. Five factors, i.e., *ICT implementation, logistics integration, investment and alliance, customer service,* and *business re-engineering*, are critical for international carriers in providing global logistics services; of these, the factor "*ICT implementation*" is the most important. In addition, seven factors, i.e., *facilities, operations, service, government, cost, market,* and *political stability,* are relevant to the success of a global logistics hub; of these, the factor "*operations*" is the most important.

Chapter 7 Suitable Transport Policies and ICT Development Strategies

Chapter Aims:

- Examine three hypotheses supported by primary and secondary data
- Explain suitable government transport policies and ICT development strategies

7.1 Introduction

This chapter, based on the literature review in Chapters 2, 4, 5 and the statistical analysis in Chapter 6, is intended to find the answer to the research question, to prove the hypotheses, and to make sure research objectives are achieved. It will also explain how government transport policies and strategies that exist fit into and related to research question of this research. The three hypotheses are:

H1: International trade is influencing global logistics services

H2: ICT implementation is a key factor in providing global logistics services

H3: Suitable government transport policies can successfully establishing global logistics hubs

7.2 International Trade and Global Logistics Services

This section includes two parts; the first part will examine Hypothesis One and the second part will analyse the advantageous/disadvantageous driving force items in Taiwan. The analysis is intended to make sense of the analysis in the light of finding of the hypothesis. The hypothesis is as follows.

H1: International trade is influencing the evolution of global logistics services

7.2.1 The Development of International Trade and Transport

The last few decades have seen a steady growth of international trade in terms of either value or volume. This was addressed in Section 4.2.1 of Chapter 4. Asian countries have also experienced the growth of their international trade in recent years except the financial crash in 1997 (Biers, 1998). In 2003, **China** became the largest market for its Asian neighbours, accounting for 10.1% of Asia's exports, exceeding for the first time the share of Japan (8.8%) (WTO, 2004). The growth of international trade has led to the growth of international freight transport. Containers are transported worldwide along east-west, north-south and intra-regional routes; the major east-west routes are crossing the three continents of Asia, Europe and North America; north-south and intra-regional routes are articulated around the major production and consumption centres of Europe, the Far East and North America (UNCTAD, 2004). In addition, international freight transport by air is becoming more and more important to international trade as the cargos transported by air represent high-valued products.

East Asian countries have a significant presence in the global container shipping network. By May 2004, eleven of the world's leading 20 container shipping companies, as shown in Table 4-2, were based in East Asia; they were Evergreen (Taiwan), APL (Singapore), Hanjin (Korea), NYK (Japan), COSCO (China), China Shipping (China), OOCL (Hong Kong), K-Line (Japan), MOL (Japan), Yang Ming (Taiwan), and Hyundai (Korea). Together, these leading East Asian container shipping companies operated 30.6% of the existing TEU carrying capacity (UNCTAD, 2005). East Asian countries have also a significant presence in the global airfreight network. By 2004, ten of the world's top 25 airlines in terms of revenue ton kilometres, as shown in Table 4-3, were based in East Asia; they were Korean (Korea), Singapore, Cathay Pacific (Hong Kong), China Airlines (Taiwan), EVA (Taiwan), JAL Group (Japan), Asiana (Korea), Malaysia, Air China

(China), and Nippon Cargo (Japan) (AB, 2005).

7.2.2 International Carriers and Their Logistics Subsidiaries

A global logistics service refers to the provision of international freight transport and logistics functions by a logistics service provider for global shippers to conduct global sourcing, marketing, and/or production. Global logistics service providers can be carrier-based, warehouse-based, brokerage/forwarder-based, or information-based. At present, almost all of the leading international carriers have provided logistics services to global shippers. Table 7-1 shows the selected leading international carriers and their logistics subsidiaries.

Table 7- 1: Selected World-Leading Carriers and Their Logistics Subsidiaries

Carriers	Logistics Service	Notes
Maersk Lines	Maersk Logistics Inc.	The company, a part of A.P. Moller-Maersk group, was established in 2000, and now operates in more than 70 countries and employs over 4,500 people
APL	APL logistics Inc.	APL Logistics is a part of NOL group. Now operates more than 115 offices and 200 warehouses in 100 countries and employs over 4,700 people
NYK	NYK Logistics Inc.	Established in 1980s. Now operates 330 warehouses and offices and employs over 17,000 people
K Line	K Line Total Logistics	Set up logistics department to enhance logistics service by combining forwarding, consolidation, ocean carriage, air carriage, transloading, distribution and trucking under a one-stop service.
Evergreen	Round-The-World Logistics Corp.	Founded in 1987. Now operates 25 offices and 300 agents in the world to provide fully integrated air & ocean freight forwarding and logistics services.
OOCL	OOCL Logistics Inc.	Formerly named Cargo System, which was established in 1979. Now operates 64 offices in over 28 countries.
Yangming	Yes Logistics Inc.	Established in 1999. Now operates one distribution centre and 3 offices, and employs over 300 people
Hanjin	Hanjin Logistics Inc.	Established in 2001, mainly provides inter-modal service and seamless networking through the US, and other supply chain, transport and information services for global shippers.
MISC	MISC integrated Logistics Sdn Bhd (MILS)	MILS, a subsidiary of MISC, provides integrated logistics services including ocean freighting, distribution, freight forwarding, warehousing etc. in Malaysia, regionally and globally
FedEx	FedEx Trade Networks FedEx Supply Chain Service	The FedEx Trade Networks was established in 2000 to provide global ocean and air cargo distribution, customs, brokerage and advisory services. The FedEx Supply Chain Services was established in 2001 to provide transport and logistics management, consulting and other customised services
DHL	Danzas Air & Ocean Inc.	With the strengths of DHL Worldwide Express, the company now offers its range of products and services on a one-stop basis - a complete range of express, parcel and logistics solutions to global shippers

Source: Compiled by Author

7.2.3 Analysis of Taiwan's International Trade and Transport

Taiwan has trade with almost all of the nations in the world. Its international trade has

increased remarkably in recent years, rising from US$ 121.9 billion in 1990 to US$ 341.8 billion in 2004 (MOEA, 2004). The cargos transported by sea were 134,267,667 metric tons in 1990 and reached 235,824,445 metric tons in 2004, of which 21.74% were containerised. During the same period, the cargos transported by air were 625,430 metric tons and 1,782,513 metric tons respectively (MOTC, 2004).

Table 7-2 shows that the United States and Japan were Taiwan's major trade partners in the 1990s. By 2000, the United States, Japan, Hong Kong, and Germany were Taiwan's four trade partners in terms of trade value; of which, the United States accounted for 30.14% of Taiwan's international trade value. By 2004, Japan, accounting for 16.62%, was Taiwan's leading international trade partner, followed by China (14.83%), the United States (14.55%) and Hong Kong (9.34%).

Table 7- 2: Partners' Share of Taiwan's International Trade

	US	N. Am.	JP	HK	MO	CN	SG	Asia	DE	GB	Europe
Import	%	%	%	%		%	%	%	%	%	%
1990	23.05	**24.58**	29.24	2.64	0.01	0.62	2.57	**43.41**	4.96	2.11	**17.52**
1995	20.06	**21.60**	29.23	1.78	0.03	2.99	2.86	**49.10**	5.49	1.59	**18.06**
2000	17.54	**18.86**	26.05	1.63	0.04	4.90	3.39	**54.91**	3.96	1.37	**13.58**
2004	12.89	**13.60**	25.99	1.25	0.05	9.93	2.56	**56.76**	3.47	1.03	**12.69**
Export											
1990	32.35	**34.67**	12.40	12.73	0.15	0.00	3.28	**38.22**	4.76	2.95	**18.20**
1995	23.65	**24.93**	11.78	23.38	0.17	0.34	3.95	**52.54**	3.44	2.16	**14.08**
2000	23.04	**24.74**	10.83	21.50	0.22	3.31	3.51	**51.69**	3.46	2.89	**15.99**
2004	16.16	**17.10**	7.59	17.14	0.17	19.55	3.64	**62.04**	2.59	1.94	**13.47**
Total											
1990	28.18	**30.14**	19.96	8.20	0.09	0.28	2.96	**40.55**	4.85	2.57	**17.89**
1995	21.92	**23.33**	20.18	12.99	0.1	1.61	3.42	**50.88**	4.43	1.88	**16.00**
2000	20.41	**21.88**	18.09	12.02	0.13	4.07	3.45	**53.25**	3.70	2.16	**14.82**
2004	14.55	**15.38**	16.62	9.34	0.10	14.83	3.11	**59.45**	3.02	1.49	**13.08**

Source: derived from Customs Statistics, MOEA

Prior to 2000, Asian markets accounted for only 40 to 50% of Taiwan's international trade value. Since then, Asian markets have become more important to Taiwan's international trade than other regions. By the end of 2004, Asian markets had reached 59.45% of Taiwan's international trade value. Despite political confrontation, general

trading activities between Taiwan and China have been growing rapidly since the 1990s. In 2004, China ranked as Taiwan's second trade partner; however, it had become the most important region for Taiwan's imports and exports, as most of Taiwan's trade with Hong Kong (9.34%) and Macao (0.1%) were destined for or transhipped from China. Besides China and Japan, other countries, such as South Korea, Vietnam, Thailand, and Malaysia, have become Taiwan's important trade partners in Asia (MOEA, 2004).

Table 7-3 shows the container cargo handled through the seaports and air cargo moved through the airports in Taiwan during 1985-2004, presenting their increases year by year. During 1985-2000, Taiwan enjoyed a growth rate of 16.12% per annum by volume in container transport and 20.92% by weight in air cargo transport. The year 2000 was the turning point for Taiwan's container traffic. After that, the container traffic became stagnant, both in local flow and hub flow. The growth rate of Taiwan's container traffic decreased to only 6.0% per annum during 2000-2004; in contrast, Taiwan experienced a high air cargo growth rate in both air cargo flow and hub flow, reached 10.64% and 122.43% per annum respectively.

Table 7- 3: Gateway and Hub Flow of Taiwan's Container and Air Transport

	Container Transport (TEUs)					**Air Cargo** (metric tons)				
	Total	Local/share		Hub/share		Total	Local/share		Hub/share	
1985	3,075,150	2,503,486	81.4%	571,664	18.6%	302,158	302,158	100.0%	-	0.0%
1990	5,463,563	4,014,074	73.5%	1,449,489	26.5%	625,430	625,430	100.0%	-	0.0%
1995	7,665,178	5,294,798	69.1%	2,370,380	30.9%	805,529	744,398	92.4%	61,131	7.6%
2000	10,510,762	6,171,055	58.7%	4,339,707	41.3%	1,250,328	1,160,859	92.8%	89,469	7.2%
2001	10,427,714	5,914,687	56.7%	4,513,027	43.3%	1,272,819	1,035,553	81.4%	237,266	18.6%
2002	11,608,634	6,658,852	57.4%	4,949,782	42.6%	1,469,588	1,137,603	77.4%	331,985	22.6%
2003	12,094,753	7,025,575	58.1%	5,069,178	41.9%	1,579,025	1,186,032	75.1%	392,993	24.9%
2004	13,034,362	7,578,141	58.1%	5,456,221	41.9%	1,782,513	1,254,888	70.4%	527,625	29.6%
'85-'00	16.12%	9.77%		43.94%		20.92%	18.95%			
'00-'04	6.00%	5.70%		6.43%		10.64%	2.02%		122.43%	

Source: Annual Statistics of Transport and Communications, MOTC, 2004

Table 7-4 indicates Taiwan's air cargo trade partners. It shows that Asian countries are

the dominant markets for Taiwan's air cargo, accounting for 57.46% in 2004. It also shows that the United States, Japan and China (including Hong Kong and Macao) are the top three leading trade partners of Taiwan's air cargo trade.

Table 7- 4: Partners of Taiwan's Air Cargo Trade

	US	N. Am.	JP	HK	MO	CN	SG	Asia	DE	GB	Europe
Import	%	%	%	%	%	%	%	%	%	%	%
1995	16.01	16.54	16.08	14.82			6.79	64.50	3.13	1.61	15.62
2000	17.36	18.27	19.32	13.51		0.26	5.86	61.76	2.15	1.64	16.87
2003	15.26	15.77	23.95	12.86	3.45	3.18	4.97	68.42	2.60	1.57	13.03
2004	16.18	17.10	26.77	10.74	3.87	3.85	4.00	67.63	2.31	1.53	12.83
Export											
1995	25.64	27.14	18.94	13.64			4.18	49.86	4.93	3.38	18.57
2000	27.76	28.79	13.56	11.88		1.48	3.78	46.62	3.87	4.16	20.77
2003	20.61	21.38	14.24	12.52	2.19	9.55	3.37	54.43	3.83	2.94	20.53
2004	19.95	20.71	12.84	11.85	2.83	11.62	3.27	55.44	3.56	2.90	19.84
Transhipment											
1995	29.03	29.43	10.92	7.25			9.92	55.77	2.61	2.70	11.52
2000	35.41	36.36	5.39	10.77		0.17	8.52	53.78	1.86	1.23	7.71
2003	34.13	35.13	4.17	14.97	0.73	1.88	8.08	53.78	2.20	2.04	9.77
2004	37.04	38.21	3.83	15.18	0.97	4.06	7.90	52.6	1.67	1.62	8.05
Total											
1995	22.68	23.51	16.74	13.17			5.97	56.15	3.93	2.62	16.47
2000	24.87	25.85	14.64	12.35		0.85	5.18	53.23	2.96	2.83	17.59
2003	23.48	24.25	13.63	13.39	2.06	5.42	5.29	57.95	2.98	2.29	15.12
2004	25.51	26.47	12.95	12.84	2.39	6.75	5.22	57.46	2.52	2.06	13.55

Source: derived from Annual Statistics of Civil Aviation, CAA

7.2.4 Logistics Service Development in Taiwan

There are approximately 1,400 logistics-related businesses operating in Taiwan, including 510 sea freight forwarders, 685 airfreight forwarders and 100 air/sea international carriers (MOEA, 2004). To cope with the trend for global logistics services, the government agencies have published a number of governing regulations for these domestic firms to provide integrated logistics services of transportation, warehousing, loading and discharging, packaging, value-added processing, customs clearance and information for import and export cargo. Eight domestic firms in Taiwan had been granted permission to operate global logistics services by the end of 2004. One of them is Yes Logistics, which is a subsidiary of Taiwan-based Yangming Lines. Many foreign companies, such as UPS, DHL, Exel, NYK logistics, APL Logistics, and Maersk

Logistics, have also provided logistics services in Taiwan through setting up local offices or joint ventures with other logistics service providers. However, these logistics service providers mainly provide logistics services for small shipments. Their services include supply chain management, consolidation and distribution, warehousing and inventory control, cargo management, one-stop-shop documentation and IT solutions.

7.2.5 The Survey Result indicates the Importance of International Trade

Logistics services provided by a global logistics service provider comprise a variety of activities, such as storage and handling, transportation, consolidation, cross docking, consulting/solutions, pick and pack, light assembly, package and kitting, reverse logistics/return and repair, order processing and fulfilment, information processing, and inventory management. In order to provide a global logistics service, an international carrier would be expected to encounter more complicated processes and difficulties than to provide a domestic logistics service. The question then arises to what forces drive an international carrier's provision of global logistics services?

From the macroeconomic point of view, the key forces driving this evolution are the growing global economy, the relaxation of trade barriers, and the development of logistics management (Tavasszy, et al., 2003). From a microeconomic point of view, companies around the world expand their participation in foreign markets because of their own global strategy, which can assist the achievement one or more of the following benefits: (1) cost reductions, (2) improved quality of products and programmes, and (3) increased competitive leverage (Yip, 1989).

As described in Chapter 6, the questionnaire survey has examined that four forces, *market, cost, government and competition*, are driving the evolution of international

carriers to conducting global logistics services and that the carriers group indicated that the item, *the growth of international trade,* is of the greatest importance to the evolution of global logistics services.

Therefore, analysis of primary data from questionnaire survey in Chapter 6 and the examination of secondary data on the development of global logistics services in this Chapter show above strong support for the hypothesis:

H1: International trade is influencing the evolution of global logistics services

7.2.6 Contemporary Issues Regarding Global Logistics Services in Taiwan

In order to reinforce the findings regarding to the first hypothesis, this research has examined other stringent data. In this regard, the research has through the questionnaire survey explored issues related to global logistics services in Taiwan and these issues are presented in the section that follows.

7.2.6.1 Advantageous/Disadvantageous Driving Force Items

The literature review and questionnaire survey have examined whether four forces, *market, cost, government and competition*, drive the growth of international carriers in conducting global logistics services. The comparison of the importance and satisfaction levels of driving force items was conducted in section 6.3.1 of Chapter 6. The results shown in quadrant 1 and quadrant 2 of Fig 6-1 to 6-3 are summarised in Table 7-5. As quadrant 1 presents those more important and satisfactory items indicated by survey respondents and quadrant 2 presents those more important and less satisfactory items, they can be assumed to be advantageous or disadvantageous for international carriers in conducting global logistics services in Taiwan respectively.

Table 7- 5: Advantageous/Disadvantageous Driving Force Items

	Advantageous Items	Disadvantageous Items
Total Responses	**1. New technologies in transport and ICT** **2. Provision of JIT delivery/ D2D services** **3. Growth of international trade** 5. Expansion of services/ one-stop shopping service	**15. Relaxation of trade barriers** **14. Deregulation of transport and infrastructure** 13. Simplification of process flow and documentation **12. Global production and demand for transhipment** **9. Trade liberalisation**
Non-carriers	**1. New technologies in transport and ICT** **3. Provision of JIT delivery/ D2D services** **4. Growth of international trade** 6. Simplification of process flow and documentation	**15. Relaxation of trade barriers** **12. Deregulation of transport and infrastructure** **10. Global production and demand for transhipment** **7. Trade liberalisation**
Carriers	**1. New technologies in transport and ICT** **2. Provision of JIT delivery/ D2D services** **3. Growth of international trade** 4. Expansion of services/ one-stop shopping service	**15. Relaxation of trade barriers** 14. Simplification of process flow and documentation **13. Deregulation of transport and infrastructure** **12. Global production and demand for transhipment** **9. Trade liberalisation**

Source: Author

Note: Ranked by satisfaction for advantageous items and dissatisfaction for disadvantageous items

In Taiwan, the development of logistics services is still in its infancy. The trends in the global production of Taiwanese manufacturing, in particular the IC and IT industries, have led to the growing demands for global logistics services. Most international carriers and large forwarding companies have also begun to provide integrated logistics services for global shippers in Taiwan. As Table 7-5 shows, both the non-carriers and carriers groups indicate that three items, "*new technologies in transport and ICT*", "*provision of JIT delivery/D2D services*", and "*growth of international trade*", are advantageous for international carriers in conducting global logistics services in Taiwan. In addition, the non-carriers group indicates the item "*simplification of process flow and documentation*" and the carriers group indicates the item "*expansion of services/ one-stop shopping service*" is also advantageous for international carriers in conducting global logistics services in Taiwan.

The table also shows that both the non-carriers and carriers groups indicate that the items "*relaxation of trade barriers*", "*deregulation of transport and infrastructure*", "*global production and demand for transhipment*", and "*trade liberalisation*" are disadvantageous for international carriers in conducting global logistics services in

Taiwan. In contrast, the carriers group indicates that the item, "*simplification of process flow and documentation*", is disadvantageous for international carriers in conducting global logistics services in Taiwan.

7.2.6.2 Advantageous/Disadvantageous Global Logistics Service Items

The factor analysis of the second question in the questionnaire has discovered that five factors, namely, *ICT implementation, logistics integration, investment and alliance, customer service, and business re-engineering,* are related to international carriers gaining competitive advantages in providing global logistics services.

A comparison of importance and satisfaction levels of global logistics service items was conducted in section 6.3.2 of Chapter 6. The results shown in quadrant 1 and quadrant 2 in Fig 6-4 to 6-6 are summarised in Table 7-6.

Table 7- 6: Advantageous/Disadvantageous Global Logistics Service Items

	Advantageous Items	Disadvantageous Items
Total Responses	**1. Slot exchange/code share with other carriers** 2. Investing in terminal operations/dedicated terminal **3. Intra-organisational information networking** **5. Cargo consolidation and distribution service** **6. Providing web service** 7. Investing in warehouse/distribution centre **10. Inter-organisational information networking**	25. Joining shippers' portals **23. Information links with business partners** 21. Provision of transport/logistics plan for shippers 20. Business process re-engineering/BPR 16. Free customer service/consultation/complaints 15. Provision of land/air/sea-integrated transport **13. Providing customs clearance service** 11. Enhancing transport chain/network
Non-carriers	**1. Cargo consolidation and distribution service** **3. Slot exchange/code share with other carriers** **4. Intra-organisational information networking** 5. Enhancing transport chain/network 7. Provision of land/air/sea-integrated transport **9. Providing web service** **10. Inter-organisational information networking**	**21. Information links with business partners** 20. Joining shippers' portals 18. Providing value-added service 17. Business process re-engineering/BPR **12. Providing customs clearance service**
Carriers	**1. Slot exchange/code share with other carriers** **3. Intra-organisational information networking** 4. Investing in terminal operations/dedicated terminal **5. Providing web service** 8. Investing in warehouse/distribution centre **10. Cargo consolidation and distribution service** **11. Inter-organisational information networking**	24. Provision of transport/logistics plan for shippers **22. Information links with business partners** 20. Provision of land/air/sea-integrated transport 19. Enhancing transport chain/network 15. Free customer service/consultation/complaints **12. Providing customs clearance service**

Source: Author

Note: Ranked by satisfaction for advantageous items and dissatisfaction for disadvantageous items

The table shows that both the non-carriers and carriers groups indicate that the items *"slot exchange/code share with other carriers"*, *"intra-organisational information networking"*, *"cargo consolidation and distribution service"*, *"providing web service"* and *"inter-organisational information networking"* are advantageous for international carriers in providing global logistics services in Taiwan. However, the survey also indicates differences between the non-carriers and carriers groups. The non-carriers group indicates that Taiwan has two other advantageous items, *"enhancing transport chain/network"* and *"provision of land/air/sea-integrated transport"*; however, the carriers group indicates that *"investing in terminal operations/dedicated terminal"* and *"investing in warehouse/distribution centre"* are also advantageous for international carriers in conducting global logistics services in Taiwan.

Regarding disadvantageous items for international carriers in conducting global logistics services in Taiwan, eight items are obtained from the questionnaire in general. However, both the non-carriers and carriers groups only agree on two items, *"information links with business partners"* and *"providing customs clearance service"*.

7.3 ICT Development Strategies

This section includes two parts; the first part will examine the Hypothesis Two and the second part will examine Taiwan's ICT development strategies. The analysis is intended to make sense of the examination of Taiwan's ICT development strategies in the light of finding of the hypothesis. The hypothesis is as follows.

H2: ICT implementation is a key factor in providing global logistics services

7.3.1 Seamless Global Logistics Service

A firm needs a seamless supply chain, which is a lean enterprise in which all of the players think, communicate, and act as one so that the total chain benefits through achieving a high customer service level (Towill, 1997/2000). A firm must also be market-oriented. It should know where its customers are and produce what the customers need. Childerhood (2002) defines a seamless market-orientated supply chain as encompassing three main concepts: firstly, supply chain integration via seamless operations; secondly, customer focus via the matching of supply chain strategy and product type; and thirdly, the effective management of multiple supply chains by a single organisation. It is obvious that an advanced supply chain not only needs to be integrated, but also needs to be market-oriented if it is to thrive in today's highly competitive marketplace.

The global logistics is an essential component in the supply chain for a global firm. To provide a global logistics service, the service providers also need to establish a seamless and market-orientated global logistics system integrated into the firm's supply chain. Firstly, the participants of a service provider need to be integrated. A global freight transport chain moves cargo/containers from a domestic seller's inventory through an inland transport carrier's ICD/warehouse or directly to the domestic terminal for loading onto the ship/airplane; as the ship/airplane arrives at the foreign seaport/airport, the cargo/containers move to a foreign ICD/warehouse or directly to the buyer's warehouse/distribution centre. More than 27 participants, such as trade facilitators, government offices, cargo forwarders, warehouse/distribution centre operators, inland transporters, port/terminal operators, international carriers and cargo distributors, are involved in cargo movement at the places of origin and destination. It is without doubt that any delay or damage of cargo at a node of connection will cause additional cost to

the shipper. Thus every participant of a global logistics service needs to work together and coordinate to form a seamless operation.

Secondly, the service provider must put the customer first and produce premium customer value. They have to place greater emphasis on the services received, such as reliability, timeliness and efficiency. They also have to provide what the customer wants when the customer wants it (Lewis and Naim, 1995). What customers want are: (1) on time delivery; (2) stock out levels/inventory control; (3) order convenience/order status; (4) shipment/tracing/expediting; and (5) cargo pickup (Coyle, et al., 2003). Therefore, the logistics service providers face the challenge of managing logistics inputs to create services that meet the requirements of the customers.

Thirdly, a service provider needs effective management of operational activities, which is a prerequisite to overall cost efficiency for a firm and a key to ensuring their ability to competitively price their products and services. The global freight transport chain is a network formed by different independent enterprises. It even establishes close relations through mergers, strategic alliances, joint ventures, acquisitions and partnerships. Managing the whole chain effectively is the key to gaining competitive advantages. The concepts used among manufacturing firms, such as outsourcing, Just-In-Time, a reducing cycle/lead time, and a global view on storage and distribution within manufacturing firms, have also been used in global logistics services as a responsibility of the service provider (Lemoine and Lars, 2003).

7.3.2 The Role of ICT in Global Logistics Services

Most global enterprises outsource their transport demands to international carriers by sea and/or by air. They have a variety of criteria to decide the selection of shipments. If

international carriers want to manage all segments of an international logistics chain on behalf a global enterprise, they need to prove that they have an in-depth understanding of the global enterprise's logistics needs; their information systems must be sophisticated enough to track and manage inventory in the pipeline at a detailed level; and their services must always be in the global enterprise's best interest (McKnight, et al., 1997). They also need to satisfy several criteria: (1) the level of service in each segment of the transport and logistics chain must be best in class; (2) service coverage must be virtually global and delivered with consistent quality; (3) service delivery must be seamless; and (4) the process must be transparent, with detailed information on shipment and inventory status being readily available through easy communication with the global enterprises' own systems. Therefore, if international carriers want to enable themselves to offer a variety of transport modes and services as their customers demand them, they need to build a global strategy approach based on: (1) the development of global logistics expertise and services; (2) the development of global network distribution, in which hub-and-spoke infrastructure plays a central role in interconnecting markets; and (3) the use of information and communication technologies (ICT) in order to interconnect all the firms within the network (Lemoine and Dagæns, 2003).

The advent of advanced ICT can make this integration easier than before, as it can move the information decoupling point as far upstream as possible for the decision-making of a firm. It helps to make planning decisions better on the basis of undistorted information concerning what is really happening in the marketplace. These information systems combine hardware and software to manage, control and measure logistics activities that occur within a firm as well as across the overall supply chain, operating 24 hour a day throughout the year according to the necessity of a firm and the services it provides. The competitive advantages are available because the data are shared through the total supply

chain (Porter and Millar, 1985; Mason-Jones and Towill, 1997/1999).

In order to provide efficient worldwide transport services, international carriers are scattering branches, offices, and agents along their geographically segmented routes. In the early days, transport communication was based on the postal system, telephone, telegram and telex through public networks. The advent of computers and automatic telecom networks has widely been implemented in the shipping and transport industries. These systems are broadly used in intra-organisational business management and inter-organisational business transactions, forming Intranets (Intra-organisational systems) interconnecting the carrier's departments, Extranets (Inter-organisational systems) linking their worldwide offices and agents, and VANs for specific trade communities. The intra-/inter-organisational computer systems of a container shipping company are used to: (1) manage service and marketing, (2) plan the sailing schedule, (3) manage the fleet and equipment, (4) control inter-modal transport, (5) control the movement of shipments, (6) provide EDI and EC services, and (7) give other ancillary support. They are commonly used for taking bookings, printing out bills of lading and invoices, and transmitting advice and information to customers. It is estimated that around 50 documents used in container shipping now can be transmitted electronically (CMRI, 2004).

With the introduction of the World Wide Web (WWW), an Intranet can use Internet technology to deliver and process information within an organisation's internal database. An Extranet is an extension of an Intranet accessible to outside companies or individuals with or without an Intranet. The links between the two are achieved through standard Internet protocol and secure solutions. The use of the Internet has made EC simple for business-to-business (B2B), business-to-consumer (B2C), and even going further to

business-to-government (B2G) applications. Nowadays, e-services provided by international carriers and shippers' web portals include freight bookings, rate quotations, issues of bills of lading, tracks and traces, routeings and schedules, documentation, response to failure, confirmation of pickup and delivery, and issues of freight bills.

7.3.3 The Survey Result indicates that ICT is the Key Factor

According to the analysis of questionnaire survey in section 6.4.2 of Chapter 6, it has been examined that five factors, *ICT implementation, customer service, investment and alliance, logistics integration* and *business re-engineering,* are relevant to international carriers gaining competitive advantages in providing global logistics services; of these, the factor of *ICT implementation* is the most important factor.

Therefore, analysis of primary data from questionnaire survey in Chapter 6 and the examination of secondary data on ICT implementation in this Chapter show above strong support for the hypothesis:

H2: ICT implementation is a key factor in providing global logistics services

7.3.4 The Review of ICT Development Strategies in Taiwan

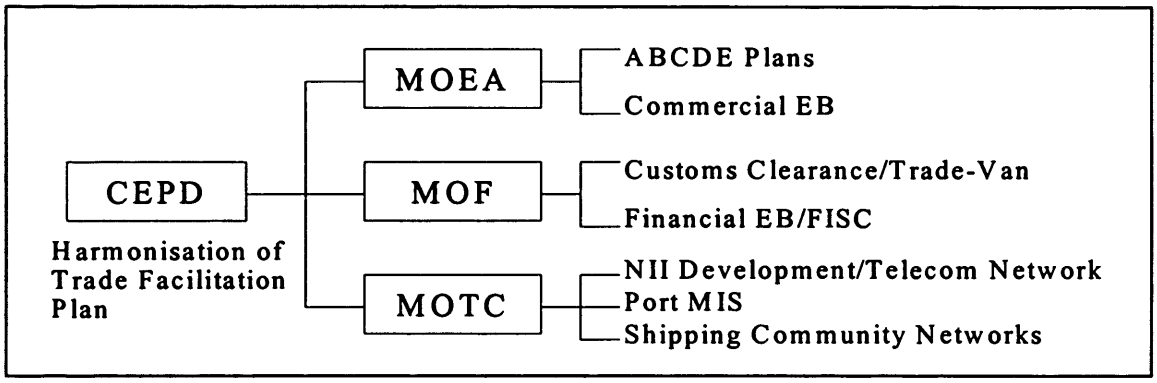
In order to reinforce the findings regarding to the second hypothesis, this research has examined other stringent data. In this regard, the research has through the questionnaire survey explored issues related to ICT development strategies in Taiwan and these issues are presented in the section that follows.

7.3.4.1 Current National Development Plans

Conducting international trade comprises a great many processes and information flows. Envisaging the importance of ICT in conducting international trade and transport,

Taiwan initiated a national development plan - the Trade Facilitation e-business Plan - in 2002, continually putting efforts into the harmonisation and integration of ICT use in trade, customs and transport in order to reach APEC's goal of paperless trade by 2008. The plan, including three re-engineering projects in trade, customs clearance and the transport industry, has been implemented by regarding government departments and harmonised through the central responsible council, the Council for Economic Planning and Development (CEPD). Fig 7-1 shows the organisational chart of the Trade Facilitation e-Business Plan of CEPD.

Fig 7- 1: Organisational Chart of Trade Facilitation e-Business Plan, CEPD



Source: Author

The aim of Taiwan's Trade Facilitation e-Business Plan is to promote information collaboration between current trade and transport information systems. The actions of the plan taken in the past years include:

- Through APROC's telecommunications centre plan, continually carrying out national information infrastructure (NII) projects. Two National Information and Communication Infrastructure Action Plans were initiated in 1994 and 1997 respectively (Wang, 1999).
- Set up a Trade-Van Information Service Company in the Ministry of Finance (MOF) to implement EDI for customs clearance. Sea cargo clearance system and air cargo clearance system came in to service in 1992 and 1994 respectively.
- Promotion of the Industrial Automation and Electronic Business (iAeB) programme by the Ministry of Economic Affairs (MOEA) since 1999 to enhance the EC in IT

manufacturing industries. The programme comprises A, B, C, D and E projects. Projects A and B focused on promoting e-procurement, while projects C, D, and E focused on introducing the e-service of cross-nation cash flow, delivery and uniform engineering collaboration.

- Set up Financial Information Service Company (FISC) responsible for inter-bank withdrawal, balance inquiry, cash advance, IC card replenishment and international withdrawal.
- Set up MTNet team under the Ministry of Transportation and Communications (MOTC) responsible for promoting EDI and Internet EC service in port and shipping industries.

7.3.4.2 The Development Strategies

A number of information systems for trade and transport have been successfully implemented by different government departments in Taiwan. The customs clearance automation systems (now owned by the private Trade-Van company) developed by the Ministry of Finance connect customs house and related organisations, such as control agencies, port authorities, warehouses, forwarders, customs brokers, airlines, shipping lines, prominent companies, banks, importers/exporters, bonded factories, distribution centres, science parks, export zone centres, and the coast guard, providing 24-hour online customs clearance services. FISC systems (now owned by the private FISC company) also developed by the Ministry provide bank withdrawal services for banks, individuals and private companies. A variety of information systems are also used in the seaports/airports for their administration, management and terminal operation and in the transport, trade and manufacturing industries for their exclusive purposes.

The strategies, which the government adopts to implement the Trade Facilitation e-Business Plan, can be summarised as: top-down ICT planning, bottom-up system development, and horizontal network integration. The top-down planning strategy is to see the whole trade and transport environment as one and then, decide what kinds of

information systems should be developed. The bottom-up system development strategy is to authorize the regarding government departments responsible for system development. The horizontal network integration is to focus on collaboration or information sharing between different systems. These three strategies are used for implementing information and communication technology extensively, not only to create a high-tech trade and transport environment, but also to meet the ICT demands and challenges faced by global enterprises and transport logistics operators. The main objective is to build a one-stop shopping portal for global enterprises conducting international trade and transport business in Taiwan.

7.3.4.3 PPP in Developing Port and Shipping Network Systems

Other than the three above-mentioned development strategies in implementing ICT use in trade and transport, it is also worthwhile to study the Public-Private Participation (PPP) in harmonising information sharing in Taiwan's seaport and shipping industry.

Vessel moving and cargo handling at a port imply a great many management and operational tasks. Since the 1980s, the government have developed a number of information systems for shipping administration, port management and terminal operation, linking to their users and reducing a lot of the paperwork. Coping with the advent of the Internet, these systems have also been upgraded to provide web-services to their users. However, there are still a number of deficiencies in: (1) interconnectivity of all major ports in Taiwan, (2) database sharing on the principles of data warehouse development, (3) common data standards, (4) common communication standards, (5) linking with shipping lines'/operators' networks and application systems, (6) state-of-the-art technology and application systems, (7) user community involvement in the development of the network, and (8) EDI over the Internet, EC and communication

links with other community networks (Lalwani, 1999).

Envisaging the above-mentioned deficiencies, the Ministry of Transportation and Communications (MOTC) believed a one-stop logistics service system, called MTNet, which oversee the logistics flow as a whole, would sufficiently reflect the positions of users in global shippers, ship-owners and logistics companies. After completion of the Feasibility Studies and the Overall Planning for Shipping and Port Operations Automation, three working groups were designated in 2000 to carry out the tasks related to seaport operations automation, shipping operations automation and telecom infrastructure development. Two private organisations, the Institute for Information Industry (III) and Chunghwa Telecom Co., were delegated to work with industries for the promotion of EDI/XML and EC uses in the port and shipping industries. In 2003, the MOTC re-drafted a strategic plan for integrating port and shipping information systems. The MTNet plan has three main objectives: (1) to assist the information systems used in seaport and shipping industries to collaborate with other systems used in trade and customs; (2) to help the seaport and shipping industries to conduct business process re-engineering; and (3) to upgrade the MTNet platform with more logistics service functionality. The plan is expected to be complete by the year 2008 and the re-shaped MTNet platform is scheduled to be ready for use in 2005. According to the plan, the MTNet platform will not only have the functions of a shippers' web portal, but also provide the functions of government-to-business, business-to-business and business-to-customer e-services for the seaport and shipping industries.

7.4 Government transport Policies on Global Logistics Hub

This section includes two parts; the first part will examine Hypothesis Three and the second part will analyse government transport policies on seaports/airports development. The analysis is intended to make sense of government transport polices in the light of finding of the hypothesis. The hypothesis is as follows.

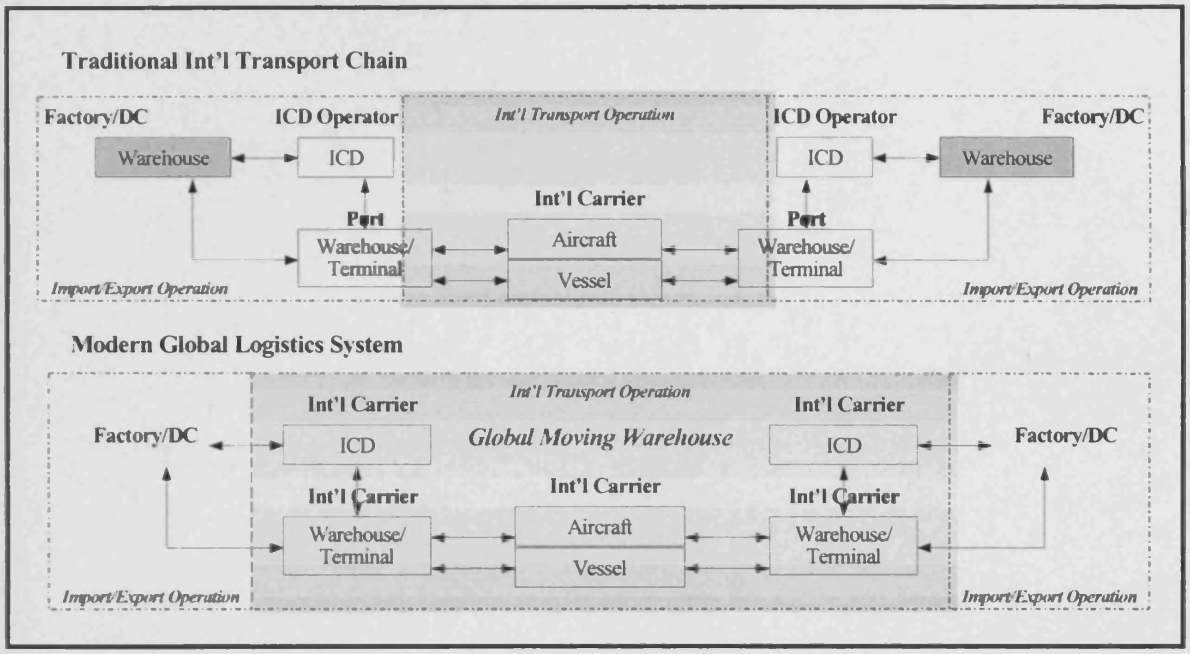
H3: Suitable government transport policies can successfully establish global logistics hubs

7.4.1 The Changing Role of Seaports/Airports in Global Logistics Services

An international freight transport chain is a network consisting of a carrier (shipping company or airline) and its related participants, providing cargo transport services from one country to another. As shown in Fig 7-2, a traditional international freight transport chain is organised by independent participants to provide international transport services from one node to another. The modern international freight transport chain is integrated with its participants as one to provide "One-Stop-Shopping" international transport and global logistics services. Thus, global shippers can count on international carriers and use an international freight transport chain as a moving warehouse. This Win-Win strategy can bring global shippers competitive advantages through reduced inventory cost and transit time of materials and products. But, an international freight transport chain comprises a variety of processes and information flows, including the documentation, data of trading, cargo handling, customs clearance, inland transport, terminal operation, and international transport from the exporting country to the importing country. Most of these processes and information handling are conducted at both ends of the international transport, the seaports or airports. Therefore, the role of a seaport/airport is changing; a

modern seaport/airport plays as not only a node for cargo transfer from one mode to another but also an important value-added logistics hub in a global logistics system.

Fig 7- 2: The Evolution of Modern Global Logistics System



Source: Author

The role of a seaport/airport is changing. It is no wonder that a seaport/airport has had to add new functions to those that it performs. Firstly, containerised transport has become a dominant technique in both sea and air general cargo trade. The expansion of hub and spoke transport networks has led to the concentration of cargo traffic on a limited number of larger seaports/airports, the so-called load centres. Secondly, a modern seaport/airport has become a centre for generating value-added activities, directly and indirectly involved in cargo re-processing or re-exporting. And thirdly, a seaport/airport, like a distribution centre, plays a key role in global cargo distribution. Therefore, a modern seaport/airport must adopt a new attitude to cope with the trend for international freight transport and logistics, or it may not compete with other neighbouring seaports/airports.

7.4.2 Logistics Hub is Government's Aspiration

Envisaging the importance of logistics hubs in global logistics chains, the world has seen a trend in the transformation of seaports/airports into logistics hubs. In East Asia, Japan has been a world-leading industrial country since the 1980s, followed by the emergence of the newly industrialised economies of South Korea, Hong Kong, Taiwan and Singapore in the 1990s and rising economic development in China and other ASEAN countries in the 2000s. The economic development in China has led the seaports of Hong Kong, Qingdao, Shanghai, Shenzen and Pusan and the airports of Hong Kong, Shanghai and Incheon to continue to grow. On the other hand, the struggle for international transport development in South East Asia has seen the emergence of new leading seaport/airport hubs in the region. Table 7-7 shows selected leading logistics hubs in East Asia. These hubs play the role of gateways for their origin-destination cargo in the country and for transhipped cargo from/to other countries.

Table 7- 7: Leading Logistics Hubs in East Asia

Country	Seaport Hubs	Airport Hubs
Japan	Tokyo, Yokohama, Kobe	Narita, Osaka
South Korea	Pusan	Incheon
China	Hong Kong	Hong Kong
	Qingdao, Shanghai, Shenzhen	Shanghai, Beijing
Taiwan	Kaohsiung	Taipei
Singapore	Singapore	Singapore
Malaysia	Port Klang, Tanjung Pelapas	Kuala Lumpur
Thailand	Laem Chabang	Bangkok
Indonesia	Tanjung Priok	

Source: Author collected

7.4.3 The Government and the Success of the Global Logistics Hub

Most governments, through their public policies have endeavoured to transform their seaports/airports into global logistics hubs for their countries and the region. However, international carriers, as the main players in these policies have a number of criteria to evaluate before they consider conducting business in a seaport or airport in a country. It

is not only whether any government would want to have a successful logistics hub, the policy should be take into account the criteria that carriers also consider in response such as whether the market is big enough and will continue to grow, whether the cost is reasonable enough to make a profit, whether the government is stable and supportive, and whether the competition from others is such as to deter entry. Thus, a logistics hub which supported by government policies and which meets the criteria of international carriers become a large international load centre which dominates world trade, a medium-sized one which controls regional exchanges, or a smaller one with influence on national commerce (Notteboom, 1997).

A global logistics hub must be able to allow regular calls for large international carriers and which would generate large cargo traffic as well as a high transhipment volume. The traditional thinking of a seaport/airport for just accommodating transport vehicles or handling cargo is no longer enough applicable for current logistics demands. Since it is important to recognise that it is trade that is generating the transport volume, a modern seaport/airport should be a centre for generating value-added activities in order to become a leading hub port and a port of call for larger ships/aircrafts (Bichou and Gray, 2004). The result of the survey, shown in Table 6-19 of Chapter 6, shows seven factors, *facilities, operations, service, government, cost, market, and political stability,* are related to the success of a global logistics hub. It is evident from this list that, ***operations*** is the most important factor relating to the success of a global logistics hub, followed by *service*, *market*, *cost*, *facilities* and *government*. It also indicates that *political stability* is significantly important to the success of a global logistics hub.

Currently, most governments in coping with the trend of deregulation and privatisation in transport industries have brought private enterprises into seaport/airport operations.

However, fully privatised seaports/airports are still rare as such most seaport/airport organisations are either a public sector agency or operate as corporations (Baird, 2002; Carney and Mew, 2003). These mechanisms, although suggesting that ownership are still in governments introduce an element of risk and allow private sector entities to manage and operate terminal in seaports/airports. It is through these mechanisms that governments intend to increase the efficiency and productivity in seaport/airport operations by focussing on the relative efficiency of commercial management in the seaport/airport business. This is achieved through the removal of regulatory constraints, operational and service improvements that provide users with greater convenience and choice, productivity enhancements through better people and facilities management, and reasonable cost through the establishment of seaport/airport pricing system. There is evidence to show that privately managed seaports/airports are more customers oriented (Carney and Mew, 2003).

There are many ways to measure seaport/airport efficiency or productivity: macro performance indicator is one and micro performance indicator is the other. The former is to quantify aggregate seaport/airport impacts on economic activity, and the latter is to evaluate input/output ratio measurements of seaport/airport operations (Bichou and Gray, 2004). In addition, strategic planning coupled with SWOT analysis can direct the seaport/airport operator to define and prioritise the key issues facing the seaport/airport (Ircha, 2001). The operator of a global logistics hub must always evaluate whether its services are good enough to its users, whether the market is big enough for international carriers conducting business in the hub, whether its operational cost is competitive, and whether the facilities of the hub is available for conducting logistics activities. Finally, political stability is also a key element to the success of a global logistics hub, as unstable politics will prevent foreign investors from investing in terminal operations and

conducting business in the hub.

As discussed in earlier sections, most governments in Asia have endeavoured to develop their seaports/airports as logistics hubs in the region. The survey results also prove that *government* is one of the factors related to successfully establishing seaports/airports as logistics hubs. In this regard, it is also seen that other factors, such as facilities, operations, services, cost, market and political stability, are to some extent related to the government's policies and actions. Therefore, analysis of primary data from questionnaire survey in Chapter 6 and the examination of secondary data on global logistics hub development in this Chapter show above strong support for the hypothesis:

H3: Suitable government transport policies can successfully establish logistics hubs

7.4.4 Contemporary Issues Link to the Success of Global Logistics Hubs

The success of a policy to create global logistics hubs is dependent on a number of variables. In the case of Taiwan, a variable is of considerable importance that the country is close to the newly emerging economy of China. In order to reinforce the findings regarding to Hypothesis Three, this research has examined other stringent data. In this regard, the research has through the questionnaire survey explored issues related to the development of global logistics hubs in Taiwan and these issues are presented in the section that follows.

7.4.4.1 The Strengths and Weaknesses of Taiwan's Seaports and Airports

A hub has its strengths and weaknesses. A hub also has its opportunities and threats. A hub operator needs have strategic planning, which defines well the mission, goal and actions to be taken. Taiwan has since 1995 initiated a series of development plans to

transform its seaports and airports into global logistics hubs in East Asia. The SWOT analysis in section 5.5 of Chapter 5 presents the strengths, weaknesses, opportunities and threats of Taiwan's seaports and airports. A comparison of importance and satisfaction levels of global logistics hub items was conducted in section 6.3.3 of Chapter 6. The results shown in quadrant 1 and quadrant 2 of Fig 6-7 to 6-9 can be assumed to be advantages and disadvantages of Taiwan's seaports and airports respectively. Both the SWOT analysis and survey results are summarised in Table 7-8.

Table 7- 8: The SWOT Analysis and Survey Results

SWOT Analysis	Survey Results
Strengths	**Advantages** (by satisfaction rankings)
-Geographic location	**-Efficiency of terminal operations (2)**
-Market-oriented government policies	**-Efficiency of seaport/airport operations (3)**
-Government-supported seaport/airport development	**-Seaport/airport infrastructure (5)**
-Strong economic hinterland	**-ICT infrastructure (6)**
-Information network	*-Security of seaport/airport (7)*
-Efficient seaport/airport operations	**-Labour quality and skilled labour (9)**
-Competitive seaport/airport charges	*-Seaport/airport facilities and expandability (10)*
Opportunities	*-Simplified seaport/airport processes and documentation (15)*
-Booming market in China	*-e-business and community network integration (16)*
-Inadequate transport infrastructure in China	*-Seaport/airport operating costs (17)*
-Rising intra-Asia Trade	
Weaknesses	**Disadvantages** (by dissatisfaction rankings)
-No direct transport links to China	**-Direct transport link to China (34)**
-Restricted seaport/airport operation	**-Political Stability (33)**
-Bureaucratic seaport/airport authorities	**-Frequent sailings/flights (32)**
Threats	**-Pro-logistics business government and officials (31)**
-Cross-strait relationships	**-Simplified Customs procedures (30)**
-Competition of neighbouring seaports/airports	-Government transport policy and actions (29)
-Market change in Asian Countries	**-Market size/large hinterland/Origin-Destination demand (26)**
	-Simplification of trade process (25)
	-Reasonable seaport/airport charges (20)
	-Seaport/airport management information system (19)

Source: Author

Note: Bold items in survey results are those agreed by both non-carriers and carriers

Taiwan's seaports/airports have several strengths, such as "geographic location", "market-oriented government policies", "government-supported seaport/airport development", "strong economic hinterland", "information network", "efficient seaport/airport operations", and "competitive seaport/airport charges". The booming market and inadequate transport infrastructure in China and rising intra-Asia regional trade provide Taiwan with a good opportunity to be a hub centre for cargo transport. The

survey result of global logistics hub items also shows that 10 items are advantageous to the success of Taiwan's logistics hub development; of these, five items, "*efficiency of terminal operations*", "*efficiency of seaport/airport operations*", "*seaport/airport infrastructure*", "*ICT infrastructure*", and "*labour quality and skilled labour*" are agreed by both the non-carriers and carriers groups.

Some weaknesses, such as "no direct transport links to China", "restricted seaport/airport operation" and "bureaucratic seaport/airport authorities", are hindering Taiwan's seaports/airports both in meeting technological changes and in their development as hub centres. The external threats to Taiwan's seaports/airports are "cross-strait relationships", "competition from neighbouring seaports/airports", and "market change in Asian countries". The survey results also indicate that 10 items are disadvantageous to the success of Taiwan's logistics hub development; of these, six items, "*direct transport link to China*", "*political stability*", "*frequent sailings/flights*" "*pro-logistics business government and officials*", "*simplified customs procedures*", and "*market size/large hinterland/origin-destination demand*", are agreed by both the non-carriers and carriers groups.

In general, Taiwan's seaports/airports have strengths and opportunities to transform into global logistics hubs. The strengths and opportunities include the geographic location of the seaports/airports, market-oriented government policies, government-supported seaport/airport development, seaport/airport infrastructure, ICT infrastructure, efficient seaport/airport and terminal operations, and a booming market in the region (China and Asia). However, the absence of direct transport links to China and unstable politics are the major weaknesses and threats to the development of Taiwan's logistics hubs.

7.4.4.2 Logistics and Free Trade Zones

Foreign Trade Zones (FTZ) or Free Trade Zones are land areas near international ports or airports under the control of governmental customs authorities. Goods in the zones have not yet entered the countries. They might eventually enter, or they could be shipped to a third nation. A free trade zone has a number of characteristics: (1) a liberal environment; (2) global linkages, hence the usual location at seaports and airports; (3) excellent infrastructure; (4) strategic location, nationally, regionally and globally; (5) access to quality human resources at a competitive rate. However, fiscal incentives and no customs duty are probably the key decisive factors for an investor. The country that hosts the free trade zone does not collect taxes, duties or tariffs on goods so long as they are in the free zones. Because there are no trade barriers, a free trade zone can be a good place to store goods temporarily in between shipments. It can also be a good place to manufacture products, especially if these products are manufactured from raw materials that come from many different places.

In the past, free trade zones were considered not to be of much importance. However, the world has changed as a result of the accelerating globalisation process. Within this change, efficient logistics systems have become increasingly reliant on production and distribution networks. The free trade zones can be integrated to complement the success of global logistics systems. The development of free trade zones appears to be occurring everywhere. The reasons are twofold; one is that it is commonly believed that a free trade zone is natural and necessary to a proposed seaport/airport development and that it could generate additional economic activities for the country; the other is that the free trade zone could additionally act as a carrot to potential seaport/airport investors. At present, not all free trade zones are set up for manufacturing purposes. Many of them are designed purely for storage and distribution, which emphasizes the importance of

location and efficient transport connections, and explains why the majority are to be found at, or near, seaports and airports.

With tree trade zones, many seaports/airports could offer modern and efficient goods processing and distribution systems. The increasing focus on logistics means that the developed economies are in a good position to offer the organized and well-planned supply and delivery of the products demanded by the market. International carriers even buy into the seaport/airport industry as part of a strategy to participate more fully in the provision of an integrated supply chain. They are looking to add value to the more basic service they offer in order to attain higher levels of profitability.

Taiwan has been endeavouring to add free trade zones and cargo distribution parks to its seaports and airports in recent years, aiming to take advantage of the natural strategic location of a seaport /airport as well to act as a support to its logistics-oriented business. However, the survey results do not indicate their importance or a demand for them from the carriers. This finding implies that the geographic advantages of Taiwan's seaports/airports are diminishing because of market changes in Asia. Therefore, the golden rule of seaport/airport development is that facilities should only be provided where there is demand. Facilities should not be built in the hope of generating traffic only.

7.4.4.3 Seaport/Airport Reform and Logistics Hub

Today's global logistics service providers have made it mandatory for shippers worldwide to be able to rely on seamless transport chains. On the other hand, most governments have also realised that a seaport/airport has a key role to play in the development of a nation's economy and its international trade. As a result, the

seaport/airport needs to adjust its role and function to ensure demand-responsiveness to the changing needs of trade and transport. The key seaport/airport reform programmes include: (1) institutional restructuring of administration, (2) seaport/airport deregulation, (3) seaport/airport privatisation, and (4) labour reform (Cullinane and Song, 2001; Notteboom and Winkelmans, 2001a/2001b; Baird, 2002; Ircha, 2001a/2001b; Feng, 1998; Carney and Mew, 2003; Forsyth, 2002; Hooper, 2002).

The main duty of seaport/airport administration is to organise in as proper and efficient a way as possible to manage the complicated and diverse flow of traffic through the seaport/airport. Although most of the physical methods used within seaports/airports vary little between them, the systems of administration and ownership vary considerably. Some seaports/airports are managed and operated under the control of central government; some are under the control of regional governments or municipal bodies; and others are under the control of independent trusts (Goss, 1990b). As a result, in accordance with who owns and provides the facilities and services, seaports/airports can be classified into three distinct categories: the comprehensive, the tool, and the landlord seaport/airport. In addition, there are two approaches regarding seaport/airport organisation: corporate management and privatisation. The essential motivation of seaport/airport privatisation is the expectation of economic benefits to be derived from improved efficiency and performance and also by the political desire to reduce the government's long-term financial and administrative responsibility, for it is an extremely expensive industry to support (Cullinane and Song, 2002). The trend for the growing participation of private parties in the provision and management of port services is obvious. Such arrangements have a long tradition in North American and West European seaports/airports, which act as landlords while private concession holders organise and conduct a variety of services (Juhel, 2001).

Taiwan's government launched the institutional restructuring of seaport/airport organisation with the initiation of the APROC plan in 1995. Earlier on, in the 1980s, private enterprises were encouraged to undertake terminal operations in both seaports and airports. The survey results indicate that the issues "*seaport/airport organisational restructure*" and "*privatisation of seaport/airport*" are not important to the success of global logistics hubs. It implies that the private participation of terminal operations could achieve the efficiency and productiveness of a seaport/airport if terminal operators could fully control their operations in the terminals. The ownership of a seaport/airport is not an important issue for terminal operations.

7.5 Summary

Globalisation is taking place and changing the nature of business strategies and operations. It is impacting on government transport policies and influencing the structure of the evolution of global logistics services and seaport/airport hubs. Government transport policies are working towards the creation of the hubs but there are challenges and threats including the implementation of ICT. All these ideas have been examined and explored in relation to the principal research question in this thesis. This research question is analysed in relation to three specific hypotheses.

This chapter also further illustrates the importance of ICT implementation and the suitable government transport policies. In order to facilitate international trade and transport, Taiwan's government adopts three strategies, *top-down ICT planning, bottom-up system development and horizontal network integration*, aiming to harmonise the information systems currently used in trade, customs clearance and the transport industries to form a paperless environment for global enterprises conducting trade and

transport business in Taiwan. In addition, this research discovers that the strategy of Public-Private Participation is also very important to the success of the plan. The involvement of users in all of the application development steps would not only ensure the success of the systems developed but also make them more likely to be used.

Regarding the government transport policies on seaport/airport development, this chapter has discovered that the key current seaport/airport reform programmes include: (1) institutional restructuring of administration, (2) seaport/airport deregulation, (3) privatisation of seaports/airports, and (4) labour reform. Taiwan has launched numbers of these reforms and has achieved some goals in the transformation of its seaports/airports into global logistics hubs. However, two issues revealed in this research, *the ban on transport links to China and the unstable politics*, have prevented Taiwan from becoming a global logistics hub in the region.

Chapter 8 Conclusions, Contributions, and Future Research

Chapter Aims:

- Summarise the research conclusions
- Identify the contributions of this research to the government and industry
- Consider the areas for further research

8.1 Introduction

This research is intended to achieve a numbers of goals. First, it aims to discover the answer to the research question, *whether Taiwan government's transport policies incorporating ICT development strategies are suitable for international carriers to provide global logistics services*. Second, it aims to examine six research objectives, O1: To identify the driving forces for the evolution of global logistics services, O2: To examine the network strategies adopted by international carriers to managing global logistics services, O3: To analyse the critical factors relevant to international carriers gaining competitive advantages in providing global logistics services, O4: To examine transport policies that most governments adopted to modernise their seaports/airports, O5: To study the unique position of Taiwan's seaports/airports in performing as global logistics hubs, and O6: To analyse the factors relevant to the success of a global logistics hub. And third, it aims to prove three hypotheses,

H1: International trade is influencing the evolution of global logistics services,

H2: ICT implementation is a key factor in providing global logistics services, and

H3: Suitable government transport policies can successfully establish global logistics hubs.

In order to achieve the goals mentioned above, this research processed from a description of research background and objectives in Chapter 1, the description of methodology in

Chapter 2, the conduct of literature review in Chapter 3, an investigation of global logistics services in Chapter 4, a study of global logistics hub development in Chapter 5, and the analysis of survey data in Chapter 6. Based on the results of literature review, case study, questionnaire survey and interview, the examination of suitable government transport policies and ICT development strategies for Taiwan are obtained and described in Chapter 7.

This chapter is intended to describe the conclusions, contributions, and limitations of the research and to suggest directions for future research.

8.2 Conclusions

This research is concerned with the role of international freight transport in the global supply chain and has focused on government transport policies and ICT development strategies in global logistics services. It has been discovered that international carriers have evolved to provide global logistics services and that they have integrated into global firms' supply chains. This research also found that the role of seaports/airports in international freight transport has changed to value-added logistics hubs in global supply chains. The conclusions of this research are presented in the section that follows.

8.2.1 Driving Forces for the Evolution of Global Logistics Services

Since the 1980s, more and more manufacturing firms, adopting globalisation approaches, engage in international trade by conducting global sourcing, marketing and/or production to pursue low-cost sources and gaining competitive advantage in the global market. They demand transportation to bridge the gaps between their sourcing, marketing and/or production activities and to provide just-in-time delivery and service to their end customers. Global firms' logistics outsourcing creates other opportunities for

international carriers to extend their capacity of the third-party logistics. On the other hand, the effective and efficient transport network services provided by international carriers help the manufacturing firms to gain a number of advantages, such as reduced cost sourcing, economic and effective service, and access to global professionals.

A variety of forces, such as international trade, global business, logistics outsourcing, competitive advantages, and government policies, have pushed the evolution of global logistics services. This research has examined that these forces can be categorised into four forces, *market, cost, government and competition*, which are driving the evolution of global logistics services. This research also strongly supports the hypothesis, **H1: International trade is influencing global logistics services.**

8.2.2 The Network Strategies in Managing global logistics services

Managing international freight transport for a firm is more complex than that of domestic transport because of the many differences among the trading nations with respect to transportation, customs regulations, infrastructure, exchange rates, culture, and language. Other than the demand for efficient transport services to link each process, global enterprises now want to integrate international transport into their global supply chain to manage effectively the whole process, from the point of material supply, production, distribution, to the point of the end customer.

To cope with the trend of more and more firms conducting global sourcing, marketing, and/or production, a variety of specialist companies provide logistics services to global firms. The growth of global logistics service providers also reflects that global firms like to outsource their logistics functions and want to integrate these logistics functions within their supply chain. This research has discovered that international carriers seek logistics

competitive advantages by adopting three network strategies: (1) **vertical integration** of the carrier and its transport participants to enhance transport services, involving inter-modal transport and terminal operations, (2) **horizontal integration** of the carrier with other carriers to expand geographic coverage, and (3) **ICT integration** within the carrier's transport chain and with its customers to improve logistics service quality.

8.2.3 Critical Factors Relevant to Global Logistics Services

A global logistics system must be seamless and market-orientated. All of the participants think, communicate, and act as one so that the total chain benefits through achieving a high customer service level; they also should know where their customers are and produce what the customers need. Thus, a seamless market-orientated global logistics chain encompasses three main concepts; firstly, logistics chain integration via seamless operations; secondly, customer focus via the matching of supply chain strategy and product type; and thirdly, the effective management of multiple logistics chains by a single organisation.

This research has examined that five factors, *ICT implementation, logistics integration, investment and alliance, customer service,* and *business re-engineering,* are critical for international carriers gaining competitive advantages in providing global logistics services; of these, ICT implementation is the most importance factor. Therefore, this research has also strongly supported the hypothesis, **H2: ICT implementation is a key factor in providing global logistics services.**

This research has also found that a global logistics chain needs to be not only market-oriented but also integrated if it wants to thrive in today's highly competitive marketplace. As a global logistics chain is formed by a great number of participants and

operations, any delay or damage of cargo at a node of connection will cause additional costs to the shippers. Thus every participant in the chain needs to work together and every process between participants needs to operate seamlessly. Advanced ICT can and has played a key role in forming integrated seamless global logistics chains. It has not only been widely used in business integration and collaboration but also commonly enforced in the areas of intra-organisational business management, inter-organisational business transactions and e-commerce with customers. The survey has also found that ICT development is focused on (1) information integration in business management, (2) information sharing among business partners, (3) information visibility and collaboration, and (4) wireless and mobile communication.

Taiwan's ICT implementation plan, which is focused on the integration of and collaboration between information systems in trade processes, customs clearance, and sea/air transport community networks, is a step in the right direction in line with the world trend. The strategies adopted by the government, including **top-down planning, bottom-up development and horizontal system integration,** could ensure the success of the plan. However, the most important issue is that the users of these systems are necessarily invited to participate in the implementation phases during system development. This kind of **public-private participation** in implementing information systems would mean that the users are likely to use these information networks.

8.2.4 Transport Policies Adopted to Modernise Seaports/Airports

The intervention of national governments in the transport sector includes investment in infrastructure, coordination of services, enforcement of operating and employment conditions, and the implementation of environmental, safety and energy policies. Since the 1970s, **"Contestability Theory"**, that free entry of new operators into the transport

market was the key mechanism to ensure efficiency and welfare maximization, has been widely accepted. The application of this theory in formulating government transport policies includes the deregulation of government transport sector, the privatisation of transport operations, the reformation of seaport/airport organisational structures, and the reform of labour employment.

The extent of seaport/airport deregulation may be limited to changes in governmental control, institutional structure and employment. The methods of seaport/airport privatisation include commercialisation, liberalisation, sale of assets, corporatisation, concession, joint ventures or management contracts. The seaport/airport organisation will therefore need to be adjusted to this changed role and function. Nowadays, more and more comprehensive seaports/airports become tool or landlord entities. However, there is still a dilemma regarding whether the seaport/airport organisation should be corporate or privatised. Many leading seaport/airport organisations would rather be independent public bodies, in which the users of the seaport/airport are invited to participate in policy-making. Therefore, this research has found that most governments endeavoured to modernise their seaports/airports through the following transport policies: **(1) institutional restructuring of seaport/airport administration to have autonomous seaport/airport authorities leading to pro-logistics attitude and actions, (2) commercial management leading to market-driven seaport/airport operations, (3) deregulation and privatisation of seaports/airports to enhance seaport/airport efficiency, and (4) review of seaport/airport infrastructure and facilities to support logistics activities.**

8.2.5 Unique Position of Taiwan's Seaports/Airports

Taiwan is a small island with limited natural resources. Its economy fully relies on

international trade, more so than other nations. In the early years of the 1990s, Taiwan began to face the challenges of high labour costs, high production costs, and the moving-out of manufacturing to countries with cheaper labour. Many countries in Asia also give favourable incentives to foreign direct investment. Therefore, many manufacturing firms in Taiwan have adopted a globalisation strategy. They keep core production in Taiwan and outsource others to foreign factories. These increase intra-Asia cargo flows and demand value-added activities in Taiwan's seaports/airports. In order to cope with this changing environment, the government, like others in the world, initiated a series of national development plans to develop Taiwan as an operation centre for facilitating enterprises doing business in the Asia-Pacific Region and to transform its seaports/airports into global logistics hubs for the region.

This research found that Hong Kong and Singapore are the leading seaport/airport hubs in both Asia and the world. However, both of them had faced challenges from neighbouring seaports/airports. It also found that there is no guarantee of cargo to and from the regions via the closest seaports/airports. Thus, a seaport/airport is only one of many links in a supply chain or a pawn in the game of global commerce. The development of a global logistics hub would be better served by enhancing its logistics functions than pursuing its transhipped cargo flow. It would be better for the development strategy to ensure the success of a global logistics hub rather than to pursue the increase of transhipped cargo flow at all prices.

Taiwan's seaports/airports have their strengths, weaknesses, opportunities and threats according to the SWOT analysis and the questionnaire survey conducted in this research. The strengths and opportunities include the geographic location of the seaports/airports, market-oriented government policies, government-supported development plans,

sufficient infrastructure and facilities, efficient terminal operations and booming market in the region. However, China, the newly emerging economy in Asia and the world, is close to Taiwan and has become Taiwan's biggest trade partner. The absence of transport links between China and Taiwan has had a negative impact for international carriers conducting business on both sides. The survey indicated that most respondents were extremely concerned two issues, *the direct transport link to China* and *political stability.* The government has to remove these two barriers to international carriers conducting global logistics services if Taiwan tries to successfully transform its seaports/airports into global logistics hubs.

8.2.6 Factors Relevant to the Success of a Global Logistics Hub

A global logistics chain is a network of a carrier (shipping company or airline) and its related participants, carrying goods and others from one country to another. It facilitates global enterprises to fulfil their logistics demand in conducting international trade and global business. The chain comprises a variety of processes and information flows, and many processes and information are processed in a seaport/airport.

A seaport/airport has been a site for transferring goods from one mode of transport to another, and now plays the role of a pivot or interface in an integrated logistics chain. It is a logistic or industrial centre, directly and indirectly involved in seamless transportation and information processes in the supply chain. At least four parties are involved in the transformation of a seaport/airport into a logistics hub. **One** is from international carriers: many international carriers have invested or participated in terminal operations in a seaport/airport to form an integrated and seamless global logistics chain. **Another** is from the government: many governments have envisaged the important roles of their seaports and airports in the global logistics chain. The

effectiveness and efficiency of their seaports and airports can not only facilitate their international transport and trade but also enable them to compete with neighbouring seaports and airports. **The third** is from inter-port enterprises: many inter-port enterprises have invested in and conducted terminal operations, forming a global port chain to service global shippers. **The fourth** is from the seaport/airport itself: the severe competition from neighbouring seaports/airports has compelled the seaport/airport to seek competitive advantages by adding logistics functions or value-added activities.

A global logistics hub can gather large cargo traffic, add value for cargo transhipment and attract the deployment of global carriers' main-hauled containerships or freighters. However, international carriers have a number of criteria to evaluate before they conduct business in a seaport/airport. They may consider whether the market is large enough and will continue to grow, whether the cost is reasonable enough to make a profit, whether the government is stable and supportive, and whether the competition from others is not intense. This research has examined that seven factors, *operations, facilities, service, market, cost, government,* and *political stability* are relevant to the success of a global logistics hub. It has also strongly supported the hypothesis, **H3: Suitable government transport policies can successfully establish global logistics hubs.**

8.3 Contributions

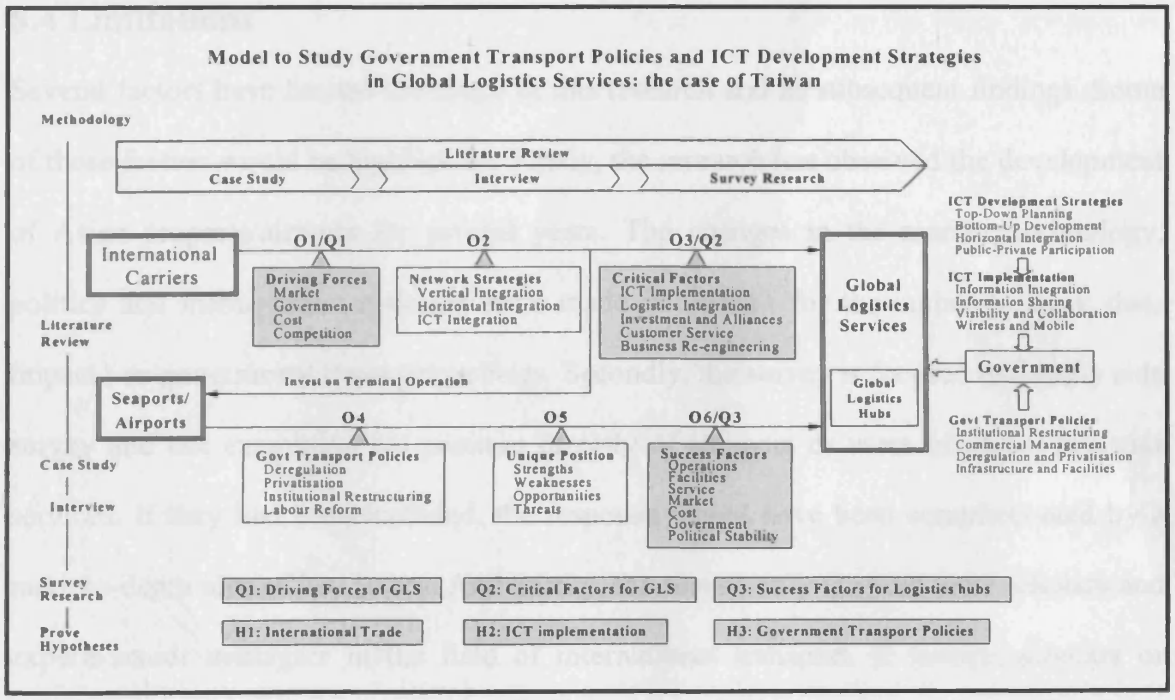
This research has examined the research question and three hypotheses to achieve the research objectives set for this research. The methodology used for this research includes literature review, case study, survey research and interview. It has been discovered that international carriers has evolved to provide global logistics services and many governments endeavoured to transform their leading seaports/airports into global logistics hubs. The suitable government's transport policies and ICT development

strategies will enhance the provision of global logistics service by international carriers.

The situation of international transport was fairly complex and complicated because of the involvement of a number of participants and the fact that the industry is international in nature. It may therefore show that there may not be a model for public policy analysis that would fit all situations. In this regard, the approach taken for this research shows a combination of ideas and concepts that are either actually in place or found through during this research.

This research used a structured approach to analyse government transport policies and strategies as seen in the case of Taiwan. The model used in this research, shown in Fig 8-1, could be used by others, including researchers, governments and carriers, to examine whether their transport policies incorporating ICT development strategies are suitable for international carriers to provide global logistics services.

Fig 8- 1: Model Used for this Research



Source: Author

In addition, this research is seen as original in examining the structure of public policies in the transport sector in relation to international logistics. The literature studied does not show similar comprehensive research elsewhere. Therefore, the results of this research examine that five factors, *ICT implementation, logistics integration, investment and alliance, customer service and business re-engineering*, are critical for international carriers gaining competitive advantages in providing global logistics services, and seven factors, *operations, facilities, service, market, cost, government and political stability*, are relevant to the success of a global logistics hub, can be used by relevant international carriers and governments for their decision making. This research also highlights the importance of ICT as a critical factor in global logistics services and thus a role for governments to define to include strategies for the ICT. While the private sector may have its own interests, governments have a role to play in providing the integration of ICT in the global logistics network.

8.4 Limitations

Several factors have limited the scope of this research and its subsequent findings. Some of these factors would be highlighted. Firstly, the research has observed the development of Asian seaports/airports for several years. The changes in the market, technology, politics and management concepts have made it difficult for the author to track their impacts on government transport policies. Secondly, the survey is focused on supply side survey and not examining the position directly of shippers or users of global logistics services. If they had been included, the response would have been complemented by a more in-depth idea of key issues. And thirdly, the survey only targeted local scholars and experts/senior managers in the field of international transport. If foreign scholars or foreign managers working in Taiwan had been included, their views would be more

international and thus offer the scope to compare strategies in other countries. The reason for this limitation is that foreign firms in Taiwan employ locals in carrying out the global logistics service activities.

8.5 Direction for Future Research

Taiwan has initiated a number of national plans to develop its seaports/airports into global logistics hubs in the Asia-Pacific region. This research has examined the driving forces for the evolution of global logistics services, the critical factors for global logistics services and the factors related to the success of a global logistics hub. Based on the survey results, Taiwan's transport policies and ICT development strategies have been reviewed. However, several directions can be suggested for future research. One is that future research could evaluate the same scope of investigation while including many nations in the study, as both global logistics services and global logistics hubs are international business. In addition, future research should also look the demand side in relation to global logistics services, such as global enterprises rather than transport intermediaries. The other suggestion is that future research could focus on how to harmonise ICT use in international trade and transport, as ICT is playing a more and more important role in every kind of business. Survey research could also be conducted to determine the bottlenecks of ICT integration in current trade and transport industries.

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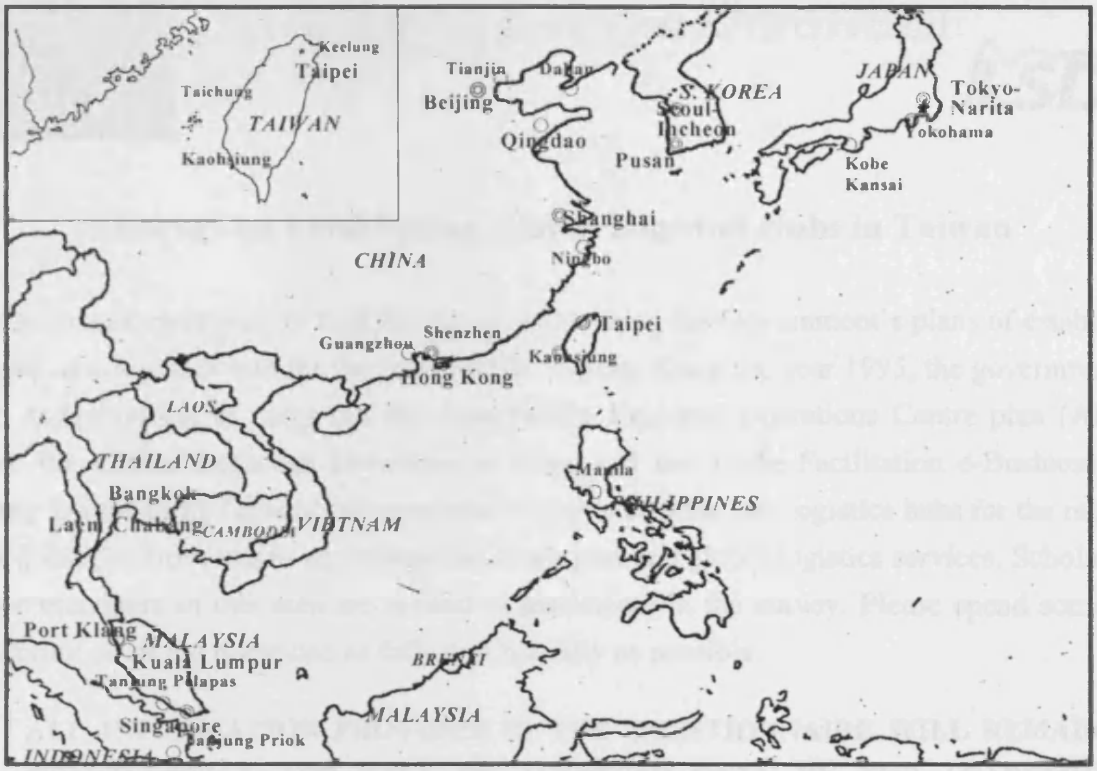
Appendix 1: Taiwan Map and Asia-Pacific Region



Leading Seaport/Airport Hubs In East Asia

Area	Seaport Hubs	WR	Airport Hubs	WR	Country
NE Asia	Tokyo	21	Tokyo-Narita	4	Japan
	Yokohama	27	Osaka/Kansai	22	
	Kobe				
	Pusan	5	Incheon	5	South Korea
	Dalian	30	Beijing	24	China
	Tianjin	16	Shanghai	8	
	Qingdao	13	Guangzhou	26	
	Shanghai	3	Hong Kong	2	
	Ningbo	15			
	Shenzhen	4			
	Guangzhou	18			
	Hong Kong	2			
	Kaohsiung	6	Taipei	13	Taiwan
SE Asia	Singapore	1	Singapore	9	Singapore
	Port Klang	14	Kuala Lumpur		Malaysia
	Tanjung Pelapas	19			
	Laem Chabang	20	Bangkok	19	Thailand
	Tanjung Priok	24			Indonesia

Note: WR, world ranking in 2005

Appendix 2: Questionnaire (English)

Survey on Establishing Global Logistics Hubs in Taiwan

This is a research project to find the factors influencing the Government's plans of establishing Taiwan as a logistics hub for the Asia-Pacific Region. Since the year 1995, the government has been endeavouring to carry out the Asia-Pacific Regional Operations Centre plan (APROC plan), the Global Logistics Development Plan, and the Trade Facilitation e-Business Plan, aiming to transform Taiwan's international seaports/airports into logistics hubs for the region. This questionnaire focuses on international transport and global logistics services. Scholars and senior managers in this area are invited to participate in the survey. Please spend some time answering all of the questions as fully and honestly as possible.

ALL INFORMATION PROVIDED IN THE QUESTIONNAIRE WILL REMAIN CONFIDENTIAL AND WILL BE ACCESSED ONLY BY THE ACADEMIC RESEARCHERS INVOLVED IN THE STUDY

Once completed, please return the questionnaire in the self-addressed envelope to:

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Q1: Driving Forces for the Evolution of Global Logistics Service

The following items are mostly driving the evolution of international carriers in conducting global logistics service. From your standpoint, please rank the **IMPORTANCE** *(1 = very unimportant, 2 = unimportant, 3 = indifferent, 4 = important, 5 = very important)* of each item and your **SATISFACTION** *(1 = very unsatisfied, 2 = unsatisfied, 3 = neutral, 4 = satisfied, 5 = very satisfied)* with them in conducting global logistics service in **TAIWAN**.

Items	*Importance* (Very unimportant ← → very important)					*Satisfaction* (very unsatisfied ← → very satisfied)				
	1	*2*	*3*	*4*	*5*	*1*	*2*	*3*	*4*	*5*
1. Growth of international trade	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
2. Global production and demand for transhipment	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
3. Shippers' logistics outsourcing	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
4. Gaining economies of scale and scope	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
5. Learning and experience from logistics service	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
6. New technologies in transport and ICT	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
7. Simplification of process flow and documentation	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
8. Decrease of cargo/product inventory	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
9. Deregulation of transport and infrastructure	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
10. Trade liberalisation	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
11. Relaxation of trade barriers	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
12. Expansion of services/ one-stop shopping service	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
13. Provision of JIT delivery/ D2D services	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
14. Increasing geographical span of logistics service	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
15. Visibility of logistics chain	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
16. Other factors *(please specify)*										
_____	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
_____	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐

17. General comments

_____

_____

Note:

ICT: Information and Communication Technology

JIT: Just-In-Time

D2D: Door-to-Door

Q2: The Critical Factors in Providing Global Logistics Services

The following items are relevant to international carriers gaining competitive advantages in providing global logistics services. From your standpoint, please rank the **IMPORTANCE** *(1 = very unimportant, 2 = unimportant, 3 = indifferent, 4 = important, 5 = very important)* of each item in providing global logistics services and your **SATISFACTION** *(1 = very unsatisfied, 2 = unsatisfied, 3 = neutral, 4 = satisfied, 5 = very satisfied)* with them in providing global logistics services in **TAIWAN.**

Items	*Importance* (very unimportant ← → very important)					*Satisfaction* (very unsatisfied ← → very satisfied)				
	1	*2*	*3*	*4*	*5*	*1*	*2*	*3*	*4*	*5*
1. Cargo consolidation and distribution service	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
2. Enhancing transport chain/network	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
3. Provision of transport/logistics plan for shippers	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
4. Provision of land/air/sea-integrated transport	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
5. Freight bill audit and payment	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
6. Large ships/aircraft or simplified transport fleet	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
7. Investing in terminal operations/dedicated terminal	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
8. Investing in warehouse/distribution centre	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
9. Provision of inventory control service	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
10. Providing value-added service (e.g. marking/packaging)	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
11. Providing service for specialised cargo	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
12. Product returns and repair	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
13. Free customers service/consultation/complaints	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
14. Providing customs clearance service	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
15. Business alliances with global shippers	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
16. Order entry, processing and fulfilment for shippers	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
17. Slot exchange/code share with other carriers	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
18. Partnership or joint venture with other carriers	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
19. Merger, acquisition of other carriers	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
20. Business process re-engineering (BPR)	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
21. Enterprise Resource planning (ERP)	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
22. Intra-organisational information networking	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
23. Inter-organisational information networking	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
24. Information links with business partners	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
25. Providing web service (e.g. on-line booking, tracking)	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
26. Joining shippers' portals	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
27. Other factors *(please specify)*										
_____	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
_____	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐

28. General comments

_____

Q3: The Factors Relevant to the Success of a Global Logistics Hub

The following items are mostly relevant to successfully establishing Taiwan's seaports/ airports as logistics hubs for Asia-Pacific region. From your standpoint, please indicate the **IMPORTANCE** *(1 = very unimportant, 2 = unimportant, 3 = indifferent, 4 = important, 5 = very important)* of each factor and your **SATISFACTION** *(1 = very unsatisfied, 2 = unsatisfied, 3 = neutral, 4 = satisfied, 5 = very satisfied)* with them in implementing the plan in **Taiwan's seaports/airports.**

Items	*Importance* (very unimportant ← → very important)					*Satisfaction* (very unsatisfied ← → very satisfied)				
	1	*2*	*3*	*4*	*5*	*1*	*2*	*3*	*4*	*5*
1. Efficiency of seaport/airport operations	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
2. Efficiency of terminal operations	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
3. Labour quality and skilled labour	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
4. Simplified seaport/airport process and documentation	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
5. Simplified Customs procedures	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
6. Seaport/airport management information system	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
7. e-business and community network integration	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
8. Reasonable seaport/airport charges	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
9. Seaport/airport operating costs	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
10. High cargo generating/value-added activities	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
11. Market size/large hinterland/OD demand *(OD: Origin-Destination)*	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
12. International trade-related industrial complexes	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
13. Regional development around seaport/airport	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
14. Level of inland transport and inter-modality	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
15. Natural conditions of seaport/airport (e.g. weather)	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
16. Geographic location/market accessibility	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
17. Seaport/airport infrastructure	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
18. Seaport/airport facilities and expandability	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
19. Free trade zone	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
20. Logistics and trade centres	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
21. ICT infrastructure	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
22. Seaport/airport services to users	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
23. Introduction of modern logistics services providers	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
24. Frequent sailings/flights	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
25. Pro-logistics business government and office	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
26. Government transport policy and actions	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
27. Privatisation of seaport/airport	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
28. Organisational restructure of seaport/airport	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
29. Direct transport link to China	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
30. Guarantee of foreign investment	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐

Items	*Importance* (Very unimportant 1 2 3 4 5 very important)	*Satisfaction* (very unsatisfied 1 2 3 4 5 very satisfied)
31. Openness of foreign labour	☐ ☐ ☐ ☐ ☐	☐ ☐ ☐ ☐ ☐
32. Political Stability	☐ ☐ ☐ ☐ ☐	☐ ☐ ☐ ☐ ☐
33. Security of seaport/airport	☐ ☐ ☐ ☐ ☐	☐ ☐ ☐ ☐ ☐
34. Simplification of trade process	☐ ☐ ☐ ☐ ☐	☐ ☐ ☐ ☐ ☐
35. Other factors *(please specify)*		
_____	☐ ☐ ☐ ☐ ☐	☐ ☐ ☐ ☐ ☐
_____	☐ ☐ ☐ ☐ ☐	☐ ☐ ☐ ☐ ☐

36. General comments

_____

_____

Q4: The Background Of Respondent

1. Name of respondent (*option*): _____
2. Position of the respondent: _____
3. Telephone number: _____
4. E-mail: _____
5. Name of organisation/company: _____
6. The size of your company/organisation *(option)*

   Number of Employees: _____, Annual Revenue: NT$_____ million
7. Which of the following best describes your present field?
   - ☐ Academic/ Consultant
   - ☐ The Ministry of Transportation and Communications/ / Seaport Authority/ Airport Authority/ Government Official
   - ☐ International Ocean carrier/ Shipping Company
   - ☐ International Air Carrier/ Airlines
   - ☐ Cargo Forwarder/ Warehousing Operator
8. Please indicate the length of your working experience
   - ☐ Less than10 years
   - ☐ 10-20 years
   - ☐ 20-30 years
   - ☐ More than 30 years
9. Do you wish to receive an executive summary of the results?
   - ☐ Yes
   - ☐ No

Thank You for Your Kind Help

Appendix 3: Questionnaire (Chinese)

建立台灣爲亞太運籌中心之調查研究

本研究計畫主要在探討影響我國建立亞太運籌中心之因素，自從民國 85 年起政府即積極推動亞太營運中心計畫、全球運籌發展計畫及貿易便捷化計畫，期使我國的港埠及機場能成爲國際運籌的基地。

本問卷針對從事國際運輸及運籌服務相關業務者爲對象，因此邀請在此業務之相關學者及主管來參與，懇請回答有關的問題。

所有的資訊僅作學術研究之用，並會絕對保密。

本問卷完成填答後，請用所附的信封寄回或交由本人。

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問題一：全球運籌服務的推動因素

下列項目可能是國際運輸業者提供全球運籌服務的推動因素，請從您的觀點，就每一項指出其對推動全球運籌服務的**重要性** (*1 =非常不重要， 2 = 不重要， 3 = 普通， 4 =重要， 5 =非常重要*) 及在台灣地區提供運籌服務的**滿意度** (*1 =非常不滿意， 2 = 不滿意，3 = 普通， 4 =滿意， 5 =非常滿意*)。

因素項目	*重要性*					*滿意度*				
	非常不重要				*非常重要*	*非常不滿意*				*非常滿意*
	1	2	3	4	5	1	2	3	4	5
1. 國際貿易的持續成長	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
2. 跨國製造及轉運的需求	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
3. 託運人的運籌委外 (Logistics Outsourcing)	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
4. 擴大營運的經濟規模及範圍	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
5. 提供運籌服務可獲得學習及經驗	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
6. 新科技/資訊通信技術的應用	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
7. 作業流程及文件的簡化	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
8. 貨物/產品庫存的減少	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
9. 運輸及商業金融管制的開放	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
10. 貿易自由化	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
11. 貿易障礙的解除	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
12. 增加服務範圍/ 提供單一窗口的服務	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
13. 準時交貨及戶到戶 (D2D) 服務	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
14. 擴大運輸/ 物流服務的區域	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
15. 運籌流程的透明化 (Visibility of Logistics Chain)	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
16. 其他 因素 *(請填列)*										
_____	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
_____	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐

17. 綜合建議

_____

_____

問題二：國際運輸業者全球運籌服務的關鍵因素

下列因素有關國際運輸業者獲得競爭優勢，請從您的觀點，就每一項目指出運輸業者在推動全球運籌服務的重要性 *(1 =非常不重要， 2 = 不重要， 3 = 普通， 4 =重要， 5 =非常重要)* 及在台灣地區執行此一項目的滿意度 *(1 =非常不滿意， 2 =不滿意， 3 = 普通， 4 =滿意， 5 =非常滿意)*。

因素項目	*重要性*					*滿意度*				
	非常不重要				*非常重要*	*非常不滿意*				*非常滿意*
	1	2	3	4	5	1	2	3	4	5
1. 拆併貨及配送服務	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
2. 強化整體運輸鏈 (transport chain)	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
3. 提供託運人運輸/物流的規劃	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
4. 提供海/陸/空聯運整合服務	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
5. 運費/貨價的稽核及收取服務	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
6. 大型或單純化船舶/ 飛機使用	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
7. 投資專用碼頭/場站之營運	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
8. 投資倉儲/發貨中心營運	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
9. 提供存貨管理服務	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
10. 貨物的加工/加值服務 (如包裝及貼標籤)	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
11. 特殊貨物的處理	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
12. 產品的回收及修理	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
13. 免費顧客服務/申訴處理/諮詢	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
14. 提供海關報關服務	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
15. 與託運人業務聯盟 (Business Alliance)	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
16. 提供貨物訂單之輸入、處理及交付服務	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
17. 同業間的艙位互換/共用班號/策略聯盟	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
18. 參與或投資相關同業	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
19. 合併或購入相關同業	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
20. 業務流程再造 (Business Process Re-engineering)	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
21. 企業資源計畫 (Enterprise Resource Planning)	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
22. 組織內部部門資訊連線作業	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
23. 組織外部部門資訊連線作業	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
24. 業務夥伴資訊連線作業	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
25. 提供顧客網際網路服務 (如線上訂艙，貨況追蹤)	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐

因素項目	重要性 *非常不重要* 1 2 3 4 5 *非常重要*	滿意度 *非常不滿意* 1 2 3 4 5 *非常滿意*
26. 加入網路平台 (Shippers' Web Portal) 的建置及服務	☐ ☐ ☐ ☐ ☐	☐ ☐ ☐ ☐ ☐
27. 其他因素 *(請填列)*		
_____	☐ ☐ ☐ ☐ ☐	☐ ☐ ☐ ☐ ☐
_____	☐ ☐ ☐ ☐ ☐	☐ ☐ ☐ ☐ ☐

28. 綜合建議

_____

_____

問題三：影響台灣發展成爲運籌中心之因素

下列項目有關台灣發展港埠及機場爲亞太地區國際運籌中心，請從您的觀點，就每一項認爲政府在推動國際運籌計畫的重要性 *(1 =非常不重要，2 = 不重要，3 = 普通， 4 =重要， 5 =非常重要)*及對政府在推動此一計畫的滿意度 *(1 =非常不滿意，2 =不滿意， 3 = 普通， 4 =滿意， 5 =非常滿意)*。

因素項目	*重要性* *非常不重要* 1 2 3 4 5 *非常重要*	*滿意度* *非常不滿意* 1 2 3 4 5 *非常滿意*
1. 港埠/機場作業效率	☐ ☐ ☐ ☐ ☐	☐ ☐ ☐ ☐ ☐
2. 碼頭/場站作業效率	☐ ☐ ☐ ☐ ☐	☐ ☐ ☐ ☐ ☐
3. 工人的素質及技術	☐ ☐ ☐ ☐ ☐	☐ ☐ ☐ ☐ ☐
4. 港埠/機場作業及文件的簡化	☐ ☐ ☐ ☐ ☐	☐ ☐ ☐ ☐ ☐
5. 海關作業的簡化	☐ ☐ ☐ ☐ ☐	☐ ☐ ☐ ☐ ☐
6. 港埠/機場資訊系統及其整合	☐ ☐ ☐ ☐ ☐	☐ ☐ ☐ ☐ ☐
7. 電子商務及資訊系統的整合	☐ ☐ ☐ ☐ ☐	☐ ☐ ☐ ☐ ☐
8. 港埠/機場費率 (due and charge)	☐ ☐ ☐ ☐ ☐	☐ ☐ ☐ ☐ ☐
9. 港埠/機場作業成本	☐ ☐ ☐ ☐ ☐	☐ ☐ ☐ ☐ ☐
10. 附加價值的作業 (如包裝及貼標籤)	☐ ☐ ☐ ☐ ☐	☐ ☐ ☐ ☐ ☐
11. 市場規模，穩定的貨源及市場	☐ ☐ ☐ ☐ ☐	☐ ☐ ☐ ☐ ☐

因素項目	*重要性*					*滿意度*				
	非常不重要				*非常重要*	*非常不滿意*				*非常滿意*
	1	2	3	4	5	1	2	3	4	5
12. 國際貿易相關的工業區的設置	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
13. 臨近港埠/機場地區的發展	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
14. 內陸運輸及海陸空聯運	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
15. 港埠/機場的天然條件	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
16. 港埠/機場的地理位置	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
17. 港埠/機場的基礎建設	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
18. 港埠/機場的設施及其擴建空間	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
19. 自由貿易港區的設置	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
20. 物流及貿易中心的設置	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
21. 資訊通信基礎建設	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
22. 港埠/機場對使用者的服務	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
23. 運籌/物流服務業的引進	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
24. 航線/航權的開拓	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
25. 政府對運籌/物流業發展的政策	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
26. 政府的運輸政策及措施	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
27. 港埠/機場的民營化	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
28. 港務局/航站管理組織的調整	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
29. 兩岸直航的開放	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
30. 外國投資的保障	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
31. 引進外籍勞工的鬆綁	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
32. 政治的穩定度	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
33. 港埠及機場的保安	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
34. 貿易作業流程的簡化	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
35. 其他因素 *(請填列)*										
_____	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
_____	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐

36. 綜合建議

_____

_____

問題四：填答者基本資料

1. 填答者姓名 *(可不填寫)*： _____

2. 填答者職務： _____

3. 電話：(____) — _____

4. 電子信箱： _____

5. 公司/組織名稱：_____

6. 公司/組織規模 *(可不填寫)*：在台員工人數： _____人，年營業額：_____億元。

7. 請勾選最適合於您的工作領域：

☐ 學術/ 顧問單位
☐ 政府單位/交通部/港務局 /民航局/航站
☐ 國際海運業者/ 船公司
☐ 國際空運業者/ 航空公司
☐ 承攬業/ 倉棧營運者

8. 請提供您在此領域的工作年資

☐ 未滿 10 年 ☐ 滿 10 年，未滿 20 年 ☐ 滿 20 年，未滿 30 年 ☐ 30 年以上

9. 您是否要此調查的結論摘要？

☐ 是 ☐ 否

非常感謝您的填答及協助

Appendix 4 Questionnaire Data

1. Question one-Importance and Satisfaction

cod	name	nat	job	rcj	tit	ex	dat	i1	i2	i3	i4	i5	i6	i7	i8	i9	i10	i11	i12	i13	i14	i15	s1	s2	s3	s4	s5	s6	s7	s8	s9	s10	s11	s12	s13	s14	s15
1	Lu	1	1	a	1	1	1	5	5	3	4	4	5	5	5	5	5	5	5	3	5	3	3	2	2	3	3	3	2	3	5	5	3	3	3	3	3
2	Wang	1	1	a	1	2	1	5	5	4	4	4	4	4	4	4	5	4	4	5	4	5	4	3	3	4	4	3	4	4	4	4	4	4	4	3	3
4	Yang	1	1	a	1	3	1	4	4	3	3	4	4	5	4	3	4	4	4	5	4	3	3	3	2	3	4	4	4	4	3	3	2	3	4	4	3
5	Chen	1	5	b	1	4	2	5	5	5	4	4	4	4	4	4	4	4	4	4	5	4	4	3	2	2	3	3	3	3	3	3	4	4	4	3	3
6	Shang	1	1	a	2	1	1	3	4	5	3	3	5	3	3	3	3	3	3	5	5	4	3	3	2	3	3	3	4	3	2	3	3	3	2	2	2
7	Liu	1	2	a	1	3	1	4	4	3	4	4	3	3	3	3	2	2	3	4	4	3	4	4	3	4	4	3	3	3	3	2	2	3	4	4	2
8	Chen	1	2	a	2	2	1	5	5	3	4	4	5	5	5	5	5	5	5	5	4	5	3	3	3	4	3	3	3	4	4	4	2	4	4	4	4
9	Bao	1	2	a	1	3	1	5	5	4	4	4	4	5	3	3	4	4	4	4	3	3	4	3	3	3	3	3	3	3	3	3	4	3	3	3	3
10	Li	1	2	a	1	3	1	3	5	4	5	4	5	5	4	5	5	5	5	5	3	4	4	4	4	3	3	5	3	3	2	3	3	2	2	3	3
11	OOT1	1	3	b	2	3	1	5	3	2	3	2	3	2	3	3	2	2	3	3	2	2	2	2	3	2	3	2	3	2	3	3	3	2	2	1	1
12	OOT2	1	3	b	2	3	1	5	3	2	3	2	4	4	3	4	4	4	4	4	3	3	2	2	1	1	1	2	2	2	3	2	3	2	2	1	2
13	Chen	1	1	a	2	2	1	4	3	3	4	5	4	5	3	5	5	4	3	3	4	5	2	2	3	2	2	4	4	3	2	2	3	2	3	2	3
14	IOT 1	1	2	a	3	2	1	4	5	5	5	5	5	5	5	4	5	4	5	5	5	4	4	4	4	3	4	4	3	4	4	4	4	4	4	4	3
15	IOT 2	1	2	a	2	3	1	3	5	4	3	3	4	3	3	4	5	3	4	4	4	4	3	2	2	2	2	3	3	3	3	3	3	3	2	2	3
16	TAC1	1	5	b	2	2	1	4	5	5	4	5	4	5	3	5	5	4	5	5	4	4	3	3	3	4	4	2	2	2	3	3	2	3	2	3	4
17	TAC2	1	5	b	2	3	1	4	5	3	4	3	3	5	5	4	4	4	5	5	4	4	3	4	4	4	3	2	3	3	3	4	4	4	4	3	3
18	TAC3	1	5	b	2	3	1	4	4	4	4	5	5	5	5	5	5	5	4	4	5	5	4	4	4	3	3	4	3	3	3	4	3	3	4	3	3
19	Lin	1	2	a	1	2	1	5	5	4	4	4	4	5	4	4	3	5	4	4	4	5	4	4	3	4	3	3	3	4	4	3	3	4	4	5	3
20	EVA 1	1	4	b	2	2	1	5	5	3	3	4	4	3	3	5	5	5	3	4	5	5	3	4	4	3	4	3	3	3	3	4	4	3	4	4	3
21	EVA 2	1	4	b	2	2	1	5	5	3	5	4	5	5	5	5	5	4	4	4	4	4	3	2	3	4	4	4	4	4	3	3	3	4	3	3	4
22	EGC1	1	5	b	2	2	1	5	5	4	4	4	5	5	5	5	5	4	5	4	4	4	3	5	3	4	2	5	2	4	4	3	4	2	3	4	4
23	EGC2	1	5	b	1	3	1	5	3	5	3	2	4	5	3	4	5	5	3	4	3	3	5	2	5	3	2	4	5	2	4	5	5	2	4	3	3
24	BW 1	2	3	b	1	3	1	5	5	5	4	4	4	4	5	5	4	4	5	5	4	5	4	3	3	3	3	4	3	3	3	3	3	3	3	3	3
25	BW 2	2	3	b	1	4	1	4	5	4	5	5	5	5	5	5	5	4	5	5	5	5	4	3	3	3	4	4	3	4	3	3	4	3	3	3	3
26	YMT1	1	3	b	2	2	1	4	4	3	4	4	4	5	4	5	5	4	4	4	3	3	3	3	3	3	2	4	4	3	3	1	3	3	4	4	3
27	YMT2	1	3	b	3	1	1	5	5	3	4	3	4	4	4	4	5	4	4	5	4	4	3	2	3	3	3	4	3	4	2	3	2	3	4	3	3
28	YMT3	1	3	b	2	2	1	5	5	3	4	2	4	4	3	4	3	3	3	3	4	2	3	4	2	3	2	2	3	3	2	3	3	3	3	2	2
29	YMT4	1	3	b	2	2	1	4	4	3	4	2	5	4	2	4	4	3	3	3	3	2	3	3	2	3	3	3	3	4	3	3	3	3	3	3	2
30	YMT5	1	3	b	2	2	1	4	5	4	4	4	4	4	4	5	5	5	4	5	5	3	2	2	3	3	2	3	3	3	2	2	2	3	4	3	3
31	UPS1	2	4	b	1	2	1	5	4	5	4	4	4	4	4	4	5	4	4	3	5	3	4	4	4	3	4	4	4	4	4	3	3	4	3	4	4
32	UPS2	2	4	b	2	2	1	5	5	5	5	4	4	4	4	5	5	5	5	5	4	4	3	3	4	3	3	3	3	3	3	3	3	3	3	3	3
33	YMK1	1	5	b	2	3	1	4	4	3	5	4	5	3	4	5	5	5	4	4	3	2	3	2	3	3	2	2	3	3	2	2	2	3	3	2	2
34	YMK2	1	5	b	3	3	1	4	5	5	5	5	5	4	4	5	5	5	4	5	5	5	3	2	3	2	3	4	2	3	4	3	3	4	3	4	4
35	YMK3	1	5	b	2	3	1	5	5	4	5	3	3	5	4	5	5	5	4	3	3	3	3	4	2	2	2	2	1	3	1	1	1	2	3	2	3
36	KHB1	1	2	a	1	4	1	5	5	4	5	4	5	5	5	5	5	5	5	5	5	4	4	4	3	3	3	3	3	3	3	3	3	4	3	3	3
37	KHB2	1	2	a	2	3	1	5	4	4	4	4	4	5	4	4	5	5	4	4	3	3	3	4	4	4	4	4	5	4	4	4	4	3	3	2	3
38	KHB3	1	2	a	1	4	1	5	5	4	3	3	4	4	4	4	4	4	4	4	4	3	4	3	3	3	3	3	2	3	2	2	2	3	4	3	3
39	KHB4	1	2	a	1	3	1	4	5	4	4	3	5	4	2	4	5	5	4	4	4	3	3	3	2	2	3	2	2	3	3	2	2	3	3	3	2
40	KHB5	1	2	a	2	4	1	4	5	4	5	4	5	5	4	4	5	5	4	4	5	4	3	3	3	4	3	3	3	4	3	4	4	2	2	3	3
41	SH K1	2	5	b	1	4	2	3	3	4	3	4	2	3	3	4	4	4	4	4	4	3	4	4	4	4	3	4	2	3	2	3	1	3	3	3	3
42	SH K2	2	5	b	2	3	2	5	4	2	4	3	4	4	3	4	4	4	4	3	4	3	2	3	3	2	3	4	2	3	2	3	3	3	3	2	3
43	Sud1	2	3	b	2	2	1	5	4	3	4	4	4	4	3	4	4	4	4	3	4	4	2	2	3	2	3	2	2	3	3	3	3	3	3	3	3
44	Sud2	2	3	b	2	2	1	4	5	4	5	4	5	5	5	5	5	5	5	5	5	4	2	2	2	3	3	2	3	3	2	2	2	3	2	2	2
45	CAL1	1	4	b	2	3	1	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	3	3	3	3	5	4	4	4	3	3	3	4	4	4	4
46	CAL2	1	4	b	3	1	1	5	5	4	4	3	4	3	5	5	5	5	4	4	3	4	3	3	3	2	4	4	4	3	2	2	2	2	3	3	3
47	CAL3	1	4	b	1	3	1	4	5	5	4	4	5	4	5	5	4	4	4	5	5	5	4	5	4	4	3	4	3	4	4	5	4	5	5	4	4
48	NCL1	2	3	b	2	2	1	4	4	4	4	4	5	5	4	4	4	4	5	4	4	4	3	3	3	3	3	4	4	3	3	3	4	3	3	4	3
49	NCL2	2	3	b	2	2	1	5	5	4	4	4	5	4	5	4	4	4	4	4	4	3	3	3	3	2	2	3	3	3	4	3	3	3	4	3	4
50	KLB1	1	2	a	2	2	1	4	4	2	3	3	4	5	3	4	4	4	3	3	3	3	2	2	3	3	2	2	2	3	2	2	2	3	3	3	2
51	KLB2	1	2	a	1	4	1	4	4	3	4	4	4	5	5	5	5	4	5	5	5	5	3	2	2	3	3	3	3	3	3	3	3	4	4	3	3
52	KLB3	1	2	a	1	4	1	4	5	4	4	4	5	5	4	5	5	5	4	4	5	5	3	3	3	3	3	4	3	3	3	2	2	3	3	3	2
53	GMT1	2	3	b	1	3	1	5	5	5	4	4	5	5	5	5	5	5	4	5	3	5	2	2	3	3	3	4	1	2	1	2	2	3	3	3	4
54	GMT2	2	3	b	1	4	1	5	4	4	3	3	4	3	4	5	4	3	4	4	3	3	3	3	4	3	2	3	2	2	3	3	3	4	4	2	3
55	MOL1	2	3	b	1	3	1	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	3	2	3	3	3	4	3	4	2	3	2	4	4	3	3
56	MOL2	2	3	b	2	3	1	4	4	3	4	3	4	4	3	4	4	4	5	4	4	4	3	3	3	3	3	2	2	3	2	3	3	2	3	3	3
57	APL1	2	5	b	2	3	2	5	5	4	5	4	4	4	4	5	5	4	4	4	4	3	3	3	3	4	2	3	2	3	2	2	3	3	3	3	3
58	APL2	2	5	b	1	3	2	5	4	3	4	3	4	4	4	5	5	4	4	5	4	4	4	4	3	3	3	4	3	3	4	4	3	4	4	3	3
59	LeeM	1	1	a	1	3	2	5	4	4	5	4	5	5	5	5	5	5	5	5	5	5	4	4	4	5	4	4	4	4	4	4	4	4	4	4	4
60	COS1	2	3	b	2	2	1	4	3	3	4	4	4	4	3	4	4	4	3	4	3	3	4	3	3	3	3	3	3	3	3	3	3	3	3	3	3
61	NYK1	2	3	b	2	3	1	5	4	4	5	5	5	5	5	5	5	5	5	5	5	5	3	2	3	2	2	3	3	3	2	3	2	3	3	2	2
62	NYK2	2	3	b	2	3	1	5	3	5	5	3	5	5	3	5	5	5	5	5	5	5	3	3	4	3	3	4	3	3	3	3	3	4	3	3	3
63	KLT1	2	3	b	2	3	1	5	5	5	5	5	5	5	4	5	5	5	5	5	5	5	4	3	1	1	3	1	2	2	1	2	2	2	3	2	2
64	KLT2	2	3	b	3	2	1	5	5	3	4	4	5	5	4	5	5	5	5	5	4	5	5	2	2	3	2	3	2	2	3	3	3	2	2	3	2	2
65	MSC1	2	3	b	1	3	1	5	4	2	4	4	4	4	4	5	5	5	4	5	5	5	3	3	2	2	2	3	3	3	2	3	2	4	3	3	3
66	Clux1	2	4	b	2	2	1	5	4	4	3	4	5	5	5	4	5	4	4	4	4	4	3	2	3	3	3	2	2	3	3	2	2	3	4	2	3
67	Clux2	2	4	b	3	1	1	5	5	4	3	3	2	5	3	4	4	5	4	5	4	4	3	3	3	2	4	4	2	4	2	4	1	3	4	4	4
68	Yu	1	1	a	1	1	1	4	5	4	4	4	5	5	4	4	4	5	5	5	4	5	3	2	2	4	2	3	2	3	2	2	2	2	3	3	2
69	PIL1	2	3	b	1	2	1	5	5	3	4	3	4	4	4	5	5	5	5	4	4	4	3	3	3	3	3	3	3	3	3	3	3	4	4	4	3

70	PIL2	2	3	b	1	3	1	5	4	4	5	5	5	5	5	5	5	5	5	3	5	5	3	4	3	3	2	3	3	2	1	1	1	2	3	2	3
71	TCB1	1	2	a	2	4	1	5	4	4	5	4	5	5	5	5	5	4	4	5	5	5	4	4	3	4	4	4	3	3	3	4	3	3	3	3	3
72	JAA1	2	4	b	2	2	1	5	5	4	4	4	5	5	4	4	4	4	5	5	5	4	3	2	3	3	3	2	2	3	3	3	3	2	2	2	3
73	EMT1	1	5	b	3	3	2	5	4	3	5	5	5	5	5	5	3	3	5	5	4	5	5	4	2	5	3	4	2	4	3	2	3	2	2	2	4
74	EMT2	1	5	b	2	3	2	5	4	4	5	4	5	4	3	4	5	4	3	4	4	4	4	4	4	5	4	5	4	3	3	3	3	4	3	4	3
75	EMT3	1	5	b	1	3	2	2	3	3	3	4	5	4	3	3	4	5	4	3	3	4	3	3	4	2	3	3	3	2	2	3	4	3	2	2	3
76	EMT4	1	5	b	2	1	2	3	3	3	3	4	5	5	4	3	5	4	4	4	3	4	3	3	4	2	4	3	3	2	3	3	4	4	3	2	3
77	CKS1	1	2	a	1	4	1	5	4	4	4	4	4	4	5	4	4	4	4	4	4	4	3	4	4	4	3	4	4	4	3	2	2	4	4	4	4
78	CKS2	1	2	a	3	3	1	5	5	5	4	5	5	5	5	5	5	5	5	5	4	3	4	3	4	3	3	4	4	4	3	3	3	4	4	3	3
79	LHT1	2	5	b	3	1	2	5	4	3	4	4	5	5	4	5	5	5	5	5	5	5	4	3	3	3	3	3	3	4	3	4	3	3	3	3	3
80	LHT2	2	5	b	3	1	2	5	4	4	4	5	5	5	4	5	5	5	5	5	5	5	4	3	2	2	3	3	4	2	3	2	2	2	3	3	3
81	COS2	2	3	b	2	3	1	5	5	5	5	4	5	5	5	5	5	5	5	5	5	5	5	4	2	3	2	2	3	3	3	3	2	2	3	3	3
82	SAC1	2	4	b	2	4	2	5	4	4	5	5	5	5	5	5	5	5	5	5	4	5	3	2	3	3	3	2	2	3	3	3	2	3	4	3	3
83	Lin	1	1	a	3	2	1	4	5	5	4	3	3	4	4	5	5	5	4	5	4	5	3	4	3	3	4	5	4	4	4	5	5	4	5	4	4
84	HpL2	2	3	b	1	4	2	4	4	4	4	4	4	5	4	4	5	5	5	5	4	4	3	3	3	3	3	3	2	3	2	2	2	2	3	3	3
85	HpL1	2	3	b	2	3	2	5	5	4	4	4	5	4	5	5	5	5	5	5	5	5	4	3	4	3	3	3	4	3	4	4	4	3	4	3	3	3
86	OOK1	2	5	b	2	3	2	5	4	4	5	4	4	5	5	4	5	5	5	5	5	5	5	3	1	3	2	3	4	1	3	3	2	3	4	3	1	3
87	OOK2	2	5	b	1	4	2	2	4	4	4	4	4	5	4	5	5	5	4	5	4	4	3	1	3	4	3	4	2	4	2	2	2	4	4	4	3
88	OOK3	2	5	b	2	4	2	5	4	4	4	4	5	5	4	4	5	4	5	5	4	5	4	3	3	3	3	4	4	4	4	4	3	4	3	3	3
89	OOK4	2	5	b	2	3	2	5	5	4	3	4	5	5	4	4	5	4	4	4	4	3	3	2	2	3	3	3	3	3	3	2	2	3	3	2	2
90	SHT1	2	3	b	2	2	1	5	5	5	5	3	4	5	4	5	5	5	5	5	5	5	2	2	2	3	2	3	2	2	2	3	2	2	2	2	3
91	SHT2	2	3	b	3	1	1	5	5	4	5	5	5	5	4	3	5	5	5	3	5	4	2	2	3	3	2	3	2	4	2	2	2	3	3	4	2
92	TCB2	1	2	a	2	2	2	5	5	5	5	4	5	5	5	5	5	5	3	4	4	3	3	3	2	3	3	4	3	3	2	3	2	3	3	3	3
93	TCB3	1	2	a	1	3	2	5	5	3	3	4	5	5	5	5	5	5	5	5	4	4	4	4	3	3	3	4	4	4	3	3	3	3	3	3	3
94	Exel1	2	5	b	2	3	2	5	4	3	4	3	4	5	4	5	4	5	4	4	5	4	3	3	3	3	4	2	2	3	3	3	3	4	3	3	3
95	EvT1	1	5	b	2	2	1	5	5	4	5	4	5	5	4	4	5	5	4	5	5	4	3	2	2	2	2	2	2	3	3	2	2	3	2	2	2
96	EvT2	1	5	b	3	1	1	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	3	2	2	2	2	2	1	2	2	2	2	3	3	3	3
97	Feng	1	1	a	1	2	1	5	4	3	4	4	5	5	4	5	5	5	4	4	3	4	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
99	WHT1	1	3	b	2	2	2	5	5	4	5	5	5	5	5	4	5	5	5	5	5	5	4	3	3	3	2	3	4	4	4	3	4	2	4	3	4	3
100	WHT2	1	3	b	2	2	2	5	5	5	3	4	4	4	4	5	5	5	5	5	5	5	5	4	4	4	3	3	3	3	3	4	4	3	3	4	4	3
101	WHT3	1	3	b	2	2	2	5	5	5	4	4	5	5	4	5	5	5	3	4	3	3	3	2	3	2	2	2	2	3	1	3	2	3	3	3	2
102	Zim1	2	3	b	2	3	2	5	4	3	4	4	5	5	4	4	5	5	5	5	4	4	4	3	3	3	2	3	3	3	3	3	2	3	3	3	2
103	HMM1	2	3	b	2	4	2	5	5	3	5	4	5	5	4	4	5	5	5	4	5	5	3	3	4	3	4	3	3	4	3	4	3	3	3	4	3
104	HMM2	2	3	b	1	3	2	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	3	3	4	3	2	2	2	2	3	4	1	2	1	2	4
105	Th A1	2	4	b	2	2	2	5	4	4	5	4	4	4	5	4	5	5	5	4	4	5	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4
106	NW1	2	4	b	2	2	2	5	5	4	3	4	5	5	5	5	5	5	4	3	5	4	2	2	3	3	2	4	2	3	2	2	2	3	3	3	4
107	CL 1	1	3	b	2	1	1	5	5	5	5	5	4	4	4	5	5	5	5	5	5	4	3	3	3	3	3	2	2	2	3	2	2	3	3	3	3
108	CL 2	1	3	b	3	2	1	5	5	4	5	4	4	3	4	5	5	4	5	5	4	5	3	3	3	4	4	4	3	4	4	5	2	4	3	4	3
109	CL 3	1	3	b	3	1	1	5	4	5	4	5	5	5	5	4	4	5	4	5	4	5	3	3	3	3	3	3	2	3	2	3	3	3	3	3	2
110	KH A	1	2	a	1	3	1	5	5	4	5	5	4	4	5	5	5	5	5	5	5	5	2	2	3	2	3	3	3	3	2	3	2	2	3	3	3
111	Chou	1	2	a	1	3	2	4	5	5	4	3	4	4	4	4	4	5	4	5	5	4	3	2	2	3	3	4	3	3	4	4	2	3	3	3	3
112	Wang1	1	2	a	1	4	2	4	5	4	4	4	5	5	4	4	4	4	4	3	3	3	3	4	3	3	3	4	4	3	4	4	4	3	4	3	3

2. Question Two

2.1 Importance

cod	name	nat	job	rcj	tit	ex	dat	i1	i2	i3	i4	i5	i6	i7	i8	i9	i10	i11	i12	i13	i14	i15	i16	i17	i18	i19	i20	i21	i22	i23	i24	i25	i26
1	Lu	1	1	a	1	1	1	5	5	5	4	5	4	5	5	5	5	5	4	5	5	5	5	5	4	3	5	5	5	5	5	5	5
2	Wang	1	1	a	1	2	1	4	4	4	5	3	3	5	4	4	4	3	4	4	4	5	4	5	5	4	4	4	5	5	4	5	4
4	Yang	1	1	a	1	3	1	5	4	4	5	4	3	4	5	4	5	4	4	5	5	4	5	5	5	4	5	4	5	5	5	4	5
5	Chen	1	5	b	1	4	2	3	5	5	5	4	4	4	4	3	5	4	4	4	4	5	4	4	4	5	5	5	5	5	5	5	5
6	Shang	1	1	a	2	1	1	4	4	5	5	5	3	3	3	3	4	3	3	2	2	5	4	4	5	5	4	4	5	5	5	5	5
7	Liu	1	2	a	1	3	1	3	3	4	4	2	3	4	3	4	4	2	3	3	4	4	3	2	2	3	3	3	4	3	4	4	3
8	Chen	1	2	a	2	2	1	4	5	4	5	4	3	5	4	5	4	3	3	4	5	4	4	4	3	2	5	5	5	5	5	4	5
9	Bao	1	2	a	1	3	1	4	4	4	4	4	3	3	4	4	4	4	4	4	4	3	4	4	4	3	4	4	4	4	4	4	3
10	Li	1	2	a	1	3	1	5	5	4	5	3	4	3	4	3	5	3	3	4	4	4	4	4	3	3	5	4	5	5	5	5	4
11	OOT1	1	3	b	2	3	1	4	2	3	3	3	3	2	4	2	3	3	2	2	3	4	3	3	2	2	3	2	3	2	4	3	2
12	OOT2	1	3	b	2	3	1	3	3	2	2	2	2	3	2	2	3	1	2	2	4	2	2	1	2	1	3	1	2	2	2	3	1
13	Chen	1	1	a	2	2	1	4	3	4	5	3	3	3	3	3	3	3	3	5	4	3	3	4	3	3	5	5	4	5	4	3	5
14	IOT 1	1	2	a	3	2	1	4	5	5	5	4	4	4	4	3	4	4	4	4	5	4	4	4	4	5	4	4	4	4	4	5	4
15	IOT 2	1	2	a	2	3	1	3	4	3	4	3	4	4	3	5	4	4	3	3	4	3	3	4	4	3	3	4	3	3	3	3	3
16	TAC1	1	5	b	2	2	1	5	5	3	4	4	3	4	3	4	3	4	3	5	5	4	3	3	3	3	4	4	4	5	4	4	5
17	TAC2	1	5	b	2	3	1	4	5	4	4	4	4	4	5	5	5	5	4	5	4	4	4	5	4	3	5	5	5	5	5	4	4
18	TAC3	1	5	b	2	3	1	5	5	5	5	5	4	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5
19	Lin	1	2	a	1	2	1	5	5	4	4	4	3	4	4	4	3	4	3	3	3	4	4	5	4	4	4	4	4	3	5	5	4
20	EVA 1	1	4	b	2	2	1	3	4	3	4	4	5	5	5	5	3	5	2	4	4	3	3	3	2	2	3	3	5	5	4	3	3
21	EVA 2	1	4	b	2	2	1	4	5	5	5	4	4	5	4	5	4	5	4	4	4	5	4	5	4	4	4	4	4	4	4	5	5
22	EGC1	1	5	b	2	2	1	5	5	5	4	5	5	5	5	5	4	5	4	4	4	4	4	4	4	4	4	4	5	5	4	5	4
23	EGC2	1	5	b	1	3	1	5	5	5	3	3	2	4	3	4	5	4	3	5	5	3	4	3	4	4	3	3	4	4	5	5	4
24	BW 1	2	3	b	1	3	1	5	5	5	5	4	4	4	4	4	5	4	4	4	4	4	3	5	4	4	4	4	4	4	4	4	5
25	BW 2	2	3	b	1	4	1	5	5	5	5	4	4	5	5	5	5	4	4	5	5	4	5	5	4	4	4	4	5	5	4	5	5
26	YMT1	1	3	b	2	2	1	4	4	3	4	5	4	4	4	2	3	4	3	5	3	3	3	5	3	5	5	5	4	4	4	5	3
27	YMT2	1	3	b	3	1	1	4	3	5	5	5	4	4	5	3	5	5	3	4	5	3	5	5	4	4	3	4	5	5	5	5	5
28	YMT3	1	3	b	2	2	1	4	5	3	4	3	3	5	4	3	3	3	3	3	4	3	2	5	4	4	4	3	4	4	4	4	2
29	YMT4	1	3	b	2	2	1	4	5	2	3	3	3	4	3	3	3	2	2	3	3	3	3	5	4	4	5	3	4	3	3	4	3
30	YMT5	1	3	b	2	2	1	4	5	5	4	4	3	4	4	4	4	4	4	5	4	3	4	5	2	2	5	5	5	5	5	5	3
31	UPS1	2	4	b	1	2	1	3	5	3	4	4	2	3	3	4	4	3	3	4	4	2	4	2	3	3	5	5	5	5	5	5	3
32	UPS2	2	4	b	2	2	1	4	5	4	5	4	5	5	5	4	4	4	4	4	5	4	4	5	4	4	4	4	5	5	5	5	5
33	YMK1	1	5	b	2	3	1	4	5	5	5	4	2	3	3	4	4	3	2	3	4	4	3	2	3	3	3	3	3	4	4	4	5	3
34	YMK2	1	5	b	3	3	1	4	5	5	5	4	4	4	4	4	4	5	4	5	5	5	4	5	3	4	4	4	4	3	4	5	4
35	YMK3	1	5	b	2	3	1	3	5	4	5	4	4	4	3	3	3	3	3	3	3	3	3	4	4	3	3	4	5	4	4	5	4
36	KHB1	1	2	a	1	4	1	4	5	4	4	5	4	4	4	5	5	4	4	4	4	4	4	4	4	4	5	5	4	4	4	5	5
37	KHB2	1	2	a	2	3	1	3	3	3	3	5	3	4	3	3	3	3	5	3	5	4	4	3	3	3	5	3	4	4	4	4	4
38	KHB3	1	2	a	1	4	1	3	4	4	4	4	3	4	4	4	4	3	4	4	3	4	4	5	4	3	4	4	4	4	4	4	4
39	KHB4	1	2	a	1	3	1	4	5	3	4	5	4	4	4	3	3	3	3	3	4	4	3	4	4	3	4	3	4	3	3	4	4
40	KHB5	1	2	a	2	4	1	4	5	5	5	4	4	4	4	4	4	3	3	4	4	4	5	4	3	4	4	4	4	4	5	5	5
41	SH K1	2	5	b	1	4	2	3	3	3	3	4	3	4	3	3	3	3	3	3	4	3	3	4	3	3	3	3	4	3	3	3	3
42	SH K2	2	5	b	2	3	2	3	3	3	4	3	3	4	4	4	3	3	3	3	4	3	2	3	3	3	3	2	4	4	4	4	4
43	Sud1	2	3	b	2	2	1	.	4	4	4	3	3	3	3	3	3	3	4	4	4	4	4	4	3	3	4	3	4	3	4	4	3
44	Sud2	2	3	b	2	2	1	5	5	5	5	5	5	4	5	4	4	5	4	5	5	4	4	5	3	3	5	5	5	5	4	3	3
45	CAL1	1	4	b	2	3	1	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5
46	CAL2	1	4	b	3	1	1	4	5	5	3	4	3	3	3	3	2	2	3	4	4	2	4	3	2	2	4	4	4	4	4	4	4
47	CAL3	1	4	b	1	3	1	4	5	4	4	4	5	4	4	5	5	4	4	5	4	4	5	5	5	4	4	4	5	5	5	5	5
48	NCL1	2	3	b	2	2	1	3	3	4	4	4	5	4	4	3	3	4	4	4	3	3	4	4	4	4	3	3	3	3	3	4	4
49	NCL2	2	3	b	2	2	1	3	3	2	2	2	3	3	2	3	2	2	3	4	4	4	4	5	4	4	5	5	5	4	4	3	3
50	KLB1	1	2	a	2	2	1	4	4	4	4	3	3	3	4	4	3	3	3	3	4	2	3	3	3	3	4	4	4	4	4	3	4
51	KLB2	1	2	a	1	4	1	4	5	4	4	3	3	4	4	4	5	3	4	5	4	4	3	4	4	4	4	4	5	5	5	5	4
52	KLB3	1	2	a	1	4	1	4	5	4	5	3	4	3	4	4	5	3	3	5	4	4	4	4	4	4	4	4	4	4	4	5	5
53	GMT1	2	3	b	1	3	1	5	5	4	5	3	3	2	4	4	3	5	3	4	5	3	4	4	3	3	4	4	5	5	4	4	4
54	GMT2	2	3	b	1	4	1	3	4	4	5	3	4	5	4	3	4	4	4	4	3	3	3	5	4	4	4	4	4	4	3	4	3
55	MOL1	2	3	b	1	3	1	5	5	5	5	5	5	5	5	5	5	4	5	5	5	4	5	5	4	4	4	5	5	5	5	5	4
56	MOL2	2	3	b	2	3	1	4	4	4	4	4	4	4	4	4	4	3	4	4	4	4	4	4	4	4	3	4	4	4	4	4	4
57	APL1	2	5	b	2	3	2	4	5	4	5	4	4	4	4	3	4	4	3	4	4	4	4	4	4	3	4	3	4	4	3	4	4
58	APL2	2	5	b	1	3	2	4	5	4	4	4	4	3	3	4	4	4	4	4	4	3	4	4	3	3	4	3	4	4	4	4	3
59	LeeM	1	1	a	1	3	2	5	5	5	4	5	4	4	4	4	4	5	5	5	4	4	4	5	4	4	4	4	5	5	5	5	5
60	COS1	2	3	b	2	2	1	4	3	3	3	3	4	3	3	4	3	3	3	3	3	3	3	3	2	2	4	3	4	3	3	4	3
61	NYK1	2	3	b	2	3	1	5	5	5	5	4	4	5	5	5	5	5	5	5	5	5	4	5	5	5	5	5	5	5	5	5	4
62	NYK2	2	3	b	2	3	1	4	5	5	5	5	5	5	5	3	3	3	3	3	5	4	3	5	4	2	3	3	5	5	4	5	3
63	KLT1	2	3	b	2	3	1	5	5	5	5	3	3	4	5	5	4	3	3	4	5	4	5	4	3	3	4	4	4	4	4	4	4
64	KLT2	2	3	b	3	2	1	4	5	5	5	4	4	4	5	4	4	5	4	4	5	5	5	4	3	3	4	4	4	3	4	4	4
65	MSC1	2	3	b	1	3	1	3	5	4	3	3	4	5	3	3	3	3	3	3	3	3	3	5	2	2	3	3	5	3	4	5	4
66	Clux1	2	4	b	2	2	1	4	4	5	4	4	5	4	5	5	4	5	3	5	4	4	3	3	3	4	3	2	5	4	5	5	4
67	Clux2	2	4	b	3	1	1	4	5	3	3	3	3	4	4	3	3	4	4	5	5	5	5	5	3	2	4	3	5	5	5	5	5
68	Yu	1	1	a	1	1	1	5	5	4	5	4	4	5	5	4	5	4	4	4	5	4	4	4	3	3	5	4	5	5	5	5	5
69	PIL1	2	3	b	1	2	1	4	4	3	4	3	3	3	3	3	3	4	3	4	4	3	3	3	3	3	3	3	4	4	4	4	4
70	PIL2	2	3	b	1	3	1	3	5	5	5	5	3	5	4	4	3	3	4	3	5	5	5	3	4	2	5	5	4	4	4	4	3
71	TCB1	1	2	a	2	4	1	4	5	4	5	4	5	5	4	4	4	4	4	5	5	5	4	5	4	5	4	4	5	5	5	5	5
72	JAA1	2	4	b	2	2	1	4	5	4	5	4	4	4	4	4	4	3	4	3	4	3	4	4	4	4	3	4	4	4	4	4	4
73	EMT1	1	5	b	3	3	2	5	5	5	5	5	5	5	5	5	5	5	4	5	5	5	5	5	4	5	5	5	5	5	5	5	5
74	EMT2	1	5	b	2	3	2	5	4	4	4	4	4	4	5	5	5	5	4	4	5	5	4	5	4	4	4	4	4	4	4	4	5

75	EMT3	1	5	b	1	3	2	3	3	4	4	3	2	2	3	2	3	2	2	4	4	3	3	3	2	2	2	2	2	4	4	5	4
76	EMT4	1	5	b	2	1	2	3	3	4	4	3	2	2	3	3	3	2	2	4	4	3	3	3	2	2	2	2	2	4	4	4	4
77	CKS1	1	2	a	1	4	1	5	4	3	4	4	3	3	3	4	4	4	4	3	4	4	3	4	4	3	3	4	4	4	4	4	4
78	CKS2	1	2	a	3	3	1	5	4	3	3	3	4	3	3	3	3	4	4	4	3	4	3	3	3	3	4	4	4	4	4	5	5
79	LHT1	2	5	b	3	1	2	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	5	5	5	5	5
80	LHT2	2	5	b	3	1	2	4	5	5	5	4	4	4	4	4	4	4	4	4	5	4	4	4	4	4	4	5	5	5	5	5	5
81	COS2	2	3	b	2	3	1	5	5	4	5	4	4	5	4	5	5	5	4	4	5	4	4	5	4	4	4	5	5	5	5	5	4
82	SAC1	2	4	b	2	4	2	5	5	5	5	5	4	5	5	5	5	5	5	5	5	5	5	5	4	4	4	4	4	5	5	5	5	5
83	Lin	1	1	a	3	2	1	5	5	4	4	3	4	4	5	4	5	5	4	4	4	5	4	5	4	4	5	4	3	3	3	4	4
84	HpL2	2	3	b	1	4	2	4	4	4	4	4	4	4	4	3	3	3	4	4	4	4	4	3	3	4	4	4	4	4	4	4	4
85	HpL1	2	3	b	2	3	2	4	4	4	5	4	4	3	4	4	4	4	5	5	5	4	4	5	4	4	4	4	5	5	4	5	5
86	OOK1	2	5	b	2	3	2	4	5	4	4	4	5	5	5	4	4	4	3	4	4	4	4	5	5	5	5	5	5	5	3	5	5
87	OOK2	2	5	b	1	4	2	5	4	5	4	3	4	5	4	4	5	4	4	4	4	3	4	4	4	4	4	4	4	4	4	5	4
88	OOK3	2	5	b	2	4	2	4	5	5	5	4	5	5	5	5	4	4	5	4	4	4	4	5	5	4	4	4	5	5	5	5	5
89	OOK4	2	5	b	2	3	2	4	4	4	4	3	2	5	3	4	4	4	4	4	4	3	4	4	3	2	3	3	4	4	4	4	4
90	SHT1	2	3	b	2	2	1	5	5	5	5	4	5	4	5	4	5	4	4	4	4	5	4	5	4	5	4	4	4	4	4	4	5
91	SHT2	2	3	b	3	1	1	5	5	5	5	1	5	3	3	2	4	3	2	1	5	1	4	5	3	3	4	4	5	5	5	5	5
92	TCB2	1	2	a	2	2	2	5	5	5	5	5	4	4	4	4	4	4	4	4	4	3	4	4	3	3	3	3	4	4	3	4	5
93	TCB3	1	2	a	1	3	2	4	4	3	4	4	3	4	4	4	4	4	3	4	4	3	4	4	3	3	4	4	4	4	4	4	4
94	Exel1	2	5	b	2	3	2	4	4	4	4	3	3	4	4	4	3	3	3	4	4	3	4	4	3	3	4	3	5	5	4	5	4
95	EvT1	1	5	b	2	2	1	4	5	5	5	5	4	4	4	4	4	5	4	5	5	5	5	5	4	4	5	5	5	5	5	5	5
96	EvT2	1	5	b	3	1	1	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5
97	Feng	1	1	a	1	2	1	4	5	4	4	4	3	3	4	4	4	4	4	4	4	4	4	4	4	3	3	4	4	5	5	5	5	4
99	WHT1	1	3	b	2	2	2	3	5	5	5	4	5	5	4	4	2	2	2	5	3	4	4	5	4	4	4	4	5	5	5	5	5
100	WHT2	1	3	b	2	2	2	5	5	5	5	3	4	5	5	5	3	5	3	4	4	4	5	5	4	4	4	4	5	5	5	5	5
101	WHT3	1	3	b	2	2	2	5	5	4	5	4	5	4	4	4	3	3	3	5	5	4	4	4	3	4	3	3	4	4	4	4	4
102	Zim1	2	3	b	2	3	2	5	5	4	5	4	3	4	4	4	4	4	3	3	3	3	4	4	3	3	3	4	5	5	5	5	2
103	HMM1	2	3	b	2	4	2	5	5	4	5	5	5	5	5	5	5	3	5	4	4	4	3	4	5	4	4	4	4	4	3	4	3
104	HMM2	2	3	b	1	3	2	5	5	5	5	5	3	5	5	5	5	5	5	5	5	4	4	4	5	4	5	5	5	5	5	5	5
105	Th A1	2	4	b	2	2	2	5	5	4	5	4	3	4	4	4	5	3	5	5	5	5	4	5	4	4	5	4	3	4	4	4	1
106	NW1	2	4	b	2	2	2	3	5	4	5	3	5	4	3	4	5	5	3	4	4	3	2	5	3	2	4	4	5	5	5	5	5
107	CL 1	1	3	b	2	1	1	5	5	5	5	5	5	5	5	5	5	5	4	5	4	4	5	5	5	5	5	5	5	5	5	5	5
108	CL 2	1	3	b	3	2	1	5	5	5	4	4	4	5	5	4	3	4	4	4	3	5	4	5	4	4	4	4	5	5	5	5	5
109	CL 3	1	3	b	3	1	1	3	4	4	3	4	4	5	3	3	1	4	3	5	4	4	4	5	3	3	4	4	5	4	5	5	5
110	KH A	1	2	a	1	3	1	4	5	4	4	4	5	5	5	4	5	4	4	5	4	4	4	4	4	4	5	4	4	4	4	5	4
111	Chou	1	2	a	1	3	2	5	4	3	4	3	3	4	4	4	5	4	3	3	4	4	4	4	3	3	4	4	5	5	5	5	4
112	Wang1	1	2	a	1	4	2	3	4	3	3	3	3	3	4	3	3	3	2	2	3	3	3	2	2	2	3	2	3	3	3	3	3

2.2 Satisfaction

cod	name	nat	job	rel	tit	ex	dat	s1	s2	s3	s4	s5	s6	s7	s8	s9	s10	s11	s12	s13	s14	s15	s16	s17	s18	s19	s20	s21	s22	s23	s24	s25	s26
1	Lu	1	1	a	1	1	1	5	5	3	3	3	4	5	3	2	2	5	3	4	2	2	4	5	5	3	4	3	5	5	3	4	2
2	Wang	1	1	a	1	2	1	4	4	4	4	3	3	3	4	4	4	3	4	4	4	4	3	4	4	4	4	4	4	4	3	4	4
4	Yang	1	1	a	1	3	1	4	3	3	4	3	3	3	4	4	4	3	3	3	3	2	3	4	4	4	3	3	4	4	3	4	4
5	Chen	1	5	b	1	4	2	3	3	3	3	4	4	4	4	4	4	4	3	4	4	4	4	4	4	3	3	3	3	3	3	4	4
6	Shang	1	1	a	2	1	1	4	4	4	4	3	3	3	3	3	3	3	3	3	3	3	4	4	3	3	3	3	3	2	2	2	2
7	Liu	1	2	a	1	3	1	3	3	4	4	2	3	4	3	4	4	2	3	3	4	4	3	2	2	3	3	3	4	3	4	4	3
8	Chen	1	2	a	2	2	1	3	4	3	4	3	3	5	4	4	3	3	3	4	2	4	4	4	3	3	4	4	4	3	5	3	4
9	Bao	1	2	a	1	3	1	4	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
10	Li	1	2	a	1	3	1	4	4	3	2	3	4	3	3	3	3	3	2	3	3	3	3	4	3	3	3	4	4	3	4	3	2
11	OOT1	1	3	b	2	3	1	1	2	2	2	1	2	2	2	2	1	2	1	2	2	3	2	3	3	2	2	1	2	2	3	1	2
12	OOT2	1	3	b	2	3	1	2	1	1	1	1	1	2	1	1	2	1	1	2	2	1	1	1	1	1	2	1	1	1	1	2	1
13	Chen	1	1	a	2	2	1	4	3	3	4	4	4	4	3	3	2	3	3	3	4	3	4	4	2	2	3	3	3	4	3	2	3
14	IOT 1	1	2	a	3	2	1	4	4	4	4	4	4	4	4	4	4	4	4	3	4	4	4	4	4	4	4	3	4	4	4	5	4
15	IOT 2	1	2	a	2	3	1	4	3	3	3	3	3	4	4	3	2	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
16	TAC1	1	5	b	2	2	1	4	3	3	4	4	3	4	4	4	4	4	4	4	3	4	4	4	3	3	3	2	3	3	1	2	2
17	TAC2	1	5	b	2	3	1	3	2	2	2	3	3	3	4	2	2	3	3	4	3	3	2	3	4	4	3	4	4	4	4	4	4
18	TAC3	1	5	b	2	3	1	3	3	3	4	4	4	4	4	4	4	4	4	4	4	3	3	4	3	3	3	3	4	3	3	3	3
19	Lin	1	2	a	1	2	1	4	4	4	4	4	3	4	4	4	4	4	3	4	4	5	4	4	4	4	4	4	4	4	5	5	5
20	EVA 1	1	4	b	2	2	1	3	3	3	4	4	5	5	4	4	3	3	3	3	4	3	4	4	3	3	3	3	3	2	3	3	2
21	EVA 2	1	4	b	2	2	1	3	4	4	4	3	4	3	4	4	3	4	4	3	4	4	4	4	4	4	3	3	4	4	3	4	4
22	EGC1	1	5	b	2	2	1	3	2	3	4	4	5	4	4	5	3	4	1	2	1	2	2	3	4	4	4	3	3	3	3	4	3
23	EGC2	1	5	b	1	3	1	3	4	4	3	3	2	4	3	4	3	3	3	4	4	3	4	3	3	3	3	2	3	3	3	4	3
24	BW 1	2	3	b	1	3	1	3	3	4	3	3	3	3	4	4	4	4	3	4	3	4	4	4	3	4	4	4	4	4	4	4	4
25	BW 2	2	3	b	1	4	1	4	3	4	4	4	4	5	5	4	4	4	4	4	4	4	4	5	3	3	3	3	4	3	3	3	3
26	YMT1	1	3	b	2	2	1	3	3	3	4	3	4	3	4	3	4	4	3	4	3	3	3	5	3	3	4	4	3	3	3	3	3
27	YMT2	1	3	b	3	1	1	3	3	3	4	3	3	2	3	3	4	4	4	4	3	3	4	4	4	4	4	4	3	3	3	4	3
28	YMT3	1	3	b	2	2	1	4	4	2	3	3	3	4	3	3	3	2	2	3	3	2	3	4	2	2	4	3	3	2	3	3	3
29	YMT4	1	3	b	2	2	1	3	3	2	2	3	3	4	3	3	2	2	2	3	3	3	3	4	3	3	3	3	3	2	2	3	3
30	YMT5	1	3	b	2	2	1	4	3	3	3	3	3	3	4	3	3	3	3	3	4	3	3	4	3	3	3	3	3	2	3	2	3
31	UPS1	2	4	b	1	2	1	3	4	3	4	4	3	3	3	4	4	3	3	4	4	3	4	3	4	3	3	4	3	3	3	3	3
32	UPS2	2	4	b	2	2	1	3	3	3	2	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	2	2	3	2
33	YMK1	1	5	b	2	3	1	4	2	2	2	3	4	3	3	3	4	3	3	3	4	2	3	4	3	3	3	3	2	2	2	4	2
34	YMK2	1	5	b	3	3	1	4	3	4	4	4	3	3	3	4	4	3	4	4	4	3	4	4	4	3	4	4	4	4	4	4	3
35	YMK3	1	5	b	2	3	1	2	1	2	2	3	2	2	3	3	2	3	3	3	3	3	3	4	3	3	3	4	4	3	2	3	3
36	KHB1	1	2	a	1	4	1	4	4	4	4	4	3	3	3	4	4	3	3	4	4	4	4	4	4	4	4	4	4	4	4	4	4
37	KHB2	1	2	a	2	3	1	3	3	3	3	3	3	4	2	3	3	1	1	3	1	3	2	3	3	3	2	3	2	2	2	2	3
38	KHB3	1	2	a	1	4	1	3	4	4	4	4	3	3	3	3	3	3	3	3	3	3	3	4	3	3	3	3	3	3	3	3	3
39	KHB4	1	2	a	1	3	1	4	4	3	4	4	3	4	3	3	3	3	3	3	4	4	3	4	3	3	3	3	4	3	3	4	4
40	KHB5	1	2	a	2	4	1	4	3	3	4	3	3	4	4	3	3	2	2	3	3	2	4	3	3	3	3	2	4	4	4	3	3
41	SH K1	2	5	b	1	4	2	3	2	2	3	3	3	3	2	3	3	3	2	3	1	3	3	4	4	3	3	3	4	3	3	3	3
42	SH K2	2	5	b	2	3	2	3	3	3	3	3	3	4	3	3	3	3	3	3	4	2	2	3	3	3	3	2	4	3	3	3	3
43	Sud1	2	3	b	2	2	1	.	2	3	3	3	3	3	3	3	3	3	3	3	3	2	2	3	3	3	3	2	3	3	3	3	3
44	Sud2	2	3	b	2	2	1	4	4	3	3	4	4	4	4	3	4	3	3	3	4	3	3	4	3	3	3	4	4	4	4	3	3
45	CAL1	1	4	b	2	3	1	4	3	3	3	3	3	3	3	3	3	3	3	4	4	3	3	3	3	3	3	3	3	3	3	4	3
46	CAL2	1	4	b	3	1	1	4	4	4	4	3	4	2	4	2	2	2	2	3	4	2	3	2	2	2	2	2	3	3	3	3	3
47	CAL3	1	4	b	1	3	1	5	4	4	4	4	5	5	5	5	4	4	4	5	5	4	5	4	4	4	4	4	5	5	4	5	5
48	NCL1	2	3	b	2	2	1	3	3	3	3	3	3	3	3	3	3	4	4	3	3	3	4	4	3	3	3	3	4	4	4	4	4
49	NCL2	2	3	b	2	2	1	3	3	3	3	3	3	3	3	3	4	3	3	2	3	3	3	3	3	3	4	4	4	4	4	3	3
50	KLB1	1	2	a	2	2	1	3	3	3	3	2	3	2	3	3	2	3	2	3	4	2	3	3	3	3	3	2	3	2	2	2	3
51	KLB2	1	2	a	1	4	1	3	3	2	2	2	2	2	2	2	2	2	2	3	3	2	3	3	3	2	3	3	3	3	3	3	2
52	KLB3	1	2	a	1	4	1	3	3	3	2	3	3	3	3	3	3	3	3	3	4	3	3	4	3	3	3	3	3	3	3	3	3
53	GMT1	2	3	b	1	3	1	1	2	3	3	5	4	3	2	2	3	2	2	2	3	3	2	3	3	3	2	2	4	4	2	3	2
54	GMT2	2	3	b	1	4	1	3	3	4	3	4	4	4	3	3	4	4	3	2	2	3	3	5	4	4	3	4	2	2	3	2	2
55	MOL1	2	3	b	1	3	1	4	4	4	4	4	4	4	4	4	4	3	3	4	4	4	4	4	4	4	4	4	4	4	4	4	4
56	MOL2	2	3	b	2	3	1	3	3	2	2	3	3	4	4	3	3	2	2	2	3	3	3	3	3	3	2	3	2	2	2	2	3
57	APL1	2	5	b	2	3	2	4	3	3	3	3	3	3	3	3	3	2	3	2	1	3	3	4	3	3	2	3	3	3	3	2	3
58	APL2	2	5	b	1	3	2	3	4	4	4	4	4	3	3	4	4	4	4	4	4	3	4	4	3	3	4	3	4	4	4	4	3
59	LeeM	1	1	a	1	3	2	4	4	4	4	5	4	4	4	4	4	4	3	4	4	4	4	4	4	4	4	4	5	3	3	4	4
60	COS1	2	3	b	2	2	1	3	3	3	3	4	4	3	3	4	3	4	3	2	3	2	3	3	2	2	3	3	3	3	3	4	3
61	NYK1	2	3	b	2	3	1	3	3	4	3	3	3	3	3	3	4	3	3	3	3	3	3	4	3	3	3	3	4	3	3	4	3
62	NYK2	2	3	b	2	3	1	4	3	3	3	4	4	4	4	3	3	3	3	3	3	3	3	5	4	3	3	3	5	4	3	4	3
63	KLT1	2	3	b	2	3	1	3	2	1	1	3	3	3	2	2	3	3	3	2	1	3	2	3	3	3	3	3	3	3	3	2	2
64	KLT2	2	3	b	3	2	1	3	3	2	2	3	3	2	2	2	2	3	3	2	3	3	3	3	2	2	2	2	3	3	3	3	3
65	MSC1	2	3	b	1	3	1	4	5	4	3	3	4	4	3	3	3	3	3	3	3	3	3	5	2	2	3	3	4	3	4	3	3
66	Clux1	2	4	b	2	2	1	2	2	3	2	3	2	2	3	2	3	2	3	2	3	2	3	2	2	3	2	3	2	3	3	2	3
67	Clux2	2	4	b	3	1	1	3	2	2	2	3	3	2	2	3	3	4	2	3	4	3	2	1	3	3	1	2	3	3	2	4	4
68	Yu	1	1	a	1	1	1	4	3	2	2	2	3	4	4	2	3	2	2	2	2	2	2	3	3	3	2	2	3	3	3	3	3
69	PIL1	2	3	b	1	2	1	4	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	4	4	4	4	3	3
70	PIL2	2	3	b	1	3	1	2	3	3	2	2	3	2	2	2	2	2	2	1	2	2	2	1	3	2	1	3	3	3	3	2	2
71	TCB1	1	2	a	2	4	1	4	3	3	3	3	4	4	4	4	4	3	3	3	4	4	3	4	3	3	3	3	3	3	3	3	3
72	JAA1	2	4	b	2	2	1	3	2	3	2	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	2	2	2	3	3
73	EMT1	1	5	b	3	3	2	4	4	3	3	4	4	4	4	4	4	3	3	3	3	3	3	4	3	3	3	4	4	4	4	4	3
74	EMT2	1	5	b	2	3	2	3	4	4	4	2	4	4	4	4	3	3	3	3	2	2	4	5	4	4	3	3	2	2	2	2	3
75	EMT3	1	5	b	1	3	2	2	2	3	3	2	3	3	2	3	2	3	3	3	3	2	2	2	3	3	3	3	3	3	3	4	3
76	EMT4	1	5	b	2	1	2	3	2	3	3	3	3	3	2	3	3	4	3	3	3	2	2	3	3	2	3	3	3	3	3	4	3

77	CKS1	1	2	a	1	4	1	3	3	3	3	4	3	3	3	4	3	4	3	3	4	3	4	4	3	3	4	3	4	4	3	3	3
78	CKS2	1	2	a	3	3	1	4	4	3	3	4	4	4	4	4	4	3	4	4	4	3	4	3	3	3	3	3	3	4	4	3	4	4
79	LHT1	2	5	b	3	1	2	4	4	4	4	3	4	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
80	LHT2	2	5	b	3	1	2	3	2	2	3	3	3	4	3	3	3	2	2	1	2	2	2	3	2	3	3	3	3	3	3	3	3	3
81	COS2	2	3	b	2	3	1	3	3	2	2	3	3	3	3	3	3	2	3	3	3	2	2	3	3	3	3	3	3	3	3	3	3	3
82	SAC1	2	4	b	2	4	2	3	3	3	2	3	4	3	2	2	2	2	3	2	3	3	3	3	3	3	2	2	3	2	2	2	2	2
83	Lin	1	1	a	3	2	1	5	4	4	5	4	4	5	5	4	4	3	3	3	4	4	4	5	4	4	4	3	3	4	3	5	3
84	HpL2	2	3	b	1	4	2	3	2	2	2	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
85	HpL1	2	3	b	2	3	2	3	3	3	3	3	3	3	4	4	4	3	3	3	3	3	3	3	3	3	3	3	4	4	3	4	4	4
86	OOK1	2	5	b	2	3	2	2	3	3	4	4	4	5	5	4	2	3	3	4	3	3	4	4	4	4	5	3	4	4	3	4	4	4
87	OOK2	2	5	b	1	4	2	1	4	3	4	3	3	4	4	4	1	2	1	3	3	3	3	5	4	4	4	4	4	4	4	4	4	4
88	OOK3	2	5	b	2	4	2	3	3	3	3	4	4	4	4	4	3	3	4	4	3	4	3	4	4	4	3	4	4	4	4	4	4	4
89	OOK4	2	5	b	2	3	2	3	2	2	3	2	2	4	2	2	2	2	2	2	2	2	2	3	2	2	2	2	2	1	2	2	2	2
90	SHT1	2	3	b	2	2	1	2	2	2	2	3	3	3	1	3	1	4	4	3	3	4	4	4	4	4	3	3	4	3	3	3	1
91	SHT2	2	3	b	3	1	1	3	3	2	3	3	4	2	2	2	3	3	2	4	2	4	2	3	3	2	2	2	2	3	4	4	2
92	TCB2	1	2	a	2	2	2	4	4	3	3	3	4	4	4	3	4	4	3	4	3	3	3	3	3	3	3	3	4	4	3	3	3	3
93	TCB3	1	2	a	1	3	2	4	4	3	4	4	3	4	4	4	4	4	3	4	4	3	4	4	3	3	4	4	4	4	4	4	4	4
94	Exel1	2	5	b	2	3	2	3	3	2	4	3	3	3	2	3	3	3	3	3	4	3	3	3	3	3	2	3	4	4	3	3	2
95	EvT1	1	5	b	2	2	1	3	2	2	3	2	3	3	3	3	3	2	3	3	3	2	3	2	3	3	2	3	2	3	2	3	2	2
96	EvT2	1	5	b	3	1	1	3	3	3	3	3	3	3	3	3	2	3	3	3	3	3	3	3	3	2	2	2	3	3	3	3	3	3
97	Feng	1	1	a	1	2	1	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
99	WHT1	1	3	b	2	2	2	3	3	3	2	4	4	4	3	3	3	3	3	4	3	4	4	5	4	3	4	4	4	4	4	4	3
100	WHT2	1	3	b	2	2	2	3	4	3	4	3	3	3	4	4	4	3	3	3	4	4	4	4	3	3	4	4	3	3	3	3	4
101	WHT3	1	3	b	2	2	2	2	3	2	2	2	4	3	3	3	2	3	2	2	2	3	3	4	3	3	3	3	2	3	3	3	2
102	Zim1	2	3	b	2	3	2	3	3	3	2	2	3	3	3	3	3	3	3	3	3	3	3	4	3	3	3	3	4	4	4	4	2
103	HMM1	2	3	b	2	4	2	3	4	4	3	3	3	4	3	3	3	3	3	3	4	4	3	3	4	3	4	3	3	4	4	3	4	3
104	HMM2	2	3	b	1	3	2	3	2	2	1	2	1	2	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	4	1	1	1	1
105	Th A1	2	4	b	2	2	2	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4
106	NW1	2	4	b	2	2	2	3	4	3	2	3	2	3	3	4	2	2	3	3	3	3	3	3	3	2	3	3	4	3	3	4	4
107	CL 1	1	3	b	2	1	1	3	3	3	4	4	3	2	2	2	3	2	2	2	2	3	2	4	2	2	2	2	3	3	3	2	2
108	CL 2	1	3	b	3	2	1	3	4	4	4	4	3	3	3	3	3	3	3	3	4	4	4	4	5	4	5	4	4	3	3	3	3	3
109	CL 3	1	3	b	3	1	1	3	3	3	2	3	3	2	3	3	3	3	3	3	2	2	2	3	4	3	3	2	2	1	1	1	1	1
110	KH A	1	2	a	1	3	1	3	3	4	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	4	3	3	3	3	3
111	Chou	1	2	a	1	3	2	3	3	3	3	3	3	4	2	2	3	3	3	3	3	2	3	3	3	3	2	2	4	2	2	3	2	2
112	Wang1	1	2	a	1	4	2	3	3	3	2	2	3	4	4	3	3	3	2	2	3	3	3	3	2	2	3	3	3	3	2	3	3	3

3. Question Three

3.1 Importance

cod	name	nat	job	rcj	tit	ex	dat	i1	i2	i3	i4	i5	i6	i7	i8	i9	i10	i11	i12	i13	i14	i15	i16	i17	i18	i19	i20	i21	i22	i23	i24	i25	i26	i27	i28	i29	i30	i31	i32	i33	i34
1	Lu	1	1	a	1	1	1	5	5	5	5	5	5	5	5	5	5	5	4	4	4	5	5	5	5	5	5	5	5	5	5	5	5	5	4	5	5	3	5	4	5
2	Wang	1	1	a	1	2	1	4	5	5	4	5	5	5	5	5	5	5	5	5	4	3	5	5	5	5	5	5	4	4	5	4	4	4	5	5	5	4	5	4	4
4	Yang	1	1	a	1	3	1	5	4	4	5	5	4	5	4	4	5	4	4	5	5	4	5	5	5	5	5	4	5	5	4	5	4	4	5	4	5	4	5	4	5
5	Chen	1	5	b	1	4	2	4	4	4	4	4	5	5	4	4	5	5	5	5	4	4	4	5	5	5	5	5	5	5	5	5	5	4	4	4	4	4	4	4	5
6	Shang	1	1	a	2	1	1	4	4	4	4	4	5	5	5	5	4	3	2	2	3	5	5	5	3	2	2	5	3	3	4	5	5	2	2	5	3	3	5	2	3
7	Liu	1	2	a	1	3	1	3	3	3	3	4	4	4	3	4	3	3	2	2	4	2	2	3	4	3	4	4	3	3	3	3	3	2	2	3	2	3	2	2	3
8	Chen	1	2	a	2	2	1	5	5	5	5	5	4	4	3	4	4	4	4	4	4	5	5	5	5	5	5	5	5	5	4	4	4	4	4	5	4	4	5	5	4
9	Bao	1	2	a	1	3	1	4	4	4	4	4	4	4	4	4	4	4	3	3	4	4	4	4	4	4	4	4	4	4	4	5	4	3	3	5	4	4	5	5	5
10	Li	1	2	a	1	3	1	5	5	4	5	5	5	5	4	4	4	4	4	4	5	4	4	4	4	4	4	5	4	4	5	5	5	4	5	5	4	4	5	4	5
11	OOT1	1	3	b	2	3	1	4	4	3	3	3	3	2	3	3	2	3	3	2	2	3	3	3	2	2	3	2	2	2	2	3	3	4	2	3	2	3	3	2	3
12	OOT2	1	3	b	2	3	1	3	3	3	3	4	3	2	3	3	1	1	2	2	3	3	3	3	2	2	2	3	3	2	3	2	3	2	3	2	2	2	4	2	3
13	Chen	1	1	a	2	2	1	4	3	4	3	3	5	5	3	3	4	5	4	4	4	3	2	4	4	3	3	4	5	4	5	5	4	3	3	5	4	3	4	3	3
14	IOT 1	1	2	a	3	2	1	4	4	4	4	4	4	5	5	4	4	4	5	5	5	5	5	4	4	5	5	4	4	5	4	4	3	3	4	5	3	3	4	4	4
15	IOT 2	1	2	a	2	3	1	3	3	3	3	4	4	3	4	4	4	5	5	3	3	3	4	3	4	4	4	5	4	4	3	4	3	5	4	5	4	3	3	3	3
16	TAC1	1	5	b	2	2	1	5	5	4	4	5	5	4	4	4	4	5	3	4	4	4	5	5	4	3	2	4	3	3	4	4	5	2	3	5	2	3	5	5	4
17	TAC2	1	5	b	2	3	1	5	5	5	5	4	4	4	3	5	5	4	4	4	2	2	3	3	3	5	5	4	4	5	5	5	4	3	3	5	5	4	5	5	5
18	TAC3	1	5	b	2	3	1	5	5	5	5	5	5	5	4	4	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	4	5	5	5
19	Lin	1	2	a	1	2	1	5	5	4	4	3	4	4	5	4	3	5	4	5	4	4	5	5	5	5	5	5	4	4	3	4	4	3	3	5	3	5	5	5	5
20	EVA 1	1	4	b	2	2	1	5	5	5	5	5	4	4	5	5	3	5	4	5	5	4	5	5	5	4	4	5	5	5	5	5	5	4	5	5	4	2	5	5	3
21	EVA 2	1	4	b	2	2	1	5	5	4	5	5	4	4	5	5	4	5	5	4	4	4	4	4	4	4	4	4	4	5	5	5	4	3	3	5	5	3	5	4	5
22	EGC1	1	5	b	2	2	1	4	4	4	4	4	5	5	5	5	4	4	4	5	4	5	5	5	5	3	4	4	4	4	5	5	5	5	4	5	5	5	5	5	5
23	EGC2	1	5	b	1	3	1	5	5	5	5	5	5	5	5	3	3	3	5	5	5	4	3	4	5	5	4	4	5	4	4	5	5	4	4	4	5	3	3	5	4	5
24	BW 1	2	3	b	1	3	1	5	5	5	5	5	5	5	5	5	5	4	4	4	4	4	4	4	4	4	4	4	4	5	5	5	5	4	4	4	5	4	4	4	4
25	BW 2	2	3	b	1	4	1	5	5	4	5	5	5	5	5	5	4	4	4	4	5	4	4	5	5	5	4	5	5	5	5	5	5	4	4	5	5	4	5	5	5
26	YMT1	1	3	b	2	2	1	5	5	4	4	4	3	4	5	5	4	4	4	4	4	5	4	4	4	3	3	4	4	4	4	5	4	4	4	4	3	3	4	3	3
27	YMT2	1	3	b	3	1	1	4	4	4	5	5	5	5	5	5	5	3	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	4	5	5	5	5	5	5	5
28	YMT3	1	3	b	2	2	1	4	5	4	3	5	5	5	5	5	3	5	3	3	4	4	3	3	3	3	5	3	3	3	4	4	3	3	5	3	3	4	3	3	3
29	YMT4	1	3	b	2	2	1	4	5	4	4	5	5	4	3	3	3	5	3	3	4	4	3	5	4	3	3	3	5	3	3	3	4	4	3	4	3	3	2	5	3	3
30	YMT5	1	3	b	2	2	1	5	5	5	5	5	5	5	4	4	4	5	4	4	5	3	4	5	4	4	4	5	5	4	5	5	5	3	3	5	5	2	3	4	5
31	UPS1	2	4	b	1	2	1	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	3	4	4	4	4	4	4	4	4	4	4	4	4	5	5	5	5	4
32	UPS2	2	4	b	2	2	1	5	5	5	5	5	5	5	5	4	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	4	5	5	5	5
33	YMK1	1	5	b	2	3	1	4	4	4	3	5	5	5	5	4	4	4	4	4	4	3	4	5	4	5	5	5	4	4	5	5	4	5	5	5	4	1	5	3	5
34	YMK2	1	5	b	3	3	1	5	5	4	5	5	4	4	4	5	4	4	4	5	5	5	5	4	5	4	4	5	5	5	4	5	5	4	4	5	5	4	5	5	5
35	YMK3	1	5	b	2	3	1	5	5	5	5	5	4	4	4	4	3	4	4	4	3	5	5	5	5	5	4	5	4	4	5	4	4	5	3	5	5	3	5	5	5
36	KHB1	1	2	a	1	4	1	5	5	4	4	4	4	4	4	5	4	5	5	5	5	5	5	5	5	5	4	4	5	5	4	5	5	5	4	5	5	3	5	5	5
37	KHB2	1	2	a	2	3	1	4	4	5	4	5	4	4	5	5	3	3	3	3	3	3	3	3	4	4	1	1	3	3	3	3	5	5	5	5	5	5	5	5	5
38	KHB3	1	2	a	1	4	1	2	3	3	4	4	4	4	4	4	3	4	4	4	4	3	3	4	4	4	4	4	4	4	4	4	4	4	4	5	4	3	4	4	4
39	KHB4	1	2	a	1	3	1	4	4	3	3	5	5	4	5	4	4	3	4	3	5	4	4	4	4	5	4	4	4	4	5	5	4	3	4	5	4	4	5	4	4
40	KHB5	1	2	a	2	4	1	5	5	4	5	5	5	4	5	5	5	4	5	5	5	5	5	5	5	5	4	4	5	5	5	5	4	5	5	5	5	5	5	5	5
41	SH K1	2	5	b	1	4	2	4	4	3	3	4	4	3	4	4	3	4	4	4	4	4	4	4	4	3	3	4	4	3	5	3	4	4	3	5	5	3	4	4	4
42	SH K2	2	5	b	2	3	2	4	4	4	4	4	5	5	4	4	4	4	3	3	4	4	4	4	4	4	3	3	4	4	3	3	4	4	3	3	4	4	3	5	4	5
43	Sud1	2	3	b	2	2	1	5	5	4	4	4	4	4	4	4	3	4	4	4	3	4	4	4	4	4	3	4	4	4	4	4	5	4	.	5	5	4	5	5	4
44	Sud2	2	3	b	2	2	1	5	5	5	5	5	5	5	5	5	5	5	4	5	5	5	5	5	5	5	5	5	5	5	5	5	5	3	4	5	5	4	5	5	5
45	CAL1	1	4	b	2	3	1	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5
46	CAL2	1	4	b	3	1	1	4	4	4	4	5	5	5	5	5	3	5	4	4	4	3	4	4	3	4	4	4	2	2	5	4	4	3	3	5	5	2	4	4	4
47	CAL3	1	4	b	1	3	1	5	5	4	5	5	5	5	5	5	4	5	5	5	5	4	5	5	5	5	5	5	5	5	5	5	5	4	4	5	5	4	5	5	5
48	NCL1	2	3	b	2	2	1	5	5	5	5	5	5	5	5	5	5	4	4	5	5	5	5	5	5	5	5	4	4	4	4	5	5	4	4	5	4	3	4	5	4
49	NCL2	2	3	b	2	2	1	5	5	4	4	4	4	4	5	5	4	4	3	5	5	5	4	4	4	3	4	4	4	4	4	4	4	5	3	5	4	4	4	3	4
50	KLB1	1	2	a	2	2	1	5	5	5	5	5	5	5	3	4	4	4	5	4	4	4	4	5	4	4	4	4	4	4	4	5	4	4	4	4	3	4	5	5	4
51	KLB2	1	2	a	1	4	1	4	4	4	4	4	4	5	4	4	5	5	4	4	4	3	4	4	4	5	5	4	4	4	5	4	4	4	4	4	3	3	3	4	4
52	KLB3	1	2	a	1	4	1	4	4	4	5	5	5	5	4	4	4	4	4	4	5	4	4	4	4	5	5	5	5	5	4	5	5	5	4	5	5	5	5	3	5
53	GMT1	2	3	b	1	3	1	5	5	5	5	5	5	5	5	5	3	4	4	3	4	4	4	5	4	4	5	5	4	3	5	5	5	4	3	5	4	2	5	4	5
54	GMT2	2	3	b	1	4	1	4	4	3	4	3	4	4	4	3	3	4	4	3	4	4	3	4	4	5	4	5	4	3	4	4	5	4	4	5	4	3	5	4	3
55	MOL1	2	3	b	1	3	1	5	5	5	5	5	5	5	5	5	4	4	5	5	5	5	5	5	5	5	5	5	5	5	4	4	4	5	5	4	5	5	5	5	5
56	MOL2	2	3	b	2	3	1	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	5	4	4	5	4	4
57	APL1	2	5	b	2	3	2	4	5	4	4	4	4	4	5	5	4	5	3	5	4	4	5	5	4	2	3	4	4	3	4	4	5	4	4	3	4	1	5	4	4
58	APL2	2	5	b	1	3	2	5	5	4	4	5	4	4	4	5	4	5	4	4	4	4	3	4	5	4	4	4	4	4	5	5	4	5	4	5	4	4	5	5	4
59	LeeM	1	1	a	1	3	2	4	4	5	5	5	5	5	4	5	5	5	5	5	5	4	5	5	5	5	5	5	5	5	5	5	5	4	5	5	5	3	5	5	5
60	COS1	2	3	b	2	2	1	4	4	4	4	3	3	4	3	3	3	4	3	4	4	4	4	4	4	4	3	3	3	3	3	4	4	3	4	4	4	4	4	5	4
61	NYK1	2	3	b	2	3	1	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	4	5	5	5	4	5	5	5
62	NYK2	2	3	b	2	3	1	5	5	5	5	5	5	5	5	5	3	3	3	3	4	5	5	5	5	5	5	5	5	5	5	5	5	3	3	5	4	3	4	4	5
63	KLT1	2	3	b	2	3	1	5	5	5	4	5	5	4	4	4	4	5	5	4	5	4	4	4	4	5	5	5	5	5	5	5	5	5	4	5	5	4	5	5	5
64	KLT2	2	3	b	3	2	1	5	5	5	5	5	5	5	4	4	5	4	4	4	5	4	5	4	5	5	5	5	5	5	5	5	5	5	5	5	5	4	5	5	5
65	MSC1	2	3	b	1	3	1	5	5	5	4	5	4	4	5	5	3	5	4	5	5	5	5	5	4	4	4	5	5	4	5	4	5	4	3	5	4	3	5	5	4
66	Clux1	2	4	b	2	2	1	4	4	5	5	5	4	3	4	4	4	5	3	3	4	3	3	3	4	3	4	3	4	3	5	4	3	4	3	5	4	2	3	5	4
67	Clux2	2	4	b	3	1	1	5	5	5	5	5	5	5	3	5	5	3	4	2	5	5	3	4	5	4	4	5	5	5	4	5	4	2	3	4	4	4	5	5	5
68	Yu	1	1	a	1	1	1	5	5	5	5	5	5	5	4	4	5	5	4	4	5	5	5	5	5	4	4	5	5	5	5	4	5	4	4	5	4	4	5	5	5
69	PIL1	2	3	b	1	2	1	5	5	5	5	5	5	5	5	4	4	4	3	4	4	4	4	4	4	3	3	4	4	4	4	4	5	4	4	5	4	4	4	4	4
70	PIL2	2	3	b	1	3	1	5	5	5	5	5	5	5	5	5	4	5	5	3	5	5	5	5	5	5	5	5	5	4	5	5	5	5	5	3	5	3	5	5	5

71	TCB1	1	2	a	2	4	1	5	5	5	5	5	5	5	5	5	5	5	4	4	4	5	5	5	5	5	4	4	4	4	4	5	5	5	5	5	5	5	5
72	JAA1	2	4	b	2	2	1	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	3	5	5	5
73	EMT1	1	5	b	3	3	2	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	4	5	5	5	5	5	3	1	5	5	5
74	EMT2	1	5	b	2	3	2	5	5	4	5	5	4	4	5	5	4	5	4	4	5	5	5	5	5	5	5	5	4	4	4	4	4	5	5	5	5	5	5	5	5
75	EMT3	1	5	b	1	3	2	4	4	4	4	4	3	4	4	3	3	2	2	3	3	2	3	4	3	2	3	3	3	2	2	3	2	2	2	4	3	2	5	3	2
76	EMT4	1	5	b	2	1	2	5	5	4	5	5	4	4	4	4	4	2	3	3	3	2	4	4	3	2	4	3	4	2	2	4	4	3	3	4	3	3	5	4	4
77	CKS1	1	2	a	1	4	1	4	4	4	4	4	4	4	3	3	4	3	3	4	4	3	3	4	4	4	4	4	4	4	4	4	4	3	3	4	4	4	5	4	4
78	CKS2	1	2	a	3	3	1	4	4	4	4	4	4	4	4	4	4	5	5	5	5	3	5	4	4	5	4	4	4	3	5	4	4	3	4	5	5	3	5	4	4
79	LHT1	2	5	b	3	1	2	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	4	4	5	5	5	5	5	5	4	5	5	5
80	LHT2	2	5	b	3	1	2	5	5	4	5	5	5	5	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	5	5	5	4	4	5	4	5	5	5
81	COS2	2	3	b	2	3	1	5	5	5	5	5	5	5	5	4	4	5	5	5	4	4	5	5	5	4	4	4	5	4	5	4	5	4	4	5	5	2	5	5	5
82	SAC1	2	4	b	2	4	2	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	3	4	5	5	5	5	5	5
83	Lin	1	1	a	3	2	1	5	5	5	4	4	3	4	5	5	5	5	4	4	3	5	5	5	4	4	5	4	5	4	4	5	4	4	5	5	4	3	5	3	3
84	HpL2	2	3	b	1	4	2	4	4	4	4	5	4	4	4	3	3	4	3	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	5	4	3	4	4	4
85	HpL1	2	3	b	2	3	2	5	5	5	5	5	5	5	5	4	5	5	4	4	4	4	4	4	4	5	4	5	4	4	5	5	5	5	5	4	4	3	5	5	5
86	OOK1	2	5	b	2	3	2	4	4	4	4	5	4	4	4	4	4	4	5	4	4	4	4	4	5	4	4	4	4	4	4	4	4	4	4	5	4	3	5	4	4
87	OOK2	2	5	b	1	4	2	5	5	5	4	5	5	5	4	4	5	4	4	5	4	3	3	4	4	4	4	4	4	4	4	5	5	5	4	5	3	2	4	5	5
88	OOK3	2	5	b	2	4	2	5	5	5	5	4	5	5	5	5	4	5	4	5	5	5	4	5	5	5	5	5	5	5	5	4	4	4	4	5	4	4	5	5	5
89	OOK4	2	5	b	2	3	2	4	4	4	4	4	4	4	4	4	4	4	3	4	3	4	4	4	4	4	4	4	3	4	4	3	4	5	4	4	5	4	4	4	4
90	SHT1	2	3	b	2	2	1	5	4	4	5	5	5	5	4	4	5	5	5	4	5	5	4	4	4	5	5	4	5	5	5	4	4	4	5	5	5	5	4	4	4
91	SHT2	2	3	b	3	1	1	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	4	3	5	5
92	TCB2	1	2	a	2	2	2	5	5	5	5	5	5	5	5	5	5	5	5	4	5	4	5	5	5	5	5	5	5	5	5	5	5	4	4	5	5	4	5	4	5
93	TCB3	1	2	a	1	3	2	5	5	5	5	5	5	4	4	4	3	4	3	4	4	4	4	4	4	4	4	4	4	4	4	5	4	4	4	3	5	4	3	4	3	4
94	Exel1	2	5	b	2	3	2	5	5	4	4	5	4	3	4	4	4	3	4	4	4	4	5	4	4	5	5	4	5	4	4	5	5	4	4	4	4	3	5	4	5
95	EvT1	1	5	b	2	2	1	5	5	5	5	5	5	5	4	4	4	4	4	4	5	5	5	5	5	4	4	5	5	4	5	5	5	4	4	5	5	3	5	5	5
96	EvT2	1	5	b	3	1	1	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5
97	Feng	1	1	a	1	2	1	5	5	4	5	5	4	5	5	5	4	5	3	3	4	5	5	5	5	5	4	5	5	4	5	4	4	4	4	5	4	3	5	5	5
99	WHT1	1	3	b	2	2	2	5	5	5	5	4	5	5	4	5	2	5	5	4	4	4	4	5	4	5	5	5	4	4	5	5	5	4	3	5	5	4	5	4	5
100	WHT2	1	3	b	2	2	2	5	5	4	5	5	5	5	5	5	3	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	4	4	5	5	5	5	5	5
101	WHT3	1	3	b	2	2	2	5	5	4	5	5	5	5	4	4	4	4	4	5	5	5	4	4	3	4	4	5	4	5	5	4	5	4	4	5	3	5	5	3	5
102	Zim1	2	3	b	2	3	2	5	5	5	5	5	5	5	5	5	3	5	4	5	5	5	5	5	5	5	5	5	5	4	5	5	5	4	5	4	4	4	5	5	5
103	HMM1	2	3	b	2	4	2	5	5	5	5	5	5	5	5	5	5	5	4	4	5	5	5	5	5	5	5	5	5	4	3	4	3	4	4	4	3	5	5	5
104	HMM2	2	3	b	1	3	2	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5
105	Th A1	2	4	b	2	2	2	5	4	4	4	4	4	4	4	3	5	4	4	4	5	4	4	4	4	4	4	4	4	4	4	4	4	4	4	5	4	3	4	4	4
106	NW1	2	4	b	2	2	2	5	5	5	5	5	4	4	5	5	3	5	4	5	4	5	5	4	4	4	4	4	3	4	5	5	5	2	4	5	4	1	5	5	5
107	CL 1	1	3	b	2	1	1	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	4	5	5	5	5	5	5	5	5	4	5	5	5
108	CL 2	1	3	b	3	2	1	5	5	5	5	5	5	5	5	5	4	5	5	4	5	4	5	5	4	5	4	4	4	5	5	5	5	5	4	4	5	3	5	4	5
109	CL 3	1	3	b	3	1	1	5	5	5	5	5	5	4	5	5	1	5	5	4	4	5	5	5	5	5	4	5	5	4	5	4	4	5	4	5	4	4	5	4	5
110	KH A	1	2	a	1	3	1	4	4	5	4	4	5	4	5	4	4	4	5	4	3	4	4	3	4	4	4	4	4	4	4	4	4	4	3	4	4	3	4	4	4
111	Chou	1	2	a	1	3	2	5	5	4	4	5	5	5	3	4	4	5	4	5	4	4	4	4	4	5	5	4	4	4	4	4	4	4	4	5	5	3	5	4	5
112	Wang1	1	2	a	1	4	2	5	5	4	4	5	4	4	3	3	4	4	3	3	4	3	3	4	4	4	4	4	4	3	4	4	4	2	2	5	4	2	4	4	3

3.2 Satisfaction

cod	name	nat	job	rcj	tit	ex	dat	s1	s2	s3	s4	s5	s6	s7	s8	s9	s10	s11	s12	s13	s14	s15	s16	s17	s18	s19	s20	s21	s22	s23	s24	s25	s26	s27	s28	s29	s30	s31	s32	s33	s34
1	Lu	1	1	a	1	1	1	5	5	4	3	2	2	2	4	4	3	3	4	3	3	5	5	5	3	3	3	5	4	4	2	4	4	3	3	1	4	3	1	4	3
2	Wang	1	1	a	1	2	1	4	4	4	4	4	4	4	3	4	3	4	4	4	4	3	4	4	4	3	4	4	4	4	5	4	4	4	4	3	4	4	3	3	4
4	Yang	1	1	a	1	3	1	4	4	4	3	3	3	3	4	4	4	3	4	3	3	3	4	3	3	3	3	4	4	4	3	3	4	3	2	2	3	3	4	4	4
5	Chen	1	5	b	1	4	2	4	4	4	4	4	4	4	4	4	3	3	3	3	4	4	4	4	4	4	3	4	4	4	4	4	4	4	4	4	4	4	4	4	4
6	Shang	1	1	a	2	1	1	3	3	3	4	2	4	3	2	2	3	2	2	3	3	4	3	3	3	2	3	3	3	3	3	3	3	3	2	2	3	3	2	4	3
7	Liu	1	2	a	1	3	1	3	3	3	3	4	4	4	3	4	3	3	2	2	3	2	2	3	4	3	4	4	3	3	3	3	3	2	2	3	2	3	2	2	3
8	Chen	1	2	a	2	2	1	5	5	5	4	2	3	3	3	4	4	3	2	4	3	5	5	5	4	4	4	4	5	4	3	4	3	3	3	1	4	3	1	5	3
9	Bao	1	2	a	1	3	1	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
10	Li	1	2	a	1	3	1	4	4	4	4	3	3	3	4	4	3	4	4	4	4	4	4	4	3	3	3	5	4	3	3	4	4	3	2	1	4	3	3	4	3
11	OOT1	1	3	b	2	3	1	3	3	2	2	3	2	1	2	2	1	1	2	2	2	2	2	2	2	2	3	2	1	1	1	1	2	2	2	2	2	2	2	2	2
12	OOT2	1	3	b	2	3	1	2	3	2	2	3	2	2	2	3	1	1	1	2	2	2	3	3	2	2	1	2	2	2	2	2	2	2	2	2	1	1	2	1	2
13	Chen	1	1	a	2	2	1	4	4	4	3	3	2	2	3	3	2	3	3	2	3	3	3	2	2	2	2	3	2	3	2	3	2	2	2	1	3	2	2	3	3
14	IOT 1	1	2	a	3	2	1	4	4	4	4	4	4	4	4	4	4	3	4	4	5	5	5	5	4	5	5	4	4	5	3	2	3	3	2	2	3	4	1	4	5
15	IOT 2	1	2	a	2	3	1	4	4	4	3	3	3	3	3	3	2	3	3	4	4	4	3	3	3	3	3	3	3	3	3	3	3	3	3	2	3	3	3	3	4
16	TAC1	1	5	b	2	2	1	2	3	2	2	2	2	2	1	1	2	3	3	2	4	2	2	2	3	3	2	2	4	3	2	2	3	3	3	1	4	3	1	2	2
17	TAC2	1	5	b	2	3	1	4	4	4	3	2	3	4	4	3	2	4	3	3	3	4	3	3	3	4	4	3	3	2	2	2	2	3	3	1	2	2	1	3	3
18	TAC3	1	5	b	2	3	1	4	4	3	3	3	3	3	4	4	4	4	3	3	4	4	4	3	3	3	3	3	3	3	3	3	3	4	3	2	3	4	2	4	3
19	Lin	1	2	a	1	2	1	4	4	3	4	4	4	4	4	4	3	4	4	3	4	4	4	5	4	4	4	4	4	4	3	4	4	3	3	2	3	1	1	4	4
20	EVA 1	1	4	b	2	2	1	4	4	5	3	2	4	4	1	2	3	2	4	2	4	3	4	2	2	3	3	4	3	5	1	1	1	2	1	1	4	4	1	3	3
21	EVA 2	1	4	b	2	2	1	4	4	4	3	3	4	4	3	3	4	4	4	3	4	4	4	4	4	3	3	4	4	4	3	4	3	3	3	2	3	4	2	4	3
22	EGC1	1	5	b	2	2	1	5	4	4	3	2	5	5	4	4	4	3	4	1	4	2	2	2	1	3	3	4	4	4	5	2	2	2	3	1	5	4	2	5	2
23	EGC2	1	5	b	1	3	1	2	3	3	3	1	3	3	4	3	3	3	2	3	3	3	4	3	3	3	3	3	3	4	4	3	3	3	3	1	3	3	3	3	3
24	BW 1	2	3	b	1	3	1	3	4	4	3	3	3	4	3	3	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	3	3	3	3	3	3	3	3	3	3
25	BW 2	2	3	b	1	4	1	4	4	3	3	3	3	3	3	3	4	4	4	4	3	4	5	5	5	5	4	5	4	4	3	3	3	3	3	3	5	3	4	5	3
26	YMT1	1	3	b	2	2	1	2	3	2	3	3	3	3	3	3	3	2	3	3	3	4	3	3	4	3	4	3	4	3	3	4	3	3	4	4	4	3	3	4	3
27	YMT2	1	3	b	3	1	1	3	3	3	3	3	3	4	3	3	4	3	3	4	3	5	3	3	3	3	3	5	4	3	3	3	3	3	3	2	3	3	2	3	3
28	YMT3	1	3	b	2	2	1	3	4	2	3	2	2	3	2	3	2	3	3	3	2	3	3	2	2	3	3	3	3	3	2	2	3	3	3	3	3	3	3	3	3
29	YMT4	1	3	b	2	2	1	4	4	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	2	2	3	2	3	3	3	3	3	3
30	YMT5	1	3	b	2	2	1	3	3	3	3	2	2	2	3	2	3	3	3	3	3	3	5	4	4	4	3	3	3	3	1	2	3	3	3	1	5	3	3	3	3
31	UPS1	2	4	b	1	2	1	2	2	2	3	3	2	2	2	2	2	1	3	1	2	2	4	3	3	3	4	2	2	3	2	2	3	4	2	1	3	2	1	4	3
32	UPS2	2	4	b	2	2	1	3	3	3	2	3	3	3	2	2	2	2	2	2	3	3	4	3	2	2	3	2	3	2	3	2	2	2	3	1	3	3	1	3	3
33	YMK1	1	5	b	2	3	1	3	4	4	3	1	2	2	1	1	3	2	2	1	4	4	4	2	3	1	2	2	2	1	1	1	1	5	1	1	2	4	1	3	1
34	YMK2	1	5	b	3	3	1	4	4	3	4	2	3	3	4	4	4	3	3	2	3	3	4	3	2	4	3	4	4	3	4	3	3	3	2	1	4	3	2	4	2
35	YMK3	1	5	b	2	3	1	4	4	4	2	2	3	3	3	2	3	2	3	2	3	4	5	2	2	1	1	2	3	2	3	2	3	3	2	1	3	3	1	4	1
36	KHB1	1	2	a	1	4	1	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	3	4	4	4	4	4	4	4	4	2	4	3	2	3	4
37	KHB2	1	2	a	2	3	1	2	2	1	2	1	2	2	4	4	3	3	3	3	3	3	3	2	2	1	1	3	3	3	3	1	1	1	3	1	3	2	1	3	3
38	KHB3	1	2	a	1	4	1	4	4	4	4	2	3	3	4	4	4	4	3	2	3	4	4	3	2	2	3	4	4	3	3	3	3	4	2	2	4	3	4	4	4
39	KHB4	1	2	a	1	3	1	4	4	3	3	2	3	3	3	3	3	3	3	3	3	3	4	4	4	4	4	3	4	4	3	3	3	3	3	2	3	2	3	5	2
40	KHB5	1	2	a	2	4	1	4	4	2	2	2	2	2	4	4	3	3	3	3	3	2	3	4	4	4	4	3	3	3	3	3	2	2	3	2	1	2	1	1	2	1
41	SH K1	2	5	b	1	4	2	4	4	4	1	1	3	3	2	3	2	3	3	3	3	4	4	4	4	1	3	3	4	3	2	3	3	2	4	4	1	3	2	3	3
42	SH K2	2	5	b	2	3	2	4	4	3	3	2	2	2	4	4	3	3	3	3	3	4	4	4	4	2	2	3	3	3	2	2	3	4	3	1	4	2	1	5	2
43	Sud1	2	3	b	2	2	1	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	4	4	3	.	4	3	3	4	3	3
44	Sud2	2	3	b	2	2	1	5	5	4	4	4	4	3	3	3	3	3	2	3	3	4	4	4	3	3	3	4	4	3	3	3	3	4	4	1	1	3	2	3	4
45	CAL1	1	4	b	2	3	1	4	4	4	4	4	4	4	4	4	3	3	4	4	3	4	4	3	3	3	3	3	4	3	3	3	3	3	3	3	3	4	3	4	4
46	CAL2	1	4	b	3	1	1	4	4	4	4	4	3	3	3	3	3	2	2	3	3	3	3	4	3	3	3	4	4	3	3	2	3	3	3	3	2	4	3	3	4	3
47	CAL3	1	4	b	1	3	1	4	4	4	4	4	4	4	4	4	4	4	4	4	5	4	4	4	4	4	5	4	4	3	4	4	4	3	4	3	4	4	3	4	4
48	NCL1	2	3	b	2	2	1	3	3	3	3	3	3	3	3	3	3	3	3	4	4	4	4	4	3	3	3	4	4	4	3	3	3	3	3	1	3	3	2	3	4
49	NCL2	2	3	b	2	2	1	3	3	3	3	3	3	3	4	3	3	3	3	3	3	4	4	4	4	3	3	3	4	3	3	3	3	4	3	2	3	3	3	2	3
50	KLB1	1	2	a	2	2	1	3	3	4	3	3	3	3	4	3	3	3	2	3	4	4	4	4	3	3	3	3	3	2	2	3	2	3	3	2	3	3	3	4	3
51	KLB2	1	2	a	1	4	1	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	4	4	3	3	3	2	3	3	3	3	3	3	3	3	4	3
52	KLB3	1	2	a	1	4	1	4	4	3	4	4	4	3	3	3	3	3	3	4	3	4	4	4	4	4	4	4	4	3	3	3	3	3	3	3	2	1	1	3	3
53	GMT1	2	3	b	1	3	1	3	3	3	1	1	2	2	1	2	2	2	4	3	2	3	3	2	2	3	3	3	2	3	1	2	1	3	3	1	2	3	1	4	1
54	GMT2	2	3	b	1	4	1	3	2	2	3	2	2	2	4	3	4	3	2	2	2	2	3	2	2	3	2	3	3	3	4	2	1	1	2	1	2	1	1	3	3
55	MOL1	2	3	b	1	3	1	4	4	3	4	4	4	4	4	3	3	4	3	4	4	4	4	4	4	3	3	3	3	2	2	2	2	2	2	2	1	2	3	2	3	3
56	MOL2	2	3	b	2	3	1	4	4	4	3	1	3	3	1	3	3	3	3	2	2	2	2	2	2	2	2	2	2	3	1	2	3	3	2	1	3	1	1	3	3
57	APL1	2	5	b	2	3	2	2	3	3	3	1	3	3	2	2	3	3	3	2	3	3	4	3	3	1	3	3	2	3	2	1	3	3	3	3	3	3	1	3	2
58	APL2	2	5	b	1	3	2	4	4	4	4	3	3	3	3	4	3	4	4	4	3	4	3	4	5	4	4	4	4	4	4	3	4	4	4	3	4	4	3	4	4
59	LeeM	1	1	a	1	3	2	3	3	3	4	3	3	3	3	4	3	5	4	3	4	5	4	4	4	3	3	3	3	4	3	3	4	2	2	4	3	3	3	4	4
60	COS1	2	3	b	2	2	1	3	3	3	3	3	3	3	3	2	2	3	2	2	2	3	3	3	3	3	3	3	2	2	3	3	3	3	2	2	2	3	3	3	3
61	NYK1	2	3	b	2	3	1	3	2	3	3	3	3	2	3	2	3	3	3	3	3	4	4	4	4	3	3	4	3	3	2	3	3	3	3	2	3	3	2	3	3
62	NYK2	2	3	b	2	3	1	3	3	3	3	4	3	3	2	2	3	3	3	3	4	4	5	3	3	3	3	3	3	3	3	4	4	3	3	3	3	3	4	3	3
63	KLT1	2	3	b	2	3	1	2	2	4	3	1	3	3	3	3	4	2	1	4	3	4	4	4	4	1	1	2	2	1	2	1	1	1	2	1	2	3	1	2	1
64	KLT2	2	3	b	3	2	1	3	3	3	2	2	2	2	2	2	2	3	3	3	3	3	3	3	3	2	3	3	3	3	2	2	2	2	1	2	3	1	2	2
65	MSC1	2	3	b	1	3	1	4	4	4	4	4	4	4	3	3	3	1	3	4	1	2	3	3	3	2	2	4	4	3	1	2	2	3	3	1	4	3	3	4	3
66	Clux1	2	4	b	2	2	1	3	3	2	2	2	3	3	2	3	3	2	3	3	2	2	3	2	3	3	3	3	3	3	2	3	3	3	2	2	3	3	3	2	3
67	Clux2	2	4	b	3	1	1	1	1	1	2	2	1	1	3	3	3	4	4	4	3	4	4	4	2	3	2	3	3	3	3	4	3	4	3	3	4	4	3	4	3
68	Yu	1	1	a	1	1	1	4	4	3	3	2	2	2	3	3	2	1	3	2	2	4	4	3	3	2	2	2	3	2	2	3	2	3	2	1	2	3	1	3	2
69	PIL1	2	3	b	1	2	1	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	1	3	3	3	3	3
70	PIL2	2	3	b	1	3	1	1	2	1	2	3	3	3	1	2	3	3	3	3	2	1	3	1	2	1	2	3	2	2	1	1	1	1	3	3	3	3	1	2	2
71	TCB1	1	2	a	2	4	1	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	3	3	3	3	3	3	3	3	3	3	3	3	3	3
72	JAA1	2	4	b	2	2	1	2	2	2	2	2	2	2	2	3	3	2	2	2	2	2	3	3	2	2	2	2	2	3	3	2	1	1	1	3	3	3	1	1	2

73	EMT1	1	5	b	3	3	2	3	4	3	3	3	3	3	2	3	3	4	3	3	3	3	3	5	3	2	3	3	3	3	2	2	2	4	3	2	3	1	2	2	2
74	EMT2	1	5	b	2	3	2	4	4	4	4	4	3	2	3	3	3	3	3	3	4	4	4	3	3	3	3	3	3	3	3	3	3	3	2	4	3	1	2	3	
75	EMT3	1	5	b	1	3	2	3	3	3	3	3	2	3	3	2	2	3	3	2	2	3	3	3	2	3	2	2	3	3	2	2	3	3	3	1	3	3	4	3	3
76	EMT4	1	5	b	2	1	2	2	3	3	3	2	2	3	3	2	2	2	2	2	3	3	3	2	2	3	2	2	2	2	2	2	2	2	2	1	3	2	2	2	3
77	CKS1	1	2	a	1	4	1	4	4	4	3	4	2	3	4	4	3	4	3	3	3	3	4	4	3	3	3	3	4	3	3	3	3	3	4	2	4	3	2	4	3
78	CKS2	1	2	a	3	3	1	5	5	4	4	4	4	4	4	4	4	5	3	3	3	4	5	4	4	3	3	4	4	4	1	3	3	3	3	1	5	4	3	4	4
79	LHT1	2	5	b	3	1	2	4	4	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	4	3	3	3	2	3	3	1	3	2	1	3	3	
80	LHT2	2	5	b	3	1	2	3	2	1	2	2	2	2	2	2	2	2	2	2	3	3	3	3	2	2	2	3	3	2	2	2	2	2	2	2	3	3	1	3	2
81	COS2	2	3	b	2	3	1	3	3	3	2	2	3	3	2	2	2	3	2	3	3	3	3	4	3	3	2	3	4	3	3	3	2	3	3	2	2	3	2	3	3
82	SAC1	2	4	b	2	4	2	2	3	3	2	2	3	3	3	3	2	3	2	2	2	3	3	4	2	3	3	3	3	3	2	2	3	3	1	4	2	1	4	2	
83	Lin	1	1	a	3	2	1	5	5	4	4	4	4	4	3	4	4	3	4	4	3	4	4	4	3	3	3	4	4	4	3	4	4	3	3	3	4	3	3	4	4
84	HpL2	2	3	b	1	4	2	3	3	3	2	2	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	2	2	3	3	2	3	3	3	3	3
85	HpL1	2	3	b	2	3	2	4	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
86	OOK1	2	5	b	2	3	2	4	4	4	4	1	4	4	4	4	2	4	5	4	4	5	5	4	2	3	4	4	4	4	4	4	5	5	4	1	4	3	3	3	4
87	OOK2	2	5	b	1	4	2	4	5	5	3	1	4	4	4	4	1	4	4	3	4	4	4	2	4	4	4	4	4	4	1	2	2	5	4	1	4	4	2	5	5
88	OOK3	2	5	b	2	4	2	4	4	3	3	2	3	4	4	4	4	4	3	4	3	4	4	4	4	3	4	4	4	4	4	3	4	4	3	3	3	4	3	4	4
89	OOK4	2	5	b	2	3	2	2	3	3	2	2	4	4	3	2	4	2	4	4	3	3	4	3	4	3	4	4	3	3	3	2	2	2	3	1	3	2	1	4	3
90	SHT1	2	3	b	2	2	1	2	2	3	3	2	2	2	2	2	3	2	2	2	2	2	4	4	4	4	3	3	3	3	3	3	3	3	3	1	2	2	2	2	2
91	SHT2	2	3	b	3	1	1	3	3	3	3	3	3	3	3	3	3	3	3	3	2	3	4	2	3	2	3	3	3	3	3	3	3	2	2	4	1	2	3	3	4
92	TCB2	1	2	a	2	2	2	4	4	4	4	4	4	4	4	4	4	4	4	3	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	2	4	3	3	4
93	TCB3	1	2	a	1	3	2	4	4	4	4	3	3	3	4	4	3	4	3	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	3	3	3	3	2	3
94	Exel1	2	5	b	2	3	2	3	3	2	3	2	2	3	3	3	3	3	3	3	3	3	3	4	3	2	2	2	3	3	3	3	2	2	3	3	2	3	3	1	3
95	EvT1	1	5	b	2	2	1	2	2	2	2	2	2	2	3	3	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	1	1	2	2	1	2	1	1	2
96	EvT2	1	5	b	3	1	1	3	3	2	2	1	2	2	2	2	2	3	3	2	2	3	3	2	2	3	3	2	3	3	2	2	2	2	2	1	2	1	1	2	2
97	Feng	1	1	a	1	2	1	3	3	4	4	4	3	3	3	3	3	3	3	3	4	4	3	3	3	3	3	3	3	3	3	3	3	3	3	2	3	3	3	3	3
99	WHT1	1	3	b	2	2	2	3	3	3	3	3	3	3	3	3	3	4	4	3	2	2	3	4	3	3	3	3	3	3	4	3	3	4	3	1	2	4	1	4	4
100	WHT2	1	3	b	2	2	2	4	4	3	3	3	4	4	2	2	3	3	3	4	4	4	4	4	3	3	3	3	3	4	2	3	3	3	3	3	3	2	2	3	3
101	WHT3	1	3	b	2	2	2	3	3	2	2	3	2	3	3	2	2	3	4	2	2	2	3	4	2	4	4	5	3	2	1	1	3	2	3	1	2	1	1	2	3
102	Zim1	2	3	b	2	3	2	3	3	3	3	2	3	3	2	2	3	2	3	3	2	2	4	3	3	3	3	3	3	3	3	2	3	3	2	3	2	3	2	3	2
103	HMM1	2	3	b	2	4	2	3	3	3	3	4	3	3	4	3	2	2	3	3	4	3	3	4	4	3	4	4	3	3	2	3	3	3	4	3	3	3	1	3	2
104	HMM2	2	3	b	1	3	2	3	3	2	2	2	2	2	1	2	2	1	1	3	2	2	2	3	1	2	2	1	2	2	1	1	1	2	3	1	3	1	1	4	3
105	Th A1	2	4	b	2	2	2	3	3	4	3	3	4	4	3	3	4	4	4	3	4	4	3	4	4	3	3	3	3	3	3	3	3	4	4	3	3	4	2	3	4
106	NW1	2	4	b	2	2	2	2	2	1	2	2	3	3	4	3	2	2	3	3	3	3	3	2	4	3	3	3	3	2	2	2	3	3	1	3	1	1	1	3	3
107	CL 1	1	3	b	2	1	1	3	3	3	3	3	3	3	2	2	3	3	3	3	3	3	4	4	4	3	3	3	3	3	2	3	3	3	3	3	3	1	3	3	3
108	CL 2	1	3	b	3	2	1	4	4	4	3	4	3	3	3	3	4	3	2	3	3	3	3	4	4	4	4	4	3	4	3	3	3	3	3	3	2	3	3	4	3
109	CL 3	1	3	b	3	1	1	3	4	4	3	3	3	3	2	2	3	1	2	3	3	4	3	3	3	2	3	2	2	3	1	3	2	2	3	1	3	3	1	2	2
110	KH A	1	2	a	1	3	1	4	3	3	4	4	3	3	3	3	3	3	4	3	3	4	3	3	3	3	3	3	3	3	2	3	2	3	3	2	2	3	2	3	3
111	Chou	1	2	a	1	3	2	4	4	3	3	3	2	2	4	4	3	2	3	3	3	4	4	4	4	4	3	4	3	3	2	3	3	3	3	1	2	3	1	4	3
112	Wang1	1	2	a	1	4	2	4	4	3	4	3	4	4	3	3	3	3	2	3	2	3	3	3	4	4	3	4	3	3	3	4	4	3	2	3	4	3	3	4	4