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Choice Behavior of China Shippers for Shipping Services and Transshipment Ports
- Tianjin Case-

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ABSTRACT

Since the competition among ports in Northeast Asia is increasing, the Chinese ports have been strengthening their competitiveness for transshipped containers by networking ports through a coastal feeder service. In addition, because they can aggregate local cargo, Chinese local hub ports – including Dalian, Tianjin and Qingdao – are generating sufficient demand to induce direct shipping services to North America and Europe.

As a result, the need for aggregation at Korean ports prior to intercontinental shipment may be reduced. Nevertheless, Korean ports have been trying to expand their appeal to shippers by developing the logistics infrastructure of the port of Busan, the port of Gwangyang and the port of Incheon, and lowering their port tariffs to capture transshipment cargoes in Northeast Asia and to strengthen their role as hub ports.

Korean hub ports, e.g., the Port of Busan, have been collecting T/S containers of China and other Northeast Asian countries shipped by feeder shipping companies. Since the early 2000s they have been faced with a strong challenge from the Chinese ports. It is imperative for Korean ports to consider the main factors on which shippers and shipping companies focus when they choose the liners and the ports.

This study surveyed choice behavior of Chinese shippers by using two methodologies: AHP analysis and the logit model. In AHP analysis we collected the answers to the questionnaire by Chinese shippers at Tianjin port and analyzed the answers. In contrast to this AHP analysis, the logit model used the enormous PIERS (the Port Import Export Reporting Service) data produced by the U.S. Customs Administration.

This logit choice analysis largely confirms the major conclusions of the survey analysis, to the extent that we can adequately measure the variables presented in the survey with customs data. The most statistically and economically significant variable is cost, the component that emerged as most important in the AHP analysis. Shipping time was also a statistically and economically significant determinant of choice. This is a large, though not the only, component of service, and the only one that is easy to measure in the shipping choice data (there is insufficient direct service to use liner-quality ratings as another indicator of service quality). This is also consistent with the AHP's conclusion that service is very important, even though we were unable to measure all service components in the logit model. Finally, the shipper's country played a small but significant role in determining choice, a key company factor that also emerged in the AHP analysis of the survey.

We suggested some means for the Korean government and policymakers which could be gained from the field survey about the choice behavior of Chinese shippers and from the logit model about behavior of Chinese shippers who moved their export cargoes to the Americas in 2005. For the Korean government there are a few suggestions: inducement of shipping companies into the port operating industry, expanding marketing activities among larger shippers, and broadening the feeder networks of Korean ports. We could suggest some recommendations for port authorities in Korea, such as the establishment of the Busan U-port system, cash incentives to shipping companies, productivity improvement, development of distripark, and so forth.

Chapter Ⅰ. Introduction

1. Background

Due to its rapidly growing and potential economy, the container movement in Chinese ports has recorded a higher growth. In order to meet the strong demand for logistics infrastructure, the Chinese government has been building ports, highways, port hinterlands and other facilities. The newly built Chinese ports induce severe competition among the Northeast Asian ports to absorb transshipment containers from neighboring regions and countries. Hence many ports in Northeast Asia regions reduced their port tariffs and developed larger facilities to maintain their market share against offensive strategy of Chinese ports.

Since the competition among ports in Northeast Asia increases, the Chinese ports strengthen their competitiveness for transshipped containers by networking ports through coastal feeder service. In addition, because they can aggregate local cargo, Chinese local hub ports including Dalian(大連), Tianjin(天津), Qingdao(青島), are generating sufficient demand to induce direct shipping service to North America and Europe.

As a result, the need for aggregation at Korean ports prior to intercontinental shipment may be reduced. Nevertheless, Korean ports have been trying to enlarge their appeal by developing the logistics infrastructure of the port of Busan, the port of Gwangyang and the port of Incheon, and lowering their port tariff to capture transshipment cargoes in Northeast Asia and to strengthen their role as hub ports.

2. Necessity and Purpose

Korean hub ports, e.g. port of Busan have been collecting T/S containers of China and other Northeast Asian countries shipped by feedering service shipping companies. From early 2000s they have been faced with adamant challenge from the Chinese ports. It is imperative for Korean ports to consider the main factors on which shippers and shipping companies put an emphasis when they choose the liners and the ports.

Firstly, this study will review shipping network of Tianjin Port and discuss strategy of major shipping companies in main routes and feedering shipping companies in the Northeast Asian regional market.

Secondly, this study will analyze location and characteristics of Chinese shippers around Tianjin port, who tend to use the port of Tianjin as their gateway for export and import of commodities.

Thirdly, we will survey Chinese shippers evaluation for shipping service and transshipment ports through the questionnaire to shippers at the hinterland of Tianjin port. We collect the answering from interview, telephoning and visiting. Especially we adopt AHP analysis to analyze shippers' preference and main factors which Chinese shippers consider important.

Fourthly, this study will develop a logit model of Chinese shippers' route choice behavior for shipping service and apply this model to analyze the competition among the Northeast Asian ports. In this model the shippers will strategically choose the logistics route to minimize their costs, which will predict the transshipment container throughput of hub ports throughout Asia. Predictions will be based on logistics.

We intend to assist the Korean government in assessing the competitive advantages and disadvantages of Korean ports in the face of strategic development and port price cutting by other countries. This study will help to assess alternatives for increasing the competitiveness of feedering service to Korean ports through analyzing the choice behavior of Chinese

shippers for the shipping services.

3. Literature Review

Shippers choice behavior is a topic of much interest, so it is widely accepted that researchers have conducted studies with similar methods. However, we are aware of no studies that have specific and practical surveys as ours, looking at more than small cases when considering shippers choice, or that seek to integrate choice behavior analysis into an AHP analysis and a probit logit model.

There have been a number of analyses of shipper behavior and route choice, which are useful in identifying key variables. For example P. Tiwali, H. Itoh and M. Doi (2003) conducted a survey on choice behavior of shippers in China, using a shipper level database obtained from a survey of shippers of containerized cargo in China in 1998. They used a discrete choice model, in which each shippers faces a choice of 14 alternatives, based on shipping line and port combinations and makes his decision on the basis of various shipper and port characteristics. Their main conclusion is that the distance of the shipper from the port, distance to destination, distance from origin(in case of imports), port congestion and shipping lines fleet size play an important role. This study indicated that the most important variables are the location of the port as expressed by sea transportation time and cost, land transportation time and cost, and port characteristics including number of ship calls, total TEU handled, TEUs of cargo per crane, TEUs per berth, usage factors (handling volume per length of quay), number of routes offered, and port loading charges.

Song and Yeo's(2004) review of competitive analysis of Chinese Ports also provides a descriptive starting point for competitiveness of Chinese ports. This review identified the competitiveness of container ports in

China, using the AHP(Analytic Hierachy Process) Method. They collected information and data through surveys on group of experts, such as shipowners, shipping company executives, shippers, terminal operators, academics and researchers in the region. Experts identified the five most important criteria for the competitiveness of port businesses : cargo volume, port facility, port location and service level. As a result of empirical analysis, port location(0.452) is considered to be the most influential factor to competitiveness, followed by port facility(0.198), cargo volume(0.178) and service level(0.174). Its implication is that physical location and facilities play a more vital role than service quality.

An-Shuen Nir, Kuang Lin and Gin-Shuh Liang(2003) use a logit model to capture the distribution of export activity among Taiwan's three international portsin the west coast of Taiwan : port of Kaoshiung. port of Keelung and port of Taichung. They adopted three different models to find revealed preference of shippers : basic choice model, experienced choice model and competitive choice model. Through these models, they found that generalized measures of travel time and cost to the ports were significant. In addition they calculated time value per hour of each container transportation : 1,580 NT dollars in the basic choice model, 1,580 NT dollars in the experienced choice model and 2,480 NT dollars in competitive choice model. In contrast to Tiwari, et al., they found service frequency, routes and port facilities or level of port services were not a significant factor. While they observed that ports are competitive, in that shippers do not always choose the port closest to them, the analysis does not capture the diversity of those choices.

T. C. Lirn, H. A. Thanopoulou, M.J. Beynon and A. K. Beresford(2006) use a AHP analysis to reveal and analyze the port selection by global carriers. They found 47 relevant service attributes from a literature review, then narrowed them to four main service attributes : port physical and technical infrastructure, port geographical location, port management and administration and carriers terminal cost.

There are a number of analyses development models of shippers choice behavior and competitive port aspects, and they focus on larger broad areas or regions. Contrarily this study will focus on choice behavior of China shippers at Tianjin port in the transpacific route.

Chapter Ⅱ. Review of Shipping Network at Tianjin Port

1. Major Shipping Routes in China

1) Asia/America(Transpacific) Route

(1) Demand/Supply

The Northeast Asia has become the leading market in global container shipping industry(〈Table 2-1〉). In 2005, the region recorded a 35% share in the total global volume of port traffic, reaching 140 million TEU[1]. Furthermore, China alone accounted for 18.1% of global throughput in 2005 and Hong Kong for a further 5.6%[2]. Actually, Intra-Asia route was the biggest market, accounting for 27.9% of world container trade in 2005. Transpacific route ranked as the second market, sharing 15.5% of world container trade. Also Northeast Asia/Europe trade supplied shipping companies with the third market volume, accounting for 12.2% of world container trade.

The volume in container traffic in the eastbound transpacific trade route showed strong growth in 2006, rising by 11.7% compared to 2005. Utilization of net capacity in the eastbound transpacific trade reached 84.0%, down from 84.3% in 2005 and from 85.4% in 2004. With regard to westbound transpacific trade, demand growth is projected to reach 8.8%, the same as in 2005. Utilization of net capacity in westbound transpacific trade was recorded at 41.8%, down from 44.3% in 2005.

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1) Drewry Shipping Consultants Ltd, *The Drewry Annual Container Market Review and Forecast 2006/7,* 2006. p. 2.

2) Ibid, p. 2.

The major actors in the transpacific trade and their market shares are as follows : Maersk Line(15%), CKYH(22%)- COSCO/K-Line/Yangming/ Hanjin -, New World Alliance(15%)[3], Grand Alliance(14%)[4] ,Evergreen/ Italia Maritiima/Hatsu Marine/ COSCO(10%), China Shipping(4%), CMA CGM etc(5%), MSC(3%) and ZIM etc(3%)[5].

〈Table 2-1〉 Estimated 2005 World Container Trade by Route

Unit : 1,000TEU, %

Route		Eastbound	Westbound	Total	Share
East/West	Transpacific	12,905	5,119	18,024	15.5%
	Northeast Asia/Europe	4,883	9,259	14,142	12.2%
	Transatlantic	2,383	3,500	5,883	5.1%
	Europe/MidEast	1,975	700	2,675	2.3%
	North America/MidEast	329	177	506	0.4%
	Northeast Asia/Mid East	520	3,125	3,645	3.1%
	Eurpoe/South Asia	675	1,050	1,725	1.5%
	NorthAmerica/ South Asia	281	684	965	0.8%
	Northeast Asia/South Asia	950	1,225	2,175	1.9%
	MidEast/South Asia	75	525	600	0.5%
	subtotal	24,976	25,364	50,340	43.4%
North /South	NorthAmerica/ Latin America	2,100	2,386	4,486	3.9%
	Europe/Latin America	1,175	1,775	2,950	2.5%
	Northeast Asia/Australia	1,900	1,025	2,925	2.5%
	others	5,560	4,371	9,931	8.6%
	subtotal	10,735	9,557	20,292	17.5%
Intra Region	Asia			32,325	27.9%
	Europe			9,000	7.8%
	North America			1,410	1.2%
	Latin America			1,085	0.9%
	others			1,495	1.3%
	subtotal			45,315	39.1%
Total				115,947	100.0%

Source : Drewry Shipping Consultants Ltd, *The Drewry Annual Container Market Review and Forecast 2006/7*, 2006.

3) including APL, HMM and MOL.

4) including Hapag-Lloyd, MISC and NYK.

5) Op.cit., p. 84.

〈Table 2-2〉 Asia/America Supply/Demand Position

Unit : 1,000TEU, %

Item/year		2000	2001	2002	2003	2004	2005	2006
Cargo Demand	Eastbound	7,249	7,400	8,974	9,684	11,406	12,905	14,417
	Westbound	3,791	3,655	3,951	4,398	4,707	5,119	5,569
Net Capacity	Eastbound	8,910	9,666	10,336	11,683	13,362	15,314	17,158
	Westbound	6,955	7,544	8,108	9,219	10,622	12,240	13,772
Slot Utilization	Eastbound	81.4%	76.6%	86.8%	82.9%	85.4%	84.3%	84.0%
	Westbound	54.5%	48.4%	48.7%	47.7%	44.3%	41.8%	40.4%

Source : Drewry Shipping Consultants Ltd, *The Drewry Annual Container Market Review and Forecast 2006/7*, 2006.

(2) Major Shipping Companies' Strategy

The mega carriers like Maersk line can allot its slots more flexibly according to market fluctuation. Due to its abundant capacity, Maersk line s strategy in Northeast Asia tends to lead shipping market. In 2006, the line has strengthened its capacity of TP-8 service in Northeast Asia/North America route by superseding 5 container vessels in 4,080 TEU size with 5 container vessels in 5,700 TEU size.[6] TP-8 service is the representative service connecting northern China ports with North America West Coast ports. Furthermore, the line has added a 4,100 TEU size vessel at TP-8 service in 2007.[7] The comparatively strong demand in Europe route may hinder its putting more slots at TP-8 service.

Some members of CKYH alliance - K-Line/Yangming/Hanjin - have not a direct service connecting Tianjin with North America West Coast ports. Actually, COSCO, a member of CKYH, has supplied CEN express service, which includes Tianjin, Dalian, Qingdao and North America ports. Other members have chartered slots supplied by COSCO. In 2006, COSCO

6) Ocean Commerce Ltd., *International Transportation Handbook*, 2006/2007.
7) An HKSG Group Publication, *Shipping Gazette*, Jun 25, 2007. p. 148.
Informa UK Ltd., *Containerisation International Yearbook 2007,* 2007. p. 298.

enlarged its capacity of CEN express service by substituting 5 container vessels with speed 24.5 knots/hour in 5,600 TEU size for 5 container vessels with speed 21 knots/hour beneath 3,900 TEU size[8]. The rapid vessels could delay the final departure time by aday in Northern Chinese ports. Hence, in late 2006 COSCO added the port of Yantai(煙台) at Shandong Province in Northern China and Yokohama in Japan to its CEN express. It would be a potential menace to feeder shipping companies for COSCO to network small- and medium- sized ports in Northeast Asia with transpacific services by allotting larger mother vessels. If COSCO continually include Chinese small ports to its trunk route, the foreign ports which are connected by feedering service with China small ports, for example Busan and Gwangyang, can be confronted with the decrease of T/S volumes from/to small ports in the Northern China.

Also, New World Alliance has increased its slots by deploying larger vessels. In 2006, the alliance enlarged its capacity of PCE service by substituting 5 container vessels in 3,500~4,700 TEU size for 5 container vessels in 3,220~3,400 TEU size.[9] In addition, the alliance has added calling at the port of Qingdao in Northern China, deleting Guam and Naha in Japan. At the port of Los Angeles, the ocean-shipping service can be connected with rail transportation, which can supply the network service to inland cities in the United States.

2) Northeast Asia/Europe Route

(1) Demand/Supply

The Northeast Asia/Europe route amounted to 14.1 million TEU in 2005, reaching 12.2% of the global port volumes(〈Table 2-1〉). In 2006, the westbound volume of Northeast Asia/Europe is expected to show a strong

8) Ocean Commerce Ltd., *International Transportation Handbook*, 2006/2007.
9) Ocean Commerce Ltd., *International Transportation Handbook*, 2006/2007.

positive trend, rising 13% in 2005. This will be followed with a strong 11.1 % performance this year.

China has continued to increase its exports to the European area in 2006. Official statistics from the Chinese Ministry of Commerce showed the 20.9% increase in the value of exports for the seven month period to July 2006, compared to the same period in 2005. In contrast, EU tariffs, particularly for shoes, has induced the export of certain commodities from China, with some production switching to Vietnam. China is also understood to have taken market share of other products away from Indonesia and the Philippines.[10] As far as origin cargoes are concerned, FEFC figures also show that China has increased its share of trade with northern Europe. Chinese exports accounted for 63% of exports to northern Europe in the first half in 2006, compared to 51% in the same period in 2005.

Eastbound volumes to the Northeast Asia increased more slowly than westbound trade. In 2006, net slot utilization factors for the eastbound trade should reach as much as 59.9% ; 87.6% for the westbound.

〈Table 2-3〉 Northeast Asia/North Europe Supply/Demand Position

Unit : 1,000TEU, %

Item/year		2000	2001	2002	2003	2004	2005	2006
Cargo Demand	Eastbound	2,678	2,824	2,987	3,256	3,700	3,860	4,158
	Westbound	4,076	4,075	4,432	5,204	6,064	6,690	7,560
Net Capacity	Eastbound	3,588	4,031	4,199	4,534	5,345	6,142	6,943
	Westbound	4,477	4,999	5,176	5,581	6,538	7,505	8,635
Slot Utilization	Eastbound	74.6%	70.1%	71.1%	71.8%	69.2%	62.8%	59.9%
	Westbound	91.0%	81.5%	85.6%	93.2%	92.8%	89.1%	87.6%

Source : op. cit.

10) Drewry Shipping Consultants Ltd, T*he Drewry Annual Container Market Review and Forecast 2006/7*, 2006, p. 113~115.

The major actors in the Northeast Asia/Europe trade are as follows : MaerskLine (20.9%), COSCO/K Line/Yangming/Hanjin/SENATOR(20.9%), New World Alliance (13.7%), Grand Alliance(14.1%), Evergreen/Italia Maritima/Hatsu Marine(6.8%), China Shipping(4.1%), China Shipping/ ZIM(2.0%), CMA CGM(4.5%), MSC(3%) and ZIM etc(3%).[11]

(2) Major Shipping Companies' Strategy

In late 2005, Maersk group took over all activities in P&O Nedlloyd, which was the result of a merger between P&O Containers and Dutch Nedlloyd line in 1996.[12] This merger has brought fundamental change in the Northeast Asia/Europe service, enabling Maersk to allot its extra slots into the service. Furthermore, Maersk and Grand Alliance finished bedding in their revised networks, and the completion of their various loops was a major reason behind their capacity increases.[13]

Actually, in 2006 Maersk has started new service between Northern China ports-Dalian and Tianjin- and European ports. At this AE service, Maersk has deployed larger vessels in 7,230~7,700 TEU size than the vessels in transpacific service.

Simultaneously, Grand Alliance has adopted similar active measures to collect container volumes in Northern Chinese ports and to defend its share in the market. The alliance has allotted 9 vessels in 6,700-8,100 TEU size to its Northern China/Europe service.

In 2006, COSCO and HANJIN have begun new service with 8 container vessels in 5,300-6,600 TEU size, FEX service in Northeast Asia/Europe trade. Other members of CKYH Alliance- K-Line/Yangming/Senator - have chartered slots supplied by COSCO and HANJIN. The calling ports of FEX service in Northeast Asia are Tianjin, Gwangyang, Busan and

11) Ibid, p. 103.
12) www.maersk.com/en(2007. 9. 13).
13) Drewry Shipping Consultants Ltd, *The Drewry Annual Container Market Review and Forecast 2006/7*, 2006, p. 103.

Kaoshiung.

For this extra competition and additional deployment in the Northeast Asia/Europe service, the utilization rate in westbound routes in 2006 was recorded at 87.6%, down from 89.1% in 2005.

2. Direct-call Network from/to the US Ports at Tianjin Port

In recent years, Tianjin (Xingang) container terminal, which is operated by two major companies (Tianjin Harbor Container Co. and Tianjin Orient Container Terminals), has provided a variety of direct-call liner services by more than 20 liners, regardless of shipping routes. The 〈Table 2-4〉 describes the terminal operators and shipping companies as their customers.

〈Table 2-4〉 Direct-call liner Services in Tianjin Port Container Terminal

Terminal Operator	Liners	No. of Liners
Tianjin Harbor Container Co.	Chipolbrok, Cosco, Evergreen, Fairweather, Maersk Line, MOL, PIL, Rickmers, Senator, Sinokor, Sinotrans, TMSC	12
Tianjin Orient Container Terminals	Dongnama, Hapag-Lloyd, Heung-A, HMM, Maersk Line, Namsung, RCL, SITC, TSK Line, Wan Hai, Zim	11

Source : Containerisation International Yearbook, 2007.

〈Table 2-5〉 Direct-call Service from Tianjin to US Ports (Transpacific)

Unit : TEU

Liner(Alliance)	Route	Frequency	Avg. Ship Size	Capacity/year
CKYH	T-P	Weekly	5,446	283,970
Grand Alliance	T-P	Weekly	3,399	177,213
Maersk Line	T-P	Weekly	4,062	211,804
New World Alliance	T-P	Weekly	3,801	198,195
Sum(Avg.)			4,177(avg.)	871,182

Source : Drewry Shipping Consultants, *Drewry Annual Container Market Review 2006/07*, June 2006. KMI, Activation of the port of Gwangyang mid term Report(2007).

Among direct-call services at Tianjin port, we studied the services connecting North American ports. As shown in the 〈Table 2-5〉, those services are only 4 provided by 4 liners ; CKYH, New World Alliance, Grand Alliance and Maersk Line. Total annual operational capacity is 871,182 TEU and the average ship size is 4,177 TEU. Comparing with the port of Shanghai, Tianjin port's annual capacity is about a tenth of that of Shanghai.

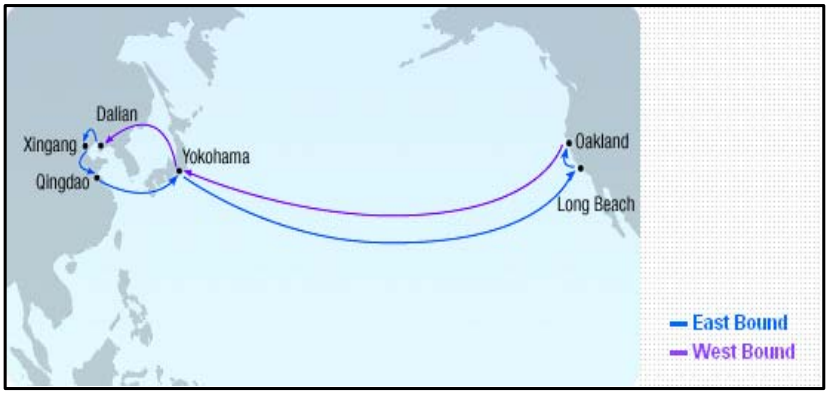
CKYH group's CALCO-Q service connects 3 major northeast Chinese ports such as Dalian, Xingang, Qingdao with Long Beach and Oakland via the port of Yokohama in Japan. This service is operated through 5 vessels providing a weekly service, and 35 transit days per route. The 〈Table 2-6〉 and the 〈Figure 2-1〉 explains their operations and shipping routes.

〈Table 2-6〉 CKYH Group's Direct Service from Tianjin to US Ports

Name of Service	Route	Frequency	No. of Vessel	Annual capacity
American Direct Call (CALCO-Q)	Dalian→**Xingang**→Qingdao →Yokohama→**Long Beach**→ **Oakland**→ Yokohama→Dalian (35 days)	Weekly	5(5,446TEU)	283,970TEU

Source : K Line, Hanjin Shipping Co. (Tianjin Branch); *Drewry Shipping Consultants, Drewry Annual Container Market Review 2006/07*, June 2006.

〈Figure 2-1〉 China Northeast - US West Coast Service (CEN)



Source : Hanjin Shipping.

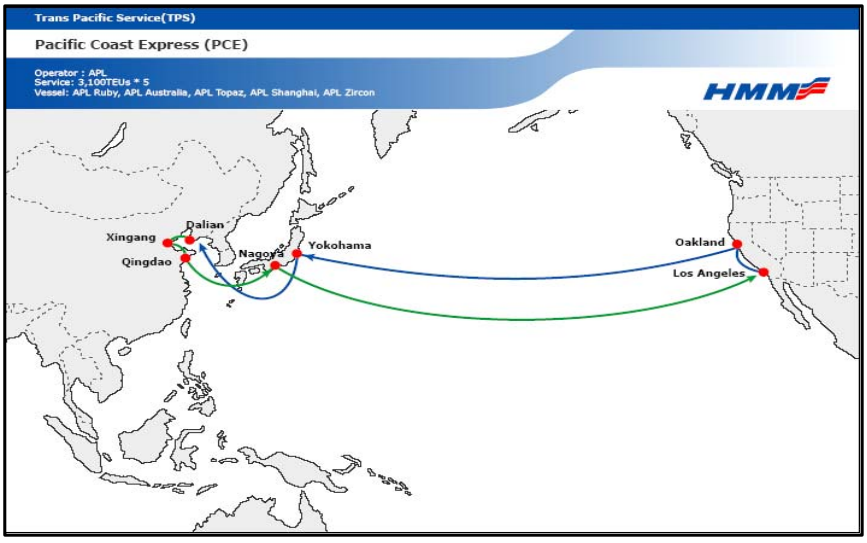
As for the New World Alliance (NWA)' s string, which connects Dalian, Xingang and Qingdao with LA and Oakland via Nagoya and Yokohama in Japan, NWA provides a weekly service with the five 3,800 TEU ships, operated by APL. Their operations and shipping routes are shown in the 〈Table 2-7〉 and the 〈Figure 2-2〉.

〈Table 2-7〉 New World Alliance's Direct Service from Tianjin to US Ports

Name of Service	Route	Fre-quency	No. of Vessel	Remark(At Xingang)
Pacific Coast Express(PCE)	Dalian→**Xingang**→Qingdao→ Nagoya→Yokohama→LA→ Oakland→Yokohama→Dalian (35 days)	Weekly	5(3,801 TEU)	From Sun(11:00) to Mon(07:00)

Source : HMM homepage(2007. 9.13); Drewry Shipping Consultants, *Drewry Annual Container Market Review 2006/07*, June 2006.

〈Figure 2-2〉 Pacific Coast Express(PCE) by New World Alliance



Source : HMM Homepage.

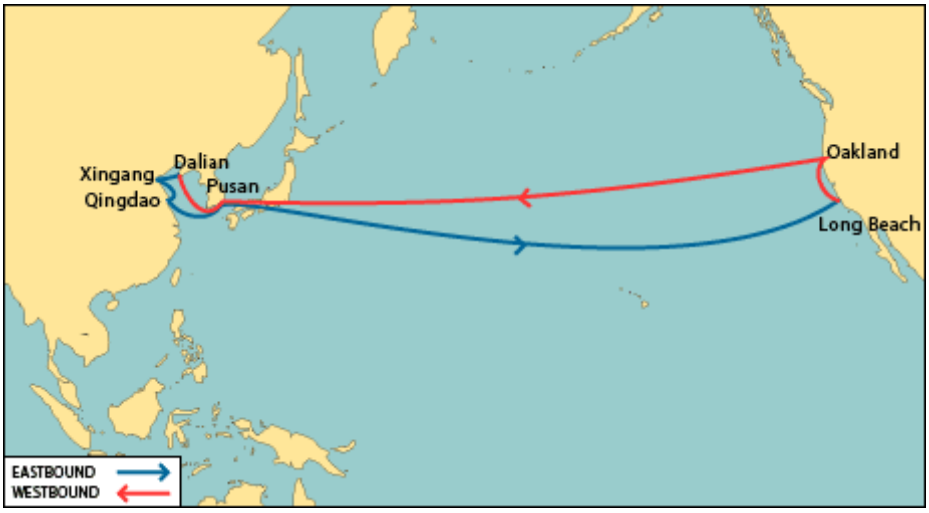
The Grand Alliance partners, consisting of Hapag-Lloyd, NYK, OOCL, provide a North China Express (NCX) similar to other Alliances' services. Their service string weekly connects Dalian, Xingang and Qingdao with Long Beach and Oakland via Busan in Korea. The partners put the string into the five vessels with the average ship-size of about 3,400 TEU. The Grand Alliance also has a little different service named as the North and Central China East Coast Express (NCE), which connects Dalian, Xingang, Qingdao, Ningbo and Shanghai with the US east coastal ports such as New York, Norfolk and Savannah via Panama, leaving from/to the port of Busan. Therefore, the NCE service takes longer transit time, about 56 days, than the NCX service. The 〈Table 2-8〉, 〈Figure 2-3〉, and 〈Figure 2-4〉 explain their operations and service routes.

〈Table 2-8〉 **Grand Alliance's Direct Services from Tianjin to US Ports**

Name of Service	Route	Fre-quency	No. of Vessel	Remark (At Xingang)
North China Express(NCX)	Dalian→Xingang→Qingdao→ Busan→Long Beach→ Oakland→Busan→Dalian (35 days)	Weekly (Fixed Day)	5 (3,399 TEU)	From Sun to Mon
North and Central China East Coast Express(NCE)	Busan→Dalian→Xingang→ Qingdao→Ningbo→Shanghai →Panama→NY→Norfolk→ Savannah→Panama→Busan (56 days)	Weekly (Fixed Day)	5	From Mon to Tue

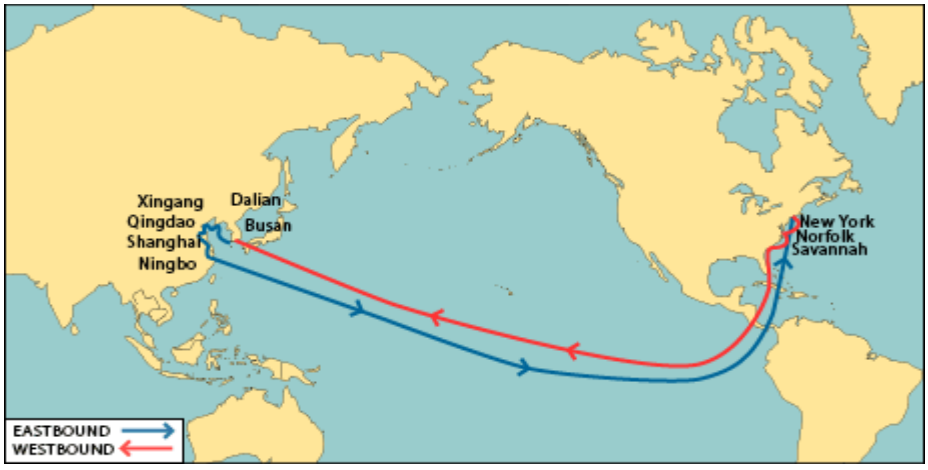
Footnote : Name of 5 Operating vessels on the NCE service - LUDWIGSHAFEN EXPRESS, NYK COSMOS, NYK GALAXY, TBN, KITANO.
Source : NYK Homepage(2007. 9. 12); NYK Tianjin Branch.

〈Figure 2-3〉 Grand Alliance's North China Express (NCX) Route



Source : NYK Homepage(2007. 9. 13).

〈Figure 2-4〉 Grand Alliance's the NCE Service Route



Source : NYK Homepage(2007. 9. 13).

Lastly, we have researched the Maersk Line's service, which is the direct route from the Northern China ports, especially focused on the port of Tianjin (Xingang) to the North America. Maersk provides a direct service, which connects Dalian, Xingang, Qingdao with LA and Oakland

via Busan, Gwangyang, Nagoya and Yokohama in Korea and Japan. The five operating vessels, MAERSK Buffalo, MAERSK Bentonville, MAERSK Boston, MAERSK Brooklyn, and MAERSK Baltimore, are capable of carrying container boxes of about 210 thousand TEU per year. The 〈Table 2-9〉 shows the Maersk Line's TP8 service.

〈Table 2-9〉 **Maersk Line's Direct Service from Tianjin to US Ports**

Name of Service	Route	Fre-quency	No. of Vessel	Remark (At Xingang)
Transpacific 8 (TP8)	Dalian→**Xingang**→Qingdao→ Busan→Gwangyang→Nagoya →Yokohama→ LA→Oakland→Dalian (35 days)	Weekly	5	THU (mostly)or THU to Fri

Source : Maersk Line Homepage(2007. 9. 13).

In conclusion, there are several characteristics about the direct-call service focused on Tianjin port. First, all of liners or alliances calls at Tianjin port with Dalian and Qingdao port in the Northern China due to their rapidly growing economy although the distance among three ports are relatively too close to call together. Second, most services calling at Tianjin port connect the US west coastal seaports like LA/LB and Oakland, except the NCE service of the Grand Alliance. Third, there is no 'real' express service from the Northern China directly to the US ports without any other calling. In other words, most shipping companies call at one more ports in Korea or Japan during a voyage.

In addition shippers at Tianjin port have got an enlarged opportunity to move their cargoes directly from the port to the main foreign ports inthe major routes. Through coastal shipping network and inland network the port of Tianjin could broaden its hinterland and upgrade level of service.

Chapter Ⅲ. Costal Shipping Network and Inland Logistics at Tianjin Port

1. Facilities of Tianjin Port

Container carriers operate in an increasing competitive and market-driven environment. Most of them continuously provide their services using hub-and-spoke networks. Under a hub-and-spoke network, economies of flow can be realized by consolidating freight through a hub and using large ships. However, routing all freight through a hub is not necessarily appropriate in any situations. Although the average shipping cost per TEU decreases on line-haul legs of hub-and-spoke networks, freight originated in feeder ports must be transshipped through a hub, and incur extra shipping distance, shipping time, port charges and stevedoring charges. Therefore, container carriers must decide whether to route a shipment through a hub or directly to its destination.

Even though hub and spoke system by lager liners can provide shippers with diversity and convenience at ocean routes, shippers, terming operating companies, local government and port authority are trying to get direct service with main ports in major routes. Especially the higher rate of volume increase in Northern china sea basins has stimulated the related organizations to build lager port facilities, to construct express way and railroad for cargo transport and to enlarge coastal shipping service. At Tianjin due to its strong logistics demand we can detect simultaneous changes and development in shipping service port

development, enlarging feeder network with major ports in Northeast Asian regions, Chinese government policy on coastal shipping and increasing direct shipping service in main routes by lager liners. Some factors could strengthen the hub and spoke system in china, also the other factors might improve the connectivity and the centrality of foreign ports in the Northeast Asia.

1) Few Harbours and Global Hubbing[14)]

Along with growth in ship sizes, the costs related to calling into ports have massively increased. One method that international shipping companies have begun to use to contain costs is hubbing; that is rather than using multiple ports in a region, to use only one large, central hub like Singapore or Hong Kong to ship or transship cargoes. Reducing in the number of port calls translates to savings in money and time. Hubbing is becoming a global trend driven by the size of ships that companies operate.

2) General Description of Tianjin Port

The Port of Tianjin, situated at the estuary of the Haihe River in the west of Bohai Gulf, is one of the hub ports and an important international trading port in China. Tianjin Port, located 5km to the southeast, is the second largest general port in China, inferior to Shanghai port. The port consists of two subports: Tanggu and Xingang. Another name which is also used is Taku Bar. The main port is located just some 170 kilometers east of Beijing and serves as the capitals port. The port has now 62 public productive berths, among which 47 are berths for vessels of over 10,000 DWT. the total length of quay line is 11,243m and the land area is more

14) Paul O' Neill, Key Issues in Global Shipping, Deloitte: Global Aviation and Transport Services, December 2005, pp. 3~4.

than 20km^2. Vessels of 70,000~80,000 dwt can sail in on tide. Tianjin Harbor is the largest manual harbor in China having business with over 300 ports of more than 170 countries and regions with 75 berths, among them, 48 deepwater berths with 10 thousand tons.

Tianjin Port, the largest port in north China, aims at 270 million tons of freight traffic in 2007 to conform with rise of the city's Binhai New Area. It also aims at 7 million 20-foot equivalent unit (TEU) of container turnover. The Binhai New Area, a coastal area, plans to become an international shipping center and an international logistics center in northern China. From January through December 18 in 2006, Tianjin Port had recorded cargo throughput of 250.2 million tons. The full year figure in 2006 is expected to reach 255 million tons, up 6.3 percent year-on-year .

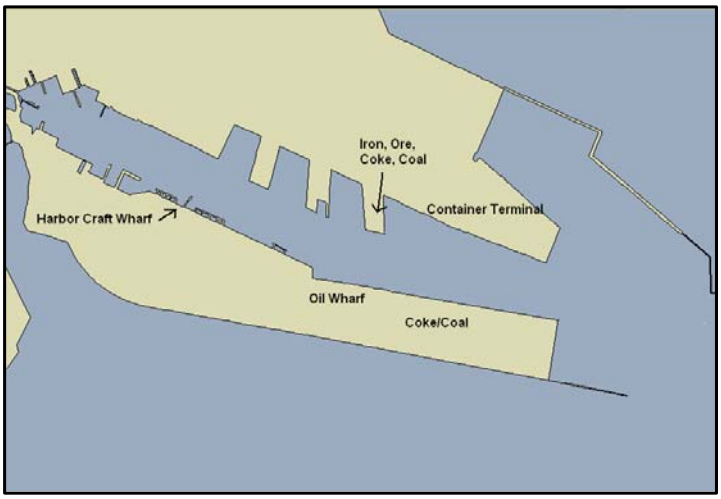
The port's container turnover is expected to reach 5.9 million TEU in 2006, up 22.9 percent year-on-year. The Binhai New Area, about 120 kilometers to the southeast of Beijing, is a national pilot reform base listed in the country's development plan for the 2006~2010 period. Upon completion, it will cover an area of 2,270 square kilometers.

〈Table 3-1〉 Tianjin Port Summary

Items	Detailed contents
Port Position	Long: 117 45'E, Lat: 38 59'N
Terminal Type :	General Port
Time Zone :	GMT +8 (+/- hours)
Nearest Airport :	Tianjin airport
Authority :	Port of Tianjin authority
Max	Draft Excl Tide:12m , Length :398m, DWT: 50,000 mt
Main Import :	Equipment, fertiliser, general cargo, grain &steel
Main Export :	Coal, coke, manufactured goods, non-metal ore &salt
Tides :	Minimum 1.3m, Maximum 3.8 m, Average 2.5 m
Weather(winds)	Summer: SE, Winter: NW, Spring: SW, Autumn: SW
Working Hours:	Throughout 24 hours a day, 08.00-16.00, 16.00-24.00, 24.00-08.00

Source : http://www.lethagencies.com/port.asp?port=TIANJIN.

〈Figure 3-1〉 Tianjin Port Presentation



By 2010 Tianjin Port is expected to develop into a 300-million ton international port. Its container handling capacity will exceed 10 million TEU. It will construct 16 deep-water berths that can load the sixth generation container vessels, a 100,000-ton mineral ore and oil dock, a 100,000-ton deep-water navigation channel and the largest bulk cargo logistics center in North China covering 12km^2.

3) Shipping Lines of Tianjin Port[15)]

Tianjin Port has trade with more than 400 ports from 180 countries and regions in the world. In 2007, 47 regular container vessel lines and nearly 200 world container-shipping lines are operating at Tianjin Port. It has been one of the transportation hubs of containers.

15) Http://www.portoftianjin.com.

〈Table 3-2〉 World Container Shipping Lines of Tianjin Port

Lines	Routes	Frequency
Western U.S.	Tianjin Port-Western Coast of U.S.	Twice a week
Persian Gulf	Tianjin Port-Hong Kong, Singapore, Karachi, Kuala Lumpur, Durban	Once a week
Korea	Tianjin Port-Busan	Four lines a week
Southeast Asia	Tianjin Port-Manila, Singapore	Twice a week
Japan	Tianjin Port-Tokyo, Yokaichi, Osaka, Yokohama and Nagoya	Seven lines a week
Europe	Tianjin Port-Hamburg, Rotterdam	Twice a week
Eastern Coast of U.S	Tianjin Port-New York	Once a week
Japan-Australia	Tianjin port-Sydney, Melbourne, Tokyo	Once a week
Hong Kong	Tianjin Port-Hong Kong	Fourteen lines a week
Taiwan	Tianjin Port-Kaohsiung, Keelung	Once a week
Short coastal lines	Tianjin Port-Qingdao, Shanghai, Guangzhou, Hong Kong	Twice a week

Note : Direct service only.

2. Feeder Services between Busan Port and Tianjin Port

Feeder services are fully integrated with intercontinental deep sea traffic from the Europe, the Americas and further away. Cargo is first shipped to hub ports : Busan, Shanghai, Qingdao and so on and from there, feeder services carry the cargo to smaller China and Japan ports in smaller volumes. The same of course applies the other way around. The quality and quantity of feeder services allow large global carriers to call at only a few Northeast Asian ports, thus saving time and costs. As the mainport of China, also Tianjin has tried to enlarge its function as a hub port.

〈Table 3-3〉 **Feeder Services between Busan and Tianjin Port**

Lines	Routes	Vessel Name	Frequency
China Shipping	BS/Xingang/Dalian	Denderah Rickmers	Weekly
CK Line	US/BS/Xingang/Dalian	Skypride	Weekly
Co-heung/ Cosco	BS/Xingang/Dalian BS/US/Xingang	Qi Yun Hee Xin Hui He	Weekly Weekly
Dongnama	BS/KY/Dalian/Xingang	Lunar Star	Weekly
EAS	BS/Xingang BS/Xingang	Dongjiang EAS Line Tianjin	Weekly Weekly
Hanjin	BS/KY/Xingang	Rong Feng	Weekly
Heung-A	BS/US/KY/Xingang	Nadja	Weekly
Nam Sung	BS/US/MS/KY/Xingang	Victory Star	Weekly
Sinokor	BS/US/KY/Xingang/Longkou	Golden Trade	Weekly
Sinotrans	BS/Xingang	Yi Fa	Weekly
SITC	Dalian/Xingang/Yantai/BS/Jap	Sky Bright	Weekly
Total		14 Vessels	13 times/ week

Source : http:// www.yellowsea.org/

The main actors in the route between Busan and Tianjin are Chinese and Korean liners. By bilateral shipping agreement between Korean and Chinese. Concluded in 1993, both parties had adopted mutual agreement system to deploy additional container ship and to open a new trade route under the principle of fair cargo sharing. Therefore both new entry of Korea-China trade route and free competition between shipping lines are limited. Korea and China have equivalent market power by deploying same number of ships. The feedering service between Tianjin and Busan could be restricted by this agreement. The third party liners for example, Maersk, NYK and so on would be uninterested in activation of sea route between China and Korea.

3. Domestic Feeder Network

1) China Government Policy for Coastal Shipping Promotion

In china, waterway transport has enlarged its role as a major transportation mode for bulk cargoes. The share of waterway transport reached 12.2% on the basis of tonnage but its share on the basis of tonnage · km was 63.0% in 2006.

Propelled by the rapid growth of economy and foreign trade development, China's domestic container feeder transport market has maintained a sustained and rapid development.[16] The container volume of domestic feeder in 2005 rose to 5.24 million TEU, up 19.8% on the volume in 2004, including 3.7 million TEU for coastal ports movement and 1.54 million TEU for river ports movement. By the end of 2005, 50 feedering shipping companies were engaged in trans-province domestic feeder line service: 25 companies for the Yangtze River feeder service, 9 for coastal feeder service, and 16 for both Yangtze River and coastal feeder service.[17]

In 2005, the Chinese government carried out a new experiment to transport domestic and foreign trade containers on the same ship and to transship international container cargo by Chinese-flag international ships. Since 2003 the leaders of the Ministry of Communications and the General Administration of Customs of China have held discussions on the feasibility of transport of domestic and foreign trade containers on the same ship. By adopting this policy the Chinese government has been trying to facilitate the formation and development of China's container hub ports, to increase the utilization rate of container carrying capacity, to improve the transport service and to reduce the cost of logistics.[18]

By the end of the year 2005, the Ministry of Communications of China

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16) Ministry of Communications of China, *The Report of China's Shipping Development*, 2006, p. 58.
17) Ibid, p. 58.
18) Ibid, pp. 66~67.

completed the registration procedures for 5 shipping enterprises and 13 port enterprises that applied for transporting domestic and foreign trade containers on the same ship. Registration procedures were completed for more than 100 Chinese-flag ships of Chinese. Those companies were Shanghai Pan-Asia Shipping Co., Shanghai Puhai Shipping Co., China Shipping Container Lines Co., China Yangtzee River Shipping Co. , Dalian Jifa Bohai Rim Container Lines Co. and so on.

The Chinese government assessed this policy to be successful. Transport of domestic and foreign trade containers on the same ship could positively increase the capacity utilization of domestic feeder ships, optimize the layout of container shipping lines and make better use of waterway transportation.

In addition, the Chinese government established the standardization policy for river vessels. The Ministry of Communications of China emphasized the development of two different types of vessels on the Yangtze river and Pearl river trunk lines : 200-250 TEU size container vessel and 100-150 TEU container vessel.

In contrast, the north-south coastal domestic-trade transportation service in China maintains its leading position in the domestic trade transport market, accounting for roughly 90% of China s total waterway container throughput. Container ships deployed in the north-south coastal domestic services are mainly from 1,000 TEU size to 2,000 TEU size, but some over 5,000 TEU size ships are operated in the coastal services.

2) Major Domestic Shipping Companies

(1) Shanghai Pan Asia Shipping Co.

Shanghai Pan Asia Shipping Co. is a representative coastal container shipping company in China, established by COSCO in 2004.[19] Its registered capital amounts to 668 million Yuans. Its major service routes

19) www.panasiashipping.com(2007. 9. 10).

are China-Japan route, coastal shipping route and Yangtze river route. The total slots of container vessels amount to 30,400 TEU. The Bureau of Feeder Service at the company has three department : Yangtze River Department, Coastal Shipping Department and Pearl River Department. The company provides Yangtze river service, Bohai Rim coastal service, Pearl river service and other coastal shipping services in China domestic market. Its major hub ports are the port of Shanghai and the port of Shenzhen. Through coastal feeder services the company could build diverse shipping network for China ports.

〈Figure 3-2〉 **Coastal Shipping Network of Shanghai Pan Asia Shipping Co.**

〈Table 3-4〉 **Coastal Shipping Service of Shanghai Pan Asia Shipping Co.**

route	vessel	calling ports	frequency
Shanghai/ Tianjin	Sha He	Shanghai, Tianjin	weekly
Shenzhen/ Yingkou	Song He,Zhung He,Bing He	Shenzhen(Shekou),Xinshia,Dalian, Jinzhou, Yingkou	3voyages/week
Shenzhen/ Shanghai	Bai An, Han Tao He, Xin Cheng Gong	Shenzhen(Shekou),Hwangpu, Qianzhou, Shanghai	3voyages/week
Qianzhou/ Tianjin	Lifeng Nanhai, Lifeng Donghai, Borun	Qianzhou, Shantou, Yingkou, Tianjin	weekly
Jiangyue/ Tianjin	Luo He, Liao He, Yin He	Jiangyue, Zhangzhou, Xiamen, Qianzhou, Tianjin, Yingkou, Jinzhou	2voyages/week
Shenzhen/ Taichang	Han Jiang He, Han Tao He	Shenzhen(Shekou),Hwangpu, Taichang	2voyages/week
Hwangpu/ Tianjin	Min He, Pu He, Gao He	Hwangpu, Tianjin	2voyages/week
Shenzhen/ Lianyungang	Qiu He, Yu He, Chao He	Shenzhen(Shekou), Hwangpu, Shantou,Rizhao,Qingdao, Lianyungang	weekly
Shanghai/ Lianyungang	Ling Yun He	Shanghai, Dalian, Qingdao, Lianyungang, Shanghai	weekly
Haikou/ Hwangpu	Ling Quan He	Haikou, Zhenjiang, Hwangpu	weekly
Hwangpu/ Tangshan	Chun He, Xiang He,Xing He	Hwangpu,Shenzhen(Shekou), Qianzhou, Tangshan, Yantai	weekly
Shanghai/ Yingkou	Bo Feng	Shanghai, Yingkou	weekly
Qingdao/Shidao	Xin Shidao	Qingdao, Shidao	weekly
Qingdao/ Tianjin	Gao Cheng	Qingdao, Yingkou, Qinghwangdao, Tianjin	weekly
Qingdao/Weihai	Chao Shan	Qingdao, Weihai	weekly
Wenzhou/ Ningbo	Xing Tai	Wenzhou, Ningbo	weekly
Dalian/Shidao	Yuan Feng	Qingdao, Dalian, Shidao	weekly
Dalian/Longkou	Huan Lian	Dalian, Yantai, Weihai, Daian, Longkou	weekly
Dalian/Yingkou	Yuan Feng	Dalian, Jinzhou, Yingkou, Daian	weekly
Ningbo/Haimen	Kai Feng	Ningbo/Haimen	weekly

Source : An HKSG Group Publication, Shipping Gazette, Jun 25, 2007.

(2) China Shipping Container Lines Co.

China Shipping Container Lines Co. is a container shipping subsidiary of China Shipping Group Co. China Shipping Group (China Shipping) was founded in 1997 and is a state-owned shipping enterprise under the direct administration of the Chinese government.[20] Its major service routes are China-Europe route, China-Mediterranean route, Northeast Asia shipping route and coastal shipping route.

〈Table 3-5〉 **Coastal Shipping Service of China Shipping Co.**

route	vessel	calling ports	service
Shanghai / Yingkou	Xiang Kai, Xiang Pu, Xiang Ning	Shanghai, Pangcheng, Nanxia, Yantai, Yingkou	weekly
Jinzhou / Yingkou	Xin Zhan Jiang, Xin Yingkou	Jinzhou, Nanxia, Yingkou	biweekly
Shanghai / Yantai	Tao Yuan	Yingkou, Shanghai, Yantai	weekly
Tianjin / Qianzhou	Xin Jin Zhou, Xin She Kou	Tianjin, Yingkou, Jiangyue,Qianzhou,Tianjin	weekly
Hwangpu / Pangcheng	Xiang Hu	Hwangpu, Pangcheng	weekly
Hwangpu / Taichang	Xiang Fei, Xiang Teng	Taichang,Ningbo,Hwangpu, Taichang	weekly
Lianyungang / Shekou	Xin Hwangpu	Lianyungang, Shekou	weekly
Qinghwangdao / Nanxia	Xin Shan Tou, Xin Dan Dong	Qinghwangdao, Dalian, Nanxia	weekly
Tianjin / Shantou	Xiang Lui, Xiang Mao, Xiang Li	Tianjin, Shantou, Qianzhou, Dalian, Yingkou, Shantou, Xiamen	weekly
Lianyungang / Rizhao	Xiang Cang	Lianyungang, Qingdao, Rizhao	2voyages/ week

Source : An HKSG Group Publication, Shipping Gazette, Jun 25, 2007.

The group has also a subsidiary company for feeder service in China and in Northeast Asia : Shanghai Puhai Shipping Co.. Shanghai Puhai Shipping Co. has been focusing its network on the port of Shanghai and the port of Ningbo and trying to extend its service to Tianjin, Dalian,

20) www.cnshipping.com/english/gsjt.asp (2007. 8. 10).

Qingdao in the north of China and Wenzhou and Xiamen in the south of China.

Its major service routes are coastal shipping routes and the Yangtze River service. Coastal shipping route can be divided into the Bohai Rim service, North China Coastal service and South China Coastal service. Through coastal feeder services the company could build diverse shipping network for China ports. Actually Shanghai Puhai Shipping Co. has strengthened its Yangtze river service. It has feeder network at Chongqing, Yichang, Changsha, Wuhan, Jiujiang, Anqing, Wuhu, Nanjing, Yangzhou, Nantong, Taicang, Shanghai and other cities in Yangtze river basin.[21)]

4. Coastal Feeder Services between Tianjin and Shanghai

There are a few feeder services between the port of Tianjin and the port of Shanghai, which is one of the major competitors for the port of Busan in capturing transshipment container cargoes moving from and to the United States.

〈Table 3-6〉 **Feeder Network between the port of Tianjin and the port of Shanghai**

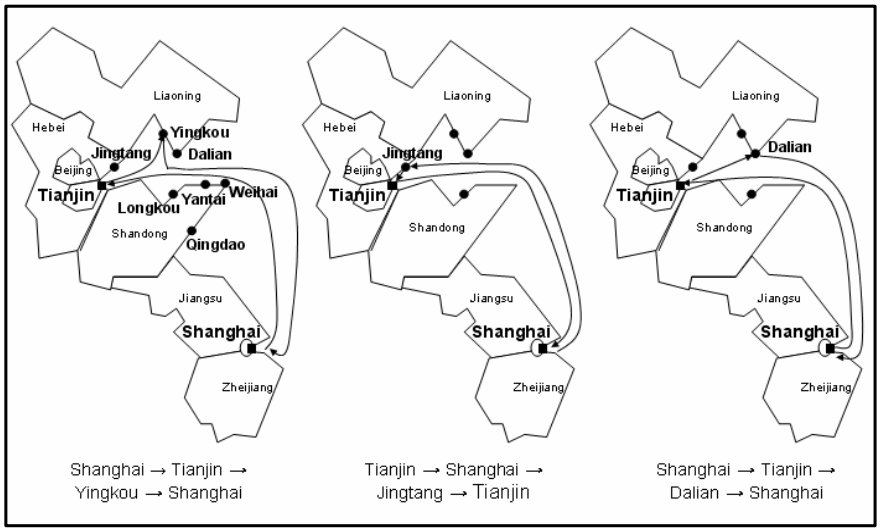
Name of Liner	Frequency	Route				Transit Time	Remark
PANASIA	Weekly	Shanghai→Tianjin→Yingkou→Shanghai				7 Days	Feeder service
		1st day	3-4th day	5th day	7th day		
CSCL	Weekly	Tianjin→Shanghai→Jingtang→Tianjin				6 Days	Domestic
		1st day	3rd day	5th day	6th day		
SYMS	Weekly	Shanghai→Tianjin→Dalian→Shanghai				7 Days	Domestic
		1st day	3rd day	4th day	7th day		

Footnote : PANASIA-Shanghai PAN-ASIA Shipping Co., Ltd.
CSCL-China Shipping Container Lines Co., Ltd.
SYMS-SHANGDONG YANTAI INTERNATIONAL MARINE SHIPPING CO.
Seouce : China Shipping Gazette, Feb 07, 2007.

21) Shanghai Puhai Shipping Co., *The Presentation of the Shipping Lines in Yangtze River by Shanghai Puhai Shipping Co.*, 2005.

We can find 3 major feeder liners such as PAN-ASIA, CSCL and SYMS, between two concerning Chinese ports through by checking the China Shipping Gazette. They provide weekly services at Tianjin via another port such as Dalian port, Longkou(龍口) port at Shandong Province and Jingtang(京塘) port at Hebei Province.

〈Figure 3-3〉 Shows the service route for 3 feeder liners.



Source : Author.

The PAN-ASIA Co. is a subsidiary of COSCO, which is one of the Top 10 Container Liners over the world. CSCL, a Chinese company, also is one of the global Top 10 companies. Unlike two major Chinese mega-carriers, SYMS, with its main activity at the Shandong Province in China, is the medium-size shipping company, which focused its slots on the regional services surrounding Northeast and Southeast Asia, especially the China-Japan route.

We can assume that the purpose of the feeder service between Shanghai port and Tianjin (Xingang) port is not only supporting domestic trades of their hinterlands but also helping out to transship the cargos from Shandong Province to North America due to lots of services in the port of

Shanghai.

In 2006, Shanghai port provided 41 liner services to America, the highest record in the Northeast Asia ports, operated by more than 15 liners or alliances. Total shipping capacity per annum is about 9 million TEU and the average ship size is 3,911 TEU. The CKYH group of COSCO, K Line, Yangming and Hanjin operates the 11 service routes with the annual capacity of about 2.6 million TEU, which number is the highest among liners or alliances. New World Alliance(NWA) partners (APL, Hyundai Merchant Marine and Mitsui OSK Lines(MOL)) and Grand Alliance partners(Hapag-Lloyd, NYK, OOCL) follow the CKYH group with an annual capacity of around 1 million TEU. As a liner, Maersk Line, which is the largest container shipping company in the world, provides 3 transpacific services at Shanghai with the capacity of 0.84 million TEU per annum. The 〈Table 3-7〉 explains the direct-call services connecting the port of Shanghai to American ports.

〈Table 3-7〉 **Direct-call Service from Shanghai to US Ports (Transpacific)**

Unit : TEU

Liner(Alliance)	Route	No. of Service	Average ship size	Capacity/year
CKYH	T-P	11	4,676	2,622,930
CMA CGM	T-P	1	3,163	146,614
CMA CGM/CSCL	T-P	4	3,901	794,489
CSAV/Gold Star	T-P	1	3,110	162,148
CSCL	T-P	2	4,378	456,533
Evergreen	T-P	3	4,146	648,454
Evergreen/Cosco	T-P	1	2,855	130,253
Grand Alliance	T-P	4	4,315	899,957
Hapag-Lloyd/APL	T-P	1	4,293	223,858
Maersk Line	T-P	3	5,381	841,766
MSC	T-P	1	6,719	350,358
New World Alliance	T-P	4	4,748	942,415
Wan Hai/CSAV	T-P	1	2,858	149,024
Wan Hai/Sinotrans	T-P	1	2,702	140,890
ZIM/CSAV/CSCL	T-P	1	3,337	173,985
ZIM/Emirates	T-P	1	2,805	16,251
ZIM/Italia Marittima	T-P	1	3,103	161,805
Sum(Average)		41	3,911(avg.)	8,861,730

Source : Drewry Shipping Consultants, *Drewry Annual Container Market Review 2006/07*, June 2006. KMI, Activation of the port of Gwangyang mid term Report(2007).

We tried to survey the feeder network for each carrier, which don't call at Tianjin (Xingang) port but call at Shanghai port for transpacific services, such as CMA CGM, Zim, MSC, Evergreen, Wan Hai, and so on. For instance, we found how the CMA CGM operates the feeder service from Tianjin port to Shanghai port, shown in the 〈Table 3-8〉.

〈Table 3-8〉 CMA CGM's Liner Services including Feedering (July 2007)

Name of Service	Route	Fre-quency	Feeder Network	Remark
North America West Coast	Xingang→Shanghai→ Ningbo→LA (20 days)	Weekly	Xingang→ Shanghai	
North America East Coast	Xingang→Pusan→Panama Canal→NY→Savannah →Miami (38 days)	Weekly	Xingang→ Pusan	
Trans-Pacific Express	Xingang→Pusan→Seattle→ Vancouver(→others) (15 days)	Weekly	Xingang→ Pusan	
Central America/Caribbean Express, West Coast of South America Express		Weekly	Xingang→ Pusan	

Source : CMA CGM (Tianjin Branch).

5. Inland Logistics Network of Tianjin Port

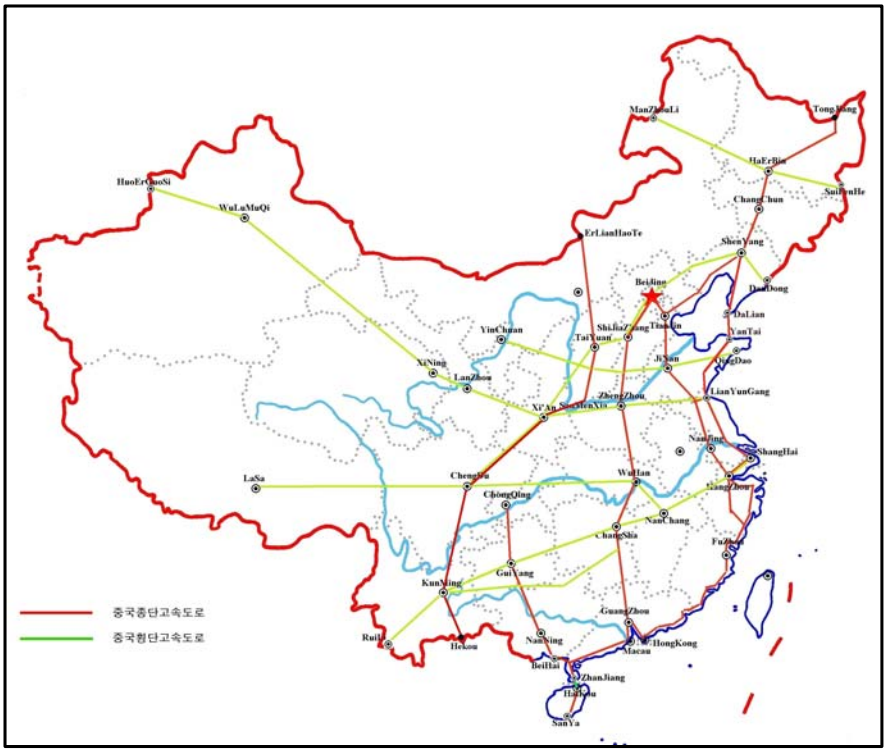
Inland logistics infrastructure is constituted of expressway, railroad, inland container depot, truck terminal and other logistics facilities.

1) Trucking Transport Network of Tainjin port

China government commenced to build expressway in 1988, starting at Shenyang(瀋陽)-Dalian Expressway, Beijing-Tianjin-Tangkou(塘沽) Expressway, Jinan(濟南)-Qingdao(青島) Expressway, Shanghai(上海)-

Nanjing(南京) Expressway and Beijing-Shijiajang(石家庄) Expressway simultaneously.[22] Through Beijing-Tianjin-Tangkou Expressway the port of Tianjin could be connected with hinterlands and main cities in China. By 2005 China has built 34,300km expressway, building a unified expressway network for country.[23] China government is planning to build major trunk expressway by 2007 and to complement branch network by 2008.

〈Figure 3-4〉 China Major Expressway Network



Source : KITA, China Logistics Market, 2006, p. 46.

22) Liu Nian(劉念), *Logistics Geography(物流地理)*, China Machine Press(機械工業出版社), China Beijing, 2005, p. 102.
23) China Transportation Press, Yearbook of China Transportation & Communication, 2006, p. 709.

China has major 5 vertical expressways and 7 crosscutting expressways which have played as trunk route in China. Major 5 vertical expressways are as follows: Tongjaing-Sanya Expressway(5,439km),Beijing-Fuzhou Expressway(2,478km), Beijing-Zuhai Expressway(2,310km), Chongching-Zhanjiang Expressway(1,344km) and Erlianhot-Hukou(3,451km). Major 7 crosscutting expressways are as follows: Lianyungang-Houerguoshi Expressway(4,304km), Shanghai-Chengdu Expressway(2,726km), Shanghai-Ruli Expressway(3,663km), Hengyang-Kunming Expressway(1,854km), Qingdao-Yinchuan Expressway(1,602km), Dandong-Lasa Expressway (4,989km) and Suifenha-Manzhouli(1,527km).

Since the Ministry of Communications of China had decided to construct container terminal at Tianjin and Shanghai in 1975,[24] trucking transport of container has been a main mode connecting ports with their hinterlands. In 1978 China government permitted the private transport company to manage cargo trucking business on the base of market system. During early 1980s some leading container trucking transport companies were established by the Ministry of Communications.

2) Railroad Transport Network of Tianjin port

China has enormously vast railroad network, providing 103 thousand km in 2005. The share of China railroad double line reaches only 25.4%: 25,600km. The remaining line is composed of single line, making bottleneck in railroad transport. At railroad transport, bulk cargoes like coal and have a tendency to be moved from the northern area to the southern area.[25] Contrarily foreign trade cargoes like container and electronic products would be moved from the southern and the eastern

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24) Zhang Seng Shu(張聲書), *China Modern Logistics Study(中國現代物流研究)*, 1998, pp. 92~93.

25) Zhang Seng Shu(張聲書), *China Modern Logistics Study(中國現代物流研究)*, 1998, p. 79.

areas to the northern and the western areas. China has 9 inland international stations[26] which have been handled foreign trade cargoes between China and other neighboring countries.

China has 5 railroad container transport corridors as in the follwings.[27] First corridor is connecting Beijing, Baotou, Wulumuqi and Northwest region with Tianjin port. Second corridor is connecting Shenyang, Changchun, Haerbin and Northeast region with Dalian port and Dandong port. Third corridor is connecting Jinan, Shijiajiang, Xian, Lanzhou, Wulumuqi and Western region with Qingdao port and Lianyungang port. Fourth corridor is connecting Jiangshu province, Anhui province, Hubei province, Chongching, Zhejiang province and Southwest region with Shanghai port and Ningbo port. Fifth corridor is connecting Gwangdong province, Hunan province, Hubei province, Henan province and Southern region with Shenzhen port, Guangzhou port and Hong Kong port.

Furthermore, China has major 8 vertical railroad lines and 8 crosscutting railroad lines which have played as trunk line in China.[28] Major 8 vertical railroad lines are as follows: Beijing-Haerbin-Manzhouli line(2,346km), Shenyang-Zhanjiang line(4,183km), Beijing-Shanghai line (1,463km), Beijing-HongKong line(2,475km), Beijing-Guangzhou line (2,294km), Datong-Leizhou-Haikou line(2,982km), Baotou-Lieuzhou-Nanning line(3,012km) and Lanzhou-Kunming line(2,179km). Major 7 crosscutting expressways are as follows: Beijing-Lanzhou line(3,974km), Datong-Chinhawangdao-Hwanghwa line(1,467km), Taiyuan-Qingdao-Rizhao line(1,913km), Lianyungang-Lanzhou-Arasankou line(4,152km), Nanjing-Xian line(1,028km), Shanghai-Chongching line(2,200km), Shanghai-Kunming line(2,699km) and Kunming-Zhanjiang line (1,249km).

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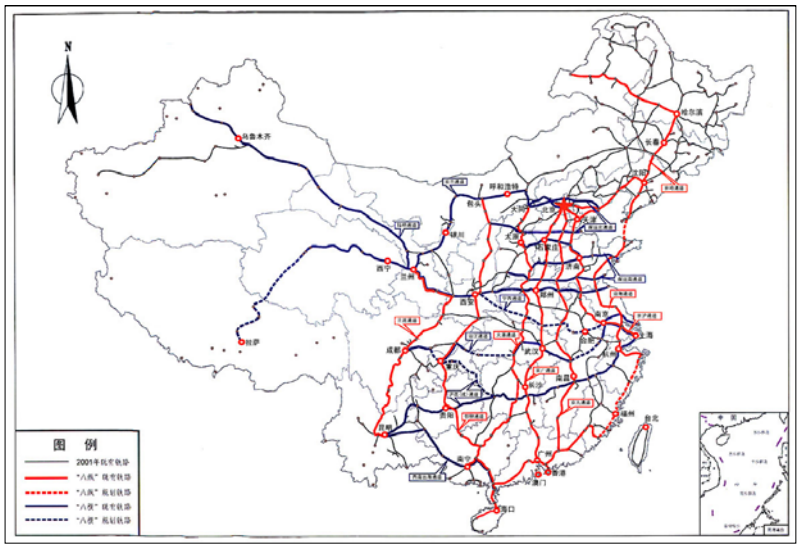
26) Including Alataw-Shankou, Erlenhot, Manzhouli, Suifenhe, Tumen, Jian, Dandong, Pingxiang and Shanyao.

27) Han Zheng Lin(韓增林), *Container Port Development and Strategy Study (集裝箱 港口 發展 與 布局 研究)*, Navy Army Press(海軍出版社), China Beijing, 2006, pp. 160~162.

28) KITA, *China Logistics Market*, 2006, pp. 71~77.

〈Figure 3-5〉 China Railroad Network



Source : KITA, China Logistics Market, 2006, p. 71.

There are two freight station in the port area at Tianjin : Tangku Freight Station and New Port Station. Tangku Freight Station is belonging to Beijing-Shanhaiguan Line and plays an important role to handle general cargoes and container cargo in domestic size and ISO size. From New Port Station, the branch lines are divided into the container terminals at Tianjin port.

Chapter Ⅳ. Location and Characteristics of Shippers at Tianjin Port

1. Hinterland around the port of Tianjin

Before 2006 in China Bohai basin there were only two ports, Tianjin and Dalian which handled lager sized mother vessels in trunk routes. Hence these two ports could enjoy peaceful market share which were decided by the factors of inland logistics costs, coastal shipping costs and feeder service rate. In 2006, COSCO, Chinese biggest liners, added Yantai port at Shandong province into its calling network. In addition the Hebei province government is considering the development of container terminal near to Tianjin port. The port of Tianjin is facing with the swift change of international logistics environment produced by logistics providers, Chinese government, foreign and neighboring container ports.

The port of Tianjin is located at the Bohai bay, gateway to Beijing, Hebei province, Xanshi province and Inner Menggu province. It has many logistics infrastructures, e.g. airport, sea port, warehouse, and railway cargo station. Its main hinterlands are Tianjin, Beijing, Hebei province, Xanshi province and Inner Menggu province. In 2003 the share of Tianjin for the container throughput of the port of Tianjin was about 50%. The share of Beijing was about 20%. The share of Hebei was about 12%.

The major transport mode connecting the port with hinterland is trucking transport, its share is about 95%. The share of the coastal shipping in China is about 4%. The share of the railway is about 1%.

〈Table 4-1〉 Tianjin Port`s Hinterland and its Volume(2004)

unit : Thousand TEU, %

province/item	inbound		outbound		Sum of volume
	volume	share	volume	share	
Tianjin	683	49.4	839	51.4	1,522
Beijing	272	19.7	325	19.9	597
Hebei	160	11.6	193	11.8	353
Xanshi	61	4.4	60	3.7	121
Inner Menggu	22	1.6	24	1.5	46
Ganshu,Liaoning, Sinjiang	66	4.8	57	3.5	123
Shandong	91	6.6	106	6.5	197
Others	26	1.9	28	1.7	54
sum	1,383	100.0	1,632	100.0	3,015

Source : KMI, Strengthening of Logistics Network for the port of Gwangyang, 2004, p. 100.

〈Table 4-2〉 Tianjin Port`s Inland Transport Modes and Volume(2004)

unit : Thousand TEU, %

year/item	trucking		railway		Coastal shipping	
	volume	share	volume	share	volume	share
2001	1,901	94.5	14	0.7	96	4.8
2002	2,297	95.4	16	0.6	95	4.0
2003	2,880	95.5	19	0.6	117	3.9

Source : KMI, Strengthening of Logistics Network for the port of Gwangyang, 2004, p. 101.

1) Tianjin

The city of Tianjin is mostly composed of the plain, mountainous and hilly areas shares only 4.6% of the total area.[29] Tianjin is located at the east site of Beijing and the distance between two cities is 120km. Tianjn is the municipality, under the central government of China. It is under

29) www. tjinvest.gov.cn(2007. 8. 19).

construction of becoming logistics hub city and economic center of northern China. Its population in 2006 is 10.8 million.

China has built and integrated networks of expressways. Through expressways the city of Tianjin could be connected with wide range of areas northern, central and southern China. The expressway is 1km away from the port. Railway could be serviced in the port and also in the Tianjin Port Free Trade Zone. There is Tianjin Binhai international airport to handle cargoes.

〈Table 4-3〉 China`s Regional GDP (2006)

Unit : Billion China Yuan, %

Region/item	2000		2005		2006	
	amounts	share	amounts	share	amounts	share
Tianjin	170.2	1.6%	369.8	2.0%	433.8	2.0%
Beijing	316.1	2.9%	688.6	3.6%	772	3.5%
Hebei	504.4	4.6%	1,009.60	5.4%	1,161	5.3%
Shanghai	477.1	4.4%	915.4	4.9%	1029.7	4.7%
Shandong	833.8	7.7%	1851.6	9.8%	2184.7	9.9%
Guangdong	208	1.9%	407.6	2.2%	480.2	2.2%
others	8387.6	77.0%	13626.6	72.2%	15988.1	72.5%
Total	10897.2	100.0%	18869.2	100.0%	22049.8	100.0%

Source : China Statistical Press, China Statistical Abstract, 2007.

〈Table 4-4〉 China`s Regional export and import (2006)

Unit : Billion Dollar

Region/item	O/D basis		Address basis	
	export	import	export	import
Tianjin	32.7	34.6	33.5	30.9
Beijing	24.9	45.6	37.9	120.2
Hebei	15.2	8.3	12.8	5.7
Shanghai	108.5	112.7	113.6	113.9
Shandong	60.3	50.3	58.6	36.6
Guangdong	305.4	236.3	301.9	225.3
others	422.1	303.8	410.8	259
Total	969.1	791.6	969.1	791.6

Source : China Statistical Press, China Statistical Abstract, 2007.

The regional GDP of Tianjin records 433.8 billion China Yuan(about 55.51 billion US Dollar) in 2006 from 369.8 billion China Yuan(about 47.3 billion US Dollar) in 2005.[30] The amount of Tianjin export commodities in 2006 is recorded as 3.27 billion US Dollar from 2.74 billion US Dollar in 2005 on the basis of Customs Office record. The amount of Tianjin import commodities in 2006 is recorded as 2.49 billion US Dollar. The employee at Tianjin amounts to 5.63 million persons.

2) Beijing

Beijing, capital of China is mostly composed of the plain. Its registered population in 2006 is 15.81 million, but the population unregistered at the official document is estimated at about 4 million. Through expressways Beijing could be connected directly with Shenyang, Tianjin, Jinan, Shijiajiang, Shanghai, Hongkong, Makao and major cities. There is Beijing Capital international airport at the northern site of the city.

Its regional GDP records 772.0 billion China Yuan(about 98.8 billion US Dollar) in 2006 from 688.6 billion China Yuan(about 88.1 billion US Dollar) in 2005.[31] The amount of Beijing export commodities in 2006 is recorded as 3.27 billion US Dollar on the basis of Customs Office record. The amount of Beijing import commodities in 2006 is recorded as 4.56 billion US Dollar on the basis of Customs Office record.

3) Hebei(河北)

The Hebei Province encircles Beijing and Tianjin. Its regional capital is

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30) Development Planning Board of Tianjin Economic-Technological Development Area, Annual Report of Tianjin Economic-Technological Development Area 2006, 2007.

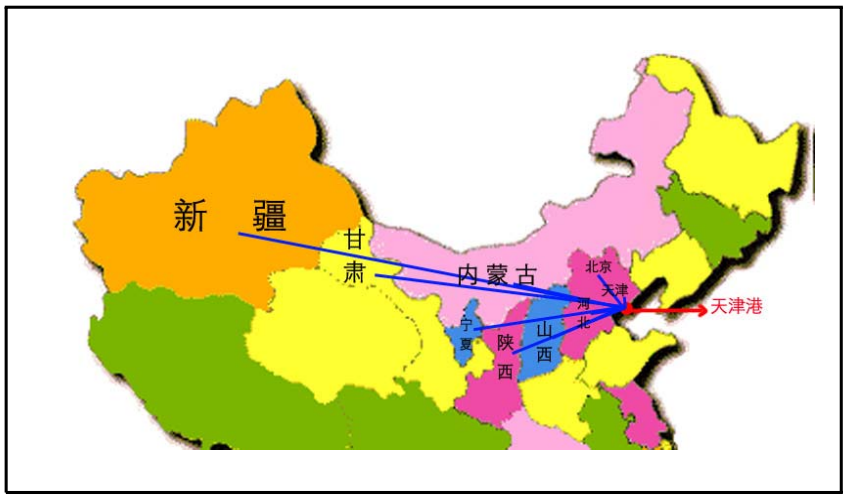
31) Development Planning Board of Tianjin Economic-Technological Development Area, Annual Report of Tianjin Economic-Technological Development Area 2006, 2007.

the city of Shijiajiang(石家庄). Its major cities are Qinhwangdao(秦皇島), Tangshan(唐山) and Chengde(承德). The regional population is 68.98 million. Its regional GDP records 1,161.4 billion China Yuan(about 148.66 billion US Dollar) in 2006 from 1,009.6 billion China Yuan(about 129.2 billion US Dollar) in 2005.[32] The amount of Hebei export commodities in 2006 is recorded as 8.3 billion US Dollar on the basis of Customs Office record. The amount of Beijing import commodities in 2006 is recorded as 15.2 billion US Dollar on the basis of Customs Office record.

2. Dispersion of Shippers around the port of Tianjin

Main hinterlands of the port of Tianjin are Tianjin(天津), Beijing(北京), Hebei(河北) province, Xanshi(陕西) province and Inner Menggu(内蒙古) province.

〈Figure 4-1〉 Hinterland of the port of Tianjin



32) Op.cit..

The major industrial complexes managed by the Chinese government are scattered at the development zones in each province: Tianjin Economic and Technological Development Area(TEDA), Beijing Economic and Technological Development Area, Honhot Economic and Technological Development Area at Inner Menggu(內蒙古) province and Tianjin Port Free Trade Zone. In addition the other development areas managed by the provincial government are Beijing Tianzhu(天竺) Export Processing Development Area and Beijing Tianzhu(天竺) Airport Development Area, Hebei Provincial Langfang(廊坊) Economic Development Area and Hebei Provincial Tangshan Seaport Economic Development Area.

In 2005 Guangzhou Economic and Technological Development Area producing 65 billion China Yuans recorded the 1st rank among 32 national wide Economic and Technological Development Area, 16.2% up from 56.2 billion Yuans in 2004. Tianjin Economic and Technological Development Area is ranked as the 2nd producing 64.2 billion Yuans in 2005, 21.1% up from 53.0 billion Yuans in 2004. Beijing Economic and Technological Development Area is ranked as the 11th producing 23.5 billion Yuans in 2005, 84.9% up from 12.7 billion Yuans in 2004.

At TEDA there are global manufacturing companies : Motorola(China) Electronic Co. Ltd., Tianjin Toyota Automotive Co. Ltd., Tianjin Samsung Telecommunications Co., Tianjin Samsung Electronics Co., Tianjin TEDA Construction Co, Tingsing International Group., Tianjin Coca-Cola Co. Ltd. and so on. At TEDA totally there are 150 industrial categories with 10,000 enterprises, majoring in electronic, automotive, metallurgy, machinery, chemical, textile and medicine industries. Besides, a complete industrial service system has been formed here.[33)]

33) www. teda. gov.cn (2007. 10. 20).

〈Table 4-5〉 China State Level Economic & Technological Development Areas and Their Product Record

Unit : Billion Yuan, %

Development Area/Year	2005	2004	growth rate
Guangzhou	65.3	56.2	16.2%
Tianjin	64.2	53	21.1%
Suzhou	58.1	50.3	15.5%
Kunshan	53.6	41.1	30.4%
Dalian	45	36.1	24.7%
Qingdao	37.2	27.6	34.8%
Jinqiao	36.8	39.5	-6.8%
Jiaohejing(漕河經)	33	24.2	36.4%
Yantai	28	20.2	38.6%
Ningbo	23.5	17.7	32.8%
Beijing	23.5	12.7	85.0%
Shenyang	19.9	15.7	26.8%
Others	176.7	142.1	24.3%
Total	664.8	536.4	23.9%

Source : China Financial & Economic Publishing House, *2006 China Development Zones Yearbook*, Beijing, 2006, p. 463.

The Beijing Economic and Technological Development Area (BDA) is the only State-level development zone in Beijing, part of which is the Yizhuang Science Park under Zhongguancun Scientific & Technological Park. About 80 percent of the total industrial output in the BDA is contributed by such high-tech pillar industries like pharmaceuticals, information technology, integrated mechanic-electronic products and new materials.[34)]

Tianjin Port Free Trade Zone is the largest free trade zone in northern China as well as the only free trade zone in northern China and north-western China. Tianjin Airport Industrial Park and Tianjin Airport International logistics Zone are composing the extensive areas of Tianjin Port Free Trade Zone.[35)] The three zones all belong to Tianjin Binhai New

34) www.chinadaily.com.cn(2007. 10. 20).
35) english.enorth.com.cn(2007. 10. 19).

Area, facing the northeast of Asia and connecting with 13 provinces and municipalities. In order to make Tianjin Port Free Trade Zone, Airport Industrial Park and Airport International Logistics Zone as the international logistics center serving northern China, the modern processing & manufacturing industrial park of bonded goods with sea and air ports advantages, the R&D and manufacturing base of hi-tech industries and the green channel for international merchandise, the three economic zones keep on pursuing high economic development standard, realizing new jumping and creating the best investment environment with the idea of totally, appropriately and persistently development, during the important development period with strategic opportunities.[36)]

Qinhuangdao is an emerging industrial city in Hebei Province. It has four pillar industries : machinery manufacture, metal rolling and casting, grain, oil and foodstuff processing and glass and construction material s.[37)] Qinhaungdao is trying to become the biggest food and oil processing base, sea outlet base of heavy equipment, 1 million ton ship building base, fine dry red wine producing center and glass producing and further processing base in the north of China. Qinhunangdao(秦皇島) Economic and Technological Development Zone (QETDZ) was established in October 1984 with the approval of the State Council of China.

It consists of two parts (East and West), covering a total land area of 111.76km^2 (92km^2 of the West and 19.76km^2 of the East).[38)] It covers a sea area of 23.81km^2 and has a coastline of 7.0km. By the end of 2002, the number of approved projects reached 3062, in which 578 projects are foreign investment, with a total investment of US$3.37 billion. The total amount of contracts was US$2.182 billion, and the actual value invested from the contracts was US$0.922 billion. The rest projects were domestic investment with a total investment of RMB Yuan 8.167 billion. At present,

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36) Op.cit.
37) www.qhd.gov.cn (2007. 11. 1).
38) www.qetdz.Com.cn (2007. 11. 1).

investors from as many as 28 countries and regions, including the United States, Germany, Japan, Australia, South Korea, Singapore, etc. have invested in QETDZ. A hi-tech industrial system, with electromechanical integration, biological engineering, new materials, new energy sources and information industry as major categories, has been basically formed. Some famous transnational companies, such as Bandy Company, Australia, Fujitsu Corp., Japan, LG International Group, South Korea, Chia Tai International Co. Ltd., Thailand, Demag Co. Ltd., Germany, TI Group, Britain and ADM Corp., US, and various other companies have invested in QETDZ. At present, QETDZ shows great potential in economy and has become the most important foreign investment area in Qinhuangdao, covering 70% of the total amount of foreign investment and foreign exchange earning of Qinhuangdao.

3. Shipper's Case Study

Larger shippers can negotiate the rate for their container and easily can get shipping space in time. From June 2007, at Tianjin and Qingdao sometimes the shipping companies in the route of Europe and Middle East could not satisfy the demand of shipping containers from the small and medium shippers. If the small and medium size shippers can not load their cargoes in proper time, they try to load their cargoes by transshipment at the ports of Busan, Singapore and others.

1) Beijing Hyundai Motor's Case

The major shareholder of Beijing Hyundai Motor(BHM) are established by Hyundai Motor Korea(HMK) and China's partner. As for inbound cargo the China partner does decide the logistics companies. The import is based mostly on fob but the export is based mostly on ex-work. For outbound

cargo Hyundai Motor Korea does decide the logistics companies. Before deciding of the logistics companies, HMK hears Beijing Hyundai Motor s opinion on the logistics companies. BHM has used the port of Tianjin. BHM export engine and the other parts to Russia, India, Malysia, Korea and Turkey. Some part shipped to Korea are exported again after reprocessing in Korea. HMK has been using the port of Busan as a transshipment hub for Russia and North America. HMK is considering BHM as a global sourcing hub.

HMK and GLOVIS, its logistics agent decide logistics company and shipping company by considering credit rating, cost, time, and the other factors. HMK and GLOVIS entrust the tasks of shipping for the export container to the forwarders on the basis of annual contract.

2) Daewoo Electronics' Case

The major shareholder of Daewoo Electronics Tianjin(DET)is Daewoo Electronics Korea. Its factory is located at the city of Tianjin. Their major products are microwave oven, refrigerator, washing machine and air conditioner.

As for inbound cargo, DET decide the logistics paths and companies. The volume of import container amounts to 1,200 TEU/year. The most of import container comes from Korea, Gwangyang, Incheon and Busan. Major commodities of the import container are motors, compressor and particles. For outbound cargo mostly Daewoo Electronics Korea or buyers decide the logistics paths and companies. The volume of export container amounts to 10,000 TEU/year. And the forwarders select the transshipment port for the export container. The most of export container is arrived at Korea, USA, CIS, Europe and the other countries.

〈Table 4-6〉 Daewoo Electronics Import Countries

Import		Departure ports	T/S ports
countries	share		
Korea	90%	Gwangyang, Inchon, Busan	
Hong Kong	5%		

Source : Daewoo Electronics Tianjin.

Annually Daewoo Electronics Korea decides the forwarders that will supply logistics service for their container cargo.

〈Table 4-7〉 Daewoo Electronics Export Countries

Export		Arrival ports	T/S ports
countries	share		
Korea	25%	Pyungtaek, Inchon, Gwangyang, Busan	
USA	30%	Miami,Lyndhurst, Lamilada, LA	
CIS	20%	Hamina(Finland),Almaty, Ukraina	
Europe	20%	Italy, Bulgaria, Germany, Poland, Spain	
Others	5%		

Source : Daewoo Electronics Tianjin.

Chapter Ⅴ. China Shippers□□Evaluation upon Shipping Service at Tianjin Port

1. Interaction of Shipper's Evaluation and Liners Decision

While liners decide their calling ports and size of vessels to deploy and port authorities consider the development plan of facilities, shippers should think about the conditions of location for their factories and then try to optimize their logistics activities. After shippers fix the allocation of factories, they will make a decision on logistics ; export and import port, liners, warehouse and so on.

As a demander for port service and shipping, shippers have an effect on logistics service. On the other hand, logistics providers e.g., liners and terminal operators as a supplier give shippers a variety of service and a chance for choice. Shippers would select a set of logistics service from the multiple sets supplied by different companies. Hence it is imperative that Korean ports should put an emphasis on the evaluation of Chinese shipper upon shipping services. Especially Busan port and Gwangyang Port partially have played a role of transshipment port for the shippers in Northern China regions.

2. Method and Data

The researcher at KMI travelled to visit major shippers in northern China. The researcher found that small and medium shippers in Qingdao and Shandong Province in China were not maintaining detailed data about

their origin and destination for shipped goods; only the general datum of Qingdao City and the inland trucking rate information was available.

In July and August 2007, the researcher has visited at Tianjin, Beijing (北京) and Hebei(河北) Province in China to meet the Chinese shippers. At Tianjin, Beijing and Hebei Province, the size of major companies is medium and large. There, we can find the famous companies, Hyundai Motors, Samsung Electronics, Daewoo Electronics, Hyosung and so on. Shippers inland transport path is simple, and ports for loading containers are fewer than those at Shandong Province. Previous papers of KMI and Nankai University of China in 2004 estimated the origination and destination share of Tianjin port.

Also while in China, KMI has did pilot survey of the questionnaire with Chinese forwarders and with Korea Shipping Companies Meeting at Tianjin. This survey is designed to collect data from shippers on their preferred liner attributes, including factors such as service, reliability, price, availability of direct, express or transshipment routes. A key variable will be preference over the nationality of the liners: do Korean companies in China place additional value on using a Korean owned liner, or are they just as happy using a Chinese owned liner. This is a key question because Korean owned liners are more likely to operate hubs in Korea, supporting the Korean transshipment and hub port industry. Following the pilot, we refined the survey for broader data collection.

CIFA Logistics Consulting Co., a subsidiary of China International Freight Forwarders Association, has done the work for the questionnaire for China Shippers choice behavior on shipping service. Investigators collected the answers through interviewing, visiting, telephoning, sending a facsimile message and so on from August 21 to September 20.

The location of major answerers was composed of Tianjin, Beijing and Hebei Province. The sample size was 500 manufacturing companies. The goal of answering was 50 case. Actually 70 answers were collected, among them 28 answers were adopted at Analytical Hierarchy Process (AHP)

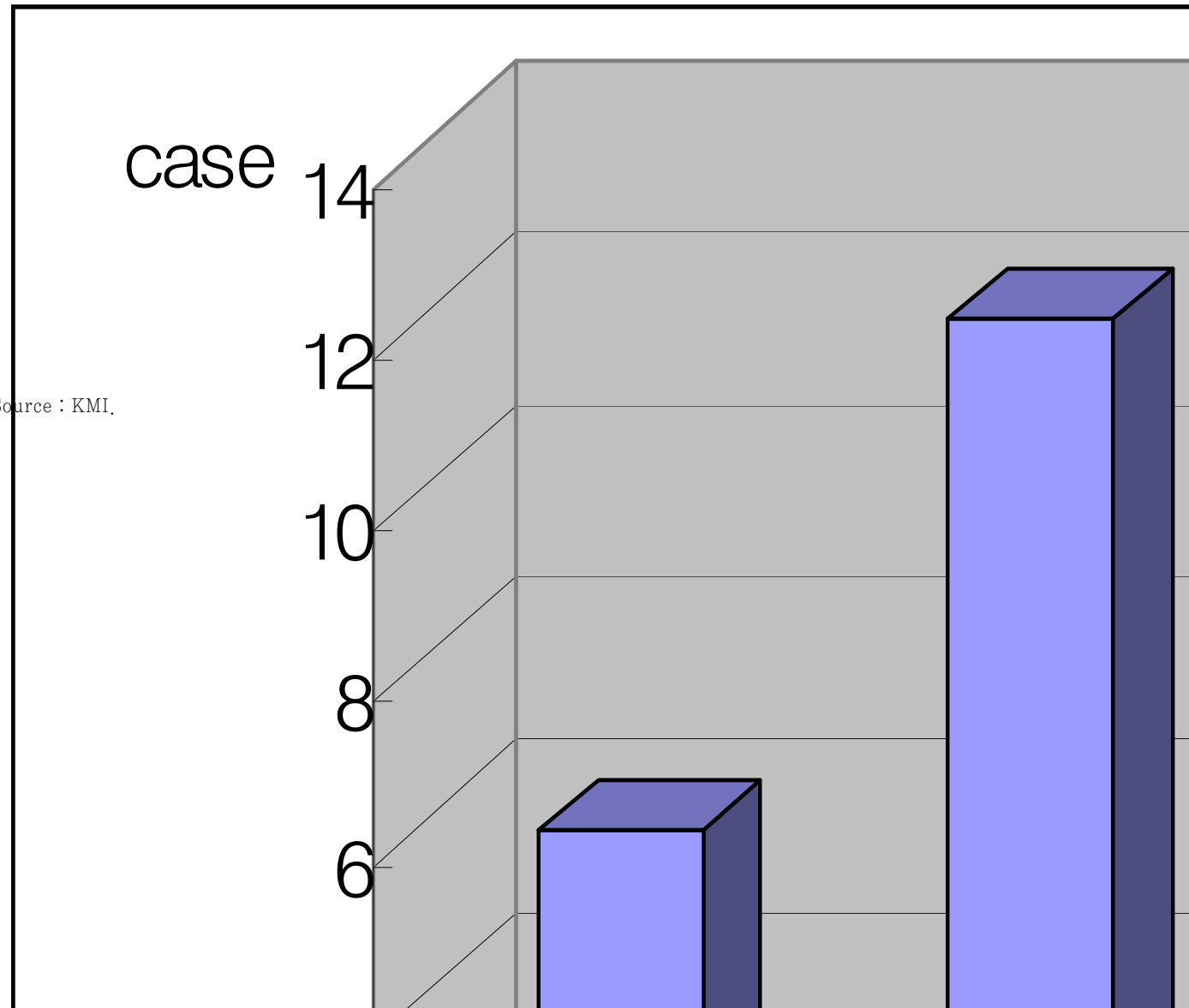
analysis. The ratio of inconsistency of answers is 0.12, lower than 0.15, a rejection value. Nevertheless major answers are from the medium and small size companies. Hence additional analysis is needed to get exact criteria of China shippers behavior by adding the opinion of larger size companies.

3. Answers and Results

1) Answers

Answering companies are mainly from under 100 TEU volume companies, 38.9% of the total. The ratio of medium size companies from 999 to 100 TEU volume is 33.3%. The larger size companies over 1,000 TEU volume account for 16.7% of the total. There are 11.1% of not answering companies.

〈Figure 5-1〉 Answering Companies by Annual Container Volume



Source : KMI.

In the questionnaire, 4 major factors of China shippers criteria for shipping are defined as follows: logistics cost, shipping service, vessel characteristics and company characteristics. Hence major factors can be divided into lower factors; logistics cost : inland transport cost from factory to the port, shipping cost from origin port to destination port and total logistics cost from origin factory to destination port, shipping service : frequency, credibility, direct service or not, wide feeder network and customs clearance, vessel characteristics : slots at the route and company total capacity, company characteristics : nationality and business service.

〈Table 5-1〉 China Shippers Criteria for Shipping Service

Item		Share			
		Total	Larger	Medium	Small
COST (subtotal)		0.475	0.362	0.616	0.397
	INLAND	0.068	0.049	0.068	0.056
	SHIPPING	0.204	0.211	0.274	0.210
	TOTAL COST	0.204	0.102	0.274	0.132
SERVICE (sub total)		0.275	0.348	0.174	0.397
	FREQUENCY	0.023	0.041	0.010	0.022
	CREDIBILITY	0.085	0.092	0.064	0.146
	DIRECT	0.063	0.066	0.041	0.093
	FEEDER	0.035	0.041	0.026	0.059
	CUSTOMS CLEARANCE	0.069	0.108	0.034	0.077
VESSEL (sub total)		0.158	0.176	0.123	0.103
	SLOTS	0.118	0.088	0.092	0.077
	COMPANYS TOTAL CAPACITY	0.040	0.088	0.031	0.026
COMPANY (sub total)		0.092	0.114	0.087	0.103
	NATIONALITY	0.015	0.019	0.015	0.017
	BUSINESS SERVICE	0.077	0.095	0.072	0.086
Inconsistency Ratio in Answer		0.12	0.130	0.05	0.02

Source : KMI.

2) Evaluation

(1) Total Answers of China Shippers

The answerers emphasize comparatively the factors as in follows: logistics cost(0.445), service(0.275), vessel characteristics(0.158) and company characteristics(0.092). China shippers are considering logistics cost as a first important factor.

For lower factors the answerers emphasize comparatively the factors as in follows: shipping cost(0.191), total logistics cost(0.190), slots at the route(0.118), service credibility(0.077), business service(0,077), direct service or not(0.062) and so on.

Generally, Chinese shippers tend to consider their criteria practically and economically.

(2) Larger Size Shippers

Larger size companies, over 1,000 TEU volume per year, emphasize comparatively the factors as in follows : logistics cost(0.362), service (0.348), vessel characteristics(0.176) and company characteristics(0.114). China larger size shippers tend to put more emphasis on service quality and vessel characteristics than medium size shippers.

For lower factors the answerers emphasize comparatively the factors as in follows: shipping cost(0.211), customs clearance service(0.108), total logistics cost(0.102), business service(0,095), service credibility(0.092), slots at the route(0.088), total capacity(0.088) and so on.

(3) Medium Size Shippers

Medium size companies, from 999 to 100 TEU volume per year, emphasize comparatively the factors as in follows : logistics cost(0.616), service(0.174), vessel characteristics(0.123) and company characteristics

(0.087).

For lower factors the answerers emphasize comparatively the factors as in follows: shipping cost(0.274), total logistics cost(0.274), slots at the route(0.092), business service(0,072), inland transport cost(0.068), service credibility(0.064) and so on.

(4) Small Size Shippers

Small size companies, beneath 100 TEU volume per year, emphasize comparatively the factors as in follows: logistics cost(0.397), service (0.397), vessel characteristics(0.103) and company characteristics(0.103).

For lower factors the answerers emphasize comparatively the factors as in follows: shipping cost(0.210), service credibility(0.146), total logistics cost(0.132), direct service or not (0.093), business service(0.086), customs clearance service(0.077) and so on.

3) Decision for Logistics Activity

(1) Maritime Transport

As for maritime transportation services in export, 63% of them were decided by importers, 31% by Chinese exporters and 6% by others. Also, as for transshipment ports in export, 56% of them were decided by importers, 18% by Chinese exporters and 13% by others. When it comes to inland transportation in China, most of the cargo owners used only trucks and a few of them used partially railways.

As for maritime transportation services in import, 55% of them were decided by Chinese importers, 35% by exporters and 10% by others. Also, as for transshipment ports in import, 59% of them were decided by Chinese importers, 18% by exporters and 13% by others. When it comes to inland transportation in China, most of the cargo owners used only trucks.

(2) Transshipment Port

① Shippers of export cargoes to North America

As for cargoes to the US, most of the Chinese shippers(81%) preferred direct shipment, and their intention to use Busan port or Shanghai port for their transshipment port varied according to the amount of cost reduction.

To the question whether they would use Busan port as a transshipment port; when there is over 30% of cost reduction, 6% of them said yes; 30%~25% of cost reduction, 3% yes; 25%~20% of cost reduction, 2% yes; 20%~15% of cost reduction, 6% yes; 15%~10% of cost reduction, 2% yes; and 10%~5% of cost reduction, 1% of them said yes.

To the question whether they would use Shanghai port as a trans-shipment port; when there is over 30% of cost reduction, 7% of them said yes; 30%~25% of cost reduction, 3% in yes; 25%~20% of cost reduction, 3% in yes; and 20%~15% of cost reduction, 3% of them said yes.

② Shippers of export cargoes to Europe

As for cargoes to Europe, most of the Chinese cargo owners(81%) preferred direct shipment, and their intention to use Busan port or Shanghai port for their transshipment port varied according to the amount of cost reduction.

To the question whether they would use Busan port as a transshipment port; when there is over 30% of cost reduction, 6% of them said yes; 30%~25% of cost reduction, 3% in yes; 25%~20% of cost reduction, 5% in yes; 20%~15% of cost reduction, 3% in yes; and 15%~10% of cost reduction, 3% of them said yes.

To the question whether they would use Shanghai port as a transshipment port; when there is over 30% of cost reduction, 7% of them said yes; 30%~25% of cost reduction, 2% in yes; 25%~20% of cost

reduction, 3% in yes; 20%~15% of cost reduction, 2% in yes; and 15%~10% of cost reduction, 2% of them said yes.

Conclusively most of China shippers tend to put an emphasis on service and logistics costs when they decide shipping service. Nevertheless lager sized shippers consider service more importantly than medium sized shippers. As for shipping for export and transshipment ports over half of them are decided by importers. Hence for transpacific routes, Korean ports should focus their marketing resources more on importers in North America continent. It would be proper means for Korean ports to improve quality of port service considering shippers criteria for transshipment.

Chapter Ⅵ. Model Building and Its Implication for Shippers□□Choice

1. Methodology

1) Approach

This chapter will develop a model of Chinese shippers' route choice behavior for shipping service and apply this model to analyze the among the Northeast Asian ports. In this model the shippers will strategically choose the logistics route to minimize their costs, which will predict the transshipment container throughput of hub ports throughout Asia. Predictions will be based on logistics costs, including the costs of transportation and storage and the costs of transit time from origin to final destination. This study will explain the choice behavior of shippers for shipping service by adopting the cost minimizing choice model.

2) Data

We are developing simultaneous approaches to the problem of understanding the factors that are important to shippers, and how shipper choices might influence volumes at ports. We begin with the premise that shippers do not themselves choose ports directly. Rather, the shippers choose liners, and with them the ports the chosen liners use for direct service and transshipment. The ultimate choice of port, done by the liners, can be thought of as a combination of derived demand from direct shipper demand for shipment with certain attributes, and idiosyncratic incentive agreements and negotiated contracts between ports and

shippers; this project will focus on the elements of derived demand by studying the shipper selection problem.

We are conducting two kinds of data collection to develop qualitative, behavioral and optimization models of shipper choice.

The first source of data is the data, produced by the filed survey and the questionnaire for Chinese shippers.

The second source of data is the PIERS database of imports into the United States, managed by Dr. Anderson. PIERS import data has information on two foreign ports of origin for each shipment: the origin port, and the last port at which the container was handled prior to being shipped to the United States. The first port is the origin port, and the second, if it is different, is the transshipment port. This data allows us to identify key features of shipments, and with basic information about liners' schedule structure from the origin region, we can study the choices of liner and service (express, direct or transshipped), and thus ports, to learn what is important to shippers.

3) Methods

KMI's shipper survey provided qualitative data on features that shippers state to be important. We wrote a summary of shipper comments, along with presenting tables of results to qualitative questions. This also helps us identify the key variables for inclusion of theoretical and behavioral statistical models.

The behavioral statistical model leverages the PIERS data to understand how shippers weigh various factors in making a choice of liner and service, and therefore shipping route. This provides some validation of the survey results, based on a large sample of observed choices.

Formally, we are adopting a perspective of random utility (Luce 1959), in which the utility the shipper receives for shipment *i* from choosing liner service *j* is represented by $U_{ij}=V_{ij} + \varepsilon_{ij}$, where V_{ij} is a known (to the

investigator) component of utility based on the described attributes, and ε_{ij} is an unknown component, treated as random to the investigator, based on both the measured attributes and other factors which are idiosyncratic to the shipper or shipment, unknown, or for which we do not have or cannot get data. When evaluating a choice among services, the shipper compares the utility from each service and selects the one yielding highest utility. From our perspective as investigators, who do not know ε, the probability service j is chosen is $\Pr(Y_i=j)=\Pr(U_{ij}=\max_k(U_{ik}))= \Pr(V_{ij}+\varepsilon_{ij}=\max k(Vik+\varepsilon ik))$. The observed portion of utility can be modeled as $V_{ij} = X_{ij}\beta$, where X_{ij} is a vector describing the attributes of service j and β is a vector of weights on those attributes. Note that the attributes of service j can be specific to the shipment, such as the freight charge to service j from the foreign origin port, or the distance to shipment i's final inland destination.

A conditional logit model will treat all services as substitutable in equal proportion, though this might not be true if shippers are in the hurry, and or have a preference for lower costs associated with transshipment services. Therefore, we will try to model service choice as a two level choice: first, a choice among direct services and transshipment services, and then a choice among services within each of those categories. The probability of choosing service type (direct, express, transshipment) m, with attributes Z_{im} that differ between service types but are shared among ports within service type m, from service types 1,…, M, is given by

$$\Pr(Y_i = m) = \frac{\exp[Z_{im}\gamma + \theta_m I_m]}{\sum_{l=1}^{M} \exp[Z_{il}\gamma + \theta_m I_m]},$$

where

$$I_m = \ln\left[\sum_{j=1}^{J_m} \exp\left[\frac{X_{ij}\beta}{\theta_m}\right]\right]$$

is the "inclusive value" that captures the expected maximum utility from the services within service type *m* the maximum utility is of interest because it is the option within service type *m* that the router will select, but it is an expected maximum from the researcher's perspective because the router's utility function is not completely known. The nested logit model reduces to the conditional logit model when m=1 for all *m*.

The overall probability of choosing service *j* is the joint probability of choosing *j*"s service type *and* service *j* within that coast. Estimation of the random utility parameters β and γ, as well as the inclusive value coefficients, is carried out via the method of maximum likelihood.

To apply this logit model, the PIERS data will need to be supplemented with information the available service type and service alternatives for specific shipments. We anticipate compiling information from shipping companies on regional shipping schedules for a subset of the PIERS data, that originating from Tianjin/Hsinkang, our focus port in northern China. This will allow us to establish shipping times for available alternative services for each shipment. We will include liner nationality and a measure of liner quality as attributes of the service.

2. Analysis of Port Choice Data

The Port of Tianjin includes terminals in both Tianjin and Xingang, which are listed as separate origins in the PIERS database. For purposes of this analysis, we aggregate shipments originating at these two terminals. There were 144,434 shipments originating at Tianjin/Xingang, totaling 383,876 TEU. Most of these were handled (loaded on the ship that delivered them to the US) at intermediate transshipment hubs. 〈Table 6-I〉 shows the top 10 last ports of handling for shipments destined for the top US ports.

〈Table 6-1〉 Last Port of Handling for US-bound Cargo Originating in Tianjin/Xingang

Last Port of Handling	TEU	Shipments
BUSAN	158637.5	64734
XINGANG	137320.49	47229
TIANJIN	30204.84	11851
HONG KONG	10124.22	3173
KWANGYANG	8802.34	2548
SHANGHAI	8069.98	3188
NINGPO	6160.56	2195
SHEKOU	6151.36	2297
YOKOHAMA	5384.99	1643
CHIWAN	4402.1	1647

Source : PIERS.

Shipments with a last port of handling of Tianjin or Xingang are direct shipped. Transshipment through Busan is the most common route from Tianjin/Xingang, when direct shipment from the two terminals is counted separately. Busan handles for 41.3% of total TEU from the region, while 43.6% of TEU are direct shipped. Hong Kong handles the next most TEU, but is a far smaller player, handling only 2.6% of TEU. Therefore, this study will focus on the choice of whether to direct ship cargo from Tianjin/Xingang or to transship it through Busan.

1) Liner Activity

The tables below show the top ten shipping lines doing direct shipment to the US from the Tianjin and Xingang terminals, as well as the top ten shipping through Busan.

Perhaps it is not surprising that there is some tendency for large Chinese liners to be the largest direct transport from the Chinese ports, and for the Korean liner Hanjin to be the largest through Busan. This suggests that the structure of companies' hub-and-spoke networks is a factor in determining cargo routes. This also means that Busan's role as

a transshipment hub may be threatened by expansion of direct transport capacity from Chinese liners headquartered in growing Chinese ports. However, other factors must play a role also, as the CSCN is the second largest liner transshipping through Busan.

〈Table 6-2〉 Major Shipping Lines by Last Port of Handling

Liner	TEU	Shipments
Tianjin		
CSCN	14283.88	4863
MLSL	5850.7	1879
CACG	3994.32	1972
YMAL	927.8	645
KLIN	805.04	303
CSCO	755.93	859
CNFT	738.04	217
HYMM	449.98	136
OSKL	438.39	166
NYKL	381.81	124
Xingang		
CSCO	45126.02	13501
MLSL	27314.19	8206
AMPL	14299.19	3894
HYMM	12059.82	4098
YMAL	10019.72	5068
KLIN	7066.6	2029
OSKL	5206.04	1388
MDSC	2309.15	853
OOCL	1974.4	652
CACG	1927.1	1742
Busan		
HJSC	26203.52	10577
CSCN	18058.06	6992
OOCL	13613.14	5085
EVER	12474.75	4571
MDSC	12262.46	4449
HYMM	10152.06	3645
YMAL	9954.13	6292
NYKL	9435.62	2065
AMPL	7669.56	2251
LLTR	7002.12	2629

Source : PIERS.

2) Destination Ports

Examining the US ports to which the shipments that are direct rather transshipped are destined can help identify the routes on which there is the most competition.

Cargo being directly shipped out of Tianjin/Xingang is overwhelmingly headed to Long Beach and Los Angeles, and to a lesser extent other west coast US ports. While transshipment through Busan is not uncommon for those ports, a major role played by Busan is as a place for cargo to be transferred to vessels going to east coast US ports, especially New York.

〈Table 6-3〉 TEU Volume at US Destination Ports by Last Port of Handling

	Busan	Xingang	Tianjin
CHARLESTON	3,648	466	29
HOUSTON	245	1,186	18
LONG BEACH	52,789	61,834	6,075
LOS ANGELES	20,577	47,050	19,239
NEW YORK	29,517	2,135	322
NORFOLK	4,383	645	80
OAKLAND	7,107	11,577	3,111
SAVANNAH	8,638	1,223	66
SEATTLE	16,490	1,339	162
TACOMA	15,243	9,866	1,103

Source : PIERS.

3. Leading Shippers

Understanding the dynamics of route choice also requires understanding who is shipping. Table IV shows the leading companies shipping from Tianjin/Xingang to the US, with section a showing the leading direct shippers, and section b showing those routing through Busan.

The list of leading shippers indicates some shippers do an enormous amount of business at Tianjin, with 11 companies each shipping more than 1000 TEU each. Notably, these companies are a range of nationalities, including American companies like General Electric and Pacific Cylces, Canadian companies like Dynamic Tire, Chinese companies like Gloveco, Japanese companies like Yamaha and Toto, and even Korean companies like LG.

〈Table 6-4〉 **Leading Direct Shippers**

Shipper	TEU	Shipments
(Consolidated)	28320.88	9712
GENERAL ELECTRIC	9319.71	647
PACIFIC CYCLES	4484.78	220
L G ELECTRONICS	2606.35	433
FNS	2227	514
DYNAMIC TIRE	2171.61	368
GLOVECO	1318.66	661
TOTO	1195.55	116
W F WHELAN	1026	166
YAMAHA CORP OF AMERICA	1024.65	43
STAR PIPE PRODUCTS	1016.92	307
L G SOURCING	953.75	258
ASHLEY FURNITURE IND	888	444
FNS IN LAX	886	238
MASTERBRAND CABINETS	884.66	336
BAOAM INTL INVESTMENT	879.32	187
STANLEY FURNITURE	837.92	99
STANLEY BOSTITCH	819.49	115
JCA	809	242
FNS CUSTOMS BROKERS	779.72	148
J C PENNEY	753.48	175
INTERCON	727.85	281
THOMSON DISPLAYS	723.56	55
ENTERTAINMENT LTD	710.24	116
COSA FREIGHT	709	223

Source : PIERS.

〈Table 6-5〉 Leading Shippers Transshipping in Busan

Shipper	TEU	Shipments
(Consolidated)	38277.84	12477
MIDWEST AIR TECHNOLOGIES	2875.85	462
L G ELECTRONICS	2605.7	557
SAMSUNG ELECTRONICS	2129.41	643
DYNAMIC TIRE	1820.62	338
WORLD KITCHEN	1765	132
LEGACY CLASSIC FURNITURE	1519.07	676
HOME ESSENTIALS & BEYOND	1346.13	156
LANE FURNITURE	1339	150
PILLOW KINGDOM	1144	393
TARGET STORES	970.19	331
CAI	956.06	107
ROOMS TO GO	903	222
OLYMPIC FOUNDRY	884.16	94
STAR PIPE PRODUCTS	863.28	322
SONY	857.12	103
DMI FURNITURE	824.32	286
NORTH VERNON IND	809.18	33
HUNTER DOUGLAS	777.37	28
J C PENNEY	759.76	156
L G SOURCING	737	201
COSTCO WHOLESALE	711.64	365
TABLETOPS UNLTD	670	181
GREENBALL	665.63	250
GLOVECO	654.36	330

Source : PIERS.

Examining the companies transshipping through Busan reveals much the same pattern as the set of companies who are direct shipping: there are a fair number of companies that do a large volume of business, and they come from a range of nationalities. However, two of the top three companies are Korean.

It is also interesting to note that several companies show up on both lists: LG Electronics, LG Sourcing, Dynamic Tire, J.C. Penney and Gloveco use both transshipment and direct shipment regularly enough to be among to top companies on both tables. What are the factors that govern their

choice of route? One factor might be the availability of direct routes to the US ports of interest. The 〈Table 6-6〉 shows the number TEU directly shipped and transshipped for each US port for these four companies.

〈Table 6-6〉 TEU Shipped on Each Route by Leading Companies

	Transshipped		Direct	
	TEU	Shipments	TEU	Shipments
CHARLESTON	373	93		
LONG BEACH	2,122	519	943	268
LOS ANGELES	1,907	366	4,948	913
NEW YORK	583	179	3	1
NORFOLK	8	4	7	4
OAKLAND	844	242	1,183	554
SAVANNAH	290	82		
SEATTLE	231	47	2	1
TACOMA	219	50	718	154

Source : PIERS.

While Charleston and Savannah are never accessed directly, and other east coast ports are accessed directly only rarely, major west coast ports are routinely accessed both directly and through connecting in Busan. Clearly a more complex set of factors is in play in the decision of whether to transship through Busan, and we understand that through the logit analysis of choice data. The next section presents a logit analysis of shipments from Tianjin to the major west coast ports of Los Angeles, Long Beach and Oakland.

4. Constructing Data for Choice Analysis

Our hypothesis is that freight charges and shipping time are the major factors that determine whether a shipment is directly route or transshipped in Busan. However, country affiliation of the shipper (e.g.,

Korean companies may be more loyal to Busan, other things equal), possible delays associated with making a connecting vessel, or other shipment-specific factors may also play a role. The question is how large a factor these are relative to cost and time, and whether there is an opportunity to Busan to implement policies that make transshipment more attractive relative to direct shipment.

The PIERS database provides us with extensive information on shipments, and we have supplemental databases providing limited information on shipping times. From this, we have choice observations that will serve as a basis for a logit model. However, the PIERS data describes only the attributes of the route that is actually chosen in each observation. The logit analysis compares the attributes of the chosen port to that of the unchosen ports to infer the weights on the key route attributes that make the set of observed choices most likely. Therefore, it is also necessary, for each shipment, to construct the key variables for the unchosen route.

Unfortunately, the major variables of *SeaTime* and *FreightChargeare* available only for the chosen alternative, and must be constructed for the unchosen alternative. We impute these variables based on available data from observed choices. The sections below describe our preliminary models for constructing these variables.

1) Imputing SeaTime

As mentioned above, SeaTime varies not only with route, but also with the liner, and even service within a large liner, that is chosen by the cargo router. Which liner and service would have been chosen by the cargo router for each alternative port is not available, so we construct a simple linear regression models for each foreign port-US port pair to predict the selected length of SeaTime, as a function of a constant (average), TEU and cargo value, as well as route-specific variables. We choose these variables

because larger shipments and shipments of higher value may be needed faster, and may be more likely to put on direct, express or faster services when available.

The simple model below shows the effects of key variables on shipments for which our supplemental schedule database has shipping time information. The analysis focuses on only shipments to Los Angeles, Long Beach and Oakland, as we do not have schedule information to other ports. This database provides the time from Busan to the US port chosen or from Xingang to the US port chosen; there is no service from the Tianjin terminal in our database (though shipping times are likely similar). We were able to identify scheduled shipping times for 21,014 of the 86,664 shipments from Tianjin/Xingang to the US in our sample.

Source	SS	df	MS	Number of obs =	21014
				F(11, 21002) =	14078.39
Model	124764.251	11	11342.2046	Prob > F =	0.0000
Residual	16920.1836	21002	.805646301	R-squared =	0.8806
				Adj R-squared =	0.8805
Total	141684.434	21013	6.74270377	Root MSE =	.89758

seatime	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]
LA	12.14039	.0694221	174.88	0.000	12.00432	12.27646
LB	10.17418	.0689611	147.54	0.000	10.03901	10.30935
OAK	14.36692	.0777586	184.76	0.000	14.2145	14.51933
dLA	3.371638	.1040873	32.12	0.000	3.165901	3.577374
dLB	3.033535	.1113378	29.14	0.000	2.829516	3.237554
dOAK	1.573581	.0211184	14.13	0.000	1.35535	1.791811
lnteus	-.0066844	.0078423	-0.32	0.752	-.0480782	.0347093
lnval	-.1499034	.0117545	-19.11	0.000	-.1652749	-.134532
lntons	.2104722	.0117545	17.91	0.000	.1874324	.233512
dteus	.0080716	.0295023	0.27	0.784	-.0497552	.0658985
dvalue	.1302018	.0118053	11.03	0.000	.1070625	.153341
dtons	-.2064162	.0171772	-12.02	0.000	-.2400849	-.1727476

The model is estimated without a constant, so the indicator variables for each destination port indicate the relevant average shipping from Busan, about 10 days to Long Beach, 12 to Los Angeles and 14 to Oakland; Oakland is usually served after a stop in Los Angeles. The d-(port) interaction variables show additional time involved in direct shipping from Xingang, about three more days to Los Angeles and Long Beach, and about 1.5 days to Oakland. The other variables indicate how features of the shipment affect time. Most likely the mechanism causing variation is that shippers of certain cargos seek out faster routings. This model indicates that the size (number of TEUs) of the shipment matters little, and that lighter and more valuable shipments are put on faster connecting services. Value and weight interacted with the direct indicators (d-attribute) offset the primary effect, leading to no net difference.

This vanishing attribute-based variation in direct service predictions reflects that there is little variation in available services, there are only a few ships going to North America from Xingang, and they all go at about the same speed. In fact, while the transshipment times used in the port choice model are the predicted values from this model, plus four days for feeder service and transfer, constant values are substituted for direct service. Values of 14 days for direct service to LA, 15 for Long Beach and 17 for Oakland explain the choice data better than the predictions of this model. These values are used in all subsequent analysis.

2) Imputing Freight Charge

In addition to how long the unchosen route would have taken a shipment, we need to know how much it would have cost. The freight charge field in the PIERS dataset is itself a statistical prediction of freight charge calculated by PIERS, as a function of shipment and route characteristics. If we had this model, it would be possible to generate predictions from it to determine what the freight charge would have been

had each of the other nine ports been chosen. However, the PIERS model is proprietary. Instead, we predict freight charges for the unchosen ports by regressing the PIERS predicted freight charges on shipment and route characteristics for the 85,770 observations from Tianjin/Xingang that we have with realistic predicted freight charges,[39] effectively trying to recover the PIERS model. The coefficients of this regression can then be used to predict comparable freight charges for the unchosen routes for each shipment.

Freight charges are predicted by regressing the log of the PIERS-calculated freight charges on characteristics of the shipment and the shipping route. Shipment characteristics include log of the shipment value, log of shipment weight, log of the number of TEU, indicators for whether the container is hazard or reefer.[40] Most variables are also interacted with ln(TEU). Below are the results of this model.

```
  Source |       SS       df       MS          Number of obs =   85770
---------+------------------------------       F( 13, 85756) =37191.97
   Model |  194957.829     13   14996.756       Prob > F      =  0.0000
Residual |  34579.0202  85756  .403225666       R-squared     =  0.8494
---------+------------------------------       Adj R-squared =  0.8493
   Total |  229536.849  85769  2.67622158       Root MSE      =    .635
```

39) We exclude from analysis observations larger than 0.5 TEUs and predicted freight charges greater than $10,000 per TEU. These are unrealistically high values, even considering the nature of the cargo, and clearly artifacts of the form of the PIERS model that are outliers in our model.

40) Log values are shifted to avoid undefined or negative values for small shipments. Thus lnTEUS=ln(TEUs+1), lnval=ln(value+1) and lnmtons=ln(mtons+.01).

lnfchg	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]
seatime	-.38682	.0032422	-11.93	0.000	-0450367	-0323273
lnteus	1.021112	.0301362	33.88	0.000	.9620451	1.080179
lnval	.3409766	.0030993	110.02	0.000	.334902	.3470512
lnvalteu	-0282448	.0030552	-9.24	0.000	-.034233	-0222566
lntons	.490631	.0046915	104.58	0.000	.4814357	.4998262
lntonsteu	-0803686	.0033535	-23.97	0.000	-0869415	-0737958
hazmat1	-0367724	.0118124	-3.11	0.002	-0599246	-0136202
reefer1	.0157245	.0283348	0.55	0.579	-.0398115	.0712605
direct	.2266739	.0177306	12.78	0.000	.1919221	.2614257
directteu	.0586164	.0107684	5.44	0.000	.0375104	.0797224
directtons	-.029608	.0044131	-6.71	0.000	-0382577	-0209584
LA	.0839292	.0048091	17.45	0.000	.0745035	.0933549
OAK	.0618813	.0122444	5.05	0.000	.0378824	.0858802
_cons	2.656378	.0431266	61.59	0.000	2.571851	2.740906

The model fits reasonably well, with an R-squared of 0.85. Consistent with expectations, shipments that are have more TEU, are heavier, and are more valuable cost more to ship. The US destination port also affects the charge, most likely because of the different distances and port fees associated with those ports. Direct shipment is more expensive, and slower routes are less expensive.

This model is used to predict the charge that would have been levied had the other route been chosen. For consistency, although the PIERS estimate is available for the chosen route, the prediction of this model is used for both routes.

5. Logit Choice Analysis

The analysis above completes the set of the variables on which we hypothesize route choices are made. Since there are two available routes of interest (direct and through Busan), we use a binary logit model. The choice of route is modeled as a function of ln*dfchg*, the log of the

transshipment cost premium over direct shipment (Busan price-direct price),[41] *dseatime*, the transshipment time premium over direct shipment (Busan time-direct time), the interaction of ln*dfchg* and log TEUs and the log of the number of TEUs in the shipment, and the log of the weight of the shipment. The dependent variable is 1 when the shipment is shipped directly. The results of the model, on the 85,770 observations with reasonable predicted freight charges are in the table below.

Logistic regression — Number of obs = 85770
LR chi2(5) = 14232.05
Prob > chi2 = 0.0000
Log likelihood = -50533.586 — Pseudo R2 = 0.1234

direct	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]
lndfchg	1.671986	.0308655	54.17	0.000	1.611491	1.732482
dfchgteu	.0098555	.000185	53.29	0.000	.009493	.010218
dseatime	.3928663	.0055442	70.86	0.000	.3819998	.4037328
lnteus	2.175024	.0367488	59.19	0.000	2.102998	2.24705
lnval	1.208079	.0164519	73.43	0.000	1.175834	1.240324
_cons	-2.536911	.0901436	-28.14	0.000	-2.713589	-2.360233

This model correctly predicts 70.6% of the observations, a meaningful improvement over the 50% baseline of random choice. The positive coefficient on the freight charge variable means that the more expensive than transshipment is than direct shipment, it is more likely that the shipper will choose the direct route. This difference is larger still for larger (more TEUs) shipments, possibly reflecting the greater sophistication of large shippers, or greater sensitivity to differences in larger amounts of money. This results uses choice data to corroborate the AHP analysis of the survey data; shippers care primarily about cost. Similarly, the positive seatime coefficient indicates that shippers are more likely to choose the direct route if it is faster. Other things being equal, larger shipments and more valuable shipments are more likely to be

41) The log of the difference is defined as sign(*dfchg*)*ln(abs(*dfchg*)+1).

shipped directly. The negative constant indicates a representative shipment is more likely to be transshipped through Busan, however it is important to note that it may also capture any inaccuracy in the (average) amount of time assumed into the seatime calculation for feedering and transferring in Busan; a change in the difference in seatime would also enter the model as a linear constant.

While correctly predicting 70% of the observations is a fair rate, focusing the analysis on only larger shipments, those greater than half a TEU, indicates the coefficient results are robust, but predictive power is much higher.

Logistic regression	Number of obs	=	68353
	LR chi2(5)	=	20823.19
	Prob > chi2	=	0.0000
Log likelihood = -34683.641	Pseudo R2	=	0.2309

temp	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]
lndfchg	5.823883	.1013452	57.47	0.000	5.62525	6.022515
dfchgteu	.0104183	.0004539	22.95	0.000	.0095287	.0113078
dseatime	.4513777	.0069514	64.93	0.000	.4377532	.4650022
lnteus	5.137362	.0990205	51.88	0.000	4.943285	5.331438
lnval	2.812037	.0278022	101.14	0.000	2.757545	2.866528
_cons	3.334493	.3904364	8.54	0.000	2.569251	4.099734

This model correctly predicts 76.3% of the sample, and the model has lower overall variance, reflecting that these larger shipments get greater consideration in routing.

Including in the model indicator variables for the shipping line chosen increases predictive power, with essentially similar coefficients, to 87.3%, but much of this predictive gain arises because not all liners offer direct service, and their shipments can be very accurately predicted as they will

transship regardless.

To test whether the shipping company's country of origin affects routing choices, we attempted to identify the national origin of major shippers. We identified 84 companies that shipped more than 100 shipments in our dataset. Of these, we were able to Google company name and shipped product information to find the company's web site, and with it the company's country of origin for 79 companies. (The five other companies had names so non-specific it was not possible to identify them conclusively.) Of the 79 companies, five are Chinese, three are Korean, 65 are American, and five are from other countries. We added indicator variables for these large shippers to the logit model and found the country of origin to be a significant factor.

Logistic regression Number of obs = 68353
LR chi2(9) = 21661.07
Prob > chi2 = 0.0000
Log likelihood = -34264.7 Pseudo R2 = 0.2402

temp	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]
lndfchg	5.939894	.1024247	57.99	0.000	5.739145	6.140643
dfchgteu	.0107878	.0004571	23.60	0.000	.0098918	.0116837
dseatime	.4616313	.0070315	65.65	0.000	.4478498	.4754128
lnteus	5.275468	.0949472	52.61	0.000	5.07892	5.472015
chinaco	1.03183	.0556755	10.87	0.000	.8457366	1.217923
koreaco	-1.437435	.0249864	-25.82	0.000	-1.546557	-1.328313
usco	-.1052857	.0515156	-4.21	0.000	-.1542582	-.0563132
otherco	.1292624	.0283417	2.51	0.012	.0282937	.2302311
lnval	2.889416	.0283417	101.95	0.000	2.833868	2.944965
_cons	3.194259	.3929534	8.13	0.000	2.424084	3.964433

The addition of the *chinaco, koreaco, usco* and *otherco* variables increases the predictive accuracy of the model to 77.2%, a modest improvement. While the magnitude and significance of the major variables

in the previous models stays essentially the same, the country variables tell a surprising story. Large US and other country shippers are, as a group, only slightly differently likely to direct ship than smaller shippers, regardless of country. However, large Korean shippers and large Chinese shippers are much more likely to use the port of their home country as the port of record for exporting to the US: Chinese companies are more likely to direct ship, and Korean companies more likely to transship through Busan, than smaller shippers, or shippers from other countries. Since this result relies on choice from only a few companies in each country, it is not a strong one, but the result is surprisingly intuitive.

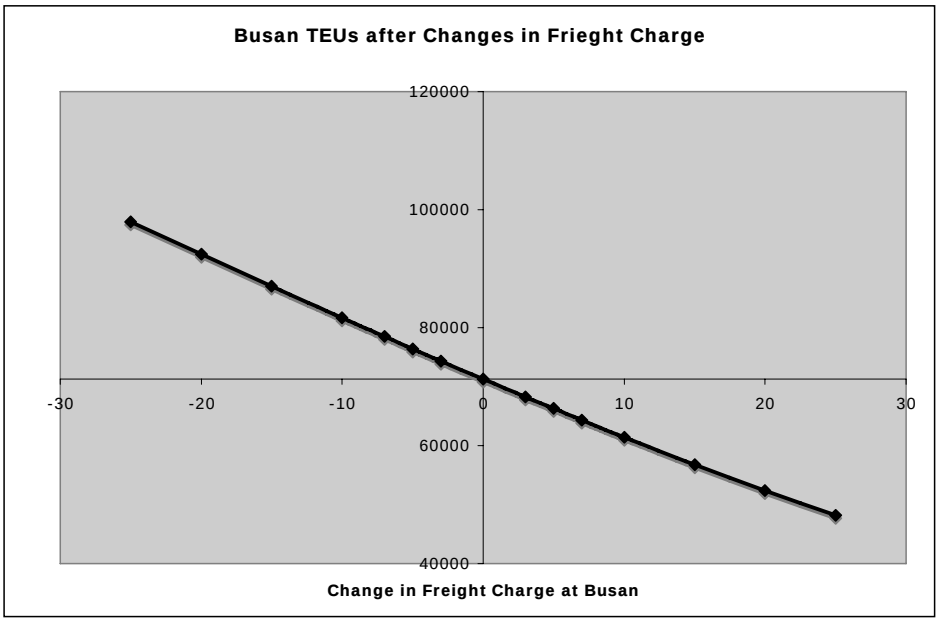
1) Freight Charge Results

The model generates predictions of the probability each shipment chooses direct or transshipment. By multiplying the probability of transshipment by the number of TEUs for each shipment and summing across shipments, it is possible to calculate the expected number of TEUs being sent through Busan. The large shipment model uses data on a total of 223,963 TEUs, of which 78,588 are actually transshipped. The model predicts 71,276 TEUs will be transshipped, underestimating the actual number by 10%. However, using this as a baseline, the values of the independent variables can be changed to measure their effect on the demand for transshipment services at Busan, from the subset of the market being considered in the analysis.

The 〈Figure 6-1〉 shows the number of TEUs expected at Busan following a change in the freight charge, per TEU, at Busan. At current transshipment charge rates of $150/TEU, a unilateral 10% increase ($15) in freight charges at Busan would result in a demand reduction of 14,500 TEUs, while a 10% decrease in fees would result in an additional 15,700 TEUs. Since the model is responsive only in differences in freight charges, if Tianjin/Xingang matched a fee increase or reduction, there would no net

change predicted, and if Tianjin/Xingang unilaterally reduced fees, it would have the same effect as if Busan unilaterally raised its fees.

〈Figure 6-1〉 The Effect of Changes in Freight Charge



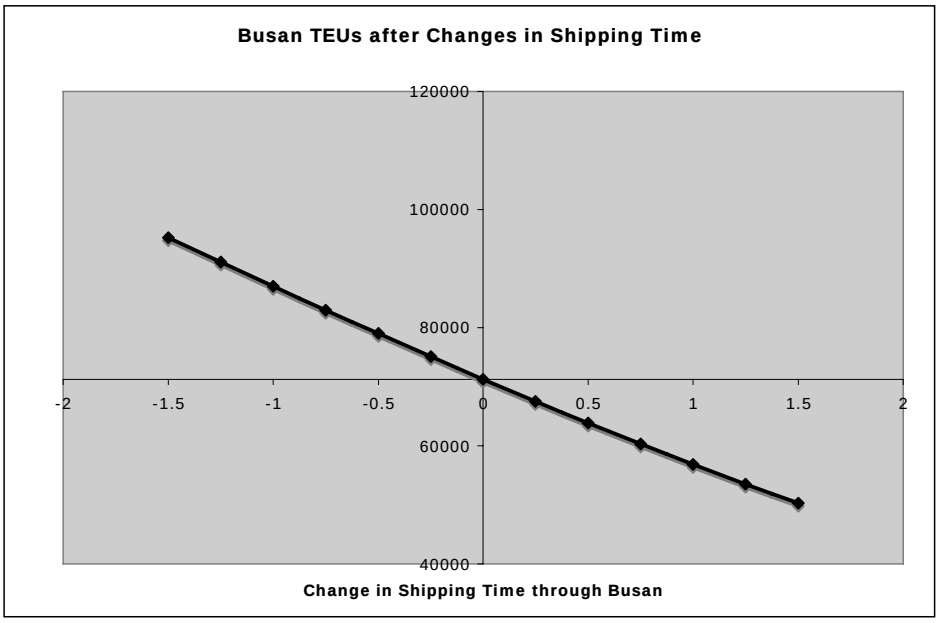
2) Shipping Time Results

Many of the investments being made a Busan New Port are focused on speeding port services and transshipment. These include RFID technologies, better terminal handling and reduction of congestion, and also incentives to increase feedering services, so shipments do not need to wait as long for a feeder ship, and can make trunk line vessels leaving sooner. Using the same technique as above, it is possible to predict demand at Busan following changes in shipping time.

The 〈Figure 6-2〉 shows the number of TEUs the model predicts to be demanded at Busan following changes in the time of transshipment. If improvements make Busan half a day faster, on average, than

Tianjin/Xingang then it should expect an additional 7,700 TEUs, but if it becomes half a day slower than Tianjin/Xingang, it will lost 7,400 TEUs.

〈Figure 6-2〉 The Effect of Changes in Shipping Time



Chapter Ⅶ. Conclusion

1. Conclusion

Shipping companies in large size or small-medium size have continually adjusted their strategy to focus their capacity on newly emerging and continuously growing markets. In Northeast Asia by early 2000s liners in trunk route selected those ports as regional hub ports, which are Kobe, Tokyo, Yokohama, Shanghai, Qingdao, Busan, Gwangyang and Kaoshiung. At those times the Chinese Northern ports were regarded as trivial by shipping companies, because the amounts of container at the Chinese Northern ports were much smaller than those of regional hub ports. Hence mother vessels in trunk route could not enter into Chinese Northern ports.

From mid 2000s the strong demand for container movement of Chinese shippers has enticed ocean going shipping companies to allot more slots on China routes than the other routes. Even at Chinese Northern ports shipping companies could produce higher utilization of their slots, earn more revenues and deploy larger vessels at the ports. In addition shipping companies have included Chinese Northern ports into calling ports in trunk route.

Therefore recently shippers in Chinese Northern regions, e.g. Qingdao, Tianjin, Beijing, Hebei, Liaoning, Heilongjiang and Jirin, are facing with diverse alternatives of shipping service : direct shipping service, T/S service through Chinese hub ports, T/S service through foreign hub ports and sea express service.

On the other hand, the enlargement of direct shipping service in China market would threaten the feedering network of neighboring foreign ports : Busan, Gwangyang, Kaoshiung, Kobe and etc. Especially in 1990s the

feedering network of Busan port had been so stubborn that a lot of shipping companies including Chinese liners could supply shipping service to Chinese Northern ports through Busan port. To maintain their role of hub port and to enlarge their market share, Korean ports have been adopted several means : port tariff cut, building Free Trade Zone at the port background site, reform of customs clearance procedure and so on. Nevertheless there have been few policy and means which are directly focusing on Chinese shippers.

This study surveyed choice behavior of Chinese shippers by using two methodology : AHP analysis and logit model. In AHP analysis we collected the answers of the questionnaire to Chinese shippers at Tianjin port and analyzed the answers. Contrarily to this AHP analysis, the logit model used the enormous PIERS(the Port Import Export Reporting Service) data produced by US Customs Administration.

The logit choice analysis largely confirms the major conclusions of the survey analysis, to the extent that we can adequately measure the variables presented in the survey with customs data. The most statistically and economically significant variable is cost, the component that emerged as most important in the AHP analysis. Shipping time was also a statistically and economically significant determinant of choice. This is a large, though not the only, component of service, and the only one that is easy to measure in the shipping choice data. This is also consistent with the AHP's conclusion that service is very important, even though we were unable to measure all service components in the logit model. Finally, the shipper's country played a small but significant role in determining choice, a key company factor that also emerged in the AHP analysis of the survey.

We have thus taken two approaches to understanding the choice of shippers at Tianjin/Xingang to ship directly or to transship using Busan. The survey allowed the responding shippers to characterize their preferences very generally, and across a broad range of routes, but was

limited to the relatively small set of shippers who responded. The logit analysis focused on a single set of routes, and had limited measures of some determinants of shipping choices, but included a broad sample of data from a very broad range of shippers. From these two different approaches emerges essentially the same set of conclusions: cost is most important, service (especially shipping time) is also quite important, and there are some idiosyncratic features of the company shipping that play a somewhat smaller role.

2. Suggestion

1) Korean Government

In Northeast Asia competition for hub ports has stimulated the governments, policy makers and port authorities to invest larger budget to develop logistics facilities : container terminal, port hinterland, road network, railway and so on. Due to its quick decision system of socialism , China has strength in view of speed of development of social infrastructures.

But in Korea it is difficult for policy makers to disregard opinions from different interest groups and to make quick decision for policy establishment. Furthermore the logistics providers, e.g., shipping companies, forwarders, integrators in air transport and global terminal operators, tend to input their resources into the promising markets. Hence it would be better for the Korean government to try to find the specific strength and merit in logistics area which other countries can not make easily and soon.

We could suggest some means which could be gained from the field survey about choice behavior of Chinese shippers and from the logit model about behavior of Chinese shippers who moved their exports cargoes to

American countries in 2005.

First, as the freight rate at Chinese ports is rising, higher than the rate at Korean ports, ocean going shipping companies tend to evade T/S activities. Hence it is essential for the Korean government to guarantee proper revenue for larger shipping companies. If shipping companies will operate their own container terminal in Korea, the volume in Korean ports could be steadily increased. Unfortunately in Korea major operators of container port are global terminal operating companies. The means for transforming operating system to induce shipping companies into port operating business in Korea should be studied and established.

Second, larger shippers can demand for shipping companies to change their schedule. In order to induce shipping companies into Korean ports, the efforts to supply shippers with integrated logistics service would be good means to attract shipping companies to Korean ports. Hence marketing activities for Korean ports should be focused on larger shippers in Northeast Asia regions

Third, much broad and close feeder network in the Northeast Asia based on Korean ports would bring higher throughput in Korea container terminals. This will primarily reduce the disadvantage of transshipment, as frequency in feeder networks would make it possible for shipments to arrive in time to catch earlier trunk line vessels, reducing the overall point-to-point time. Aids to feeder shipping companies could be proper means for that. We could suggest some means: financial aids for shipbuilding and ship operating, tax exemption, port tariff cut, exclusive container terminal for feeder vessels, improvement of connectivity between mother vessel and feeder vessel and so on.

Fourth, by rebuilding railway and road linkage between South Korea and North Korea, the logistics facilities in Korea could enlarge their hinterlands into China Northeast inner regions and Russian Far-East areas. It could be cooperative strategy for Korea against China, because the newly built container terminals tend to be eager to increase their

handling volumes and to find cargoes at feedering market. Activitization of connectivity between South Korea and North Korea could heighten the competitiveness of Korean logistics service.

Fifth, networking logistics information system among Northeast Asian ports which will be leaded by Korea could strengthen the competitiveness of Korean ports.

2) Port Authority

Shippers consider their logistic decisions on an overall cost-minimizing strategy. They choose shipping lines and ports through which their goods can be moved reliably and economically, particularly for containerized high value-added cargo. Shippers thus maximize profits by minimizing their cost of transportation and while doing so they will choose a combination of shipping line and port that is the most cost-effective in terms of the overall chain of production.

This study suggests that the most important service attribute is cost, followed by service (shipping time, delays and reliability). Advertising, frequency, and quality of service are crucial factors in determining the selection of a shipping line. A good or bad points of ports service system may affect the user's port choice behavior, or even influence the cost of the whole fleet or shipper, so port choice is an important part of port transportation demand behavior. Crucial policy implications should be suggested as the results of the study;

First, the establishment of the Busan U-Port System is required. A Ubiquitous port, a high-tech intelligence port, provides relevant companies and authorities with real-time port logistics information encoded on RFID chips, which are used on all exporting and importing containers and vehicles passing the port. Busan U-Port System can make a significant contribution to increase in the port sales and a reduction in the logistics costs. U-Port initiatives address both cost and service

aspects, as technologies make it easier to identify where containers care, and easier to process them quickly. With less handling, the marginal cost of handling containers is reduced, and thus fees charged to liners can be lowered.

Second, Busan Port Authority should offer cash incentives to container lines to stave off growing's competition form China ports as it aims to be the preferred transshipment and logistics hub for the northeast Asia. Currently, a total of $5M will be returned to shipping lines depending on their share of transshipment cargo at Busan Port. Lines hubbing at Busan are also exempt from paying wharfage fee, port fee and container fee and container tax for transshipment cargo.

Third, productivity improvements, less congestion and an extensive feeder network with regular and fast connections to China, Japan, Russia and East Asian countries is able to serve as strong attractions for shipping lines. Shipping lines can thus market faster point-to-point service to their customers.

Fourth, the authority should develop a district-park, for which there is ample space. It will offer comprehensive logistics and port services that will serve as further attractions to shipping lines. It is also important for the authority to do its best to draw investment in the district-park of Busan Port from foreign companies.

Fifth, the Logistics Management and Technology Center need to be established by Busan City, Ministry of Commerce, Industry & Energy, and BPA jointly. It will result in strengthening international competitiveness in Busan Port and logistics-related industries.

Sixth, the analysis of shippers' choice of shipping lines and ports is essential for policy formulation related to improving port infrastructure and services, in addition to market entry/exit decisions of shipping lines. Port authorities must understand the necessity of improving their services in order to respond to greater competition among ports and the growing pressure from shippers for lower port and shipping charges.

Ports form a vital link in the overall trading chain and, consequently, their level of utilization determines to a large extent their domestic and international competitiveness. In order to maintain a competitive edge in these markets, port authorities must understand the factors that affect their competitiveness.

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APPENDIX

<Table 1> Current Shipping Lines between Busan and Tianjin for one month

Vessel Name	Operator	Transit Time
HEUNG-A SEOUL(KXS)	Heung-A Line	2 days
Qi Yun He	MOL	3 days
sky jupiter	RCL	3 days
Hanjin Gothenburg	Senator - Hans Strong	N/A
Oriental Carrier	Sinotrans	N/A
HANJIN GOTHENBURG	Yang Ming	2 days
ORIENTAL CARRIER(CXN1)	Heung-A Line	3 days
OOCL Sydney	CMA	5 days
OOCL XIAMEN	APL	3 days
YM INITIATIVE	Yang Ming	1 day
sky jupiter	RCL	3 days
MOL CREATION	APL	20 days
xutra bhum	RCL	2 days
Viking Osprey	Gold Star Line - Star Shipping	3 days
Pohang Senator	"K" Line	8 days
BUXHILL(NIS)	Heung-A Line	3 days
MAERSK DARTMOUTH	Maersk Line	4 days
HEUNG-A SEOUL(KXS)	Heung-A Line	2 days
california mercury	RCL	3 days
ANL Explorer	CMA	N/A
Oriental Carrier	Sinotrans	N/A
HANJIN BUDAPEST	Yang Ming	2 days
ORIENTAL CARRIER(CXN1)	Heung-A Line	3 days
APL DALIAN	APL	3 days
YM INCEPTION	Yang Ming	1 day
CMA CGM NABUCCO	APL	20 days

Portland Senator	"K" Line	N/A
Xin Hui He	TOL - Million	N/A
wana bhum	RCL	2 days
HANJIN QINGDAO(NIS)	Heung-A Line	3 days
HEUNG-A SEOUL(KXS)	Heung-A Line	2 days
Qi Yun He	TOL - Million	N/A
frankfurt express	RCL	3 days
passat spring	RCL	3 days
Hanjin Tianjin	Senator - Hans Strong	N/A
HANJIN TIANJIN	Yang Ming	2 days
ORIENTAL CARRIER(CXN1)	Heung-A Line	3 days
APL OSAKA	APL	3 days
YM INSTRUCTION	Yang Ming	1 day
CMA CGM PARSIFAL	APL	20 days
Hanjin San Francisco	"K" Line	N/A
bay bridge	RCL	
STX ASIA(NIS)	Heung-A Line	
HEUNG-A SEOUL(KXS)	Heung-A Line	2 days
Qi Yun He	ANL	N/A
sky jupiter	RCL	3 days
HANJIN BREMERHAVEN	Yang Ming	2 days
OOCL MUMBAI	APL	3 days
YM INCREMENT	Yang Ming	1 day
CMA CGM TOSCA	APL	20 days
Xin Hui He	TOL - Million	N/A
xutra bhum	RCL	2 days
Qi Yun He	TOL - Million	N/A
California Mercury	RCL	3 days
HANJIN WASHINGTON	Yang Ming	2 days

Source: http://www.schednet.com.

<Table 2> Freight Charges Model on Characteristics of the Shipment & the Shipping Route

```
Source |       SS       df       MS       Number of obs =  121461
-------------+------------------------------   F( 92,121368) = 6299.19
Model |  215666.818     92  2344.20455   Prob > F      =  0.0000
Residual |  45166.3301 121368  .372143647   R-squared     =  0.8268
-------------+------------------------------   Adj R-squared =  0.8267
Total |  260833.149 121460  2.14748188   Root MSE      =  .61004
```

lnfchg	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]
lnTEU	(dropped)					
lnval	.2563012	.0033082	77.48	0.000	.2498173	.2627852
lnval	0.256301	0.003308	77.48	0	0.249817	0.262785
lnvalteu	-0.0105	0.002859	-3.67	0	-0.01611	-0.0049
lntons	0.553552	0.00342	161.88	0	0.54685	0.560254
lntonsteu	-0.09021	0.003028	-29.79	0	-0.09614	-0.08427
hazmat1	-0.08573	0.008872	-9.66	0	-0.10312	-0.06834
reefer1	-0.075	0.023061	-3.25	0.001	-0.1202	-0.0298
_Ifport_2	-0.01857	0.009613	-1.93	0.053	-0.03741	0.000271
_Ifport_3	0.014702	0.01347	1.09	0.275	-0.0117	0.041102
lnTEU	1.015306	0.042871	23.68	0	0.93128	1.099332
_IfpoXlnte~2	0.004921	0.008229	0.6	0.55	-0.01121	0.02105
_IfpoXlnte~3	0.034362	0.011405	3.01	0.003	0.012009	0.056714
_Iusport_2	-0.61878	0.126658	-4.89	0	-0.86703	-0.37054
_Iusport_3	-0.07114	0.042279	-1.68	0.092	-0.15401	0.011727

_Iusport_4	-0.03841	0.04281	-0.9	0.37	-0.12232	0.045494
_Iusport_5	0.09075	0.043097	2.11	0.035	0.00628	0.17522
_Iusport_6	-0.01905	0.05312	-0.36	0.72	-0.12317	0.08506
_Iusport_7	-0.21878	0.044275	-4.94	0	-0.30555	-0.132
_Iusport_8	0.012765	0.050702	0.25	0.801	-0.08661	0.112139
_Iusport_9	0.0811	0.043944	1.85	0.065	-0.00503	0.167231
_Iusport_10|	0.190601	0.043889	4.34	0	0.104579	0.276623
_IuspXlnte_2	0.135	0.11902	1.13	0.257	-0.09828	0.368277
_IuspXlnte_3	-0.1878	0.032326	-5.81	0	-0.25116	-0.12444
_IuspXlnte_4	-0.1383	0.032665	-4.23	0	-0.20232	-0.07428
_IuspXlnte_5	-0.20224	0.033088	-6.11	0	-0.26709	-0.13739
_IuspXlnte_6	0.02971	0.039846	0.75	0.456	-0.04839	0.107808
_IuspXlnte_7	-0.11102	0.034165	-3.25	0.001	-0.17798	-0.04406
_IuspXlnte_8	-0.20804	0.038307	-5.43	0	-0.28312	-0.13296
_IuspXlnte_9	-0.15148	0.03376	-4.49	0	-0.21765	-0.08531
_IuspXlnt~10	-0.15928	0.033835	-4.71	0	-0.22559	-0.09296
_Isline_2	-0.40985	0.39965	-1.03	0.305	-1.19316	0.373454
_Isline_3	-0.0663	0.024304	-2.73	0.006	-0.11393	-0.01866
_Isline_4	-0.10856	0.019906	-5.45	0	-0.14758	-0.06955
_Isline_5	-0.13728	0.022411	-6.13	0	-0.18121	-0.09336
_Isline_6	0.332845	0.445166	0.75	0.455	-0.53967	1.205363

_Isline_7	-0.10101	0.019839	-5.09	0	-0.1399	-0.06213
_Isline_8	-0.06393	0.021367	-2.99	0.003	-0.10581	-0.02206
_Isline_9	-0.03324	0.030711	-1.08	0.279	-0.09343	0.026953
_Isline_10	-0.0939	0.043524	-2.16	0.031	-0.17921	-0.0086
_Isline_11	-0.13583	0.020919	-6.49	0	-0.17683	-0.09483
_Isline_12	(dropped)					
_Isline_13	-0.49685	0.258938	-1.92	0.055	-1.00436	0.010668
_Isline_14	0.007408	0.023739	0.31	0.755	-0.03912	0.053935
_Isline_15	0.034465	0.029589	1.16	0.244	-0.02353	0.092458
_Isline_16	-0.2155	0.038355	-5.62	0	-0.29068	-0.14032
_Isline_17	0.14612	0.121657	1.2	0.23	-0.09232	0.384565
_Isline_18	-0.13372	0.027941	-4.79	0	-0.18848	-0.07895
_Isline_19	-0.04265	0.019684	-2.17	0.03	-0.08123	-0.00407
_Isline_20	0.096705	0.109938	0.88	0.379	-0.11877	0.312182
_Isline_21	-0.00169	0.032587	-0.05	0.959	-0.06556	0.062184
_Isline_22	-0.04814	0.024373	-1.98	0.048	-0.09591	-0.00037
_Isline_23	0.168841	0.028599	5.9	0	0.112788	0.224894
_Isline_24	-0.20081	0.046951	-4.28	0	-0.29284	-0.10879
_Isline_25	0.320138	0.141905	2.26	0.024	0.042007	0.598269
_Isline_26	0.25794	0.095112	2.71	0.007	0.071522	0.444358
_Isline_27	0.346749	0.853932	0.41	0.685	-1.32694	2.020442

_Isline_28	2.543086	10.70281	0.24	0.812	-18.4343	23.52042
_Isline_29	0.163461	0.057066	2.86	0.004	0.051613	0.27531
_Isline_30	-0.22849	0.046529	-4.91	0	-0.31968	-0.13729
_Isline_31	-0.15638	0.021716	-7.2	0	-0.19894	-0.11381
_Isline_32	-0.34323	0.08167	-4.2	0	-0.5033	-0.18315
_Isline_33	0.292576	0.287333	1.02	0.309	-0.27059	0.855744
_IsliXlnte_2	0.281203	0.376878	0.75	0.456	-0.45747	1.019878
_IsliXlnte_3	0.001451	0.031972	0.05	0.964	-0.06121	0.064116
_IsliXlnte_4	0.018411	0.017541	1.05	0.294	-0.01597	0.052791
_IsliXlnte_5	0.102838	0.021781	4.72	0	0.060148	0.145529
_IsliXlnte_6	-0.18501	0.42422	-0.44	0.663	-1.01648	0.646453
_IsliXlnte_7	-0.02273	0.015416	-1.47	0.14	-0.05295	0.007483
_IsliXlnte_8	0.006032	0.016538	0.36	0.715	-0.02638	0.038446
_IsliXlnte_9	-0.08545	0.023459	-3.64	0	-0.13143	-0.03947
_IsliXlnt~10	-0.0132	0.036846	-0.36	0.72	-0.08542	0.059018
_IsliXlnt~11	0.08167	0.016546	4.94	0	0.049241	0.114099
_IsliXlnt~12	1.044566	0.550378	1.9	0.058	-0.03417	2.123298
_IsliXlnt~13	0.478249	0.221438	2.16	0.031	0.044233	0.912264
_IsliXlnt~14	-0.05356	0.018081	-2.96	0.003	-0.089	-0.01812
_IsliXlnt~15	-0.04538	0.02134	-2.13	0.033	-0.08721	-0.00355
_IsliXlnt~16	0.005103	0.03015	0.17	0.866	-0.05399	0.064197

_IsliXlnt~17	-0.09813	0.072739	-1.35	0.177	-0.2407	0.044433
_IsliXlnt~18	-0.00503	0.021698	-0.23	0.817	-0.04755	0.037501
_IsliXlnt~19	-0.04007	0.014445	-2.77	0.006	-0.06838	-0.01176
_IsliXlnt~20	-0.08265	0.079788	-1.04	0.3	-0.23903	0.073734
_IsliXlnt~21	-0.08751	0.022411	-3.9	0	-0.13144	-0.04359
_IsliXlnt~22	0.015988	0.018908	0.85	0.398	-0.02107	0.053047
_IsliXlnt~23	-0.15201	0.020906	-7.27	0	-0.19298	-0.11103
_IsliXlnt~24	0.005715	0.033839	0.17	0.866	-0.06061	0.072039
_IsliXlnt~25	-0.42253	0.128762	-3.28	0.001	-0.6749	-0.17016
_IsliXlnt~26	-0.30921	0.077359	-4	0	-0.46083	-0.15759
_IsliXlnt~27	0.187726	0.875394	0.21	0.83	-1.52803	1.903485
_IsliXlnt~28	-3.60055	14.80599	-0.24	0.808	-32.62	25.41894
_IsliXlnt~29	-0.22907	0.040585	-5.64	0	-0.30861	-0.14952
_IsliXlnt~30	0.067528	0.037719	1.79	0.073	-0.0064	0.141456
_IsliXlnt~31	-0.01302	0.018058	-0.72	0.471	-0.04841	0.022375
_IsliXlnt~32	0.23562	0.059405	3.97	0	0.119188	0.352053
_IsliXlnt~33	-0.20328	0.193838	-1.05	0.294	-0.5832	0.176642
_cons	3.244239	0.052941	61.28	0	3.140476	3.348002

<Questionnaire on Port Services in the Yellow Sea>

The Korea Maritime Institute (KMI) wants to find ways of improving cooperation in distribution services between China and Korea and Japan; and to understand Chinese trade companies' preference for harbor services in the Yellow Sea. Your cooperation will be highly appreciated.

July, 2007

Written by: Park Yong An /
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1. Your company name and address?

(Company Name: , Address:)

2. Your major products?

( )

3. How much TEU do you export a year?

(TEU), TEU : Twenty-foot Equivalent Unit)

4. For your annual export, please, complete the following table.

Export		Port of Arrival	Transfer Port (if applicable)
Country	Share (%)	Port: Share (%)	

5. In China, who decides a maritime service for export?

Exporter ( ), Importer ( ), Shipping Company( ), Non Vessel Operating Common Carriers ( ), Agent-Forwarder ( ), Others ( )

6. In China, if applicable, who decides a transshipment port for export?

Exporter ( ), Importer ( ), Shipping Company( ), Non Vessel Operating Common Carriers ( ), Agent-Forwarder ( ), Others ( )

7. In China, what is the ratio of each inland transportation service that you use for export?

Truck ( ) %, Railway ( ) % : Freight Station ( ),
Coastal Transportation and Canal ( ) %

8. How much TEU do you import a year?

(TEU), TEU : Twenty-foot Equivalent Unit

9. For your annual import, please, complete the following table.

Import		Port of Departure	Transfer Port (if applicable)
Country	Share (%)	Port: Share (%)	

10. In China, who decides a maritime service for import?

Exporter ( ), Importer ( ), Shipping Company( ), Non Vessel Operating Common Carriers ( ), Agent-Forwarder ( ),
Others ( )

11. In China, if applicable, who decides a transshipment port for import?

Importer ( ), Exporter ( ), Shipping Company ( ), Non Vessel Operating Common Carriers ( ), Agent-Forwarder ( ),
Others ( )

12. In China, what is the ratio of each inland transportation service that you use for import?

Truck ( ) %, Railway ( ) % : Freight Station),

Coastal Transportation and Canal ( ) %

13. In deciding a maritime transportation service, what is important in the following table?

〈Table〉 Factors Considered to Decide a Maritime Transportation Service

Category	Sub-category
ㅇ Cost	- Inland transportation costs from departure factory to shipping port - Maritime transportation costs from shipping port to discharging port - Total costs from departure factory to final destination
ㅇ Service	- Frequency of maritime transportation services(per week) - Reliability of maritime transportation services - Availability of direct maritime transportation services - Various feeder networks and service networks - Convenience in customs clearance
ㅇ Ship	- Size of ships for relevant routes - Total number ships of a shipping company
ㅇ Shipping Company	- Nationality of a shipping company - Closeness with a sales person

13-1. As for main categories, check what you think is more important. Check once for each item.

Item	Importance																	Item
	Absolutely Important		Very Important		Important		Somewhat Important		Same		Somewhat Important		Important		Very Important		Absolutely Important	
Cost																		Service
Cost																		Ship
Cost																		Shipping Company
Service																		Ship
Service																		Shipping Company
Ship																		Shipping Company

13-2. As for costs, check what you think is more important. Check once for each item.

Item	Importance																	Item
	Absolutely Important		Very Important		Important		Somewhat Important		Same		Somewhat Important		Important		Very Important		Absolutely Important	
Inland Costs																		Maritime Costs
Inland Costs																		Total Costs
Maritime Costs																		Total Costs

13-3. As for service, check what you think is more important. Check once for each item.

Item	Importance																	Item
	Absolutely Important		Very Important		Important		Somewhat Important		Same		Somewhat Important		Important		Very Important		Absolutely Important	
Frequency																		Reliability
Frequency																		Direct Transportation
Frequency																		Feeder Networks and Service Networks
Frequency																		Convenience in Customs Clearance
Reliability																		Direct Transportation
Reliability																		Feeder Networks and Service Networks
Reliability																		Convenience in Customs Clearance
Direct Transportation																		Feeder Networks and Service Networks
Direct Transportation																		Convenience in Customs Clearance
Feeder Networks and Service Networks																		Convenience in Customs Clearance

13-4. As for ships, check what you think is more important. Check once for each item.

Item	Importance																	Item
	Absolutely Important		Very Important		Important		Somewhat Important		Same		Somewhat Important		Important		Very Important		Absolutely Important	
Ship Size																		Total Number of Ships

13-5. As for shipping companies, check what you think is more important.

Item	Importance																	Item
	Absolutely Important		Very Important		Important		Somewhat Important		Same		Somewhat Important		Important		Very Important		Absolutely Important	
Nationality																		Closeness with a Sales Person

14. Instead of a direct service from Tianjin to the US, if you use Shanghai port or Busan port as transshipment ports, what are reasonable service charges?

Item	Cost Reduction Ratio							Don't Consider
	Over 30%	30%~25%	25%~20%	20%~15%	15%~10%	10%~5%	Under 5%	
Transshipment at Shanghai Port								
Transshipment at Busan Port								

15. Instead of a direct service from Tianjin to Rotterdam, if you use Shanghai port or Busan port as transshipment ports, what are reasonable service charges?

Item	Cost Reduction Ratio							Don't Consider
	Over 30%	30%~25%	25%~20%	20%~15%	15%~10%	10%~5%	Under 5%	
Transshipment at Shanghai Port								
Transshipment at Busan Port								

Thank you.

Park Yong An, Researcher at KMI
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<TABLE 3> Questionnaire for Chinese Shippers

< 黃海沿岸海港利用民意調查問卷 >

您好！韓國海洋水產開發院目前正摸索中國、韓國、日本等國家之間的物流協力方案，爲此要調查中國進出口公司對黃海沿岸港湾及海運服務的看法。通過本民意調查，將听取各位的意見。

2007年 8月

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KMI 한국해양수산개발원 KOREA MARITIME INSTITUTE

1. 贵公司的名称及总工厂地址？
(公司名称 , 地址 :)

2. 贵公司总工厂的主要生产品种都有哪些？
( )

3. 贵公司总工厂年均**出口**集装箱货物运量为多少？
(_____TEU), TEU : Twenty–foot Equivalent Unit)

4. 贵公司总工厂年均**出口**集装箱货物运量的各国占有率及**各主要到达港占有率**以及转载海港？

出口		到达港	转载海港 (只限有转载海港)
国 **家**	**占有率(%)**	**到达港 : 占有率(%)**	

5. 哪一方决定在中国出口到海外时所利用的海运服务？
出口公司 ( ), 进口国家进口公司( ), 海运公司( ), 无船承运公司 ( ),
货运代理公司-Forwarder ( ), 其它 ( )

6. 哪一方决定在中国出口到海外时所利用的转载海港？
出口公司 ( ), 进口国家进口公司( ), 海运公司( ), 无船承运公司 ( ),
货运代理公司-Forwarder ( ), 其它 ( )

7. 在中国出口到海外时所利用的运输工具比率是？
公路运输比率 ( ) %, 铁路运输比率为( ) % : 所利用铁运站名为( ),
沿岸运输和内陆运输之比率为( ) %

8. 贵公司年均进口集装箱货物运量为多少?
(_____TEU), TEU : Twenty-foot Equivalent Unit

9. 贵公司年均进口集装箱货物运量的各国占有率及**各主要出发港占有率**以及转载海港？

进口		出发港	转载海港
国家	占有率(%)	出发港 : 占有率(%)	(只限有转载海港)

10. 哪一方决定从中国进口时所利用的海运服务？
出口公司 ( ), 进口国家进口公司( ), 海运公司( ), 无船承运公司 ( ),
货运代理公司-Forwarder ( ), 其它 ( )

11. 哪一方决定从中国进口时所利用的转载海港？
进口公司 ( ), 出口国家出口公司( ), 海运公司( ),
无船承运公司 ( ), 货运代理公司-Forwarder ( ), 其它 ( )

12. 从中国进口时所利用的运输工具比率是？
公路运输比率 ( ) %,
铁路运输比率为( ) % : 所利用铁运站名为( ),
沿岸运输和内陆运输之比率为( ) %

13. 贵公司选定海运公司(包括无船承运公司)时主要考虑哪些主要因素？
(请参考以下大项及小项中的内容)

<表> 决定海运公司海运服务的各项因素

大项	**小项**
○ 费用	- 制造工厂到出发港的内陆运输费用 - 出发港到进口国到达港的海运费用 - 制造工厂到最终目的地的总运费

○ 服务特点	- 海运服务频次 (每周 00航次) - 海运服务的信赖性 - 海运服务是否提供直达航线 - 各种支线网及服务网 - 通关方便性
○ 船舶特点	- 投入到该航线的船舶规模 - 海运公司所持有的船舶总量
○ 海运公司特点	- 海运公司的国籍 - 营业人员的周到服务

调查13-1. 政策**大项**的相对重要度评价 :在相应栏框中填入一个"√"或" / "标号

评价项目/评价	**相对重要度评价**																	评价项目
	绝对重要		非常重要		重要		略为重要		相同		略为重要		重要		非常重要		绝对重要	
费 用																		服务特点
费 用																		船舶特点
费 用																		海运公司特点
服务特点																		船舶特点
服务特点																		海运公司特点
船舶特点																		海运公司特点

调查 13-2. 费用**小项**的相对重要度评价 :在相应栏框中填入一个"√"或" / "标号

评价项目	评 **价**																	评价项目
	绝对重要		非常重要		重要		略为重要		相同		略为重要		重要		非常重要		绝对重要	
内陆运费																		海运费
内陆运费																		总物流费
海运费																		总物流费

调查 13-3.**服务**小项的相对重要度评价 :在相应栏框中填入一个"√"或" / "标号

评价项目	评 **价**																	评价项目
	绝对重要		非常重要		重要		略为重要		相同		略为重要		重要		非常重要		绝对重要	
服务频次																		服务的信赖性
服务频次																		是否有直达航线
服务频次																		各种支线网及服务网
服务频次																		通关方便性
服务的信赖性																		是否有直达航线
服务的信赖性																		各种支线网及服务网
服务的信赖性																		通关方便性
是否有直达航线																		各种支线网及服务网
是否有直达航线																		通关方便性
各种支线网及服务网																		通关方便性

调查13-4. **船舶特点**小项的相对重要度评价

评价项目	评 **价**																	评价项目
	绝对重要		非常重要		重要		略为重要		相同		略为重要		重要		非常重要		绝对重要	
该航线船舶规模																		海运公司所持有的船舶总量

调查13-5. **海运公司特点**小项的相对重要度评价

评价项目	评 **价**																	评价项目
	绝对重要		非常重要		重要		略为重要		相同		略为重要		重要		非常重要		绝对重要	
海运公司国籍																		营业人员的周到服务

14. 如果贵公司不利用天津港到美国的直达航线而利用上海港和釜山港的转载运货服务时，转载服务费用考虑哪一水准？

评价项目	运费折扣率							不考虑
	30%以上	30%-25%	25%-20%	20%-15%	15%-10%	10%-5%	不到5%	
上海港转载折扣费用								
釜山港转载折扣费用								

15. 如果贵公司不利用天津港到鹿特丹的直达航线而利用上海港和釜山港的转载运货服务时，转载服务费用考虑哪一水准？

评价项目	运费折扣率							不考虑
	30%以上	30%-25%	25%-20%	20%-15%	15%-10%	10%-5%	不到5%	
上海港转载折扣费用								
釜山港转载折扣费用								

谢谢您参与调查。联系人：韩国海洋水产开发院 朴容安 研究委员
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Choice Behavior of China Shippers for Shipping Services and Transshipment Ports - Tianjin Case -

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