8-30-2008

The comparative study of container logistics and marketing channel design of Shanghai Waigaoqiao and Yangshan container terminal

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The Comparative Study of Container Logistics and Market Channel Design of Shanghai Waigaoqiao and Yangshan Container Terminals

By

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A research paper submitted to the World Maritime University in partial Fulfillment of the requirements for the award of the degree of

MASTER OF SCIENCE

INTERNATIONAL TRANSPORTATION AND LOGISTICS

2008

DECLARATION

I certify that all the material in this research paper that is not my own work has been identified, and that no material is included for which a degree has previously been conferred on me.

The contents of this research paper reflect my own personal views, and are not necessarily endorsed by the University.

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ACKNOWLEDGEMENT

Firstly, I appreciated my professor Mr Xu Dazhen who gives me a lot of advice to of my dissertation and provide me the suitable suggestion to my dissertation. Thanks to his advice and encouragement, I can finish this dissertation smoothly.

And I also want to thanks for Professor Zhao Gang who give me the suggestion of the dissertation framework at the initial writing period of my dissertation.

Thank you for my friends Miss. Wu Jun who is the student of previous intake of this program, she give me lots of guidelines on of how to write standard dissertation. I would like to thank Mr. Jang Wei who helps me collect some information about container terminals.

At the same time, I want to thank Ms Zhou Yingchun, Ms Huang Ying and Mr Lu Tongan who are in charge of this MSC program on the behalf of Shanghai Maritime University. Their guidelines of this program during the class are really important to me.

At last, I want to thank my parents who give me full encourage and support in life during my period of dissertation. I am always loves them forever.

ABSTRACT

Title of Dissertation: **The Comparative Study of Container Logistics and Market Channel Design of Shanghai Waigaoqiao and Yangshan Container Terminals**
Degree: **MSC**

Shanghai container throughput has been ranked as the No.2 in the world in 2007, and it also support most of the China container trading. But the faster growing container throughput in Shanghai does not mean the Shanghai container terminals can successfully meet the faster changing market. There are really some problems in the faster developing speed.

So this dissertation uses comparative study to find out the gaps between Shanghai Waigaoqiao and Yangshan container terminals which are the main container terminals in Shanghai with developed container terminals. Three main aspects which are general condition, container logistics and market channel structure of container terminals are discussed. The suggestions of shortening the gaps which are discussed at above three aspects are involved in later part of dissertation which are the channel designing of suggestion matrixes

The purpose of this dissertation is to enhance the competitive advantage among global terminals industry, so through the way of competitive study of finding gaps and shortening gaps, then channel designed can carried out to provide some suggestions of future developing way of Shanghai Waigaoqiao and Yangshan container terminals.

KEYWORDS： comparative study, container logistics, market channel, container terminal

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List of Abbreviations

ECT	European Combined Terminal
SIPG	Shanghai International Port Group
APMT	A.P Moller Terminal
PSA	Port of Singapore Authority
AHP	Analytic Hierarchy Process Model
AEI	Automatic Equipment Identification
EDI	Electronic Data Interchanger
SEM	Structure Equation Modeling
GPS	Global Positioning System
BCG	Boston Consulting Group
RTG	Rubber Type Gantry Crane
AGV	Automatic Guided Vehicle
RMG	Rail-Mounted Gantry Cranes
PDS	Position Detecting System
AGSS	Automatic Gantry Steering System

Chapter 1 Introduction

1.1 Background of this dissertation

Since the Port Law encourages both Chinese and abroad invests in the port operation from 2004, China's port industry has been given historical opportunities to establish and improve diversified port service. This openness of law accelerates the Shanghai port industry development. Dock construction in Shanghai has been injected with vitality since the period of the construction of Shanghai International Shipping Center supported by Chinese government 10^{th} five year development plan. Shanghai Waigaoqiao and Yangshan terminal have taken the greatest weight of container traffic. Waigaoqiao terminal which locates near the central city has also developed into Phase 6 terminal. And the congestion problems inside or outside terminals are alleviated by the openness of a new port, Yangshan, which is located far from the city and it is a truly deep sea port. Thanks to this new terminal successfully operating, today, the total container throughput of 2007 in Shanghai is about 26.15 millions TEU which will be possible ranked as the second in the world container throughput according to the statistics from the Port Authority of Shanghai. Yangshan terminals handle all the Asia-Europe trade, Waigaoqiao terminals mainly handles the transpacific trade service. Both terminals share the market of intra-Asian, Mediterranean services.

1.2 The objective of this dissertation

The purpose of this dissertation is to enhance the competitive advantage of Shanghai

Waigaoqiao and Yangshan container terminals through comparative study and channel desgin. Although the container throughput in Shanghai has been greatly improved in the recent years, that's not meaning the operation level of Shanghai containers are enhance to international level simultaneously. So through comparative study of Shanghai Waigaoqiao and Yangshan terminals with other terminals, the gaps are found out to be improved. There are few scholars doing the comparative researches to provide suggestion to enhance both Waigaoqiao and Yangshan container terminals. This paper is an attempt to do this kind of research. And due to the changing market of shipping and container terminals, the market channel integration of container terminals are being regarded better ways of enhance competitive advantage. So this paper does an attempt to do the market channel design of Waigaoqiao and Yangshan container terminals. The comparative study is the support of channel design. Only the gaps to be found, and the supposed improvement to shortening the gaps are involved in the channel design of future development which is effective to enhance the competitive advantage of Waigaoqiao and Yangshan container terminals.

1.3 The main content of this dissertation

This dissertation mainly consists of five sections brief introduced below:
First section (Chapter 2) is the literature review and methodology of this dissertation. The literature review gives the supporting reason of using comparative study method and market channel structure researches. The literature review also point out the trend of container terminal industry developing. Then the methodology of the paper is explained. The criteria of selecting comparable factors are introduced.

Second section (Chapter 3) is the analysis of general condition of Shanghai Waigaoqiao and Yangshan container terminals. The latter part of this section is the comparative study of Chinese container throughput growth rate which shows out the Shanghai container

terminals current position in Chinese container market. The summary of challenges from domestic container terminals is given at last.

Third section (Chapter 4) is the comparative study of container logistics. This section uses comparative study of various factors classified by the basic functions and new trend of container logistics in terminal. The basic function factors are ship to shore factor, container stacking factor, transshipment factor. The new trend factors are intermodal factor, value added service factor and information technology factors. Then the summary of finding the gap between Shanghai container terminals and other terminals are discussed follow.

Fourth section (Chapter 5) is the comparative analysis of the market channel structure of containers terminals in the world. Shanghai Waigaoqiao and Yangshan container terminals are being in the example of discussing. The governmental market channel, the shipper channel under supply chain concept, the shipping lines and global terminal operators channel and labor channel are separately analyzed. Shanghai Waigaoqiao and Yangshan container terminals are being in the example of discussing. The summary of gaps between Shanghai containers and other developed channels are given.

Fifth section (Chapter 6) is the market channel design based on suggestion matrix. Five suggestion matrixes are designed based on gaps done by the general condition of terminals, the comparative study of container logistics factors and market channel design. Future channel development direction of Waigaoqiao and Yangshan are given in these suggestion matrixes.

Chapter 2 The literature review and methodology

2.1 Literature review of the current research of container logistics

2.1.1 The review on container terminals operation research by simulation model

Simulation model has been most scholars preferred to optimizing the terminal operation. Early in the 1990s, Kuo (1992) successfully developed a container terminal simulation which is applied in the Terminal 18 at the Port of Seattle. Holguin-Veras (1996) did the performance analysis by a simulation model of relevant factor, I do think the author pointed out the Automatic Equipment Identification (AEI) device by information technology is very creative at that time, but I doubt the wide spread of this technology still hard to be applied even 10 years after that proposal. Alkhedher (2006) emphasized the importance of the transshipment issue in the configurations of the container terminal by a detailed simulation model to compare measurement indicator for different terminals. Since 2000, simulation model about container terminals are develops faster, but most literatures focus on the traditional terminal operation. Few researches have been

discussed about container terminal logistics system. Sha Mei (2008) pulled out the generality methodology of general simulation model for container terminal logistics system which is an innovative approach. The simulation software usually focuses on single operation and several kinds of operation, so it cannot covers the whole container logistics as Sha regarded.

2.1.2 The review on comparative study of container terminals and logistics

Literatures about comparative study of container terminals usually analyze the different comparable objective. Wang (2004) do the comprehensive comparative study of China ports with international counterparts using efficiency measurement. This study provides in-depth policy implications and managerial insights for China's government to optimize the future development of its port sector to the benefit of its wider economy and social welfare maximization. Peng Chuanshen (2008) did the comparative study of Shanghai container ports with Hong Kong and other international ports by rate of productivity. I suppose it only did the comparison by the factors like the number of quayside gantry cranes, the year throughput and the coastlines which is a brief comparison study. Jasmine (2006) did the comparison of cost competitive terminal operators in Singapore, Port Kland and Tanjung Pelepas by data using terminals facilities between 1998 and 2002. And the paper also highlights the opportunities available to these terminal operators. I strongly agree with author’s method because he based on the existing operation data.

2.1.3 The review on vertical integration of container logistics in terminals by shipping lines

Liner shipping companies now days are taking mergers and acquisition not only on the horizontal integration, but the vertical integration along the transportation chain, so

terminal operation have been taken into action. Heaver (2002) says the liner shipping company are adjusting themselves by providing integrated logistics service because their shippers seek to integrate and improve the performance of their supply chains. Notteboom (2006) analysis various factors that liner shipping doing freight integration for well aware of growing importance integration along the logistics chain to include landside terminals and logistics operations. Heaver (2001) found that shippers are seeking improved transportation services and integration in their supply chains. So integrated logistics service is extend into the business of container terminals. Empirical evidence reveals that the use of dedicated container will push the freight integration as Notteboom (2002) noted. In order to reduce the operating cost more, liner shipping especially the top liners are aggressively taking into terminal operation. Carrier and stevedores arm-wresting in the northern European port were discussed by Franceso (2007), Pure stevedores (like PSA), hybrid terminal operators(like APMT) and integrated carrier (like NOL) are classified by according to the attribute and degree of participating the container terminal operations. But Fremont (2006) regarded there are more co-operation between liners and terminal operators in the trend based on a carrier standpoint to analyze. I strongly agree with this point due to the big customer of terminal is the liner company. Stopford (2002) conclude the deeper of draft of the ports is one of the factors which have drive the trend of bigger container ships. But container vessel which has been enlarged to run in the hub terminals will give the pressure to the challenge the capability of terminal operator. Liner being involved in terminals can really solve this problem. Notteboom (2004) believed the logistics subsidiary of the liners will develops efficient truck haulage so that to make the terminal rotation quickly. I think besides truck, intermodal mode like train and barge is also popularly used by modern terminals, but truck mode has the attribute of flexibility which is also the main mode of Shanghai two container terminals. Chin-Shan (2003) find the time related factor is crucial to the shipper-carrier partnering relationships based on a shippper’s perspective. I agree with this point due to there is less possible to make vessel sails faster,

while there is great potential to save time in terminal operation which is also the reason of liners taking into terminals industry. Piyush (2003) do the research of shipper's selection on port and carrier in China and find out the distance between shipper and port, the fleet size and port congestion are main factors. He also agree the market of liner-port combination market is develops as the preference of shipper changes. So this idea strengthens the trend of co-operation between liners and terminals operators

2.1.4 The review on new trend of container terminal logistics development

The literature review focuses on integrated container logistics inside and around the terminal can be found more recently because the terminals are changing their strategy in order to meet the changing market. Intermodal facilities

The degree of implementing intermodal facilities is very important to the efficiency of moving container to the right place at the right time. In the early 1990s, De Castilho (1992) pointed out a direct-transfer terminal design that allows trains carrying container to be loaded and classified by the destination at the same time which can largely eliminating the need for future trains processing at downstream rail yards. I argue about this method which cannot be fully used in the developing countries' terminals. Van Zijderveld (1999) used a computer program in order to optimize sizes of stacks and usage of various equipments in a rail terminal. This program has been verified on the Maasvlakte Rail Service Centre at Rotterdam. Eftihia (2007) discussed the assessment of intermodal freight transport and logistics terminals in the Central European. A weighting and grading system has been used in order to prioritizing the transport and logistics terminals. I strongly agreed with the method Eftiha used because he did the comparison of container logistics in a span of geographic coverage.

Notteboom (2004) has concluded that leading terminal operators have developed diverging strategies in order to control larger parts of the supply chain. He showed out the Hutchison as an example of begining to operate inland logistics in China. Notteboom

(2002) also discovered Germany terminal operators have been directly involved in intermodal rail transport. I agree with that because the Shanghai International Port Group (SIPG) which owns greatest share in the Shanghai container terminals has been step separate road haulage logistics companies to take part in the supply chain. Bichou and Gray (2005) try to conceptualize ports from a logistics and supply chain management approach in order to lower cost and enhance customer satisfaction. Port performance has been measured based on the value-added logistics activities. Although the port concept is extend to passenger port, I suppose the idea of classified port a logistics channel, a trade channel and a supply chain channel is also applied in a container terminal. The role of terminal operators is also facing the challenge of higher integration under supply chain management. Valentina and Marcella (2004) used a supply chain management approach to analyze the port of Le Harve in Renault's supply chain. Although this article discusses more on car transport, the successful example of integrated logistics service for dedicated terminal customer is worth studied for container terminals.

As the demand of customer has changes according to the boom of technology used in the logistics service, some terminals are facing to solve the problems. Petering (2007) suggested the real time control of seaport container transshipment in the terminals based on his internship and on-site experience at a major terminal in Asia. I do agree with this method because this can use modern information technology to improve existing container logistics and equipment usage for both the customer demand and terminal operator management. Due to China factor in maritime transport and logistics service, both domestic and foreign scholars have been doing research of container logistics. Claude (2004) did the research of analyzing the China port systems in three regions, four interrelated transformations: port privatization, port expansion, modification of transactional networks and the emergence of a new business environment. I suppose he his research are based on a wide view and did not concern some detailed container logistics service. But I do agree the port and terminal privatization is the trend of

container terminal develops faster in China. Maritime transport has been changed from labor-intensive to capital-intensive as Lourdes and Gustavo (1999) regarded. They think port privatization can brings more chances of integrating logistics chain to serve more function. Kevin and Song (2003) have concluded the successful example of implementing port privatization and deregulation policies on Korean container terminals. I agree with this point due to the privatization of terminal industry to private will continue providing capital and management support to do more vertical or horizontal logistics service.

2.1.5 The review on market channel theory applied in container terminal

The marketing channel means the distribution channel on the large scope of definition. And few literatures have been worked on the marketing channel structure and relationship. Due the globalize economic, the container terminal has been operated by various market player through the way of horizontal and vertical integration of container terminal. Bart (2001) use the market channel flow to analysis the market of the European intermodal container terminal and classified the maritime and continental container terminal marketing channel by logistics and transport market. I think he did the research more on the view from the customer need and satisfaction, but did not emphasis on the channel structure in the container terminal. Bichou (2007) did the assessment of the channel structure and relationship on the internationalization and consolidation of port industry which I think is more specialize the scope of marketing channel on the container terminal such as the active member of shipper, shipping lines, port agent and intermediaries. Channel power and conflict is the main objective. He used the structure equation modeling (SEM) which is a statistical method of investigating the channel structure and relationship.

2.2 The Methodology of this dissertation

This paper mainly uses comparative study method as the research method. The comparative study mainly used in Chapter 3, Chapter 4 and Chapter 5. In Chapter 6, the channel design is using the method from BCG matrix. Detailed Method are explained below:

In Chapter 3 and 4, the comparable factors selected are based not only on the objective of time and cost saving, but also on the premium various dedicated service for liner shipping company. The paper will first introduce the terminals being taking at the comparison including Shanghai two terminals and other terminals in the world. Then various factors will be compared among Shanghai container terminal and developed terminals, such as Port of Los angles/Long beach, ECT terminal, APM terminals, P&O ports, HHLA terminals, PSA terminals. The purpose of using comparative study is to find where Shanghai terminals do worse and better than other terminals among the factors related to container logistics and how much the distance existing. The factors compared are discussed from the basic function of container logistics to new trend of container logistics service popularly in the terminal industry. Original terminals data are selected from various literatures and news press in books, on the internet and journals. The data will be adjusted according to the same standard in order to make them comparable and practical. Then comparison data analysis like tables and figures are calculated by the Microsoft Excel Spreadsheets.

In Chapter 5, the comparative analysis of market channel structure of Shanghai container terminals are another method of digging the relation between terminals and other parties. The comparison is also dicussed between Shanghai container terminals and other terminals. but this kind of comparison is explorative because the market in other countries is different. Through the popularity of the concept of supply chain

management and globalize economic, the channel structure of modern container is more or less has some same character. This kind of comparison is based on the type of channel, and the channel conflict is also discussed later. The market channel structure which influences container logistics has strong relation with comparison of container logistics done before.

In Chapter 6, the market channel design is using the way of suggestion matrixes of Shanghai Waigaoqiao and Yangshan terminals is based on the internal results of comparison of container logistics and results of comparison of channel structure. The model used the matrix modified from the Boston Matrix. The matrix is about the combination of container logistics and various channels. The horizontal axis is the importance of market channel, while the vertical axis is the importance of container logistics. There are four kinds of container the importance of both container logistics and channel structure is based on the previous comparison studies. When the matrix is carried out, the analysis of competitive of Shanghai Waigaoqiao and Yangshan terminals can be concluded. The suggestion solutions of promoting and improvement of the unit of container logistics are carried based on these matrixes in order to maintain the competitive and enhance the international service level of Shanghai Waigaoqiao and Yangshan terminals.

The research layout is showed out in Figure 1 below. The general condition of Waigaoqiao and Yangshan terminals in Chapter 3 are the supporting Chapter 4 and Chapter 5. The comparative study the core content in Chapter 4 and Chapter 5, there are also some comparative study in Chapter 3. All the comparable results which show out the gaps are the basement of market channel design of suggestion matrix. The gaps are to shorten in the suggestion matrix

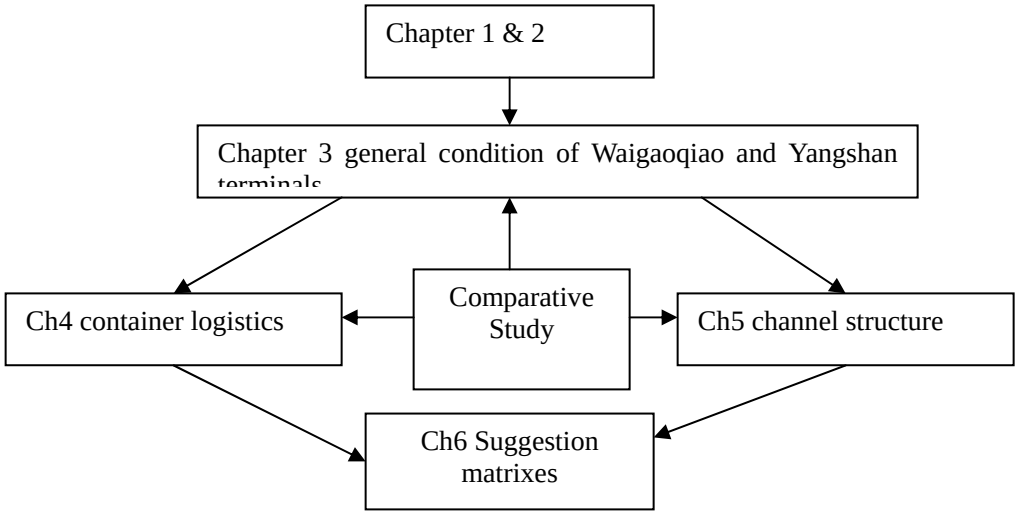

Figure 1 Dissertation layout

Chapter 3 The analysis of general condition of Waigaoqiao and Yangshan container terminals

3.1 The introduce of Shanghai Waigaoqiao and Yangshan container terminals

3.1.1 The geographic location

Shanghai Waigaoqiao terminals are located in the Waigaoqiao Free Trade Zone. They are a group of terminals with 4 separate terminal operated by different companies. Waigaoqiao container terminals have been constructed to Phase 5. There are all together six phases of container terminals. Phase 1 is Shanghai Pudong International Container Terminals Co., Ltd. Phase 2 and 3 are under SIPG Zhendong Container Terminal Branch Ltd. Phase 4 is Shanghai East Container Terminals Co., Ltd. Phase 5 is Shanghai Mingdong Container Terminals Ltd. All the four terminals are located at the estuary of the Yangtse River. Phase 6 is a multi-use terminal which is excluded from the research.

Shanghai Yangshan container terminals are located in the Qiqu Archipelao. It links with Luchaogang in the Nanhui district by a bridge of 32 kilometers which is in Hangzhou Bay south of Shanghai. The Yangshan container terminals now have three phase project which is in operation.

3.1.2 The investment structure of Waigaoqiao and Yangshan terminals

Since 2000 the gradual openness of the policy allowness of foreign investment in port

and terminal pushes this industry, the investment of Shanghai container terminals have grasped the opportunities under this policy and develop even faster. Shanghai International Shanghai Waigaoqiao Terminal Phase 1 called Shanghai Pudong International Container terminal is a joint-venture terminal invested by Shanghai International Port Group (40%, Hong Kong's Hutchison Whampoa(30%), COSCO Pacific Ocean (China) Investment Co., Ltd(30%). And COSCO Pacific has bought the 10% share of this terminal from Shanghai Industry Group in order to strength its position. Waigaoqiao Terminal Phase 2 and 3 which is called SIPG Zhendong Container Terminal is wholly invested and operated by SIPG. Waigaoqiao Terminal 4 a joint-venture invested by SIPG and APMT Terminals. Waogaoqiao Terminal 5 is another joint-venture invested by SIPG and Hutchison Port Holding (HPH).

The Yangshan container terminals are a multi-investment project. The Phase 1 is a wholly project invested and operated by SIPG, and the Phase 2 terminal is invested by five world class terminal operator, they are SIPG, Hutchison, APTM, COSCO and China Shipping Group. Phase 2 terminal is managed by the joint venture company called Shanghai Mingdong Container Terminal Ltd.

3.1.3 The facilities and equipments and of Waigaoqiao and Yangshan terminals

In a modern container terminal, lots of equipments and technologies have to be procured and used in order to serve terminal customer better and also reach terminal goals. Container terminal business has been regarded as capital investment business just like the vessel building. So the find out the number and scatter status of equipment in each container and what kind of technology they are using is the basic way of investigating container terminals in the Chapter 4.

In Shanghai container terminal business, SIPG which is the most power player in the

market is also the biggest manage and operation controlling company in each of Waigaoqiao and Yangshan container terminals. SIPG operates 125 berths on a total quay length of around 20 kilometers, among which, 82 of these berths can accommodate vessels of 10,000dwt class or above.

Waigaoqiao Phase 1(SPICT) has 3 container berths which has 12 meters depth and can be berthed the fifth and sixth generation container ship. The total berth length is about 900 meter. The total area is 50 hectares which has 8200 ground slots total, and it can be piled up 30,000 standard containers at the same time. This terminal has 147 pieces of mechanical equipment including 10 container quay cranes, 42 RTG Granes(6 cannot be used), 73 container trucks and 11 container forklifts and so on. The reefer plug is about 720. This terminal was opened at Feb, 2003.

Waigaoqiao Phase 2 &3(SIPG Zhengdong Branch) has all together 5 container berths. Phase 2 has 3 berths and Phase 3 has 2 berths. Phase 2 terminal has 9 quay cranes. Phase 3 terminal has 3 quay cranes. Phase 2 has a berth length of 900 meters and Phase 3 has a 665meters. Phase 2 was opened at Jul, 2000, and Phase 3 was opened at Dec, 2001.

Waigaoqiao Phase 4 (SECT) has 6 berths, 4 14.2 meters depth berths and 2 barge 8.5meter depth barge berths with the total length of 1,250. The total area is 163 hectares which has 15,564 slots. There are 14 quay cranes, 48 RTG, 15 forklifts and reach Stackers and 72 trucks. The terminal was opened at Feb 2003

Waigaoqiao Phase 5(SMCT) has 4 12.8 meters depth container berth and 2 4.5 meters depth barge berths. The total berth length is about 1290 meters. The total area is about 160 hectares which has 24,649 group slots There are 14 quay cranes, 48 RTG cranes, 16 forklifts(4 heavy duty ones) and 2 reachstackers. This terminal was opened at Dec, 2005. The table below is the Main facilities in Waigaoqiao termnals

	Main facilities about Waigaoqiao terminals				
	Phase 1	Phase 2	Phase 3	Phase 4	Phase 5
Construction Begin	1997/07	1997/09	1999/10	2000/03	2003/03
Construction Ends	1998/06	1999/08	2001/11	2003/01	2004/12
Berth number	3	3	2	4	3
Berth length (meter)	900	900	665	1250	1100
Depth of berth (meter)	-12	-13.2	-13.2	-14.2	-14.2
Quayside width (meter)	45	50	50	54.5	58
Total land width (meter)	553	1200	1020	1200	1220
Quayside bridge	4	4	3	4	4
Gantry crane number	10	19		14	14
RTG number	36	61		48	48
Total land hectare	50	102.13	63.86	155	163
Yard area hectare	21	49	26	55	76

Table 1 The facilities of Waigaoqiao terminals

Source: from WQG terminals webstie

Yangshan container terminal (SSICT) Phase 1 and Phase 2 have 9 16 meters depth berth with the total berth length of 3,000 meters which can be berthed the biggest container vessel in the world. The total land area is about 240 hectares. The stacking area is about

139 hectares which can hold the total container numbers of 150,000 TEU. There is an intelligent gateway with 20 entrances and 13 exits. There are all together 34 quay cranes including 13 double 40 foot container crane, 108 RTG cranes and 220 trucks. The Phase 3 of Yangshan terminal is under the test operation which has 4 depth berths with total berth length of 1350 meters. Phase 1 was opened at Dec, 2005; Phase 2 was opened at Dec, 2006. The table below is the main facilities in Yangshan

	Yangshan container terminals	
	Phase 1	Phase 2
Construction Begin	2002/06	2005/06
Construction Ends	2005/12	2006/11
berth number	5	4
Berth length (meter)	1600	1400
Depth of berth (meter)	15	15
Quayside width (meter)	90	100
Gantry crane number	34	
RTG number	108(13 double 40 cranes)	
total land hectares	240	
yard area hectares	139	

Table 2The facilities of Yangshan terminals

Source: Port of Shanghai

3.1.4 The fierce competitions among local and global terminal to obtain operation in Shanghai Waigaoqiao and Yangshan container terminals

The competition of grasping the investment allownance has been never stopped since

1998. Waigaoqiao terminals have been planned to build with the policy of government of extending them to an international harbour. The Hutchison Group is the first global terminal operators entering the terminal market in the Shanghai, because the group helps Shanghai terminals renovate three old terminals in Huangpu riverside which is called Shanghai Container Terminal since 1993. Due the stronger relationship with Shanghai government, Hutchison have taken shares in 3 terminals in Waigaoqiao and Yangshan terminals. While APM Terminal which is a subsidiary company of A.P. Moller Group has grasp the opportunity of Waigaoqiao terminal expansion in Shanghai. Because the endearvour of Maresk not only from political and enonomic support for China have make Shanghai Port Authority cooperated with him. Another important reason is that, APM terminals is also a leading terminal operators in the world. Bringing APM facilities and experience can boost the single Hutchison cooperation mode and avoid the over control of container traffic by Hutchison which was worried both by Chinese government. Now we can see that after the APM and Hutchison both have the entered Shanghai container terminal industry, they are have the same question of developing Waigaoqiao terminals compared with Yangshan terminals expansion of Phase 3A and 3B terminals. In Dec 2007, the Yangshan Phase 3A terminal is in the test operation, but the joint-venture company has not yet formed due the fierce competition in shareholders. The final shareholders may be PSA , CMA CGM, China Shipping and SIPG. And NYK and HLA are also looking into way of involving in the Phase 3 terminals. Obviously, Hutchison and APM terminals will be exclude out in the Phase 3 terminals. Not matter what the cooperation between Chinese terminal operator and foreigner operators, the biggest play will be still in Chinese terminal operators. The trend of Shanghai container terminal is going on the way of multi-operators. So there will be more difficult to control and manage these operators under the changing world container business.

3.2 The comparative study of Shanghai container terminals with other Chinese

container terminals by container throughput

3.2.1 The analysis of container throughput in Waigaoqiao and Yangshan terminals

Shanghai container terminals mainly consists of three parts, they are Shanghai container terminals, Waigaoqiao terminals and Yangshan terminals. Other small container terminals su Shanghai Container terminals has a longer history and is a mega terminal which is located in Puxi and scattered at three area which are Jun Gong Road, Zhang Huabang and Baoshan area. They are built and invested by SIPG and Huntchison in the early 1993. Waigaoqiao container terminals have 5 phase terminals under 4 individual brands, while Yangshan terminals have two high capacity terminals. All the terminals in Waigaoqiao and Yangshan have been handle much more container throughput in Shanghai since the faster developing from 2000. In Dec 2005, Yangshan terminals successful openness have inject new power in Shanghai terminals industry. Figure below shows the two year Jan to March throughput.

We can see from the Figure 2 and Figure 3 below that Waigaoqiao Terminals take about 78% of total throughput in three month of the year 2005, while in the year 2007, Waigaoqiao takes 64% and Yangshan holds 22% which all together are 88%. Looking into the figure about Shanghai Container Terminals, the percentage falls from 22% to 14%. And this terminal handles most domestic trading containers in Shanghai containers throughput which takes about half of its terminals throughput every years. So the position of Waigaoqiao and Yangshan terminals handle most container throughput in Shanghai. And the trend will be go on due to the developing plans of Yangshan terminals has been never stopped. Another thing we can see from the figure is that the percentage of Waigaoqiao terminals has been lowered than the year 2005 when Yangshan terminals has not been built. In the year 2005, the Phase 5 terminal has just been into operation, so the percentage is above double in the year 2007. So the following comparison of Shanghai container terminals with other area terminals can reflect Waigaoqiao and

Yangshan terminals overall condition.

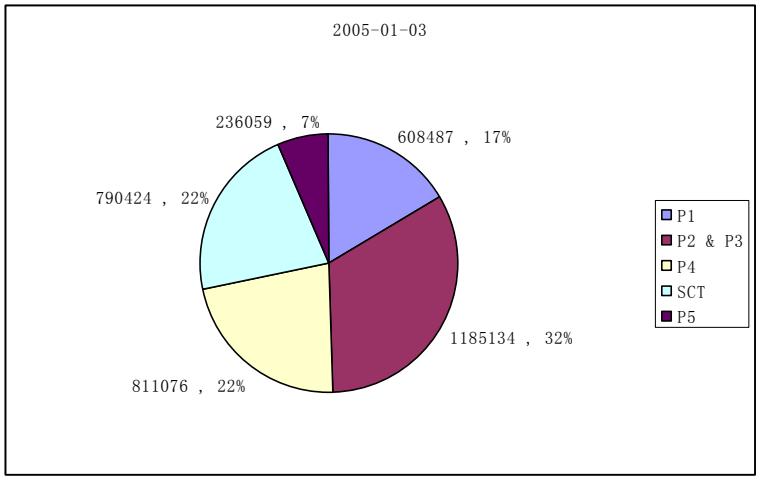

Figure 2 The first quarter of 2007 container throughput of Shanghai container terminal (P1 means Waigaoqiao terminal Phase 1, SCT means Shanghai Container Terminal which is a terminal near Waigaoqiao district)

Source: calculated based on data from Port of Shanghai

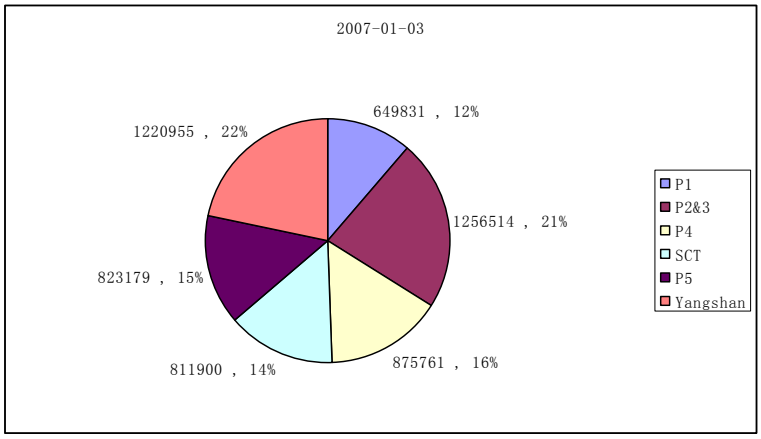

Figure 3 The first quarter of 2007 container throughput of Shanghai container terminals

Source: calculated based on data from Port of Shanghai

3.2.2 The comparison of the growth rate of container throughput among Chinese port city

In this section, the container throughput is calculated on the whole port city, Shanghai Waigaoqiao and Yangshan has take 86% of main throughput of SIPG, while SIPG has over 95% of the total Shanghai container terminals, so Shanghai total container throughput can really the throughput generated from Waigaoqiao and Yangshan.

Container throughput has been regarded as one of the most important factors in evaluating the terminal operation condition. In China, this factor has been widely used to compare the scale of container terminal. In some district, port man has great passion on enhancing the throughput in their terminals. In Jan 2008, the Shanghai Government announced the total container throughput in Shanghai in 2007 has reached 26,150,000 TEU. But the total throughput cannot see the period growth condition with other Chinese port. The comparison throughput offers a better way of investigating the simultaneously growing rate and the gaps between Shanghai container terminals and other costal terminals.

Shanghai total container throughput ranked No.1 in every month since 2005, no one can catch up or move the position. Table 3 below uses the Top 8 container throughput data which select most recently March 2008 and March 2005. Shanghai has holds the No.1 throughput position for recent three years. The gaps between No1 and No2 has bee enlarged in the past three years. But in the growth rate of monthly compare and three month total volume growth rate, Shanghai is not No. 1. Ningbo port and Qingdao ports shows dramatically growth with over 120%. The three months data is even higher than 140%, while Shanghai is almost same growth rate by over 60%. The main reasons is the terminal expansion rate in Ningbo and Guangzhou is faster than Shanghai. All the Shanghai Waigaoqiao terminals expansion has been finished in the early 2005, while the Yangshan terminals opened at Dec, 2005.

Rank	Port city	2008 March (10000 TEU)	2005 March (10000 TEU)	growth%	2008 Jan to Mar (10000 TEU)	2005 Jan to Mar (10000 TEU)	growth%
1	Shanghai	239	142	68.31%	660.31	395.73	66.86%
2	Shenzhen	171.35	116.05	47.65%	493.84	346.05	42.71%
3	Guangzhou	97.47	52.94	84.11%	279.5	147.25	89.81%
4	Ningbo-zhoushan	86.82	38.08	127.99%	254.77	103.32	146.58%
5	Qindao	83.56	36.75	127.37%	244.47	101.38	141.14%
6	Tianjin	69.19	34.19	102.37%	189.91	88.92	113.57%
7	Xiamen	38.48	25.8	49.15%	112.18	76.78	46.11%
8	Dalian	35.7	21.1	69.19%	100.26	57.54	74.24%

Table 3 The comparison of container throughput of ten port cities.

Source: calculated based on data from www.portcontainer.cn

All China ports container throughput growth rate is influenced by China macroeconomic and global container shipping market. Each terminal throughput is determined not only by the special hinterland and shipping customers, but also is decided by the China economic development condition. Figure 5 below shows out Top 5 port city monthly throughput from April 2007 to March 2008. We can see the volume of container in each port area. The rank follows from Shanghai to Tianjing port area by the total throughput. Although each port city is different from other port city, there is similar trend of volume of container throughput in every line. The most obvious slow down is the 11 point in the figure which is the February of the 2008. Because this month is the Chinese Spring Festival which half of the month Chinese celebrate and do not work. The meaning of this

figure is to show out each terminal under certain port city develops with the path of the country to some extent.

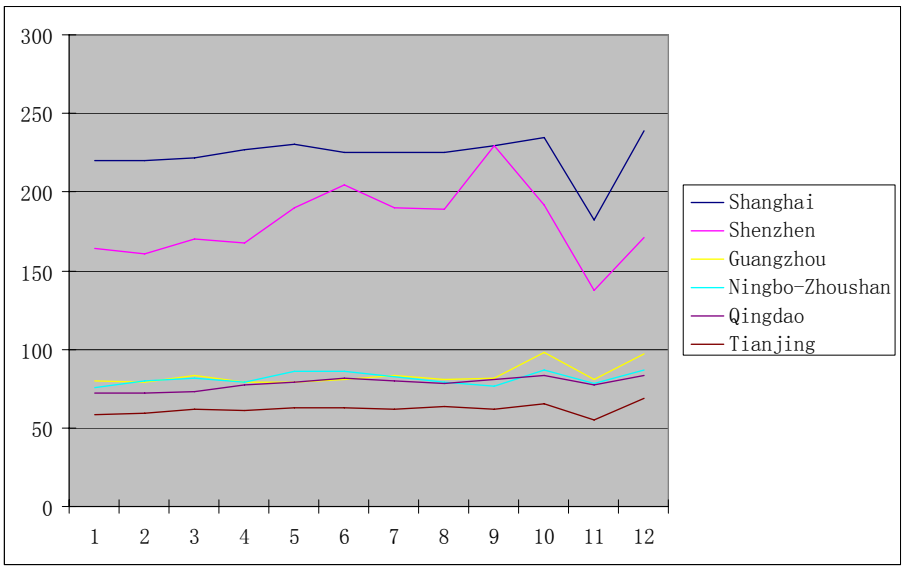

Figure 4 Similarity of container throughput trend of each port cities (unit 100,000TEU)
Source: calculated data from Port of Shanghai

We can see from Figure 5 below that the yearly growth rate in Chinese container terminals are various under the economic environment in the terminal industry. There is only Ningbo-Zhoushan terminals has the increasing growth rate. And there are only two port cities has increased growth rate than other terminals in the year 2006 because other terminal including Shanghai terminals have met the slowness of growth. Shanghai growth rate falls almost 10%. The reasons of the 2006 slowness are the Chinese government set down the policy of controlling the fast developing steps. Looking at the absolute rate, Shanghai growth rate is not stable and higher than the medium size terminals such as Guangzhou and Ningbo terminals. And Shenzhen as the second container throughput has the not very good growth rate in the past three years. There is a decline trend of developing although the terminals. But only investigating the container throughput cannot find the problems and gaps between Shanghai terminals and other

terminals. For example, Shanghai has been the No.1 container throughput in China, and the throughput gap between No.1 and No. 2 is enlarged bigger. So due to terminals investment is capital investment and influenced by its hinterland, the growth rate of Shenzhen can hardly catch up Shanghai terminals throughput. This will also brings hide other threats and weakness of a container terminal. Shenzhen terminals have been regarded the most competitive terminals in China by the Chinese Water Transportation report made by Chinese economic information network. The criteria of the ranking of the most competitive terminal consist of five factors. This year is the first years of changing from total throughput to throughput growth rate. While we can see from the year 2005 to 2007, the Shenzhen container terminal growths is declining, but we cannot use throughput growth rate to say that Shenzhen terminals are not good as other terminals. In the next paragraph, Shenzhen terminals are showing out great performance. So throughput growth rate is only one aspects of the condition of terminal operation.

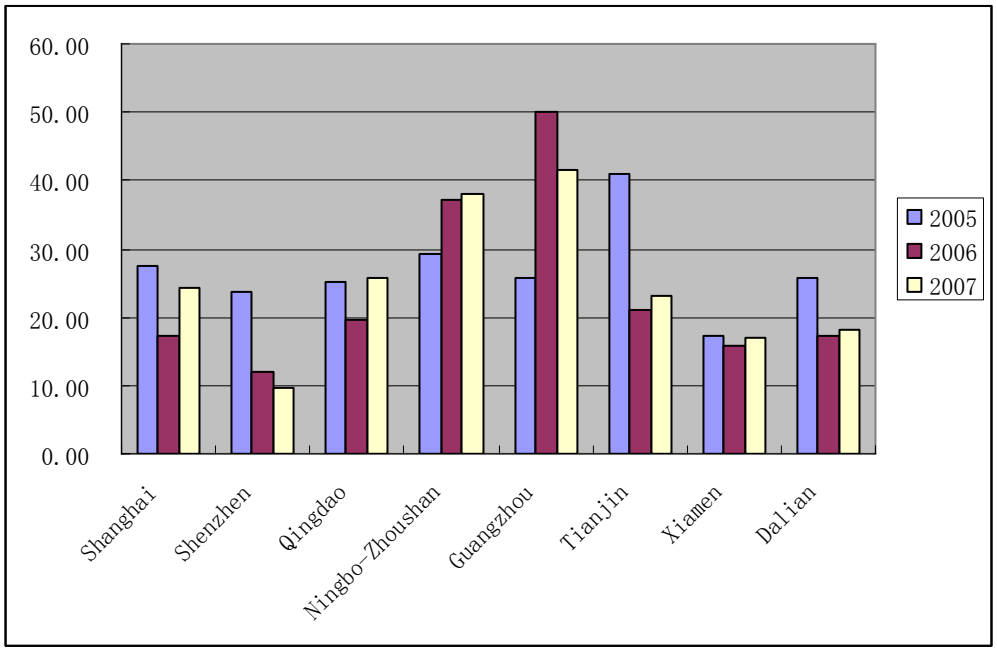

Figure 5 Three yeas container port cities average throughput growth rate (%)

Source: calculated based on data from www.portcontainer.cn

3.3 The Chapter summary

Shanghai Waigaoqiao and Yangshan container terminals have met the historical chances of building period since five Phases of Waigaoqiao terminals runs into operation since 1997, and the Yangshan container terminals have been build in very short construction period. The faster building speed is injected with foreign terminals operators such as HPH, APM Termnal. So the faster container throughput in Shanghai has been ensured. But the problems occurs from the Yangshan terminals running into operation, the Waigaoqiao container terminals throughput has been influenced a lot since the discussion above, the gaps appears in Shanghai two terminals area are founded. When analyzed the container throughput growth rate, Shanghai container throughput has lower month container throughput growth rate, only half of rate compared with Ningbo, Qingdao and Guangzhou throughput. There are similarity container throughput curve of container throughput of month in a year between various terminals, we can see that Shanghai has been influence more than Ningbo and Guangzhou port. This means the macro economic of shipping, global economic and Chinese economic will influence Shanghai terminals a lot. From yearly container throughput analysis before, the Shanghai container terminals are not showing continuous growth, only Ningbo terminals can do. So although the total container throughput in Shanghai has been ranked to No.2, its position is really being challenged from Chinese terminals, such as Ningbo and Guangzhou. So in the following chapter, the dissertation will find the gaps on the container logistics between other developed terminals. The purpose is to find the reasons of developed terminals attracting container cargoes.

Chapter 4 Comparative study of container logistics

4.1 The comparison factors selected

The container logistics in a container terminal is the core business and main responsibility. Container logistics can be classified by various functions. The container logistics in a container terminal mainly deal with importing, exporting and transshipment containers. The terminal has been used a place of stacking and moving container from one direction to another direction by its individual function. In this chapter, it compares Waigaoqiao and Yangshan terminals with global terminals in the world in order to stand at an international point of view to find the difference and the reasons of gaps between Shanghai terminals and other terminals. The comparable factors are selected and classified by two main factors group. The first is the tradition function factor which includes ship to shore container logistics, container stacking area logistics and transshipment logistics. The other is the new trends of container logistics in terminal which are intermodal connectivity such as road, water and railway; value added service and information technology used in container terminals.

When comparing with Shanghai Waigaoqiao and Yangshan container terminals, world similar container terminals on some factors are selected for comparative study. But the selecting terminals focus on the similar scale not too bigger and too smaller which will show out wrong disadvantage and advantage of Shanghai container terminals. Although container logistics happened in the modern terminals are influenced by many factors, which is not to say we cannot make comparative study. Due to the standardized size of

the containers almost since the Malcom Mclean age, this brings more or less some same factors in container terminals can be compared by welling selecting comparable terminals and factor. So the container terminals in the world have the same factor to compare. The ship to shore container logistics, the stacking area logistics and the intermodal connection are the main function in modern container terminals.

4.2 The comparison of factors related to the basic function of container terminals

This section discusses the basic function of a container terminal. The ship to shore movement is the most important sector ensuring the containers smoothly in and out vessels. The stacking area usually piles up container ready to export and import. Apart from these the transshipment factor is always involved in above two movements. International terminal must has large percentage or large potential of transshipment containers. The transshipment factor has been more and more regarded as the necessary factor of developing an international terminals, and without transshipment containers, som far east terminal will lose its leading position. So that's reason of this section selecting transshipment to be the basic comparable factors. This section use the way of comparing the terminal facilities and equipment and the performance they show out because most of terminal construction and maintenance cost piles in the equipment used in the ship to shore and stacking area movement. The characteristic of these equipment can large differ the performance they made.

4.2.1 The analysis of ship to shore container logistics

In a container terminal, ship to shore container movement is one of the most important factors that decide a terminal performance. The speed of loading and discharging container from vessel is the key function of serving the one of the two big customer of a terminal that is shipping lines. The trend of enlargement of container ships has met the

dramatic developing speed which will later brings the container terminal more pressure. This pressure will move on the most important equipment in the quayside that is the quayside gantry crane.

Waigaoqiao terminals have some old gantry crane which is around 4^{th} and 5^{th} generation, especially the Phase 1 and Phase 2, the building date is the oldest in the Waigaoqiao terminal area. And that's reason in why the Waigaoqiao Phase 1, 2, 3 have lower average gantry crane handling speed than Waigaoqiao Phase 4 and 5 which has new quayside gantry crane. The quayside gantry crane in the Phase 4 and 5 is one of the longest outside length which reaches to 63 meter, other gantry crane width is about 55 meters can cover 22 rows of container vessel and it is one of the most sophisticated crane in the world. Yangshan terminal can reach to 68 meter which can accommodate the largest vessel in the world while the working load of the gantry crane in Shanghai is much busier than the Europe and American terminals. The main reasons is that the high container growth rate in the Asia regions which pushes the crane productivity at the same time. While the European terminals equipments are more abundant than us and the terminals choices are abundant than, the total efficiency of gantry crane is lower than Asia.

There are two performance indicators listed below. The first is the average container numbers being loading and discharge rate per hour. This indicator is the rate of the total number of the containers loading and discharge dividing the total time of loading and discharging of the vessel. This indicator is determined by the terminal equipment and the operational management in the terminal. Another indicator is average container terminals moving by the shore gantry crane. This indicator measures the individual crane working performance by the rate of the number of containers moved by the crane and the hours of crane working.

In 2004, the total handling speed of Waigaoqiao quayside is around 26 moves per hours lower than Hong Kong terminal average speed which is 30 moves per hours. And the Hong Kong Modern handling speed has even reached at average 33 moves per hours. Compared with domestic terminal in 2004, the Shenzhen Yangtian terminal has 32 moves per hour on average. And in 2006, the Hong Kong average move per crane is 40.While after the Yangshan terminal operation, the average handling speed is enhanced to 35 moves per hour, the numbers of containers handling per move is enlarged by double 40 foots gantry crane. So the comparison of handling speed now uses the number of containers handling per hour to compare the speed more often. In May 2007, the world record is refreshed by Yangshan terminal with 97 containers movement per hour, and after half a year, the record also refreshed to 123.16 containers movement per hour thanks to the 13 double 40 foot lifted gantry cranes in the Phase 2 of Yangshan terminals. This speed is almost double than the speed in 2004 in Waigaoqiao with 68.49 containers per hours in the Table 4 below.

Port	Time	TEU/Hour	Highest crane speed TEU/Hour
Hong Kong	20010201	336	68
Waigaoqiao	20040130	359.23	60.14
Waigaoqiao	20040627	529.23	81.85
Yangshan	20070519	690	97
Yangshan	20080107	850.53	123.16

Table 4 Container Handing speed of crane in Asia

Source: Port statistics data

Although the new record has been refreshed by Yangshan terminal by two times in less than one year, the average handling speed of Yangshan is not revealed and Waigaoqiao terminal areas has lower growth rate of handling speed in the recent years after the

construction of Phase 4 and Phase 5 has being operated at full speed. There is a trend of rebuild the existing shore gantry crane to enhance the handling capacity because the rebuild cost is much lower than buying a new crane. Some of the Korea terminal gantry cranes called Harbor Mobile Cranes have been rebuild to better serve the enlargement of the vessel. And the out strength of crane is about 50 meters to 70 meters which is almost as the Yangshan terminals crane.

The Korea container terminal has large space compared with Shanghai Waigaoqiao terminals. Under the shore gantry crane which they called Harbor Mobile Crane, the area of truck and trailer is 6 lanes, and there are another 20 to 30 meters width connected to the stacking area. And in Waigaoqiao terminal Phase 2 & 3, there are only less than 10 meters width between quay crane and the stacking area. This will make the congestion of quayside container logistics. Due to Korea international terminals have large percentage of transshipment containers, the old terminals and new building terminal has setting more space around the shore gantry crane in order to make the container movement faster and efficient.

The ship to shore container logistics rely on number of berth, quay length, the mega equipment such as shore gantry crane, but the performance showed out by the mix of these infrastructures is crucial factors which can be compared between terminals in the world. The ship to shore container logistics is highly concentrated with various hardware and software usually working simultaneously. The below comparison Table 5 is measured by various factors which show out detail gap between Shanghai container terminals with worldwide terminal. There are three groups of factors

They are: the crane efficiency (the total throughput divide number of crane)

the quay length efficiency is the total throughput divide quay legth.

and the land usage is total throughput divide total area.

Comparison of efficiency of the terminal productivity							
Criteria	Unit	W1	W2&W3	HITH.K.	ECT	CTA	SPA
Berth	Number	3	5	14		5	37
Quayside crane	Unit	10	19	46	30	15	117
Quay length	Meter	900	1565	4327	3600	1400	10315
Total area	Hectare	50	165.99	141	248	110	343
Throughput	10000TEU	274.24	486.6	781	435	180	2319
Crane Efficiency	TEU/unit	247240	256105.3	169782.6	145000	120000	198205
Quaylength efficiency	TEU/meter	2747.11	3109.27	1804.95	1208.33	1285.71	2248.18
Land usage	TEU/ha	49448	29315	55390	17540	160363	67609

Table 5 2005 throughput and terminal condition.

Source: Peng Chuanshen (2007)

Above figures shows the comparison of terminal efficiency of selecting terminals by above factors. All the data get is retrieved in 2005. At this year, the Yangshan container terminals are just opened at the end of 2005. Due the Waigaoqiao Terminal Phase 4 and 5 are opened not longer in 2005, so selecting Wagaiqao Phase 1, 2& 3 to compare is more meaningful which all 17 lines did not moved to Yangshan at that time. HIT terminal 4, 6&7, 9 and 8 east terminals are selected for they are all under HIT Group management. And concerning the trend of automatic technology used in the container terminals, ECT in Rotterdam has been operated since 1994, the ability of enhancing existing ECT Delta terminal is very limited, and we can see the Netherland Government is planning Maasvlakte terminals. And the only expansion of Shanghai container terminal all arrives on the Yangshan terminals. While CTA has been operated since 2002, the highly automatic technology need high maintenance cost, and the design capacity is about 1900,000 TEU, in 2005, it is about 1800,000 TEU. Although there is

less potential of higher usage, the stable, safety, reliable and high efficiency operation will be continued popular by both shipper and shipping lines. ECT data is mainly about the Delta Terminal marine businesses which are all automatic handling operations. Singapore data is selecting all the container terminals as a whole.

We can see the terminal land usage is a little bit lower than HIT terminals in Hong Kong and Singapore because the Shanghai Waigaoqiao terminals are hinterland terminals, while a large amount of containers in Hong Kong and Singapore are transshipment containers which sure leads the higher land usage. The dwelling time of a container in Waigaoqiao is more than it in transshipment terminals. If Shanghai Waigaoqiao terminals provide the pre arrange of trucking transportation, there is potential of enhancing the land usage.

The efficiency of Waigaoqiao terminals are all higher than HIT Hon Kong and Singapore, and even twice as the CTA compared with Waigaoqiao Phase 2 & 3. If we just seeing from the data above, we can surely think the equipment used in the Waigaoqiao terminal are better. This is due to the better equipment acquisition and maintenance in the following operating years. While another important reason is that the lower land usage of quayside. We can see that Waigaoqiao Phase I and Singapore are not very big on the efficiency of crane, but in fact the running time of Shanghai crane is much longer than the Singapore ones. So long time running need high maintenance cost. If Shanghai container terminal are competing crane efficiency in the later, this will not be necessary and will generate high cost which will sacrifice other terminal resource.

According to the efficiency of quay length, we can see the Shanghai Waigaoqiao terminals are higher than any other terminals because Shanghai terminals have been hinterland terminals which need efficiency operation in the stacking area and land transportation system. The complicated and busy quay length is very hard to easy and

save time and space. The ability of enhance lies in the intermodal connection.

There are some gaps between Shanghai Waigaoqiao with other terminals. The initial design of the berth depth of Phase 1 and 2 are a little lower which cannot let the big vessel calling the terminals. Thanks to the Phase 4 and Phase 4 construction, the berth is designed to deepen to 12 to 14.2 meters, and now Yangtze River is under river building, so the smaller depth of the terminal is around 9.5 meter which should let the vessel wait the high tide time to enter the Waigaoqiao terminal. And Most European and North American terminal are at least deep at 14 meter which Waigaoqiao terminals deepest is 14 meter around, there is big gaps. Hong Kong, Singapore and Shenzhen Yantian terminals's nature deep is around 14, and through basic digging, the berth depth can reach to 15 meter which allows 8000 TEU go in and out freely. The Yangshan container terminals Phase 1 and Phase have the berth depth around 16 meters which have make several container vessel over 10,000 TEU. During March and April in 2008, there are 6 vessel under Maersk Lines. These vessels have the initial name of "e" which have the same characteristic: about 400 meter long, 56.4 wide, total tonnage is about 170,974, and can loading 11,000 TEU. This means the Yangshan terminal berth depth can be satisfied at current situation. While that is not to say that all the vessel can calling Yangshan, in the 2007, there is a MSC vessel with 15.4 depth has hardly touch the bottom of the berth which means the Yangshan terminal are not being regarded as can making all vessel calling in the future.

The land depth of container terminals is being an important factor of determining the existing operation and potential development. Looking at the Figure 6 below, the Yangshan terminals has 750 meters of land depth which has been restrained by the mountain in Yangshan Island. And the Waigaoqiao Phase 4 and Phase 5 have the longest depth of terminal land which reaches 1250 meters longer. The only comparable terminal is the CSCL terminals joint venture terminal in Los Angeles which reaches almost same.

ECT Delta terminal and Eurogate Hamburg terminal are only having half land depth as the Waigaoqiao terminals. And North American terminals looking the Los Angeles ones below, the land depth are longer than Europe and some Asia terminal because the intermodal facility such as railyway has account large amount of land. This figure also shows out that Waigaoqiao terminal and Yangshan terminal has great potential of letting more container piles. And this also show out the container movement speed of ship to shore are hard to enhance due to the longer transport way and time in the deeper terminal land.

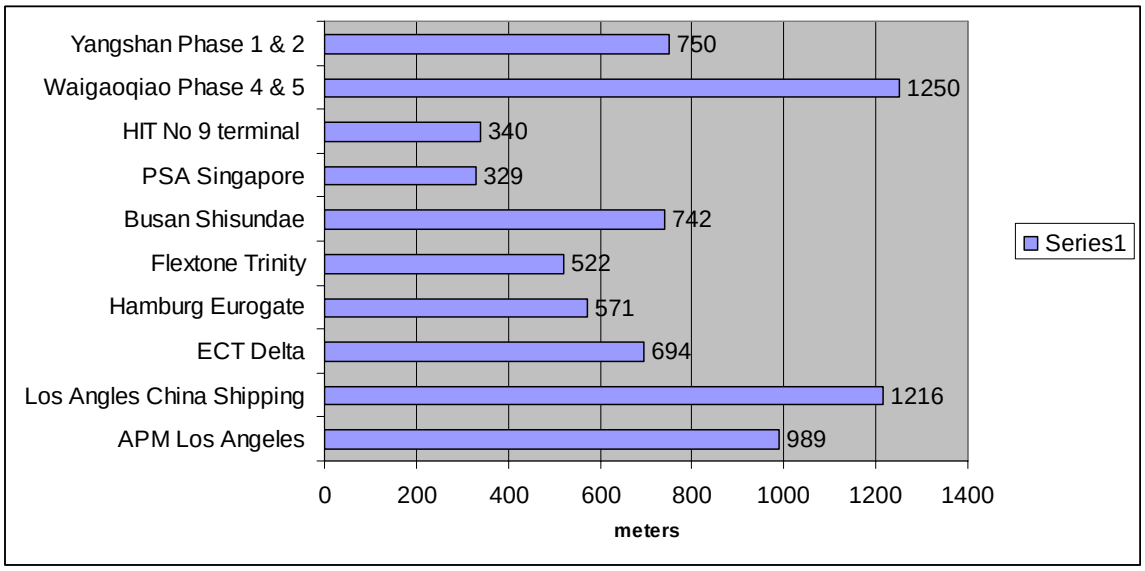

Figure 6 Comparison of land depth of main container terminal
Source: Calculated from various port authorities

The figure below also shows out the container throughput in 2005, this factor is carried out by the yearly total throughput and the number of berth. The berth throughput in Asia is much more higher than the figure in Europe and North America. This is also influenced by the container trade lines booming from the Asia. Looking at the below Table 6 shows out the main container trade lines in the world. The trade line, the vessel

number serving this trade, and the TEU. The figure is done by the Container International- Online. The concentration is in East Asia to East North Asia, East South Asia, Far East to west costal of North American and Far East to Europe. The figure shows out the reason of the berth throughput.

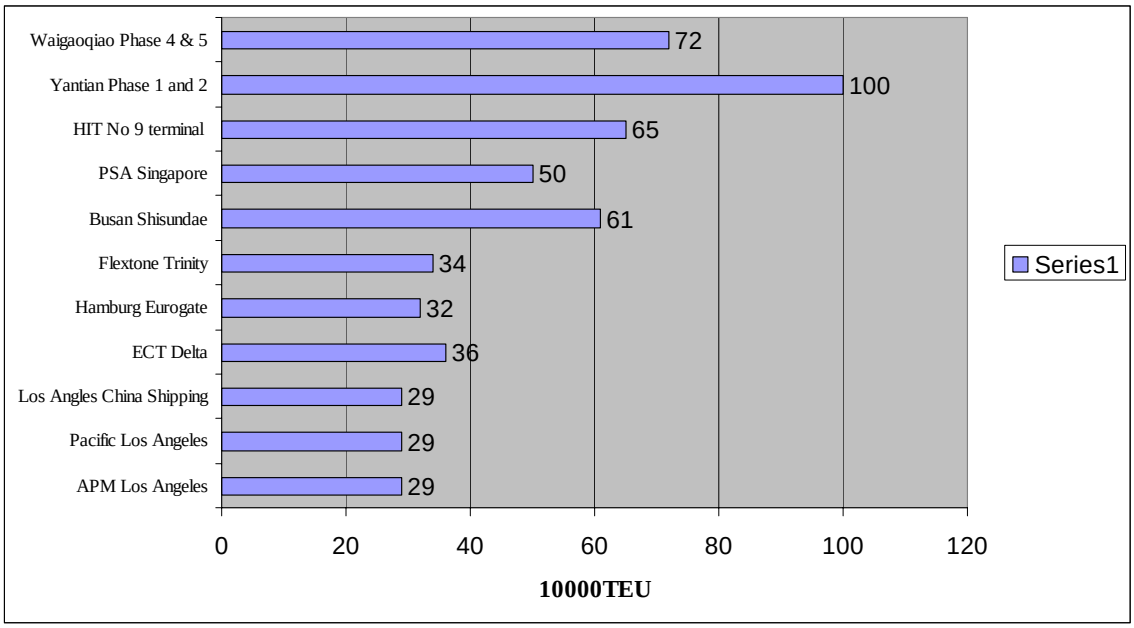

Figure 7 2005 Container throughput per berth

Source: Bao Qifan (2006)

Trade Line Name	Vessel number in service	TEU
East Aisa to East North Aisa	762	2278649
East Aisa to East South Aisa	715	2354071
Far East to North America west coast	376	1699280
China-U.S. Caibbean Sea to NAWC.	307	790047
Europe to Mediterranean Sea	266	941680
East North Asia to East South Aisa	260	757310
Europe to Far East	250	1617995
Far East to Middle east	215	831035
Far East to Mediterranean Sea	214	1154844

Table 6 The main trade line and its containers transport capacity

Source: CI-Online 2007 March

4.2.2 The analysis of container stacking factor analysis

The most popular stacking system used in the domestic and worldwide terminal are two kinds of system. One kind is the Rubber-Typed Gantry Crane with the truck and trailer system, The other kind is the Rail-Mounted Gantry Cranes with truck and trailer system. The truck and trailer will used the drivers to accomplish the movement between ship to shore container logistics. The figure below

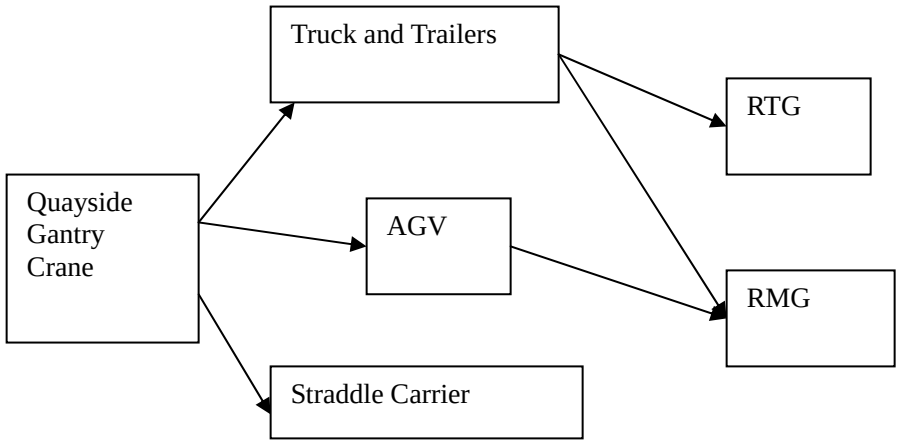

Figure 8 The equipment in stacking area

Source: Self design

This Figure 8 shows out the equipment used in the container terminal. The quayside has the gantry crane, the truck and trailer system and AGV system connected to RTG or RMG system in the stacking area. The truck and trailer system can connect to both RTG and RMG. The Straddle carriers is independent used between stacking area and cooperate with quayside gantry crane.

The horizontal container transport in the terminal usually uses also two kinds of tools. One kind is the truck and tailor system, the other is Auto guided vehicle called AGV system. The AGV can be positioned and operated in the centre office by the computer manipulated by terminal men. The advantage of AGV is faster speed and less labor worker in the stacking area which enhances the efficiency and safety of the stacking area. But the higher requirement of layout and equipment procurement in the first building stage cannot be avoided in the applying terminals no matter this terminal is rebuilt and new building.

Most Korea terminals use RTG (rubber type gantry crane) in the stacking area. The

height of the stacking area is about 4 to 5 container high. The width of these crane is about 6 lines of container which is about 23.5 meters. The Shenxian Tai container terminal has used RMG (rail mounted gantry crane). The width of the crane is about 28.5 meters which can occupy 9 container lines. The height of the container can be stacked at 6 to 7 containers which is very effective than the RTG system in other Korea terminal.

Looking at another terminal using excellent RMG and AGV system, the ECT terminal has used all automatic stacking controlling system which is the most efficient terminals in the world. The system used Rail Mounted Gantry Crane to move the container in the stacking area. This system is well benefit for the large amount of containers in and out stacking area because the enlargement of the vessel. Only a few operators in the centre system are controlling all the system operating. In Asia, the automatic stacking system has been broadly prompted and used, but the results are not widely applied to existing container terminal. Only small areas in existing terminal in Chinese are under the testing operating. And Waigaoqiao container terminal Phase 2 has been under the test operation. In 1993, the first automatic container terminal in the Rotterdam was opened which is ECT. After that time, ECT later built the Delta Dedicated East terminal and Delta Dedicated West terminal. In Asia, the Hong Kong HIT terminal and Sinapore Pasir Panjang then applied this technology. The Pasir Panjang is under expansion construction due the Phase 3 and Phase 4 container terminal are planned and began construction since October, 2007.

Due to the higher labor cost in the European countries, ECT terminals are successfully implemented this technology. That's reason of the testimony area in the Phase 2 of Waigaoqiao terminals are using the RMG system with the truck and trailer system in order to lower the space and cost. Due to the restrain of capital investment and technology applied, the Hong Kong HIT terminal and Singapore Pair Panjang terminal

are only using the RMG with trucks at the ship to shore quayside operation. They need terminal men to cooperate the operation between RMG and truck. While in the China, the labor cost is not as higher as developed countries, most terminals have slower steps of the desire automatic stacking technology. The main reason is that the main container logistics in China are using trucks. If the AGV technology is used in the terminal in the quayside operation, the movement between gateway and stacking area will still using RMG to position to specific truck.

Hamburg Container Terminal of Altenwerder (CTA) terminal under HHLA investment now is the most sophiscated terminal in the world, the wider choice of intermodal connection such as railway and barge brings the condition of the automatic stacking techonology into operation. They are using the Double Rail-Mounted Gantry Crane designed and produced by the ZMPC, which is a Shanghai based company and the most famous enterprise producing container crane and enhanced the handling capacity by 44% after installation While looking into the Waigaoqiao test stacking area begins in 2004, the technology seems to the test place of bringing the latest technology into other container terminal not used in the domestic terminals. The One reasons of is that the Yangshan container terminal has shorter construction period. So the new technology is costly and higher risk of applied on mega terminal.

And in recent years, Shanghai container crane market has the global competitive advantage due to a company called Zhenhua Port Machinery (ZPMC). ZPMC provide more and more ship to shore machine. The most famous one is the gantry crane. SIPG is cooperated with ZPMC to testing several electrical RTG solutions in Shanghai container terminals which Waigaoqiao terminals is a example. The purpose of this is to provide a real time platform of designing and compare what kind of solution is better for the trend of modern container terminals and enlargement of vessel. And also there is more and more products available for existing terminal renew equipment. Shenzhen’s Dachan Bay

which has 5 container berth and its quay length is about 1830 meter long has taken delivery of second batch of electrical RTG cranes in April, 2008. The first batch also brought from ZPMC. So this terminal first using the electrical RTG solutions in the world is really a symbol of Chinese gantry crane advanced technology. While the speed of technology development in ZPMC seems later because most WQG terminals are using traditional RTG, and even Yangshan has not used the best technology of stacking equipment.

The straddle carrier in the stacking area has been used a lot in the Europe. The Port of Le Havre is the biggest container terminals in France which account 60% of container traffic in 2007 has 18 container berths. These terminals are using the straddle carrier to do the main container logistics in the terminal. And some small terminal in Hamburg and Netherlands are more prefer to use straddle carriers due to the simplistic equipment on the stacking area which will less the working procedure compared the RTG and RMG system. The straddle carrier avoid of using the truck and tailor. But the disadvantage of using straddle carrier is the high maintenance cost and broken chances. And straddle carriers also request the driver have higher experience. This equipment is not economic when moving containers in deeper terminal land. So none of the Shanghai terminals have selected the Straddle carrier to be the main stacking area tools due to the large stacking area and land depth of the terminals discussed in the previous chapter.

4.2.3 The analysis of container transshipment factor analysis

In Asia, the transshipment rate of transshipment terminal is around 40% which brings a lot of pressure on the terminal equipment. In the transshipment center, the average working amount is 130,000 TEU per year per gantry crane. While the working amount of gantry crane in no-transshipment terminal is about 40,000 TEU per year. The berth working amount is 1200 TEU/Meter than 850 TEU/Meter. Due to the improvement of

the working amount hard to gain in the mega terminals, the transshipment rate is difficulty to enhance to a new level in Asia. And in the past 10 years, the throughput growth differs greatly by the type of the terminal. The tables below shows out the growth rate respectively. Shanghai container terminal has been in the position of world gateway terminal. Looking at table 7, the growth rate between world transshipment and world gateway is not big, only 1% growth in differ. While the transshipment rate in Shanghai Waigaoqiao and Yangshan terminals are very low due to the long time low rate of international transshipment along the Chinese coastline

World transshipment terminal	World gateway terminal	Regional terminal	Small terminal
12.20%	11.20%	8.10%	6%

Table 7 various type of container growth rate

Source: Shanghai Port Authority

Up to now, China has not formed an international transshipment container terminal with competitive force. Most exporting container in China has go abroad to transship due to three main reasons. One is the shipping policy restraining which do not allow the main shipping routine transfer in China port which means international lines are not allowed to operate between two domestic ports. While some shipping lines are working in the grey area of Chinese maritime law, for example MSC consolidated boxes at Ningbo terminals by moving them from other domestic feeder ports. The second reason is the better transshipment policy in the Korea terminal such as Busan and Sunshine terminal which lower their charge in almost every sector bringing the benefit to the shipping company. In 2005, MSC has move back to Busan ports to set up its transshipment center in April, 2007 which is a great lost for Shanghai container terminals. According to statistics, 70% of the domestics container trading has been transshipped in foreigner terminal. In the transshipment center in Asia is Korea Busan terminals, 46% of the

container throughput is from China. There is great potential of eating the big piece of cake of transshipment from Busan terminals. Thanks to the building of Yangshan and the loosing of policy which means setting up the Yangshan terminal as bonded terminals before the running of opening the Phase 1 terminal. The present of SIGP Mr Chen has set up the goal in 2007 to increase grasping the containers from Japan and Korea to Europe and United States from existing 10 percentages to 30 percentages at the end of 2010. And the Yangshan terminal transshipment fee has been set the discount to 50% off which is really risk of attracting the international transshipment cargo in 2006. And now the discount rate is about 30%. But the transshipment rate is not enhance at large extend. In the first three month of 2008, the international transshipment rate is 11.69%, the domestic transshipment which means water to water is about 90860000 TEU, an 71.01% growth rate and account 52.5% of total container throughput in three months. The water to water means the containers being transshipped by feeder and shuttle barge along the Yangtze River terminal including Waigaoqiao terminals. The liner service has increased to 35 lines connecting Europe and South Africa routine. The total throughput is about 6,110,000 TEU in 2007

There are usually two kinds of transshipment type. One type is the hub and spoke system. One transshipment center attracts the containers from other small and medium size terminals around. The terminals around are not involved in international lines. Most of containers from China usually go to Hong Kong, Japan and Busan terminals to catch the international lines there. The other type is called the intersected trade lines transship. This type of transshipment center is determined by the liner shipping company. The liner usually arranges certain lines connected with its self other lines or other company different lines at a selected terminal. These lines are all major international trading lines in the terminals. For example, the shipping lines sailing from Japan and Korea terminals to be transshipped at the Hong Kong and Singapore terminals. So that’s reason of transshipment center in terminals like Hong Kong, PSA Singapore forms and developed

very stable due to many liner company are all choosing these terminals. But this type of transshipment center also has disadvantage. If the major liner suddenly quit most of international lines to another terminal, this will surely affect the throughput in the terminals. One typical example happened in 2001 Maersk Lines moving most of its Asia lines to Malaysia Pelabuhan Tanjung Pelepas terminals. This move has reduced 10 international lines from PSA Singapore and the direct container lost is about 1,000,000 TEU which most of them are transshipment center. The third type of transshipment center is based on the distribution center developed in the free zone logistics park. This kind of park usually provides better factory and policy to attract the raw material and semi-product to the distribution center which provide value-added service. After the products are processed in the free zone, the cargo is reloading into the container being transshipment to another country. PSA terminals in Singapore are using this kind of type to ensure this kind of transshipment in the recently years at stable rate.

The Table 8 shows out the Yangshan terminal have the competitive advantage of attracting the transshipment containers from Busan terminals. If the container is exported from Qingdao terminal, suppose it has three ways of transshipment in order to be loaded on the specific routine vessel. They can be transshipped from Korea Busan terminals, or Waigaoqiao terminals or Yangshan terminals. If the container goes to Europe, at this table using Rotterdam as the destination, the cost listed below only refers to the loading and discharging fees excluding respective liner company discount. We can see the Yangshan cost is lower than Busan and the voyage days are also a little bit shorter than Busan in both trade line to Europe and North America. While Waigaoqiao terminals have lowest competitive because the total cost and voyage days are all higher than other two terminals which are the reasons before the building of Yangshan, most containers go to Busan terminals to finished transshipment.

transshipment mode	Qingdao to Europe			Qingdao to North America		
	Busan	Waigaoqiao	Yangshan	Busan	Waigaoqiao	Yangshan
voyage days	32	34	30	18	23	18
cost (dollars)	1709	1815	1585	1909	2115	1885

Table 8 Comparison of transshipment cost

Source: Various statistics

Although Yangshan terminals can effectively attract domestic transshipment containers from Korea, the international transshipment rate will not be faster increased at the same time of domestic transshipment increasing. But at least, it can diminish the position of Busan and Kaosung transshipment volume

Kaosung container terminal throughput has shows out declined since 2005, in that year it is the first year that the container throughput decline since the building year. The transshipment center has declined by 4.32%. In 2000, the Busan terminals throughput has speed up the Koasung terminals. While in 2003, the third throughput position has been taken over by Shanghai terminals due to the expansion of Waigaoqiao terminals. The position of Shanghai container terminals has been lifted to now No.2 place. The reason may be the openness of Yangshan container terminals in Shanghai. Because the high growth rate surprised the world terminals industry since its building period is so short and the later yearly throughput is also higher.

The Table 9 below shows out the number of vessel calling since the openness of the Yangshan terminal Phase 1 in Dec 2005, we can see the first five month is a not increasing faster than later month. But the month of reaching 5000 callings and 8000 callings are less and less. One of reasons is that the Phase 2 is opening at Dec.2006. The transshipment rate is higher than the first openness of these terminals. And from the number of vessel, we can see it really grasp some vessel calling from Kaosung and

Busan terminal.

Yangshan faster growing vessel callling				
Date (month)	200512	200605	200709	200804
Vessel calling	1	1000	5000	8000
Internal month		5	4	3

Table 9 The faster growing of Yangshan vessel calling

Source: SIPG Shendong Co.

From above Table 9 Yangshan terminals has successful operated since the end of 2005. The increasing vessel calling has proved the Yangshan terminals global position. But the position of Hong Kong and Singapore terminal has been fixed for a long time. It is very hard to make the shipping lines to change or not calling Hong Kong and Singapore terminals. Before Yangshan terminals openness, Shanghai has not enough berth depth allowing bigger vessel into the terminals. After Yangshan goes into operation for more than 2 years, the hinterland cargo has the limited growth to satisfy the larger container vessel. So that's reason of the necessarily of shipping lines going to international transshipment center to load more containers to Europe, the purpose of going these terminals is to ensure the full laden of each vessel in the loop between Asia and Europe. COSCO container lines have changes its liner service after Yangshan terminals being into use. European trade lines will probably cancel calling the north terminals above Shanghai, they have deployed large container vessel depart at the beginning of Yangshan terminals. Let some feeder lines going from Dalian, Qingdao, Lianyugang to Yangshan terminals in order to transshipped to large vessel. This is really saving time and cost for liner express service. COSCO Asia N.W. Europe weekly express (AES) has set Shanghai as the beginning port not calling any North China port is a typical example. They use feeder service to do the transshipment in Yangshan terminals. COSCO Taiwan/ Korea/ U.S. Southwest Coast express (HPSX) has not calling North China terminals such as Qingdao, Xingang. And Pacific Southwest Coast service (PSW4) has

also two terminal calling that is Shanghai and Ningbo, then the lines goes to Kwangyang and Oakland, at last at Los Angeles which also saving calling North China ports which means Yangshan terminal has been chosen by domestic shipping lines to do the transshipment between Shanghai and North China terminals which has much advantage than foreign shipping lines not allowing to do so.

Although Shanghai Waigaoqiao and Yangshan container terminals faster development, the transshipment rate including international and domestic transshiopment is having last gap compared with Singapore terminals. The transshipment in Singapore terminals has occupied to 75% of their total throughput which each year can bring about 1000 million us dollar. There are also fierce competition in the transshipment center not only domestic market which is from the Nothern China terminals and Sunshing terminal in Korea. The policy of port authority of Singapore has allows the internal stacking the transshipment container in their terminal so this policy boosted Singapore into No.1 transshpment center. While the terminal policy is very important to the business developing plan of the vessel owner and liner company, they prefer the lower cost and loose policy to obtain their maximum profit.

4.3 The comparison of factors related to new developing trend of container logistics

The above section has discussed the basic or traditional factors related to the container logistics in the terminals such as the terminal layout and equipment usage in the quayside and stacking area. In this section, the intermodal connection such as road transport by trucks, water transport by barge, the railway transportation by train. This is being regarded more and more important whose terminals doing better will levitate the congestion of terminals. And the value added service which will bring more profit to terminals is also selected as new trend of container logistics. At last, the information technology in terminals is analyzed to find the distance of Waigaoqiao, Yangshan and

other terminals.

4.3.1 The analysis of road transport mode

The road haulage in the world terminals has been the main intermodal connection to the hinterland. The advantage of road is that by using truck the container can be directly moved to the shipper factory and importer door. But the disadvantage is the higher cost on long haulage transport, easily congestion on the route and population to the environment which is more and more serious in developing countries. Looking at the figure below, the Shanghai containers transportation mode by road is about 80% in 2007, while the water and railway is not more than 20%, so the congestion and uneven balance is a normal condition of Waigaoqiao terminals due to its nearest terminal to the city center.

mode transportation of Shanghai containers logistics			
model	road	water	railway and other
percentage	80%	15%	3-5%

Table 10 The intermodal transportation of Shanghai container logistics
Source: Shanghai Port Authority

The terminal in the world matured port has the trend of declining road transport in the recent years. While Shanghai terminals has only increased the road haulage in the past three years, the main reasons is that the road construction correspond the Yangshan terminal intermodal using road haulage as the main mode. Rotterdam has the well intermodal connection, in 2001, the road haulage reach 38% of the total container volume, the percentage is down due to the congestion in the road and more restrict environment controlling. The road haulage in the Anterwap container terminals are also showing the trend of declining. The percentage falls from 61.3% in 2001 to 59.5%. There are some problems in the Hamburg which also relies much on road transport by

49% in 2001. Looking at Yangshan container terminal, two speedways connects to the terminal. And the speed way called A2 is the only way directly linked to the Luchao logistics park. Another one called A30 is connecting to A2 at the end part of A2. At Waigaoqiao terminal, there is A20 connected to the terminal which is along the biggest road circle around Shanghai and connects to the hinterland Zhejiang and Jiangsu Province. So due to the main mode of intermodal transport in Waigaoqiao and Yangshan is road haulage. And there will be stable increase in the following years until railway and barge service matures.

Although the trucks are the dominant mode of transportation in Waigaoqiao and Yangshan terminal, the management of truck between two terminals are different due to the geographic location. The turnaround time in Waigaoqiao is less than Yangshan. When seeing from the world average tractor turn time, the Waigaoqiao terminals have the advantage of comparison. The average turn time in 2004 is around 18 minutes per truck. And the world figure is about 25 to 30 minute. The Yangshan terminal can less the turn around time below 10 minutes, but there will be another 30 minutes to connect to the landside highway because all the trucks have to pass the bridge in Yangshan connected to mainland. Usually the seamless transportation between gateway and highway around terminal is sets as the truck using 10 minutes to connect to highway by no less than 80% chance. While the Yangshan terminals cannot meet this requirement because all the truck has to been pass on a 32.5 kilometers bridge called Donghai Bridge. The designed transportation capacity is about 5000000 TEU above per year. Although some people are worrying about the weather condition which will lower the total operating time of the bridge, the real stop operating hours of the bridge is about 12 hours in 2006 due to heavy fog and bad weather. And in that year there are two cold air storms in Shanghai, all the Waigaoqiao terminals are stoped, while the Yangshan terminals can still operate. In the 2006, the total operating days of Yangshan is 5 more days than Waigaoqiao terminals. So the weather condition is not a big problem for the road

connection of the Yangshan terminals. There will be 500 RMB higher than Waigaoqiao terminal due there are almost 100 kilometers road distance between to terminals.

In order to gain seamless the road transportation, various terminal are set up trucking company to enlarge the vertical integration of the terminals industry. The advantage of this is to ensure there are sufficient and controllable truck fleets to move as many as containers from the terminal and levitate the congestion problems in the terminals. This vertical integration gives more big market to terminal operators to grasp the condition of container cargo more directly. Many terminal operators has set up logistics company. The Eurokai which is a Germany company which now do the vertical integration to operate the logistics company which owns trucks, total area 365,000 square meters warehouse. And their trucking and warehouse facilities in 42 cities in the European countries serve the retailer and manufacture company with integrated container logistics between their terminal and customer door

The Waigaoqiao and Yangshan terminals have not fallen behind. The biggest truck fleet owned by the terminal operator SIPG is the SIGPL. The SIPG Logistics company has been operated by SIPG group which is reformed in Dec 2006. The business area covers not only the intermodal transport but also the third party logsitcs service provider. SIPGL also has strong support of ships agency, freight forwarder, warehouse, information software company and so on. This logistics company is an integrated logistics company. The SIPGL has the biggest truck groups in Shanghai while providing the road transportation used by freight forwarder not only by Logistics company business, but also take the jobs from other cooperation partner. This company is invested by SIPG to approximate 300 million us dollars in order to make the company has better infrastructure. In 2001, the SIPGL has built a trucking company which is invested by SIPGL, Shanghai Transportation Investment Group and Shanghai Baoshan investment Group. The SIPGL has the nearly 80% stakeholder of the trucking company. The truck

fleet is about 500 trucks with GPS position equipment. This fleet which now is the biggest fleet in Shanghai serves all Shanghai container terminals.

Although the vertical integration of truck fleet into the terminals business, there is little terminal operator can do about exporter and importer preference of the time of road haulage to the terminals. Many European terminals also has the problems of the concentration of receiving trucks to discharge and loading containers in several period of days. In Waigaoqiao container terminals, there is uneven traffic jam inside and outside the terminals. There is a trend of time calculated by the Waigaoqiao terminals company. The concentrating picking container time is around 7:00 am to 9:00, and the sending container to terminal time is around 20:00. The reason of this trend is that the normal door to door loading and discharging is in the 8 hour daytime period. For example, the export container is loaded in the daytime at the shipper factory, and the truck with container will be hauled in the night, and the second day morning around 7 to 9 o'clock, the truck will arrived in the Waigaoqiao terminals. For import container, the truck usually picks the container in the night time around 20:00 in the terminal gateway, and the container is transported in the night and arrives at the importer's warehouse. So the vertical integration is hard to manage the truck to let truck go into and out the terminals at even time because the shipper's preference is very hard to change and small and medium size trucking company which are not integrated by terminals operators are also hard to manage.

4.3.2 The analysis of water transport mode

Since the openness of the Yangshan terminals, all the European trading lines have been move from Waigaoqiao to Yanghsn terminals. This also brings out the barge service and transshipment service between Wagaoqiao and Yangshan, and Yangtze River and Yangshan terminals. For example, in 2006 COSCO container lines set up the direct

barge service between Wuhai and Yangshan terminals with 3 shuttles in each week. Each barge can be loaded by 245 TEU. This barge service also directly attracting from the landside transportation which is certainly lower the time cost and capital tie-up of the cargo in the container. Due to Chinese regulation, the river boat in normal domestic trading can not sailing on the sea, so this push more and more barge service using vessel directly to Yangshan terminal. And under the strategy named as “Yangtze Strategy” of SIPG, there is a plan of deploy 1000 TEU vessel between Shanghai Yangshan terminals and Nanjing container terminals. There are some shipping lines has operated these barge service. The joint venture with Sinotrans Yangtze shipping company and MOL shipping company has opened the Nanjing Longtan container terminal to Yangshan terminal barge service now on 17 loops per week which has become the busiest barge service in Yangshan terminal. This service is also transported the empty container between Nanjing to Yangshan terminals. There will be 500 TEU vessels between Wuhai and Waigaoqiao terminals, 200 TEU vessel will be run between Chongqing and Waigaoqiao terminals. In the future most terminals in the Yangzte River will use Waigaoqiao terminal to do the transshipment to large international or shuttle barge transship to Yangshan. In 2008, there are more shuttle barge open into operation. Taichang container terminal which is a joint venture terminal with MTL has open the shuttle barge from Taichang to Yangshan terminal directly with two vessel with 250 TEU each. This shuttle lines linked Shanghai hinterland such as Shuzhou, Wuxi and Changzhou district. A major shareholder of this shuttle lines are Shanghai Changjiang shipping company. This shuttle lines has the typical example of developing barge service between Yangshan with container terminals in the Yangtze River instead of using Waigaoqiao terminals which is welcome by the shipper because the transportation cost is saving 500 yuan compared using road transport each container to Waigaoqiao, and another 500 road transportation to Yangshan, totally there will be 1000 yuan cost saving. And in the future, there will be three shuttles on both directions on daily running. All the barge service above show out the initial water to water transshipment running after Yangshan

terminal successfully operation, the percentage of transshipment of water to water has greatly increased to 50% in first quarter in 2008 discussed previous chapter. The problems of the shuttle barges all arrives when the market is booming. Along the Yangtze River, the barge capacity is having shortage, some barge are over capacity running between barge terminal and Waigaoqiao and Yangshan Terminal which are not safe in the long time running. The road connection is domain player in the Waigaoqiao and Yangshan. The road connection in the Waigaoqiao area is not at the same speed of construction as the terminal Phase developed

The bottleneck of Yangtze River transshipment service is the depth of Yangtze River. Although the integration planning of deeping the river channel in the 10 years ago, there are more than 3 billion Yuan invested since 1999 to make the river deeper, but the result of dredging is not as good as the initial planning because there are constant sands and mud flowing from the upper stream of Yangtze River which gradually stays at the dredged bed area. This is off set the dredge effect of the engineer working of dredge plan. So the large container vessel such as third and fourth generation should also wait tide up to going into their terminals. This is surely affected the feeder lines explored into the upper stream of the river, and then the transshipment of water to water between Waigaoqiao , Yangshan terminals with other terminals will be influenced a lot. And the barge service which vessel is smaller is more popular operated called as shuttle barge instead of large feeder vessel.

Compared with European container terminals, they have well nature condition and network of developing barge service. The better geographic location of Rotterdam, Antewap and Hamburg is the nature advantage. The terminals in Rotterdam are located in the entrance point between Meuse River and Rhine River. The Antwap terminal is well linked to France, Netherlands by the Danube and Rhine River. Due to limitation on location of river port condition and lacking better new terminal place, the Antewap

terminal is turning the terminal construction into the digging more deep draught and forming convenient intermodal connection.

The SIPG has also do the barge integration in order to attract more container cargo from the Yangtze River. Shanghai Jihai Shipping Company was set up in 2001 invested by SIPG, Shanghai Haihua Shipping Group and Pennavico Shanghai. This company business scope is to develop the Yangtze River container transport, China coastline container transportation. The shipping routine of the company connect more than 30 cities in China. The company has 80 vessels. The total capacity is around 11053 TEU in 2006. The container throughput of this company is growing dramatically since 2002

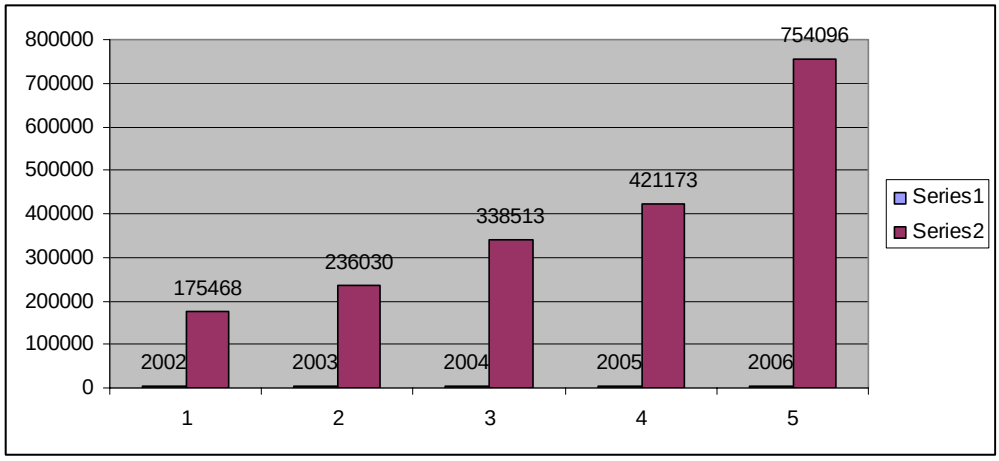

Figure 9 Container throughput of Shanghai Jihai Shipping Company
Source: Company profile

The ECT City terminal gives very much attention to the barges service. ECT has a 50% of the Rotterdam Short Sea Terminal which benefit both City terminal and Short Sea terminal to provide them enough container volume. The advantage and new trend of intermodal transport is using the barge transportation by river and short sea channel. The advantage is the lower cost and pollution and higher capacity. The unit box cost of barge service is relative lower comparing with truck. And it is safer and environment friendly

for shipper concerns. The EU has done the research of various transportation mode influences on the society including the accident, air pollution, noise, congestion and affect to rural and city). They find that the road transport occupied 91.5%, and airline 6%, railway 2%, water only 0.5% in the countries such as Netherlands, Belgium and Hamburg, there are consolidated standard of river and canal which can regulate them well. Some bridges are lifted higher for barge transportation in the river which can reach most northern Europe and west Europe. The barge haulage in the Rotterdam has been increase a lot since 2001. In that year, the percentage of total hinterland containers throughput by short sea reaches 21%. There are growing numbers of barge container terminal being built. There about 20 barge shuttle in each day sailing in and out the mega container terminals. In 1991, the total percentage in the transportation of container is only 19%, in 2001; the figure is lifted to 31% in 2004. The barge service has been increased from 29.9% in 2001 to 31.2% in 2002. And the barge can go to 40 terminals in the Europe. And each year there will be 5200 vessels in and out the Antewap terminals. 42% of the inland container is transported by river. While in the Hamburg, the barge service is around 10% in recently years due to the port authority are developing the railway transportation.

The European Union has given a lot policy to develop the intermodal connection among its member countries in order to facilitate the total transportation chain compared with China government. Since early 1992, there are many policy including PACT, Also Donube and RECORDIT planning to open the market of intermodal transportation, especiall the river ways. The EU released 1.79 Euro in 2004 to compensate the loading and discharging the container on the barge, and providing the 24/7 hours service in the terminal along the Rhine River. And the shippers are really happy to use barge from the deep sea terminal. There is no registered tonnage on the barge which is much better to operate the barge service compared with the restrict tonnage on the road transportation. There is freedom pricing system allowing in the barge service. The customer clearance

is allowed into the inland river terminal which is to make the barge running like flowing warehouse. And some countries are limited the longest truck haulage and time to push the shipper to use the barge service instead of single mode of transport which will cause the congestion to road infrastructures. The ECT Trimodal Container Terminal Belgium is well known by the excellent barge service it provides. TCT Belgium strategic situation attract many shippers and logistics service providers not only because of the direct connection to the European network of motoways but also the seamless transport by barge service via Scheldt-Brussels Canal. It has inland barge shuttle every workday to Rotterdam and Antwerp. Shipper prefers using this terminal because they can avoid the congestions happen in roads in Belgium and saving the cost effectively.

4.3.3 The analysis of railway transport mode

The railway mode connects to the container terminals has more advantage than disadvantage for terminal having large hinterland container cargo in and out the terminals. The container train is more stable to do the transportation between hinterland and terminal. But the higher facilities and large land occupied are problems remains to be consider when the terminal operators are choosing. In the developing countries, the railway facilities along the hinterland are not good as the developed countries although the longer distance the train will save more transportation cost than truck. In the developed countries some terminal operated are doing vertical integration on railway system connected to their terminals. The railway container haulage has been showing the growth rate in developed European port cities. The railway transportation in Antewarp is 8.8% in 2001, and the increase rate is slow but stable, in 2002, the rate lifted to 9.3%. While the Hamburg is the biggest railway container transshipment center, in the hinterland connection larger than 150 kilometers, the percentage of railway is about 70% in 2004. The intermodal transportation by the sea and rail is future developed in Hamburg which connects the manufacture center scattered in the European hinterland.

And due to the Hamburg terminal is near the Baltic Sea which also attracts more liner shipping calling their terminal can boosted the rail intermodal.

In Europe, the ECT Delta Terminal has the better railway infrastructure and facilities. The total area is about 18 ha. The total throughput in 2006 is about 525,000 TEU. It has 4 rail cranes to do the loading and discharging containers from the trains. In the heart of Rotterdam, the city terminal is a modern container terminal also operated by ECT. The intermoal terminal of City terminal is the example of fast come in and out of the terminal in the Europe. It has been updated since 1984. The terminal technology keeps developing with the modern technology used in the terminal fields. Due to the superior geographic location which is just adjacent to the Rail Service Center Rotterdam (RSC), the containers can be fast transported between Delta terminal and RSC with more than 100 rail shuttles per weeks running very efficiently. The newly built railway in 2007 which is Betuwe railway connected the Rotterdam and the border of Germany. The Betuwe line is operated by the company called Keyrail is owned by Port of Prorail 50% which is a rail infrastructure company, Port of Amsterdam own 15%, and Port of Rotterdam owns 35%.

The railway transport leader countries are in the North America. The APL brand which is now under NOL controlling carried out the report in 1995 of promoting the railway as the main container transportation. They regarded the railway as the green choice. It showed out the benefit of railway. Through the comparison, between the haulage around 2414 and 3219 kliometers, the double stack train carrying ten 40 foot container saves 9092 Liter fuel as the trucks carrying the same number of containers. And even the length of 805 kilometer which is relative short in United State, the train is only using one third fuel as the trucks do. This report also has the company strategic plan of prompting his railway haualage, but there is also deficiency not being mentioned. There are not so many train are new designed of fueling saving engine. Through the city expansion, many

rurual area which the train pass through now is becoming the satellite city of big city. So there noise from the train is influencing the people lives just around the railway. Although there are severe congestion in the Long Beach terminals in the recently years, the intermodal facility and connection is still regarded as the best U.S. intermodal hub of process containers from Asia. The Long Beach terminals have handled more containers than any other terminals in the U.S. The Los Angels is adjacent the Long Beach which is also very busy of asia containers. But that's not the reasons for the main Asia containers trade, but the intermodal connection both the highway passing to the South California which has large consumers stays there and the railway connection. Long Beach has connected to world busiest double stacking railway complex operated by Union Pacific Railroad. And the double stacking trains are running between hinterland and terminals by Union Pacific and Burlington Northern Sante Fe which are two major rail lines.

As about the Canada, The container terminal has also the advantage of rail haulage. Deltaport is the Port of Vancouver's largest container terminal. There are eight rail tracks (3500 feet each) providing capacity for four 7,000 foot double stack trains at 440 TEU per train. The terminal uses Multi-trailer system to do the movement of the containers from rail to vessel. The rail haulage service is provided by two intercontinental railways which are CN and CPR. Terminal Systems Inc operates Deltaport and Vanterm on long-term leases with Vancouver Port Authority. Delta Truck gate hours are not 24 hours, 7days operated. Monday to Thrusday, they work 14 hours, in Friday, only 8.5 hours, Weekends are all closed. This is has the advantage and disadvantage. The Waigaoqiao and Yangshan terminal gateway are 24 hours working.

In China, there railway system for passenger is matured than cargoes, and the railway has been in the slow progress compared with above developed countries improvement on railway. The Shanghai container cargo railway has been in the building progress, not the rebuilding and improvement as the Europeans system. So the gap is very large. In

recent years, there are some shuttle container trains developed in North China terminals like Dalian, Qingdao. But in Shanghai, the railway system has been investigated for long time, there is a railway being built and planned to connect the Waigaoqiao and Yangshan terminals in the future, but the process is very slow due to several factors. The container railway construction in Shanghai Waigaoqiao and Yangshan container terminals are developing in the recent years. In 2004, the Phase 1 of Pudong railway construction begins, and after one year period, the Phase 1 project has been complete. But the routine of the railway is from Jinshan District which is the biggest chemical industry area in Shanghai to Luchao Logistics Park. The total length of the railway is about 42.87 kilometers. In Dec 2005, the first container line of Pudong railway departed from Luchao Station of Shanghai Railway Container Terminal. The total project of Shanghai railway is under planning. The Phase 2 of Pudong railway is planned to go from Luchao Logistics Park to Waigaoqiao terminals, than go through the Huangpu River and reach the Baoshan District which will connected to Shanghai Railway network. The total length of railway is about 110 kilometers and the speed will be 100kilometer per hour. But the since the Phase 1 project openness, the construction of Phase 1 is still in the progress of mature the infrastructure along the Phase 1 project. For example, the main structure of Luchao Station of Shanghai Railway Container Terminal has been finished in January, 2008 which is later than the Phase 1 project and has surely influence the designed capacity of 1800000 TEU per year. Although this station has been opened and operated one year later in October 2006, after the Phase 1 project finished. Another important problem is whether the railway should go to Yangshan terminal in the island is also under research period. Because Shanghai container terminals has used road haulage for container transport since the openness of container terminals in the early 1990. If the Phase 2 of this railway do not connected well to the Waigaoqiao and Shanghai railway network, the construction of railway to Yangshan will be a huge risk. And this is also the weakness of Waigaoqiao and Yangshan container terminals with Los Angles and Long Beach terminals with well railway connection.

4.3.4 The value added service around and inside the container terminals

The value added service of container terminals includes many aspects. The CFS station operation, the dangerous and reefer container maintenance, custom clearance and inspection in the terminals, the free trade logistics park besides the container terminal are all attributed to the value added service. The value added service is regarded from various user, the shipper may view faster customer clearance and inspection of the terminal saving the penalty and time which added the value of his customer. Some container cargo are so urgent need by the cargo owner, so whether the connection to custom and other related government department of the terminal is good is very important. The CFS station is the tradition value added service, but in the recent year, this function is moved back to the logistics park instead of occupy more space in the deep sea terminals. In Shanghai Waigaoqiao terminal and Yangshan terminal, they are letting most of their value added service integrated into the logistics park just around the terminals. Compared with Rotterdam, the value added service is scatter to their inland terminals and hinterland logistics park in area not far from the terminals, most of the custom and commodity inspection are done before containers are being transported to deep sea terminals. These two type of value added service area in Shanghai and European are different mainly because there is more land area in Shanghai setting up to do value added service than other terminals do. And both of them have taken share in inland terminal and logistic park. The disadvantage of direct container logistics park is that the large capital investment in the park. If trade lines operated by the liner company has changed or moved, the distribution center which relies on mainly these lines will change to the lines correspondently. This is happening after Yangshan terminal running into operation because the Waigaoqiao terminal is suffers a lot since the 17 international lines moved from their terminal to Yangshan, the free zone logistics park has suffer some lost due to the high transportation cost from Waigaoqiao to Yangshan.

The free trade logistics park in Shanghai develops successfully in Shanghai, because more and more Waigaoqiao Bonded Logistic Zone was built in 2004, this zone was approved by China government. This zone is invested both by Shanghai Waigaoqiao Group and SIPG. The objective of this zone is to provide an environment of bonded policy to enhance the competitive advantage of Waigaoqiao terminals. The bonded zone is directly linked to Waigaoqiao Phase 3 terminal. The zone has two gate which are inner gate and out gate. Out gate is connected to Phase 3 terminal. There is a container yard with 140000 square meter including import export area. International distribution center A and B is just besides international transshipment center. There will be an area of 700000 square meter's modern warehouse inside the international distribution center. The designed purpose of handling containers is about 10,000,000 TEU. The Phase 1 warehouse in the zone is 100% leased, and Phase 2 warehouse is above 50%. There are many logistics company set up distribution center, such as international player like DHL, MOL, NIPPON Express, PIL, C.Steinweg warhousing, OOCL, ALPS logistics, and domestic company like Shanghai Industrial-walianfa International Logistics. SIPGL is the partnership to provide the third party logistic service.

In Yangshan container terminals, there is also a value added area which is called the Luchao logistics park in the mainland connected to Donghai Bridge. The main function of this park is to conducts the general logistics function of Yangshan terminals. It is also the important part of Yangshan free zone port area. There is a support area of Yangshan terminals opened at the same time with Yangshan terminal in the Luchao logistics park. This area is invested by SIPG and Shanghai Tongshen logistics park with both 50 to 50 percentage of shareholding. The company is called Shanghai deep-sea port international logistics Co. Ltd. The main business includes the Customs inspection, container temporary storage, depot, and container storage against force-move, CFS station, reconsolidation of transshipment cargo, inbound protective-trade cargo & container

distribution, dangerous cargo. There are mainly three areas which are customs inspection area, anciliary area, dangerous cargo area. And in the Luchao logistics park, there are more and more logistics company setting up. The biggest container freight station business company named as Globelink has set up logistics company in order to attract more CFS cargoes from Korea and Japan to finished at Yangshan terminals.

When looking into the service of special container cargo such as dangerous and reefer containers, the ECT City terminal has an advanced reefer storage brand that is called Home Reefer Care. This brand set up derived from the reefer container cargo ratio which is about one quarter of the total volume handled in the City terminal. Because there is a lot of trading of shipping lines calling city terminal transported reefer containers from South Africa, South America and Australia and New Zealand which are the producing center of bulk fresh products. Such customer brings the faster mature reefer container service in the City terminal. This brand is a joint venture with ECT and Smith Holland. This joint venture is win-win integration due to the Smith Holland is a professional cooling and freezing installation for ships industry and containers which provide various brands of cooling system such as DAIKIN, Thermoking and so on. It is also Netherlands company.

The ECT terminals are using inland terminals to support its Delta and City deep sea terminals. Three main inland terminals named as Trimodal Container Terminal Venlo, Trimodal Container Belgium and Decete Duisburg is the strong support of the most the value added service. Most of the customer clearance of containers goes by barge and rail pre done by the inland system. The barge in the feeder service is equipment with GPS system in order to better controlling along the transport in the Danube and Rhine River. This technology accompanies with EDI system shortens the custom clearance at great extend. And there are large CFS stations in these three stations. This is really good to avoid the congestion bringing to the deep sea terminals. One of the reasons of the well

connection between inland terminals and deep sea terminals are the vertical integration of these terminals by ECT. The Decete Duisburg is located at the center of Ruhr area which a number of 12 million consumers lives and works there. Decete is to provide all the intermodal logistics activities ranges from container storage including hazardous cargo, empty depot, maintenance and repairs and handling customs formalities. Rail and barg shuttle are the competitive advantage so that it can support the ECT deepsea terminal. Inland barge shuttle to Rotterdam: 5 times a week, rail shuttle to Rotterdam 6 times a week. It has 4 barge cranes serving along the terminal. Trimodal Container Terminal Venlo has a good connection with port of Rotterdam. It is a fully owned subsidiary of Europe Container Terminals. This inland terminal has the great advantage of rail shuttle. It provides three shuttle trains per day between TCT Venlo and ECT terminals in Rotterdam Massvlakte. It has 3 owned rail tracks. And it has three shuttles a week to the city area of Rotterdam like Waalhaven and Eernhaven. And the barge service between TCT Venlo and Rotterdam terminals will be available in this year. ECT will owns fully right of the barge terminal with 1 barge crane. The ECT container terminals have the well connection with its inland terminal like TCT Venlo, TCT Belgium and Decete. Each inland terminal has the constant contact with ECT terminals by the linked computer system. For example, the containers information will be pre-notified to the ECT terminal which they will go by the intranet system. This is really superior compared with Shanghai inland terminal which should make all the clearance before the containers going into the deep sea terminals in the Waigaoqiao and Yangshan terminals.

The difference of ECT terminals and Waigaoqiao and Yangshan terminal in the value added service is the distance of support area. The ECT has well linked to its three inland terminals which it has take some shares in those terminals. And after that there are small or large free trade logistics zone which support the inland terminals. While the Waigaoqiao and Yangshan terminals are direct using Logistics zone to support the all

the value added service which may happen around container terminals.

4.3.5 The information technology used in the container terminal

Some specilists have suggested using the information technology to solve the congestion happened in the world terminals will be the trend in the following years. The rebuilding the older terminals and adding new terminal will be constrained by several factors. For example, the developed countries building new container terminal should do lots of environment testimony to ensure the future operation will not affect the nature and ecology of the planned area. While some developing countries are lacking the money to be invested into modern terminal facilities and land procurement is also limited to the policy of local port authority constrain. And there are some port cities are not lacking the investor but they are not allowed to be invested by foreigner terminals operators because this will influence the market of domestic terminal industry and cause the labor problems later. The information technology also needs capital investment in the initial building stage, while the amount of money is relative much lower than rebuilding and new building terminal. According to one logistics information company in the California, they regarded the annual growth of the transport and logistics system will be around 7%.

A modern container should be equipped with a modern terminal management system. This system can have several business unit including the vessel stowing, the stacking area, the gateway and the webcam system in order to seamless the transaction among various resource used in the container terminal. Shanghai Waigaoqiao and Yangshan container terminals are all use one brand system which is called the Mile brand terminal and logistics information solution. This brand is developed by the a company called Shanghai Harbor E-Logistics software company which is both invested by SIGP and SIPG subsidiary Macao company. Under Mile brand, there are all together three system which are Mile TOPS, Mile LEADS and Miles SOMS. Mile Tops (terminal operation

process system) is a integrate terminal operation system including operation system (OPS), vessel planning system(VPS), vessel management system VMS, yard management system (YMS), EDI, wireless transmission system (WTS), and customer service system (CSS), tractor paging (WTS) and TMS which collect the charges and SAS statistics system. All the Waigaoqiao and Yangshan are using the TOPS system, the difference happens in the version of the system has been updated on the new terminal.

The Waigaoqiao Phase 2 terminals are over designed capacity which is 2.5 million TEU per year at the first year openness. Now this terminal yearly throughput is about 5.9 million TEU almost above double quantites. The internal digging of potential throughput for future development relies on the information technology. Due to the handling equipment used in Waigaoqiao is all the combination of tractor and RTM crane in the stacking area accompany with the quayside gantry crane. Looking into the figure below:

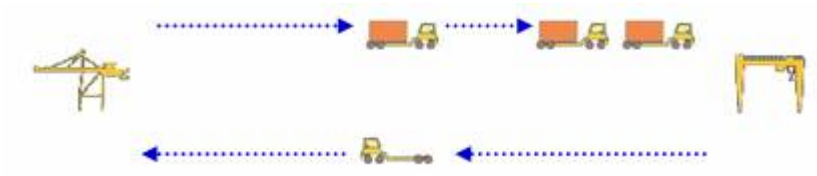

Figure 10 The operation flows of truck trailer in Waigaoqiao terminals
Source: SIPG

So there is a problem of tractor serving the dedicated quayside gantry crane in one direction loaded container and another direction with empty tractor. This insufficient usage of tractor will make the equipment idle at large extend and will use more tractors to do the work. In Waigaoqiao terminal, the empty driving percentage to 50% is a normal condition. In 2000, the SIPG together with Phase I and Phase 2 terminal

operators and with the Harbor E-Logistics company are begin doing the research of setting up the TPS. In 2001, there are only 10 tractor equipped with the wireless terminal in order to test the system. In 2002, there testing extend to 70 tractors. And in 2004, the Phase 2 has been setting up the matured TPS with intelligent system of letting the tractor avoid empty running. And the tractor can go to loading multi-task crane instead of the single crane. And the wireless technology successfully replaced the calling by the radio transmitter. Both direction of the loading has the loading containers, the figure below shows out information technology excellent results:

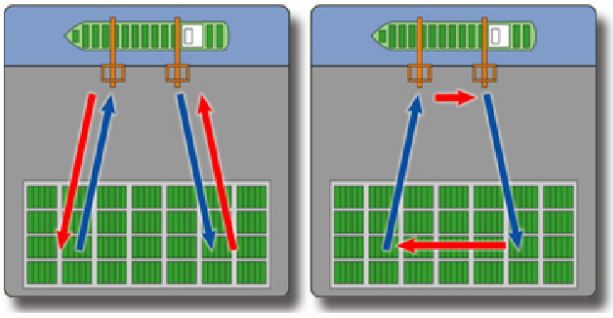

Figure 11 The changed transportation circle of truck and trailer
Source: SIPG

In the 2006, the Yangshan terminal has been updated by the GPS system into the TOPS system. It is short the turn time of the tractors doing one loop of working. Another problems push the GPS into the TPS is that Yangshan has the quayside gantry which can double lifting 40ft containers. So the tractor should be precisely positioned in order to accompany the double gantry crane. In the 34 number of gantry crane, the gantry crane is moved around 2 minutes, the turn time of the tractor is shorted by 1 minute, the total number of tractor when facing the job can saving by 17 tractors. This is better solved problem of empties running and busy time imbalance. And this system can also reduce the number of RTG and straddle carrier move in the stacking area. The working line is judge by the system according to importance, waiting time and the distance to be

considered. The information technology is also in the innovation process. For example the Waigaoqiao terminal Phase I has used for the wireless technology first in China by a local information company called GBCOM since April 2008, they are using a technology called MESH system mainly support the container stacking area operation by wireless GPS system to provide the position of trucks and large crane. PDS (Position Detecting System) and AGSS (Automatic Gantry Steering System) are two operation related to terminal daily operation. Because there are many equipments sending wireless signal and receiving equipment will be many, while GBCOM advantage is to avoid the signal disturbances.

While looking into the product of world leading terminal software company, which called Navis, there products covers every function of a terminal. They have one integrated system called SPARCS which is a really one package of software including many subsystem, such as Vessel Auto Show, Prime Route which is optimize the straddle and terminal tractor utilization, Exper Decking which is a yard controlling system, WebAccess for streamline customer communication by quick find the information of a container and it controlling the gateway traction also, other system are Analytics, Monitor, Live View. We can compare that the Navis product have more real time subsystem than Mile TOPS which just separated the subsystem by the function of a terminals. The Navis Express is the independent system accommodated used with SPARCS TOPS system by controlling the data management for automatic bookings, billing, report function. SPARCS Monitor is designed for managers at the terminal for them to control the Key performance indicators (KPI) of terminal workers. It can improves terminal efficiency by focus on the operational goals, and find the emerging issues. SPARCS Analytics are designer for executives to make continuous improvement and make strategic decision more easily because this software is very friendly using by them. While MILE TOPS are lacking the relevant software to generate more level used software in order to make the report easily by the higher level managers. The Express is

complement with SPARCS TOPS, because it is more friendly used by the basic worker who normally is doing the data input and generate the many specific report according to the worker criteria creation.

Many terminals using the Navis products showing success improvement compared with the previous software. APL Kaohsiung terminals have increased total average move per hour from 28.55 to 35.15, and used 6 cranes instead of 7 cranes which really lower the cost of handling operation. In the stacking area, the re-handles reduced by 22% in the stacking area in 2004. Before using the Navis products, the staffs have to do transaction by multiple systems to meet termnial's different planning requirement. By the Navis Express, the staff can do the request from customer more easily by using one combined system.

While the Shanghai Waigaoqiao terminals are Yangshan terminals are all using the MILE TOPS to be the information system no matter in HPH 50% or APMT 50% shareholders in Waigaoqiao Phase 5 and Phase 4 terminal. But looking from the global view, HPH has its owned terminal operating system called nGen, and APMT terminal worldwide are using Navis product in almost every dedicated terminal in the world such as terminals in Los Angeles, Aqaba. APL dedicated terminals in the world are selecting the Navis such as Kobe, Yokohama, Los Angeles, Dutch Harbor. And in the regional area, we can see that the Navi products are really successful scattered around almost every state. In Asia, not only DP world terminal are using Navis, but also China terminal are using the products, such as Qingdao Qianwan Container terminals, Shekou container terminals, Xiamen port group Haitian container terminal. In Europe, the Port of Felixstowe, Europe Container terminals are also selecting the Navis product.

In 2002, the ECT delta terminal selects the complete Navis terminal software suite to replace all their previous management software. After several phase implementations after two years, the terminal has increased the productivity and lower costs now with the

highly automation handling equipment. The Automated Guided Vehicles (AGVs) and Automated Stacking Crane (ASCs) are welled managed by the PrimeRoute which can really optimize the movement of these equipments. Looking the HPH terminal information, the next generation terminal management system called nGen has also beginning spread to other terminal except the Hong Kong home base terminal. Yantian container terminal is using this system which was used at the terminal opening, and now it has shoot being the No.1 terminal in the previous discussion about the Chinese container comparison. And the PSA terminals are using a system called CITOS which is a computer integrated terminal operation system and being qualified to manage high volume of containers going through Singapore. The real time controlling and fast speed some sector in the terminal are in the leading position in the world. For example, the Flow-through gate system that allows trucks to clear the in-gate under 25 seconds which is really faster. It has the artificial intelligence to optimize every process in the terminal operation.

4.4 The chapter summary

In this chapter, the gaps between Shanghai Waigaoqiao and Yangshan container terminals are being found through the basic function and new trend of container logistics. The ship to shore logistics is much higher after Yangshan running into operation, but the average loading speed is not the stable and highest compared with Singapore PSA terminals and Hong Kong terminals. The stacking area technology in Waigaoqiao and Yangshan although have been improved a lot since the new stacking system is gradually used on the terminals, the existing performance cannot be superior than full automatic terminals like ECT terminals which will be the future bottleneck of congestion problems when the container throughput grows in the future. Looking at transshipment rate, the rate of international transshipment is still lower very lower as Hong Kong and Busan terminals, but Yangshan container terminal has been the future solution of cost saving

transshipment center only waiting loose transshipment policies which constrain the existing transshipment. While the new trend of container logistics in Waigaoqiao and Yangshan has huge gaps with other terminals. Road is the main transportation mode, Yangshan has only road connection to mainland. Railway construction is at the beginning stage. North American terminals are doing railway transportation much better than Shanghai terminals. The barge service is also lacking big enterprise and network in Yangtze River compared with Europeans river transportation. The value added service in Waigaoqiao and Yangshan are lower than ECT terminals. The gaps in that are the number of value added service is well constructed around inland container terminals. But Waigaoqiao and Yangshan have set up logistics parks around their terminals which will brings congestion in the future. The information terminals operation system of Waigaoqiao and Yangshan is not advanced as the world leading software because the terminal operators are more accustomed to make innovation by themselves. They are unwilling to choose world leading software which has been by many famous terminals which will make the gaps much bigger in the future.

Chapter 5 Comparative study of market channel structure in container terminal

5.1 The introduce of market channel structure in container terminal

The terminals industry has been involved many players in the recent years. In 2007 Bichou has made the analysis of market channel structure and relationship under the trend of international and consolidation of the container port industry. He has emphasis the all the channel connected to the terminals including both the contractual relationship channel and contractual relationship channel which the channel is usually contacted by terminal operators. And in this dissertation, this section will use this channel structure theory to do the comparable analysis of external market channel and internal market channel. The reason of using market channel is to emphasis the relationship with the market because almost every channel has its individual market which is linked to the terminals industry. Terminal investor, Liner shipping company, the shipper and consignees' channel, the intermodal service provider channel, the freight forwarder and ship agency channel, terminal workers including both operation and management level worker are major player which most of them have direct or indirect contractual relationship with terminals owners and operators. Other market channels such as port authority, port related governmental department are contactual channel which support and make research of the terminal development on macro-economic level. To investigate these market channels of Waigaoqiao and Yangshan terminals with other terminal

channel will find the channel structure, channel power and channel conflict which may exists when the terminals are in the daily operation which has been discuss on previous chapter. This section stands on the market channel view in order to find the reasons back and hidden behind daily terminals operation.

5.2 The analysis of governmental channel of container terminals

This governmental channel means the market channel mainly consist of port authority, custom offices, commodity inspection office and governmental office related to port. This channel is the upper management leader of the each container terminals. Almost all the container terminals policy is carried under these channels. Shanghai government has given a lot of policies related to container terminals development in Shanghai. We can see from the 1990s, there is only 1 million TEU at the early year, and the container terminal has been developed from Huangpu River to external mouth of Yangtze River that is Waigaoqiao terminals areas, and then 2005, the container terminals have been covers to the Yangshan Islands. Behind the faster developing stage in the recent 10 years, there are great policy support from Chinese government and Minstry of Transport of China. The investment of Yangshan is so large amount in the existing Phase 1, 2 and 3 projects. Phase 1 is used 13.06 billion RMB, and if all the berth have been completed, the total investment will be 80 billon RMB. Most of capital investment is put by Chinese government first to ensure the building speed not to be influenced. The governmental channel in Shanghai are more complicated than other terminals in the world because the SIPG has group has incorporated Shanghai Port Authority in it, the Shanghai government has the direct leadership of SIPG, so there is limitation compared with European terminals. In Belgium and Netherlands, the ports are a subsidiary department of the government. The terminals in the port cities are directly operated under the landlord management type. The landlord terminals means the port authority has more freedom on the managing issue. The terminal layout and, equipment and the relevant

industry around the terminal and the land usage are under the port authority controlling. So the port authority has the wider operating and managerial independence and usage right of the terminals. In Germany, the Hambrug terminals are also under local government management. But on the economic development, the terminals development priority is far much larger than the city development planning in order to ensure terminals develops are not influenced by external factors. So the Hamburg terminals are likes one state inside state which means the city planning cannot restraint the terminal developing.

Shanghai Waigaoqiao and Yangshan container has been under the SIPG group controlling and management. So the group developing has its advantages. One of them is that the strategy of building mutli-channel relationship with other terminal related company. The SIPG group has been listed in the A shares in Shanghai stock market which means the assets management is ensured the longer and better solution opened to the capital market. The meaning of listing company is very important in merge and acquisition in the Chinese small and medium company, such as the terminals in the Yangzt River, the cargo owner company and even the private company or foreigner company. The purpose of around the asset management is to ensure the hinterland cargo resource. The successfully turnout from a government company to independently operating of SIPG is the great chance of merging the resource behind the terminals. For example, the Yangzte River Strategy has pushed 12 companies being setting up to form the network of Yangtze River layout in order to obtain. But there are also disadvantage of the SIPG group. This market channel conflict main arrives there are so many shareholders in SIPG, the Chinese central government, the local Shanghai government and China Merchant Shipping group, so there future development of Shanghai Waigaoqiao and Yangshan has been approved by these shareholders. If one suggestion is mostly refused by the shareholders, this suggestion will be over. For example, the opening of transshipment policy in Shanghai Waigaoqiao and Yangshan has been

controlled by governmental channel, and when this policy will be more open, it has no direct answers. In Singapore, the governmental channel is more easy and simple for the container terminals development. Singapore government use the better deep sea terminal condition to attract international investment project of crude oil refining, shipping companies in order to boost the hinterland economic such as electronic equipment and financial trading center which will attract more container throughput. Due to the dedicated container operator, the Singapore port authority not only provides the traditional operation right, but also treats them as the public terminals, for example providing extra container flows to dedicated terminal so as to increase the berth usage.

The governmental channel power should be raised more and more attention because some restrict rules setup is very hard to overcome, and situation will still existing and no improvement can be done in the following yeas. A typical example is the poor trucking system has gradually threatened Hong Kong container temrnals. Fairplay's HK correspondent recently find the problems of lacking the progress of lowering the cost of trucking a container from mainland Dongguan for export via HK's Kwai Chung terminals. This also influences the Hong Kong container market share of China mainland's direct-export containers from 90% in 2006 to 50% in 2004. And there is the HK's Legislative Council is protecting their truckers by the way of not letting mainland driver freely taking container in and out the Hong Kong and China mainland boundary. And the average trucker age is higher; some scholars estimate the whole chain of trucker will be on the retirement age in the few years. Although there are cooperation between Hong Kong and Guangzhou Province, the total cost for shipper to export 40 TEU containers more $250 from Hong Kong terminals than Shenzhen Yangtian terminals. The direct reason is the Guangdong authorities charge five years trucking license fee of about $ 14079 per truck which is running between boundaries. Although Hong Kong has the main advantage over the decades, but the powerful government channel of Guangdong and Hong Kong is the main bottleneck.

5.3 The analysis of changing shipper channel of container terminals

5.3.1 The shipper channel of container terminals under supply chain concept

Supply chain management has been prevalent in many industries area. More and more shipper and importer are looking forward to use the integrated transportation solutions of their products and the logistics service they need. Terminal has been in one important point of transferring the transport mode. Bichou and Gray (2004) have measured the port performance by a supply chain management approach. When the terminal is loading a number of containers, the terminal performance is added to total supply chain of these containers. The efficiency in the terminal area will surely push the later transportation into a more smooth way. Some shippers in the world are paying attention from the terminal throughput to the role of the terminal playing in the supply chain management.

In the high oil price era, shippers want to find the most cost saving method of container logistics solution. In China, the shippers prefer to choose the terminal whose has the bigger container throughput which means having the capacity of handling large number of containers. They also like choosing the reputable brand of shipping lines and container terminal which means the company the select can guarantee the service level they want. But the shipper in developed countries is choosing more and more third party logistics company to help them to solve the total solutions. Their containers may be transported by road and loading and discharging in several harbors and other complicated mode transferring. They are letting the third party logistics to design the routine in order to save the time and cost in the transport channel. And they are prefer the terminals which have better infrastructure. Intermodal connection for example is more and more liked by now days shippers. One of main reasons is that container logistics is not only around the terminal inside logistics, but also the smoothness of the

intermodal connection such as road, rail and water ways. And the yearly weather condition of the terminal area is also considered by the shipper and third party logistics company for they want their container to be moved in and out efficiently to match the cargo that need them in the supply chain management in order to obtain low cost, time saving and stable.

5.3.2 The changing attitude of shipper channel on Waigaoqiao and Yangshan terminals

In Shanghai container market, the shipper channel more prefers the Waigaoqiao terminals at the beginning of operation of Yangshan terminals due to the high transportation cost about 500 Yuan per containers compared with Waigaoqiao terminals. After more than two years operation, the number of shipper which dislike Yangshan has been reduced a large extend. This market channel has accepted Yangshan terminals for its faster handling speed and lower transshipment rate. And the Waigaoqiao terminals congestion has been effective levitated after Yangshan terminals operation. The channel conflict has been weakening as the mature degree of Yangshan terminals. Some shipper are not concerned whether his containers are going through Yangshan terminals or Waigaoqiao, what he concerns is the total transport time of his cargo. One reminder is given to containers going through Yangshan will be a little bit expensive than Waigaoqiao, and the supply chain management has really weaken the awareness of choosing terminals before doing trading at previous time. This channel power of shipper is not big as the governmental channel because most of Europe lines are forced to move to Yangshan terminals which is really strong enough to letting shipper accustomed to Yangshan instead of letting market to decide container trade lines separation between Waigaoqiao and Yangshan terminals

Global shipping companies are also should consider their customer because shippers are

their customer and profit margin. So there is seldom company who will choose the container terminal which most shippers on the routine do not like. And there is seldom company which will make the investment in the terminals which do not have a better future. So in Shanghai terminals, the governmental channel moving European trade lines to Yangshan terminals is also showing risk at that time because the intermodal channel of Yangshan terminals at the beginning operation is really not good as expected. And the shipping company has finally let the power of governmental channel wins at last. The intermodal channel has been work efficiently although there is one bridge linked to the terminals. The freight forwarder, the ship agency, the transport company and multimodal operators are setting up sub office in Yangshan terminals to wide their business operation to meet the building stage of the supply chain of Yangshan terminals. One of the main reasons is that setting up early can get well relationship with the custom and inspection office which will ease the normal work for shipper. This is very important in Chinese container trade market. The shipper feels confidence of his freight forwarder or third party logistics providers due to the strong relationship with almost every procedure in exporting.

Modern container terminals should dealing with freight forward and ship agency more often due to the terminals need grasp the information and control both the shipper information and vessel condition to serve both customer satisfied which is also very difficulty. The main reasons is that so freight forwarders and ship agency are having a large amount of number whose scales are ranging from smaller to bigger. When terminals are dealing daily business with these guys, the channel structure is determined by the relationship among these parties, this is especially true in China.

5.3.3 The shipper and intermodal channel influencing the terminal

The terminals operator now days are really should looking into their channel from time

to time because their channel changes from time to time, and sometime terminal operators are not even aware the reduced container throughput slowly reduced is connected to the market channel condition. Intermodal channel means the road, railway or water mode development. The changing of the channel is not showing container throughput growth or reduced in several weeks, and one or two months, usually half years or more time will results to influence the container throughput of a deep sea terminals. Another channel here means the shipper channel refers to the distribution center around the terminals. The changes of this channel means the new building or rebuild distribution center nor far from the deep sea terminals. The shipper here knows as the distribution center which will need lots of raw or semi-products importing from the deep sea terminals and after process of these material, they are exporting again to domestic market or international market which will using the deep sea terminal again. The situation of North American terminals below is showing channel changing can really boost or weaken the business of terminals operators.

The east containers terminals in the United States are not only running in competition of the container throughput, but also the channel structure of their terminals. Rail and road access to their terminals are being considered and action for these fields. The setting up of distribution center in the location selecting has influence the individual terminal market. Charleston and Miami terminals both show out throughput fall in the recently years, while the neighboring port, Savannah has meet the 20% increasing in 2007. The direct reasons of the huge effect from the Distribution Center built in Georgia. The port authority of the Charleston has quickly learned from the successful experience from Savannah. They are building 1.9 million square meter's warehouse in South Carolina and a plan of 526ha distribution center near Orangeburg to enhance the attractiveness of the Charleston terminals for container cargos. The rail connection to container terminal can boost the container terminals. Staten Island's New York Container Terminal and New Jersey container throughput has grown stable after the improved rail connection.

After rail system has been updated, the Port Authority men are thinking to improve the congestion happening in the road connection between terminals and enterprise factories. There is constraint of railway running into the distribution centers in the Southern New Jersey. East port authority are finding the solution extended into the indirectly channel such as the road access to terminals from distribution centers.

In Shanghai Waigaoqiao terminals and Yangshan terminals, there are some channels changing which has show out some changes in the container throughput. After Waigaoqiao bonded logistics zone setting up , the container throughput has been growth at stable rate in the following years, but after the Yangshan terminal running into operation, the growth rate has been slow down for these years, and some month even has show out negative growth due to many European cargo based logistics company has moved from Waigaoqiao terminal to Yangshan Lingang logistics zone. This result is the shipper channel changing. And due to there are more and more distribution and logistics center building in Yangshan Lingang logistics park, the container throughput in Yangshan will be growth dramatically after the distribution center runs fully. Due to intermodal channel, the barge service successfully running between Yangshan and Waigaoqiao has both increases the throughput although most of them are water to water transshipment. In May, 2008, the openness of Hangzhou Bay bridge will be allowing container truck going on it which is really the future attack of changing Yangshan terminals throughput, because the hinterland cargo has more total another cheaper intermodal connection to Ningbo container terminals which is the biggest competitor discuss in the Chapter 3. The future Pudong Railway which will connected Waigaoqiao and Yangshan terminals will large change the intermodal channel of each terminals. So before building, the research work is running to ensure the win-win project for both terminals.

Due to the congestion problems in the European terminals, the Maersk Lines are

changing ways of delivery containers. Normally, they are waiting the customer to pick the containers. This has waste the land in the terminal. So they are finding the solution of moving the container immediately after the container arrives at the terminal by truck, barge and railway. They have also considered arranging the barge and railway connection before the vessel arrives. This will surely levitates the congestion problems, but only the dedicated terminal will have this result.

5.3.4 Comparison of manufacturing supply chain and terminal supply chain

The supply chain membership of traditional manufacture company consists of the suppliers, manufactures, distribution and consumers. While in China the container terminal supply chain mainly involves almost all the channel: cargo owner (supplier), shipping lines, container terminals, ships agency and freight forwarders, customs and China Entry-exit inspection and quarantine (CIQ). The value-added service in the SCM of container terminals: The traditional manufacture company does the value added by the manufacturing and package through the chain. While the modern containers do not produce any new things except the logistics zone behind the terminal, the main profit comes from the loading and discharing, storage.

The objective of normal manufacturing company has the similar objective along the supply chain which is to lower the cost of storage from supplier, manufacturer and distribution. While the several factors along container terminals are having conflict objective. The shipping lines channel wants to short the time in terminals in order to lower the cost and enhance the profit. But the container terminals hops the to use the terminal resource at most, and the cargo owner the total transport chain to be safe, faster and lower transportation fee when container are transported, loading, discharging and storage.

The traditional channel power of manufacturing company is around the manufacture center to lower the cost and enhance the competitive advantage which is alleviated to the whole supply chain integration. While in the supply chain in container terminals, the main channel power comes from the shipping lines and terminal itself.

The container terminal has been integrated point of three main flows which are container logistics flow, information flows and capital flows which has been running between various channels. Container logistics flow is running from the beginning of shipperside and to ending of the consignee side, this main really visible flow is simultaneously coordinated by the information flows around the containers. Due to the huge numbers of containers moving in and out from the container terminals, there is huge amount of information serving these containers. Various departments inside the container terminals and the connection between outside agency, such as the vessel agency, the intermodal service providers, and other related department are needed in the daily operation condition. And the capital flows around all the channel ensures each channel has its cost and profit to earn. Through the huge amount container cargoes, the capital flow should be developed correspondently. The banks inside the terminals, the insurance of the terminals equipment and vessel, the leasing companies are developed at greater speed to serve the customer from various sector views.

The terminal in the world is controlling various channels along its supply chain because they want to lower the instability of the supply chain of container terminal. There are many channels going through along the chain of container terminals such as importer and exporter, cargo owner, shipping lines, agency, customs and inspection department. The procedure is very complicated. And the changes are always happened later not early, so the prompt feedback from various sectors in order to save cost and time of the cargo along the chain is very crucial. The service of container terminal cannot be store which will generate the instability according to the changing demand. In China, from January

to March is the low season, while from September to December, it is a period of peak season. So the terminal and shipping lines should avoid the peak season and balance the low and peak season. Some cargo should use low season which will not influence the cargo. This solution will lower the cost of peak season terminal charge and enhance the terminal usage. Lower the cost in the low seasons and increase the cost in peak season is the usually way of controlling the balance of the operation of a terminal. And the terminal should also use the non-production time to do the maintenance of the equipment and infrastructure in the terminals in order to avoid the equipment breakdown which will brings the instability in the total supply chain.

5.4 The analysis of shipping lines and global terminal operators market channel

5.4.1 The shipping lines channel doing vertical integration into terminal

The shipping lines are doing more and more vertical integration of terminal in the world terminals because policy openness from various countries. . Shipping lines operated not only with liner shipping but also the terminals. They are APMT, OOCL COSCO and NYK. Third is the integrated operator like NOL, Evergreen, CMA-CGM, MSC, Hanjin and K-liner. Some liner has separated terminal operation company such as APM terminal, APL Eagle Marine, COSCO terminals. Some liner has taken shares in terminal business such as MSC, Hanjin, CMA-CGM. The liner shipping wants to control more terminals to serve their ships better. China has meet the chance of shipping lines vertical integration not too later, since 2000, the cooperation way of shipping lines and local terminal operators are showing the great speed. And there are four ways of liner shipping involves in the terminals' facilities and operation in order to lower their cost and enhanced the reliability of the service. The enlargement of vessel also brings out the benefit to the terminal, shipping lines are not easily change the terminals from one place to another because of the capacity and handling equipment technology are not easily met. So they are willing to do the vertical integration of terminals operation.

According to the Franceco & Musso (2007), there are main four types of shipping lines involving in the terminal industries.

1. Special agreement with shipping lines. They terminal operators are agree to provide the berth priority and crane priority by ensure the terminal operators negotiable volume of box throughput. PSA Singapore and ECT delta terminals

2. Minority share by liner shipping in the terminals. These kinds of terminal, liner shipping are not directly involved in the daily operation. They just get the dividends of the shareholders. For example, COSCO takes shares in HPH terminals. MSC also runs this type of integration due to its lacking the experience in terminal business.

3. 50/50 joint venture terminals are invested both by liner and terminal operators. The terminal operation is usually carried out by the 50% terminal operators. They are also some terminal outsource to a third-party operators. Because the liner usually did not have experience of terminal operation, while letting the third party to do can also show the fairness of the operation.

4. Dedicated terminal with 51% and more owned by the liner. They are not only serving their own vessel, but also attracting other liner company to berth their terminal. Such operator is unusually the independent player such as APM terminals in the Log Angels (Pier 400) and Rotterdam. This kind of terminal usually serves the alliance fleet more often.

The Shanghai Waigaoqiao and Yangshan terminals have also been invested by many shipping lines. There are no terminals like type 4 vertical integrations because the SIPG is a typical Chinese domestics group which means he will not allow its terminal share to be over by 51% of share because this will lose management power over the terminals. There is one terminal which is similar the type 3 vertical integrations, they are Waigaoqiao Phase 4 and Phase 5. Phase 4 terminal are 50/50 joint venture by SIPG and APM terminal. The APM terminals are under A.P Moller Group which has Maersk Line.

The Waigaoqiao Phase 1 is similar the type 2 vertical integration which has newly 40% of shipping lines terminals operation named as COSOC Pacific. And Yangshan terminals are typical type 2, because COSCO and CSCL are separated 10% of Yangshan Phase 2 terminal. The reasons of Shanghai container terminal prefer global terminal operators such as HPH and APMT are they wants to learn more industry experience from them. While pure shipping lines investment can really brings more vessel calling, and the priority berthing will be the problems if so many shipping lines having taking shares in the terminals.

5.4.2 The market channel conflict between shipping lines and terminal operators.

Although the world container terminal market is controlled by the pure terminal operators such as HPH, PSA, DP world, Eurogate, the shipping lines terminal integration really make the pure terminal operator feel worry about their business more and more rely on shipping lines. So there is conflict in letting shipping lines vertical integration into their terminal. Maritime transport is a seasoning business influenced greatly by the trading among various countries. The pure operators may loose bargaining power when the traffic is lower. At that time, the liner will have more power due to they can berth their dedicated terminal without making the terminal loosing larger than the pure terminal operator who need vessel a lot to compensate the operating cost which generated from the high equipment operation cost.

There are greatly expansions of pure terminals operators in recently years. It seems of the pure terminal operators having anticipate today’s competition from shipping lines vertical integration into terminals. Before they step out the international merger and acquisition, they have very strong and well terminal business in their home town which has make the ready to go to the other countries terminal industry. The typical example is HPH based its business on Hong Kong and mainland, they only use two years from

having a small percentage share turning to the biggest shareholders in ECT terminals. And PSA group has never stopped the face of integrating in the north European market after strongly hometown business of PSA Singapore. Whether SIPG should go on this way, is the discuss topic of the following ways of developing. In 2006, they have considered buying shares in APMT in Zeebrugge, and now they have not beginning oversea expansion, but seems to prefer domestic horizontal integration. The liberalization in the terminal industry has help many international players got more share in the foreigner market. Dubai Port World has been the newly pure terminal operators in the recent years especially after it take over the P&O terminals network.

Seeing from the pure terminal operator, the shipping lines are developed more dedicated terminals to serve them better and avoid having constraints by pure terminal operators. The liner shipping has set up their bargaining power by providing the dedicated terminals and take shares in the terminal operators. This ways can really lower the cost and get berth and operation priority of their vessel service. While there are co-operation happened widely in the between pure terminal operators and liner carrier. Pure operators are prefers to provide dedicated service to Top 5 liner carriers for better serve more vessels. But there are also some pure terminal operator refuse to do so. One typical example is that the PSA refuse to give the dedicate service to Maersk and Evergreen cause Singapore lost 3 million TEU. The Malaysia terminal in Tanjung Pelapas has attracted this business successfully. And this point, the SIPG is very careful choosing shipping lines and pure terminal operators into joint venture terminals. Existing terminals has no terminal has very strong dedicated services, all most all the terminals are public usage. Because dedicated terminal sometimes are very powerful. For example after the opening of APM terminals in Virginia, it influenced other terminals near the new APM terminals. All six Maersk lines have been transferred from Virginia state terminals to APM new terminal which is of course understand by dedicated concept of Maresk Group strategy. Some dedicated service really increase container throughput by

opening more liner service under Liner Alliance member. The Ceres Paragon container terminal in Amsterdam is a typical example. Through a very short transition period of the new built indented Berth, the terminal has begined to add the service of China and Western Europe via the Middle East since the EU1 running between Janpan and Western Europe. This terminal indented Berth gives more confidence of the members of Grand Alliance such as NYK, Hapag Lloyd, OOCL and MISC. They are bringing more big vessels into this terminal. Liner Alliance cannot position becomes weaken than before, so dedicated terminals has bottleneck in the future. Some alliance members are unwilling to reveal the landside capabilities to each other. Because their strategy is different some prefer the port to port business and other like to serve integrated door to door service. They are unable to share the landside transport to other member to do their business although there are may be large amount of cost saving in landside shore-base activities.

There is the conflict between pure operator and ocean carrier. Pure operator wants the lower cost and stable income, and ocean carrier want greatest productivity and lower cost. This conflict make the birth of dedicate service happened in the terminal area.

The pure terminal operators will have to consider the liner shipping and change the market strategy to meet the liner needs. The trend of joint-venture of terminal should these trends. The Top 5 liner operators need more dedicated terminal to run the network of terminal service for their hub and spoke type network in order to deploy the 13000 TEU vessels. Such player is APM, Evergreen, MSC and CMA-CGM. They do not like to be restrained by the third party player. While other liners they have invested in many terminal’s facilities, but terminal operators have different view on them comparing the first tier customer. The co-operation and competition is influenced by three main factors which are channel draught, terminal future capacity and intermodal connection.

The channel draught is the crucial point of allowing big vessel to be berthed to the terminal. Some container vessels have to wait tide which means deeper river channel to go to the terminal and depart from terminal. Terminal future capacity is explained by the new terminal project in the world port city. Maasvlakte 2 project in Rotterdam is typical example of expansion to meet the great capacity. In Shanghai, the Yangshan terminals will has 4 Phases container project in 2013 which Phase 3 will be ready in the end of 2008. As discuss before, the intermodal connection is very important factor in the future terminal development trend because this factor will strongly influence the time and cost of transport between cargo owner and vessel. The Rotterdam and Antwerp haves the better intermodal connection due their well barge service to the hinterland. While the Los Angeles and Long Beach terminals use road and rail to be the main intermodal ways of releasing container to the hinterland. While the congestion and environment controlling the further capacity increasing in North American. APM Virginia terminals are also looking the better long term cooperation with railway connection operated by CSX and Norfolk. We can see the efficiency of the North American terminal developed at one updated and new terminals with all the channel considered for future container flows free in and out with lowest cost and least time

5.5 Controlling the terminal performance from internal labor market channel

Internal market channel has been paying more attention since the terminal congestion problems occur in almost every mega terminals. There are usually strikes in the stevedoring company which management the terminal workers. The Los Angels terminal strike has cause the terminal stop and lost huge amount of business and even influence the economic development in the United States. So a successful operator should also building market. So many developed container terminal operator are paying more attention to the labor market channel. This market channel includes from the bottom level of managers from crane operators. Although some stevedores on the terminal are

outsource the third party labor supply company, under the great terminal environment, they are also important part of the total labor market channel.

In European container terminals, terminal operator prefers to improve the terminal workers' service ability in order to obtain the terminal productivity. Employees in the terminal are the core factor which can ensure the daily operation no matter how great the automation technology used in the terminals. Employee from the basic level such as the crane operator to the high lever such as the department managers should be treated well. The employee in operator the various equipment in the terminal should be especially trained well and work. In Waigaoqiao and Yangshan terminals the terminals worker training are not enough because they are all busy with daily work. And the terminal operators are making worker load more pressure of loading and discharging vessel in high traffic volume.

The European container terminals have use the way of let the employee has the awareness of the customer value of the terminals to control the labor market channel smoothly. Managing the employee well and satisfy them with good working condition and promoting system. The regulation of a terminal is hard to change at the same speed with the changing market. So the terminals have versatile management way of meeting the manner under the changing market of their customer. Letting the employees have belongingness to the company is more practical in developed countries. On this point, the SIPG has bee in the progress of letting employee, especially the bottom worker to feel. If the terminal has met the difficulty time, many employees will work hard to overcome the hard period. In the terminal customer center, let the employee knowing the losing customer reason and how to maintain the relationship in order to let them feel they have the special rights to do some better work to the terminal. Especially the lower level of worker having the shift working, they are the core power to let the terminal running in 24 hours in some terminals. Let them feel the working deserved is important

than just treating them as the one part of the equipment. Providing the better salary is not the only way of satisfied the worker.

In the world developing container terminals, there is a trend of controlling labor market channel. Three ways are selected which Shanghai Waigaoqiao and Yangshan terminal can use. First is the selecting and training the suitable employees. Second is the standardized service of terminal internal management. Third is setting up the customer complain system. Some terminal are opening the customer meeting usually the shipping lines representative in order to listen the suggestion given for the existing terminal operation and future demand of terminal service. And there are some terminal building the direct line of complaining channel. For example, each month is the general manager listening day. This kind of channel building is to grasp the suggestion and opinion about the terminal service and equipment performance and letting the channel go freely between the higher management level and direct customer in order to avoid the complicated management. If a customer is willing say something about the terminal itself, that's mean he is really hoping that the terminal he uses can be improved or specialize service for them. If a customer did not say anything, that customer will probably go to competitor's service.

5.6 The Chapter summary

In this chapter, the market channel such as government, the shipping lines, the shipper, the global terminal operators, terminal labor market channel is compared. The gaps between Shanghai Waigaoqiao and Yangshan terminals are very complicated, the governmental channel restraint the future development of Shanghai terminals, the shipper using Waigaoqiao and Yangshan are changing attitude under the supply chain concept. The supply chain management in Waigaoqiao and Yangshan are not good because the Shanghai terminals have large number of relationships in the supply chain of

terminals which is not better processed. The shipping lines channel has the powerful right influence the terminals, while Shanghai Waigaoqiao and Yangshan are more cooperated with pure global terminals operators in order to avoid the liner business changing strategy such as moving trade lines to other terminals. While, Shanghai terminals are also aware giving more involved in shipping lines can benefit a lot. The labor market channel in Shanghai terminals are not well managed from bottom to top level due to the lack of letting worker feel themselves as a important part of the terminals compared with developed containers. All these gaps are carried out and to be used at the later chapter for market channel design.

Chapter 6 The market channel design based on suggestion matrix of Waigaoqiao and Yangshan container terminals

6.1 Introduce of channel design by suggestion matrix from BCG Matrix

In this chapter, the channel design is based on the suggestion matrix of Shanghai container terminals, the Waigaoqiao and Yangshan terminals are carried out in order to shorten the gaps discussed in previous Chapter 3, 4 and 5. The gaps are gained from the comparison previous chapter consists mainly from the container logistics in the terminals and the market channel involved in the container terminals. Through the suggestion matrixed the dissertation attempt to give ways of the future development of these two Shanghai container terminals. The suggestion model is designed from the BCG Matrix form which is innovative.

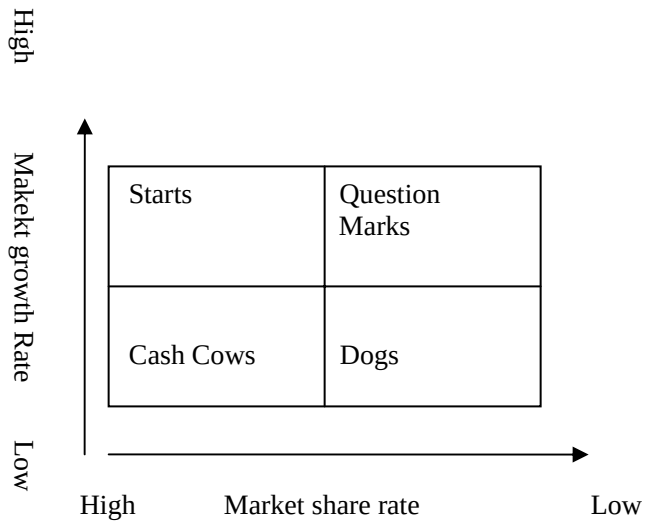

Figure 12 BCG Matix
Source: all source in this chapter are self design

This matrix is designed by the Boston Consulting Group, named as BCG matrix in the 1970s. It is the portfolio of various business units in order to determine the priority of developing or turning each unit to its best situation to earn profit. The matrix has four units which are star, cash cows, dogs and question mark in four units. There are two directions which one is the horizontal direction meaning market share, and another one is the vertical direction meaing business growth rate. Stars unit need lots of cash and the market share is very high, and investment in this units can outcome the equal results. The cash cow unit means the growth is not as high as stars products, but the market share is high. The dog products are the lower growth rate and low market share. And the question boy is usually the most controversy one in the unit which the products of this unit may turn to star unit or leave the working market. This BCG matrix is very classical finding the relation of each business unit because it connects market share and market growth together. In this dissertation, the suggestion model of Waigaoqiao and

Yangshan is based on this matrix, this is creative thinking way is learned from the excellent relation of BCG matrix. Looking at the suggestion models below:

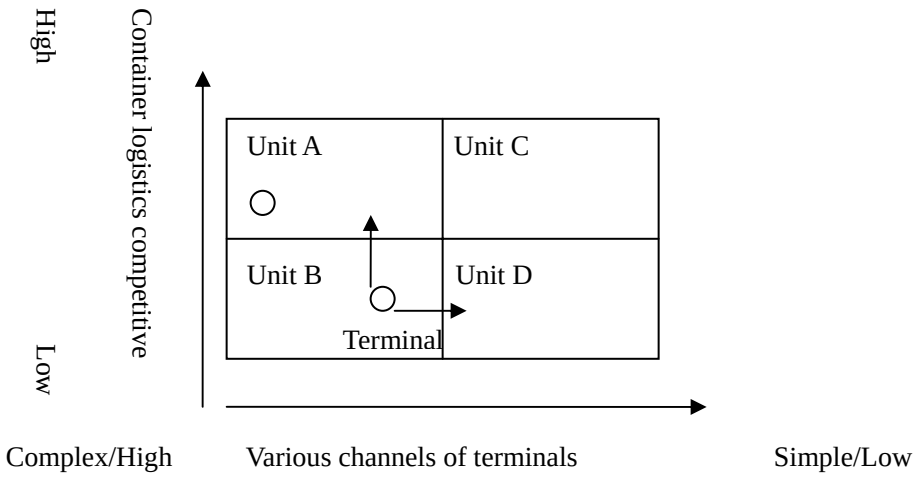

Figure 13 The suggestion matrix example

The matrix has also two directions, the vertical direction include the both the basic function and new function of container logistics, each sub function such as ship to shore container logistics, transshipment logistics, intermodal connection discussed in chapter 4. From lower to higher, this direction means the condition of terminal doing in container terminals. The degree of this direction reflects the degree of competitive advantage of this terminal from high to low. In the horizontal direction means the various channel direction. This direction consists of the channel structure analyzed in chapter 5. It includes four main channels which are the governmental market channel, the shipper market channel, the shipping lines market channel and the labor market channel. From right to left of this channel direction, it means two aspects of the channel. One is the degree of the channel relationship with terminal which is from complicate to simple. Complicate means the number of relationships with terminals, there are many conflicts

in this channel which exists. And simple means the number of relationship and conflicts are few. The other aspect is the demand degree of vertical container logistics from high at left to low at the right. The other direction means degree of the demand of vertical direction of container logistics from high too low. For example, the vertical direction aspects of container logistics is the competitiveness of transshipment of a container terminal, the shipping lines channel demand is under the matrix, and in the matrix container terminals in the unit.

There are four units in the matrix which named unit A, B, C and D. The Unit A stands for highest degree on both directions The Unit D stands for the lower degree. The circle in the unit means the container terminals. Its position is relevant to its horizontal and vertical direction of the matrix. For example, the circle in the Unit A stands at left and bottom position which means the degree of horizontal direction very high, and the degree of vertical direction is above any degree in Unit B. The arrowhead means the future terminal position turning direction. For example, the terminal in the Unit B will turn to Unit A or Unit D.

The PSA Singapore terminals are attributed to the unit A which means the PSA terminals are doing very well transshipment business, and the demand of shipping lines doing transshipment operation are very high, so that fits in the matrix just likes the BCG matrix related to terminals. So being compared in this way, we can see the clearly position of its own terminal operation and external channels demand or the relationship in the channel, whether channels are easily communicated. The results of chapter 3, 4 and 5 can be showed out all on the matrix. So the suggestion comes from the changing of terminal position from one unit to another unit from just like the products or business in the BCG matrix. From this matrix we can see the internal logistic operation together with the various market channels and suggestion is given on the turning direction from unit B to unit A, or just stay at its current unit for reducing risk of changing. The

suggestion of Waigaoqiao and Yangshan are combined given in the following discussion.

6.2 The design of governmental channel with intermodal connection

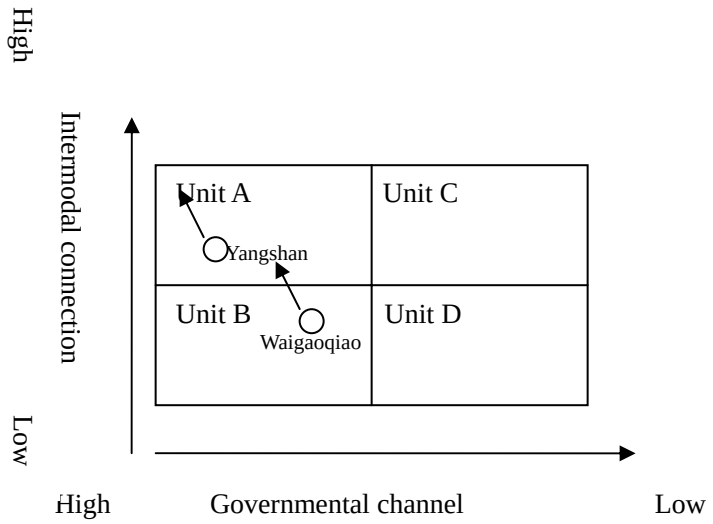

Figure 14 The suggestion matrix 1

The government market channel of container terminals is the horizontal direction of matrixes, the vertical direction is the intermodal connection with high and low channel relationship. That is meaning that the governmental policy to terminal is based on the degree of government relationship. On this matrix means the intermodal connection will be restraint if the policies made by government are not open wide as developed countries. Waigaoqiao has in the unit B which means the policy restraint the container terminal development. If more railways, barge transport policies are carried out, the Waigaoqiao terminals intermodal transportion will be good. While this channel is very complicated to deal with because there are so many investors and management sectors, each terminal

has its special relationship with government or port authority or other related governmental department. And the Waigaoqiao terminals have lose its superior development stage due to more and more policy will give the proity. Looking at Yangshan terminals, it is in the unit A which means the port related policy is released on Yangshan more quick and easily, for example the governmental policy of letting global terminal operator HPH, APMT invest in Phase 2 of Yangshan terminals, and allow domestic liner COSCO, China Shippnig Group take share of terminals. The invest of Phase 1 and Phase 2 has been all invested by government first so that ensure the container logistic equipment ready for every stage of developing Yangshan. But in this channel, the relationship is the same as the Waigaoqiao because they have to deal the same number of governmental department.

The suggestion on this matrix is to turning the Waigaoqiao gradually from the B unit to A unit, because there are so many relationship between governmental related department, and the policy making to release to Waigaoqiao terminal will use more time than Yangshan, so the terminal operator should use all its relationship to explore to get more freedom of applying new facility construction, but should always find the problems to solve the congestion in Waigaoqiao terminal area due to there are more and more problems happen every month in Waigaoqiao district. The suggestion matrix of Yangshan terminals is turn it from A to C unit, because as the time past, various player in Yangshan terminals has been added to a large number. The relationship between them will be very complicated at the beginning just like now the terminals have only been used for two years. So the terminal operator should make the advantage of historical chance given by the governmental channel, and make the channel has simple relationship among them. So the suggestion is turn to simple channel relationship in order to ensure all container logistic in the terminal and use the policy to enhance the competitive of container logistics. This is the strong support channel for terminals continuous developing.

6.3 The design of shipping lines channel

6.3.1 The design of shipping lines channel with ship to shore container logistics

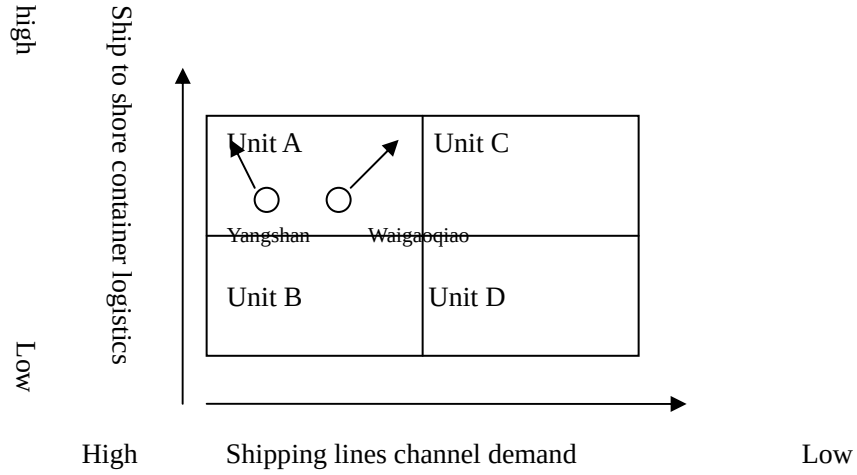

Figure 15 The suggestion matrix 2

The matrix uses horizontal direction of shipping lines market channel demand from high to low. The vertical direction is about the ship to shore container logistics on vertical tradition, the matrix below shows that Waigaoqiao are in unit A because the terminal because there are still many trade lines calling at Waigaoqiao terminals, and ship to shore logistics is above average handling speed. But after Yangshan terminals running into operation, most European trade lines are moving from Waigaoqiao to Yangshan, so in the future the mega container ship will more and more difficulty to go to Waigaoqiao terminals due to lower depth of river channel, and the strategy of Waigaoqiao will be turn to medium vessel, the feeder and barge service will be the trend of Waigaoqiao terminals.

So the position of Waigaoqiao now is in unit A, and the suggestion is to turn it to unit C which keep the higher competitive ship to shore container logistics although the international shipping lines channel demand are slowly reduced, and the ship to shore equipment should be renew and rebuilt in order to avoid the break down of the total supply chain management. Due to the Waigaoqiao will attract more barge and feeder service, so considering the solution of arranging the berth service so as to accommodate with different vessel as much as possible.

Looking into Yangshan terminals, its position falls into unit A, but it position is more left than Waigaoqiao terminals, and Yangshan are on the left side of Waigaoqiao, due to this deep sea what really attracts more and more international shipping lines to call. So the suggestion is to manage the ship to shore container logistics more efficiently instead of breaking out individual handling speed to pursue the world record of handling. The Yangshan has best equipment in Shanghai container terminals; the double 40 foot crane is the most efficient crane in the world, so enhancing the average speed of them is very important to accommodate larger number of vessel calling. The size of the vessel is getting bigger and bigger, increasing the average speed of loading and discharge will make the berth usage move into a higher level. The demand of ship to shore container logistics is higher than Waigaoqiao, and some period even higher than PSA terminals. The supply of terminals related to ship to shore should be enhance at a new level, adding more crane to Yangshan, especially double 40 foot crane which will boost handling speed. Another suggestion is to make efficient and feasible maintenance plan to avoid the suddenly broken down. Because the Yangshan terminals are operating 24 hours/ 7 days, terminal operator has less awareness of maintenance work because they think the machine is newly bought, but if the quay crane broken down when loading and discharge, this will sure increase the instability of the total supply chain of Yangshan terminals. So the suggestion may be very practical.

6.3.2 The design of shipping lines channel and intermodal connection

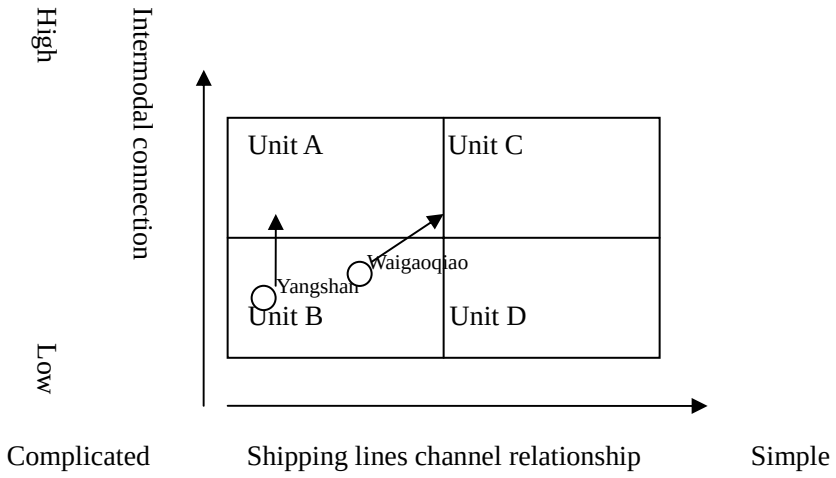

Figure 16 The suggestion matrix 3

This matrix vertical direction is using the competitive of intermodal connection of container terminals. The horizontal direction is the liner shipping channel with complicated and simple criteria. Liner shipping demand of intermodal transportation of terminal is becoming higher gradually because the intermodal facilities are restrained mainly by terminal operators and other intermodal service provider. And the liner shipping channel request on intermodal service of container terminal are very complicated due to there are more than 300 shipping lines set up business relationship with SIPG, the dominant service provider.

The suggestion matrix of Waigaoqiao fells in the unit of B on upper and right position, and the turning way is to unit A and move closer to unit C. This means the intermodal connection really works not well but can accommodate the traffic after Yangshan terminal building which can levitate traffic a lot. The suggestion is to enhance the river

and railway connection as more and more medium vessel will call Waigaoqiao which terminal operator should really enhance the competitive into Unit A. When refers to shipping line channel relationship with intermodal request more simple, not so complicated now which means terminal operator should use more resource to find the solution of quick moving out containers in and out the terminals because Waigaoqiao is more near to the city.

Looking at Yangshan terminals, the position fells into the lower and left than Waigaoqiao, and the turning position is to unit C. The intermodal connection mainly is road and water, no railway. And due to there are 85 kilometers away the city center which is more longer than Waigaoqiao, so the intermodal connection competitive of Yangshan terminals is lower than Waigaoqiao, and shipping lines are accustomed to this situation since the opening of the terminals. That's reasons of shipping lines channel relation is a little bit simple than Waigaoqiao because shipping lines cannot push terminal operators to improve intermodal connection easily. Suggestion on Yangshan is to building the railway connection to island terminals, make the shipping lines feel more easily to let the containers in and out more quickly. And due to the trend of liner company setting up self logistics company, the procedure of intermodal transportation for them should be more easily set by terminal operators.

6.4 The design of shipper channel with value added service

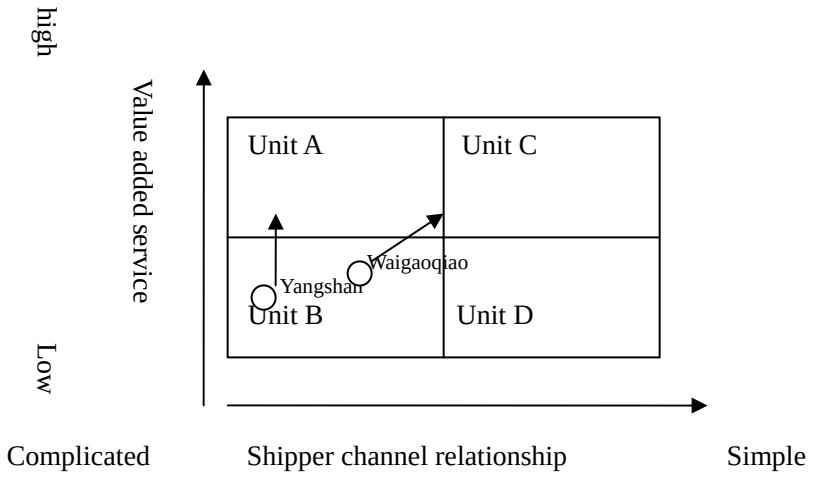

Figure 17 The suggestion matrix 4

This matrix combine the shipper channel with relations complicated or simple and the value added service competitive around and in container terminals. This shipper mainly refers as international logistics company or distribution which they are doing value added service such as semi-products, package and transshipment. The Waigaoqiao fells in the upper right corner of unit B, the turning position is to move to unit C. So the suggestion is to make the shipper feel more efficient and simple to do the value added service about his containers. Waigaoqiao terminals have a free trade zone which has been operated for years, but the zone has limitation on land which is a concentration of international logistics company. They are only in this park to do free trade value added service. While terminals ECT terminals are scatter largely behind the inland terminals which are really easy for smooth value added service. So the suggestion on Waigaoqiao terminals is to set up more free trade zone around Waigaoqiao terminals. And letting SIPG logistics company which is under SIPG taking some shares in the new building free trade zone. This will make terminal operators have more relationship with free trade

zone so that they can provide superior business which will let the relationship simple and at the same time making more value added service.

Looking at Yangshan terminal, the position is around left and lower position. The terminals are only running for two years. The Luchao logistics park is being built up at wide land. The disadvantage is also the long distance away cities and factory which is the main hinterland of the terminals. Although the setup of logistics company or distribution center in the logistics park, the progress of doing value added service is more complicated than Waigaoqiao, the applying procedure has been passed to various governmental channel. And general condition of logistics infrastructure is at new building stage which is poor than Waigaoqiao. So the turning position is to simple the shipper channel, letting exporting and importing cargoes move to logistics park more easily. Learning from the Singapore terminals, the Yangshan should really smooth the progress of attracting value added distribution center in Luchao logistics park so that the value added transshipment can be achieved in the future. This will surely increase transshipment rate which is relative lower now. This suggestion should be also cooperated by the governmental channel. Another suggestion is to attract more domestic distribution center into Luchao logistic park due to this will boost the transshipment rate at great extend.

6.5 The design of labor channel with information operation

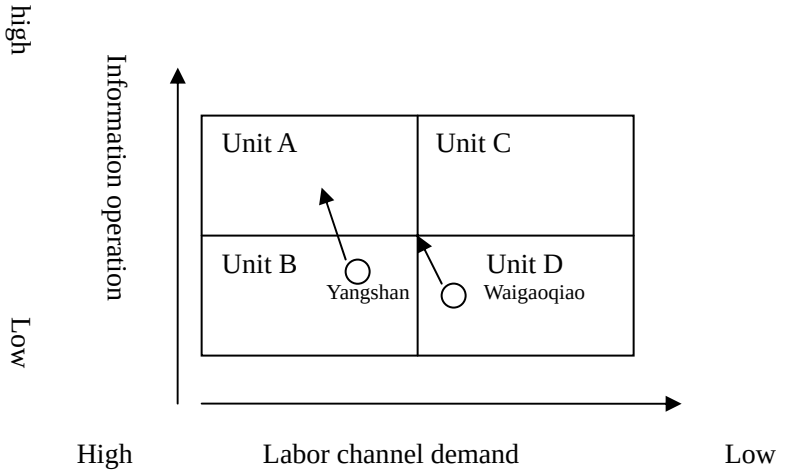

Figure 18 The suggestion matrix 5

This matrix horizontal direction is the labor channel with from high demand to low demand, and vertical direction is the information operation of container terminals. We can see from chapter 4 discussions, the Waigaoqiao and Yangshan terminals information operation is all carried out by local information technology company. Although the terminals are being added with more and more information technology, the whole terminals operation system operation level is not as better as the international terminals operation system. There is a trend of many terminals operation system are selecting common international terminal system brand such as NAVIS products. Looking at Waigaoqiao and Yangshan, the system named Mile is lacking the well connection with terminal labor not only the manager level, but also the workers on the terminals. So the position on of Yangshan falls in unit B, while Waigaoqiao fells in terminals D. Because Yangshan is newly built, the implementation and design is more advance the Waigaoqiao terminals. Due to Waigaoqiao terminals Phase 1, 2 and 3 has been built

early. The labor in Waigaoqiao has the less demand of information operation because they management level are not willing to change a lot of their existing operation. So the turning point is moving Waigaoqiao and Yangshan to high demand of information technology. The suggestion is letting world leading terminal operation taking share in the local terminals information company. This will not bring out new technology into various sub systems. And according to the labor market channel, the suggestion is to give more information terminal operation trainings to let them gradually has more awareness of using information technology instead of low demand of information thinking.

7. Summary

The dissertation has do the comparative study of Waigaoqiao and Yangshan terminals by the selected factors related to the general condition, the basic and new function of container logistics in and around container terminals. And through domestic and international comparison about the equipment usage and its throughput performance, the dissertation finds out the gap between Waigaoqiao, Yangshan terminals with other terminals. Through market channel of containers terminals operation, various market channels such as the governments, shipping lines, shipper and labor channel has been comparable with global container terminals, and the gaps are also founded. At last, the suggestion matrixes are carried out. They purpose of these matrix is shorten the gaps based on the gaps gained from the various factors in container logistics and market channels of Waigaoqiao and Yangshan terminals so that the competitive advantage can be gain in the future. The thinking of the matrix based on the BCG matrix is innovative, but there are some limitations of research due to terminal operations will be changed by many market channels, and the whole terminals industry has to bear the faster changing market of shipping industry from time to time.

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