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WORLD MARITIME UNIVERSITY

Shanghai, China

**RESEARCH ON THE DEVELOPMENT OF
TRANS-REGIONAL OPERATION OF SHANGHAI
YANGSHAN PORT**

By

WANGDIE

China

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 TRANSPORT AND LOGISTICS)

2007

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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ABSTRACT

Title of Dissertation: **Research on the development of trans-regional operating of Shanghai Yangshan port**

Degree: **Mater of Science in International Transport and Logistics**

The research paper is a study on the development of trans-regional operating of Shanghai Yangshan port, with the help of the Gray Model.

A brief look is taken at the present situation of the Shanghai Yangshan port, and the theory of trans-regional operating of port is introduced. Some successful examples in case are illustrated and related experience from practice is indicated.

The necessity of developing trans-regional operating of container transportation of Yangshan port is analyzed. And the forms of trans-regional operation of Yangshan port are talked about in this text.

The development prospect of container transportation of Yangshan port is pointed out, on the basis of the forecasting of container throughput of Yangshan port. And development of inland transportation of Yangshan port is indicated. Additionally, the relationship between Waigaoqiao port and Yangshan port is talked about.

The barriers and suggestions to implement trans-regional operating of Shanghai Yangshan port is pointed out, on the base of analysis above. A number of recommendations are made concerning the future development of the Shanghai Yangshan port.

KEYWORDS: gray system model, forecast, Yangshan port, trans-regional

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Chapter 1 Introduction

1.1 The background of topic choosing

Shanghai port locates in the mid point of Chinese mainland coastal line and in the estuary of Yangtze River. This superior geographic location makes Shanghai port as pivot port in Chinese multiple transportation system. With center of world economy and trade transfers from Atlantic to Pacific, also with the high development rate of the economy of Yangtze River Delta Region, Shanghai is facing a great opportunity to be an international shipping center.

At the end of last century, with the high development rate of Chinese economy, especially the rate of Yangtze River Delta Region, the great success of opening policy in Pudong, and the expansion of export-oriented industry in Shanghai and surrounding area, Shanghai port is gaining abundant container cargo resources. Shanghai port had taken 35 years to achieve 100 million tons throughput from 1949 to 1984. For 200 million tons throughput, it had taken 16 years till 2000. For 300 millions tons throughput, it only took 3 years. In year 2003, Shanghai port becomes the third largest container port only listed below Singapore and Hong Kong with a container throughput of 11.28 million TEUs. In year 2005, Shanghai port made tremendous achievement with a container throughput over 18.09 million TEUs.

But the rapid growth of container transportation also makes new requirements for Shanghai port. Being lack of container terminal capacity, port draft, and logistics

support, Shanghai port must seek new chances to realize sustainable development. The successful experiences of other famous foreign ports shows that the port should break the restriction of administration division and adopt trans-regional operation. Should Shanghai port adopt trans-regional operation? If so, which mode should take? What problems will emerge and how to solve them? This dissertation is about to research these questions.

Nowadays, more and more macro-scale ships are launching one after another. It has been less than 10 years since the first post panamax container ship (4240 TEUs) in the world launched in 1988 when the fifth era container ships with a capacity of 4800 TEUs and the sixth era ones with a capacity of 8736 TEUs launched. As survey shows, the fifth era container ships with over 14 meter draft and 5000 TEUs capacity had become the mainstream type of ships during year 2000 to 2005. Among the ships operating in the top 3 east-west oriented trunk lines in the world, post-panamax container ships will take up the proportion of 55 to 65 percent in 2010. And this figure will turn to 65 to 70 percent in year 2020. So it is extremely necessary and urgent for Shanghai port to construct 15-meter deep sea-routes and berths to accommodate the fifth and the sixth era container ships.

Corresponding to the policy of building international shipping center in Shanghai, some relevant experts did great amounts of argumentation for nature conditions, economic benefits, ecological benefits and social benefits. They had put forward some plans that build new port in Luojing(in north suburb of Shanghai) , Waigaoqiao(in east suburb of Shanghai) or Jinshanzui(in south suburb of Shanghai). But these locations can not meet the requirement of draft neither. Then the experts turn to the current Yangtze River sea-routs that has at least 12.5-meter deep draft without considering renovate costs or long-term input-output benefits. So Shanghai

port is now chiefly concerning about finding an exurb region with superior nature conditions and inviting foreground to develop its container transportation. The construction of Yangshan Port is a bold attempt of breaking the restriction of administration and investing port construction trans-regionally for Shanghai port. And this attempt will provide important practice experiences for Shanghai port's trans-regional operation in aftertime.

Shanghai port is facing furious competitions in container business. These include interior competitions with Ningbo port, Nantong port and Taicang port in the Yangtze River Delta Region port cluster. And exterior competitions with Bo Sea Gulf port cluster, Zhujiang River Delta Region port cluster and port of Hong Kong, Guangzhou and Shenzhen are also included. Furthermore, there are competitions with ports in southeastern Asia countries such as Pusan, Kobe and Singapore.

In detail, Ningbo port, which is not far away from Shanghai port, will have immeasurable development room because of its ascendant nature and geographic conditions as well as the construction of Hangzhou Gulf Bridge. Most of the containers that import and export in Shanghai port from Jiangsu Province and Zhejiang province will be separated around into Ningbo port and Lianyungang port. And challenges from these promising container ports such as Tianjin, Shenzhen, Qingdao, Dalian, Hong Kong and these Korean ports such as Pusan, Incheon and Ulsan are not ignorable. Shippers and carriers will most probably choose other ports to berth if jam and delay occur in Shanghai port. This sort of condition is continuously happening in America. In this kind of situation, how to enhance Shanghai port's competitiveness and maintain its competitive advantage in the competition with domestic and foreign ports should be taken into account. Looking at these successful experiences of these famous foreign ports, trans-regional

operation is a marvellous approach to cope with furious competitions for Shanghai port.

1.2 The significance of topic choosing

As survey shows, the total container transaction volume in Chinese ports in 2005 is 75.64 million TEUs (except Hong Kong, Macao, Taiwan) and this volume won world's first three years in a row. In contrast with other advanced ports in the world, the weakness of our ports is not in infrastructures but in managerial systems.

As the largest port in Chinese mainland, Shanghai port should release itself from the restriction of unfavorable conditions, innovate new develop concepts and modes, integrate resources of ports in Yangtze River Delta Region, and enhance self competitiveness and realize sustainable development under the gratifying situation of Chinese ports' rapid growth.

This dissertation is trying to use other international ports' successful experience for reference and quest for the necessity, modes and strategies of trans-regional operation for Shanghai port and bring forward some useful concepts and suggestions for Shanghai port's future development.

1.3 Literature Review

1.3.1 Research on port development after 1950s

The research and analysis of port industry in which make the port industry as

independent transportation sector started in 1950s. The whole world's economy has turned into fast development with ten years' recovering and adjusting since World War II ended. Almost all the industrialized developed countries such as America, Britain, Germany, France, Japan, Italy and Canada always regard the transportation industry, especially port infrastructure construction, as the basis of revitalizing the economy in the process of developing national economy. And they also regard international trade as effective measures to accelerate domestic economic development. In these western capitalist countries, Japan is the most typical one. Japanese port industry made great contribution to its national economy during the post World War II era. Economists from capitalist countries have changed their research emphases from qualitative research to quantitative analysis research phases.

The combination of mathematical tools and economic theories and its derivative subjects such as operation research, econometrics and information technologies provide credible calculation tools for the theoretical research of port industry. Eastern countries mainly represent the socialistic country camp led by former Soviet Union. Most of these countries have coastal waters and ports. Affecting by former Soviet Union's socialist theory modes, the majority of socialist countries including China carried out highly intensive planned economy mechanism. Their transportation industry and coastal ports completely actualize the managerial system of combining enterprise and administration. When it went into 1980s, many socialist countries started to pay attention to research on port problems. But there research didn't involve the revolution for traditional planned economy mechanism and the structure adjustment for economic industries. So they could hardly get breakthrough on the theoretical research of port industry.

In the beginning of 1980s, the economists from western countries started to research

and analyze the ports' production benefits and operation cost. And then, they apply modern economic theories to the fields of port investment decision, port layout, operations and management. J. O. Janasson and D. Shneprson made theoretical analysis and quoted examples for the problem of port production efficiency in their "Port Economics". Aiming at the problems occurred in the process of daily production and operation, Janasson and Shneprson put forward cost function theory and relative models by using mathematical analysis and quantitative forecast^{<1>}. Jay. W. Forrester from Massachusetts Institute of Technology combined quantitative and qualitative analysis and built a standard production function formula by turning various kinds of social factors into quantified index to make relevant researches. He thought that there are many social factors affecting ports, and these social factors formed a multiple reverse cycling system and this system changed dynamically. We could quantify these social factors properly to make them as variables, and then calculate and analyze them with dynamic mechanics method. Thus we could forecast the ports operation and development under general social environment. With the development of computer information system and relevant technologies, computer simulation technology appeared and was used to build a simulated port operation environment to do the calculations. However, for ports' production and operation process is a very complex system and various economic and social factors interlace together, we could still hardly calculate all the ports' data directly by intuitionistic mathematical ways. In the actual port operation and management process, people usually use the way of combing quantitative and qualitative analysis. Ports' position in national economy and people's recognition for ports have changed a lot, and this led to the upgrade of port function. United Nation divided the ports into three generations in 1992.

<1> J.an Owen Janasson & Dan Shneprson: Port Logistics, Publication of People Communication ,1998,8

The first generation ports represent the ports built before 1950. Their functions were transit of seaborne trade cargos, temporary storage and distribution of cargos. Ports were transportation hub then.

The second generation ports represent the ports built during 1950s to 1980s. Except the functions that the first generation ports had, they also had value adding industry and commerce functions. This made port as loading and discharging service center.

The third generation ports are mainly founded after 1980s. Except the functions that the first and second generations had, they strengthened the relationship between their city and customers. Added with transportation and trade information services and other comprehensive services, the third generation port became the logistics center in modern trade.

20 years has passed by, the functions of today's ports changed a lot in contrast with the third generation ports. Thus, we should reveal the new laws in port development. To grasp the opportunities and enhance port competitiveness has become the key issue for the academia and insiders.

Based on the facts described above, the concept of the fourth generation ports has been put forward.

Table 1-1 the trend of development of port

Item	1 st generation	2 nd generation	3 rd generation	4 th generation
Developing era	Before 1950	1950-1980	1980-1990	From 1990 till now
Main cargos	Bulk cargo	Bulk cargo and general cargo	Bulk and cargos in group	Containers
Port developing strategy	Connection point of inland and maritime transport	Center of transportation and industrial production	Center of commerce and multi-model transportation	Strategy ally of shipping companies and port enterprises
Service scope	(1) Loading/ discharging, storage, navigation	(1)+(2)Packing of goods	(1)+(2)+(3)Cargo distribution, information services	(1)+(2)+(3)+Alliance actions among different ports
Character of structure	Informal relationship between ports and customers	Relationship strengthened, primary cooperation between ports emerged	Entire cooperation between ports and cities	Trend of being managed by local enterprises
Character of production	Low value added services for cargo transit	Loading/ discharging, packing	High value added distribution and information services	Comprehensive logistic services

Source: Zhen Hong, port management, Publication of Chinese fabric College. 2000

From the table we could see that modern ports are no more the simple site for cargo exchange and transportation but the key link of global logistic network. The roll and character of ports in today's logistic chain make ports the combination of various services and functions. Thus, developing contemporary logistic is the certain choice of port development. Efficient port logistic needs the realization of port alliance, and the realization of port alliance needs trans-regional operation.

1.3.2 Domestic research on theory of port industry

Academic researches in started later than that in other foreign countries. In the traditional planned economy system, ports carried out highly intensive planned management mechanism. The academic researches are nearly blank. After Reform and Opening, the reform of port management mechanism became one of the earliest industries in the whole national economy reform. Academic researches in port industry have become consummate gradually since 1980s. Academic viewpoints that affecting economy globalization and port development largely have the following aspects:

1. Viewpoints about port development

In traditional economy system, the construction and development of coastal ports in our country are thoroughly planned and invested by government. From the foundation of China to 1980s, ports' overall arrangement concentrated in the east coast of our country. After reform and opening, local governments strengthen the construction of ports. An upsurge of constructing ports appeared. Aimed at the new conflicts in demand and supply in shipping and port industry, how to position the ports had become a key issue. By researching international politics and economy,

many experts put forward viewpoints that we should recognize the basic function of ports in the process of economy globalization.

2. Viewpoints about port regional effect

From regional economy point of view, ports and their hinterlands are interdependent. Without excellent hinterland development condition and demand, relevant ports will not develop well. So, we should analyze research ports and hinterlands both. From port production and development point of view, there are internal relationships between ports and hinterlands. Objectively, resources between ports and hinterlands should be optimally configured to make this region more harmonious.

Some experts found that there are three economically developed areas, which had their coastal ports' advantages in our country. These areas are, Yangtze River Delta Region, Pearl River Delta Region and Bo Sea Bay Economy Region. These three areas play the roll of pushing and radiation effect in the development of national economy and provide new development space for inland areas. Thus, the relativity between port layout and regional economy development has been proved further.

3. Viewpoints about quantifying the economic benefit

From the middle of 1990s, social statistics department have started to quantify the economic benefit by using the combination of modern management theory and quantitative mathematical methods. In the book named *Research on Social Economic Benefit of Transportation* which is written by Professor Ding Yizhong, she describes the concept of contribution made by transportation industry to social economic development by using input-output theory. And she demonstrated the quantitative algorithm of economic and social benefit of transport industry. And Shanghai international shipping center information center cooperated with Shanghai statistics

bureau to put forward a complete economic benefit quantifying system of port and shipping industry. This system provided scientific basis for port economic quantitative analysis.

1.3.3 Main productions of domestic and abroad research on theory of port development

In different economic development area, various research productions have been made. These productions mainly shown as follows:

1. Taking advantage of the research productions of modern economic theory and describing interdependency between port industry and economic development;
2. Analyzing the relativity between port and other transportation methods systematically;
3. Combined with the application of modern economic theory and mathematical analysis tools, turning the port theories from qualitative researches to quantitative researches.

1.3.4 Main problems of theory of port development

By evaluating the research productions of port industry development theory, nowadays, the research of port industry in our country should pay attention to the following issues:

1. Deepen the research on the basic rules of port industry development

Port industry has not only its special character but also the common rules of generic

economic action. To recognize the objective rules of port industry thoroughly is the basis of the realization of port industry development. The development of scientific technology accelerated not only the increase social productivity but also the improvement of research methods. So, we should research and explore the characters of ports further.

2. Pay attention to the research on the environment of port industry development

The traditional concepts of hinterland of ports had been broken in the recent 10 years. Shipping companies take the lead in the relationship of ports and shipping companies.

3. Consummate the theoretical system of port industry development

The theoretical system of port industry development is the basis of supporting and directing port industry development practice. The construction and completion political and market environment of Shanghai international shipping center, the settlement of the problems occurred in the reform of port management system and the construction and completion of diversification structure of port, all these need research and analysis from the combination of theory and practice point of view.

1.4 The dissertation's contents and methodology

The necessity and feasibility of trans-regional operating of container transportation of Yangshan port is analyzed in this dissertation, according to the analysis of the current situation of development trend of Yangshan port. And the meaning, modes and features of trans-regional operating of container transportation of Yangshan port is pointed out on the basis of the analysis of the successful case of foreign

trans-regional operating of port.

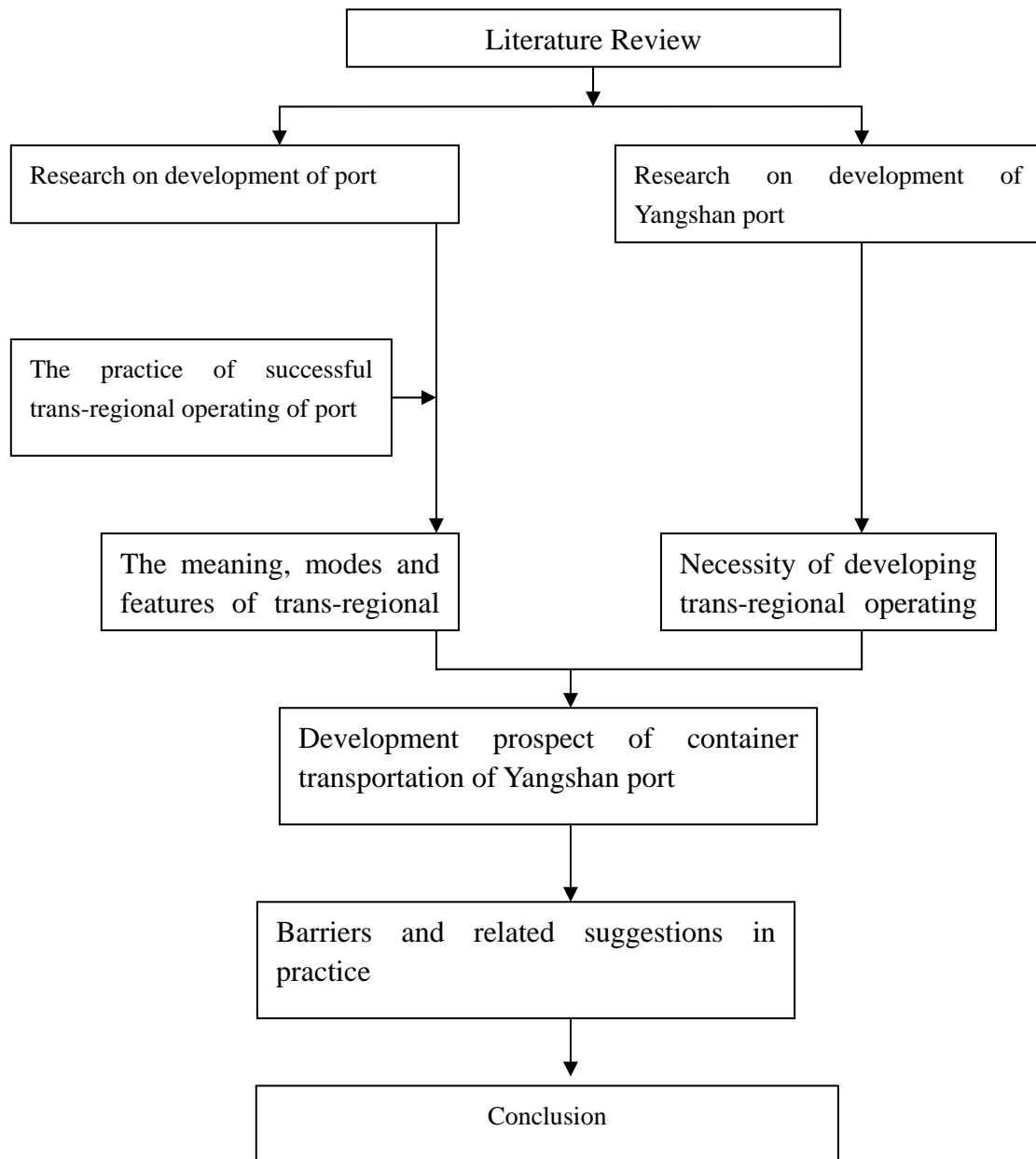


Figure 1-1 Structure of dissertation

As shown in the picture above, to begin with the development trend of modern container terminal is indicated on the basis of literature review. And then the practice

of successful trans-regional operating of port is introduced and makes it's reasonable to talk about Yangshan port. On the other hand, the current situation of Yangshan port is introduced, and development prospect of container transportation of Yangshan port is analyzed at the base of forecasting of container throughput of Yangshan port. Finally, main barriers of trans-regional operating of container transportation of Yangshan port and related suggestions are indicated.

Chapter Conclusion:

The background and the significance of topic choosing are introduced in this chapter, and the theory of port development is analyzed, at last the dissertation's contents and methodology is introduced.

Chapter 2 Current situation of container transportation of Yangshan port

2.1 Introduction of Yangshan port

Yangshan port is located at the entrance of Hangzhou Bay, and belongs to Zhejiang Shengsi Islands. Yangshan port is formed by several dozens of islands, and it is the first port located in island in China.

Yangshan port is about 30 kilometers from Luchao port in Shanghai Nanhui in northwest, and it is about 90 kilometers from Beilun port in Ningbo in south. And it passes Huangze Yang waterways through the sea in east. And it is the nearest deep water port to Shanghai.

We can learn the situation of Yangshan port from the table below:

Tale 2-1 The present situation of Yangshan port

		Opening time of the port	Coastline length (m)	Number of berth	Capacity (in thousand)
The first term program		September in 2005	1600	5	2200
The second term program		December in 2006	1400	4	2000
The third term program	Phase A	December in 2007	1350	4	5000
	Phase B	Before 2010	1300	3	

Source: Arrange on my own according to materials

Trans-regional operating of port is not so popular in China. However, Yangshan port is a typical successful case. It belongs to Zhejiang province in geology, while it is supervised by Shanghai port Authority.

2.2 Analysis of theory of trans-regional operating of port

1. The meaning of trans-regional operating of port

Trans-regional operating of port means the expansion of ports by spanning the formal area of production and operation activities. By capital, technology and management outflows, the scale of port can be enlarged quickly and the maximum of benefit can be realized.

Affected by the law of diminishing marginal returns, port management companies' expansion is constrained by the slump of the cost and the limitation of environment when it reaches its high point. Therefore, port companies should look for new operating areas, which can bring more benefits, and cooperate with the managers of the new operating areas in trans-regional investment and operating to gain more profit.

It's better for the large port companies to trans-regional investment as they have developed to the scale that it's really not so easy to expand their operating area. Nowadays, some international port companies are busy for investing in the worldwide ports. For example, PSA invests in the Antwerp port, Muara port, and Busan port, etc. Trans-regional investment can extend the main lines of business of the port company, and it can support the

development of the main port, on the other hand, it controls the potential competitors indirectly.

What's more, trans-regional operating of port is coincided with the rule of development of the enterprise. As we know, enterprises should expand its operating area into different districts when the local market is saturated. Yangshan port as the case of trans-regional operating of port is the proper choice for Shanghai port.

2. The important way of integrating and optimization

Because of the scarcity of port resource, port companies including international port operators make their great effort to integrate and optimize the port resource. Occupying and integrating more port resource means more potential for future development.

The integration and optimization is the great chance for the port company in the strategic period. And the port operators and large shipping companies are the main participators in the trans-regional operation of port, among which foreign investors as Maersk, Hutchison Port Holding, and PSA have operated trans-regional management in the way of joint venture. Apart from Maersk, CSCL and COSCO have put trans-regional operating into practice in China and the development is very fast. The main reasons are like that: On one hand, the level of container port operation and management has upgraded. On the other hand, Cooperation with port companies, which belong to shipping companies can bring more sailing route for local port authority, which means more benefits for the local port operator. Domestic port operators, especially Shanghai Container Port Company, began to implement trans-regional operation, and the general practice is to penetrate into the medium and small

port in the hinterland.

Trans-regional operating by integration and optimization is the nice trend for the development of the port industry as port companies and international port operators with comparative advantage could transplant their core competence to the new port company. However, we should make our effort to avoid monopoly in the industry.

3. The feasibility of trans-regional operating of port in China

There are several conditions that the investors need to be satisfied, which are as follows:

Firstly, considerable fund;

Secondly, good reputation and popularity;

Thirdly, rich management experience and high efficient;

Finally, brilliant human resources in investment and management.

According to the conditions listed above, we can find that comparatively large scale port in China basically satisfies the conditions. That's because the present management regime and political environment makes it possible to trans-regional operate. With the issuance of *Port Law* and the reform of domestic capital management system, it's becoming more possible to look for a new way which suits them more. Besides, the capital is maturing in China, and the channel of financing is increasing. What's more, the strength of costal ports in China is rising rapidly, and they are capable to extend. Shanghai port is in this case, it invested and implement trans-regional operating on Nantong port, Wuhan port, Jiangyin port and so on.

4. Necessity of trans-regional operating of port in China

To begin with, the trans-regional operating of port satisfies the need of the development of port in China. Affected by the law of diminishing marginal returns, port management companies' expansion is constrained by the slump of the cost and the limitation of environment when it reaches its high point. It means that large port company should break through the present operation situation and extend to the other ports.

Then, the trans-regional operating of port satisfies the need of the economy development in China. In 2006, the value of foreign trade in China is 1760 billion. It indicates that the economy development in our country is becoming more and more dependent on international market. To cope with the rapid growth of economy, ports should advance their capability, and trans-regional operating of port is the effective way for their future development.

Besides, the trans-regional operating of port satisfies the need of integration of ports in China. Affected by the regional protectionism, neighboring ports in China competes with each other fiercely. On one hand, they invest lots of money to extend their scale regardless of their actual ability. On the other hand, they execute unhealthy competence on price. This situation blocks the development of port in our country. Only integration by big port as Shanghai port can effectively manage the unreasonable operating.

At last, the trans-regional operating of port satisfies the need of responding with the international competence. The international competence Chinese ports face is fierce. Ports of Korean and Japan compete with domestic eastern coastal ports. In addition, international port investment companies extend into domestic ports. Hence, coastal hubs have to cooperate with neighboring ports

to form a network by investment and trans-regional operating. In this way, they can consolidate their core business and restrain the development of their competitors indirectly.

2.3 Experience from the development of trans-regional operating of other ports

In this part, I'll introduce the typical case of trans-regional operating of ports, and analyze the trans-regional operating strategy.

1. Hutchison port Holdings

Hutchison Port Holdings (HPH) operates in 23 countries. The port and related services group operates a total of 257 berths in 45 ports. It operates in five of the seven busiest container ports in the world.

HIT's container terminal operations was established in 1969 by the Hong Kong and Whampoa Dock Company (HWD) - Hong Kong's first registered limited company with roots dating back to the mid-19th century. Being a major ship construction and repair company for over a century, HWD diversified into cargo handling and then container operations in the 1960s.

In 1991, the Group acquired the United Kingdom's busiest port, the Port of Felixstowe. Reflecting the Group's global expansion and internationalization, Hutchison Port Holdings (HPH) was formally set up in 1994 to hold and manage the Group's ports and related services worldwide. Since 1994, HPH has expanded globally to strategic locations in 23 countries throughout Asia, the Middle East, Africa, Europe and the Americas. Today, HPH operates a total

of 257 berths in 45 ports along with a number of transportation related service companies.

HWD merged with Hutchison International in 1977 to become Hutchison Whampoa Limited.

Its headquarters are at Hong Kong International Terminals, the world's largest and busiest private-owned container terminal operator.

HPH handled a total throughput of 59.3 million twenty-foot equivalent units (TEUs) in 2006. In the United Kingdom, it owns the Port of Felixstowe (the country's largest), Harwich International Port and Thamesport. HPH also has a substantial interest in ports in the Netherlands, Belgium, Germany, Poland, Spain, Indonesia, Korea, Malaysia, Myanmar, Pakistan, Thailand, Vietnam, Egypt, Tanzania, Oman, Saudi Arabia, Argentina, the Bahamas, Ecuador, Mexico and Panama. The Group is also involved in the investment, development and operations of a number of deep-sea and coastal/river ports in Mainland China.^{<1>}

Singapore port's activity was originally centered around the mouth of the Singapore River, around which was called the old harbor. However, it was the deep and sheltered waters in the nearby Keppel Harbour which would excite Stamford Raffles enough to establish a new colony for Britain in the then sparsely populated village.

By the 1980s, maritime trading activity had ceased in the vicinity of the River except in the form of maritime passenger transport, as other terminals and harbors

<1> http://wiki.mbalib.com/wiki/Hutchison_Whampoa

took over its role. Keppel Harbor is now home to three container terminals. Other Today, port operations in Singapore are handled by two players: PSA International (formerly the Port of Singapore Authority) and Jurong Port, who collectively operate 6 container terminals and 3 general purpose terminals around Singapore.

The Port of Singapore refers to the collective facilities and terminals that conduct maritime trade handling functions in Singapore's harbours and which handle Singapore's shipping. Currently the world's busiest port in terms of total shipping tonnage, also handles a quarter of the world's shipping containers as the world's busiest container port, and half of the world's annual supply of crude oil. In terms of total cargo tonnage handled, Hong Kong and Shanghai are behind Singapore. Thousands of ships drop anchor in the harbor, connecting the port to over 600 other ports in 123 countries and spread over six continents.

The Port of Singapore is not a mere economic boon, but an economic necessity due to the fact that Singapore is lacking in land and natural resources. The Port is critical for importing natural resources, and then later re-exporting them after they have been refined and shaped in some manner, for example wafer fabrication or oil refining to generate revenue. Only then can the service industry such as hospitality services typical of a port of call, for example, restocking a ship's food and water supplies, take their role. The Straits of Johor is currently impassable by all ships as the Johor-Singapore Causeway links Singapore to Malaysia.

PSA operates its trans-regional business in 16 countries. We can learn that from the picture below.



Picture 2-1 Terminals of PSA

Source: <http://www.internationalpsa.com/>

3. The port of New York/New Jersey

The port of New York/New Jersey is the largest port complex on the East Coast of North America and is located at the hub of the most concentrated and affluent consumer market in the world, with immediate access to the most extensive interstate highway and rail networks in the region. In addition, The Port Authority directly oversees the operation of seven cargo terminals in the New York-New Jersey region. Each terminal offers comprehensive shipping services, a qualified, highly productive labor force and competitive pricing.

Different from HPH and PSA, the trans-regional operating of the port of New York and New Jersey is the alliance between governments. On April 30, 1921, The Port of New York Authority was established to administer the common

harbor interests of New York and New Jersey. In 1972, the organization's name was changed to The Port Authority of New York and New Jersey. (See picture 2-2)

As shown in the picture 2-3, the Port of New York/New Jersey Authority only manages the port operation, but also manages aviation, tunnel, bus terminals and station.

We can learn a lot from the successful case of trans-regional operating of port of New York/New Jersey. Firstly, the Port Authority is a financially self-supporting public agency that receives no tax revenues from any state or local jurisdiction and has no power to tax. It relies almost entirely on revenues generated by facility users, tolls, fees, and rents. The Governor of each state appoints six members to the Board of Commissioners, subject to state senate approval. Board Members serve as public officials without pay for overlapping six-year terms. The Governors retain the right to veto the actions of Commissioners from his or her own state. Board meetings are public. Besides, as the operator and manager of state of New York and New Jersey, the mission of the port Authority of New York and New Jersey is as follows: providing the highest quality, most efficient transportation and port commerce facilities and services that move people and goods within the region, providing access to the rest of the nation and to the world, and strengthening the economic competitiveness of the New York-New Jersey metropolitan region. The safety and benefits of the people, not the economic benefits, is what the Port Authority looking for.



Picture 2-2 Picture of Port of New York/New Jersey

Source: <http://www.panynj.gov/>



Picture 2-3 the picture of jurisdiction of The Port Authority of New York and New Jersey

Source: <http://www.panynj.gov/>

4. Summary of experience from the development of trans-regional operating of other ports

From the introduction of the trans-regional of HPH, PSA, and the port of New York/New Jersey, we can get the features of the port shown in the table 2-2:

Table 2-2 Features of trans-regional of HPH, PSA, and the port of New York/New Jersey

Port	Operators	Character of operators	Scale of trans-regional operating	Form of trans-regional operating
Hong Kong	HPH	enterprise	Other countries, and other state	Capital operation, investment, and financing
Singapore	PSA	enterprise	Other countries, and other state	Capital operation, investment, and financing
New York/New Jersey	the Port of New York/New Jersey Authority	government	neighbouing ports	co-management

Source: Arrange on my own according to materials

From the table above, we can get the experience that: Firstly, the forms of trans-regional operating of port are various. Both the enterprise and the government could implement trans-regional operating. Secondly, to co-operate with each other is very important. Thirdly, trans-regional alliance, merger is the main approach for the development of international terminal. At last, support

from government and perfect legal system is vital for the trans-regional operating of port.

Chapter Conclusion:

In this chapter, the author introduces the theory of trans-regional operating of port, and talks about the present situation of Yangshan port, which is the case of trans-regional operating of port. And then from the analysis of the trans-regional of HPH, PSA, and the port of New York/New Jersey, we analyze the experience.

Chapter 3 Necessity of developing trans-regional operating of container transportation of Yangshan port

With the globalization of global economy, fast development of information technology and reformation of modes of transportation, the operating environment and market of Shanghai Yangshan port suffers great change. To respond to the great challenge, Yangshan port needs to implement trans-regional operating of container transportation.

3.1 The necessity of constructing Shanghai international shipping center

Shanghai port is the third container terminal in the world and is the first one in China. “To constructing Shanghai international shipping center” is the important strategy in our country. As the economic center in eastern coast in China, Shanghai has the peculiar qualifications of growth in natural environment and infrastructure.

However, the resource of Shanghai port is limited and regional constraint, while to operate the strategy of “constructing Shanghai international shipping center” needs boundless and international operating. Then establishing a market-oriented trans-regional operating of container transportation system is vital in nowadays.

Different from other terminal in the world, Shanghai port is a typical hinterland port.

The cargo resource of Shanghai port is not the international transfer, but the Yangtze River area. “In upper Yangtze River, there is daily container liner service from Chongqing port to Shanghai port; in middle reaches of Yangtze River, more than 80% of container needs to be transferred in Shanghai port; and the down reaches of Yangtze River, nearly a half of container of Nanjing port is carried to Shanghai port.”

However, Shanghai port suffers the problem of limited of draft of Shanghai port. To solve problem, Shanghai port implements trans-regional operating, and invests on Yangshan port. As we know, affected by the scale of economy and specialization of ocean vessel, the large vessel is the trend of the development of shipping industry from 1970s.

Let’s take container vessel for example: from the table 3-1, we can find that capacity of the fourth container vessel is 4000TEUs, and required depth is -13.2 meters. While in 2015, the ninth container vessel which carries 18000 TEUs requires -23.1 meter depth of water. The situation of tunnel and depth of Shanghai port is not optimistic. Apart from Yangshan port, Shanghai port can’t satisfy the needs of new large vessel.

Table 3-1 draft and required depth for container in different time

	Type of vessel	Applicable time	Capability (TEUs)	Line of container	Draft(M)	Required depth(M)
The fourth	Panama size	to 1990	4000	13	12	-13.2
The fifth	Panama size	to 1995	6000	14	14	-15.4
the sixth	Panama size	to 1997	8736	17	14.5	-16
The seventh	Panama size	to 2005	13000	22	15.2	-16.7

The eighth	Panama size	to 2010	14000	23	17.1	-18.8
The ninth	Malacca size	to 2015	18000	24	21	-23.1

Source: Chinese Ocean Shipping Proclamation, 2003,4

In conclusion, there are still some natural environment conditions that confining the constructing Shanghai international shipping center. Shanghai port has to implement trans-regional operating of container transportation of Yangshan port to cope with international competition.

3.2 Accelerating subsidiary business of port industry

Subsidiary business of port industry means a range of cluster of industries that locates near port and its development relies on the port resource. The development of subsidiary business of port industry can supply rich cargo resource for Shanghai port and support the constructing Shanghai international shipping center.

There are several problems about subsidiary business of port industry in Shanghai port. Firstly, the limited coastline and land resource in the city restrain the development of the subsidiary business. Let's take Minsheng berth in Pudong for example, the Minsheng berth locates in the important district in Pudong, and there is no boundary between city and port, but the land area for operation is so limited that it's impossible develop subsidiary business. What's more, the transfer of manufacturing business from Shanghai to Zhejiang and Jiangsu province, causes the decrease of the volume of logistics.

However, trans-regional operating of port could solve these problems and accelerate subsidiary business of port industry as follows:

1. Optimizing the port layout, cutting cost

The establishment of Yangshan Port has brought in the new opportunity for the development of Shanghai Port, by making adjustments to the function of Shanghai Port, unifying the terminal and the logistics center. The build-up of Yangshan Port has separated the port from the city for the establishment of new terminal. Taking advantage of low land cost and the scale economy of the deepwater port, the subsidiary economic zone of Yangshan Port could cut cost to attract international companies to build factories in the zone, for the aim of setting up the comprehensive product industries.

2. Getting rid of the situation of self-management for each port, the development of subsidiary industries could carry out the business of trans-region and trans-nation by making use of resources of home and abroad. The trans-regional operation for ports could keep the growth of subsidiary industries harmoniously by carrying out the potential of port resources based on the principle of integrated benefits for the whole port.

3. The subsidiary economic zone has often grown to be the leading factor for the regional economy due to the cooperation with other ports.

The Yangshan subsidiary economic zone could comply with Pudong Development Zone by taking advantage of the particular position and the processing service. The industry structure of processing trade, re-exports and logistics distribution could be set up by using the strength of abundant land resource with supporting policies. In that case, the Yangshan port would be bound to be the essential terminal of global

supply chain. And Shanghai port would be an indispensable force for seaborne trade.

As stated above, only through trans-regional operation could Shanghai Port overcome the difficulties that the subsidiary business is confronted with, to keep the sustainable economic development of Shanghai.

3.3 Promoting the development in Yangtze River region led by Shanghai port

The Yangtze River Delta is the crucial economic zone in China, including 7 provinces and 2 municipalities directly under the Central Government. It is not only the key economic zone of China, but also the direct and essential hinterland for Shanghai. From the perspective of valley economy and international experience, the competence of national and regional economy could be directly influenced by the economy of the river valley. For instance, the boom of the US for the first 20 years of the 20th century was closely related to the prosperity of the Mississippi. The development of France, Germany and Holland was reflected in the Rhine Valley. It has informed us that the process and quality of our country's economy development was directly related to the success of growth of Yangtze economy in the early 21st century.

The Yangtze River is the web through which Shanghai and other cities. While being built as the international shipping center, Shanghai Port has already established and carried out the "strategy of Yangtze River": doing the trans-regional operation through capital infiltration. The container logistics web would be set up by setting the city ports in Yangtze River as points, the tracks as lines, and logistics as blood.

Chapter Conclusion:

This chapter mainly analyses the reason and the necessity of trans-regional operation of Shanghai port. It is decided by the goal of building the international transportation center for Shanghai port. Through trans-region operation, the throughput of containers in Shanghai port could be enhanced, while the problem of water depth could be solved. Trans-regional operation is also the way, through which the economy of Yangtze River Delta and subsidiary industries nearby Shanghai port could be developed.

Chapter4 Modes of trans-regional operating of container transportation of Yangshan port

Learning from foreign ports' successful experiences of trans-regional operation and current operation modes used in Shanghai port, we could find that every trans-regional operation mode has its own advantages and disadvantages. This chapter is going to discuss the advantages and disadvantages for various modes from different classification and provide some useful concepts and ideas for Shanghai port's trans-regional operation.

4.1 Trans-regional operation with capital bond

In the process of trans-regional operation, almost all of the foreign ports gain their managerial authority and shareholding by a capital bond. The modes for a capital bond are: investing ports and berth trans-regionally, joint operating or co-operating with other companies, and by mergers and acquisitions.

4.1.1 Mergers and acquisitions

Mergers and acquisitions represent a trans-regional operation mode that a port enterprise gains a port's proprietorship and managerial authority by purchasing other port enterprises' stock equity and bringing them into its own operation system.

The advantages of mergers and acquisitions are listed as below:

1. The trans-regional operating port enterprise could enormously decrease the construction and investment cycle of their projects and enter the market immediately.
2. Enter the market with a low cost by purchasing other enterprises with a relatively low price when the target enterprises are in predicament.
3. Easily to obtain the current resources of the enterprise being purchased, such as technology, management, market network, information and human resource etc. Thus the trans-regional operating enterprise could realize the localization of operating and gain competitive advantage.
4. Greatly reduce the uncertainty and risk of investment in contrast with constructing new ports and berths.
5. Realize economics of scale rapidly by absorb the market share of the enterprise being purchased.

But mergers and acquisitions also have their disadvantages. They are mainly embodied as follows:

1. Mergers and acquisitions need great amounts of cash in one time.
2. The management system and operating concept of the enterprise being purchased usually have great difference with the mother enterprise. And this will possibly lead to operating failure.
3. The asset assessment is very complex and difficult.

With the increase of the proportion of foreign and private individual capital investing in infrastructure of port, the way that large port enterprises purchase their subordinate companies or other small port enterprises seems to be a ideal expansion method. But whole purchase is still rare in port industry because of the public character of the

ports. However, this way is feasible for some small ports. And this method has not been adopted in the process of trans-regional operation of Shanghai port.

4.1.2 Investing the construction of ports and berths trans-regionally

The characteristic of investing the construction of ports and berths trans-regionally is that the trans-regional operating enterprise carry out the project's planning, construction, operation, management and functioning directly and independently. So, the remarkable advantage of direct investment is that the port enterprise could grasp the initiative in a great degree in most aspects of the project. In contrast with mergers and acquisitions, the evident disadvantage of investing the construction of ports and berths trans-regionally is that it needs a great deal of preparatory work, so it has a long construction cycle and large investment risk. The construction of Yangshan Port is a bold attempt of investing the construction of ports and berths trans-regionally by Shanghai port.

4.1.3 Joint operating with local port enterprises

Joint operating is a way of trans-regional operation that a port enterprise invests in other ports' construction by becoming a shareholder and shares the benefits and risks. Now most ports' infrastructures are constructed by joint operating. Port enterprises invest in major ports according to their own strategy and thus fulfill the plan of occupying strategic resources and enlarging market shares. For the moment, in Shanghai port's Yangtze River strategy, the trans-regional operations with port of Wuhan, Nanjing and Chongqing belong to this way.

The advantages of establishing joint operating enterprises are:

1. The joint operating with local port enterprises could bring the support of local government.
2. It is propitious to use local resource advantages better and obtain local market information and management experiences.
3. It helps to reduce the entrance barriers and risks by using local financing channels and market reputations.
4. Reduce cash investment of the investor.

And the disadvantages of joint operating enterprises are:

1. The two parties will have conflicts on daily management when they have different profit goals.
2. More conflicts will happen in aspects of dividing profit, making price and personnel appointment etc. The intensification of these conflicts will affect the enterprise's operation efficiency and even leads to the disintegration of the enterprise.
3. The key technological and economical secrets will be easily betrayed.

4.1.4 Co-operating with local port enterprises

This way of trans-regional operation means a port enterprise cooperate with local port enterprises. When this way is build upon the basis of stock ownership, it turns to be joint operation. When it is build upon the basis of contract, it remains to be co-operation. The advantage of this way is that every investor have alternatives and they don't have to deal with the problems of stock equity controlling. And the trans-regional operating port enterprise could bring their advanced managerial concepts into local port enterprises without large amounts of investment.

4.2 Trans-regional operation with different subjects by joint operating

Trans-regional operation could be divided into three different modes according to the classification of capital source. In detail, they are: joint operating with port operation companies, with shipping companies and with domestic port groups.

4.2.1 Joint operating with port operation companies

These world class transnational port operation companies play the leading roll in global container port operation. For example, HPH operates 24 container terminals, P&O operates 22 container terminals, SSA operates 13 container terminals and PSA operates 19 container terminals. The whole container transaction volume of above 4 companies accounts for 40 percent in world's total. HPH has 44 ports and 255 berths all over the world at present. This figure respectively takes 50%, 25% and 14% quotient in Hongkong, Chinese mainland and global maritime transport trade^[38].

The entrance of these world famous port operation companies also brings in the giants of shipping company. Normally, port operation companies will cooperate with shipping companies to make their symbiosis stable and ensure their competitive advantage in the region. Yantian port witnessed a drastic change after Yantian port group successfully attract HPH. Since vessel "Algeciras" entered Yantian port in 1994, the port's ocean routes occupied 70% in that of Shenzhen port. And all of the world's top 20 liner shipping companies have entered Yantian port. Shanghai International Port Group and Port Authority of Singapore exchanged their stocks to

make a share for each other. That makes Chinese port participate in the international port operation. Meanwhile, we can learn advanced management experience from famous port operation companies.

4.2.2 Joint operating with world famous shipping companies

With container's size becoming larger and larger, ocean shipping companies operation risk is continuously increasing. Nowadays, many large shipping companies start to participate in port operation to make their fleet enjoy safer and more convenient loading/discharging services and reduce their operation costs. Maersk, COSCO and China Shipping are all the shipping companies that operate in both shipping and port investment and hold ports.

It can obviously afford benefits for port operator to cooperate with world famous shipping companies to invest in port. Firstly, with shipping company's stock rights in port investment, the port operator could enormously reduce his earlier phase investment. And then, shipping companies will surely consider their joint operating ports when they are planning their route layouts. For example, Qingdao port has turned to be the most competitive port in northern China after Maersk became the shareholder of the port.

4.2.3 Joint operating with domestic port enterprises

The internationalization of logistics and full integration of international liner shipping make the port integration inevitable and necessary. Port's horizontal

integration appears as the formation of strategic cooperation relationship of regional port cluster. Port cooperation could bring many obvious benefits, such as enhance port investment return ratio, enlarge port economics of scale, reduce operation cost, increase port income ratio, stabilize port operation, accelerate technology development, reduce operation risk and improve service quality to both parties of the cooperation. However, port cooperation is a double-edged sword. It could bring both benefits and the risk of losing opportunities to the port. So, whether the port cooperation could succeed or not depends on the division of benefits, the share of information, the asymmetry between ports, the fluctuation of market and some other factors.

In China, joint operating between port groups becomes a new tendency. Shanghai port is carrying out its expansion strategy over Yangtze River Delta Region energetically to steady its leading position roll as international shipping center. These cooperation includes investing in Ningbo container port, realizing total strategic cooperation with Nantong port by investing 500 million Yuan, and cooperating with Yangtze River coastwise ports such as Nanjing, Chongqing, Yangzhou, Anqing etc. in different forms. In 2003, Shanghai port purchased 40% of Wuhan port's stock. And in 2004, Shanghai port further purchased a controlling percentage of Wuhan port's stock. Meanwhile, Shanghai port was very bullish on Chongqing port because of its location advantage in southwest China. So Shanghai port cooperated with Chongqing port as well. Furthermore, Ningbo port and Zhoushan port integrated their resources and formed a port development company led by Zhejiang province government. Other pivot ports also started their action to invest in middle or small ports to realize cooperation.

4.3 Carry out trans-regional operation in different areas

4.3.1 Trans-sea port building

Build and operate deep water port trans-regionally is the necessary tendency for Shanghai port to make up its disadvantage of lack of deep water, to build international shipping center and to participate in global competition. The construction of Yangshan port is a daring attempt of Shanghai port to build port trans-regionally.

Yangshan deep-water port locates in Big and Small Yangshan area in Shensi county in Zhejiang province. Experts thought that to build deep-water external port in Big and Small Yangshan area is the optimal choice after ten years' verification. In the earlier planning, reconnaissance and construction phase of this trans-regional important infrastructure project, the government of Zhejiang province and Shanghai cooperated tightly. Meanwhile, they solve the problem of benefit distribution caused by region division by market mechanism by learning the experiences of international pivot port.

The construction of first phase of Yangshan port had already completed and had been put into running. And the second phase had also been put into use in December in 2006. The second phase of Yangshan port is a specialized container port. It locates in the west of the first phase and its 1400-meter-long coastline is joined with the one of first phase. The land area of the second phase is about 700 thousand square meters. The second phase of Yangshan port has 4 deep-water berths and has a throughput capability of 2.50 million TEUs. The investment scale of the second phase is about 6

to 7 billion Yuan. The second phase adopted joint operating mode. Five shipping industry giants, SIPG, HPH, MAERSK, COSCO and CSCL cooperated and formed a joint operating company together. In this company, HPH and MAERSK hold 32% stock each, SIPH hold 16%, COSCO and CSCL hold 10% each. The investment proportion was approved by China National Development and Reform Commission.

As a matter of fact, the construction of Yangshan deep-water port had already attracted the attention of some port enterprises and shipping companies earlier. Some of the world top ten shipping companies and port management enterprises had contacted Yangshan port and expressed their willingness to participate in the construction and operation of Yangshan port three years before. In the construction and operation process of the second and third and later phases, Yangshan port will also fetch in international companies to participate in. PSA, with world-class management level, will probably cooperate with Yangshan port as well.

The construction of Yangshan deep-water is a daring attempt for Shanghai port to break the restriction of administration and build port trans-regionally. And this attempt will provide important practical foundation for trans-regional operation for Shanghai port from now on.

4.3.2 Yangtze River Strategy—joint operating with container ports along the river

“Yangtze River strategy” means constructing regional pivot port by capital, technology, management output and cooperation with ports along Yangtze River and finally realizing the win-win situation between Shanghai port and its hinterland.

Located in the sea gate of Yangtze River and in the intersection of Yangtze River economic belt and east coastal line economic belt, Shanghai port has a tremendous geographic position. But 95% of Shanghai port's foreign trade containers comes from Yangtze River region, and nearly 60% of internal trade containers distributes in Yangtze River region ports. So, Shanghai port should develop inland water transportation resource and cooperate with ports along Yangtze River tightly to realize its final target—to construct international shipping center.

There are various kinds of cooperation modes in Yangtze River strategy in Shanghai port's blueprint such as joint operating with local ports to construct terminals or to operate shipping business. But the final target is to construct a perfect logistic network—which means expand Shanghai port's hinterland from Yangtze River Delta Region to the whole drainage area by cooperate with other hinterland ports in the aspects of capital and business.

To accelerate the realization of Yangtze River strategy, Shanghai port started to cooperate with Ningbo port early in July in 2002. SIPG hold 45% of Ningbo port's stock and formed a logistic company with Ningbo port. Then a container feeder line opened. From then on, Shanghai port started to cooperate with Nanjing, Wuhan, Chongqing, Yangzhou and other ports at different levels.

In the end of September in 2003, Wuhan Port Container Co., Ltd. which is mainly managed by Shanghai Port Container Co., Ltd and Wuhan Port Group formally came into existence. This indicates that the cooperation between Shanghai port and Wuhan port had entered the substantive period. In July 2004, Shanghai port participated in the reform of Wuhan Port Group again. In this reform, Shanghai port and Shanghai Port Container Co., Ltd invested 201 million Yuan and 168 million Yuan separately.

In November 6th 2004, Shanghai port signed a merger and acquisition project which worth of 100 million Yuan with Wuhan port again. Till then, Shanghai port finally obtained the controlling percentage of Wuhan port's stock. Shanghai port planned to build Wuhan port as a pivot port in middle reaches of Yangtze River and to make Wuhan port as an important container cargo resource in 5 years' time.

In October 28th 2003, the vessel "Yuji 618", fully loaded with 100 containers, sailed from Chongqing Jiulongpo container port to Shanghai port. This was the first sailing of Chongqing Jihai Shipping Company, which was jointly founded by Shanghai port and Chongqing port.

In May 2005, SIPG and Nanjing port signed a cooperation agreement. They wanted to enhance the cooperation between biggest Chinese inland port and sea port by capital fusion and to achieve win-win effect. Till then, Shanghai port had linked the most important three Yangtze River coastwise ports (Chongqing, Wuhan, Nanjing) in row. Yangtze River strategy took shape.

4.3.3 Joint operating with coastal container ports

Till now, Shanghai port has no actions in the aspect of joint operating with coastal container ports. This dissertation only uses Jiaying port as an example to discuss the necessity and feasible modes for Shanghai port to cooperate with coastal container ports.

Jiaying port is the only sea gate in northern Zhejiang province and a convenient channel for southern Jiangsu province region to go to the sea. Jiaying port could be a

specialized port for Pudong development zone and Suzhou industry zone and a supporting port for Hangzhou Bay industry zone.

Jiaxing port has two geographic advantages: The first is that containers transporting to southeast Asia will possibly not be transferred to Ningbo port by trans-sea bridge if Jiaxing port could handle these containers because the fee of trans-sea bridge will increase customers' costs. The second is that Jiaxing port has superior inland transportation conditions.

Table 4-1 Compare Jiaxing port with other ports in Yangtze River Delta

Port	Type	Inland transportation condition	Distance to Shanghai international shipping center (km)
Nantong	inland port	without railway	128
Zhangjiagang	inland port	without railway	140
Zhenjiang	inland port	good	305
Nanjing	inland port	good	392
Jiaxing	sea port	good	90

Source: *Analysis of prospect of Jiaxing port, China shipping, 2003.5*

In view of Jiaxing port's superior geographic location and its roll in Yangtze River Delta Region port cluster, Shanghai port should cooperate with Jiaxing port to

manage container terminals jointly.

4.3.4 Cross-border investment, joint operating container terminals

Look back to the development process of world's two biggest port operators HPH and PSA, cross-border operation development strategy is one of the most important reasons that leads them to success. With world container transportation develops quickly, the scale of ports have expanded consequently. Even Hong Kong and Singapore could not meet the expansion need of HPH and PSA. So HPH and PSA turned to foreign markets. HPH and PSA operate and manage ports from over thirty countries and regions all over the world by purchasing and sharing stocks.

Different operating environment from different countries and regions make port operators accumulate abundant operation and management experience. They get deeper understanding for customers' needs and controlling power of container transportation channels gradually. Strong market controlling power makes port operators be capable of integrating port relevant service system and advancing port development.

To construct Shanghai international shipping center, Shanghai port should have deep-water berths and routes, high volume of container throughput, thick liner shipping lines, high proportion of international transit containers and world class port operators and relevant port logistic services. So, Shanghai port should concern not only ports in Yangtze River Delta Region, but also ports outside it and participate in the competition of international port industry.

The feasible modes for Shanghai port's trans-regional operation are:

1. Investing in host countries to found enterprises. Cross-boarder operation should carry out localization strategies, absorb local talents with high level of professional knowledge and strong ability of developing markets.
2. Joint operating with foreign enterprises, especially with cross-boarder enterprises to buck for win-win effect.
3. Mergers and acquisitions. In this way, the trans-regional operating enterprise could reduce time of market entrance.

However, during the process of trans-regional operation of Shanghai port, Chinese imports and exports banks should build good service platform for the port. In the earlier time, port enterprises are usually lack of information about the host country. Banks should provide comprehensive services then. Meanwhile, banks should also provide financial support for the port enterprises.

Chapter conclusion:

This chapter mainly analyzed the modes of trans-regional operation of Shanghai port. Shanghai port could choose different modes in different conditions. Some of these modes had been adopted by Shanghai port and created considerable benefits. Shanghai port could also cooperate with Jiaying port. In the future, Shanghai port could develop international business further and try to become a world class port operator.

Chapter5 Analysis of development prospect of container transportation of Yangshan deepwater port

5.1 Forecasting of container throughput of Yangshan port

The container throughput of Yangshan deepwater port in 2006 is 3,230,000TEUs, while the Waigaoqiao harbour district container throughput is 18,480,000 TEUs. Since the Waigaoqiao harbour district has already been saturated, we can estimate that the container throughput will not change a lot in 2010. Therefore in the coming several years, the increasing amount of container throughput of Shanghai harbor should be the one of container throughput of Yangshan deepwater port.

5.1.1 Gray system model

Gray system refers to the system both containing known information and the information unknown or information not so certain. Professor Deng Julong took this theory seriously firstly in 1982, having brought forward home and abroad, having aroused by our country scholar. Gray system theory has provided the new system resolving problems.

Gray system behavior may build the systematic gray model after generating ampere.

The gray model manifests outstanding superiority when exploring the probability of characteristic property is less than system.

GM (1, n) expresses the model of one order, the n variable differential equation forecasting. The following joins the forecast model being the container handling capacity on this account with the (1, 1) model introducing GM.

The primitive progression should be set as follows:

$$x^{(0)}(t) = \{x^{(0)}(1), x^{(0)}(2), \dots, x^{(0)}(n)\}.$$

assuming a summation $x^{(0)}(t)$, according to $x^{(1)}(k) = \sum_{t=1}^k x^{(0)}(t)$, we can get

$$x^{(1)}(k) = \{x^{(1)}(1), x^{(1)}(2), \dots, x^{(1)}(n)\}.$$

Then GM (1, 1) model differential equation of $x^{(1)}(k)$ is:

$$\frac{dx^{(1)}}{dt} + ax^{(1)} = u \quad (1)$$

Parametric in (1) can indicate as $\hat{a} = (a, u)^T$

Estimating a parameter according to minimum two multiplication, then we can get

$$\hat{a} = (B^T B)^{-1} B^T Yn \quad (2), \quad \text{in (2)}$$

$$B = \begin{pmatrix} -0.5(x^{(1)}(1) + x^{(1)}(2)) & 1 \\ -0.5(x^{(1)}(2) + x^{(1)}(3)) & 1 \\ \dots & \dots \\ -0.5(x^{(1)}(n-1) + x^{(1)}(n)) & 1 \end{pmatrix}$$

$$Yn = (x^{(0)}(2), x^{(0)}(3), \dots, x^{(0)}(n))^T$$

With substitution \hat{a} to (1), we can get the GM (1, 1) model time responding to function model. And it is the formula of GM (1, 1) model, which is

$$x^{(1)}(k+1) = (x^{(0)}(1) - u/a)e^{-ak} + u/a \quad (3)$$

With $x^{(0)}(k+1) = x^{(1)}(k+1) - x^{(1)}(k)$, we can get the estimation of year $k+1$.

5.1.2 Establishment of the gray model and forecasting on container transportation

According to container throughput of Shanghai port of 1995-2006 (see table 5-1), we can establish gray model GM (1, 1) on container throughput.

Table 5-1 Container throughput of Shanghai port of 1995-2006

Tabulation unit: 10 thousands TEUs

Year	1995	1996	1997	1998	1999
Throughput	152.7	197.14	253.7	306.6	421.6
Year	2001	2002	2003	2004	2005
Throughput	634	861	1128	1454	1808

Source: Arrange on my own according to materials of customers

By calculation, we can get $\alpha = -0.23692$, $u/\alpha = 37.78095$, and then we can get gray model of forecasting of container throughput of Shanghai port GM(1,1):

$$\text{Which is } x^{(1)}(k+1) = (152.7 + 37.78095)e^{-0.23692k} - 153.0083 \quad (4)$$

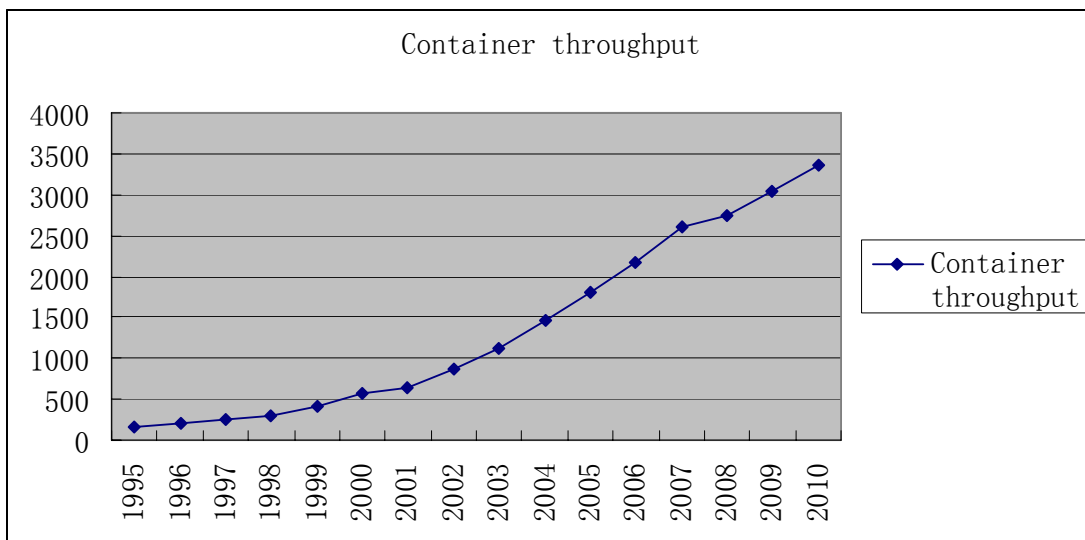
With (4) and $x^{(0)}(k+1) = x^{(1)}(k+1) - x^{(1)}(k)$, we can get container throughput of Shanghai port in 2007-2010, which is shown in Table 5-2.

Table 5-2. Estimation Value of Container Throughput of Shanghai Port in 2007-2010

Tabulation unit: 10 thousands TEUs

Year	2007	2008	2009	2010
Throughput	2600	2750	3050	3500

We can draw a liner graph with Container Throughput of Shanghai Port in 1995-2006 and the estimation value of Container Throughput of Shanghai Port in 2007-2010 as follow:



It's easy to find out that the analog result of the estimation value of container throughput of Shanghai Port in 2007-2010 has outstanding degree of fitting.

By analysis above, we can facilely get the estimation value of container throughput of Yangshan port in 2007-2010 as follows:

Table 5-3 the estimation value of container throughput of Yangshan port in 2007-2010

Tabulation unit: 10 thousands TEUs

Year	2007	2008	2009	2010
Throughput	750	959	1200	1650

5.2 Development of inland transportation of Yangshan port

There are three kinds of inland transportation of Yangshan port, highway transportation, through transportation and transshipment. In my opinion, we should put more emphasis on through transportation and transshipment, and decrease highway transportation.

1. The overloading of highway transportation

Highway transportation fits for short distance transportation with its high speed and fine fluidity. Till now there are 28000 container trucks which were registered in Shanghai. Besides, there are many more container trucks which are not enrolled in. The amount of container trucks is so large that it leads to the mess of the market, and the overloading of Donghai Bridge and highway. With the persistent increase of the container throughput of Shanghai inland transportation, the highway transportation can't sustain future situation by itself. Apart from that, with the rise of the amount of the highway container transportation, the degree of crowding of container trucks will surge, which will deteriorate our environment.

2. The shrink of through transportation

The container throughput of through transportation of Shanghai port is 80,000, accounts for nearly 0.07% of the whole amount of the container throughput of Shanghai port. However, more than one fourth of the container throughput is through

transportation. In my opinion, the reasons for the shrink of through transportation are as follows:

(1). the limitation of terminal rail facilities

(2). the separation of Yangshan port and railway station

Yangshan port was formed by land reclamation in outer sea, so it's not appropriate to build railway station near the port. Therefore, the majority of accessorial production area including the railroad is in TongSheng Logistics center. And the connection between Yangshan port and inland accessorial districts relies on the Donghai Bridge, which means that containers carried by train have to be unloaded in TongSheng Logistics center, and then they will be loaded on container truck to get to Yangshan port, Vice versa. Moreover, sometimes trucks can't go through Donghai Bridge because of the bad weather. In conclusion, the separation of the port and railway station leads to the increase of the cost of through transportation, and reduce the time effect of the through transportation.

(3). the long haul distance from Yangshan port to inland main hinterland railway system

From the analysis of the container throughput from inland cities to Shanghai in the past years, we can get that Xi'an, Chengdu, and Zhenzhou are the main hinterland of through transportation. However, these districts are the main hinterland of through transportation for Tianjin port, Qingdao port, and Lianyungang port.

Table 5-4 Haul distance from the main hinterland to different ports

Tabulation unit: KM

port / city	Xi'an	Chengdu	Zhenzhou
Yangshan port	1509	2351	1020
Tianjin port	1305	2147	920
Qingdao port	1570	2680	1075
Lianyungang port	1080	1953	583

Source: Arrange on my own according to materials of customers

We can easily find that the haul distance from Yangshan port to inland main hinterland railway system is longer compared with other ports. And because the high value goods in container are time sensitive, the long distance will affect the time effect.

(4). the limited capacity of railway transportation for container

Restricted by the low average per capita income, railway transportation still is the first choice for the tourist, especially for the long distance travel. And railway system pays more attention to the volume of passenger travel because it is considered as the source of the increase of their income. Apart from that, the transportation of energy and mineral resources occupies part of the railway transportation capacity because Shanghai is lack of energy and mineral resources. More over, there are only Beijing-Shanghai railway, and Shanghai-Hangzhou railway in Shanghai. The limited capacity of railway container transportation for container affects through transportation in Yangshan port.

(5). the weak infrastructure of inland railway transportation for container

The majority of container transfer stations in inland China are small scale, with low capability. Because of the weak infrastructure of inland railway transportation for container, they can't satisfy customers' needs as packing, stuffing, stowage and so on. Besides, the damage of the container which is caused by the lacking of the loading and discharging facility is serious.

In addition, the information system of the railway system needs further development.

3. The advantage of transshipment

Transshipment is the main mode of distribution in many container hub in the world as the cost of transshipment is nearly a quarter of the cost of the railway, and it is about one fifth of the cost of the highway. For example, transshipment occupies almost 20% of the whole amount in Rotterdam port, and Antwerp port.

Transshipment accounts for 36% of the whole container throughput in Yangshan port. And the container throughput is 3580,000 TEUs in Yangshan port from January to April in 2007, among which nearly a half is transshipment.

The advantages of transshipment are as follows: Firstly, it is better for environment protection. Compared with container trucks, vessel can carry more containers with the same amount of emission of gas. Besides, it can save energy compared to other modes. What's more, the cost of transportation for each goods is reduced as it can carry more cargo, then the competitiveness of the goods was increased indirectly.

5.3 The relationship of Yangshan port and Waigaoqiao district

The future division of work in Shanghai port is that Waigaoqiao district will pay more

attention to the needs of Yangtze Delta Area, while Yangshan port will put emphasis on the inland area in Yangtze River, like Chongqing, Wuhan. Because the draft Yangshan port is larger than that of Waigaoqiao district, vessels which are more than Waigaoqiao district can afford can dock at Yangshan port. And smaller vessel which wants to go through inland waterway, or needs some additional service, can berth at Waigaoqiao district.

As Waigaoqiao district is close to Yangshan port in geographic position, with the advantage of competitive industries of Waigaoqiao district and the natural advantage of Yangshan port, they can cooperate with each other for co-prosperity.

Chapter Conclusion:

The future container throughput is forecasted in this chapter. Besides, the author analyzes the development of inland transportation of Yangshan port, and points out that transshipment will be the emphasis in future development. At last, the author talked about the relationship of Yangshan port and Waigaoqiao district.

Chapter6 Main barriers and related suggestions of the development of container transportation of Yangshan port

6.1 Main barriers of the development of container transportation of Yangshan port

1. The conflict of trans-regional operation of port and districts' benefit

The operation of the port is usually constrained by the governmental division. The theory of modern relationship of port and city said that, the development of port and neighboring city is inter-promoting. And port accounts a lot in the development of the local economy. Ports are not only the points for the city to develop its shipping industry, but also the integrated logistics centers in the area as their hinterland are so vast. Yangshan port is located in Zhejiang province, and belongs to Shanghai officially. In some situation, the administrative intervention of local government will set back the development of the port.

2. The limitation of the governmental barrier

In China, *Port law* was promulgated, with punishment set down regarding to the illegal intervention of the local government. However, the supporting rules in local

government haven't been set down in the majority of areas. Therefore, we need to fasten the speed of enacting and improving rules and regulations to make sure that the port management company can act independently.

3. The maladjustment of the port management system in nowadays

According to *Port law*, there is only one port management Authority in one city. However, there is conflict for the Yangshan port with the regulation of *Port law* as Yangshan port is located in Zhejiang province managed by Shanghai port Authority officially. Therefore, we must reform the port management system nowadays to cope with trans-regional operation of port.

4. The immaturity of the modern enterprise system

To establish mature modern enterprise system is the fundamental of trans-regional operating of port and multiple financing. However, some port management companies in China are still state-owned enterprises. Even for some port management companies which have built up modern enterprise system, the government still can exercise influence on some important decisions. And this affects the trans-regional operation of Yangshan port.

6.2 Suggestions of the development of container transportation of Yangshan port

1. Multiple modes of trans-regional operating of Yangshan port:

(1) Establishing new berth by single proprietorship or joint venture

This is the basic way and the normal way to open new market for trans-regional operation.

(2) Hiring berth and investing on the operating infrastructure

In this way, the infrastructure of the port is built by government, and then lent to the port operators.

(3) Purchasing other berths

Yangshan port could purchase shares of other ports or transfer shares to trans-regional operation. For example, Yangshan port could cooperate with COSCO, CSCL to reduce investment risk.

(4) Enlarging stock rights

To speed up development of the port, and to take better control of port resource, Yangshan port should enlarge stock rights in other ports. In this way, Yangshan port could build its own management system and trans-regional operating will become smoother.

2. Constructing mutually-beneficial cooperation pattern

The trans-regional operating of Yangshan port is the integration of the port resources in different cities, which needs great support from local government.

To develop trans-regional operation smoothly, Yangshan port should construct mutually-beneficial cooperation pattern to eliminate other ports' managers' consideration. I think Yangshan port could cooperate with the ports in these ways:

Firstly, Yangshan port could invest in building infrastructure to solve the difficulty of

lacking of funds for small ports. Secondly, Yangshan port could retrain the formal managers to improve the management of the port. And the last one is to build long term and comprehensive coordination organization.

3. Advancing core competence of Yangshan port and establishing modern enterprise management system

The enterprise management system of Yangshan port is nice while some operation is not so normative and need to be promoted. In addition, Yangshan port should help other port companies to set up and improve modern enterprise management system.

Besides, Yangshan port should make effort to advance its core competence. That's because only equipped with core competence that can enterprise take lead in the industry

Chapter conclusion:

In this chapter, main barriers of trans-regional operating of container transportation of Yangshan port and related suggestions are indicated.

Conclusion:

With center of world economy and trade transfers from Atlantic to Pacific, also with the high development rate of the economy of Yangtze River Delta Region, Shanghai is facing a great opportunity to be an international shipping center.

At the end of last century, with the high development rate of Chinese economy, especially the rate of Yangtze River Delta Region, the great success of opening policy in Pudong, and the expansion of export-oriented industry in Shanghai and surrounding area, Shanghai port is gaining abundant container cargo resources. But the rapid growth of container transportation also makes new requirements for Shanghai port. Being lack of container terminal capacity, port draft, and logistics support, Shanghai port must seek new chances to realize sustainable development. And trans-operating of operating of Yangshan port is the great case in Shanghai port.

The main contribution of this dissertation is the establishment and application of the Gray system model of Shanghai Yangshan port. With the help of the model, the estimation of forecasting of container throughput was get. Besides, the necessity and feasibility of trans-regional operating of container transportation of Yangshan port is analyzed in this dissertation, according to the analysis of the current situation of development trend of Yangshan port. And the meaning, modes and features of trans-regional operating of container transportation of Yangshan port is pointed out on the basis of the analysis of the successful case of foreign trans-regional operating of port.

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