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The feasibility research into port cooperation between Shanghai and Ningbo

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THE FEASIBILITY RESEARCH INTO PORT COOPERATION BETWEEN SHANGHAI AND NINGBO

By

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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: **The Feasibility Research into Port Cooperation between Shanghai and Ningbo**

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This paper will study into the suitable modes and approaches of the port cooperation between Shanghai and Ningbo. The purpose for me to do this research is that China's rapid growth of its economy and foreign trade demands a strong support from the port service. But now, the capacity of China's seaports is still insufficient and lack of an international transshipment hub port.

As the two biggest ports in China, Shanghai and Ningbo have a great impact on the security of national port industry. However, the over competition in container throughput is very serious between Shanghai port and Ningbo port.

In fact, Shanghai and Ningbo are having mutual benefits. Ningbo port has an advantage of cost, nature deepwater berth and major bulk handling service. Shanghai port enjoys an advantage of management, financing and container handling service. Therefore, it is necessary to study the possibility of port cooperation between these two ports.

In this thesis, the throughput of these two ports will be forecasted and the modes of port cooperation at home and abroad will be enumerated. Some methodology will be used in this thesis to prove the cooperation basis of two ports, including that the AHP (Analytical Hierarchy Process) technique will be used to analyse the port competitive power of Shanghai and Ningbo can be increased after cooperation.

In this thesis, the standpoints will be expounded in five steps:

1, Analyzing the social and economy environment of these two ports.

2, Analyzing the hinterland of these two ports.

3, Enumerating the modes of port cooperation at home and abroad.

4, Searching a suitable mode of port cooperation between Shanghai and Ningbo.

5, Analyzing the approaches of making the ports cooperation.

KEYWORDS: Cooperation, Throughput, Simplified service, Diversified service, Major bulk, Container transport, Cooperation mode

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LIST OF ABBREVIATIONS

TEU	Twenty Foot Equivalent Unit
PRC	People's Republic of China
SPC	Shanghai Petrochemical Company
AHP	Analytical Hierarchy Process
HWL	Hutchison Whampoa Limited
EDI	Electronic Data Interchange
SPCCO	Shanghai Port Container Co.,Ltd
NY/NJ	New York/New Jersey

CHAPTER 1

INTRODUCTION

1.1The problem needs to be solved

In the last decade, with the flourish of port construction in Yangtze River Delta, the coastline resources are not as rich as before. The deep-water coastal resources become rare. Shanghai and Ningbo are the two biggest ports in China. However, the competition between these two ports is very serious. Whether these two ports need cooperation? How can the regional benefit submit to the national benefit? How to take good use of the limited coastal resource to reduce the losing of over competition? How to specify service and achieve the maximum of social benefit? These problems are all have a realistic meaning. In order to solve these problems, when the coastal resources become less and less, the governments do the decision to establish *Shanghai International Shipping Center*[1]. According to *The construction program for ports within Yangtze River Delta (2004-2010)* done by The Ministry of Communications, the Shanghai International Shipping Center will be established under "four development system" and "one rule". The four systems are as followed:

1, To establish the container transport system ---as Shanghai port in the core.

2, To establish the iron ore transshipment system---as Ningbo port in the core.

[1] According to *The construction program for ports within Yangtze River Delta(2004-2010)* done by The Ministry of Communications and Shanghai aggregated ports policy, the Shanghai International Shipping Center will not only include the Shanghai port. Shanghai International Shipping Center is an *aggregate* concept, it including all the ports located in Yangtze River Delta especially the participation of Ningbo port. But Shanghai port is the core port in this shipping center.

3, To establish the crude oil transshipment system---as Ningbo port in the core.

4, To establish the coal transshipment system--- as Shanghai port and Ningbo port in the core.

Yangtze River Delta should construct the transshipment systems of container, iron ore, crude oil and coal cargos. In order to establish Shanghai International Shipping Center, Shanghai should to be the center of this region, Jiangsu and Zhejiang to do the role as the supporters. However, this policy is not full carried out, because of the serious competition. In order to find a solution of this problem, this thesis will expand the possibility of port cooperation between Shanghai and Ningbo.

1.2 The meaning of this thesis

1.2.1 In the viewpoint of the nation

When analyse the port cooperation between Shanghai and Ningbo, we should in the view of improving the competitive power of the nation's port industry. After adopting the reform and opening policy, the development of China turns out to be incredible. From 1978 to 2005, China's economy had a continual growth rate of 8%. The investment from abroad reaches 60 billion US$ in 2005. China has become the World Factory. The rapid growth of China's economy and foreign trade demands a strong support from container port service. In addition, China want to establish four crude oil reserves centers and set up a lot of mega infrastructure construction projects. This means that the importing of crude oil and major bulk cargos will be increased and specified ports to handle raw materials have to be built. But now, the capacity of China's seaports is still insufficient. Especially, the ore and crude oil ports began to be strained.

In such a challenge condition, in order to secure China's Shipping industry, China

needs to establish its own international shipping center and international hub port. This demand is not only meet the needs of shipping industry but also secure the transportation of nation's strategic supplies such as crude oil and iron ore. However, China lakes of an international transshipment port and a large number of cargos choose the other port around China to transport. There are more than 950 thousand TEUs transshipped from Pusan port or Kobe port to United States or Europe annually, which waste more than 2.7 billion US$ freight of China. As the two biggest ports in China, Shanghai port and Ningbo port should represent Chinese ports to compete with these foreign ports. But the simplified service, over competition and insufficient port handling capacity limited the competitive power of these two ports. If without coordinated development, the situation will become worse. Therefore, it is necessary to research of the port cooperation between these two ports.

1.2.2 In the viewpoint of region

In the Yangtze River Delta, including Shanghai, Jiangsu province and Zhejiang province, there are about 16 big ports along the trunk and line of the Yangtze River and the Coastline in East China. These 16 ports are shown in Table 1. Shanghai port and Ningbo port are the two biggest ports in Yangtze River Delta and Shanghai International Shipping Center. According to China's port development strategy, these 16 ports are required to develop with their own special functions and full use of the limited resources. In 1996, the government established the aggregated ports of Yangtze Delta, including 16 ports. This region obtains 21 percent of the total coastal line resources of China. According to the strategy planning and traditional port service, these ports are specified in their operations. For example: Shanghai port makes use of its unique financing and service environment to create an international comprehensive port with the container business at its core. Ningbo is famous for handling the major bulk cargo and crude oil. Zhangjiagang has gradually developed

into the largest lumber import and exchange center in East China.

Table 1-The container and cargo throughput of ports in Yangtze River Delta in 2005

Ports	Cargo Throughput (10000 tons)	Annual growth	Container throughput (10 thousand TEUs)	Annual Growth
Shanghai	44317	16.7%	1808.49	24.2%
Ningbo	26881	18.9%	520.8	30%
Zhoushan	9037	22.5%	5.6	13.3%
Jiaxing	1704	26.3%	1.43	-13.4%
Whenzhou	3630	5.2%	23.02	9.5%
Nanjing	10700	11.3%	60.4	24%
Nantong	8327	15.4%	30.12	4.8%
Suzhou	11918	31.6%	75.2	45.2%
Taicang	1510	45.2	25.1	172.5
Changshu	2050	26.4	12.4	40.2
Zhenjiang	5800	19.9	17.7	8.6
Jiangyin	4278	59.5	4.8	-4.65
Yangzhou	3500	17.1	16.0	22.1
Qinzhou	2290	21.5	4.16	66.4
Lianyungang	6016	38.2	100.5	100.2

Source: *Report on the port and shipping development of shanghai 2005*

However, in recent years, with the booming-up of container transportation, all of the ports are focus on the container operation and do everything they could to improve the container handling facilities. The development of container transportation industry will leads to the booming-up of related industry such as logistics industry, service industry, production industry and so on. This tendency leads to more serious competitions on container business among these ports. Among these competitions, the most serious one can be found between Shanghai port and Ningbo port. Therefore, the ports in Yangtze Delta need to cooperate with each other and service diversification is a good way for ports cooperation. The cooperation is the demand

for improving the competitive power of regional ports, when they suffer a serious competition with the ports outside.

1.2.3 In the viewpoint of Shanghai port and Ningbo port

As shown in Table 2, Shanghai and Ningbo are the two biggest ports in China. Both of the local governments of Shanghai and Ningbo are focus on the shipping industry. These two cities have both adopted the policies as "Prosper the city through port development ". In the previous years, the competition between these ports was not serious. Shanghai was specialized in container handling operation and Ningbo was specialized in major bulk handling. However, the present competition between these two ports is the most serious and complex one in Yangtze Delta and also in China. The main reason is that Ningbo not only wants to develop its traditional major bulk service, but also wants to improve its container service, which is the core business of Shanghai port. When the service of both port been simplified, the competition for the cargo resources become the core competition between Shanghai port and Ningbo port. Besides the competition between themselves, they confront more serious competition from the ports outside Yangtze Delta.

Table 2-The world top 10 cargo ports

Port	Country or Region	Year 2004 10000tons	Year 2005 10000tons	Annual increase
Shanghai	China	37896	44317	17%
Singapore	Singapore	39342	42327	7.6%
Rotterdam	Holland	35236	37023	5.1%
Ningbo	China	22585	26881	19%
South Louisiana	USA	22566		
Guangzhou	China	21520	25037	16%
Tianjin	China	20616	24069	17%
Hong Kong	China	22088	23014	4.2%
Pusan	Korea	21976	22345	1.7%

Qingdao	China	16265	18678	14.8%

Source: The date derive from the annual statistic on every port's official web-site and some of the data was derive from the magazine named as ISL

1.2.3.1 Competition with the ports in neighboring countries

When Shanghai promote the establishment of International Shipping center and Ningbo want to become a hub port, they confront with the competition from Korea's Pusan-Gwangyang port, Japan's Tokyo Gulf ports group and Kaohsiung Port. Nowadays, the land-use fee of Pusan port is just one-fifteenth of that of Shanghai and Pusan promote its port construction which invested 9 billion US$. The Kaohsiung port is cooperating with Keelung port to improve its competitive power. The Tokyo Gulf ports group attracts cargo together to improve the integrative competitiveness. The Kobe port set up express line linking itself with the ports along the Yangtze River including Shanghai port to attract the transshipment cargos from these areas and built 62-hectare area near its port for developing the business between Sino – Japanese. The competition is very serious.

1.2.3.2Competition with the other ports at home

As the two biggest ports in Yangtze River Delta, Shanghai and Ningbo not only confront with the competition from abroad but also the competition at home. China has three major ports group, Yangtze River Delta ports group，Zhujiang Delta ports group and Bo Hai Gulf ports group. Located at the middle position of these three ports group, Yangtze River Delta will not only compete with the Zhujiang Delta for container cargo resources but also compete with the Bo Hai Gulf for the major bulk cargo resources. As to the hinterland, the middle and south part of China are the common hinterlands of Yangtze River Delta ports group and Zhujiang Delta ports group. The east and west part of China are the common hinterland of Yangtze River Delta ports group and Bo Hai Gulf ports group. The other two ports groups are both

want to become the shipping centers. Especially in Zhujiang Delta, the combined throughput of Hong Kong port and Shenzhen port is larger than Shanghai and Ningbo. So if Shanghai port and Ningbo port don't coordinated developed, the leading position of these two ports would be lost.

1.2.4 Concluding remarks

The ports competition between Shanghai and Ningbo is seriously existed, which damage the competitive power of these two ports and our nation's port industry. If Shanghai and Ningbo want to create their advantage within the competition with the other ports, they need to cooperate with each other. If these two ports cooperate with each other, the integrated competitiveness and throughput of Shanghai International Shipping Center will be improved. This is beneficial for Shanghai International Shipping Center to become the international hub port and transshipment port. At last, the cooperation will improve the competitive power China's port industry.

1. 3 The theoretic evidence and literature review

1.3.1 Port Economics

The ports competition and cooperation is a branch of port economics. Port economics is a new subject. It is a typical industry economics. The study and research of port economics began in 1960s. And the integrated theory was established in 1980s. There were a lot of books published in those years. *Jansson, J. and D. Schneerson (1982), Port Economics Frankel, E.G. (1987), Port Planning and Development* were two famous books in research the port economics. Port economics is a very important theory for government to make policy and it can offer the theoretic evidence for port authority to do the macro-management.

1.3.2 The concept of cooperation and strategy alliance

In the situation of market economy, the relationship between two ports just likes the relationship between two enterprises. So the theory used to analyse the enterprise is also suitable to analyse the port. Adam. Brandenburger, professor in the commercial department at Harvard and Barry J. Nalebuff, professor at Yale propose the concept of “cooperation “. That is to say, various enterprises can cooperate with each other while competing. Furthermore, those enterprises, which are dedicated in the same or similar business scope, can realize the win-win strategy by cooperating before competing. I think the crossing competition can be adopted between the adjacent ports through making good use of their own advantages. When condition permitting, these ports could carry out the strategy of Port Alliance.

Since J. Hopland, CEO of Co, DEC in America and R. Nigel, expert in the management proposed the strategy of alliance, Strategy Alliance has became the focus in the field of managing study and different enterprises. The so-called strategy alliance between enterprises is means that two or more than two enterprises and specified departments with the common strategy goal, by means of enterprise agreement and combined organization, are developing into an alliance in which various enterprises maintain the advantageous competence, share the profit, risk and the responsibility.

1.3.3 The literature review

The port cooperation has been studied by a lot of people. The result is that some ports doing the cooperation such as New York and New Jersey, Shenzhen and Hong Kong. On the contrary, the other ports are still confronted with a very serious competition, the most serious one of which is between Shanghai port and Ningbo port. There is a lot of research paper focus on the port competition between Shanghai

and Ningbo. There are two opinions, one of which think it is possible for these two ports to do the cooperation and the other think it is impossible for them to do the cooperation.

In the article named as *Port competition between Shanghai and Ningbo*, Professor Kevin Cullinane thought Shanghai port and Ningbo port were compete with each other and they would not cooperate with each other. The reason is that the growth rate of Ningbo port is very fast and its development is not depending on Shanghai. In addition, the nature condition of Ningbo port is much better than Shanghai port. Therefore, Shanghai port and Ningbo port will compete with each other in the following years.

However, a lot of people think it is possible for Shanghai port and Ningbo port to do the cooperation. For example, in the article named as *The management of port corporation*, Xu Da Zheng, Zhu Geng Qiu think the port cooperation is benefit for these two ports. In *The strategic research on Shanghai international shipping center*, Yuan Shun Cai thought Ningbo port is a part of Shanghai international shipping center. In addition, in the *The outline of the Transportation layout of the modernization highway and waterway of Yangtze River Delta region*, we can find that the government also hope that these two ports can do the cooperation.

1.4 The methodology

The Regression method will be used to forecast throughput of Shanghai port and Ningbo port in 2010. In addition, the Delphi technique will be used to gather opinions about the port cooperation between Shanghai and Ningbo from the exports in port field. At last the AHP technique will be used to make the decision whether these two ports could get mutual benefit through cooperation.

CHAPTER 2

DEVELOPMENT CONDITION OF SHANGHAI PORT AND NINGBO PORT

2.1The status of Shanghai port and Ningbo port

2.1.1 Port of Shanghai

Shanghai is the biggest city and the largest port in China. Shanghai port is located in the center of China's 18000 km coastline and it is the sea gate of Yangtze River. Apart from these, Shanghai port is one of the biggest comprehensive and multi-propose commercial and foreign trade port of China. From table 3 we can see that the port construction of Shanghai develops very quickly these years. Until 2005, including public ports and private ports, Shanghai has 1023 coastal berths (including 5 deep-see berths of the first phase of Yangshan port) and 2192 river berths. Among the 1203 ocean berths, 31 are all container berths.

Table 3-The infrastructure of Shanghai Port

Year	The length of berths (10000 meters)	Berths Number	Within these berths	
			10000-tons-class berths	Container berth
1980	1.28	92	46	2
1985	1.39	98	46	4
1990	1.77	122	64	7
1995	1.90	140	68	12
1996	1.90	138	69	12
1997	1.96	142	71	12
1998	7.58	1108	109	13
1999	7.69	1110	113	18

2000	7.64	1098	111	18
2001	7.67	1087	112	18
2002	7.62	1096	115	20
2003	8.76	1202	125	24
2004	8.9	1198	123	24
2005	9.06	1203	127	31

Source: The data until 1997 was from the Stat. of Shanghai Port Authority. The data from 1998 to 2005 is from the Stat. of Shanghai International Port (Group) Co. Ltd.

Today, there are more than 70 shipping companies established their headquarters or branches in Shanghai. Shanghai port has opened shipping lines around the globe, extending to Europe, America, Australia, Japan and Southeast Asia. Just in 2005, there are 30 new international shipping lines, which were first time to be opened, being launched out from Shanghai.

2.1.1.1The performance of Shanghai Port

The development of Shanghai port was amazing. As shown in Figure 1, in 2000, the throughput of Shanghai port was just over 200 million tons. However, in 2005, the port handled a total of 443 million tons of cargo with an increase of 16.9% over the previous year and accounting for about 15% of the total tonnage via all the large coastal ports of China. The port of Shanghai, for the first time, surpassed the Port of Singapore, which handled a total of 423 million tons of cargo, and became the largest port in the world.

As to the container business, as shown in table 4, in 2005, the container throughput of Shanghai port overreached 18.9 million TEUs, rising 24.2% over the previous year and amounting to 23.9% of the container through all the Chinese ports. The container throughput of Shanghai port was just less than that of Singapore (23.2 million) and Hong Kong (22.4 million) *(according to the latest statistics of the*

Shanghai Port Management Department). In terms of growth rate, the container handling capacity of Shanghai grew much faster than that of Singapore.

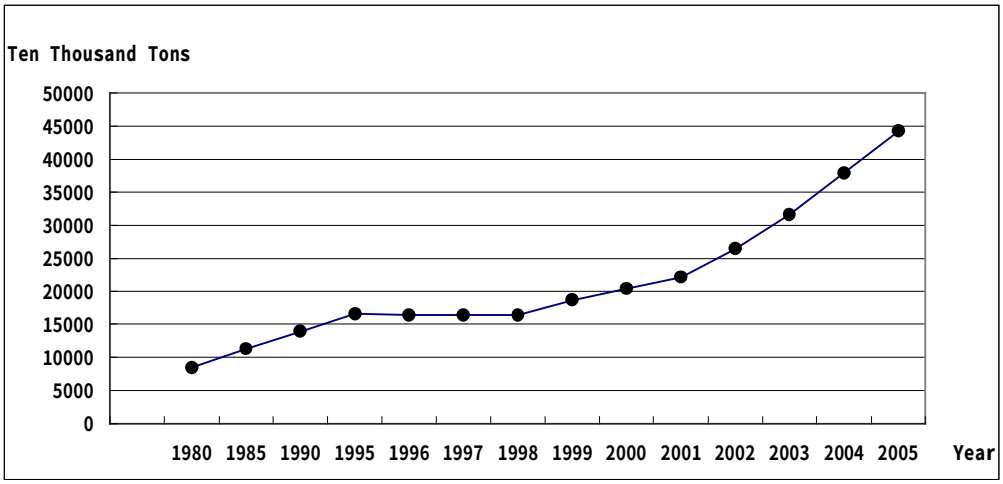

Figure1- Cargo Throughput of Shanghai Port

Source: Data derive from the *Shanghai Statistical Yearbook 2005* by Shanghai Statistics Bureau

However, there is still a big gap between Shanghai and Singapore in container handling capacity, but the gap between Shanghai port and these two ports was narrowed. When the construction of Yangshan port will have been completed in 2010, Shanghai's container handling capacity will be improved. Shanghai will be the biggest container port in the world in the near future.

Table 4- Container throughput and foreign trade cargo throughput of Shanghai Port

Year	The container throughput (10000 tons)	The container throughput (TEUs)	Within these containers (TEUs)		The foreign trade cargo (10000 tons)
			In	Out	
1980	23.4	2.99	1.56	1.43	1791
1985	184.4	20.45	10.80	9.65	2871
1990	445.5	45.60	22.40	23.20	2593
1995	1388.9	152.60	69.30	83.30	4086
1996	1785.1	197.10	92.40	104.70	4136

1997	2303.6	252.80	114.70	138.10	4713
1998	2765.7	306.60	141.10	165.50	4904
1999	3948.5	421.60	196.70	224.90	6285
2000	5169.6	561.20	266.10	295.10	7633
2001	5911.4	634.00	305.40	328.60	8653
2002	7821.7	861.20	414.10	447.10	10609
2003	10225.1	1128.25	544.40	583.80	12968
2004	13294	1455.4	699.60	755.80	15836
2005	16385.5	1808			

Source: Dates derive from *Shanghai Statistical Yearbook 2005* done by Shanghai Statistics Bureau

2.1.1.2 The international shipping center and construction of Yangshan Port

The idea to transform Shanghai port into an international shipping center was initially proposed by the government in 1996. However, although Shanghai has such a big number of berths, they are not deep-see berths. Even after the second-phase of the Yangtze River Mouth Deep-draft Fairway Construction finished in 2005, the water depth of Shanghai port was 10 meters, which couldn't pass the full container ship larger than 2000 TEUs (twenty-foot equivalent units). Its limited depth limits the development of Shanghai port. So Shanghai had chosen Yangshan Island, which belongs to Zhejiang province, to construct a deep-water port. The water depth of Yangshan Island is 15 meters, which can pass the biggest container ships of the world. Yangshan port's first phase opened on 2005 December 10 and the Yangshan Port Customs were also launched in mid-December.

As shown in table 5, the first phase of Yangshan port will bring 5 deep-see berths to Shanghai port. When the whole construction of this port will have been finished in 2020, Shanghai port will have 30 deep-see berths and 12 km's deep-see coastline, which will afford a strong support to Shanghai's ambition to become the international hub port.

Table 5- The layout of Yangshan Port

Construction	The year of completion	The berths will be built	TEUs (million)
Phase I	2005	5	3
Phase II	2006	4	2
Phase III	2010	9	5

Source: The data derive from the *Layout of Yangshan Port* done by Shanghai Municipal Port Administration Bureau

2.1.1.3 The prospect of Shanghai port

The fast growth of Shanghai port makes the capacity of Shanghai port insufficient. But the rapid growth of China's economy and huge potential of foreign trade give Shanghai a good opportunity to speed up the construction of port and port facility. According to the government policy, Shanghai will become the core port of Shanghai International Shipping Center. Shanghai port faces a great challenge and also a great chance in becoming a International Shipping Center and hub port.

2.1.2 Port of Ningbo

Ningbo is the second largest port in China and the largest port in Zhejiang province. The port of Ningbo is situated in the middle of the coastal area of China and on the south side of Hangzhou Bay. Ningbo port is different from other ports in China. It is a nature deep-see port. "*With deep water and smooth current, the port area of Ningbo is free from strong winds and waves. The entry channel is normally over 18.2 meters deep. Large ships of 250,000 up to 300,000 tonnage can come and leave at tide.*"(The official web-site of Ningbo port http://www.nbport.com.cn)

According to the statistics by the Ministry of Communication of the PRC in 2005, Ningbo port had 191 berths, 39 of which were 10000-ton class. As shown in table 6,

Ningbo port has good facilities to handle the major bulk cargos. The biggest berth is the berth of 300000-ton class, which is specified in handing the crude oil. In addition, Ningbo has iron ore berth of 200000-ton class and special 50000-ton class berth for handling the liquid medical cargo.

Table 6- The main infrastructures of Ningbo Port

Berth Type	The Berth number	The Length of Total Berth (m)	The depth of berth (m)	Tonnage Class (10000tons)
Crude oil	8	8903	13-20	3\5\25
Container	12	3838	13.5-17	3\7.5
Iron ore	5	1361	12-20.5	2.5-20
Product oil	2	580	9.5-14	
Coal	8	1808	7-15	0.3-6
Liquefied Chemical	4	803	7-14	0.5\1\5
Multi-function	12	1804	5.5-11.8	
Foodstuff	2	500	7-15	4\8
Passage	5	200	3.8	0.1
Car ferry	2	100	4.5	0.3

Source: The official web-site of Ningbo port http://www.nbport.com.cn/index.php

2.1.2.1 The performance of Ningbo Port

In order to achieve correlated development of the port and the city, Ningbo has turned its port advantages into a driving force of the local economy. When the economy is booming-up, this will also prompt the development of port industry. In traditional opinion, Ningbo is famous for handling crude oil, iron ore, liquid chemicals and coal. Handling the major bulk cargo is the competitive advantage of Ningbo Port. As shown in Figure 2, in 2005, the throughput of Ningbo Port was 269 million tons, an increase of 18.99% over the previous year. This achievement secures its number two position in all China ports, ranking the fourth in the world.

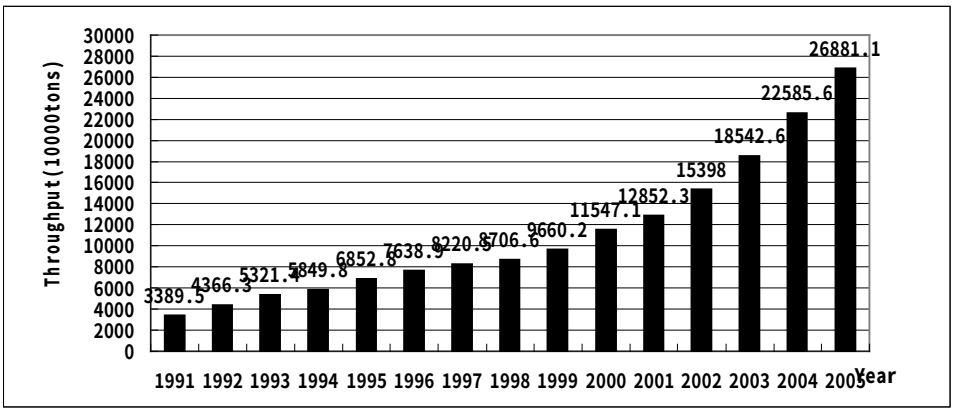

Figure 2- The Cargo Throughput of Ningbo Port

Source: The official web-site of Ningbo port http://www.nbport.com.cn/index.php

What we should mention is that the crude oil import through Ningbo port, in 2005, was 40 million tons, amounting for 30.52% of the crude oil, which were imported through all the Chinese ports. The volume of the crude oil imported through Ningbo port was the largest one in China in 2005.

But in recent years, Ningbo port is not satisfied for just handling the major bulk cargo. Port of Ningbo pays more attention on developing its container business. As shown in Figure 3, in 2005, the container throughput of Ningbo Port has exceeded 5.2 million TEUs, which was the fourth biggest in China's container port industry. The growth rate of the container throughput of Ningbo port was number one for the sixth consecutive year among all Chinese container ports.

Therefore, Ningbo port not only want to become one of the biggest major bulk cargo handling ports of China, but also want to become the hub port of China.

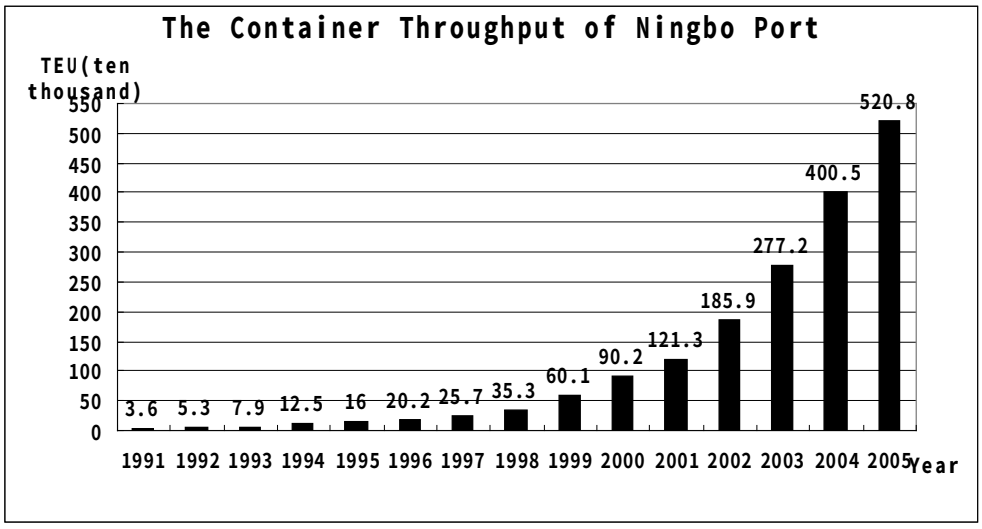

Figure 3- The Container Throughput of Ningbo Port

Source: The official web-site of Ningbo port http://www.nbport.com.cn/index.php

2.1.2.2 The merger of Ningbo port and Zhoushan port

With the fast growth of port construction, the deep-water coastal resources of Ningbo port are being sufficiently used. Port of Ningbo is lack of deep-water coastal resources for further development. So as early as in the 1996, in the *Intermediate planning of Ningbo Port and Zhoushan Port* done by the Zhejiang Province in 1996, the idea of merger of Ningbo port and Zhoushan port was came into being. After ten years arrangement, this giant idea was come true on December 26th 2005, and The Ningbo-Zhoushan Port Administration Committee had been established on the same day. The name of 'Ningbo-Zhoushan Port' was officially being used on 1st Jan 2006. This means Ningbo port and Zhoushan port officially merged into one single port since 2005. The merger has improved the competence of Ningbo port. "*The merger is mutually beneficial, with Zhoushan providing its rich deep-water coastal resources and islands and Ningbo offering financial and technological support.*" according to Lu Zushan, governor of Zhejiang Province. After This merger,

Zhoushan port could become the driving force of the development of Ningbo port in the future.

2.1.2.3 The prospect of Ningbo Port

It is estimated that over 30 billion RMB will be injected into the construction of Ningbo port. After merging the Zhoushan port, Ningbo expects to be the third largest port in the world by 2010. Apart from these, in China's strategy of energy supply, Ningbo is one of the four crude oil reserves centers. Therefore, when Ningbo focuses on container business, it will still not neglect its advantage in major bulk handling.

2.2 Forecasting the throughput of Shanghai port and Ningbo port

When we want to find a coordinated development mode for Shanghai port and Ningbo port and analyse whether these two ports have a problem on over construction, we should first have an understanding of the situation about the throughput of these two ports

2.2.1 Shanghai port

As shown in **Appendix 2 paragraph 1 and 2**, I adopt the Regression Analysis Method to forecast the container and cargo throughput of Shanghai port. I can use historical data to forecast the future throughput of shanghai port. According to the forecasting I do in **Appendix 2**, the container throughput of Shanghai port will have reached 29.5 million TEUs and the cargo throughput will have been more than 620 million tons by 2010.

2.2.2 Ningbo port

I use the same method to forecast the container and cargo throughput of Ningbo port. According to the forecasting I do in **Appendix 2 paragraph 3 and 4,** the container

and the cargo throughput of Ningbo port will achieve 10.6 million TEUs and 509 million tons in 2010.

2.2.3 Zhoushan port

Because Ningbo port has merged Zhoushan port in 2005, so the throughput of Zhoushan port should be taken into consider. The container throughput of Zhoushan port was limited in previous years. It is difficult to adopt the historical data to forecast the container throughput of Zhoushan port. In addition, Zhoushan port is located at the open sea, the direct hinterland of Zhoushan port is limited, which restrict its container business. But Zhoushan is famous for handling the major bulk cargos and the transshipped cargos. According to the forecasting in **Appendix 2 paragraph 5,** the cargo throughput of Zhoushan port will more than 187 million tons in 2010.

CHAPTER 3

ANALYZING THE ECONOMIC ENVIRONMENT OF SHANGHAI PORT AND NINGBO PORT

3.1 An analysis of the hinterland of Shanghai port

When we want to set up a development strategy to a port, we should analyse the economic environment of it. Shanghai is located in the center of China's coastline and it is the sea gate of Yangtze River. So when we analyse the environment of Shanghai port, we should focus on three levels. They are the environment of Shanghai, Yangtze River Delta and the valley of Yangtze River.

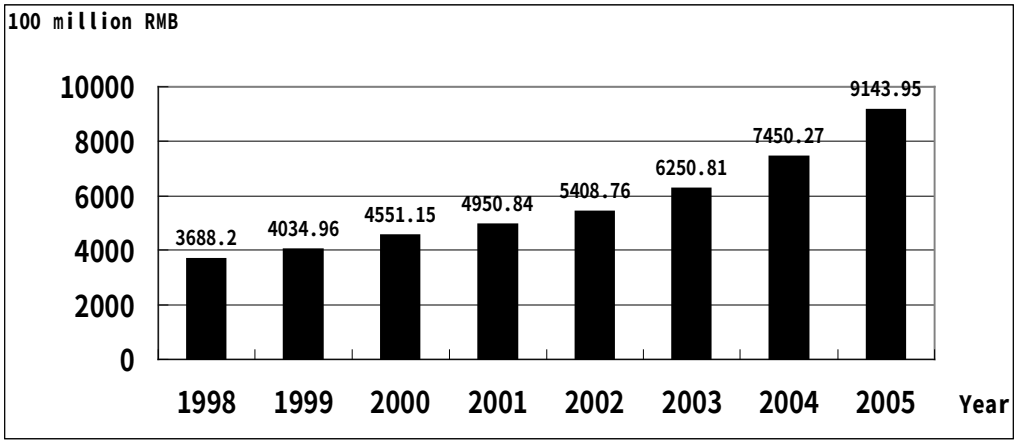

Figure 4- The GDP of Shanghai

Source: The data derive from the *Shanghai Statistical Yearbook (1998-2005)* written by Shanghai Statistics Bureau

3.1.1 An analysis of the condition of Shanghai economy development

Located at the Yangtze River Delta，Shanghai is not only the biggest city in China but also the most developed regions in China. Today's Shanghai is the center of finance, economy, trade and shipping in China. Furthermore, Shanghai will be built into the international finance, economy, trade and shipping center. There are more than 17 million people living in Shanghai.

As shown in Figure 4, the GDP of Shanghai was more than 914300 million RMB in 2005, with an average continual growth rate of 11% since 1998. The financial revenue of Shanghai reached 395000 million RMB in 2004, which had a continual growth rate of 18.5% since 2000. The Table 7 told us that the revenue of Shanghai accounted for one eighth of the China's total. The total volume of import and export goods of Shanghai port was 282600 million US$, accounting for 24% of China's total.

Table 7-Shanghai's proportion in China's total

Guideline	Unit	China	Shanghai	Shanghai/ China
GDP	100 million RMB	136515	7450	5.5%
Financial revenue	100 million RMB	26300	3952	13.7%
Total volume of social retail goods	100 million RMB	53950	2455	4.6%
Port's throughput	100 million tons	40	3.79	9.5%
Gross fixed asset formation	100 million RMB	70073	3085	4.4%
The total volume of import &export goods	100million US$	11548	2826	24.5%

Source: The data derive from *The statistical bulletin of China* Written by National Bureau of Statistics of China the *Shanghai Statistical Yearbook 2005* written by Shanghai Statistics Bureau

The fast growing of China's economy is the driving force of Shanghai's development. Shanghai is one of the cities, which were opened to the outside, in China. It has an improved transportation system and financial system, which attract the foreign investor to do the investigation in Shanghai. The flourishing economy of Shanghai increases the transportation volume of Shanghai. Most of the goods in and out of Shanghai are manufactured goods, specific purpose material, chemically product, textile and so on. This means most of the foreign trade cargos of Shanghai are container suitable cargo. So the container industry is booming up in Shanghai in these years. The container throughput of Shanghai increased from 2.2 million TEUs in 1996, to 18 million TEUs in 2005.

Apart from container transportation, Shanghai also needs to import a lot of major bulk and crude oil, because Shanghai has an iron and steel company named as Bao Steel, which is the biggest iron and steel company in China. In addition, there are two car-manufacturing enterprises, Shanghai Volkswagen and Shanghai General Motors, located in Shanghai. Furthermore, Shanghai has a big petroleum chemical corporation named as Shanghai Petrochemical Company (SPC). SPC process 9.493 million tons of crude oil, 96.42% of which are imported. Apart from these, as a metropolis, Shanghai is confronted with a shortage of energy and most of the power plants are thermal power generation power plants. So Shanghai need to import a huge amount of coal.

3.1.2 An analysis of Yangtze River Delta

Yangtze River Delta is the direct hinterland of Shanghai port. It consists of three provinces, that are, Shanghai, Jiangsu and Zhejiang. This Delta is the most prosperous region in China. As a highly industrialized and internationalized region, the Delta has its unique advantage that is embodied in the layout of the river and

seaports and its outcome of industrialization. The fast growth in shipping and port industry in this region is the result of the flourishing economy of Yangtze River Delta. According to the latest survey, shown in Figure 5, the GDP of the Delta reached 3 trillion Yuan, which is 22 percent of national total[1].

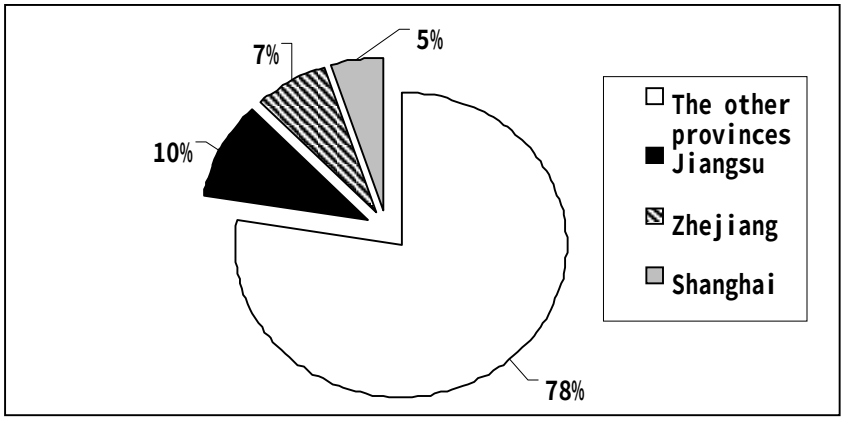

Figure 5- The three provinces' GDP proportion of China's total in 2005
Source: *The statistical bulletin of China* 2005Written by National Bureau of Statistics

Apart from its unparalleled location, the tradition of foreign trade in this region also contributes to the thriving economy. The opening ports, manning exchange and the long history of foreign trade have made this area much closer to the world market than the other parts of this country. As shown in Figure 6, in 2005, total foreign trade volume amounted to US$ 500 billion in Yangtze River Delta, accounting for 35.4 percent of China's total[2].

The fast growth of GDP and foreign trade has promoted the development of ports. Ports, as key links in shipping and logistics, play a prominent role in the local economy. According to the *Planning of the ports construction in Yangtze River Delta*

[1] The data derive from the *2005 The Report of The Condition of The Economical Operation in China's Three Major Economic Circle* written by The National Development and Reform Commission
[2] The data derive from http://www.tt91.com

done by the ministry of communications, in 2010, the capacity of ports throughput in this delta should increase by 700 million tons.

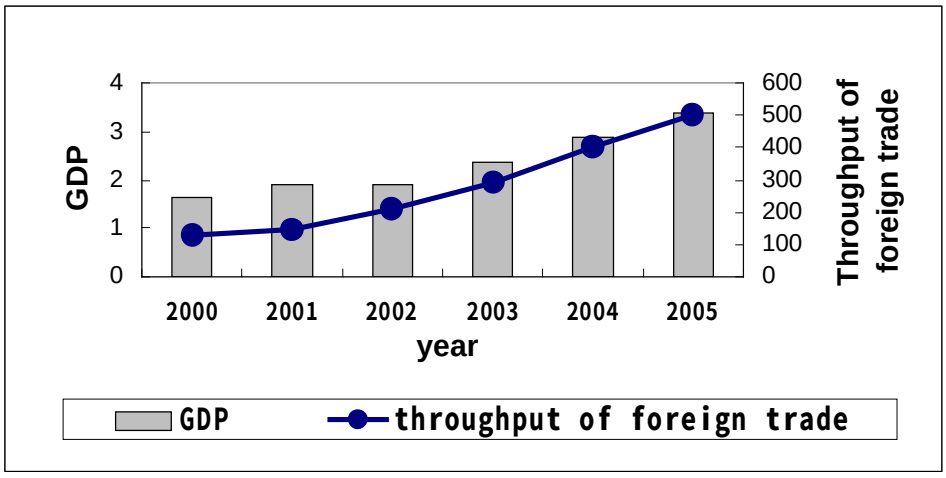

Figure 6 -The GDP and foreign trade volume of Yangtze River Delta
Source: The data derive from the statistics on the Internet every year.

There is huge processing capability and few mineral resources in these areas. The industry in these provinces is focus on processing industry. Steel, petrochemical, electric power and textile industry have enjoyed flourishing development. Their assortments, quality and scale ranks at the top throughout the country.

For shortage of mineral resources, most fuel and resources have to be imported from outside of the country. Most of the iron ore demanded by the iron and steel factories, most crude oil used by refinery, in this region, are import from abroad.

3.1.3An analysis of the Yangtze River Valley

Shanghai located at the sea gate of Yangtze River Delta. There is a high percentage of the foreign trade cargo and containers generated from the area along the Yangtze River are transferred through Shanghai port. Yangtze River is been regard as the

"Golden River" in China. The importance and strategic meaning of this river are couldn't be ignored. The valley of Yangtze River covers with 9 provinces and 1.83 million square meters, accounting for 20 percent of the county. The GDP and population of the Yangtze River Valley accounts for 40 percent and 36 percent of China's total. The river closely relates with the trading and economy of the river valley. Most of the goods in and out of this valley are transport through the waterway of Yangtze River. Among the cargo that transport trough Yangtze River Delta, crude oil, coal and iron ore are accounting for the biggest percent. But the container throughput of Yangtze River Valley is booming up these years. The container industry was growing from zero in 1976 to 2.06 million TEUs in 2004.

The industries in the upstream area of Yangtze River are focus on the metallurgy, petrochemical, energy, textile, foodstuff, mechanism and so on. With the nation's "West Development" policy, this region has a great potential in economy development. According to the forecasting by the Changjiang[1] Waterway Bureau, shown in Table 8, the container generation volume of the upstream area of Yangtze River will achieve 1.2 million TEUs in 2010, with a continual growth rate of 18%.

Table 8 –Forecasting the container generation volume of Yangtze River

	Year 2010(10 thousand TEUs)	Annual Growth Rate (%)
Upstream	120～150	18～25
Midland	300～330	25～26
Downstream	1400～1500	14～17
Total	1800～2000	15～18

Source: *An analysis and forecasting of the condition of container cargo resource of Yangtze River Delta* done by Shanghai Shipping Exchange (2004).

[1] Changjiang equals to Yangtze River.

The industry in the middle reaches of the Yangtze River are focus on the petrochemical, building materials, manufacturing of heavy machine and raw material. The cargo throughput, especially the container throughput of this region will increase a lot in the future. According to the forecasting by the Changjiang Waterway Bureau, the container generation volume of this region will achieve 3 million TEUs in 2010, with a continual growth rate of 25%.

The downstream of Yangtze is the area with the most flourishing export-oriented economy and the fastest growth of economy. The export processing industry is the central industry in this area. So the container transportation is very popular in this area. According to the forecasting by the Changjiang Waterway Bureau, the container generation volume of this region will achieve 14[1] million TEUs in 2010, with a continual growth rate of 14%

As shown in Figure 7, the growth rate of foreign trade developed very quickly. The fast growing of foreign trade and government's supporting policies lead to the booming up of the water transportation industry. The provinces along the river are all pay as much as they can to enlarge the capacity of their ports' throughput and improving the handling facilities. Along the Yangtze River there are 25 main ports. In 2004 the cargo throughput of these 25 ports are more than 430 million tons with a growth rate of 39.6%. There are five iron and steel factories, six refineries and nine fertilizer plants located along the river. These large-scaled enterprises need to import and export a huge number of crude oil, iron ore, coal and other major bulk cargo. So in today's situation the major bulk cargo is still accounting for a high percentage of the total cargo that transport through the waterway of Yangtze River.

[1] The throughput of Shanghai port is within this forecasting.

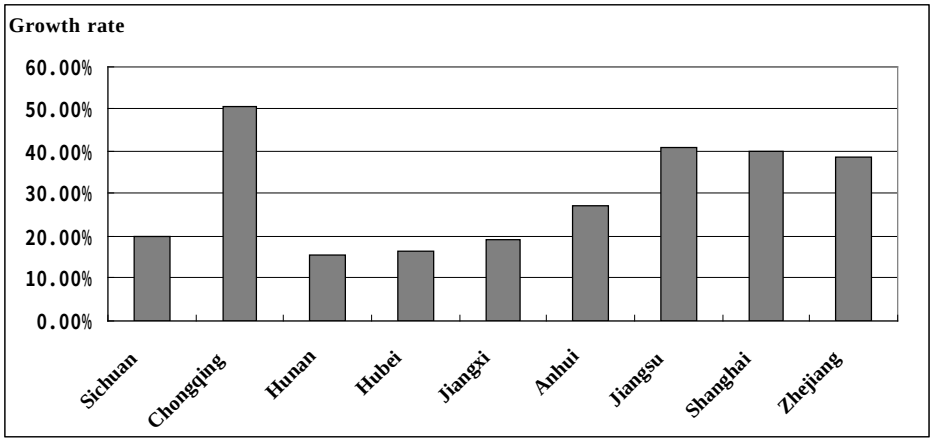

Figure 7- Growth rate (2004) of foreign trade of the provinces along the Yangtze River
Source: The growth rate derives from the official government web-site of these provinces.

3.2 An analysis the hinterland of Ningbo port

Ningbo is the biggest port in Zhejiang province. The direct hinterlands of Ningbo port are the city of Ningbo and Zhejiang province. The indirect hinterlands are Shanghai, Jiangxi, Anhui, Hunan and Jiangsu. Analyzing the hinterland of Ningbo port will contribute to our strategy planning of Ningbo port. In 2005, Ningbo port merged the Zhoushan port.

3.2.1 An analysis of the condition of Ningbo economy development

At the end of 2005, there are 5567,000 people living in Ningbo. As shown in Table 9, the city's GDP has reached 244, 64 billion RMB with a growth rate of 12.5%. The total export trade volume was 33.495 billion RMB. Besides, the export processing trade volume has accounted for 23.4% of the overall export trade volume. The booming economy has triggered the flourishing commerce. In 2005, the social consumption retailing rates was 75, 98 billion RMB that has increased by 74.7% with an average growth rate of 11.8%.

In the industry of Ningbo, petrochemical industry has occupied the largest proportion of the whole city's industry. By the end of 2004, there were 179 petrochemical enterprises in Ningbo and the asset of this industry was 27, 9 billion RMB. Actually, the petrochemical industry is mainly benefited from the port advantage of Ningbo. As China's biggest crude oil import port, Ningbo has the domestically largest crude oil berth and liquid chemical harbor.

Table 9 -Ningbo's proportion in Zhejiang's total 2005

Guideline	Unit	Zhejiang	Ningbo	Ningbo/ Zhejiang (%)
GDP	100 million RMB	13368.3	2446.40	18.3
Financial revenue	100 million RMB	2110.8	466.50	22.1
Total volume of social retail goods	100 million RMB	4633.1	759.83	16.4
Port's throughput	100 million tons	4.3	2.69	62.5
Gross fixed asset formation	100 million RMB	6652.5	1370.42	20.6
The total volume of import and export goods	100 million US$	1158.9	334.95	28.9

Source: The data derive from *The statistical bulletin of China* 2005Written by National Bureau of Statistics of China the and *The statistical bulletin of Ningbo 2005* written by Ningbo Statistics Bureau

In March 16, 2005, the national government approved the project---Ningbo Steel Limited Company with the total asset of 17 billion RMB. The development of Ningbo steel industry has magnificently contributed to the prosperity of iron ore transportation market.

Apart from that, the textile industry is the most advantageous industry in Ningbo.

The proportion of the sales volume of Ningbo's textile enterprises has exceeded by 20% of the total sales in the province textile industry. In 2004, there were more than 560 textile enterprises in Ningbo with the sales of 27.1 billion RMB. The import and export of the textile products and cloths promote the container transportation market.

As shown in **Appendix 1 Table 13,** the key import products among the import products of Ningbo are mineral products, chemistry products and machinery and electrical equipment. Meanwhile, the main export products are textile products, machines, furniture and plastic products.

3.2.2 An analysis of the condition of Zhejiang province

As the economic center and the largest port in Zhejiang province, the development of Ningbo port has been received great support from Zhejiang province. Zhejiang province is the largest economic hinterland of Ningbo port. As one of the most developed economic regions in China, as shown in Figure 8, the GDP of Zhejiang province in 2005 was 1336.8 billion RMB with the import and export foreign trade volume of 115.89 billion US $.

With the advanced natural conditions and developed industrial and agricultural production, Zhejiang province is one of the most flourishing regions in China. Traditional textile, hardware, foodstuff and artwork are the national main foreign trade exports products. In Zhejiang province, the main categories of product passing through Ningbo port consist of mental ore, coal, crude oil, cement, timber, building materials and sugar. The throughput of mental ore, coal, crude oil have accounted for 88% of the total cargo throughput in Ningbo port.

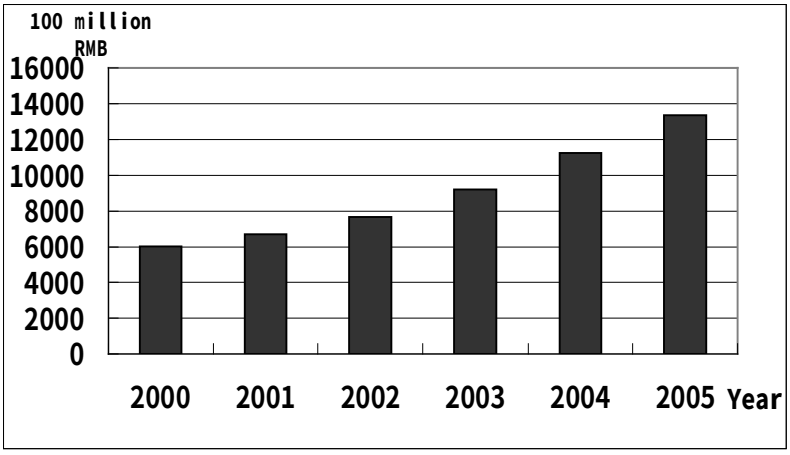

Figure 8- The GDP of Zhejiang province

Source: The data derive from the official web-site of Zhejiang Statistic Bureau http://www.zj.stats.gov.cn/

The other cities of Zhejiang province have provided cargo resources to the development of Ningbo port. For instance, shoes and clothes in Wenzhou and small wares in Yiwu are good cargo resources for Ningbo's container transportation.

With the improvement of traffic facilities, the future direct economic hinterlands in Ningbo will consist of Zhejiang, Jiangsu, Anhui, Jiangxi and the most areas in Hubei province. The indirect economic hinterlands will covered by Sichuan, Chongqin, Hubei, and Shanghai. Furthermore, the indirect economic hinterlands will also cover the areas along the Yangtze River valley and the area of Fujian, Guangdong along the coast railway. In addition, Ningbo will provide transshipment service for major bulk in Shanghai and the middle and lower reaches of the Yangtze River.

3.3 Analyzing the impaction of the infrastructure construction on both ports

3.3.1Three Gorges Dam

In the aftermath of renavigation of Three Gorges Dam in 2004, the shipping condition of the Yangtze River has been improved. The improvement of the shipping

condition has contributed to the enhancement of ship passing capability, the increasing proportion of water transport volume and the dramatic growth of the container transport volume. Three Gorges Dam improve the cargo throughput of the upstream of Yangtze River. As the shipping center of the upstream in the Yangtze River, Chongqing is playing an increasing role in leading the economic development in the neighboring areas like Sichuan and Guizhou. So the cooperation between Shanghai port and Chongqing port will enlarge the cargo volume, which gather from upstream of Yangtze River Delta, transshipped through Shanghai port.

3.3.2Hangzhou Bay Bridge

The west coast of Hangzhou Bay Bridge is linking with the highway of Jiaxing -Suzhou and the highway from Suzhou to Hangzhou. The south coast of Hangzhou Bay Bridge is connecting with No.329 national road. People can directly get to Zhenan and Mingdong areas along the under constructed highway which will cross Ningbo, Taizhou, Wenzhou, Fujian. The construction of Hangzhou Bay Bridge will make Shanghai the center of “2-hour traffic circle” in the Yangtze River Delta.

The linkage of the bridge will shorten the distance between Shanghai and several important economic cities in Zhejiang. Meanwhile, there will be an alternative choice for cargo owner in Yangtze Delta to transport goods through Ningbo port. Therefore, the construction of Hangzhou Bay Bridge will become the driving force of the development of Shanghai International Shipping Center. However, this bridge will make Ningbo port the tough competitor to Shanghai port in the area of attracting the cargo resources from the Yangtze River Delta. If there are no efficient measures taken into consideration for attracting cargo resources for Shanghai port, the construction of Hangzhou Bay Bridge will perhaps exert an adverse effect on Shanghai’s cargo resource from Yangtze River and its delta.

3.3.3Runyang Bridge, Sutong Bridge and Huchongtong Direct Passage

The construction of Runyang Bridge, Sutong Bridge and Huchongtong Direct Passage have shortened the distance between Jiangsu and Shanghai and have fundamentally changed the inconvenient traffic relations between Shanghai and the middle and north areas of Jiangsu. In addition these infrastructure constructions directly link the northern Jiangsu to Shanghai economic zone. Furthermore, the integrated process of the Yangtze River Delta areas at the core of Shanghai will be accelerated.

The linkage of Sutong Bridge and Huchongtong Direct Passage will accelerate the economic and foreign trade development in the northern and middle areas in Jiangsu with a dramatic enhancement of cargo support to Shanghai port. However, the construction of the bridge has also reduced some internal feeder route cargo volume from Nantong to Shanghai.

3.3.4“Pan-Zhujiang Delta 9+2” Planning

“Pan-Zhujiang Delta 9+2” is an economic zone consisting of 9 provinces---Guangdong, Fujian, Jiangxi, Sichuan, Hunan, Yunnan, Guizhou, and Hong Kong as well as Macao.

There will be multiply effects in the construction of “Pan-Zhujiang Delta” regional cooperation. (1) The integration of regional market will bring about the integration of traffic transportation. (2) The opening of regional market, free personnel exchange, logistics and market exchange order will further expand the sharing scope of regional trade and capital market. The framework of Pan-Zhujiang Delta will lead to the more convenient and unimpeded movement of production factors and multiple winning structures.

The cargo resources in Jiangxi, Hunan, Sichuan, Yunnan and Guizhou in the "Pan-Zhujiang Delta" will be transferred in the regional large container ports (Hong Kong and Shenzhen), which will make an influence on the attractive power of Shanghai and Ningbo to foreign trade cargo in these above provinces.

3.4 Concluding remarks

After analysis of the hinterlands of Shanghai port and Ningbo port, it is clearly that the categories of the cargo resources of these two ports are different. Shanghai has advantage in container suitable goods and Ningbo has advantage in major bulk cargos. Although the hinterlands of these two ports are overlap in some area, with the fundamental constructions and nation's development strategy, the division of the hinterlands will be more reasonable and clear. The problem of over competition on attracting cargo resources between these two ports is can be solved.

CHAPTER 4

NECESSITY AND MEANING OF PORT COOPERATION BETWEEN SHANGHAI AND NINGBO

4.1 AHP technique analysis

When analyzing the port cooperation of Shanghai and Ningbo, there are two problems should be solved, whether it is benefit to do the cooperation and what's the advantage of cooperation?

AHP (Analytical Hierarchy Process) technique[1] and Delphi technique[2] can be used to analyse the advantage of port cooperation between Shanghai and Ningbo. First, the Delphi technique has been adopted to acquire of the advices from the experts of port and shipping industry. 15 questionnaires had been issued and 11 of them were feed back[3]. In the questionnaire, the exports are required to choose whether these two ports need cooperation or independent. Furthermore, if they think these two ports should cooperate with each other, they are required to give some methods and ideas in the cooperation between these two ports. The result of this questionnaire is show in the Table 10. Most of the exports are suggest that these two ports should cooperate with each other.

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[1] Thomas Saaty, an professor working at University of Pittsburgh, developed the concept of AHP in 1971. AHP decision- making technique can help people to solve the multi-objective problem.

[2] The Delphi technique is an information survey technique, which was developed by the RAND Corporation in the late 1960's.

[3] The exports are all from Shanghai Shipping Exchange Information Department. They wrote *The Report on China's Shipping Development* annually. Therefore, they have good understanding on China's port industry.

Table 10 The development mode of Shanghai port and Ningbo port

	Ballot	Hit rate
Independent development	2	18%
Cooperative development	9	81%

Then I can use the AHP technique to analyse the whether the cooperative development between Shanghai port and Ningbo port is superior to independent development between these two ports. (The process for using the AHP technique is shown in **Appendix 3**) The result is that the cooperative development (0.3575) is the best mode and it is a worst choice of Ningbo port to develop independently (0.2912). The mark for Shanghai port to develop independently is 0.3511. Therefore, in order to achieve the best interest of both ports, these two ports should adopt the cooperative development mode.

4. 2 The meaning of the port cooperation between Shanghai and Ningbo

According to the AHP technique we did in 4.1, port cooperation is suitable to Shanghai and Ningbo. Then we should analyse the positive effect of the cooperation strategy between Shanghai port and Ningbo port.

1.To reduce the operational risks

Port construction demands huge investment, long-period of construction and has relatively high risks. The port managers of Shanghai and Ningbo can reduce operation risks by joint investment, for examples, and joint investment in the harbor infrastructure, operation equipment, and hinterland multi-model transportation. In this way, it can dramatically reduce the risks caused by sole investment.

2.Maket Penetration

In the long run, being the two biggest ports in China, the port managers of Shanghai and Ningbo could not be confined to local development. A successful port manager must be a successful businessman. By raising capital, he can penetrate into the other port area, extend business scope, and achieve economic of scale. With the linkage in capitals, these two ports should jointly enlarge their ports businesses and hinterlands in the form of joint-venture port enterprises and mutual share hold.

3.To strengthen the capacity of port to resist the outside competition

By collaborating with each other, the port managers of Shanghai and Ningbo can jointly use of the energy, resources and facilities to enhance the survival power and competitive power such as, the ability to negotiate with shipping companies and cargo owners.

4. To improve the organizational structure and service level

The positive competition promotes port managers to improve management level and service quality. Meanwhile, the communication and share of information, technology, equipment and personnel between these two ports will ensure the enhancement of two party's service level.

5 To reduce costs and improve economic efficiency

The improvement of port service will attract more and more ships to call this port. The enhancement of ship passing capability and port usage rate will increase the economic efficiency. At the same time, the economic of scale that expands the port production will reduce the cost of cargo handling. The cooperation between these two ports will not only contribute to enlarging the number of harbors, but also to enlarging the service scale.

CHAPTER 5

THE FEASIBILITY ANALYSIS OF PORT COOPERATION BETWEEN SHANGHAI AND NINGBO

5.1 The port cooperation modes at home and abroad

In this chapter, there will be an analysis on the port cooperation modes, at home and abroad, existed in today's port industry. The port cooperation modes could be helpful to find a suitable mode for Shanghai and Ningbo to do port cooperation.

5.1.1 Government guiding mode

The government sector is playing a major role in the cooperation. The advantage of this mode is that the government can do the macro-management by means of right and policy to coordinate various relations so that the port will be developed in an ideal environment.

5.1.1.1 Two ports completely coalition (Marseilles-Fos mode)

This mode requires a completely coalition between two ports. The bigger port will merge the smaller one. This coalition is not only referred to the port facilities, but also the management authority. After the cooperation and coalition, two ports will be combined into one entity and the shipping industry will treat these two ports as one. A port authority will manage the operation and business of both ports. The typical example of this mode is Marseilles-Fos port.

Today's Marseille port is the largest port in France and the second largest European port next to Rotterdam. But the port was not such big at beginning. The coalition leads to the economic of scale of Marseilles port. The port had a coalition in 1966. In April 1966, Marseille port had merge Caronte port, Lavera port, Fos port and Port-Saint-Louis-du-Rhône as well as the Fos and Lavera industrial zones. As the only port authority had been reserved, the Port of Marseille Authority control and manage these ports and industrial zones' facilities and operation. After the coalition Marseille port has enough coastline and hinterland resource. The development of Marseilles-Fos port is visible.

5.1.1.2 Aggregated ports (New York-New Jersey mode)

This mode is a typical port cooperation mode. But this cooperation is not as easy as we though, because it concerns the profit of each port. In this mode, ports could belong to different district areas, but they have a similar geography condition and close to each other. If ports want to adopt this mode, the coalition of these ports is inevitable. After the coalition, these ports have a single port authority to manage their operation, but the right is still belonging to the local area. In this cooperation mode, we cannot find one merge the other. This is business cooperation; the port authority, which is established after the coalition, manages all the operations, which done by the ports before the coalition. In addition, the members from both ports compose the authority. In this cooperation, the port can get what they want but without from the other port. For example, if one port has competitive advantage in capital and management experience, the other port has competitive advantage in harbor resource and hinterland; they can choose this cooperation mode to have the mutual benefits. The typical modes of this cooperation are New York/New Jersey port and Ningbo/Zhoushan port. I use the NY/NJ (New York/New Jersey) ports as an example.

According the words in the official web-site of NY/NJ port (www.panynj.gov) "In the history, New York and New Jersey had an endless dispute over their shared harbor and waterways. The impasse eased when the two states agreed that the port area was, in effect, one community and that conflict squandered the port's potential." So on April 30, 1921, The Port of New York Authority was established to administer the common harbor interests of New York and New Jersey. "The Governor of each state appoints six members to the Board of Commissioners to manage the port."(http://www.panynj.gov) The function of this Board of Commissioners is to research the problems existing in the port management, port construction and port operation. But the big decision related to the development of the ports must be done by both of the states government. After these two ports have been combined into one unite, the development of NY/NJ port is very quick. It was definitely a mutual benefit business cooperation.

5.1.1.3 Entire propaganda to the public (Tokyo Gulf mode)

In this mode, every port has its own port authority to manage their operations and they have different port policies. But in ports' layout and ports' propaganda to the public, these ports have cooperation. As to geography, these ports are very close to each other and they have similar hinterland. So the publics always regard these ports as a single port aggregate. But these ports could be located in different district. The government doesn't make any compelling policy to restrict the development of these ports or guiding these ports to do the cooperation. But the government promotes the cooperation among these ports and offers them some preferential policies to their cooperation. As to the ports themselves, in their development planning, they think much of intercross cooperation. They offer different services. When they service the customer, they work as one entity and they attract the cargo together. In this way, they can promote the competitive power of all these ports and develop the economy

of the region, which they located in. Tokyo Gulf is an example.

Tokyo Gulf has a very good geographic position. The area of Tokyo Gulf is the biggest port industrial estate and the biggest cities group in Japan. Tokyo port, Kawasaki port, Chiba port, Yokosuka port, Yokohama port, Kimitsu port are the six biggest ports In this area. In order to improve the competitive power, these six ports cooperate with each other. They operate the ports in their own way. But when they compete with the port outside this area, they are working as a single unite. They are attracting the cargo together and do the entire propaganda to the public. These work improve the whole popularity of these ports. The port authority is under control of the local government. But these ports authorities are using the unified management. So these ports can compete with the other ports as an entity.

5.1.2 Enterprise Guiding mode

The two parties are independent of each other, whose cooperative behavior is completely equal to the enterprise behavior. The advantage of this mode is that enterprises respond quickly, voluntary, actively and reliably to the market economic development rules in the flexibility.

5.1.2.1 Co-manager (Hong Kong- Shenzhen mode)

This mode is totally controlled by enterprises, consisting of common managers and shareholders between these two ports. The co-manager adjusts the business activities between two ports. In relevant to their own interests, they will be bound to conduct reasonable resource arrangement of the ports belong to them. In this fashion, this mode will intangibly reduce the excessive competition and overlapping construction. The co-manager can realize the maximum efficiency by means of adjusting the production in these two ports.

The cooperative mode in Hong Kong and Shenzhen is one of cases that are conformed to the above method. As shown in Figure 9, Yantian port, Shekou port and Chiwan port are located in Shenzhen. As we all known, Yantian port that and Hong Kong port are coordinated developed. They are developing in the cooperative relation with a co-manager, that is, HWL (Hutchison Whampoa Limited). At the same time, Hong Kong and Shekou are developing hand in hand through common shareholders-COSCO. Hong Kong and Chiwan are developing together with a common manager-MTL. These two ports are coordinated in the inner structure of these enterprises. To some extent, this kind of mode will also avoid resource waste.

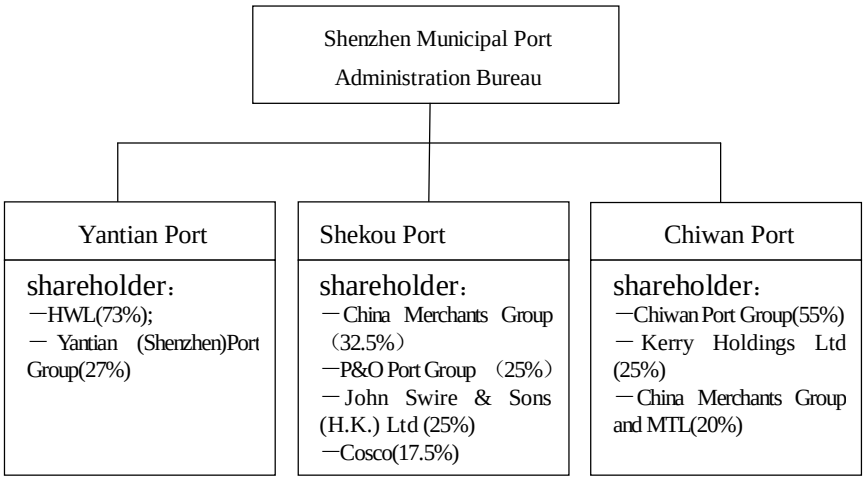

Figure 9– The capital structure of the port areas in Shenzhen port
Source: The data was from the official web sits of these three ports

5.1.2.2 Resource and informational sharing (Seattle-Tacoma mode)

This mode is the most adoptable mode for port cooperation between Shanghai port and Ningbo port at present. This mode is formed by the cooperation between the port managers. Meanwhile, the government is playing the role of coordination and communication in this cooperation. In order to compete against other ports, they have to cooperate with each other. Under this mode, the port enterprises share some

infrastructure and information that is essential in the process of production. They will unite together to produce cohesion for the same goal, that is, to develop by means of common resources. The typical example of this mode is the cooperation between Seattle and Tacoma ports. The web –site of Ministry of commerce of PRC (http://info.china.alibaba.com) offer a lot of information on the port cooperation between these two ports.

Seattle and Tacoma ports, adjacent to each other, are located in Washington State of North America. In recent years, with the rapid economic development in the Asian and Pacific region, the container throughput of far-east to west coast of America line is growing in the wide range. The ports in the west coast of America have witnessed serious competition. These two ports have to be confronted with the competition from the nearby ports like Vancouver port, Auckland port, and Los Angeles/Long beach ports. In order to strengthen the overall competitive power in the local region for the win-win strategy, when doing the competition, these two ports have adopted the strategy of coordinated development.

The two ports are cooperated with each other in the following 2 aspects: Firstly, they will realize the infrastructure cooperation between both ports. They relieve the regional traffic pressure by means of building more tunnels, bridges and other transportation routes. For examples, these two ports have invested together to build railways, linking terminals with cities, so as to promote the multi-model transportation development. Secondly, they will realize the cooperation to raise funds. In order to meet the future market demand, the cargo passing capacity between these two ports needs to be improved by means of enlarging of harbor scale. The income from these two ports is far from enough for the cost of the huge construction funds. Therefore, under the coordination of Port Association in the

Washington State, the two ports, beyond their individual interests, have raised funds together by other channels to resolve the shortage of funds.

Cooperation between Tacoma and Seattle ports will contribute to improving the competitive power in the regional ports and an increasing number of shipping companies and cargo owners will be attracted.

5.1.2.3 Stock Ownership Participation (The Yangtze River Strategy[1])

This mode is a much close cooperative method. In this kind of cooperative mode, port enterprises could establish cooperative relationship in the form of capital movement like investment and mutual share holding to realize resource integration in a wider sphere. Besides, the bigger port enterprises with relatively equal strength can build new operating entity by cooperation and establish mutually conducive cooperative relations by holding the small proportion of the other party's shares, mutual share-holding by the third party, forming strategic alliance to deal with competition and to acquire individual development. At the same time, the other business outside the alliance could also take up competition among them. Under the present condition, the strategic alliance in the form of stock ownership participation will be the main methods to realize coordinated development strategy.

In order to guarantee a stable cargo resource for Shanghai port from the Yangtze River valley, Shanghai utilized its capital advantage to cooperate with the ports along the Yangtze River these years and to realize its "Yangtze River Strategy". The mutual share holding and the establishment of joint ventures realize the cooperative mode between Shanghai port and Yangtze River valley ports. At present, the Yangtze River

[1] This strategy is set up by Shanghai. According to this strategy, Shanghai desire to cooperate with the ports along the Yangtze River, then more cargos will be attracted to Shanghai port for transshipment.

strategy of Shanghai port is focus on collaborating with the three major ports along the Yangtze River valley. In July 2005, with the share proportion of 55%, Shanghai port is in control of Wuhan port. In August of the same year, Shanghai port collaborated with Nanjing port to make an investment in the construction of Nanjing Port Longtan Container Limited Companies. In February 2006, Shanghai port collaborated with Chongqing port to build Cuntan port.

5.1.3 Concluding remarks

From above analysis and considering the respective characteristics of Shanghai and Ningbo Ports, it is very difficult to find an existing cooperative mode that conforms to the characteristics of both ports. Actually, the cooperation between Shanghai port and Ningbo port should be realized through a combination of several cooperative modes. Every mode has its quotable characteristics, which can be adopt in the cooperative mode between Shanghai port and Ningbo port. Using which mode or how to realize the cooperation should be decided through further analysis, which related with characteristics and real situations of them.

5.2 The methods for port cooperation between Shanghai and Ningbo

It is clearly that Shanghai port and Ningbo port should cooperate with each other. The further problem is that which ways should be used and which methods can be adopted to realize the cooperation. In the process of Delphi technique, the exports give a lot of suggestion about the methods for the port cooperation between Shanghai and Ningbo. These two ports could cooperate with each other in the following aspects.

5.2.1 Service Diversified

The booming-up national economy gives a god-given opportunity for Chinese ports

to develop themselves. The containerization of international trade, the international multimodal container transportation, the high profit of container industry and huge impaction on container related industry emboldened Shanghai and Ningbo pay more attention on developing the container handling business. Both of them are hope to develop the container operation as their core business in the port strategy planning.

Shanghai port want to establish the international shipping center with the container handling operation in its core business and Yangshan port is also focus on the container operation. In 2010, the capacity of container throughput of Shanghai port will overreach 20 million TEUs and the throughput of this port will reach 30 million TEUs[1]. Ningbo is also want to become a hub port in the international container transportation industry. Both of the Beilun port area and Daxie port area of Ningbo port will enlarge their container operation. According to the forecasting in chapter 2, in 2010, the container throughput of Ningbo port will more than 10 million TEUs, which doesn't include the container throughput of Zhoushan port. These situations will lead to a lot of problems.

The logistics is the increment part in the container transportation industry. But there is a comparatively lag of our nation's logistics industry, which can't offer a good service to the container transportation industry. The ports just offer the loading and unloading service in the container operation business. So if both of these two ports are do everything they could to enlarge their container business, this will lead to the overcapacity of regional container service in a short time and wasting of resource.

Apart from above reason, the biggest problem is the service simplified. The simplified service between two ports will lead to two results. First, the simplified

[1] The capacity of container throughput of Shanghai port is the design throughput of Shanghai port, when the port was been built. The capacity of container throughput is not the actually throughput. It is a theoretical value. Shanghai is a busy port. The port is always congestion. So the capacity of container throughput of Shanghai port is always smaller than the actually throughput.

service will conduct the competition price war between them. This price war will impact the profitability of both ports. Second, the cargo owners will choose one port with competitive advantage to handle their cargo and the other port will lose its service. On the other hand, if both of the ports are focus on the container business, they must neglect the other handling business such as crude oil and iron ore handling business. This will result in the shortage of the handling capacity of the other cargos and the cargo congestion at the ports. When come into this situation, even if one of these two ports realize that it is profitable to do the bulk or general cargo handling and want to change the port over to these business, it will also confront a lot of problems such as the cargo owner might choose the other port to handle the cargo and the time limited for business change. The port will lose its best development opportunity. So the diversified service should be the most important aspect in the cooperation between Shanghai port and Ningbo port.

What is diversified service? It is that the port should form its unique competitive advantage, which couldn't be imitated. The diversified service could smooth the price competition and avoid the cutthroat competition. Meanwhile, the small port can use the diversified service to preserve its market share, when it has large gap in business to the bigger port.

In fact, Shanghai port and Ningbo port can develop their own special function. Although the container industry is flourish and more profitable than the other modes of transportation, the container industry is influenced most strongly by market and foreign trade factors. So the container industry fluctuates heavily and regularly. Generally, within a coastal economic area, only one hub port can be existed. In Yangtze River Delta, because of the developed economy, flourish foreign trade, long history of container business, international prestige, wide hinterland and Yangshan

deep-water port of Shanghai, Shanghai port has been regarded as the hub port in the international container transportation industry. But container operation is a very specified business and the harbor resource of Shanghai port was exhausted, so when Shanghai port is focus on its core business of container operation, the other kinds of cargo handling business such as bulk and general cargo operation business must be weakened. Furthermore, in order to open the 2010 Shanghai EXPO, Shanghai will remove the general and bulk ports, which are including 65 harbors with 2800 meters riverside line and 1500 tons of throughputs, along the Huangpu River before 2007. After this, the general and bulk cargo handling capacity of Shanghai port will be more weakened, but bulk and general cargo demands will still persist in Shanghai.

The competitive advantage of Ningbo port is different from that of Shanghai port. Ningbo port is the biggest crude oil import port and one of the important ore import port of China. In addition, China want to establish a crude oil reserves center in Ningbo. Within Ningbo's 39 ten-thousand-class harbors, we can find 200-thousand-class ore harbor that can dock the 300-thousand-class vessel, 250-thousand-class crude oil harbor and 50-thousand-class specified liquid chemical harbor. Ningbo port has become China's main port for transshipping the iron ore, crude oil and liquid chemical products and also become the transshipment port and center for coal business in the Eastern China. In 2005, the crude oil throughput of Ningbo port was more than 40 million tons with a growth rate of 14% and its volume of crude oil transshipment accounting for 30% of China's total. The iron ore throughput of Ningbo port was more than 30 million tons with a growth rate of 12% and the steel manufactory that Ningbo port served reached 30 in 2005. Apart from these, the throughput of coal and liquid chemical products were more than 22 million tons and 3 million tons with a growth rate of 18% and 33%.

Behind the flourish of major bulk handling business of Ningbo port, there still exist a lot of problems. Because Ningbo port is focus on the container business, most of the new harbors that established are specialized in container operation. So in the up rush situation of the import volume of crude oil and iron ore in 2005, the capacity of port handling was in saturation and the cargo was congested at the ports. This status can be found in the other port of China. The major bulk cargo such as crude oil, iron ore, coal, product oil and steel account for half percent of China's total cargo throughput. With the development of China's economy and large scale of construction of infrastructure facilities, the import volume of crude oil and ore will be increased and the gap of port handling capacity will also be enlarged. So Ningbo port could utilize its existing petrifaction harbors in Zhenghai port, Suanshan port and Daxie port[1] to establish the national crude oil reserves center and transshipment hub port. In addition, Ningbo port should intensify its ore and coal transshipment business and refine its major bulk transportation system. Furthermore, Ningbo port should accelerate the development of the handling, storing and transshipment service of iron ore, crude oil, product oil, liquidity chemical products and coal businesses which was almost abandoned by Shanghai port. Only in this way that Ningbo port can develop its own core competence different from that of Shanghai port.

5.2.2 Dividing the hinterland

Of course, it is impossible for Ningbo to give up its fast growing container business. The competition between these two ports is very serious. However, in 2005, the growth rate of container throughput of Ningbo port was 30% and Shanghai port with a 24.2%. Why these two ports can achieve such a fast growth rate? The reason is that the hinterlands of these two ports are independent, which was proved in Chapter 3.

[1] These three ports are the ports areas of Ningbo port.

The cargo resources of Shanghai are from local area and Yangtze valley. In order to avoid competition with Ningbo in cargo resources, Shanghai should focus on the cargo resources of the north of Jiangsu province in the future. With the Jiangyin Changjiang Bridge, the second Nanjing Changjiang Bridge and Runyang Bridge opening to the traffic, the transport linkage between Shanghai and north of Jiangsu province will be dramatically improved. Enlarging the cargo resource of north of Jiangsu province consolidate the status of Shanghai International Shipping Center and avoiding the over competition on cargo resource between Shanghai and Ningbo.

The hinterlands of Ningbo port are Zhejiang province and part of downstream of Yangtze River. In addition, the cargo of Fujian province, Jiangxi province and Hunan province must be import and export through Ningbo port. If Ningbo wants to avoid competition with Shanghai port, it needs to pay more attention on the cargo resources of these areas. But as a part of the ports group in Yangtze Delta, when Ningbo attract the cargo resources from these areas, it will confront with a serious competition from the ports group in Zhujiang Delta, especially from Hong Kong port and Shenzhen port. In order to improve the attractive power of Ningbo port, in Zhejiang province's 11th Five Year Planning, Zhejiang will improve its southward transport system. This planning will enlarge the hinterland of Ningbo port and avoid the over-competition with Shanghai port.

5.2.3 Developing the Zhoushan Island

Today, the coastal resources of Shanghai and Ningbo are exhausted. The future of Shanghai port is Yangshan port[1], which located in the north of Zhoushan and the future of Ningbo is the islands located in the east of Zhoushan, such as, Jintang

[1] Yangshan port is a part of Zhoushan Island, which belongs to Zhejiang province.

Island and Liutang Island. So after the Ningbo merged Zhoushan port, the development of Zhoushan Island can become the basis for port cooperation between Shanghai and Ningbo. I think that there will be a three-port cooperation at last.

According to the *Layout of the ports in Zhejiang province 2005* written by Zhejiang Municipal Port Administration Bureau, Zhoushan port has a coastal line of 2440 km, including 169.6 km deep-water harbor resources. Ninety percent of the coastal resource is in its natural state.

In the development of Zhoushan Island, the best mode is that Shanghai provides the capital, Ningbo provides the project and Zhoushan provides the resources. This is because that Ningbo will become a crude oil reserves center of China, so the old coastal line and facilities must be improved. Ningbo can remove part of its business to Zhoushan port. Shanghai can utilize its advantage of capital to cooperate with the others and improve its coastal resources.

5.2.4 Complementarity for port handling capacity

1, In order to open the 2010 Shanghai EXPO, Shanghai will remove all of the general and bulk ports along the Huangpu River before 2007. After this operation, the general and bulk cargo handling capacity of Shanghai port will be more weakened. Shanghai could remove this part of throughput capacity to Ningbo port, which can not only strengthen the major bulk business of Ningbo port but also meet the cargo owners' demand and secure its strategic material transportation.

2, Yangshan port is located at the open sea. The stormy wave will have a great impaction on the operation of Yangshan port. When the port come into use, there will

be 60.7 days [1]couldn't be used annually. The line company is very sensitive to the port operation time. So Ningbo port is the best-substituted port, when Yangshan port couldn't operate in anytime of a year. Shanghai port and Ningbo port could have an agreement on the complement of port handling capacity. Ningbo can offer its port service when Shanghai port in the congestion. The Hangzhou Bay Bridge under construction makes this cooperation become possible.

3, In 1995, there was an earthquake happened in Japan's Kobe port. The businesses of cargo transshipment were all removed to the Korea's Pusan port. In order to avoid the same situation happened in Korea, the government of Korea decided to develop Gwangyang port as their second hub port. The main land area of China is larger than Korea, so it is not enough for Shanghai International Shipping Center to develop Yangshan port as its unique hub port. In addition, if Luyang bridge[2] in accident, the port of Shanghai will suffer paralysis. Therefore, in developing the cooperation mode of Shanghai port and Ningbo port, we can establish the second hub port in Zhoushan port and Beilun port. It is an accident prevention for Shanghai International Shipping Center.

4, We find that the port handling capacity of these two ports have big gaps to actually throughput. According to the *Report on The port and shipping development of Shanghai 2004 p.53* written by Shanghai Municipal Port administration Bureau, the capacity of Shanghai port in 2004 was 8.5 million TEUs but the actually container throughput of Shanghai was 14.5 million TEUs. The insufficient capacity of cargo throughput gives Shanghai and Ningbo a larger space to do the cooperation.

[1].This conclusion is from the R*eport of the operation day of Yangshan port* done by Guangdong Shenghua traffic engineering consulting Co, Ltd.
[2] Luyang bridge is the bridge that links the Yangshan island with the land of Shanghai.

CHAPTER 6

APPROACHES OF PORT COOPERATION BETWEEN SHANGHAI AND NINGBO

After analyzing these cooperative methods for Shanghai port and Ningbo port, the following problem is that how to realize the cooperation. Considering the suggestions from the exports and the real situation of Shanghai port and Ningbo port, the port cooperation between Shanghai and Ningbo should consist of 4 phases, that are, the real cooperation, resources sharing, enterprise cooperation and government cooperation.

6.1 The real projects of port cooperation between Shanghai and Ningbo

At present, these two ports should focus on the existing cooperation projects. This is the foundation for Shanghai port and Ningbo port to do the cooperation. The future cooperation should expand from the real cooperation projects.

6.1.1 The present cooperative projects

Although people always consider that Shanghai port and Ningbo port are in a sharp competition, they have made mutual cooperation with some common investment projects. Although these cooperation projects are not large-scale cooperation, they are still made a fundamental basis for these two ports to begin their all-round cooperation in the future.

1, SPCCO[1] joint investment with Ningbo Daxie Port Company to set up a joint logistics company named as Jixin Logistics co,.ltd. In addition, Shanghai set up a container feeder line from Shanghai and Ningbo. In fact, the Beilun port[2] had negotiated with Daxie port about the possibility of joint investment, but they didn't meet of minds. So we can say that with the deepening of market economy of China, the restriction of the administrative region will become lower and the different port areas within the same port still compete with each other. On the contrary, if there is a common profit between different ports, it is still possible for them to do the cooperation.

2, With the coalition between Zhoushan port and Ningbo port, the Yangshan port and the Majishan port which constructed by Shanghai Bao Steel company in Zhoushan island are also can be regarded as the cooperative projects between Shanghai port and Ningbo port. The successful operation of Yangshan port and Majishan port will provide a foundation for the large-scale cooperation between Shanghai and Ningbo.

3, In the Session for Integration of Efficient Customs & Logistic Information in the Yangtze River Delta on May 31st 2005, Shanghai port and Ningbo port signed an agreement about the integration of efficient customs between these two ports. The cargo owner in Shanghai can apply to the customs and inspection in Ningbo and vice versa.

6.1.2 The impaction of the ports integration between Ningbo and Zhoushan

In 2005, Ningbo port merged Zhoushan port. It is necessary to analyse the impaction of this merger on the present cooperation situation of these two ports. People

[1] Shanghai Port Container co., ltd(SPCCO) is a subsidiary company of Shanghai international port (group) co.,ltd.
[2] Beilun port and Daxie port are the two port areas belongs to Ningbo port.

consider this is a strategical integration for Zhejiang port industry to compete with Shanghai port. But if we on the side of national interest, we can find that it is just a business operation in order to get a maximum of profit.

As was been analyzed in chapter 3, as the major hinterland of Ningbo port, we can find a faster growing foreign trade industry in Zhejiang province these years and the growth rate of the cargo throughput of Ningbo port was the highest in China. With a series of port construction projects has been finished in Ningbo port, the deep-water harbor resources of Ningbo are exhausted and couldn't meet the demand of the long-term development for this port. As mentioned in section 5.2.3, the Zhoushan port has rich deep-water coastal resources that can be used to construct the harbors, but Zhoushan has a lot of confinement factor for development, such as, no linkage with the main land, narrowed hinterlands, poor system for inland transport and shortage of funds. So the integration of Zhoushan and Ningbo is to meet the demand of market and development. In addition, the Zhoushan port is an island, which located as the open sea of The East China Sea. Therefore, after integration of these two ports will not aggravate the hinterland competition with Shanghai port. Meanwhile, Zhoushan and Ningbo are both having advantage in major bulk handling business. The integration of these two ports can intensify their advantage to achieve complementary advantages with Shanghai port. It is a mutual profit coalition and helpful to intensify the competitive power Shanghai International Shipping Center.

6.2 Information and port resources sharing

If Shanghai port and Ningbo port want to cooperate with each other, the first phase is to realize the information and port resource sharing that was adopted by Seattle-Tacoma port cooperative mode. Both ports of Shanghai and Ningbo should share the information, port resources and facilities, technique resources and the

human resources. Then both ports should communicate in port engineering technique, container management and cargo handling technique. Through resources sharing and ports communication, both ports can reduce the cost, avoid over investment and achieve the mutual benefits.

Because of competition, two ports set up a lot of restricts to the other one, especially in the information exchanging area. These restricts make a lot of problems to the customers and also reduce the attractiveness of cargo resources. Two ports should establish an extensive platform for ports information sharing. The information sharing is incarnated in integration of the network of both ports including customs, inspection, shipping companies, cargo owners, shipping agencies and so on. People could do everything on the Internet. If two ports link with each other, they can offer a more convenient service to the customer and break the geographical and governmental restriction. This activity will build a solid basis for the future cooperation between these two ports. In addition, Shanghai and Ningbo has basis for cooperation in information sharing aspects. These two ports signed an agreement on customs integration in 2005. In the future, the integration of EDI system, which has been done between Shanghai and Ningbo, can be adopted between these two ports.

In port resources sharing aspects, the cooperation between these two ports is embodied in the fairway sharing, Hangzhou bay bridge construction and Zhoushan Island development. The rich resources of Ningbo and Zhoushan combined with the finance and capital resources of Shanghai, will build a solid basis of ports cooperation.

6.3 Business cooperation between port enterprises

After information and port resources sharing, two ports enterprises can cooperate in

some business projects. According to the 6.1.1, the business cooperation between two port enterprises has already been opened. The Daxie Jixing logistics company, which invested by SPCCO and Ningbo Daxie Port Company, has become the prologue and the platform for the cooperation between these two ports. But this cooperation is not really the cooperation between Shanghai port and Ningbo port, it is a small-scale cooperation, Daxie is just a port area of Ningbo. Dexie is representing itself to cooperate with Shanghai port not respecting Ningbo port. The future cooperation between these two ports should be in large scope and in the level of Shanghai and Ningbo.

In recent years, Shanghai International Port (Group) Co,. Ltd (SIPG) has utilized its capital advantage to cooperate with the other ports, such as Nantong port, Wuhan Port, Nanjing port and Chongqing port. Nowadays, SIPG has 20 cooperative projects along Yangtze River Valley. In the port cooperation policies of Shanghai, the SIGP has become the executant of these policies. With several years' operations, the SIGP has rich experience in capital operation and external operation with the other ports. In business cooperation between port enterprises aspects, Ningbo is also not lag Shanghai. Ningbo Port Group co., Ltd cooperates with HWL in the second phase of Beilun port construction project. In addition, Ningbo Port Group co., Ltd will combine Mediterranean Shipping Company, Evergreen Shipping Company and Italia Marittima to construct the fourth phase of Beilun port. Therefore, in the aspects of port cooperation between two port enterprises, these two ports are both have experience. The key is that they should realize the benefit of cooperation.

Since these two ports can cooperate with the others in order to achieve the business benefits, they can also cooperate with each other. Especially, the development project of Zhoushan Island affords a good opportunity for the port enterprises of

Shanghai and Ningbo to do the business cooperation. In the market economy the business cooperation between two port enterprises is the best mode for ports to achieve coordinated development.

Apart from capital cooperation, the common investor could also do something to promote the port cooperation. For example, HWL[1] is the common investor of Shanghai port and Ningbo port. Just as what it has done in pushing the cooperation between Hong Kong Port and Shenzhen Port, HWL is able to function as a bridge in the cooperation between Shanghai port and Ningbo port. By reasonably laying out its business scope between these two ports, HWL can help to reduce the port resource waste and vicious competitive behavior.

6.4 The cooperation between local governments

Nowadays, the biggest issue of the port cooperation between Shanghai and Ningbo is from the local governments. In the market economy, the management and operation of port should be done by the port enterprise. The management of port should be guided by the market and focus on achieving the maximization of profit and improvement of competitive power. Both Shanghai port and Ningbo port has separated governmental functions from enterprise management. The Port Groups Companies manage the ports' operation and business and the port authorities are doing the office services. But these two cities are both adopting the policies as "Prosper the city through port development", both of the governments are pay more attention on their port industries and want to become the shipping centers. So this condition conducts an obstacle, intangibly, in the cooperation process between these two ports.

[1] Hutchison Whampoa Limited

However, the wish for port cooperation has been awakened, when the Yangshan port has been constructed. The Yangshan is the island, which belong to Zhejiang province. In order to cooperate with Shanghai port's deep-water harbor construction, Zhejiang province affords the Yangshan Island to Shanghai. This cooperation is a good model for local governments and a mirror for the cooperation between Shanghai and Ningbo. Both governments of Shanghai and Ningbo should realize that the cooperation is the demand for developing Shanghai International Shipping center and improving the integrative competence of Yangtze River Delta Ports Group, which related to the national interest. Both governments should make the port enterprises to operate the ports by themselves and to choose whether coordinated development or independent development. With the development of China's market economy and the pressure for outside of region, both governments will realize the importance of ports cooperation.

In today's social environment, we couldn't ignore the function of government in making the port's strategy layout and coordinating with the other ports. So within the process of port cooperation between Shanghai and Ningbo, the governments should do the strategy planning in terms of developing the national and regional economy, not only the city's economy. In order to utilize the limited investment funds and natural resources to the maximum, the port cooperation between Shanghai and Ningbo should be under planning against the backdrop of the developing trend of the Yangtze Delta regional economy, national economy and Asian-Pacific areas' economy. In addition, the port cooperation should be supported by the central government. In today's society, the cooperation between governments is not only the basic foundation and but also the firmest insurance for port cooperation.

6.5 Concluding remarks

The port cooperation between Shanghai and Ningbo at the present phase should focus on the their cooperative project in Daxie port. This project is similar to the cooperative mode adopted by Shanghai and Nantong. This mode is to establish joint ventures and share port resources. The advantage of this method lies in the fact that the enthusiasm of both parties will be fully inspired, for such port cooperation is entirely performed by enterprises with the purpose of making profit. The capital advantage of Shanghai port has made a solid basis for this cooperation. In addition, the cooperation between both ports can be promoted through their common investors.

The second phase of port cooperation mode adopted by Shanghai and Ningbo can be conducted in conformity with the cooperative mode of Seattle-Tacoma port and Tokyo Gulf Ports. This phase consist two aspects, sharing the resources and attract cargo resource together. As the core ports in the Yangtze River Delta, Shanghai and Ningbo Ports should jointly publicize themselves to highlight their characteristics and to enhance the integral competitive power of the entire port region in the Yangtze River Delta. In this way, the reputation of this port region will be enhanced to a higher level and more sources of cargos will be attracted, including international transshipment cargos. Meanwhile, this operation will also attract more national support and favorable policies from the government. In the process of publicity, resource sharing should be carried out when condition is ripe. For instance, the two ports can share resources on the basis of mutual benefit in utilizing the fairway and coastal resources of Zhoushan Island and Hangzhou Gulf Bridge, in the exploitation of the pilotage resources, and in port EDI and customs integration. The key point, of course, is to sign an agreement on fee rate between the two ports to maintain a same fee charging level. This is beneficial to both parties, as they can obtain the profit that

was previously given to shipping companies in order to compete against others. As a result, business activities between both ports will be ensured to develop normally and the limited resources can be utilized to the maximum. It is what we call "maximum social economic efficiency".

In the second phase, the port corporations of both ports should strengthen their relationship and enlarge the scale and depth of the business cooperation between these two ports. The cooperation projects c.ould outside the region, they belonging to.

Finally, if it is possible that these two ports should built into an integrative port adopted by New Jersey/New York port. That is to say, one port management committee supervises two port businesses. Therefore, over-competition can be avoided as much as possible and the advantages of both ports can be fully utilized to engender best group strategy efficiency. This cooperative phase needs the participation of both ports authorities and local governments.

CHAPTER 7

CONCLUSIONS

As is predicted in Chapter 2, the container throughput and goods throughput in Shanghai will have respectively reached 29million TEUs and 620million tons by the year of 2010. The container throughput and goods throughput in Ningpo and Zhoushan ports will have arrived at 10 million TEUs and 696 million tons (including 187 million tons in Zhoushan). At present, the container throughputs of the two ports are 18 million TEUs and 5 million TEUs. Their goods throughputs are 44 million tons and 36 million tons respectively.

There is a huge gap between the set goals and the real situation for these two ports. Against the backdrop of China's economic reform and opening-up policy, our domestic ports are confronted with competition not only from domestic ports but also from their counterparts in other countries, especially in neighboring countries, for example, Pusan, Kaohsiung, Singapore, and Tokyo. If Shanghai and Ningbo ports could not satisfy the demand of goods transport, it would be unable to attract international transit goods and its own good resources would be diverted to other ports. In such circumstances, national transportation security would be threatened. Therefore, Shanghai Port and Ningbo Port should join hands to reasonably develop the resource in Zhoushan and achieve a regional scale economy, so that the entire ports region of the Yangtze Delta will have a better competitive power.

Furthermore, since Yangshan Port in Shanghai is located at open sea, it has to be out of operation for about 60 days in a year due to high winds and huge waves, during which period the transportation security of Shanghai port will be in threat. Shanghai port and Ningbo port must cooperate to deal with such a problem. In addition, the establishment of Shanghai International Shipping Center can not be realized by one single port of Shanghai but through the joint efforts made by all the ports in the Yangtze Delta. AHP technique has demonstrated that the advantages of cooperative development of Shanghai port and Ningbo port are much more than those of independent development of a single port. Therefore, Shanghai port and Ningbo port have mutual benefit to conduct cooperative development.

When it comes to the choice of development mode, there is no existing mode totally conforming to the cooperation between Shanghai port and Ningbo port. As a matter of fact, there are a variety of modes in the port cooperative development. The cooperation of Shanghai port and Ningbo port will be realized by various cooperative modes and methods in different periods. While at present great attention should be attached to the cooperation project in Daxie port, the future cooperative direction of both ports will be diverted from governmental orientation to enterprise orientation. Meanwhile, the mode of resource sharing in Seattle-Tacoma port and the mode of enterprise cooperation in Hong Kong-Shenzhen port are suited to the coordinated development of Shanghai-Ningbo port. Nevertheless, we could not underestimate the importance of cooperation between the local governments of these two ports, for governmental cooperation means a solid foundation for the cooperation of these two ports.

Diversified service and hinterland division are the two most adoptable methods for Shanghai and Ningbo to realize the ports cooperation. Only using these two methods,

the profit of these two ports can be made to the maximum. Undue competition and resource waste could be avoided by means of the above two methods. Besides, the complementary port handling capacity and joint development of Zhoushan resources are also a feasible method in the port cooperation.

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APPENDIX 1

TABLES

Table 11-The world top 15 container ports

Port	Country or Region	Year 2004 10000TEUs	Year 2005 10000TEUs	Annual increase
Singapore	Singapore	2132.9	2319	8.7%
Hong Kong	China	2198.4	2260	2.8%
Shanghai	China	1455.4	1809	24%
Shenzhen	China	1365.9	1620	19%
Pusan	Korea	1144.2	1184	3.5%
Kaohsiung	China	971.5	947	-2.5%
Rotterdam	Holland	828.1	929	12%
Hamburger	Germen	700.3	809	16%
Dubai	United Arab Emirates	642.9	762	19%
Los Angeles	USA	732.1	748	2.2%
Long Beach	USA	578	671	16%
Antwerp	Belgium	606.4	648	6.9%
Qingdao	China	513.9	631	23%
Klang	Malaysia	524.4	554	5.7%
Ningbo	China	401	521	30%

Source: The date derive from the annual statistic on every port's official web-site and some of the data was derive from the magazine named as ISL

Table 12 -The total volumes of social retail goods and foreign trade of the cities in Yangtze River Delta

Unit:100 million US$

City	The total volume of social retail goods		The total volume of foreign trade	
	Total	Growth rate	Total	Growth rate
Hangzhou	975.43	14	198.04	30.5
Ningbo	759.83	14	222.17	33.4
Jiaxing	374.44	15.1	70.44	38
Huzhou	237.75	14.3	19.96	37.8
Shaoxing	381.63	14	81.42	23.2
Zhoushan	100.14	14.4	10.69	29.2

Taizhou	439.92	16.1	51.96	36.8
Nanjing	1004.99	16.3	142.45	36.2
Wuxi	824.11	16.3	155.46	41
Changzhou	444.08	16.2	61.28	29.9
Suzhou	905.07	16.5	728.23	43.4
Nantong	536.41	16.2	57.93	33.2
Yangzhou	306.89	15.7	19.06	41.1
Zhenjiang	241.39	15	20.34	33.9
Qinzhou	233.81	15.7	13.41	40.6
Shanghai	2972.97	11.9	907.42	23.4

Source: The data derive from the official government web-site of these cities.

Table 13- Category List of the cargo import and export through Ningbo port in March 2006

1,animal	4259	266
2,foliage	2412	1587
3,propagation axunge	16	521
4,foodstuff, drink, tobacco, alcohol	6265	158
5,ore products	4066	187111
6,chemistry products	7549	46067
7,plastic, latex products	18540	14964
8,leather and fur products	5156	69
9,tember	4581	552
10,paper products	2538	3889
11,textile	74555	5237
12,shoes, cap, umbrella and filoplume products	28144	30
13,stone, cement, pottery products, and glass products	2361	213
14,pearl, gem, noble metal, jewelry	235	170
15,base metal and its products	34856	16720
16,machine:, electrical equipment	98109	24864
17,vehicle and ship	24579	212
18,instrument, horologe and musical instrument	5175	3058
19,weapon and ammo	14	0
20,furniture, lamps and toy	39285	354
21,artwork and antique	18	0
Total	362711	306044

Source: *Category List of the cargo import and export* publish by the custom of Ningbo

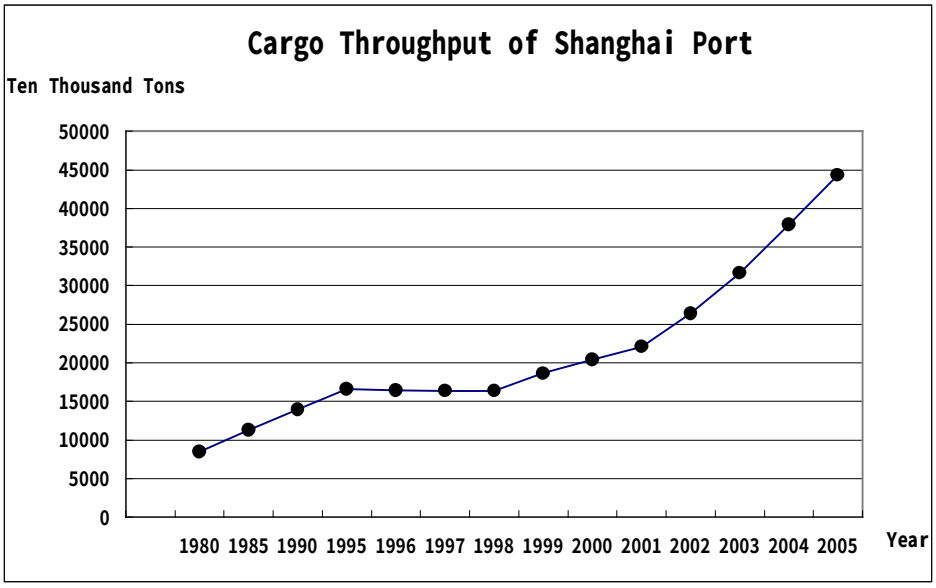

Figure 10- Cargo Throughput of Shanghai port

Source: The data derive from the official web-site of Shanghai International Port Group. http://www.portshanghai.com.cn/sipg/index.php

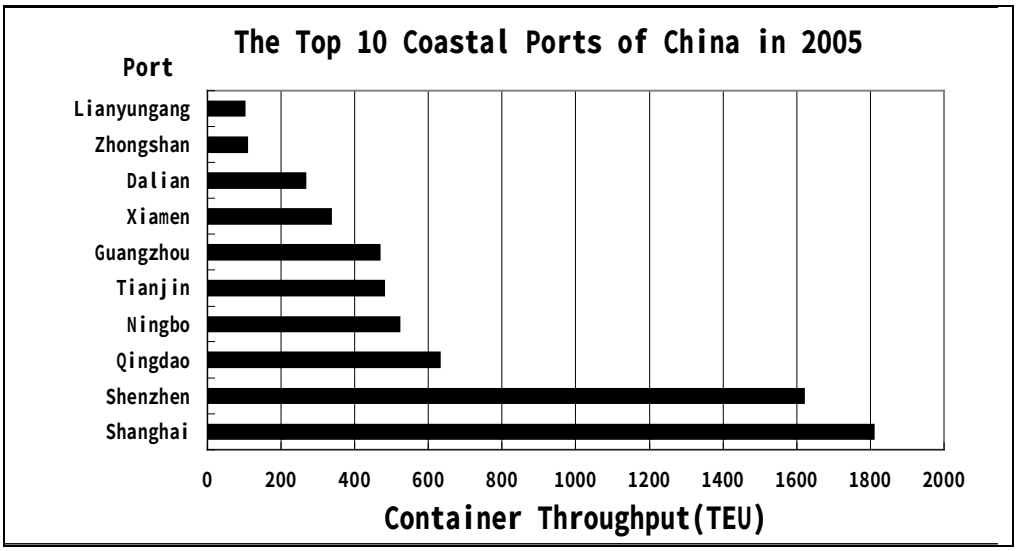

Figure 11- The top 10 coastal ports of China in 2005

Source: *2005 The Report on China's Shipping Development* written by The Ministry of communications of the People's Republic of China

APPENDIX 2

THE REGRESSION ANALYSIS METHOD

1 Forecasting the container throughput of Shanghai Port

The Regression Analysis Method will be used to forecast the container throughput. In order to have a quick and exact result, the Microsoft Excel software will be adopted to establish the regression equation. This method needs historical data to do the forecast. The more data we obtain, the more accurate our prediction will be done. For example, when we find the historical date of two variables existing quantitative relation, we can analyse the regressive relation between these two variables and using the historical data to establish the regression equation. Then we can use the equation to forecast the future data we need.

As we know, shipping industry has a very close relationship with the trade. The cargo throughput and container throughput are all related with the trade industry. So in this regression analysis method, the container throughput and the total volume of export and import goods are the two variables. After analyzing the internal relationship between The Total Volume of Export and Import Goods (X) and The Container Throughput (Y), the mathematical model can be established. In this thesis, using the historical data about the total volume of export and import goods of Shanghai port (1980-1995) and the data of the throughput of Shanghai port(1980-2005) as the basic data.

We clear that with the booming-up of foreign trade, the volume of container suitable cargo is also increased. So container throughput has a tight relationship with the foreign trade volume. This conclusion can be approved through the Figure 12.

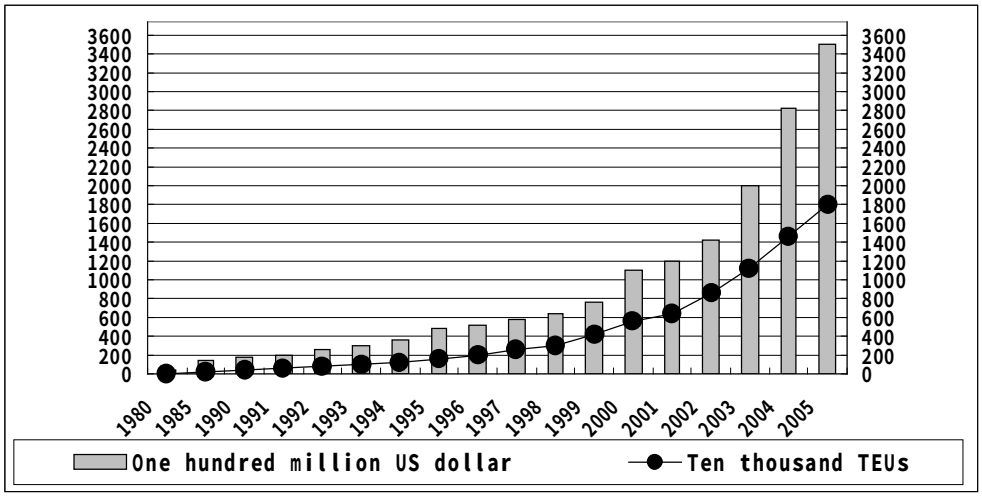

Figure 12- The total volume of import and export goods and TEUs of Shanghai
Source: The data derive from the *Shanghai Statistical Yearbook 2005* written by Shanghai Statistics Bureau

From the above chart, we can have a clear picture of the historical data about the total volume of import and export goods and the container throughput of Shanghai port. The tendencies of these two data are almost as the same. So we can use these data to make a scatter diagram. Then we use the tendency to establish the equation.

Table 14 - The volume of import and export goods and container throughput of Shanghai

Year	Volume(100 million US$)	TEUs(10 thousand)	Year	Volume(100 million US$)	TEUs(10 Thousand)
1980	148.73	2.99	1997	586.83	252.80
1985	172.89	20.45	1998	636.38	306.60
1990	204.09	45.60	1999	761.51	421.60
1991	251.5548	57.67	2000	1093.11	561.20
1992	309.3082	73.05	2001	1204.88	634.00
1993	362.4157	93.47	2002	1425.01	861.20
1994	481.37	119.9	2003	2012.01	1128.25
1995	528.7	152.60	2004	2825.75	1455.40
1996	148.73	197.10	2005	3506.8	1809

Source: The data derive from the *Shanghai Statistical Yearbook 2005* written by Shanghai Statistics Bureau

Just suppose the total volume of import and export goods as X and suppose the container throughput as Y.

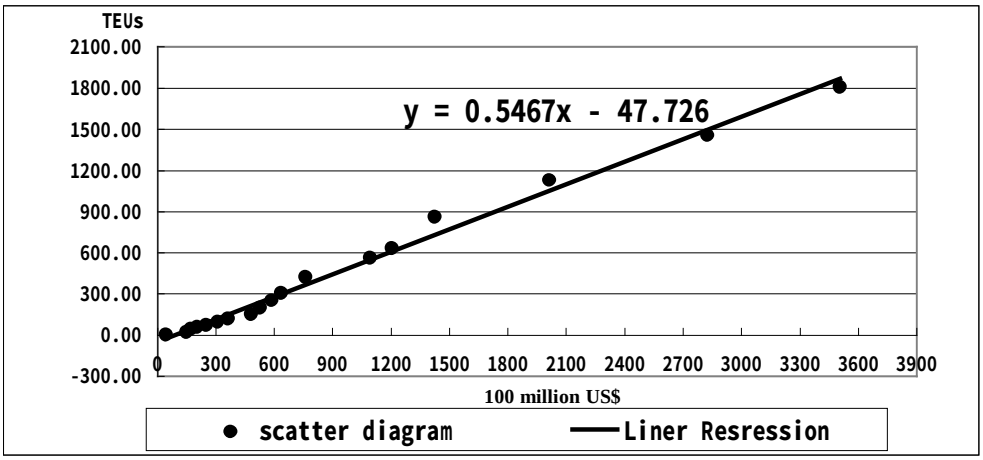

Figure 13 – Liner Regression of the container throughput of Shanghai port

The scatter diagram is tending to linearity. So we can set a equation as **Y=a+bX.**

In this equation:

$$b=\frac{\sum XY - n\overline{X}\,\overline{Y}}{\sum X^2 - n\overline{X}^2}$$

$$a=\ \overline{Y} - b\overline{X}$$

$$\overline{Y}=\frac{\sum_{i=1} Y_i}{n}$$

$$\overline{X}=\frac{\sum_{i=1} X_i}{n} \quad .$$

X means the total volume of the import and export goods

Y means the container throughput

N means how many data me select

Then we can put the historical data into this equation. As shown in Figure 13, we got

an equation as

Y=0.5467X-47.726

According to the *Report on 11th "Five Year Plan" of Shanghai* and the planning of Shanghai EXPO 2010, which were done by the local government, the Government of Shanghai forecast that the total volume of import and export of goods of Shanghai will achieve 550 billion US$ in 2010. So we replace the X with 5500, and then we get the numerical value of Y, which is 2959.12. So we can forecast that the container throughput of Shanghai port will reach **29.5912 million** TEUs in 2010.

2 Forecasting the cargo throughput of Shanghai port

The Regression Analysis Method will be used to forecast the cargo throughput of Shanghai port. In order to have a quick and exact result, the Microsoft Excel software has been used to establish the regression equation. The cargo throughput and the total volume of export and import goods are the two variables. After analyzing the internal relationship between The Total Volume of Export and Import Goods (X) and The Container Throughput (Y), the mathematical model can be established. In this thesis, using the historical data of the total volume of export and import goods of Shanghai port(1994-2005) is shown in table 14 and the data of the cargo throughput of Shanghai port(1994-2005) is shown in table 15 as data basis.

Table 15- The cargo throughput of Shanghai port

Year	1994	1995	1996	1997	1998	1999
Cargo Throughput (10000tons)	16581	16567	16402	16397	16388	18641
Year	2000	2001	2002	2003	2004	2005
Cargo Throughput (10000tons)	20440	22099	26384	31621	37896	44310

Source: The data derive from the *Shanghai Statistical Yearbook 2005* written by Shanghai Statistics Bureau

Just suppose the total volume of import and export goods as X and suppose the cargo throughput as Y. Then we can get a scatter diagram shown in Figure 14.

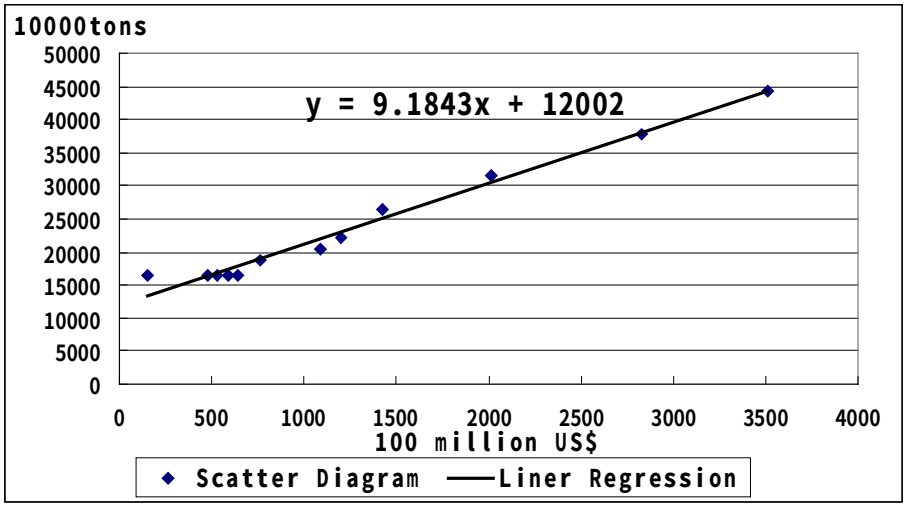

Figure 14 - The Liner Regression of the cargo throughput of Shanghai port

Using the Microsoft Excel software to establish the regression equation:

Y=9.1843X+12002

According to the *Report on 11th "Five Year Plan" of Shanghai* and the planning of Shanghai EXPO 2010, which were done by the local government, the Government of Shanghai forecast that the total volume of import and export of goods of Shanghai will achieve 550 billion US$ in 2010. So we replace the X with 5500, and then we get the numerical value of Y, which is 62515.65. So we can forecast that the container throughput of Shanghai port will reach **625.1565 million** tons in 2010.

3 Forecasting the container throughput of Ningbo Port

We use the same method to forecast the container throughput of Ningbo port. First, the historical data of the container throughput and the data of total volume of import and export goods must be selected. The data is shown in table 16

Table 16- The total volume of import and export goods and container throughput of Shanghai port

Year	Volume(100 million US$)	TEUs(10 thousand)	Year	Volume(100 million US$)	TEUs(10 Thousand)
1991	4.73	3.6	2000	75.48	90.2
1992	7.8	5.3	2001	88.995	121.3
1993	17	7.9	2002	122.81	185.9
1994	25.2	12.5	2003	188.27	277.2
1995	34.79	16	2004	260.6	400.5
1996	43.536	20.2	2005	334.9	520.8
1997	49.76	25.7			
1998	45.452	35.3			
1999	50.155	60.1			

Source: The data derive from the *Ningbo statistical bulletin* (1991-2005) written by Ningbo Statistics Bureau

Just suppose the total volume of import and export goods as X and suppose the container throughput as Y. Then we can get a scatter diagram shown in Figure 15.

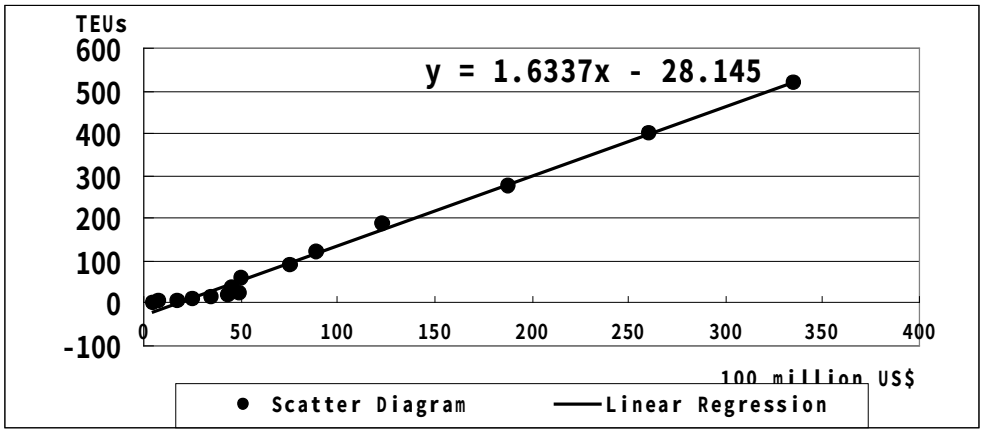

Figure 15- Liner Regression of container throughput of Ningbo port

Using the same way to forecast the container throughput of Ningbo port, just as the way has been used to forecast the container throughput of Shanghai port.

We can get a linear equation:

Y=1.6337X-28.145

According to the *Report on 11th "Five Year Plan" of Ningbo,* which was done by the government of Ningbo, the total volume of import and export goods of Ningbo port will achieve 67000 million US$. So we replace the X with 670, and then we get the numerical value of Y, which is 10.6643. So we can forecast that the container throughput of Ningbo port will reach **10.6643 million** TEUs in 2010.

4 Forecasting the cargo throughput of Ningbo Port

The Time Series method will be used to forecast the cargo throughput of Ningbo port in 2010. And take advantage of the Microsoft Excel software to establish the regression equation. The historical data is as followed:

Table 17 – The cargo throughput of Ningbo port(1992-2005)

Year	1992	1993	1994	1995	1996	1997	1998
Cargo Throughput (10000tons)	4366.3	5321.4	5849.8	6852.8	7638.9	8220.5	8706.6
Year	1999	2000	2001	2002	2003	2004	2005
Cargo Throughput (10000tons)	9660.2	11547.1	12852.3	15398	18542.6	22585.6	26881.

Source: The official web-site of Ningbo port http://www.nbport.com.cn/index.php

Using the above data, we can make a scatter diagram. Just suppose the total volume of import and export goods as X and suppose the cargo throughput as Y. Using the Excel software, as shown in Figure 16, we can get the regression equation, which is

Y=68.342X+5180

According to the *Report on 11th "Five Year Plan" of Ningbo,* which was done by the government of Ningbo, the total volume of import and export goods of Ningbo port will achieve 67000 million US$. So we replace the X with 670, and then we get the

numerical value of Y, which is50969.14. So we can forecast that the container throughput of Ningbo port will reach **509.6914 million** tons in 2010.

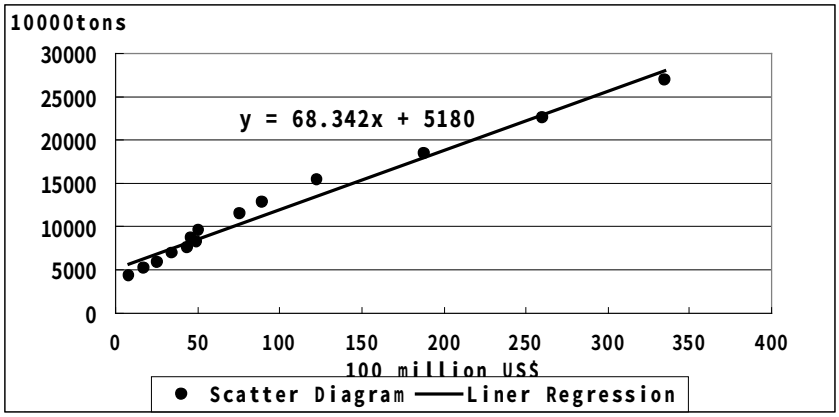

Figure 16- Liner Regression of cargo throughput of Ningbo port

5 Zhoushan port

Because the container throughput of Zhoushan port is limited in the previous years, it is difficult to adopt the historical data to forecast the container throughput of Zhoushan port. So we can just forecast the cargo throughput of Zhoushan port. The Time Series method can be used to forecast the cargo throughput. The historical data is shown in table 18:

Table 18 – The cargo throughput of Zhoushan port (1994-2005)

Year	1994	1995	1996	1997	1998	1999
Cargo Throughput (10000 tons)	570.88	883.17	1187	1384	1656	2082
Year	2000	2001	2002	2003	2004	2005
Cargo Throughput (10000 tons)	3189	3281	4068	5722	7359	9052

Source: The official web-site of http://www.zsport.com.cn/china

Then using the Microsoft Excel software to make a scatter diagram. The diagram is also tending to be a curve. So we can set up a quadratic equation to describe the diagram. Just suppose the Year Series as Xi (i=1,2…12) (X_1=1means1994,X_2=2 means1995, X3=3 means 1996 and so on) and the Cargo Throughput as Y. The equation is:

$$\mathbf{Y=80.39X^2-336.25X+1200.7}$$

When we want to forecast the cargo throughput of Zhoushan port in 2010, we just need to replace Xi with X_{17} (X_{17}=17). So we can get the forecasting numerical value, which is **187.17 16 million tons.**

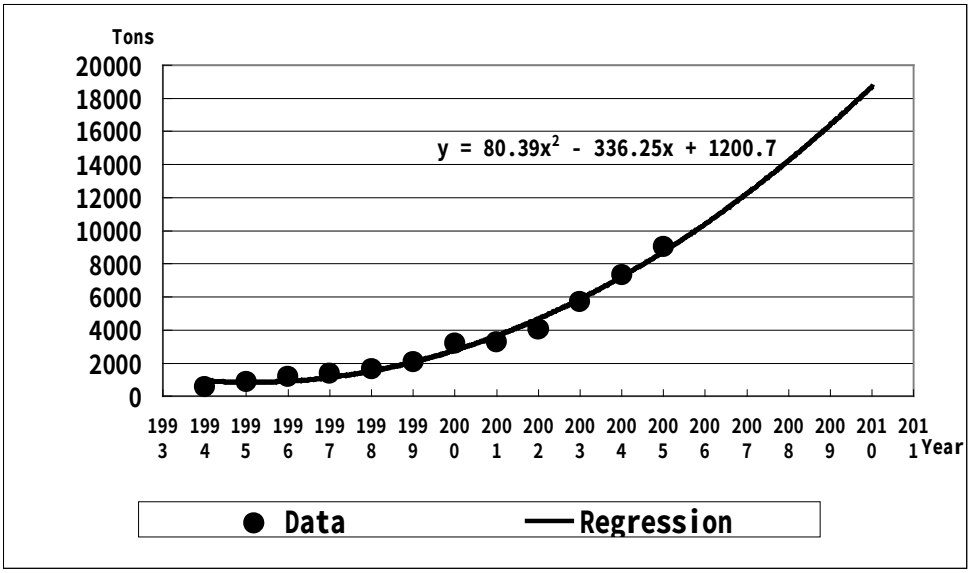

Figure 17- Forecasting the cargo throughput of Zhoushan port.

APPENDIX 3

THE AHP (ANALYTICAL HIERARCHY PROCESS) TECHNIQUE

In order to know whether the coordinated development between Shanghai port and Ningbo port is superior to independent development between these two ports, the AHP technique can be adopted to do the analysis.

The hierarchy of the evaluating elements are as followed:

1st Level: The objective of this decision-making problem is to prove the possibility of the coordinated development of Shanghai port and Ningbo port.

2nd Level: Base on result of the Delphi technique, I think 7 influencing factors impact on our decision. They are C1- nature condition C2- government policies C3-the industry and economy of local area C4-cargo resources C5-port management and construction C6-the density of shipping lines C7-inland transport system and logistics system

3rd Level: We can assume three modes for port development. They are P1-independence development of Shanghai port, P2-independent development of Ningbo port and P3-coordinated development of Shanghai and Ningbo port.

Table 19 -The weight of comparative importance among the factors in the 2nd level

A	C1	C2	C3	C4	C5	C6	C7	ϖ_i	ω_i
C1	1	1	3	3	5	5	7	2.8626	0.3086
C2	1.0000	1	3	3	5	3	5	2.5362	0.2734
C3	0.3333	0.3333	1	3	3	3	5	1.4724	0.1587

C4	0.3333	0.3333	0.3333	1	3	3	3	1.0000	0.1078
C5	0.2000	0.2000	0.3333	0.3333	1	3	3	0.6314	0.0681
C6	0.2000	0.3333	0.3333	0.3333	0.3333	1	1	0.4241	0.0457
C7	0.1429	0.2000	0.2000	0.3333	0.3333	1.0000	1	0.3493	0.0377
Σ								9.2760	1

Check out the coherence of this matrix

$$A\omega = \begin{pmatrix} 2.2142 \\ 2.0474 \\ 1.2058 \\ 0.8091 \\ 0.5235 \\ 0.3478 \\ 0.2725 \end{pmatrix}$$

$$\lambda max = \sum_{i=1}^{7} \frac{(A\omega)_i}{n\omega_i} = 7.4711$$

$$CI = \frac{\lambda_{max} - n}{n-1} = \frac{7.4711 - 7}{7-1} = 0.0785$$

$$CR = \frac{CI}{RI} = \frac{0.0785}{1.32} = 0.0595 < 0.10$$

The coherence of this matrix is satisfied. Then dealing with the feedback of the questionnaires, grade of three modes can be provided. The grades shown in Table 20

Table 20 - The grade of three modes

	P1	P2	P3
C1	6	10	10
C2	10	9	8
C3	10	8	10

C4	10	5	10
C5	10	8	9
C6	10	6	10
C7	9	8	9

After inter-comparison among the factors in 2nd and 3rd levels, we can get the weights of the importance of these three modes. The weights are show in Table 21

Table 21 the weight of the importance of three modes

		P1	P2	P3	ϖ_i	ω_i	W	λ max	CI	CR
C1	P1	1	0.6	0.6	0.7114	0.2306	0.6918			
	P2	1.67	1	1	1.1864	0.3847	1.1541			
	P3	1.67	1	1	1.1864	0.3847	1.1541			
					3.0842	1		3	0	0
C2	P1	1	1.1	1.25	1.1119	0.3695	1.1085			
	P2	0.9	1	1.125	1.0041	0.3337	1.0011			
	P3	0.8	0.89	1	0.8929	0.2967	0.8901			
					3.0090	1		3	0	0
C3	P1	1	1.25	1	1.0772	0.3571	1.0713			
	P2	0.8	1	0.8	0.8617	0.2857	0.8571			
	P3	1	1.25	1	1.0772	0.3571	1.0713			
					3.0161	1		3	0	0
C4	P1	1	2	1	1.2599	0.4000	1.2000			
	P2	0.5	1	0.5	0.6300	0.2000	0.6000			
	P3	1	2	1	1.2599	0.4000	1.2000			
					3.1498	1		3	0	0

C5	P1	1	1.25	1.11	1.1153	0.3703	1.1108			
	P2	0.8	1	0.89	0.8929	0.2964	0.8893			
	P3	0.9	1.12	1	1.0041	0.3333	0.9999			
					3.0124	1		3	0	0
C6	P1	1	1.67	1	1.1856	0.3846	1.1538			
	P2	0.6	1	0.6	0.7113	0.2308	0.6924			
	P3	1	1.67	1	1.1856	0.3846	1.1538			
					3.0825	1		3	0	0
C7	P1	1	1.125	1	1.0400	0.3461	1.0383			
	P2	0.89	1	0.89	0.9245	0.3077	0.9231			
	P3	1	1.125	1	1.0400	0.3461	1.0383			
					3.0045	1		3	0	0

At last, we can have an analysis of the result.

Table 22 Alternatives Analysis

2nd Level / 3rd level	C1	C2	C3	C4	C5	C6	C7	Total Weight
	0.3086	0.2734	0.1587	0.1078	0.0681	0.0457	0.0377	
P1	0.2306	0.3695	0.3571	0.4000	0.3703	0.3846	0.3461	0.3511
P2	0.3847	0.3337	0.2857	0.2000	0.2964	0.2308	0.3077	0.2912
P3	0.3847	0.2967	0.3571	0.4000	0.3333	0.3846	0.3461	0.3575

From the table 14 we can have a conclusion that the coordinated development (0.3575) is the best mode for Shanghai port and Ningbo port and it is a worst choice of Ningbo port to develop independently (0.2912).