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Countermeasures for the chemicals transportation of the Zhangjiagang Port

Qiangqiang Miao

World Maritime University

Shanghai, China

COUNTERMEASURES FOR THE CHEMICALS TRANSPORTATION OF THE ZHANGJIAGANG PORT

by

ss0717Miao Qiangqiang

China

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DECLARATION

I certify that all 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.

Signature:…Miao Qiangqiang…..

Date: …June 9th 2007……..

Supervised by

Professor Sha Mei

Shanghai Maritime University

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Abstract

Title of Research paper: Countermeasures for The Chemicals Transportation of The Zhang Jiagang Port

Degree: **MSc**

The chemical cargo transport is the most important cargo in Zhangjiagang port, especially since the 2002, the foundation of the Zhangjiagang free zone chemical exchange center. The SWOT analysis is one of the most important roles in the management study.

In this paper, I will use the SWOT analysis as a role to study analysis the situation in 4 different aspects, and then get a strategy for the Zhangjiagang port.
At first, I analyze the external environment and internal environment of the Zhangjiagang port. Then following the SWO and T, I analyze the strength, weakness, opportunities and the treaties one by one.

Through the above analysis, this paper introduces some `Specific` countermeasures which would fit the Zhangjiagang port's needs.

KEYWORDS: SWOT, AHP, countermeasure

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AHP: Analytical Hierarchy Process

1. Introduction

1.1 Purposes

So far, China has established an oil chemical industrial system involved in more than 20 business areas; and can manufacture over 40,000 products, among which yield of more than 10 major oil and chemical products is at high level of global business. The system has a wide variety of categories and forms a complete set of production line in general. However, compare the oil chemical processing ability with advanced countries, we are in great lack of capacity to produce raw material for chemical industry, especially for the need of crude, synthetic resin, synthetic rubber and polyethylene is mainly rely on import. Thus there is a great demand of import transportation for chemistry. On the other hand, due to the high yield of oil a chemical product in China, there is also demand for export transportation for finishing goods. Huge demand for chemicals transport brings an unprecedented opportunity to domestic ports to develop their business.

The Zhangjiagang Port, located in Yangtze River Delta region where the most advanced chemical industry in China has. It has the unique demander's resource to develop its chemical transportation; in particular, the establishment of the Yangtze River Chemical Industry Park takes the port in a perfect position for its chemicals transportation in China. Depend on the opportunity the Zhangjiagang Port has made a great progress in the past few years, especially the establishment of Zhangjiagang Bonded Area chemicals market in 2002 has promoted the development of a considerable extend. After 5 years development since the establishment of the market, the Zhangjiagang Port has become the biggest bulk chemicals trading center in China.

However, the investors of the ports were too optimistic for the new business; they saw demand for chemicals transportation only in the right beginning; but were in lack of making a proper plan to carry out the project. So the blind investment led to waste of resources to some extent.

Currently, there are five independent companies operating the nine chemicals terminal in the Zhangjiagang port, this situation makes the lack of harmonization between these companies, and the logistics system of the port is not so advanced too. It also leads a relative long transit time for the chemicals cargo distribution. Meanwhile, this kind of investment makes a quite serious redundant construction too.

Facing this situation above and consider the competitiveness by the neighbor port: Ningbo, Jiaxing, Changshu, the question that how to develop its competitive advantage for survival and development in the further, became the first issue of priority should be solved.

This paper tries to find solutions to improve the competitiveness of the Zhangjiagang Port through the improvement of the berth layout, port management and the logistic system.

1.2 Scopes

This research mainly base on the analysis of external and internal environment of the Zhangjiagang Port, and the composition of cargo resource and the cargo owners. Through these analysis build a SWOT analysis matrix, than calculate the matrix to get a score for its' external and internal environment respectively that could determine the position of the Zhangjiagang Port in the SWOT matrix.

The major customers of the Zhangjiagang Port's chemicals transportation are these various chemical production enterprises in its economic hinterland and the manufactories alongside with the Yangtze River. This paper mainly discusses the consumption of various kinds of chemical materials in the hinterland to collect a more reliable data to establish the SWOT matrix.

1.3 Research questions

The paper tries to get a general view of the problems of the Zhangjiagang Port in its' chemicals transport development, and give some countermeasures to solve these problems.

1.4 Theories and methods

SWOT is the module of this thesis to analyze 4 elements of development for liquid chemistry transportation of Zhangjiagang port. Based on the research data of major cargo resource of Zhangjiagang port, will use The qualitative prediction model to predict main product category & volume for this port to analyze the external points of its development; will use statistics of the port data to conclude internal elements; together with analysis & conclusion from other factors, will develop the SWOT module. Then will give suggestion about development of chemistry transportation in Zhangjiagang port based on analysis of the module.

1.5 Logic link of the paper

The adaptation and implementation of a series of suitable strategy could provide a powerful guarantee to improve the competitive and lead a sustainable development

for a modern port.

This paper based on the external and internal environment analysis and focused on the formation of its cargo resource of the chemicals transport, using the SWOT and AHP analysis to mark its external and internal environment. With this score and the analysis make a serious of countermeasures for the chemicals transportation of the Zhangjiagang Port.

There are seven chapters in the paper:

Chapter 1 is “Introduction”, including purpose, scope, research questions, theories and methods.

Chapter 2 is “Literature Review”, discussed the development of the port organization and strategy making.

Chapter 3 is “The general external environment and internal environment”, gave a systematical analysis on the general external environment and internal environment of the port.

Chapter 4 is “The resource of the chemicals cargo”, discussed the resource and the influence facts of the major chemicals cargo of the port.

Chapter 5 is “SWOT analysis”, using the SWOT model to analysis these facts that be discussed above, and got a score of internal and external environment respectively.

Chapter 6 is “The countermeasures for the development”, through the discussion above here gave some countermeasures for the port.

Chapter 7 is “Conclusion”.

1.6 Limitations of this paper

Limited by the time and objective conditions, there are some lacks in this paper, including the followings:

1、For the data collection: The main data of this paper is collected from the intranet of the Zhangjiagang Port and some published statistics, because of secret reason, some of the data is not open to the public, it is difficult to collect, so this paper is limited by the lack of reliable data in some extend.

2、For the forecast: Due to the lack of precise and complete statistical data of the domestic chemical industry, particularly those manufactories in the economic hinterland of the Zhangjiagang, the forecast of the cargo volume in Chapter 6 can not be very precisely.

2. Literature review

2.1 The trend of the Port development

With the changes in transportation technology and economic activities, the function of the port is becoming more and more diversified. The business model for the port is changed also. The port has been developed from the first generation to the third. According to UNCTAD (1992), compare the major commodities, the port develop strategy, and the scope of port's activities, etc, of each different historical period, we can see the trend of the port's development. The paper put these facts in the following table:

Table2.1 Comparison for the port from the 1st generation to the 3rd

	The 1st generation	**The 2nd generation**	**The 3rd generation**
Period	Before 1960s	1960s~1980s	After 1980s
Major commodity	Bulk cargo	Bulk and general cargo	Bulk and unit package cargo
Develop strategy	Conservative, the transshipment point	Expansion, the center of the transportation, commercial and industry.	The logistic center.
Scope	1)The interface for the Ship / shore conversion	1)The interface for the Ship / shore conversion 2)cargo processing and business activity	1)The interface for the Ship / shore conversion 2)cargo processing and business activity 3)distribution
Organization characteristic	Independent activities, informal relations	Close relation with port user but not the others	Organize different parts of the transportation

Source: Fourth-generation port, the Port Advisory Network，http://www.thechoice.net.cn

Along with accelerated process in economic globalization and regionalization is, since 2000s, the modern port has been developed from the third generation to a higher level. This trend could be demonstrated in the followings:

1. The port planning, construction and layout was integrated with the city around. The adaptation of the port industry in the portside city has made a win-win situation.

2. The economic hinterland has made a coordinated development around the port. And the port has become the decision-making, organization and operations base for it's' hinterland export-oriented economy. Not only the regional industrial layout, information network, and talents supply, but also the facilities for hardware and software service and the political system were tilted to the port and closer.

3. The cooperation and the competition were both existed among the ports, but the main steam was competition. It was displayed by the competitiveness among portside cities and the port hinterland economies.

4. The port has been developed to a large-scale and specialized one, and with a deeper forward berth. At present, the top 10 ports in the world all have the specialized berths with an over 15m depth.

2.2 The development of the port strategy formulation

The Development Strategy has traditional definition as well as contemporary definition. Professor Michael Porter from US Harvard University concluded Enterprise Development Strategy of 1960-1970: "Strategy is a combination of a company's goal & the way it is proceeding to achieve the goal". In 1989, H. Mintsberg stated that it is not correct to regard enterprise strategy as the result of a rational project which is based on plan, as quite a lot of cases were successful but with no plan in advance. He defined strategy as "a series or a complete set of decision or action", including any strategies that planned in advance or made in unexpected circumstances. And modern enterprise development strategy emphasizes the other aspect of the strategy – flexible, competitive and risky.

There are many strategy making methods for the port development, the PESTLE analysis, BCG model, SWOT model, etc (Benjamin Cuige, 1992). The port should not only focus on the strategy making, but also the strategy implementation and the amending.

As usual, there are four steps for the strategy making: the environment analysis, research, development and implementation, the relation is as the following:

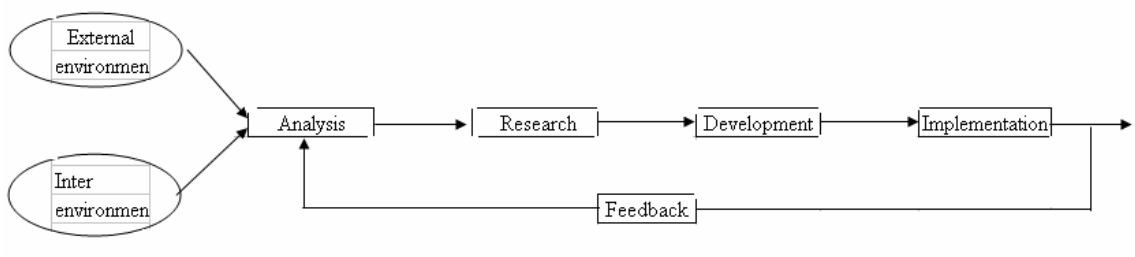


Figure 2.1 the process for the strategy making

Recently, the SWOT model is widely used in the strategy formulation process. This model was introduced by the K.J. Andrews firstly (K.J. Andrews, 1971). The origin of strategy design school can be traced in 2 influential books--the "capacity of leadership" by Berkeley Philippe • Saicinike, publication of University of California, 1957 and the “Strategy and Structure” by Chandler, MIT, 1962. These 2 books discussed the necessity of “internal condition” and “external expectation” in an organization. Because SWOT provides a clear picture of the internal & external environment of a company for decision maker to judge the situation and work out proper strategy, it is widely used in all kinds of business. But there are some shortages in the SWOT method also. Some researchers like Xi Youming argued that could not make a strategy base on the disorderly facts. （Xi Youming, 1990）

2.3 The AHP model

Due to the elements which would be analysis in SWTO model is arranged unordered, it can not reflect the relationship among each element. So AHP Analysis is introduced in this paper. Using AHP Analysis to mark the elements from 1 to 9 and establishing matrix to get the score of s、w、o、so、wo、st、wt and internal & external environment situation. It can avoid elements disorder and other influences that be taken by internal & external environment. AHP Analysis can help the manager understanding the structure of the problem、the influence level of every grade and then help them making an effective and perfect plan.

AHP was developed by Prof. Thomas L. Saaty of Pittsburgh University in 1970. His theory was based on Linear Algebr and Graph Theory, by drawing to analyze and raising the question.

AHP Analysis method worked out the weakness of elements disordered in SWOT and is used widely. It also will be adopted in this paper.

3. The general external environment and internal environment

3.1 The general external environment

3.1.1 The economic environment

1. The international economic environment development analysis

Since the World War II, Global economic integration has been and will continue as the overall trend of economic and social development. The Global economic integration is mainly reflected in these three areas: the globalization of manufactory, of financial and trade liberalization. Be pushed by this trend, the mid-production resources and the final production have been traded and moved allover the world, and this movement has been and will continue keep on growing. In 2006, the world GDP is about 60 trillion dollars, and the valued of international trade is about 37.5 trillion U.S. dollars. International trade attributed about 60% of the international total GDP. And with the development of global integration, they will play a more and more important role in the world economy.

Economic Cooperation and Development (OECD) in its latest World Economic Outlook report noted that, until recently, while crude oil and commodity prices rise dramatically, OECD countries still maintain a considerable period of non-inflationary economic growth, and will maintain this trend for a long time. Look throughout the world economic development, especially the world trade development, it is obviously that in a relative long period of time, the world economy and trade will maintain a rapid growth, and as support of the World Trade the international transport will continue to maintain a good growth.

Table 3.1 OECD on the world economy forecast

	2006 年	2007 年	2008 年
GDP real growth			
The US	3.3%	2.4%	2.7%
Japan	2.8%	2.0%	2.0%
Euro land	2.6%	2.2%	2.3%
Overall OECD	3.2%	2.5%	2.7%
Inflation			
The US	2.9%	2.6%	2.6%
Japan	-1.0%	0.2%	0.6%
Euro land	1.8%	2.0%	2.0%
Overall OECD	2.2%	2.2%	2.1%
Unemployment			
The US	4.6%	4.8%	5.1%
Japan	4.2%	3.9%	3.6%
Euro land	7.9%	7.4%	7.1%
Overall OECD	6.0%	5.8%	5.7%
World trade growth	9.6%	7.7%	8.4%

Source: economic channel website

2. The domestic economic environment development analysis

2007 China's GDP growth rate will reach 10.9%; with a growth rate slightly higher than last year's, continue to maintain a rapid growth momentum.

In 2006 China's foreign trade has grew rapidly. The net exports pushed the GDP growth maintain a high level, and stimulated the macroeconomic growth to a large extend. In 2007 the overall international economic environment will basically keep stable. All aspects of the situation show that in 2007 the foreign trade will remain actively, import and export growth will continue keep on a high level. It is expected that 2007 the import and export growth rate will reach 22.5% and 23.9%. (China Finance and Economic News, 2006)

3.1.2 The political environment

1. Bonded Zone

Zhangjiagang Bonded Zone is the unique river port-bonded area in China. Bonded Zone Customs has used the unique conditions to develop the international trade, bonded warehousing, and the export-processing. In the area, chemical, foodstuff, electronics, and textile industry all have been developed well. It has become an assembly area of high quality resources and new industrial in the Yangtze Delta economic circle, an engine of economic growth sources. The area has been an important basin of investment in China, and a bridge connecting the domestic market and overseas market.

2. Port Reform

China began the port reform in 1984. since that the government would no longer run the port construction investment. And all the ports in China began to implement the policy of “self-financing and self-reliance” to encourage the port to expand and diversify business investment by their selves. Zhangjiagang port was decentralized direct leadership of Suzhou City in 1986, after 20 years of development; it has become the first county port whose throughput over 100-million-ton in China. The Port Reform take off the shackles of Zhangjiagang port, it took the ports entered a rapid development access.

3. The analysis of port planning

Timber, grain and oil and bulk chemicals are the three major commodities of Zhangjiagang Port. Especially the establishment of the Zhangjiagang Bonded Area chemicals exchange center in 2002 took a new opportunity but also a new challenge for Zhangjiagang port to develop its chemical transport and interchange capacity.

The market has achieved a turnover of 3.47 billion Yuan in the first year of its set up in 2002. And this number has reached 17.7 billion in 2004; it was about 5.1 times of the 2002. Today's Zhangjiagang Bonded Area chemicals market has become the largest liquid bulk chemicals destination. On this basis, Zhangjiagang port planed to maintaining the advantages of the original freight, meanwhile to develop the liquid bulk chemicals transport and interchange, make sure the development goals that Zhangjiagang Port became the first liquid chemicals hub port in China.

3.1.3 The technical environment

Larger ships

Currently, using larger ships in transportation is an irreversible trend. The larger Ships increase the throughput of berthing, improve the individual crew's and port-related worker's labor efficiency, make the shipping enterprises enhanced their profitability. According to statistics, in 2004 the mainly chemicals ship who berthing in Zhangjiagang Port is in small and medium-size around 3,000 tons dwt. And by 2006 the figure of ships dwt increased to 4,000 tons, and more and more ship over 8,000 tons dwt berthing in the port.

Table 3.2 the ships tonnage Portfolio of Zhangjiagang Port berthing

Dwt(T) / Year	1000 — 1999	2000 — 2999	3000 — 3999	4000 — 6000	6000 — 7999	Above 8000
2004	7%	17%	**37%**	14%	13%	12%
2007	11%	12%	**27%**	14%	12%	**24%**

Source: collected data of the Zhangjiagang Port

3.1.4 The social environment

1. The challenging environment analysis

Zhangjiagang Port, located in the lower reaches of the Yangtze River, to the east by the East China Sea, the this area spread a lot of different ports. These ports all have their own functions and focuses; it makes the Yangtze River Delta region to form a complete port system. At the Yangtze River Delta region, there are three major professional chemicals transit and transport ports, they are the Zhangjiagang Port, the Ningbo port and Jiaxing port. But take into account of scale of the port and the importance of the domestic chemical products transit and transport. Here, we will compare the Ningbo port of Zhangjiagang Port only.

2. The challenge from the Ningbo Port

a. The chemicals berth of Ningbo Port

Zhenhai chemicals terminals of Ningbo Harbor located at the estuaries of Yongjiang; the Shore Terminal is about 1.5 square kilometers. Currently there are 7 Berths of 1,000 tons to 50,000 tons berthing capacity. It designed total handling capacity is 17 million tons; it is largest commercial bulk liquid chemical berth group in China.

Table 3.3 the berths of Ningbo Port

Name of berth	Tons (T)	Forward depth(m)	Max berthing	Design capacity	Year of commissioning
12＃	1000	－6.5	2500	30	2003
13#	3000	-6.5	5000	60	2003
14#	3000	-6.5	5000	60	1995
16-1#	10000	-9.0	15000	100	1986
16-2#	2000	-6.5	3000	50	1994
17#	50000	-14.0	80000	210	1997
18#	50000	-14.0	80000	250	2003

Source: Wang Yan, Ningbo Port Group liquid chemicals transportation development research. 2006

b. Chemicals warehousing of Ningbo Port

There are more than 160 tanks in the Ningbo Port and the capacity of these tanks is more than 670,000 cubic feet. In the tank District, there are facilities of heating, cooling, and nitrogen closed operations, and it is equipped with two sea water fire fighting pumping, and a freshwater fire fighting pumping, and equipped with biochemical sewage treatment plants and sewage water treatment plant. The irrigation district could provide the handling, storage and inter medal transportation service. It also could provide the customs, inspection reports and other services.

Table3.4Tank of Ningbo Port

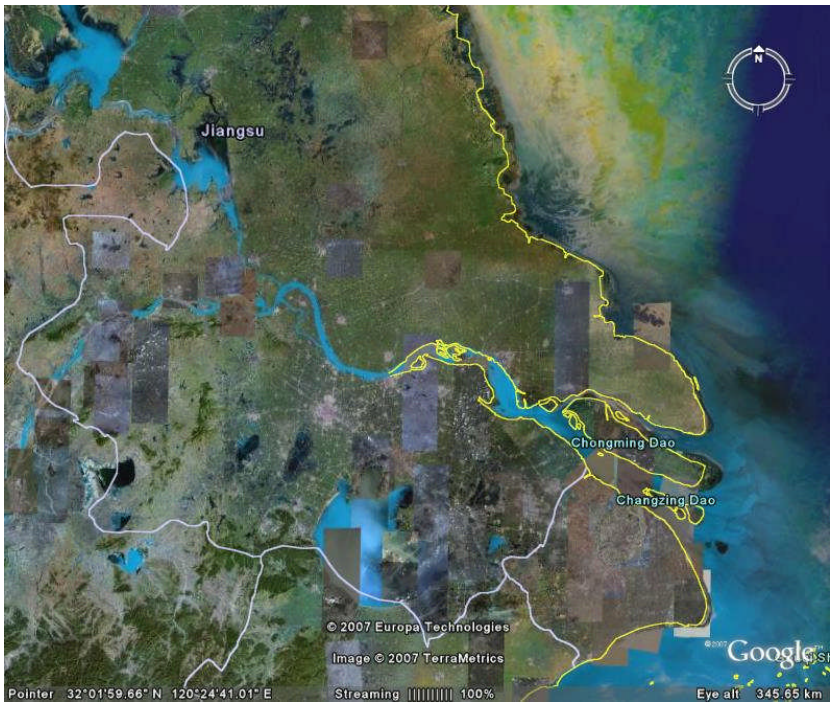
Company		Total tank capacity(T)	tanks	Tank kinds	Business model
Public Tank	Huayu	28250	14	Chemical LP	Jointly
	Haiyun	5600	3	Chemical LP	Jointly
	zhonghuajian	20000	7	Chemical LP	Jointly
	Jinhailin	19750	11	Chemical LP	Jointly
	Yueyang	18000	10	Chemical LP	Jointly
	Fubao	65200	38	Chemical LP	Jointly
	Ninxiang	13000	8	Chemical LP	Jointly
	Xinxiang	16000	4	Chemical LP	Jointly
	Ninxing	26300	13	Chemical LP	Jointly
	Zhensi	16000	8	Chemical LP	Cooperation
Private Tank	Yuandong	9900	3	Chemical LP	Cooperation
	Hangyi	15500	4	Chemical LP	Cooperation
	Cifu	9000	2	Chemical LP	Cooperation
	Tongsheng	9000	2	Chemical LP	Cooperation
	Eli.st	7200	2	Chemical LP	Cooperation
	Red sword	9000	2	Chemical LP	Cooperation
	xiangsheng	9000	2	Chemical LP	Cooperation
	Zonghang	10000	2	Chemical LP	Cooperation
	Tianyuan	9000	2	Chemical LP	Cooperation
	Huaxin	10000	2	Chemical LP	Cooperation
	Sanxin	60000	6	Chemical LP	Cooperation
	gangmao	8000	2	Chemical LP	Jointly
	LG	31000	5	Chemical LP	Owners
Subtotal (liquefied)		424700	152		
others	Shenshiyou	190000	11	Oil Tank	Owners
	Zhongran	47600	13	Oil Tank	Owners
	shunlong	14700	3	Oil Tank	Owners
Subtotal (oil)		252300	27		
Total(T)		677000	179		

Source: Wang Yan. Ningbo Port Group liquid chemicals transportation development research. SMU.2006. pp. 11

3.2 The internal environment

3.2.1 The general idea of the Zhangjiagang Port

The Zhangjiagang port was found in 1968 and committee for approval of foreign ships since the 15th National People's Congress 25th Meeting in November 1982. The port is located at the south of the lower reaches of the Yangtze River, the south-east of Jiangsu Province. It is 98 km from Shanghai, 180 kilometers from Nanjing, and 58 km from Suzhou. The channel for the vessels is called the Funan waterways which set up the 1st to 14th floating navigation lights. The channel keep the depth over 10 meters, and the ship below 30,000-ton-class could navigate no matter the days or nights. (Zhang Tongbing, 2003)



Resource: the Google earth

Figure 3.1 the location of the Zhangjiagang

Resource: the Google earth

Figure 3.2 the topographic map of the Zhangjiagang Port

3.2.2 The layout of the chemicals port

1. The chemicals berths

Currently the Zhangjiagang Port has established nigh 10,000-ton class chemical berths, which include three 50,000-ton class berths. There were also four Petrochemical berths in the port, additional, there were eight 10,000-ton-class berths being or went to be constructed. After the complicatedly construction the designed annual throughput capacity of the port will over 20 million tons per year.

Table 3.5 the layout of chemicals ports in the Zhangjiagang Port

Name of berth	Tons (T)	Forward depth(m)
1# of the International Yangtze River	50,000	-14
2# of the International Yangtze River	10,000	-10
3# of the International Yangtze River	10,000	-10
Dow Chemical	10,000	-10
Transoceanic A	10,000	-10
Transoceanic B	50,000	-14
Chemical-Link	10,000	-9
Pacific	50,000	-14
Middle East Petrochemical	50,000	-14

Source: collected data of the Zhangjiagang port

2. The chemicals tanks

All the chemicals storage capacity of the Zhangjiagang Port is more than 800,000 cubic meters which include 400,000 cubic meters' bonded storage tank.

Table 3.6 the tankers of the port

Location	Capacity	Number	Tax protected
Bonded Zone	5000	6	Yes
	4000	20	Yes
	3000	11	Yes
	2500	6	Yes
	2000	10	Yes
	1250	4	Yes
	1000	5	Yes
	500	2	Yes
Bonded Logistics Park	5000	10	Yes
	4000	5	Yes
	3000	12	Yes
	2500	20	Yes
	2000	18	Yes
	1000	12	Yes
Yangtze chemical park	8000	2	No
	5000	5	No
	4000	8	No
	3000	10	No
	1000	27	No
Yangtze high-tech industrial park	5000	7	No
	4000	10	No
	3000	15	No
	2000	20	No
	1000	27	No
Others	about100000	1	No
Total	810,000		

Source: Source: collected data of the Zhangjiagang port

3.2.3 The inter-model transport condition of the Zhangjiagang Port

Zhangjiagang Port is surrounded by the Suzhou, Wuxi, Changzhou city which with the developed economic. It is located in the jets of Yangtze river, by the Shanghai-Nanjing and Xinchang Railway, it could access the Jiangsu Expressway

Network, Shanghai-Nanjing Expressway through the Xicheng Expressway, and even the Beijing-Hangzhou Grand Canal, Taihu waterway network could also access conveniently. There is a developed inter-model system around the Zhangjiagang Port, no matter the road, railway or the waterway; we could transit the cargo efficiently. The Zhangjiagang Port is the ideal transshipment port in the middle and lower reaches of the Yangtze River.

Table 3.7 The distances of the Zhangjiagang to its major inter-model facilities

inter-model facilities		**distances KM**	**Remarks**
expressway	Shanghai-Nanjing Expressway	31	Eight lanes, the designed speed is 120km/h
	Xicheng Expressway	20	Four lanes, the designed speed is 120km/h
	Yanjiang Expressway	18	Four/six lanes, the designed speed is 120km/h
Railway	Shanghai-Nanjing railway	52	Trunk Railway
	Xinchang railway	16	Extension, link the Suzhou, Wuxi and Changzhou city
waterway	Beijing-Hangzhou Grand Canal	51	The main national north-south access
	Taihu waterway network	28	The major inland river systems of Yangtze River Delta

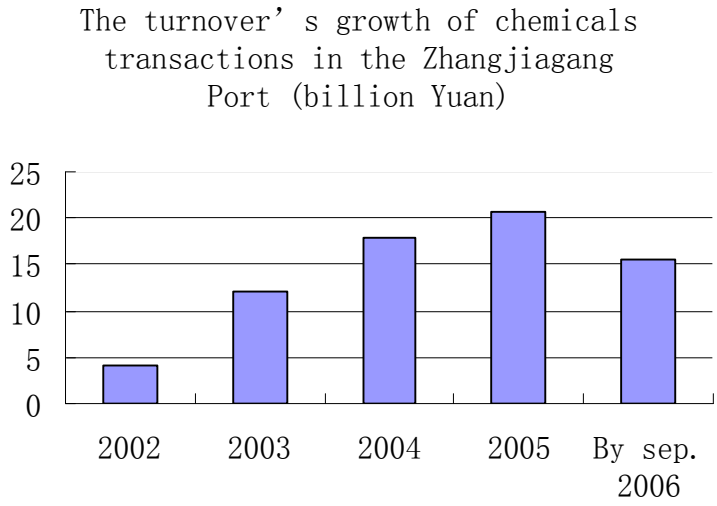
Source: collected data of the Zhangjiagang port

In addition, there is a developed highway network around Zhangjiagang Port; it could transit with the main transport facilities above quickly.

3.2.4 The throughput of chemicals cargo in the Zhangjiagang Port

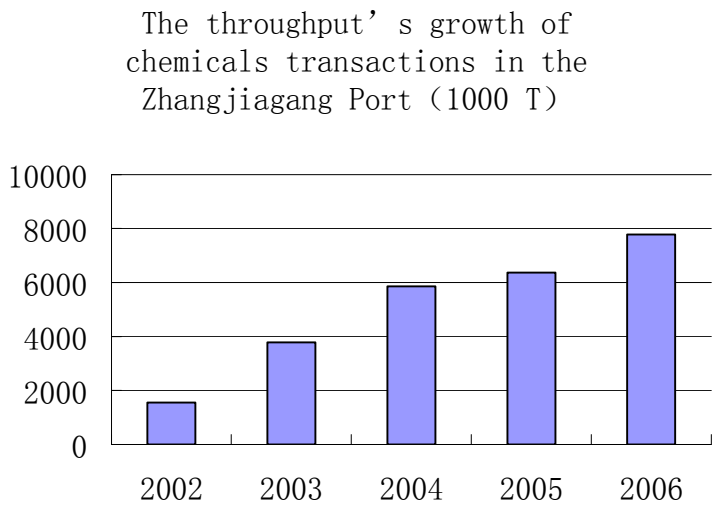
In 2006, the throughput of the Zhangjiagang port was over 100 million tons; it made the port be the first and the only county-100 million tons port in China. And the

chemicals transport in Zhangjiagang port took a major status. Along with the development of Zhangjiagang Port, its chemicals transport has made a considerable development; especially the establishment of the Zhangjiagang Bonded Zone chemicals trading market in 2002, it took a very positive promotion to the port's chemicals transport. The total turnover of the Trade Zone chemical market was 4 billion Yuan in 2002, in 2003 this finger increased to 12 billion Yuan, and for 2004 and 2005 was 17.8 and 20.6billion Yuan respectively. By the end of September of 2006 there were 569 coop rotations in the market, and the turnover has reached the amount of 15.6 billion Yuan. The chemicals throughput was increased significantly from 157 million tons in 2002 to 780 million tons in 2006.



Resource: collected of the Port data

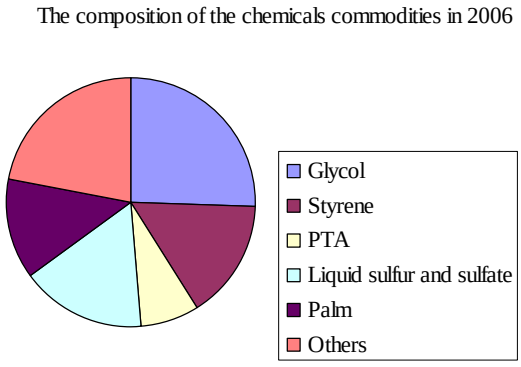
Figure 3.3 the turnover of the port



Resource: collected of the Port data

Figure 3.4 the throughput of the port

In 2006, Zhangjiagang Port involved in the following major chemicals commodities: the glycol, styrene, PTA and liquid sulfur and sulfate. The composition of the chemicals commodities in 2006 was like this:



Resource: collected of the Port data

Figure 3.5 the composition of the commodities of the port

3.2.5 The information system of the Zhangjiagang Port

Since the Zhangjiagang Bonded Zone chemicals trading market was found, it was invested nearly four million Yuan to introduce the most advanced exchange information service system for the chemicals trade in China. It also established direct links with the world famous chemical website to achieve information sharing and the foreign traders' direct communication. We can also get the first-hand world transaction price quickly through the information system to make our price more reasonable. The market also selects some domestic representative dealers to get their prices for each different product, and distinguish the truth, then after the summary to release them online.

The market cooperates with the relevant domestic and international institutions closely. Users can check the daily spot prices of Zhangjiagang chemical market through the Pushi network of the US, the Chenciross network of South Korea and some well-known domestic websites, etc.

The Zhangjiagang Bonded Zone established electronic chemicals market in 2005. Strengthening the construction of the network transactions, on-line settlement and logistics system, introduced the e-commerce transactions system for the enterprises which assigned in the market.

3.2.6 The plan of new building berth and storage ability

There are seven 10,000-ton-class chemicals berths have being or going to be constructed. The designed annual throughput capacity is over 12 million tons, it would make the port to be the largest chemicals import and export port in China.

4. The chemicals cargo resource in the Zhangjiagang Port

4.1 The development of Chemical industry

Since reform and opening up, China's petroleum and chemical industry has made considerable progress. It has been formed with more than 20 industries, would be able to produce 40,000 kinds of products, established a relatively complete, and variety industrial system. Currently, China has over 10 kinds of major oil and chemical products take the forefront of the world. But, compare to the developed petrochemical processing capacity, there are some serious shortcomings of chemical raw materials for our production, especially crude oil, synthetic resin, synthetic rubber and polyethylene capacity of the domestic supply depend on the imports to a large extent.

Table: 4.1Report of the major petrochemical products import dependency

Year	Variety	Import volume (1,000 tons)	Consumption (1,000 tons）	Reliance rate of imports%
2004	Crude Oil	122815	291722	**42.1**
2005		135792	317013	**42.9**
2004	Fuel	30539	49576	**61.6**
2005		23728	4634	**51.2**
2004	Methanol	1359	5734	23.7
2006		1306	8929	14.6
2004	Synthetic resin	1310	2343	**55.9**
2005		1299	2375	**54.7**
2004	Polyethylene	3658	9190	39.8
2005		3555	9358	38.0
2004	PVC	2002	7025	28.5
2005		2458	9105	27.0
2004	Synthetic Rubber	1095	2489	**44.0**
2005		1373	2878	**47.7**

Source: the collected of the chemicals website

Ten years ago, imports only took 6% of the overall oil demand, this figure has risen to third in 2006, and it is expected to be 60% in 2020.

4.2 The economic hinterland of Ningbo Port and Zhangjiagang Port

In this paper, it will use the shortest path method to classify the cities which within the Yangtze River Delta region into direct hinterland, indirect hinterland and cross-hinterland of Ningbo or Zhangjiagang port.

Directly hinterland refers to the area which services the area of production and consumption directly without any transit.

Indirect hinterland includes the transit hinterland and the pass-through hinterland. Transit hinterland means inter-modal transit area, while pass-through hinterland refers to this kind of hinterland whose goods transport from point A to C should pass the point B, but without any handling operations in B. (Xu Wenjuan, 2000)

Cross hinterland refers to the hinterland jointly of two different ports.

According to the definition of the State Development and Reform Commission, the Yangtze River Delta economic zone is the special region which consider the industries linkage, the geographical factors, the cultural factors region in, this area includes: Shanghai; eight cities of Jiangsu Province: Nanjing, Suzhou, Yangzhou, Zhenjiang, Taizhou, Wuxi, Changzhou, Nantong; seven cities of Zhejiang Province: Hangzhou, Ningbo, Huzhou, Jiaxing, Zhoushan, Shaoxing, Taizhou. According to the above method and the definition of the hinterland, it could classify the cities of Yangtze River Delta into the hinterland of Zhangjiagang Port or Ningbo Port as

follows:

Table 4.2 the hinterland of the port

	Direct hinterland	**Cross hinterland**	**Indirect hinterland**
Ninbo	hang Zhou、Ninbo、Zhoushan、Shaoxing、Taizhou	shanghai 、Huzhou	In addition to the Yangtze River factors, the areas along the Yangtze River, especially the upper reaches likes Anhui, and Sichuan will be included in the indirect hinterland of Zhangjiagang port
Zhangjiagang	Nanjing、Suzhou、Yangzhou、Zhenjiang、Taizhou、Wuxi Changzhou、Nantong、Jiaxing		

Source: calculate of the map

4.3 The major chemical enterprises of the Yangtze River Delta economic hinterland

4.3.1 Polyester

Chinese polyester enterprise spread across 19 provinces, autonomous regions and municipalities. Jiangsu province takes the 39% of the total production capacity of the whole country, followed by Guangdong Province, accounting for 10% of the total. Shanghai takes 9% and Zhejiang takes 9% too. East China is the most important polyester production base in China; it takes almost two-thirds of the total production capacity China.

Polyester major raw materials are PTA and ethylene glycol. Each ton of the production of polyester consume about PTA-0.86T, EG-0.338T.

In the Yangtze River Delta region, mainly involved polyester fiber manufactories are in the following areas: Xiaoshan Shaoxing, Shengze Jiangsu, and Changshu Jiangsu, Sanfangxiang fiber Group in Jiangsu and Yizheng chemical fiber in Jiangsu. According to the current situation, the PTA that imports from Zhangjiagang Port is primarily supply the Sanfangxiang Group in Wuxi of Jiangsu, the glycol import from Zhangjiagang Port supply the polyester fiber manufactories overall of the economy hinterland. This point above could prove by comparing the statistic of import volume of ethylene glycol and PTA these years of Zhangjiagang Port, and the major manufacturers' consumptions in this hinterland.

In 2006, the imports of PTA and EG from Zhangjiagang Port were 590,000 tons and 199 million tons. The produce capacity of the Sanfangxiang fiber Group is 1.2 million tons per year, because of the produce rate of the Group was around 50% in 2006, so that the demands of EG and PTA of the Group was about 520,000 tons and 210,000 tons. There are about 4.7 million tons fiber produce capacity in the hinterland, need 2.02 million tons of ethylene glycol. So, more than 99% of the ethylene glycol consumption of this hinterland is imported or transshipped through Zhangjiagang port, and the PTA which import from Zhangjiagang port was almost satisfy the Sanfangxiang Group only.

4.3.2 PVC

The PVC could classify into three major varieties: the GPPS, the HIPS and the EPS, over 98% of the raw materials of PVC was imported. There are a number of world-class polystyrene factories in the Yangtze River Delta area, especially in Jiangsu and Shanghai.

Table 4.3 the main polystyrene manufacturers in this area

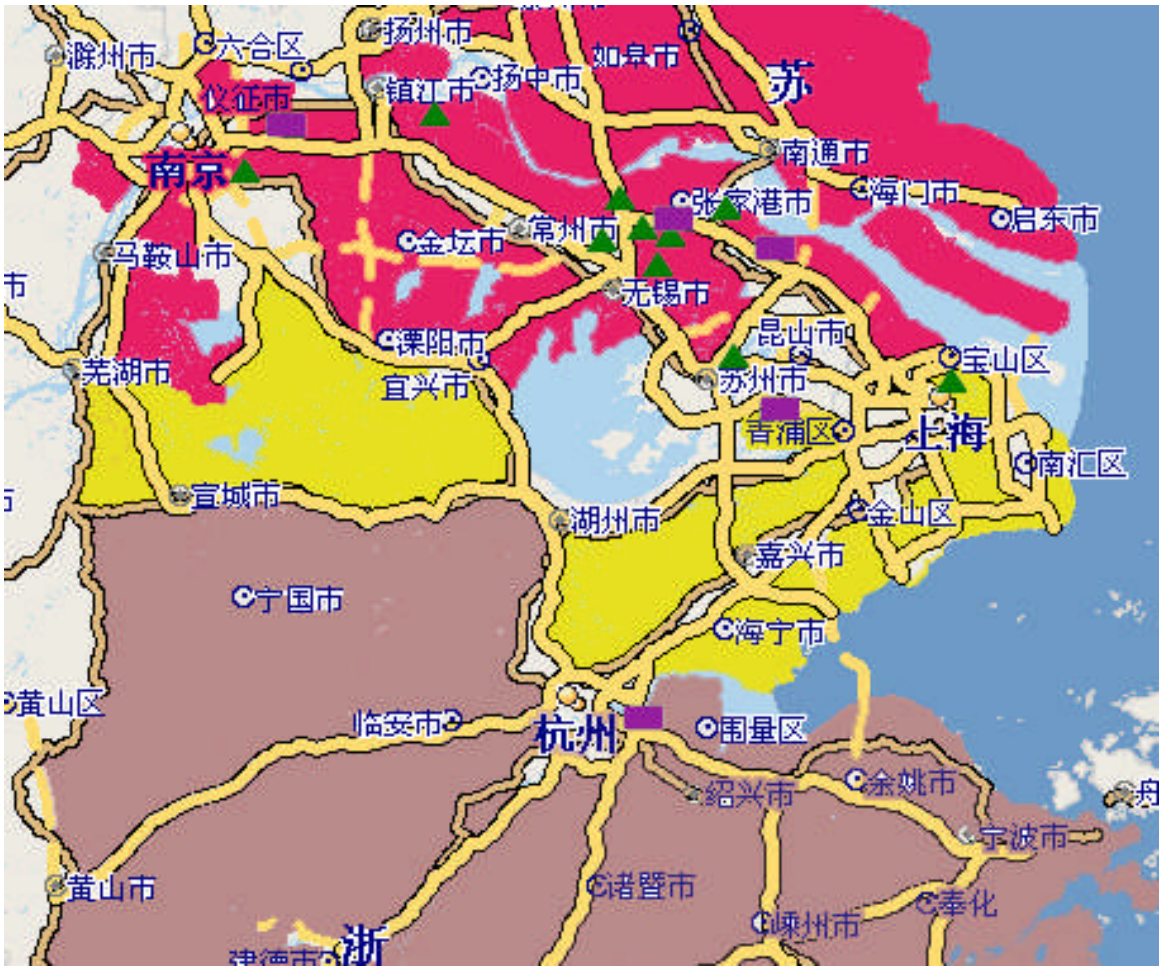
Manufacturers	**Products**	**Capacity (1000 ton/year)**	**Raw materials**	**Consumption (1000 ton/year)**	**location**
Qimei.Zhenjiang	GPPS/ABS	250	Styrene	260	Zhenjiang
BASF. Yangtze	EPS	191	Styrene	200	Nanjing
Jiangsu Xingda EPS Group	EPS	200	Styrene	210	Wuxi
Styron Petrochemical (Zhangjiagang)Co., Ltd.	GPPS	120	Styrene	125	Suzhou
Weida.Wuxi	HIPS/GPPS	200	Styrene	210	Wuxi
Jiangsu Jiasheng Chemicals Co., Ltd.	EPS	300	Styrene	315	Wuxi
Jiangsu Runhua Co., Ltd.	EPS	165	Styrene	175	Wuxi
Shanghai Gaoqiao Chemical Plant	EPS	15	Styrene	20	Shanghai
Chevron Petrochemical Company	GPPS/ HIPS	100	Styrene	105	Suzhou
Total consumption of Styrene(1000 ton/year)	**1620**				

Source: collected of the relative website

Statistics in the region mainly styrene consumption, we can see that 2006 Zhangjiagang port imports or transfers more than 75% of the total volume of styrene.

4.3.3 Sulfur and sulfate

Currently, Zhangjiagang port owns the largest liquid sulfur interim capacity in China; it has the only mature liquid sulfur seaway transit facilities in China. The major Sulfur and sulfate consulters are mainly located in the Yangtze Chemical Industry Park in Zhangjiagang and the Chemical Industry Park in Shanghai. The region consumed 1.2 million tons of sulfur and sulfate in 2006; more than 95% of them were imported from Zhangjiagang Port. (Chemical trade website)



The hinterland of the Zhangjiagang Port

The cross-hinterland of two ports

The hinterland of the Ningbo Port

The manufactory of polyester

The manufactory of PVC

Figure 4.1 the hinterland of the port and

the major chemicals manufactories in the Yangtze River Delta

5. The SWOT analysis of Zhangjiagang port chemical transport

5.1 The strength of Zhangjiagang on chemical transport

5.1.1 The strength of the port's economic hinterland

The Zhangjiagang port is in the economically developed Yangtze River Delta region, located in the last scene of the Yangtze River; it is one of the major transport hubs of the Yangtze River Delta region.

The Jiangsu, the Zhejiang, and the Shanghai account 2.2% of the total land area in China, the population of these areas account one-tenth of the whole country, and these areas create nearly one quarter of gross domestic product, and more than one third of the total foreign trade volume.

5.1.2 The regional strength of chemical industry

Yangtze River Delta region, especially the Jiangsu, accounting of 27% of the national chemical polyester production capacity, Zhejiang takes 10%, and the Shanghai takes 9%. The Yangtze River Chemical Industry Park in Zhangjiagang, Nanjing Chemical Industry Park, the Jinshan District of Chemical Industry in Shanghai and Zhejiang chemical fiber industry, they occupy a pivotal position in the national chemical industry.

5.1.3 The strength by Jiangsu factor

Comparing the three areas--the Jiangsu, Zhejiang and Shanghai which locate in the

Yangtze River Delta, we can see that, the Jiangsu region takes competitive strength in these three areas exclude the fiber products.

Table 5.1The product competitiveness index of Yangtze River Delta region by different provinces

Provinces / Products	Jiangsu	Shanghai	Zhejiang
	Competitiveness Index	Competitiveness Index	Competitiveness Index
Chemicals	17．9	0．4	9．7
Fiber products	16．4	3．9	18．2
Plastic	9．8	5．44	0．4

Source: Liu Zhibiao. (2006) CHANGSANJIAO TUOQI DE ZHONGGUO ZHIZAO. People's University of China Press. PP127

5.1.4 The strength on inter-model transport situation

The Zhangjiagang Port locates in the central of Yangtze River Delta region. Is has the developed roadway, railway, and waterway network around the hinterland. There are three major expressways named the Huning, Xicheng, and Yanjiang, two major railway which named Huning, Xinchang, and the developed waterway system which is consisted of the Yangtze River, the Beijing-Hangzhou Grand Canal and the Taihu River. This inter-model transport system could achieve the multimodal transport, provide the door-to-door logistics services.

5.1.5 Advanced information systems and market model

The establishment of the Zhangjiagang Bonded Zone chemicals trading market in 2002 took an unprecedented opportunity to Zhangjiagang port to develop its chemicals transport service. Thanks to the flexible and efficient operation of the market, and the encourage of the preferential policies, along with the growth of chemical industry in

Zhangjiagang, the Bonded Zone chemicals market has become the largest bulk liquid chemicals transactions, and spreading center in China.

Since the market was set up the related departments took great efforts on its Information System. They have cooperated with the world's major chemical trade network, it has made the customers to understand the dynamics industry market timely and make the judgment efficiently. In 2005, the market established the first online trading market for chemical products in China as an addition of the original market trading patterns, with that the customers could do the purchase, sales, and clearing on line without the actual venue. The on-line market not only improves the efficiency of the trade, but also enhances the class of the market, to convergence it with the world economy.

5.1.6 Large terminal building

Currently Zhangjiagang port owns 9 professional chemical products terminal, which was consisted by three 50,000-ton-class terminal and six 10,000-ton-class terminal. There are another seven 10,000-ton-class chemicals terminal have been or planed to build; it could meet the modern ships larger trend very well.

5.2 The weakness of Zhangjiagang on chemical transport

5.2.1 The restrictions of the river port

Compared with the major competitor—the Ningbo Port, Zhangjiagang port is a river-port, which will certainly lead to a series of adverse factors. For example, as a river-port the capacity of the self-cleaning is limited, which increase the risk of

chemicals transport of Zhangjiagang Port. Once the chemicals leaking, it is difficult to treat and the treatment costs will be significantly.

5.2.2 The space constraints in port development

Zhangjiagang Port has 14 km nature coastline, the available coastline is 4.70 km. Currently the Zhangjiagang port has 51 10,000-ton-class terminal, which include 31 International opened Shipping Terminal, added to the 7 planning or constructing 10,000-ton-class chemicals terminals, the available coastline which could be used is very limited.

5.2.3 The complex composition of the terminal and the imperfect of internal management

Currently, there are 5 companies operate the 9 professional chemical ports in Zhangjiagang Port, they are international Yangtze River, Pacific Chemical, Dow Chemical, the Chemical-Link, and the Transoceanic international chemical. This situation makes the port in a complex Component, and the chaotic management. This status brings the difficult to form a unified goal of the port. It increases the difficulty of the management, and decentralized the competitiveness of the port. It is difficult to form the core strengths of the port in an increasingly competitive market environment. It brings the low efficiency in the port management, and makes the customer complaints increased significantly that affected the image of the port to their clients.

5.3 The opportunity of Zhangjiagang on chemical transport

5.3.1 The opportunity by the development of chemical industry

Since the 1990s, China's chemicals industry has made a significant progress. The development of chemical industry contributed to the prosperity of chemical products transport market.

Here I will give a brief introduction of domestic consumption of the major chemicals which are transported in Zhangjiagang port:

1. EG

Whit the rapid development of polyester industry's in China, the consumption of glycol is growing year by year. In 2005 the apparent glycol consumption of China was 5.0883 million tons; the average annual growth rate of chronology consumption during 2000 to 2005 was about 21.06%.

2. Styrene

In 2006, the demand of in China was more than 3 million tons, while the domestic production of styrene was just about 110 million tons. That means the China imported more than 2 million tons of styrene in 2006.

3. PX

In 2006, the import of PX of China was as high as 1840 thousand tons. That the main import was from the Japan and the Korea, the Japan’s exports in 2006 was about 856,000 tons, accounting for 46.5% of total Chinese imports and the number for is about 770,000 tons, and 42%. It is expected that the import of PX of China will reach 2.7 million tons in 2007.

5.3.2 The difference of Chemical industry between the Jiangsu and Zhejiang

Currently, just in the polyester fiber chemical industry, the Zhejiang has the similar scale to Jiangsu, but in other aspects such as plastic, tannery and chemical pesticides its scale and technology is far away behind the Jiangsu. This situation makes the difference of the chemical materials between Zhejiang and Jiangsu to some extent, and has reduced the competitiveness of them. It is good for the development of the Zhangjiagang port.

5.3.3 The establishment of the Yangtze Chemical Industry Park

Jiangsu Yangtze River International Chemical Industrial Park and Suzhou Fine Chemical Corner Zone is in the direct economic hinterland of Zhangjiagang port. Currently, a number of world famous transnational chemical companies, such as the United States chevron, Unocal, Dow Chemical, DuPont, Japan's Asahi Kasei companies have already set up their branches in the Yangtze River International Chemical Industrial park, the International Chemical City has already begun to take shape.

5.4 The threat of Zhangjiagang on chemical transport

5.4.1 The threat of Ninbo port

Ningbo and Zhangjiagang are two equally competitors in the Yangtze River Delta. In the new historical period the Ningbo Port is developed with its own advantage too. Firstly the Ningbo port is a sea port, which enjoys the deep-water coastline and the better port self-purification ability. It has the sufficient space coastline for development. Furthermore, it is back by the powerful Zhengjiang economy. All these

aspects take the great potential of the development to Ningbo Port. This is the challenges that must face to by the Zhangjiagang in its development.

5.4.2 The challenges by the larger ships

Though the analysis in text 3.3.1—the larger ships, we know that the larger ships be put into the shipping market has become an irreversible trend. More and more large, specialized chemical products ships are put into usage. This trend asked high requirements of the hardware like the port facilities and the software like the port personnel management in the development of modern port. The ability to seize the opportunity to develop the port in its hardware and software will be the key to the ports' successful in a long period of time.

5.4.3 The restrictions of the market size

From the analysis of the third chapter, we can see that the Zhangjiagang port almost occupied the whole chemical transport market of the direct hinterland in some kinds of chemicals consumption, especially in styrene (90%), PTA (88%) and glycol (71%). For the port's development, it cannot rely on the increase of the occupancy of the market but the expansion of the market itself.

Summarizing the above analysis, we can show the strengths, weaknesses, opportunities and challenges of the chemicals transport in the Zhangjiagang Port in the table below:

Table 5.2 the SWOT table

	The strength	The weakness
Internal environment	S1 The strength of the port's economic hinterland	W1 The restrictions of the river port
	S2 The regional strength of chemical industry	W2 The space constraints in port development
	S3 The strength by Jiangsu factor	W3 The complex composition of the terminal and the imperfect of internal management
	S4 The strength on inter-model transport situation	W4 The lack of experts
	S5 Advanced information systems and market model	W5 The lack of financing channels
	S6 Large terminal building	W6 The imperfect Logistics systems
External environment	The opportunity	The threat
	O1 The opportunity by the development of chemical industry	T1 The threat of the Ninbo port
	O2 The difference of Chemical industry between the Jiangsu and Zhejiang	T2 The challenges by the larger ships
	O3 The establishment of the Yangtze Chemical Industry Park	T3 The restrictions of the market size

5.5 The evaluation of the external and internal elements in the chemicals transport development of the Zhangjiagang Port

5.5.1 The EFE matrix of the chemicals transport development of the Zhangjiagang Port

1. Identify external factors

The external elements in the chemicals transport development of the Zhangjiagang Port

Table 5.3 the external environments

opportunity B1	O1 The opportunity by the development of chemical industry
	O2 The difference of Chemical industry between the Jiangsu and Zhejiang
	O3 The establishment of the Yangtze Chemical Industry Park
treaty B2	T1 The threat of the Ninbo port
	T2 The challenges by the larger ships
	T3 The restrictions of the market size

2. Determine the weights of the factors

By AHP to determine the factors' weights.

a. To establish the hierarchical structure, the target layer is the Zhangjiagang Port chemicals transport development strategy, guidelines layer is the opportunities and challenges that the Zhangjiagang Port face to in its chemicals transport development, the program layer is the key factor what has been identified.

b. Establishment of judgment matrix, through the analysis and judgment of the relative importance of the lower layer elements in terms, the judgment will put in the matrix. With 1-9 scaling law to express importance by the expert-level grades and establish the judgment matrix. 1-9 scaling means compare the elements two by two, the relative importance between objectives i and j recorded as ^{a}ij. We judge the relative importance between two elements in the following way:

Table 5.4 the judgments

The relative importance（the value of ^{a}ij）	**The Judgments**
1	The comparing two objectives are equally important
3	The former is slightly important than the latter
5	The former is obviously important than the latter
7	The former is strongly important than the latter
9	The former is vital important than the latter
2,4,6,8	The median adjacent of the above judgment
Countdown	If the element i compare to j, the value is ^{a}ij; then the element j compare to i the value is ^{a}ij＝1/^{a}ji.

Here we recode the comparing results between objects i and j is ^{a}ij, then all the comparing results of the weight of every two objects can be recoded as the matrix A:

$$A = \begin{matrix} {}^{a}11\ {}^{a}12\ldots\ {}^{a}1n \\ {}^{a}21\ {}^{a}22\ldots\ {}^{a}2n \\ {}^{a}n1\ {}^{a}n2\ \ldots\ {}^{a}nn \end{matrix} = \begin{matrix} {}^{w}1/{}^{w}1\ {}^{w}1/{}^{w}2\ldots\ {}^{w}1/{}^{w}n \\ {}^{w}2/{}^{w}1\ {}^{w}2/{}^{w}2\ \ldots{}^{w}2/{}^{w}n \\ {}^{w}n/{}^{w}1\ {}^{w}n/{}^{w}2\ldots{}^{w}n/{}^{w}n \end{matrix}$$

c. Calculation of vector weight. After we get the matrix A, we can calculate the vector weight of the matrix. The usual methods of this calculation are the adder, root, characteristics root, and the least squares. This paper we will use the root method to calculate the vector weight.

Table 5.5 the judgment matrix of the opportunities and challenges

A	B1	B2	Weight
B1	1	2	0.67
B2	1/2	1	0.33

Table 5.6 the Weight judgment matrix of the opportunities

B1	O1	O2	O3	Weight
O1	1	1/4	1/5	0.0935
O2	4	1	1/3	0.2798
O3	5	3	1	0.6267

Table 5.7 the Weight judgment matrix of the treaty

B2	T1	T2	T3	Weight
T1	1	2	1/5	0.1865
T2	1/2	1	1/4	0.1265
T3	5	4	1	0.6870

3. The valuations of the factors

The valuations of the facts are made by the importance of the key factors of the Zhangjiagang Port. to the extent of the impact of. In this paper, we use the expert scoring method to value the external factors and other factors that affecting the development of the Zhangjiagang Port. According to the weights and valuations we build the EFE matrix:

Table 5.8 the EFE matrix for the Zhangjiagang Port chemicals transportation

	The key external factors	**Weight**	**Score**	**Weighted Score**
opportunity	O1 The opportunity by the development of chemical industry	0.0624	2	0．125
	O2 The difference of Chemical industry between the Jiangsu and Zhejiang	0.1867	3	0．560
	O3 The establishment of the Yangtze Chemical Industry Park	0.4178	5	2．090
treaty	T1 The threat of the Ninbo port	0.0621	4	0．248
	T2 The challenges by the larger ships	0.0422	2	0．084
	T3 The restrictions of the market size	0.2290	3	0．687
	Total	1		**3．794**

Based on the foregoing analysis, the total external environment weighted score is 3.794, it is much higher than the average, it means that there is a great opportunities for the chemicals transport of the Zhangjiagang Port.

5.2.2 The internal factors

Similar to the methods of the external factors, we can make the IEF matrix:

Table 5.9 the judgment matrix of the strengths and weaknesses

A	B3	B4	Weight
B3	1	2	0.5
B4	1/2	1	0.5

Table 5.10 the Weight judgment matrix of the strengths

B3	S1	S2	S3	S4	S5	S6	W
S1	1	1/4	1/3	1	1/2	1/3	0.0723
S2	4	1	1/2	2	1	1	0.1857
S3	3	2	1	3	3	1/2	0.2553
S4	1	1/2	1/3	1	1/2	1/3	0.0811
S5	2	1	1/3	2	1	1/2	0.1378
S6	3	1	2	3	2	1	0.2678

Table 5.11 the Weight judgment matrix of the weaknesses

B4	W1	W2	W3	W4	W5	W6	W
W1	1	3	4	2	1/5	6	0.2736
W2	1/3	1	4	1/4	2	2	0.1639
W3	1/4	1/4	1	1	1/3	1/3	0.0683
W4	1/2	4	1	1	3	1/3	0.1754
W5	5	1/2	3	1/3	1	1/3	0.1516
W6	1/6	1/2	3	3	3	1	0.1672

Table 5.12 The IFE matrix for the Zhangjiagang Port chemicals transportation

	The key internal factors	Weight	Score	Weighted Score
Strengths	S1 The strength of the port's economic hinterland	0.0484	1	0.0484
	S2 The regional strength of chemical industry	0.1244	2	0.2488
	S3 The strength by Jiangsu factor	0.1711	3	0.5132
	S4 The strength on inter-model transport situation	0.0543	3	0.1087
	S5 Advanced information systems and marke model	0.0923	3	0.1847
	S6 Large terminal building	0.1794	3	0.5383
Weaknesses	W1 The restrictions of the river port	0.0903	3	0.2709
	W2 The space constraints in port development	0.0541	4	0.2163
	W3 The complex composition of the terminal and the imperfect of internal management	0.0225	2	0.0451
	W4 The lack of experts	0.0579	2	0.1158
	W5 The lack of financing channels	0.0500	1	0.0500
	W6 The imperfect Logistics systems	0.0552	2	0.1104
	Total	1		**2.597**

Based on the foregoing analysis, the total internal environment weighted score is 2.6, it is higher than the average, it means that the inter environment is also good for the development of the chemicals transport of the Zhangjiagang Port.

According to the SWOT analysis, there are some great opportunities and internal conditions for the Zhangjiagang Port to develop its chemicals transport. The Zhangjiagang Port is at the right upper region of the SWOT matrix that means we should adopt the growth strategy for its development in the chemicals transport.

6 The countermeasures for the Zhangjiagang Port

6.1 The target of the development

6.1.1 The forecast for the throughput

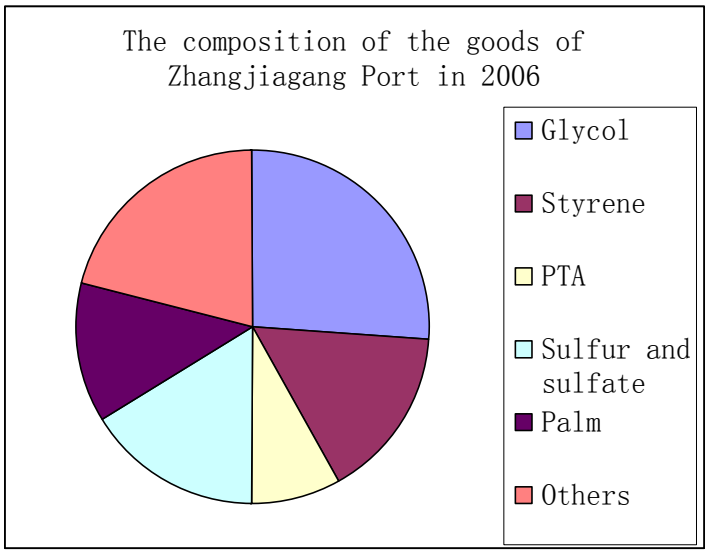
Because the development of the chemicals transport of the Zhangjiagang Port just experience five year, it cannot collect the long-term historical data to make the throughput forecast, and consider of the facts which influence the Zhangjiagang Port's throughput in a great extend, we cannot make a accurate forecast by the model which base on the historical data. So this paper will adopt the qualitative prediction model to make the forecast for the throughput of the Zhangjiagang Port's chemicals transport for the following discussion about the strategy of the port.

Through the analysis of preceding context, we know that the major chemicals goods in the Zhangjiagang Port are as follows:

Table 6.1 the composition of the goods of Zhangjiagang Port in 2006

goods	**Glycol**	**Styrene**	**PTA**	**Sulfur and sulfate**	**Palm**	**Others**
Throughput （1000 tons）	1990	1220	590	1280	1000	1720
percentage	26%	16%	8%	16%	13%	21%

Source: collected of the port data



Source: collected of the port data

Figure 6.1 the composition of the commodities

1. The forecast for the throughputs of the Glycol and PTA

According to preceding paragraphs say, the glycol and PTA are mainly used to polyester. There are 17 large polyester manufactures which consume the glycol and PTA locate in the directly economic hinterland of the Zhangjiagang Port and the totally productivities is about 4,700,000 tons/years. The leaders among them are Sanfangxiang Group which has the capacity of 1,200,000 ton/year, the Yizhen Group (600,000 ton/year), the Taicang Shenjiu Group (400,000 ton/year), and the Huaxi Group (200,000 ton/year) etc. though the analysis above, we can get the consumption of the glycol and PTA of this hinterland is about 4,040,000 and 1,590,000 tons per year. Because allover the productivities cannot be fully used for the influence by the market, especially in the 2006, the market was not so good for all the manufactories. So it was obviously that the manufactories would not fully use their capacity. But we cannot get the operating rate for the security reason. Through the hardly research, we get an estimate rate for the Sanfangxiang Group was 50% in 2006, and we suppose

that number as average level in this hinterland.

Take the 50% as the average level, we can get the consumption of the glycol and PTA was 2,020,000 and 800,000 tons in 2006, and the imports from the Zhangjiagang Port were 1,990,000 and 590,000 tons. That means this port almost occupied all the hinterland market of the glycol (99%) and PTA (73%). Let's look at this situation in another direction that also means the throughput of the Zhangjiagang Port was basically depended on the rate of the proportion, and this rate was depended by the situation of the market.

Suppose the total chemicals processing capacity of China will remain the same in the few years later, Under existing productivity constant assumption premise, we can estimate the throughput of the glycol and PTA in Zhangjiagang Port use the following function: $Q = q \times (1+a)$, here the Q-the throughput of 200X, q-the throughput of 2006, a-the growth rate of 200X.

The related data show that in the future 5～10 years in China the amount of polyesters consumption will increase by 7.4%, then we get the following form:

Table 6.2 the throughput forecast of the glycol and PTA in Zhangjiagang

Year	2007	2008	2009	2010	2011
Glycol (1000 ton)	2189	2408	2649	2914	3205
PTA (1000 ton)	649	714	785	864	950

2. The forecast of styrene throughput

There are 9 PVC manufacturers (mainly user of the styrene) with a total PVC produce capacity about 1.541 million tons per year, and the consumption of styrene is around 1.62 million tons per year. And over 98% of the total consumption was imported from foreign country. In 2006, this port has imported or transited 1.22

million tons of the styrene, accounting for annual consumption of 75% in this area. Because of the shortage of the PVC produce capacity, the operating rate was so high, around 90% in 2006. All the growth of the styrene throughput is depended on the new built productivity in this area; the throughput cannot increase dramatically if the capacity remains the same. So we will keep the styrene throughput under our former suppose.

3. The forecast of the throughput of the sulfur

Similar to the styrene, the throughput will keep stable.

6.1.2 The development objectives

Through the throughput forecast and the foregoing analysis, we can see that the throughput of the Zhangjiagang port is determined by the changes, and trends of international and domestic chemical market to a large extent. Therefore, the strengthening of the market analysis and forecast, fast and flexible to respond to the market changes, will be the key to success. Base on the above, we propose to ensure the first position for Zhangjiagang Port in chemicals transportation in China.

6.2 The countermeasures

For the achievement of the development objectives of the Zhangjiagang port we propose the following measures:

6.2.1 Establish a perfect monitoring system on chemical market

From the above analysis, the changes of market condition will impact the port

demand dramatically. So building a perfect market monitor system, especially enhancing the monitor of the domestic chemical market to hold the trend and make preparations in advance should be a Wise countermeasure for the port.

6.2.2 The differential development with the Ningbo Port

According to the above analysis we know that Jiangsu and Zhejiang are the important polyester-chemical fiber bases. Jiangsu takes up 39% of Chinese polyester-chemical fiber and Zhangjiagang is only transit shipment port for liquid sulfur in China east region. So in terms of the types of chemical goods, there are fundamentally difference between the Zhangjiagang and Ningbo. It is unnecessary to make a completely competition with Ningbo Port in all types of the chemicals cargo, and only need to take good care of our vantages: Liquid Sulfur、Styrene and Glycol.

6.2.3 Improving services to increase the added value of the services

Zhangjiagang almost has the whole local chemicals transportation market, Styrene takes up 99%、Glycol is 75% and Liquid Sulfur is 100%. So it is so different to increase the market share under this condition. What we can do right now is improve our services to raise the added value of the services.

6.2.4 Rely on the advantages of Yangtze River Chemical Industry Park continually, and speed up the port development

The Yangtze River Chemical Industrial Park is located in the east of the Zhangjiagang bonded area; the planning area for the first phrase is 6.64 square kilometers. Currently there are a lot of famous chemicals companies located in it,

likes the Chevron Phillips Chemical Company with 100,000 tons/year of polystyrene productive, the Dow Chemical Industrial Company with 120,000 tons/year of polystyrene productive, and the Tung Wah Group of Unocal LPG storage and transport, etc.

The second phase of the park is building; the planning area for it is 6.64 square kilometers too. The mainly projects which will be adopted in it is the POM project, PTA project and Methylamine project, etc. Meanwhile, the park is planning to enlarge the capacity of the existed companies. All these will ask a huge chemicals transport demand of the Zhangjiagang Port. As a port, it could rely this opportunity to develop and make a win-win situation between the chemicals companies and the port.

6.2.5 Reinforcing the port safety and introduce the Professional Consult Companies.

By the limitation of the riverside port, there are some inevitable shortages of Zhangjiagang Port. For the safety issue, the self-cleaning ability for this port is poor; it is the considerable shortage in the port safety management particularly in the chemicals transportation. To solve this problem, need to improve the safety management, make and implement a more prefect safety polices for the port. In addition, a professional advice is needed; the port could introduce some international experienced advisory companies for the port safety management.

6.2.6 Reorganization and cooperation between the chemicals transport enterprises

The component of the chemicals transport companies in the Zhangjiagang Port is too complex, and lack of the internal coordination among them. It takes a negative

impact on the establishment of an integrated logistics system in the port. To resolve this problem, the following should be done:

1. Accelerate the optimize reorganization of the chemicals enterprises. 2. Increase the coordination between the enterprises, and establish and improve the EDI system.

3. Adopt the independent advisory and intermediary companies provide professional advice and services for the logistics supporting, thereby strengthening the coordination.

6.2.7 Increase the HR reservation, train the professional personnel

In recent years, thanks to the rapidly developing economy, most of the major ports in China meet a tremendous and unprecedented opportunity for their development. It brings a shortage of the port experts, especially in the area of professional chemicals transportation. As a county port, the Zhangjiagang Port is difficult to attract senior professionals even.

Facing this situation, the only thing that the port can do is increasing the capital investment on HR, and training their own professionals to meet the needs of the development.

6.2.8 Expand financing channels; build the owner’s berths and tanks.

It is necessary to increase the capital investment to accelerate the development of the port. Been supported by the local government, the port has got adequate finance in the past years, but this kind of support is not sufficiently for the recently situation, the port should find the money through other channels too. To develop the owner’s berths and tanks could not only solve the finance shortage problem, but also attract the customers to give the port a long-term cargo resource support.

6.2.9 Improve the logistics system

To consolidate the lead position of the Zhangjiagang Port's chemicals transportation in China, raise the overall competitiveness of the port, increase the added value during the whole transportation process, the port should develop a modern integrated port system which component by the exchange, storage, processing and logistics, etc.

This port has established a Zhangjiagang Bonded Zone chemicals market which includes the exchange, storage, and logistics elements in 2002, and has had a made great achievements. In addition, the port could rely on the huge transport demand by the Yangtze River Chemical Industry Park to develop a more comprehensive and integrated logistics system to meet the customer needs better.

6.2.10 the Information Strategy

Since the establishment of the Zhangjiagang Bonded Area chemicals market in 2002, the market took very care of the information system construction and has got good achievement. But in the previous system, it only emphasis on the exchange functions and omit the logistics management. So it should reinforce the logistic management to create better, faster and more convenient comprehensive logistic services.

7. Conclusion

Firstly, this paper analyzes the external and internal environment of the chemicals transport in the Zhangjiagang port. Then discuss the main source of the transport demand. After that analysis, this paper use SWOT and AHP methods to mark the factors which discuss in the forepart of the paper. Finally, advance a develop objective to ensure the first position of the chemicals transportation for the Zhangjiagang Port in China.

For realization of this goal, a series of countermeasures have been advanced, including:

1. Establish and improve the monitoring system on the chemical market for a rapid response of the port;
2. The differential development with the competitors
3. Develop the high value-added service
4. Rely the support by the hinterland
5. Enhance the port safety management
6. Reorganization of the port related companies
7. Increase the HR reservation
8. Expand financing channels
9. Improve the logistic system
10. Improve the port information system

This paper tries to advance an overall development target of the chemicals transportation for the Zhangjiagang Port, and develop some countermeasures to realize this objective. And it also wants to give some help for the Zhangjiagang Port of its chemicals transportation development.

Reference List

Articles

Lu Guanggui. (1999). Organic chemicals market analysis. Application Technology Press.

Textbook

Michael A. Hitt, R. Duane Ireland & Robert E. Hoskisson. (2006). Strateggic management. THOMSON SOUTH-WESTREN. pp.39-49, 52-59, 78-83.

(UNCTAD, 1992) subsequent references to that source

K.J. Andrews. (1971). A concept of the corporate strategy. Harvard Business School.

Benjamin Cuige. (1992). A Strategic IQ test.

Berkeley Philippe • Saicinike. (1957). The capacity of leadership. University of California.

Chandler. (1962). Strategy and Structure. MIT.

Zhang Tongbing. (2003). Guide for the traffic routine system of the Jiangsu part of the Yangtze River. Dalian Maritime University press. pp.27, 173-177

Liu Zhibiao. (2006). CHANGSANJIAO TUOQI DE ZHONGGUO ZHIZAO. People's University of China Press. PP. 127

Qian Qinglan. (2006). The new theory for China’s manufacturing competitiveness.

Science press. pp. 18

Ni Yifang, Wu Xiaobo. (2001). the Evolution of the Strategic Management Thinking. Economic Management.

Wang Yingluo, Xi Youming. (1990). A Theory on Strategic Studies and Enterprise Strategy. Xi'an Jiaotong University Press.

Liu Yisheng. (1995). Enterprise Management Strategy. Tsinghua University Press.

Raymond H. Myers. (2000). Classical and Modern Regression with Applications. THOMSON SOUTH-WESTREN

Electronic resources

Li Heyu. (2006, April 26). China Anti-Money Laundering Act.

Shanghai Securities News. Retrieved April 26, 2007 from the World Wide Web: http://www.ce.cn/law/shouye/jgdt/200604/26/t20060426_6819627.shtml

The Port Advisory Network website gives a discussion about the Fourth-generation port

(http://www.thechoice.net.cn)

The Zhangjiagang Bonded Area chemicals market website give a general idea about this market

(Http://www.zjg56.com/scjj.htm)

Article with on author:

Zhangjiagang port development is about to face the port can use coastline shortage.

Retrieved Mar 3 2007 from the World Wide Website:
Http: //www.info.jctrans.com/xinwen/hyxw/gk/200692 296490.shtml.

Article with on author:
China's Polyester industrial development Analysis. （2006, Jun 15). Chinese polyester Network. Retrieved Mar 17 2007 from the World Wide Website:
http://www.juzhi.com.cn/index_Article_Content.asp?fID_ArticleContent=1004

Article with on author:
The top 100 enterprises in Chinese organic chemical raw materials. (2003, October). Chemical Techno-Economics. Retrieved Mar 20 2007 from the intranet of the SMU:
http://202.121.212.103/

Article with on author:
Fine Chemical Technology and Market Analysis. (2005, Apr.) Refinery Technology and Engineering Retrieved April 3 2007 from the intranet of the SMU:
http://202.121.212.103/

Theses and research papers

Wang Yan. (2006). Ningbo Port Group liquid chemicals transportation development research. SMU. pp. 11-15

Xu Wenjuan. (2004). The research of the development of the Changshu Port. SMU. pp. 16

Appendix 1

Please mark the importance of each two facts use the standard in the judgment table:

B1	S1	S2	S3	S4	S5	S6	B2	W1	W2	W3	W4	W5	W6
S1							W1						
S2							W2						
S3							W3						
S4							W4						
S5							W5						

B3	O1	O2	O3	B4	T1	T2	T3
O1				T1			
O2				T2			

The judgment table

The relative importance（the value of ^{a}ij）	**The Judgments**
1	The comparing two objectives are equally important
3	The former is slightly important than the latter
5	The former is obviously important than the latter
7	The former is strongly important than the latter
9	The former is vital important than the latter
2,4,6,8	The median adjacent of the above judgment
Countdown	If the element i compare to j, the value is ^{a}ij; then the element j compare to i the value is ^{a}ij＝1/^{a}ji.

The facts want to be marked

	The strength	The weakness
Internal environment	S1 The strength of the port's economic hinterland	W1 The restrictions of the river port
	S2 The regional strength of chemical industry	W2 The space constraints in port development
	S3 The strength by Jiangsu factor	W3 The complex composition of the terminal and the imperfect of internal management
	S4 The strength on inter-model transport situation	W4 The lack of experts
	S5 Advanced information systems and market model	W5 The lack of financing channels
	S6 Large terminal building	W6 The imperfect Logistics systems
External environment	The opportunity	The threat
	O1 The opportunity by the development of chemical industry	T1 The threat of the Ninbo port
	O2 The difference of Chemical industry between the Jiangsu and Zhejiang	T2 The challenges by the larger ships
	O3 The establishment of the Yangtze Chemical Industry Park	T3 The restrictions of the market size