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World Maritime University

Shanghai, China

**The strategy of Yingkou port development under the competition
and cooperation among three major ports in Liaoning province**

By

Dong Yangzi

CHINA

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

MASTER OF SCIENCE

ITL

2011

DECLARATION

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

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

(Signature):_____

(Date):_____

**Supervised by Professor
Wang Xuefeng
Shanghai Maritime University**

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Abstract

Along with the development of global trade, competition between ports is getting increasingly violent, which has now reached a perfervid state. Now, with the policy of revitalizing industrial economic of northeast has proposed, it accelerate the economic development of the Northeast. The north-east port group as one of Bohai ports, the competition between the internal ports are becoming fiercely. Yingkou port is the China's second largest open port in northeast; it plays an important role in our national economic development. Dalian port as a major northeastern port group plays an extremely important role in accelerating economic and social development. Dandong port as the international trade port in the northern tip of the mainland coastline in China also plays a significant role in north-east economic development. Three ports have good historical precipitation and resource endowments and form a pattern competition of "Three-Port-Opposition". Facing the strong competition, how Yingkou port to survive in this environment; what kind of strategies to achieve the greatest room for development is faced to us.

In this paper, we start from the connotation of the port competitiveness and features, the causes of the port, content and determinants of the port competition, analyze the competitive pressure of Yingkou port among the Liaoning littoral ports, and then uses the principal component analysis to empirical analyze the competitive power of Yinkou port among Liaoning littoral ports. Defined the level of Yingkou port competitiveness and the presence of the advantages and disadvantages, finally we use Pigs Game theory to analyze the cooperation between them and put forward countermeasures about Yingkou port from the overall and long term development.

Key words: Port Competitiveness, Principal Component Analysis, Pigs Game.

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Chapter 1 Introduction

1.1 Background Information

Along with the world economic development, the modern port is becoming the busiest business area. However, with the expansion of modern port function, competition between ports is getting increasingly violent, which has now reached a perfervid state. Now, with the policy of revitalizing industrial economic of northeast has proposed, it speeds up the economic development of the Northeast. The north-east port group as one of Bohai port group, the competition between those ports are becoming fiercely.

Yingkou port is located in the north side of Liaoning Peninsula which is the China's second largest open port in northeast; it plays an important role in our national economic development. Dalian port as a major hub in northeastern port group plays a vital role in accelerating economic and social development. Dandong port as the international trade port in the northern tip of the mainland coastline in China also plays a significant role in north-east economic development. Three ports have good historical precipitation and resource endowments, and with a series policy have proposed to support regional economic development in northeast, which gives an opportunity for the development of Liaoning littoral port. Dalian port will be developed targeting: "an important international shipping center in Northeast Asia", Dandong port will be targeted at "the recent sea of the new sea channel in Northeast" and Yingkou port will be targeted at "the most important hub in Northeast". The situation about "Three-Port-Opposition" has been formed, and for the time being, the competition is more than the cooperation between those ports. Facing the strong competition, how Yingkou ports survive in this environment? What kind of strategies should Yingkou port make to achieve the greatest room for development? Therefore, it's essential to find a best strategy for Yingkou port development according to the port competitiveness and the cooperation among Liaoning littoral ports.

1.2 Literature Review

1.2.1 Foreign research on the port competitiveness

Port is the main body of port enterprises and the port competitiveness is started from enterprises competitiveness. Japanese government has put forward the enterprises competitiveness earlier in the fifties. In the seventies and eighties, US government also began to study the enterprises competitiveness. But in general, western scholars on the theory of market competition can be attributed to two main theory that is Michael Porter, who represented by the theory based on competitive strategy; Prahalad and Hamel, who represented by the theory based on the competition.

Harvard Business School professor Michael Porter focuses his study on competitive strategy and competitive advantage, and less mention the word about the core competence. He is the main representative of competitive strategy, he thinks that business strategy brings the competitive advantage, its theory and thinking is reflected in his "trilogy competition". These three books put forward some comprehensive competitive analysis method and techniques by creative thinking, and proposed a more complete conceptual framework as for understanding the competitive conduct and guidance competitive action (Michael, 1980). In 1990, Prahalad and Hamel think that the core of competitiveness is the source of sustained competitive advantage. Since then, the study of core competitiveness becomes the forefront of industry issues of management theory. More and more scholars and experts began a deeper study (Prahalad, 1990).

Port competitiveness in overseas research start from 60's last century. The earliest study of port development is the British geographers Bird, who put forward "universal port model" in 20th century that is "any port model", called the first study of port (Bird, 1999). In 1957, Mayer first explores the land between the ports to the hinterland of the competition (Mayer, 1957). Later, Weigend analyze the ports to the hinterland of

competition and the joint advantage of water-port-land (Weigend, 1958).

Kenyon expand the port competitive analysis to the labor costs, productivity, convergence of the level of rail transport, port accessibility, land use and other factors.(Kenyon, 1970).

In 1987, the British economist Hoare analyze the major ports in the United Kingdom, and after that he point out that the course of port competition is not the cause of the hinterland competition (Hoare,2005). Haynes thinks that the efficiency is an important factor of port competitiveness, and high efficiency is the potential for the port development (Haynes, 1997). Fleming considers that the modern facilities and services can maintain the competitive advantage in various ways (Fleming, 1997). Notteboom and Winkelmanns propose that in order to create and enhance the port status, we must continue to exert its competitive advantages, these advantages is based on a unique, flexible competitiveness, and obtain a competitive advantage is more important than obtain more hinterland (Notteboom,& Winkelmanns,2007).

Khanna and Cullinana pointed out that the large-scale ship and joint maritime transport will affect the competition among the ports, not only local competition, as well as regional ports competition (Khanna & Cullinana, 1999). Malchow and Kanafani proposed that the distance between the sea and the hinterland is also an important factor in port competitiveness (Malchow & Kanafani, 2001). Professor Wu Heng have been proposed eight port competitiveness indicator, that is the level of port efficiency, port rates, reliability, ship port of supplier selection factors, channel depth, and adaptability to the external environment, the hinterland of convenience, product differentiation degree, and using the principal component of the port competitiveness index to demonstrate the port throughput as the dominant port indicators (Wu Heng, 2008). And the scholars of the World Economic Forum (WEF) also studied the port competitiveness (WEF, 2003). Singapore scholar Wei Yim Yap and Lam pointed out that the port competitiveness also includes human and social factors, such as technical, political, ecological, and social and geographical aspects (Wei Yim Yap &

Lam, 2006).

1.2.2 Domestic research on the port competitiveness

Our theoretical study on market competition began in 90 years, more research in the last five years; our experts have a deeper meaning to competition level of awareness and understanding. But analyzing the situation of our national, industry and enterprises competitiveness, which based on the theory of Poter's competitive strategy and the theory of Prahalad and Hamel's competitiveness, do not form a new school (Huang Daming & Chen Fuxing, 1990).

Our study on port competitiveness started at late 20th century, late 80s early 90s, our economists began to take port economic as a separate discipline, and have published a number of monographs and textbooks for our ports, which contributed to the development of port economic. The significance of representative works includes Port Economics (Ma Zhongwu & Yan Yixin, 1989).

Xu Fengguang studied the competitiveness of our ports and proposed the indicator system of port competitiveness, and gives a comprehensive evaluation of the port competitiveness, and then gives a guidance of port's operations (Xu Fengguang, 2004). Shanghai Maritime University have first studied the port competitiveness in the early 90s, they proposed and summarized the six major factors of port competitiveness, including location, inland transport links, port services and efficiency, service prices, social and economic stability, and telecommunications systems (Zheng Hui,2006). He Nan University professor Yan Yixin conducted a comparative study of the international port container traffic competitiveness in East Asia, in terms of eight areas including the geographical location and hinterland supply, hardware and software facilities, port development and operations management, operational efficiency, port charges, the overall development, micro-power and macro environment, and use fuzzy comprehensive evaluation method to evaluate the

container port transport competitiveness (Yan Yixin & Huang Jianyuan, 2004).

In the 21st century, in the situation of deepening reform, implementation of outward and expanding opening up and actively promote the development of the form of international trade, port economy has been developed, especially the “ revitalizing the northeast old industrial region” policy proposed, the development of Liaoning littoral ports economy is particularly important. Zhao Na made some suggestions about ports disorderly competition and port status in Liaoning Province in the report of resources integration port in Liaoning Province (Zhao Na & Sun Guangxin, 2007). Han Zenglin studied related research of the competitiveness of Dalian port and Yingkou port in his report of the comparison of the competitiveness between Dalian and Yingkou container port (Han Zhenglin, 2009). But how to expend the port function, improving the port environment and the coordination of international and domestic shipping system development, mainly by the competition between the ports, then the definition of the port competitiveness became the focus.

Shanghai Maritime University scholar Lu Chengyun analyze the causes, characteristics and status of port competition on the basis of the definition of the port competitiveness, and established the evaluation model of port competitiveness, then using this model evaluate the port competitiveness, then obtain the importance of five categories of indicators, finally, he pointed that the advantages and disadvantage of the three ports (Lu Chengyun, 2003). Xu Lianen proposed that the ports biggest contribution is stimulating effect on the economy (Xu Lianen, 2004). And Professor Zhong Beihua studied the index system of port competitiveness (Zhong Beihua, 2004).

In summary, many scholars and organizations have studied the port competitiveness in recent years, the general idea is that defines the port competitiveness, and then established the evaluation index and model from the port competitiveness, finally, using the empirical analysis to propose measures to enhance port competitiveness. In

the establishment of port competitiveness evaluation index system, we mainly consider the natural conditions the level of production capacity and port service as factors.

1.3 Research ideas and Methodology

1.3.1 Research ideas

In this paper, we start from the connotation of the port competitiveness and then introduce the theory of port competitiveness, on this basis, we analyze the layout of Liaoning littoral ports, Defined the level of Yingkou port competitiveness and the presence of the advantages and disadvantages, finally we use Pigs Game theory to analyze the cooperation between them and put forward countermeasures about Yingkou port from the overall and long term development. The ideas are shown in Figure 1.1.

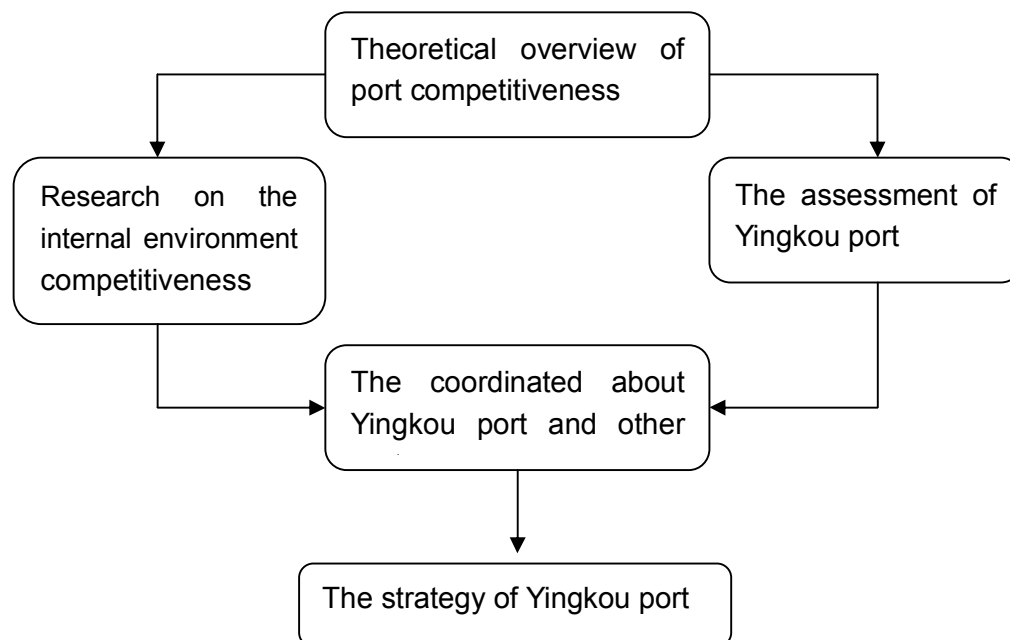


Figure 1.1 Line of research

1.3.2 The research Methodology

In this paper, there are two methods being introduced into this paper, one is the theory of principal component analysis, one is the Pigs Game theory, the principal component analysis is to evaluate the level competitiveness of Yingkou port, and the Pigs Game is to analyze the cooperation between Liaoning littoral ports.

1.4 Innovations

Firstly, we focus on the current viability of the port, and give some attention of port in the future. Secondly, we decided to analyze the competition between Yingkou port and other Liaoning littoral ports, and then pointed out the advantages and disadvantages of Yingkou port. Finally, we use the theory of principal component analysis to analyze Yingkou port and the Pigs Game theory to introduce the cooperation between Liaoning three major ports.

Chapter 2 Theoretical overview of port competitiveness

2.1 The concept of port competitiveness

Port as a specific player in market competition, its meaning is similar to the competitiveness of enterprises. To this end, we can define port competitiveness as: port of competitiveness is the system capacity for survival and development, which can compete in the shipping market and exceed rivals; it is also a port through its own elements of integration, optimization and interaction with the external environment in the shipping market competition and the ability of comparison and development capacity relative to the competitors in to seize the market, create value and maintain the sustainable development of the port. The substance of port competitiveness is the competition of enterprises in different port business. This article focuses on studying

the development of port capacity and the ability to survive. The characteristics of port competitiveness as follows:

(1) Competitiveness of our port ultimately reflected in the continued survival and port development capacity, which reflected in the objectives and the development potential.

(2) Competitiveness of port is a multi-level meaning of the integrated areas, not only to the port within the factor structure and management processes, but also involves the port external environment; not only to the port's own market share and profitability, but also involves the potential for future development of the port; the comparison is not just a static ability, but also a dynamic change in the development.

(3) Port competitiveness of enterprises is formed by the operation of the port in the production, that it is a dynamic product. Port is only through the allocation of resources, strategic planning, attracting supply, marketing, and management of port production process in order to gradually from the port competitive.

(4) Port competitiveness is a relatively competitive ability. This comparison is based on the port's competitive ability of the premise that only by comparison to reflect the competitive strengths and weaknesses. It can be divided into three types: a strong competitive edge, balanced competitiveness and weak competitiveness in order to evaluate the port and the contrast between the competitors.

(5) Port competitiveness is a systemic concept. It is characterized by a number of indicators, mainly by the natural conditions of the port, infrastructure, production, operational capacity, service levels, and several other aspects to the decision. The strength of port competitiveness is impossible to measure with a single indicator, it needs to use a comprehensive set of indicators to evaluate it.

2.2 The factors of port competitiveness

Competition between ports is the main cause of port competitiveness; the main reasons of port competitiveness are as follows:

Firstly, competing cargo supply is the direct reason of the port competitiveness. In order to survival and development, ports must continue to develop sources, develop shipping market, which have a competition for business expansion in shipping market, especially with the rapid development of economic hinterland road and rail networks and advanced road construction, inland transportation, which breaking the tradition of the hinterland, and form a phenomena that many ports serve the same hinterland, so that, the same business while cross hinterland would inevitably lead to the port competitiveness.

Secondly, the shipping capacity of market supply and demand imbalance is the reason of intensifying the competition of ports. There is a close relationship between shipping market demand and socioeconomic development, while shipping market supply is related to the scale of ports, when demand and supply are imbalance, especially the total economic development fall behind the size of the port construction, or interior cargo volume is less than the overall capacity of the port, the competition of shipping market is bound to exacerbate. On the contrary, the competitions can more appeasement. In China's shipping market, the port function is similar and fast speed of port development and port macro-control mechanism is not perfect, which makes the shipping market long-term supply and demand imbalance, especially in the higher profit container ports. Competition between container ports is increasingly becoming an import aspect in the shipping market.

Finally, the same strategic positioning of port development caused the competition. Dalian port, Yingkou port and Dandong port as traditional hub in Liaoning littoral ports, all of them proposed to build shipping centers, in general, three shipping centers in

the same circle are impossible. Port development strategy of this convergence has led too much competition for the three major shipping centers in the port's competitive. In addition, in the entire Northeast Asia region, not only a few port want to become the shipping center and international seat, even Korean Pusan, Yokohama, Japan, and Tokyo port also build their own strength, join in vying for international shipping center in the competition. They not only to maintain their hinterland of sources not outflow, but also looted around the hinterland of goods. It can be said that this kind of port development strategy has led to full competition between domestic and foreign port.

2.3 The determinants of port competitiveness

According to the characteristics of the external environment within the port, the factors which affect the port competitiveness is the port location, natural conditions, infrastructure, collection and distribution system, operation conditions ,port rates, management and service level. This article focuses on the viability of the port current and future development of research capacity. This article focuses on the current viability of the ports and the future development of research capacity. Determine the strength of port competitiveness factors are as follows:

(1) Nature conditions.

Port natural conditions include natural resources and port location factors. Natural resource is the inherent harbor resource; it is a natural substance of existence and ascension port competitiveness and the important factor to decide the port competitiveness. It is nature's long-term effects, mainly for the status of the port berth, channel depth and also by the climate, the tides and frozen influence and so on, location factor is mainly register as port location. A port's geographical position has an important influence on improving the port competitiveness and the future development Geographical location, which has decisive influence to a port's competitive ability and its potential upgrading level in terms of policy and transship cargo, determines a port's developing level in the local area and even in the nation .Secondly ,the geographical

advantage will have direct influence to a port's investment environment and shipping market which affect a port's construction and the formation of goods suppliers , thus it is important to the form of a port's competitiveness and its upgrade . The natural condition of a port will stay unchanged in usual, however ,sometimes natural elements will directly influence the port's productive work ,such as the freeze in some ports of the north in our country ,the typhoon in southern ports ,and dense fog in certain areas, which will damage the natural productive business .Nowadays, most of the pivotal ports in the world obtain great super natural conditions ,and the shipping centers mostly site in port cities with deep water routs and deep water berths in various countries. Only in that way, can they obtain advantages in the fiercely competitive international shipping market. In the meantime, the upsizing trend of ships nowadays has higher demands to the international container truck transportation, and the water depth of routs and berths .The productive business of a port is influenced by the natural elements in the local area such as the weather and so on, which can be measured by the working days in a year for a port.

(2) Productive ability

The throughput and its increment of a port is the most direct manifestation of its productive ability. It is also the most important index for a port's competitiveness, since the profit can only be guaranteed on the base of realizing the constant increment of a port's throughput, and a port can only be developed and expanded on the base of a steady foundation. The throughput and its increment, which fully show a port's competitive level, is the outcome for ports engaging in services and productive business in a competitive market. The container's throughput, which reflects a port's current situation and its developing scale, is an important part of a port's handling capability and a significant manifestation of a port's strength. The growth rate of the container throughput of a port implies the changing trend of container throughput, which represents a potential developing strength, thus the growth rate of container throughput can not only manifest the port's current situation, but also reflect the port's future developing trends. In addition, among various goods, container is a kind of one

with higher handling cost and higher profit, one with the most potential development. The bigger portion of container in a port, the bigger competitive advantage of a port has. Now, more and more scholars consider the container developing level of a port as an important signal of evaluating a international shipping center. Furthermore, the throughput of foreign trading goods, as an important part of a port's handling capability, has become a significant index measuring a port's competitiveness day by day. The handling capability of foreign trading goods and its growth rate not only reflects a port's developing capability in that term ,but also shows the dynamics of the foreign trade on a port's hinterland . It is an important guarantee of the increment in port's handling capability and container throughput, and it also reflects the developing ability of a port's throughput.

(3) The service level

As a service business the port obeys to the common rules of that business. Thus the customers and the goods suppliers are drew on the premise of their satisfaction to the service, which contributes to the ports successful dominate over the shipping market. It is a manifestation of a port's soft strength and an influential element of a port's competitiveness in terms of soft environmental construction to obtain customers' satisfaction, which includes the number of ship routes, ship density, the port rate, collecting and distributing system, information service and so on. The number of ship routes manifests a port's developing scale and its service level. There is a so-called Matthew Effect in container ship transportation which means more ship routes ,higher ship density , more goods suppliers ,capital and information will be gathered .As a result ,more ships are drew to be affiliated to the port and much higher ship density. That is a port's attraction to goods suppliers and a port's capability to take over the ship market. Thus the ship routes number and ship density are important elements of a port's competitiveness. The rate is another important element to determine a port's competitiveness, an important manifestation of a port enterprise's operational level. Only those with higher operational efficiency and lower operational cost can have the ability to draw ships and goods suppliers by their lower port rate. The rate is an

adverse index which means lower rate, more ships to be affiliated to, more competitive power for a port. The port rate is a price competition strategy used among various ports and also is an important way to test the operational benefit of a port enterprise. The situation of a port's collection and distribution is the priority consideration for every goods supplier and ship company. A port is a center for goods' collection and distribution, the operation of a port city's collecting and distributing system directly concerns to the goods' collection and distribution for goods suppliers and ship companies. A great operational system not only can shorten goods' turnaround cycle and lower the operational cost for goods suppliers and ship companies, but also can draw great attention to goods for expanding and taking over the market. Therefore, the collecting and distributing system is another important aspect to determine a port's competitiveness. This system is operated by coordination among ports, inland roads, railways, rivers, channels and airlines, which is a unit of multimodal transportation. The information service level, as a soft resource influential to a port's competitiveness mainly manifests in port's electronic information backup, information supply ability and so on. As an incorporeal property of a port, a good information service level can more easily draw ships from international ship companies to be affiliated to, obtain customers' acceptance and in the other way, it is also a manifestation of a port's soft strength and its competitiveness.

(4) Port management environment.

Port management environment mainly includes the economic environment of port, the level of economic development of port hinterland, business income and net profit of ports, etc. The economy of port city is the most direct motive power of port development, generally speaking, the GDP of port city and the growth rate of ports was positively correlation. The shipping market and the trading in there of developed city is also more developed, not only can provide the ports with sufficient supply, but also have enough funds to invest in the construction, to introduce advanced technology and equipment, this to some extent that, perfects the basic hardware facilities, promote the function and the development of ports. Port hinterland is the

geographic coverage that a port is able to attract and radiate, is the source of port output and the consumption area of input, and is the basic for ports to survive and develop and the guarantee of the goods source. It taking a port as core, layer upon layer radiate outwards, and make it having attraction to the region; it can be divided into direct hinterland of port city (directly) and indirect hinterland. Generally speaking, the higher the development level of a port, the larger the cargo throughput; and the higher the income of local people, the bigger the demand for products; this stimulates the demand of shipping market to increase the throughput of port. In addition, the world as a whole, the international trade between inland largely depends on the seaway transportation. In our country more than 80% of the foreign trade depends on the seaway transportation. This explains that port is the important basis of hinterland development. The important index which reflects the development level of the hinterland is GDP. Port business income is the sum of income out of business and business income of main port enterprises. The port net profit is the balance of the main port enterprises after deducting all costs and related costs. These two indexes are the important indexes to evaluate the development level of port. As the main body of the port, port enterprise should make the production the main business. The rapid growth of business income and net income of port means the port enterprise have enough funds to invest in its port operations equipment and infrastructure, and can improve the function of the port. Secondly, the rapid growth of business income and net income of port also shows that enterprise is energetic and has strong production capacity. This is an important guarantee for port competitiveness.

Chapter 3: Research on the internal environment competitiveness about Yingkou port and other Liaoning littoral ports

3.1 The layout of Liaoning littoral port

At present, there are six ports like Dalian, Yingkou, Jinzhou, Dandong, Huludao, and Panjin and so on along Liaoning coast, which has 16 large-scale ports like Dalian port, GanJingZi port, Ba Yuquan port; Dadong port etc, all of them has formed a development pattern primarily on Dalian and Yingkou port. By the end of 2006, Dalian port has 195 productive garages, through capacity 1.96 million tons, accounted for the corresponding quantity of 65% and 68%, and YingKou port has 57 productive berths and through capacity 5.166 million tons, accounted for the corresponding quantity of 19% and 17%. In 2006, Dalian port and Yingkou port complete their throughput 2.0 million tons and 94.77 million tons respectively, and accounting for the province's total cargo throughput of 56% and 27%. At present, our province littoral has initially primarily on Dalian port and Yingkou port and Dandong port as the auxiliary development pattern.

3.2 The competition between Yingkou port and other Liaoning littoral ports

Described by the theory of the second Chapter, we know that port competitiveness is a kind of abstract ability, only in the competition can reflect the strength of the competitive power. There are several factors to decide the port competitiveness, the most directly form is port throughput, container throughput, the economic of port city, the hinterland development level, the number of port berths, quay length, the port location and the efficiency of port handling and so on. Among them, the throughput, container throughput, foreign trade throughput are the important indicator to measure the port competitiveness. With the expansion of modern port competitiveness, more and more scholars or experts take hinterland economy, the number of garages, port quay, line length and port location as the important indicator of the port competitiveness. Therefore, analyzing the above indicator is more important to study the competitiveness of Yingkou port.

3.2.1 The nature conditions

Yingkou port is located in the middle of Liaodong Peninsula, and the second largest open port in Northeast China, not only the major hub port in Liaoning coast, but also the nearest out of harbor in northeast and eastern Inner Mongolia region. Water and land transportation in Yingkou port is convenient, the sea road can reach any domestic and foreign ports, railways are access to the important railway line in northeast, and highways can arrive to outside the province. Now Yingkou port governs Yingkou, Ba Yuquan and Xianren Island, three harbors, the land area is 26 square kilometers, there has 70 production berths including container, ro-ro cars, coal, grain, ore, large equipment, product oil and liquid chemicals and eight special terminal of crude oil, Yingkou old port has 7 berths with 6 berths of 3000 ton. 1 berth of 1000 ton and the channel depth is -17m, 27.6 kilometers long. Bayuquan channel depth is -21meters and Xianren Island port channel has been dredged up to -22 meters, 30 million tons crude oil terminal in Xianren Island and 30 million tons grade ore terminal in Bayuquan have been put into use. Yingkou port links to Shenyang-Dalian Expressway and Harbin Road, The distance between Bayuquan port and Shenyang-Dalian Expressway is 42 km, 210 kilometers to south of Shenyang and 190 kilometers to north of Dalian. The development traffic is closely linked with the entire Northeast region with a strong cargo collection and distribution capabilities.

Dalian port is located in the top of Liaoning Peninsula and the opening door in northeast; it is the intersection of the Bohai economic circle and Northeast Economic Zone, it is also the gate that the Northeast Asia gets into the Pacific Ocean and the World's marine exports. Dalian port is the famous natural deep water harbor, the port extravagant water depth, preventing the silting not frozen and ten thousand tons of cargo unblocked. Dalian port is winding coastline, which can build port and not build littoral port about 43 kilometers, the back-up littoral resources is sufficient. Dalian port, the vast water areas is 346 square kilometers. Among them, Dalian Bay water area is more than 180 square kilometers, the water area of Dayaowan is more than 30 square kilometers and 17 square kilometers of Small kin bay, the bay water area is more than 110 square kilometers. The core land area of Dalian port is about 20

square kilometers and free water area is about 340 square kilometers. The depth of new port terminal for natural waterway crude oil channel is -17.5 meters, width of 300 meters. The depth of Dayaowan for natural waterway is about -9.5 meters, width of 100 meters.

Dandong port is located in the root of Liaoning Peninsula, the west bank in the mouth of Yalu River, south of the Yellow River and near to Dalian and The Korean Peninsula across the river, the distance to Nanpu port is 119 miles and away from Renchuan port 232 miles, 844 miles from Kobe port, Dandong port is not only the northeast of the mainland coastline of international trading port, but also one of the nearest port. Dandong port governs Dadong harbor and Langtou harbor, a total of 19 productive berths and annual handling capacity is 4000 tons. The area of yard is 500 million square métiers, the channel depth is -9 meters, the channel outbound is Yellow River of 2-4 meters, it has better navigation facilities, and the length of outbound Dadong harbor channel is 10 miles, an average depth of 9.1 meters. The water and land transportation has formed a complete comprehensive transportation network. The port rail links to Shen-Dan and Beijing- Harbin lines, and connect with Bridge of Yalu River and Korean Peninsula, it can responsible for international transport tasks. The main line is primary on Shen-Dan highway, Danhuo, Hegang-Dalian and Dapan that lead to both inside and outside of province. Civil aviation has the regular flight to Shanghai, Sanya, Shenzhen and other cities. Now it has opened the bulk cargo, container and passenger routes with Japan, Korean, Russia and other fifty countries.

Compared with Dalian port, Yingkou port has better natural conditions and the natural deep water, the free water area is bigger than Dalian port, it has a great potential to develop the coast. Compared with Dandong port, Yingkou port has enough back-up resource to investment, but regarding to the location, hinterland radiation, it fall behind Dandong port.

3.2.2 The comparison of production capacity

Port cargo throughput is the direct embodiment to measure the level of port competitiveness. Comparative analysis of the throughput, we can see that the choice of the owner of the three ports over the year. To a certain extent, the number of cargo throughput and the number of cargo growth can reflect the level of port service and improvement of port services. Now we analyze the development of port throughput in recent years that has shown in figure 3.1. In order to reflect the better status and future development, we compare the three port throughput on the basis of this average growth rate in recent years.

Table 3.1 Throughput comparison charts of three ports (10,000 tons)

	Dalian port	Yingkou port	Dandong port
2005	12088	7535	1500
2006	14506	8362	2006
2007	16544	9256	1610
2008	18544	12256	3200
2009	20396	15238	4350
2010	25000	22579	5000

Source: Ministry of transport of the people’s republic of China and ports corporation website

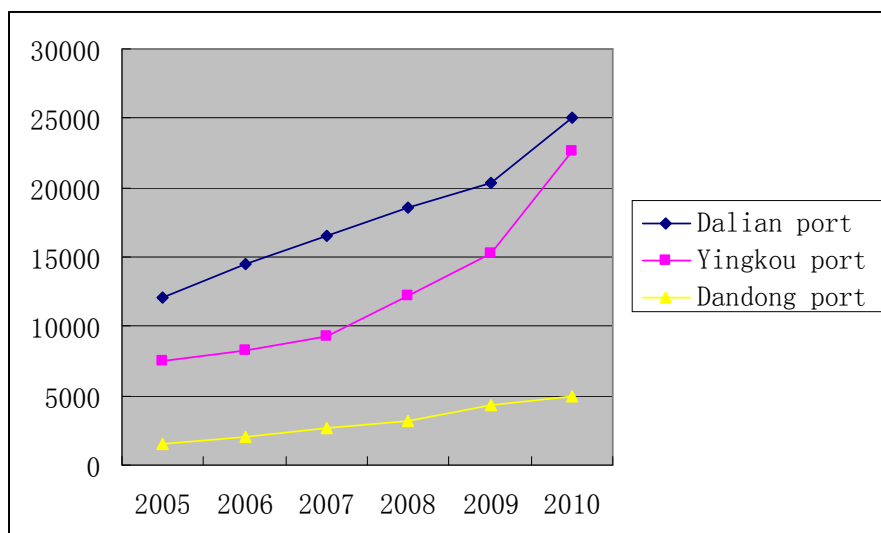


Figure 3.1 Throughput comparison charts of three ports (10,000 tons)

As the figure shown, we can see that the throughput of Dalian port is higher than the other ports, but with the development of Yingkou port, the throughput of Yinkou port increased and fast development, the future trend of Yingkou port is better. In this figure, the mainly throughput is Dalian port and Yingkou port, which accounts for a major position transport in Northeast.

Table 3.2 Containers comparison of three ports (10,000TEU)

	Dalian port	Yingkou port	Dandong port
2005	270	78	13
2006	321.1	120	15.6
2007	381	180	18.2
2008	450	220	21.7
2009	540	280	25.5
2010	648	333	30

Source: Ministry of transport of the people’s republic of China and ports corporation website

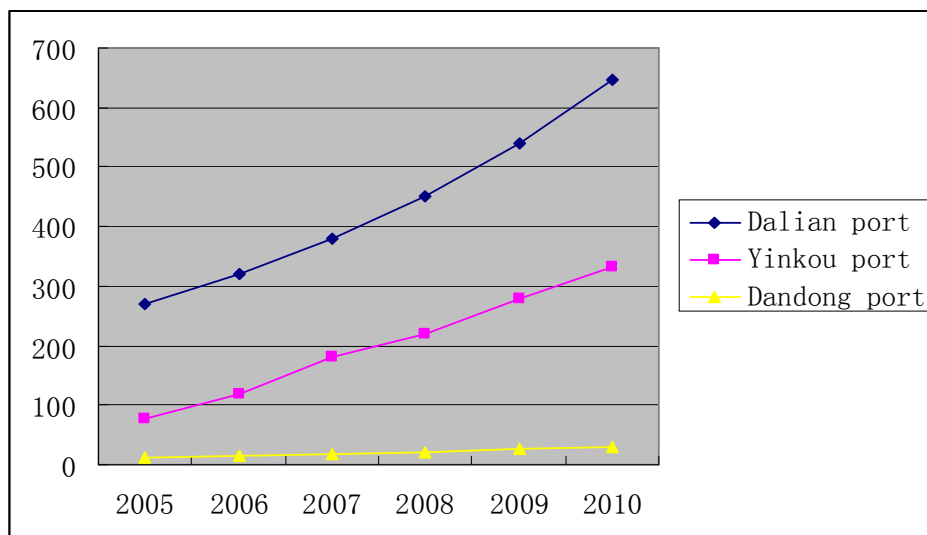


Figure.3.2 Containers comparison chart of three ports (10,000TEU)

Source: Table 3.2

Container transport represents the potential development of port capacity. From the

figure 3.2, we know that Dalian port is in a dominant position, while also growing in Yingkou port, but Dandong port is slow development. The reasons why Yingkou port container throughput falls behind Dalian port are as follows: Firstly, the small proportion of foreign trade in Yingkou port. Although Yingkou port has a strong geographical advantage and abundant resources, the foreign trade container density routes and flights are lagging far behind Dalian port, due to the Northeast of foreign trade container cargo is concentrated in Dalian port and while the economic revitalization of Northeast China did not meet the expectations, the resistance between Dalian port and Yingkou port also be very serious. Secondly, foreign trade agency market is small. By the market impact of foreign trade, the foreign trade container in Yingkou port has been no longer development and the competition among agents is relatively intense. Overall the capacity of the port agency's cargo canvassing is not very strong, and even part of the agency's main business has been transferred to other ports. The lack of support force of the trade routes in Yingkou port, that's one of the reasons why the old and new trade routes withdraw the lines. From the foregoing, Yingkou port needs to improve the foreign trade services and create efficient and easy port environment.

3.2.3 The comparison of port services

The level of port service is the important manifestation to achieve the level of port competitiveness, the three ports continue to strengthen their hardware construction, while also continue to improve their level of port service and operational environment.

Yingkou port is one of China's major ports along the coast and an important hub for integrated transport system; It is the important support for the optimization of productive forces, industrial restructuring, revitalizing old industrial bases in Northeast; It is the important strategic resources that the Northeast region, Yingkou city, Liaoning Province participate economic globalization, connect the international and domestic market and further enhance the international competitiveness; It is an important

foundation for Yingkou city of Liaoning province building the comprehensive construction well-off society, developing the port-vicinity industry and modern logistics and taking the lead in accomplishing modernization; It is also a transit port to transport Northeast energy, raw materials and also a container transport regional port. Yinkou port focus on transporting containers, iron ore, oil and steel and vigorously develop modern port service and port function. Yingkou port container routes has covered the major littoral ports and opened a number of international liner routes with Japan, Korea, Southeast Asia and other cities, which can transit all over the world. The traffic of Yingkou port is convenient; Shenyang-Dalian expressway and Harbin-Dalian expressway are along the line of the port. There are 11 special railway lines of 1050 meters. On the information service, Yingkou port opened EDI service platform, establish a smooth internal and external information exchange channels and highly information service windows, which has formed a set of port services emphasize quality and emphasis on credibility, mature companies with effective culture. At present, Yingkou port has become the domestic container distribution port that has port handling machinery for production of 682 existing units; the effective area of yard is 500 million square meters. According to the development of Yingkou littoral industrial base, we need to expand the port industry functions and become both passenger and cargo, combining domestic and foreign trade, business industry and multi-functional, comprehensive port, and become most important Northeast sea ports and regional logistics center.

Dalian is one of the main ports of China's coastal and comprehensive transportation system; it is the important support of Dalian, Liaoning province to build a moderately prosperous society and to realize modernization basically; and a important support to optimize productivity layout, adjust regional industrial structure, form a modern industrial chain and realize the revitalization of the old industrial base in northeast China; it is an important strategic resources of the northeast of China, Dalian and Liaoning provinces to participate economic globalization, connect to international and domestic market and improve the international competitiveness; and the important

foundation to build international shipping center, which makes Dalian become regional economics, financial center and fully improve the function of Dalian city; it is the main transit port of container transportation trunk port, regional energy and raw materials in China's coastal and the core of international center port of Dalian. Dalian port will focus on the container transportation route and have more than 80 flight routes of international and domestic containers, the density of flight is more than 300 monthly, it has built up a transport service system in which Da Yaowan port area as the core, flight order transportation as the main line, connecting with the inland each node of network, regional and gradient type of logistics. In the information service, "the Dalian port number of overall program" has pass by the experts, and integrate logistics and "big customs clearance" relevant information, realize the data sharing and online check, which makes the port public information platform, and realize the ports and logistics development of the "one-stop" service and "one network type" service. In recent years, Dalian port pays attention to the enhancement of its port operations ability, keeps introducing the advanced equipment. At present Dalian port has about 1000 loading and discharging equipment, and yard area reaches more than 180 square meters. It comprehensively develop the transshipment traffic of minerals, oil, bulk grain and cars, and accelerate the expanding and perfection the services of port, logistics, bonded, information, trade and international marine tourism. When accelerating the development of existing harbor district, according to the demand of the "five points and one line" of Liaoning province, Dalian Port positively promote the coastal development and construction of Changxing island. It is aiming to be an environmental protection, multi-function and comprehensive port with advanced facilities, complete functions, efficient management, and marked benefits.

Dandong port is one of the important port of Liaoning littoral areas and important hub in comprehensive transportation in areas system; it is the important support to the economic development of the northeast parts of the eastern and Dandong city and to optimize the regional distribution of productive forces, speed up the process of industrialization of Liaoning region and Dandong city; It is an important strategic

resources of Dandong city which participate in the economic globalization, connect with domestic and international market, promote the competitiveness of hinterland and it is one of the regional port container of the coast areas in Liaoning province. Now Dandong port does business with Japan, Korea, South Korea, Russia and more than fifty countries, which opened the bulk cargo, container, and passenger transportation routes. In the information services, Dandong port develops the port service supporting system, sets up the integrated business center port, develop the electronic port construction, which makes Dandong port become environmental protection, save, and convenient port. The highway assumes all the Dandong port container transportation. The development direction of Dandong port is primarily on groceries, bulk cargo and containers transportation. Positively develop and improve the port logistics, trade and port industries related functions. It gradually becomes comprehensive and multifunctional port for customers and internal trade.

These three ports have good information service system, but Dalian port has the upper hand in the number and density of the ship route. YingKou Port has the strong operation capacity and the obvious competitive advantages.

3.2.4 The comparison of operational capabilities

Economic hinterland of the port is the solid baking of the port development; port economy development level is directly related to the hinterland of the port's survival and development. The scope of the hinterland of the three major ports and the economic development is shown in table 3.3

Table 3.3 Hinterland comparison of three ports

	Hinterland range	Economic development in hinterland
Yingkou port	It is directly rely on Yingkou city, Shenyang Economic Circle and indirectly relying on the three northeastern provinces and three cities in eastern Inner Mongolia, a Union.	It is the sea to Shenyang Economic circle, and also an important port city in Northeast.
Dalian port	It is rely on Dalian city, Northeast China, eastern Inner Mongolia, Chifeng city, Hu Lun Beier League, Xingan League and Tongliao city.	It is an important heavy industry base, commodity grain base, forestry base, raw material base and export base in North China.
Dandong port	The directly hinterland is Dandong city and its surrounding areas; Deep hinterland is the eastern provinces of the Northeast.	It is the convenient sea to the Northeast Economic Zone in eastern, and also a international trade port in eastern coast of the China's mainland.

The economic of port hinterland is an important reason for port throughput growth. Direct economic hinterland is the direct drivers for the growth of port city economy. For the operating environment of the three ports, we use the traditional approach, which use the GDP of port city as a measurement of the three port hinterland economy. The GDP of their direct hinterland is shown in Table 3.4

Table 3.4 Comparison chart of direct hinterland GDP of three ports (100 million Yuan)

	Dalian port	Yingkou port	Dandong port
2005	2150	380.94	58.4
2006	2569.7	457.69	70.4
2007	3131	568.87	88.3
2008	3858.2	703.57	110.8
2009	4417.7	799.5	655.79
2010	5158.1	1002.4	728.9

Source: All around statistics website and statistical year book

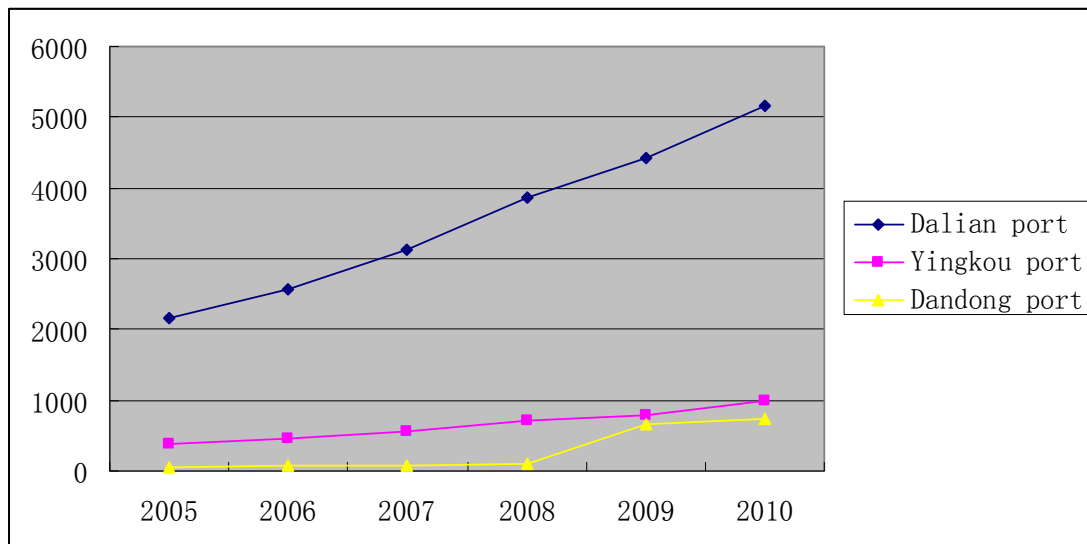


Figure.3.3 Comparison chart of direct hinterland GDP of three ports (100 million Yuan)

From figure 3.3, we can see that Yingkou port is still in the middle state compare with the other two ports in the hinterland of economic development. Before 2007, the hinterland economic development of Yingkou port can keep pace with Dandong port, and after that, the gap between Yingkou port and Dalian port is widening and this will be continue for quite a long time. Although the hinterland economic development fall behind Dalian port, we can know from figure 3.1, the growth rate of cargo throughput rate in Yingkou port is still high. So, Yingkou port is the biggest threat to Dalian port. In the blueprint of the plan to reinvigorate Northeast China, there are four bases of which three bases are close to Yingkou port or the hinterland of Yingkou port, which create

a strong support for Yingkou port throughput. In contrast, the hinterland economic development of Dalian port is not so vast and rich; the port radiation strength is also not too obvious. In recently years, many big enterprise enter into Yingkou city, which make Yingkou port have a dramatically development. In the year of 2001, the growth rate of cargo throughput of Yingkou port still fall behind Dalian port and has been much higher than Dalian port, especially in the last five years, the average growth rate of Yingkou Throughput reached 30.2%, while 16.6% of Dalian port, the development potential is great. Since the year of 1996, Yingkou port container has a fast development, the average annual growth rate is more than 30% and the market share is continuously increased, as some data shown, the container throughput of Yingkou port accounting for the throughput of Liaoning province rose from 12.87% in 2000 to 23.55% in 2007, while Dalian port container throughput down from 82.77% in 2000 to 65.49% in 2007. It can be said that Yingkou port has shaking the status of Dalian port. In addition, experts conservative predict that the throughput of Yingkou port will transcend Dalian port by the year of 2015 and it could become the first port in Northeast. Thus, Yingkou port with rapid development has been a great threat to Dalian port.

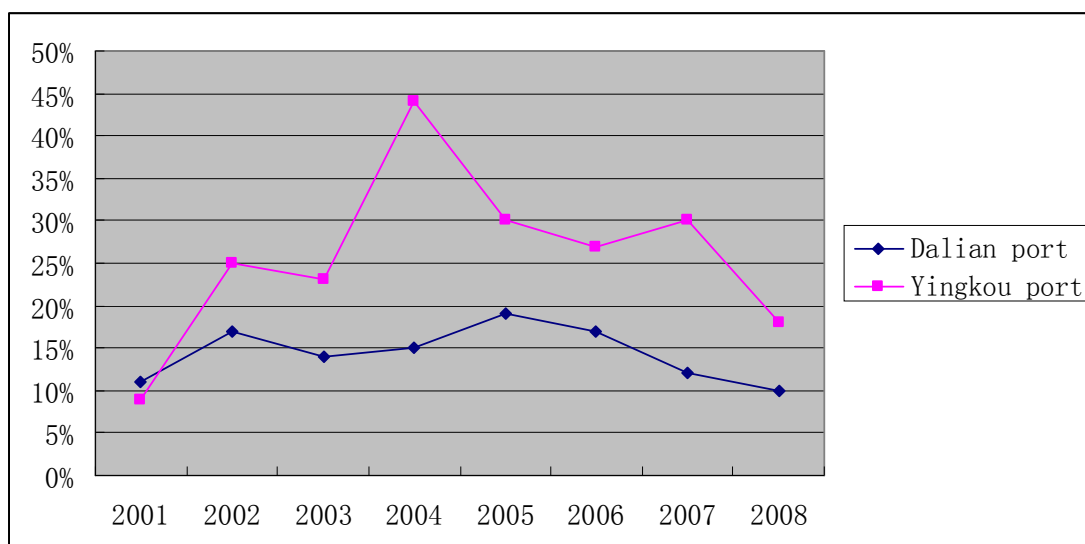


Figure.3.4 Growth rate comparison chart of Dalian port and Yingkou port (%)

Source: Ministry of transport of the people’s republic of China and ports corporation website

3.3 The advantage and disadvantage about Yingkou port

From the above analysis, the comparison between Yingkou port and Dalian port, Dandong port, Yingkou port has advantages and disadvantages, which is specific shown in the following table.

Table3.5 Advantages and disadvantages of Yingkou port

	Compare with Dalian port	Compare with Dandong port
Advantages	Nature conditions is superior Drift of channel is deep. Port hinterland radiation is strong	Plenty of reserve resources and development potential. Strong ability of port construction.
Disadvantages	Economic size is not better. Regional influence is slow.	Port hinterland radiation is not better. Direct economic hinterland contribution is small.

Chapter 4: The assessment of the Yingkou port competitiveness

4.1 The index system of port competitiveness

4.1.1 The design principle of the index

When evaluating the competitiveness of the ports, we should set up the valuation index system at first .And this valuation index system should abide by the following principles:

(1) Principle of globalist. The design of the valuation index system should reflect the overall evaluation objects at all levels entirely and integrally, including the factors that

can reflect the past, present and the future. Combining the ultimate goal with the valuation index system, it finally becomes a distinct, systematic organic wholeness.

(2) Principle of comprehensiveness. In order to reflect the evaluation objects entirely and objectively. At the beginning of the index system designing, it requires us to select the comprehensive and systematic valuation index which can reflect all aspects of the basic characteristics of the object as much as possible, so as to leave enough space to accept or reject the index system eventually.

(3) Principle of relativity. The design of the index should be comparable, only within the same time and the same space; the selected index could be meaningful and be able to evaluate the object in both transverse and longitudinal ways. At the same time, we should ensure the quantitative indexes have the same measuring units, and ensure the value of qualitative indexes based on a relative basis.

(4) Principle of objectivity. The design of the index system must be based on the basis of objective truth, it should reflect the inherent rules and basic situation of the evaluation objects in practical and realistic way. Meanwhile, individuals should use the scientific and reasonable investigation or research, combining the qualitative with qualitative information in the basis of comprehensive evaluation, carrying out the objective, real, scientific and reasonable evaluation eventually.

(5) Principle of feasibility. The valuation index system only is practical and feasible in practice, and it could obtain the real valuation results. We do not need too much valuation index, because some of the huge index group or complex index still can not reflect the objects objectively, instead, they may bring some practical problems. Index should be easy to collect and determine, computational formula or evaluation method must be scientific and reasonable, the valuation process should be simplify, so that it can be easy to grasp and operate in practice, ensuring the valuation indexes more feasible.

(6) Principles of foresight. Valuation index selection should reflect the current situation of the evaluation objects, as well as reflect the trend of objects' future development , meanwhile in the basis of the expression of past and the present situation, it finally grasp the development trend of the objects in the future.

4.1.2 The choice of the index

Shipping China, the world economy of Dalian Maritime University and Research Institute of China jointly issued "2008 China port Competitiveness Index rankings report", this published 13 of port competitiveness evaluation index. The discusses of the second chapter as a theoretical basis to decide the port competitiveness factors, reference relevant literature review and reports, and establish the following port competitiveness index system on the basis of the analysis of the third Chapter.

Table 4.1 Evaluation Index System of port competitiveness

First level indicator	Sub factor	Type of index	Source
Nature condition	Location	Qualitative	Expert commentary
	Draft of channel (m)	Quantitative	Statistical data
Port operational capacity	GDP of port city	Quantitative	Statistical data
	GDP of hinterland	Quantitative	Statistical data
Port service	Transportation	Qualitative	Expert commentary
	Yard effective area (million squire meters)	Quantitative	Statistical data
	Information service	Qualitative	Expert commentary
Production capacity	Cargo throughput(million tons)	Quantitative	Statistical data
	Container throughput (ten thousand TEU)	Quantitative	Statistical data
	Foreign trade Cargo	Quantitative	Statistical data

	throughput (ten thousand tons)		
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4.2 Principal component analysis

4.2.1 The introduction of principal component analysis

In the actual problem, there are some correlations between different variables. Because of more variables and certain correlation between them, this will certainly increase the complexity of the problem. Therefore, we need to have a kind of simplified method that can be converted the original number of variables to a new number of small and independent of integrated variables under the premise of original information without little loss. Principal component analysis is such a kind of method. Principal component analysis is mathematically defined as an orthogonal linear transformation that transforms the data to a new coordinate system such that the greatest variance by any projection of the data comes to lie on the first coordinate (called the first principal component), the second greatest variance on the second coordinate, and so on (Jolliffe,2002). Principal component analysis is a mathematical procedure that uses an orthogonal transformation to convert a set of observations of possibly correlated variables into a set of values of uncorrelated variables called principal components. The number of principal components is less than or equal to the number of original variables.

4.2.2 The basic steps of principal component analysis

- (1) Determines the analysis variables and collect data.
- (2) Standardize the original data.
- (3) Request by the normalized covariance matrix of the data Σ that is related to the

original matrix. If we do not standardize the original data, then direct calculate the correlation matrix of raw data. The equation is:

$$R = \begin{pmatrix} r_{11} & r_{12} & \dots & r_{1p} \\ r_{21} & r_{22} & \dots & r_{2p} \\ \dots & \dots & \dots & \dots \\ r_{p1} & r_{p2} & \dots & r_{pp} \end{pmatrix}$$

r_{ij} ($i, j=1, 2, \dots, p$) is the correlation coefficient of the original variables x_i and x_j , $r_{ij}=r_{ji}$.

The calculation formula is:

$$r_{ij} = \frac{\sum_{k=1}^n (x_{ki} - \bar{x}_i)(x_{kj} - \bar{x}_j)}{\sqrt{\sum_{k=1}^n (x_{ki} - \bar{x}_i)^2 \sum_{k=1}^n (x_{kj} - \bar{x}_j)^2}}$$

(4) Rearrange the eigenvectors and eigenvalues

(5) Calculation the contribution rate and cumulative contribution rate.

The formula of contribution rate is:

$$\frac{\lambda_i}{\sum_{k=1}^p \lambda_k} \quad (i=1, 2, \dots, p)$$

The formula of cumulative contribution rate is:

$$\frac{\sum_{k=1}^i \lambda_k}{\sum_{k=1}^p \lambda_k} \quad (i=1, 2, \dots, p)$$

(6) Keep the numbers of components, the approach as follows:

Generally, we take the contribution rate of 85%-95% of the principal components, the

choice of the eigenvalues $\lambda_i \geq 1$; and the cumulative contribution eigenvalue greater than 1; then draw the characteristic value curve and judgment by the turning point.

(7) Calculation the principal components.

(8) Conclusion interpretation and inference

4.2.3 The process of principal component analysis

First, on the basis of the front indicators, we collect the original data (appendix A), the geographical location, collection and distribution accessibility and port service are obtained by the expert scoring. This data process is done by SPSS 13.0 software. The process of analysis is as follows:

(1) Standardize the original data. Because of this paper selects the data from different dimension, in order to the empirical analysis and to eliminate the adverse effects of dimension, this paper standardize the raw data firstly (appendix C).

(2) Calculate the eigenvalues of the correlation matrix, variance contribution rate and the cumulative contribution rate. According to step 6, the composition of eigenvalue grater than 1, the cumulative contribute rate arrive 85%-95%, the components in the turning point can be selected, then we can determine the number of principal components.

Table 4.2 Total Variance Explained

Component	Initial Eigen values			Extraction Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %

1	8.260	82.599	82.599	8.260	82.599	82.599
2	1.740	17.401	100.000	1.740	17.401	100.000
3	7.82E-016	7.82E-015	100.000			
4	5.18E-016	5.18E-015	100.000			
5	1.06E-016	1.06E-015	100.000			
6	2.45E-017	2.45E-016	100.000			
7	-5.87E-01	-5.87E-01	100.000			
	7	6				
8	-1.09E-01	-1.09E-01	100.000			
	6	5				
9	-1.89E-01	-1.89E-01	100.000			
	6	5				
10	-3.60E-01	-3.60E-01	100.000			
	6	5				

Extraction Method: Principal Component Analysis.

From the table 4.2, we can see that the first two principal components of the cumulative variance contribution rate has arrived more than 85%, so the principal components is 2.

(3) Calculate the principal components. According to the analysis of SPSS, we use the principle components divided by the corresponding eigenvalue matrix square root, to get a coefficient matrix, and then use the standardize data multiplied by the matrix can achieve the scores of the two principal components, finally, we use the follow formula to calculate the synthetically score of three ports. And the final results are shown in table 4.3.

$$F = \frac{\lambda_1}{\lambda_1 + \lambda_2} F_1 + \frac{\lambda_2}{\lambda_1 + \lambda_2} F_2$$

(λ_1, λ_2 : represent the principle components F1, F2,)

Table 4.3 Scores of Initial Component

	F1	F2	synthetically score
Dalian port	2.204158	0.341467	2.545625
Yingkou port	-1.56331	-1.45371	-3.01702
Dandong port	-4.17818	1.112239	-3.06594

4.3 Empirical results

From the table 4.3, we can see that Yingkou port ranked second in Liaoning littoral ports, fall behind Dalian port and ahead of Dandong port. Overall, Dalian port has a very significant competitive advantage, is the leader in Liaoning littoral ports, its synthetically score is 2.545626, the gap between Yingkou port and Dalian port is more obvious, although the development of Yingkou port is increasing at an alarming rate, has threatened the hub of Dalian port, it is difficult to compete with Dalian port in terms of comprehensive strength. Dandong port is ranked third, although the development of Dandong port is increasing recent years, it is not caused too much pressure to Dalian port from the comprehensive strength. It can be seen that Yingkou port should strengthen its overall strength, speed up the port construction and port expansion. In order to build a better port, it is important to strengthen the corporation between the ports

Chapter 5: The coordinated development about Yingkou port and other Liaoning littoral ports

5.1 The theory of Pigs Game

Game theory is the study of the study of rational decision-making in its action to

happen on the interaction directly decision-making and decision-making balance problems. That is about an object subject by others, and other enterprises, and in turn affect others, other enterprises when the choice of decision making problems and balance problems.

“Pigs Games” is telling about there are two pigs in the pigsty, a big pig and a small pig. There is a slot putting the food, and the other one is a button that controls the supply of food for pigs. Click the button will have 10 units of pig feed into the slot, but the labor of press a button will consume the equivalent of 2 units of food for pigs. If you wait for the small pig click the button, big pigs eat 9 units and small pigs only eat 1 units; If the big pigs press the button and the small pigs waiting, big pigs can eat 6 units and small pigs can eat 4 units; if two pigs press the button at the same time, big pigs eat 7 units, small pigs eat 3 units. The different strategies are as follows:

Table5.1 Pigs Games

Big Pigs	Small Pigs	Push button	wait
Push button		(5,1)	(4,4)
wait		(9, -1)	(0, 0)

Any pigs must make decision, wait or press the button, for the small pigs, if they choose to wait or eat 4 units or do not eat (the final result depends on the big pig’s decision-making); if they press the button or eat 1units or eat -1 units (the final result also depends on the big pig’s decision). Therefore, the choice of small pigs is obvious, that is to wait. And for the big pigs, the choice is not so clear. And the result is that big pigs press the button and small pigs waiting to live together. This game shows that the strategy of the strong side is to take the initiative to force the weak side and the weak side needs to wait to take the strong lift. Port as a public industries, has a positive role in promoting the regional economic development. So, port in port brand, technology

innovation and the construction of shipping center can be named the boxed pigs game model of the press button, the income of the construction such as regional port of brand promotion, the increase of the container sources that is like food for pigs in terms of geographical proximity and different throughput port; while the big ports are likely to big pigs, small and medium-sized enterprise equivalent to small pigs, Now we use the "Pig Games" to analyze the game relationships of Yingkou port, Dalian port and Dandong port.

5.2 Pigs Game theory in the cooperation among the three ports

In chapter 3, the geographical location and economy hinterland and cargo throughput of Dalian port are occupied the dominate advantage, although the rapid economic development of Yingkou port, Dalian port still the leading position, we can be compared Dalian port as the "big pig" and Yingkou port and Dandong port as the "piggy". Based on the demand of container transportation around Bohai Sea, Dalian port opened a container feeder operator of public services, the business point concerns Yantai, Weihai, Longkou, Qinhuangdao, Yingkou, Jinzhou, and Dandong. Through the branch network and international shipping companies, establish the collection and distribution channels surrounding the sea ports. From this it can be seen that, Yingkou port and Dandong port can get a poison. Because of the of strong big port throughput capacity, and market development ability, especially the construction of international shipping center in Dalian port will rapidly grasp the shipping market and achieve obscene profits, while small and medium-sized port choice is to wait for the big ports of technology innovation and port construction, follow with big port, or race for the share of construction and innovation, if small port interest for large-scale port construction and technology innovation, this will be like small pigs press the button, spent large cost and there is not much impact on the expanding production and seizes the market because of the poor feeding ability. Therefore, small and medium-sized port in order to get their best interests had better take imitation and

cooperation strategy. From the above we can see that ports should take cooperation strategy and get their greatest interests and profits.

Chapter 6: The development strategy of Yingkou port

6.1 Integration of port resources, strengthen the competitiveness of Yingkou port

Recently, the ministry of communications proposed that the coastal port should increase the integration of resources, breaking through the administrative region boundaries, and giving full play to the advantages of the port groups. The key point of this is to integrate the resources from two respects, one is to coordinate the internal ports of different sizes in YingKou Port, fixing the position clearly and forming the overall competitiveness; another is to enhance the cooperation with wings ports, forming the group competitiveness. First of all, YingKou Port should fix its position clearly, through differentiated development; it improves the overall competitiveness and builds the international modern port which is multi-function, regional, focusing on domestic shipping. and it also has the international transportation function .More Specifically ,it should have the transit function, logistics dispatch function, transportation information service function, business trade function, industry function, established in the northeast of China but meeting the whole requirements in the country, and it integrates the regional economic development in northeast of Asia .The main business of it focuses on domestic trade, it has the international shipping logistics system and the function of transferred, distributed, distribution . Secondly, it takes differentiated development strategy, coordinating development with the wings ports, so as to improve the port groups' competitiveness. The ports should regard the main supplies as the starting point of fixed position, coordinating development with others and take the differentiated development strategy, YingKou Port should give priority to develop domestic trade container, steel, iron ore

transportation , comprehensive development crude oil, food, cargo transportation, and undertake the service to transport for Dalian port ; Dandong port mainly service for general cargo transportation, developing domestic trade, and also undertake container transportation. So, Liaoning coastal port group can form the complementary advantages and differentiated development pattern.

6.2 Strengthen the interaction of the port hinterland, and enhance supply channels

It has already been discussed that the increased port capacity had direct interaction with the economic hinterland GDP, this kind of interaction are mainly display in the door to the outside world, by means of the import and export transportation, the economic activities in the hinterland are increased and also promote the development of the economy. On the other hand, the hinterland is the important guarantee of the port's development, it supply the goods for the ports and accept the cargos from other ports. The higher the level of economy develops, the greater the goods demand. The economy in the hinterland may be the direct motivation to the development of the port, the more economy developed, the more abundant trade, the greater port capacity may become, so as to promote the development of the port. In order to further enhance the interaction of the port and hinterland, promoting economic development in the port, we can consider from the following three aspects:

(1) Expanding supply channels and the support of transit in hinterland. Port capacity is one important index that measuring the level of ports development. And the scale of container transportation is the important sign of the shipping center. The key point of resolving the problem and getting rid of current predicament is to increasing the supply, as well as improving the speed of port capacity development. First of all, it must be focusing on the container liner and expending ocean route positively, expanding route density radiation radius and coverage area, seeking for new supply channels and gradually forming the international shipping network worldwide. Next,

expanding hinterland and occupying the shipping markets. Interim hinterland mainly refers to Bohai Sea District in China, north Korea, South Korea, Japan, Mongolia and the Russian far east, YingKou Port should play the existing port advantage, relies on the good service level, preferential taxation policy and advantageous investment environment, attracting the supply of goods and expanding the shipping market. At the same time, cultivating the local shipping enterprises, strengthen the relation with relevant countries in the interim hinterland, and constantly reclaim the scope of cooperation, expanding the transit supply and radiation strength of YingKou Port in hinterland.

(2) Developing the radiation force of ports, changing the interior structure. This request that under the strategic plan of revitalizing the old industrial base in the northeast of China, not only develop the Dalian port economic affections, but also promoting the economic development of surrounding areas, making full use of the "four base" effects, promoting the upgrading of industrial structure. Especially to formulating the development strategy, and adjusting the development of oil chemical, coal, steel, equipment manufacturing, automotive, electronic information industry and modern agriculture and other service industries. The upgrading of the industrial structure in Dalian must change the primary goods to the high technology and high value-added goods.

(3) The optimized collection transports the network system, the enhancement of the relationship with backland. This need to be considered from three aspects: First, we must improve the network transportation system of the littoral transportation, built the Shugang highway that connects Dayaowan, Dalianwan, Changxing Island, Bayuquan, dockland of Xianren island and Shenda road; Implement of the expansion transformation of the big east port area of Dandong port and the Shugang railroad of Jinzhou port; Second, strengthen the center transportation channel, especially the construct of Ha-da railroad passenger transportation special line, the railroad channel of the east area of northeast; to built the highways of Shenyang to MeiHe,

Shenyang to Changwu, Dandong to Tonghua, Jinzhou to Chifeng and so on. Third, to perfect interior stopover station, promotes port service functions of the interior stopover station of Shenyang, Changchun, Harbin and so on comprehensively, advances the construction of the Shenyang interior stopover station international physical distribution garden area, enhance the interaction function of Yingkou port and the backland.

6.3 Highlight the status of port logistics, build information service platform

The level of development of the port integrated logistics is one of the important indexes to measure the port comprehensive competitive power; we have to train the physical distribution, to build the full integrated logistics system, increase port throughput through developing integrated physical distribution, to promote the port competitive power. First, we have to accelerate the pace of capital construction, provide the basement of the construction of logistics channel. Yingkou port has to strengthen the construction of the infrastructure of physical distribution, to improve the complement power, to create the modern logistics network which has full system, reasonable structure, free-flowing physical distribution and efficient and convenient, to achieve the relationship and corporation of base of logistics with backland at home and abroad, focus on professional logistics, third-party logistics, recommend famous logistics enterprises at home and abroad which have full system and strong drive, exert the existing industrial advantage, accelerate the construction of professional logistics centers of petroleum and products, foodstuffs, automobile, mechanical and electrical products, aquatic products, fruit and vegetable and so on, accelerate the construction of the north of Dalian food logistics center, construct the rapid transport channel of northeast major grain producing area and Southeast sales areas of food distribution. Second, construct efficient and smooth collection and distribution system. Exert road advantage, improve transport environment, and guarantee land team integrate port smoothly; make great efforts to coordinate railway interests, take care of unloading of train and the ship work, fight for the advantage policy of railway

transportation. Develop south markets, Japanese markets and Korean markets positively, develop the Eurasia Land Bridge to open up the Rail transport international business, to continue maintaining the leading position of Yingkou Harbor railway transport volume in National littoral ports. Third, create Information service platform. In the first place, create a Barrier-free customs environment, form an Information Network Data Exchange Platform which involve shipper, ship-owner, Transport companies, customs, inspection and quarantine and more Information Resources at more aspects, achieve the transfer, exchange and release function of information. Next, we have to draw up and perfect the Rules and regulations related to customs clearance, increase service quality, exert Paperless clearance, Expedited clearance, online payment, Acceptance Guarantee and other functions. Increase the Efficiency of customs clearance comprehensively, save costs for the customers. Last, strengthen the Logistics Information Processing System and Information network, expand resource of customer information and service area, provide One-stop service for the enterprise and Investors, thus to promote the level of Information Network Service of Dalian harbor.

Chapter 7: Conclusion

This article is based on the results of previous studies to determine the factors of port competitiveness, through the comparative analysis and principal component analysis, we obtain the final conclusion. The results of this article are as follows:

(1) Summarizes the major decision factors of the port competitiveness. This article is based on a lot of reading on the theory of port competitiveness and combined with the previous research results and research methods, then summarized the factors of port competitiveness, there are six aspects: natural conditions, business environment, port services and production capacity.

(2) Objective analysis the pressure of the Yingkou port in Liaoning littoral ports. Through the comparison of the port production capacity, port operating environment, natural conditions and port service,

(3) Establishing the comprehensive evaluation index system of port competitiveness, on the basis of determining the factors of port competitiveness, drawing on relevant references, and establishing the comprehensive evaluation index system of port competitiveness, including location, channel depth, the port city of GDP, the economic hinterland of GDP, port information service, cargo throughput, container throughput and several evaluation indexes.

(4) By using the principle component analysis has been decided the scores of Yingkou port. According to the evaluation index system, we collect the data and use SPSS software to analyze the principle component, and then calculate the scores of Yingkou port to achieve the final conclusion.

(5) Finally, we propose the countermeasures to improve the competitiveness of Yingkou port. According to the comparative analysis and principle component analysis results, this article proposed some strategies about how to improve the port competitiveness combined with the advantages and disadvantages of Yingkou port. Of course, there are some shortcomings in this paper, such as the study of the core of the theory may be incomplete and not systematic, especially the establishment of the index system, the data we obtained is not very detailed, which lead to the evaluation of Yingkou port competitiveness may not be very comprehensive.

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Appendix A: Original Data

index	Dalian port	Yingkou port	Dandong port
X1	6.5	5.6	5.4
X2	17.5	12	16.5
X3	3858	703	601
X4	2.94	2.94	1.63
X5	83	30	18
X6	88	28	27
X7	294	97	65
X8	6.1	5.9	5.3
X9	2.46	1.51	1.11
X10	545.2	203.6	40.2

Source: 2008 China Port Competitiveness Index ranking report, Provincial Bureau of Statistics website, Local Ports Corporation website, Chinese Port Maritime Network, Republic of China Ministry of Transport website and so on.

Notes: X1,X2,X3,X4,X5,X6,X7,X8,X9,X10 represent the location, channel depth (m) the port city of GDP (billion), the economic hinterland of GDP (billion yuan), collection and distribution accessibility, the effective area of yard (square meters), the port information service, cargo throughput (million tons), container throughput (million TEU), foreign trade cargo throughput (tons).

Appendix B: Standardize data

Index	Dalian port	Yingkou port	Dandong port
X1	1.13776	-0.39822	-0.73954
X2	0.73954	-1.13776	0.39822
X3	1.15426	-0.54959	-0.60467
X4	0.57735	0.57735	-1.1547
X5	1.13719	-0.39513	-0.74207
X6	1.15458	-0.56298	-0.5916
X7	1.14505	-0.44351	-0.70154
X8	0.80064	0.32026	-1.1209
X9	1.10563	-0.26439	-0.84124
X10	1.09513	-0.23051	-0.86462

Source: 2008 China Port Competitiveness Index ranking report, Provincial Bureau of Statistics website, Local Ports Corporation website, Chinese Port Maritime Network, Republic of China Ministry of Transport website and so on.

Notes: X1,X2,X3,X4,X5,X6,X7,X8,X9,X10 represent the location, channel depth (m), the port city of GDP (billion), the economic hinterland of GDP (billion yuan), collection and distribution accessibility, the effective area of yard (square meters), the port information service, cargo throughput (million tons), container throughput (million TEU), foreign trade cargo throughput (tons).