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SHANGHAI MATIRIME UNIVRTSITY

WORLD MARITIME UNIVERSITY

Shanghai, China

Study on Comprehensive Competitiveness of Modern Ports — Based on Study of Developing Potential of Shanghai Port

By

FENG Xinyue

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

In

INTERNATIONAL TRANSPORT AND LOGISTICS

2013

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DECLARATION

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

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

FENG Xinyue

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Supervised by

Professor ZHAO Gang

Shanghai Maritime University

ACKNOWLEDGEMENT

Almost two years of studying in Shanghai maritime university has given me the opportunity of experiencing fabulous postgraduate life, learning advanced knowledge from outstanding professors and getting to know a lot of interesting classmates. This paper implicates that my postgraduate study in international transport and logistics will finish soon.

Through this acknowledgement I want to thank transport and communication department of Shanghai Maritime University for offering me the opportunity to study here. Firstly I want to express particular gratitude to my roommates and the Greek classmate who have been nice to me and helped me in every aspect of life here. Secondly, I want to thank Professor ZHAO Gang for his patient guidance on how to construct a paper and how to make a valuable research. Last but not least, I want to thank Ms. Jiang Zhengfei and Ms. HU Fangfang for supporting and making my study and life here easier.

Although studying in Shanghai Maritime University is going to come to an end shortly, those happy and meaningful time I have spent in here will stay in mind forever.

ABSTRACT

Title of Research Paper: **Study on comprehensive competitiveness of modern ports — based on study of developing potential of Shanghai port**

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

After more than ten years of construction and development, Shanghai has gradually become one of the most competitive and promising ports worldwide. Yang Shan deep water port has reached to an international advanced level in both port construction and handling techniques; a large number of shipping companies and shipping service branches have set and established in Shanghai. Till today the construction of Shanghai port got partial achievement and has come to a new development stage.

This paper will discuss about the competitiveness of modern ports and then use quantitative as well as qualitative method to analyze the comprehensive competitiveness of Shanghai port. The evaluation system will be established for assessing Shanghai ports' competitiveness in a proper sense. I will apply the model of factor analysis to calculate the developing potential of Shanghai port in 8 consecutive years and compare Shanghai and Hong Kong port as well to get a clear clue about the major indicators influencing port competitiveness and the developing potential of Shanghai port. In the end, several suggestions will be proposed for further improvement of Shanghai port competitiveness.

Key Words: port competitiveness, Shanghai port, developing potential, factor analysis

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1 Introduction

1.1Research Background and Research Significance

1.1.1 Research Background

As the principal way of global logistics, ocean shipping is an important approach to achieve the globalization of the world economy and the main channel of the economic internationalization for all countries. More than 80% of international trading is done through ocean shipping. Port, as the beginning and end of the ocean shipping, plays the part of an integration point for intercontinental transport. Port is the node of resource distribution and processing, which performs a significant role of economy driving force.

Port development has undergone four stages: 1. Traditional logistics ——carriage, transshipment, and storage. 2. Distribution logistics —— carriage, transshipment, storage, loading and unloading, warehouse management, processing. 3. Integrated logistics —— informationized and networked logistics, which is an organic combination of commodity flow, information flow, capital flow and talent flow. 4. Port supply chain —— global logistics, participating in and organizing activities of all segments related to modern logistics, as well as connecting and coordinating of different parts. The world major ports are transforming from the first and second

generation to the third generation, some are even heading to the fourth stage of development.

The function of a modern port is not only traditional logistics activities like loading, unloading, storage and the cargo transfer joint of different ways of carriage, but also a modern international logistics center with powerful informative function and financial function. In addition, ports connect inland and water way, internal and external market, and centralize information regarding the ship owner, cargo owner, freight forwarder, land transportation party, storage party and so on. In this respect, port is a center of logistics information. Moreover, port must be a financial center possessing a strong capability of financial settlement in order to accomplish import and export trading conveniently and rapidly. It is a major premise to be equipped with a complete set of functions, fundamental infrastructure and advanced technology for implementing modern international logistics and ocean shipping.

The United Nations conference on trade and development put it in《The Third Generation of Port Market and The Challenge》that: "The function of trading port as an indispensable transition point from ocean carriage to other ways of carriage (e.g. land transportation, air transportation or inland water transportation) is decreasing, while it is increasingly becoming a strategic point for organizing foreign trade. Port now becomes a key node in an integrated shipping chain and the pillar of the development of regional economy and industry … … It is the terminal of rear service for national trade." As we can see, port now stands in a strategic position in modern logistics industry and in promoting national economy.

Becoming a modernized international port means significantly whether the city where port locates can become an international shipping center, as well as the center

of economy, international trade, finance, information and logistics. So the competition among different ports is getting more and more intense. A port being more competitive means richer cargo source, higher local import and export volume; stronger competitiveness of port promotes international trade development and port's capability of making profits, enhance national income of taxation which contributes to a country's economy development. Besides, a more competitive port will improve the world reputation of the city and country which is an intangible value of the country. In a word, it is the top priority for port corporations to strengthen their operational and managerial competitiveness, thus enhancing ports' comprehensive competitiveness.

1.1.2 Research Significance

Under the background stated above, Chinese ports encounter fierce competition from internal ports, regional ports, and also participate in extensive competition with external ports. All ports worldwide now are trying to take bigger market segment. In this case, it is of great significance to study port competitiveness.

The economy power of a country depends on its trade volume to a very big extent. Compared to other big port cities of China, Shenzhen, Dalian, Tianjin, Qingdao, Ningbo, etc., Shanghai possesses incomparable advantages in economy development, finance level, technology support, geographical traits and resource abundance. Nevertheless, Shanghai still has some certain improvement space for becoming a competitive port parallel with Hong Kong and Singapore. With this in mind, I will utilize factor analysis to study on the competitive power of Shanghai port over the year 2004 to 2011 and also compare the competitiveness of Shanghai port and Hong

Kong port so as to understand the developing potential of port of Shanghai in detail. With Shanghai being one typical shipping center on the rise, this study will be meaningful for researchers inside and outside the industry.

Specifically, research on port competitiveness is particularly meaningful in the following four aspects:

(1) Studying port competitiveness can help port enterprises better understand the gap between them and their competitors through insight into their own shortcomings and adjust the orientation of development strategies according to the market situation and customer requirements, thus promoting the overall scale of port and efficiency improvement.

(2) It will push ports to put emphasis on rational allocation of resources. Port internal resources and dispersed external resources will be organically combined to get consideration so ports will make full use of the resources and have maximum performance.

(3) Research of port competitiveness will help optimize organizational structure and promote the continuous improvement of management efficiency and level.

(4) It will drive the port corporation to reinforce administration and innovation so the port operation becomes smoother, especially for container shipping. In this way, it will attract more foreign capital to invest in port and the city, thus the integrated competitiveness of the port and the city is improved.

1.2 Literature Review

There are quite a lot of research papers on how to improve port competiveness from different points of view.

One viewpoint is based on the effects of industry clustering on port development, which is analyzed in Liu Zhiqiang and Song Bingliang's article (2004) Port and Industry Clustering. They apply the theory of industry clustering to analyzing port industry details and inter-structure in Chinese port clustering, in addition to which some suggestions for the pattern and structure of Chinese port cluster are made to enhance the market competiveness. Wang Yingji's master degree research paper (2006) aims at analyzing the crucial role that shipping industry clustering plays in the construction of Shanghai International shipping center. It is illustrated that the shipping industrial cluster is the embodiment of the Shanghai International Shipping Center.

There are some papers and academic articles on the solutions to improve competitiveness of ports. Wang Zhili's paper (2007) Exploration on the Solutions to Improve Competiveness of Modern Ports points out that logistics function of a port must be enhanced via the routes as follows: expand internal and external strategic alliance of port logistics industry; perfect port logistics pattern; improve logistics service and information technology construction. Also Sun Jiting and Shao Wenhui holds the viewpoint in their article (2009) Study on Improvement of Ports' Economic Competiveness that in order to strengthen Chinese ports' competiveness, factors of production should be improved; more emphasis should be put on developing port information technology; accelerating port service industry is quite necessary;

importance of coordinated development between ports and coastal cities should be well noted.

There are also some papers about evaluation of port competiveness. Wang Zilong and Han Zenglin use factor analysis and 2009 statistical data of index affecting port competiveness to carry out a horizontal comparison and analyze the coastal ports agglomeration around Bohai in Research On Competitiveness of Main Ports in Circum—Bohai Area(2012). An Na and Liu Jinlan (2009) propose a evaluation method based on customer satisfaction degree index in their article Port Competiveness Evaluation based on Customer Satisfaction Degree Index. Mou Ziying(2010) apply SWOT Model to analyze the current development of Ningbo-Zhoushan Harbor and proposed strategies and suggestions on its future development.

On the subject of Shanghai port and Shanghai Shipping Center Construction, Li Zhihui analyzed in her master degree paper (2010) Study on the Construction of Shanghai International Shipping Center about current problems and disadvantages facing Shanghai port. She compared the existing situation of Shanghai with the developing experience of London and Singapore. Li Zhihui holds the view that Shanghai port should choose a high-end service-oriented and hinterland-based international shipping center developing model. In promoting Shanghai to be constructed into the shipping center, Wang Xiaoping possesses the standpoint that we should seek for cooperation opportunity between Ningbo-Zhoushan Harbor and Shanghai Port, say enhancing the collaboration in port infrastructure construction and port function positioning, etc.; meantime implement cooperative development in shipping “soft environment”---ship finance, shipping consultancy, shipping research institution, shipping education and training, etc. in her article(2008) Competition and

Cooperation Between Ningbo-Zhoushan Harbor and Shanghai Port.

1.2Research Methodology

In this paper, I will apply qualitative method to analyze the factors which affect the competitiveness of modern ports and illustrate in detail the evaluation system of modern port's competitiveness. Then I will apply the method of factor analysis to analyzing Shanghai port's competitiveness of 8 consecutive years and discover the developing potential of Shanghai port time-wise. On the other hand, I will compare Shanghai port competitiveness with port of Hong Kong as well since Hong Kong is presently kind of the developing target for port of Shanghai. The purpose is to find out the factors that affect most the competitiveness of Shanghai port as well as the disparity of Shanghai with a real international shipping center like Hong Kong and try to propose some suggestions on next-step improvement.

1.4 Paper Structure

The first chapter is an introduction of the topic I am going to study as well as the research methodology. In the second chapter I am going to illustrate the theory of port competitiveness. After that is the explanation and discussion of the factor analysis methodology I am going to put into application. Then in the fourth chapter, I will apply factor analysis to calculating and assessing the developing potential of Shanghai port so as to evaluate the competitiveness of Shanghai port. At last, a conclusion based on the qualitative as well as quantitative analysis will be drawn.

2 Theory of Port Competitiveness

2.1Port-related Theory

2.1.1 The concept of port

Port refers to the workplace or base that locates in the river, on the riverbank, in the bay or along the reservoir with certain area of water or land, which provide equipment and conditions for the navigation and repair of the ship, supply freshwater and combustible materials, deal with cargo packaging, loading and unloading, storage, transport and processing, passengers' loading as well as other business activities.

Port is always located in communications center with broad hinterland. There are modernized transport network and road network consisted of river channel, railway, high road and tunnels, etc. Hence, Port is an integration point and hub of land transport and ocean carriage. The city port locates in and the regions nearby usually have relatively developed economy. However, at the moment ports' function has transformed into an intricate logistics system integrating a variety of activities.

The main indicators measuring the port size are handling capacity of the harbor, berth depth, berth quantity, handling efficiency ashore, storage space and cargo storage cycle, transporting capacity of goods distribution. Geographical environment

is a major factor influencing port indicators.

2.1.2 Port Hinterland

Port hinterland is also called economic hinterland of port. By definition, hinterland is the land or district behind a coast or the shoreline of a river. Specifically, the word is applied to the inland region lying behind a port, claimed by the state that owns the coast. The area from which products are delivered to a port for shipping elsewhere is that port's hinterland.

Hinterland of Port can be categorized into direct hinterland and indirect hinterland. Direct hinterland indicates the area which can be reached via means of transport. Indirect hinterland is also called transshipment hinterland, which refers to the range of area that cargo and passengers will reach after being handled at the port and transshipped in the other site. In a country or region where the economy is developed with dense ports the hinterlands are usually cross-over and change along with the economic power of port and city.

Having economic hinterland is a necessity for ports. Hinterland supply port with energy and spur the port to develop. Port development in turn stimulates the development of hinterland and expands the scope of hinterland. Generally speaking, the economic power of port is in direct proportion to the radius of its hinterland as hinterland is what port depends on for survival and development. Port and the hinterland rely on each other and attract each other.

2.1.3 Different types of port

Classified by natural conditions, there are estuary harbor, coastal harbor, artificial/natural harbor, ice port/ice-free port, and tidal/closed harbor. Sorted by function, there is naval port/commercial port, industrial port, specialised/comprehensive port.

From the perspective of the properties of cargo trading, there is domestic/foreign trading port and port of entry/free port. However, according to the circulation of goods, there is pivotal port, port of transshipment and port as continental bridge.

2.1.4 Principal facilities of Port

As a modernized port, in addition to possessing natural and geographical conditions, port should also have sound and fine facilities. Port facilities refer to the artificial structures and other related equipment built for the port production and operation. According to the regulations of china, port facilities include basic facilities and operating facilities.

Basic facilities of port offer services concerning ship entering and leaving, docking, passengers' embarking and disembarking, etc. Based on current international and national practice, basic facilities include the dock, waterway, dock basin, anchorage ground, breakwater, navigation lock, port roadway, buoy, passenger station, plumbing, public communications facilities, environment protective facilities and navigation facilities and so on.

Operational facilities of port provide services regarding cargo handling, storage and other production and operation related activities, which include handling facilities and storage yard.

2.1.5 Development tendency of modernized port

Port is the node of global integrated transport system. The efficiency, service level, and reliability of the port are very critical factors. Development of modern transport technology and operation mode has brought up new demands for ports' hard environment as well as soft environment.

(1) Modern ports are of larger and larger scale.

In order to adapt to the development of modern transport technology, especially that larger-sized vessels have increasingly higher requirements to the natural conditions and facilities of ports, port corporations nowadays are focusing on reinforcing port construction and enlarging port scale.

(2) Containerization

Along with the practice of container multi-model transport, containerization degree of general cargo transport is getting higher and higher. Container throughput has become the major label of measuring the function and status of a port.

(3) The trend of deepwater berth

Global container liners nowadays need water depth when entering the port channel to be deeper and deeper. As is predicted, there will be 20% of international container liner in the word that need above 13.5 meters deepwater berth and fairway.

(4) Hi-tech trend

Transformation of liners' business operating mode has put forward higher and higher requirements on handling efficiency of ports especially hub ports. All ports around

the world are actively developing new technology, improving loading and unloading process, attracting main ship callings.

(5) Information network

As the “nerve center” of integrated transport system, port information networking has become a global trend since information has to be transmitted among different transport nodes accurately and rapidly. Information network is an important way of improving port service efficiency.

(6) Modern ports transform into logistics service center.

The service port provides is becoming integrated service including packaging, storage and delivery, which ask for the function of port logistics and information to be better.

(7) Emphasize on sustainability of development of modern ports.

Environment protection has become a major subject human beings concern a lot at present. Port state control is the best example of countries put emphasis on protecting environment. In the future, port development must be based on sustainability of development in order to pursue real success.

2.2Theory of port competitiveness

2.2.1 Related concepts of competitiveness

According to Wikipedia, competitiveness pertains to the ability and performance of a firm, sub-sector or country to sell and supply goods and services in a given market, in relation to the ability and performance of other firms, sub-sectors or countries in

the same market. Another way to elaborate the definition of competitiveness is the comprehensive ability that two or more than two companies possess in the process of participating in the competition. Hence, competitiveness is an index of relativity, which can be reflected through competition.

Generally speaking, competitiveness can be big or small, strong or weak. However, it is not easy to accurately measure competitiveness in quantity sense. The subject and object of competitiveness is the major factors when analyzing competitiveness. From the perspective of subject, competitiveness can be classified into national competitiveness, industrial competitiveness and enterprise competitiveness. Based on competiveness object, there is comprehensive competitiveness, economic competitiveness and cultural competitiveness as well as military competitiveness.

In the micro-level, research on competitiveness is about enterprise competitiveness, which means in a competitive market the comprehensive ability a certain enterprise possess that can continuously provide products and service to the market with better efficiency than others, at the same time obtain profits and self development.

2.2.2 Port competitiveness

The subjects i.e. players in port market are the port enterprises. The difference between port enterprises and general enterprises is that ports now have double features after the Chinese policy “separate administration from enterprises”. One is the feature of being an enterprise in charge of independent operation as well as responsibility for its own profits and loss. On the other hand, from the perspective of social significance, port is the infrastructure of national economy, which has obvious geographical boundaries. Port enterprises bear the responsibilities of making a

contribution to the social economy development in addition to making a profit for itself. So is port competitiveness which bears the double traits of economical efficiency and sociality.

In this paper, port competitiveness is going to be studied in the domain that in the process of participating in competition, the capabilities and potentials that a port enterprise possesses to allocate and create enterprise resources as well as interact with external environment i.e. hinterland , government, etc. It is a dynamic concept since port competitiveness in this paper is going to be studied following time axis.

2.2.3 The characteristics of port competitiveness

(1) Governmental factors in port competition.

Since port is the infrastructure of the national economy and development priorities, port development has been given quite an emphasis by all levels of government. Governments of all levels compete for local maritime advantage and support port enterprises via providing port with preferential policy and funding. In this sense, current port enterprise competition is not only about market competition, but also about competition on policy. Policy orientation and ancillary facilities construction support from local government is an important aspect of the reflection of competitiveness of our port competitiveness.

(2) Location factors in port competition.

Although port enterprise competition is based on quality of service and effectiveness of facilities and operation, geographic conditions port locates in is also very crucial, including the location of ports, the water depth of waterways and berths; in addition, there are urban conditions ports depend on, such as the level of urban economic

development, environmental conditions as well as the service functions of port city; moreover, the conditions of collection and distribution, such as roads, railways, aviation, and water transport. All of these factors will directly affect the ship's and cargo owner's choice of port.

(3) Port competing focus is supply of goods

The focus of competition for ports is supply of goods. As the infrastructure of the national economy, ports are often classified as advanced development projects. Feasibility study put sufficient emphasis on the social benefits of the port construction. Port's competitiveness goal is about cargo source.

(4)Competitiveness relies on service.

Competitiveness of the port depends on the service. The efficiency of the port is the main indicator of the level of port enterprises. An important indicator reflecting the competitiveness of port operators is the port capacity. Work efficiency is the basis of the development of port enterprises. Only by enhancing the port efficiency can make it possible to lay the foundation for further development of the port.

(5) Sustainability of port competitiveness has a big demand for capital support.

The port's sustainable competitiveness requires a lot of capital support. With China's accession to the WTO, trading between China and foreign countries will become more and more frequent. In fact, many of Chinese ports are in a state of having overload operators because it has become a trend for China's port enterprise to invest in building new terminals; in addition, larger-sized container ships has been an unstoppable tendency as well so very large container vessels require higher-level port construction which significantly accelerated updating port facilities. The construction of these investments needs a lot of capital as backup. In this situation ports need to

have strong capital management capabilities.

3 Evaluation System of Port Competitiveness

3.1 Principles of establishing the evaluation index system

(1) Scientificalness.

The evaluation index system is the product of integrating theory with practice. It must be an abstract description of the objective reality about the port to study. The index system must be able to accurately reflect the material and technological foundation, internal components, current development situation as well as variation tendency of port's comprehensive competitiveness. In other words, major essential characteristics and internal regularity should also be uncovered. The index chosen should have clear concept and implication, ease of use, complete coverage as well as being representative. In the final analysis, the index system will provide advice and support to improving and boosting port comprehensive competitiveness.

(2) Integration of overall evaluation and partial evaluation.

Index system of port competitiveness is a systematic process of analysis, the basic idea of which is to realize group optimization meanwhile take into consideration organic integration of partial evaluation and overall evaluation.

(3) Quantitative and qualitative assessment combined.

Port competitiveness is a multi-dimension compound system, including competitive power of both hardware and software. Since not all the indicators can be quantized, there is the need to put qualitative index into the system to make the evaluation more complete, objective and in touch with facts.

(4) The evaluation system can reflect dynamic evolution.

Port competitiveness is a dynamic developing process hence the index system must take into consideration both current situation and future tendency, i.e. the long-term plan and potential. In this way, the evaluation system can show the present and future compete situation.

(5) Operability

Operability pertains to the principle that under the premise of meeting the evaluation objective, the index system should be designed with clear concepts and simple, understandable means of expression as well as easy data acquisition. In addition, the index chosen should not be too complicated with an excessive big quantity, in order not to get obsessive with details and miss the nature of the research object, thus negatively affecting the significance of the evaluation.

3.2 Influencing factors of port comprehensive competitiveness

The comprehensive competitiveness of port is influenced by numerous factors. It not only depends on the comparative advantage of resources endowment, but also the competitive edges determined by government, knowledge, management and human resources, etc. And all those factors are related to each other, affecting each other, interacting with each other. In general, those factors can be divided into basic

environment factor and soft environment factor. Under this circumstance, the index evaluation system should be established based on the factors discussed in the following paper.

3.2.1 Construction of basic environment

The implication of basic environment includes a lot of factors. This paper will launch the analysis from the following aspects: natural and geographical conditions of the port, the level of production and technology (including hardware facilities), transportation network, economy environment of hinterland, sustainable development capacity.

(1) Natural and geographical conditions

The natural condition is a very crucial element to port development. It mainly refers to the following aspects: weather and climate situation; probability of natural disaster happening; port hydrology; width of the waterways and water depth; the distance between international shipping arteries and port. Among those factors, climate, tide and gelivation are immutable; however, changing the water depth is quite highly costing. The inevitable trend of shipping industry development is larger-sized vessel, which directly results in higher requirements on port waterways and water depth. As is shown in researches that deeper water is a best guarantee for improving handling efficiency, meantime shortening ship's berthing time. Moreover, deep water improves the production capacity. From the above, water depth is an important factor influencing port competitiveness.

Port operation can be affected by the climate of the area where port locates, e.g. some sea area in north China may experience gelivation in winter, which affects the

normal production in port; ports in south China suffer from typhoon in summer pretty often; some ports can suffer from fog or tides. All these will impact the production efficiency, service quality and the fund turnover of ports. Eventually those indicators will be reflected by the annual working hours of the port.

(2) The level of production and technology

Port's productive and technological level is one of the most direct factors in port competitiveness. Present actual throughput, present throughput increasing rate, technological level of terminal installation, water depth and length of berth front, berth quantity; storage yard and storage capacity. Technological level of terminal equipment refers to the technological level of shoreside handling facilities, yard working equipment and horizontal carriage machinery.

(3) Collecting and distributing capacity

Collecting and distributing capacity of a port is directly related to whether cargo from hinterland can smoothly pass through a port, and also determine the scope of hinterland. Currently the major collecting and distributing network of a port includes highway, railway and multi-model transport.

(4) Economy environment of hinterland

The influence of hinterland economy environment on port competitiveness pertains to the aspect of cargo source. The factors behind cargo source are national economy development level, national economy growth rate, foreign trade development level, industry structure and product structure as well as special economic policy.

(5) Sustainable development of port

Sustainable development capability is directly related to the future developing ability and the level of development. The factors behind are port reserved land and container terminal reserved.

3.2.2 Construction of soft environment

There are two elements concerning soft environment: governmental environment and economy environment.

3.2.2.1 Governmental environment

(1) Legal environment

Legal environment mainly refers to lawmaking and law enforcement situation. Local authority adjusts the interest relationship between local region and other regions, between government and individuals via making legislation to make clear the limits of acts. However, law enforcement regards to legal environment affects people's acts in essence.

(2) Policy environment

Policy environment pertains to that government increase or reduce the interests of main market players according to local economy operation situation. Policies are established by government, including encouraging policies as well as restrictive policies. Encouraging policy means government provides certain market players or market activities with support, assistance, taxation reduction and refund as well as some privilege. Nevertheless restrictive policy includes limits, punishment, charging and approval control.

(3) Governmental institution and services

Services from government to enterprises are the most often and direct factor that influence enterprise operating efficiency. The benefit of an enterprise depends on the quality of services local government provides. Full–scale government services with guiding significance will decrease business failures in making decisions, reduce operation risks and expense in public information. Compared to policies, government services are not transitive, which can form localized soft environment.

3.2.2.2 Economic soft environment

In a broad sense, economic soft environment refers to regional soft environment which influence individuals' economic behaviors and decisions. It has the following sub factors.

(1) Shipping market environment

Shipping market refers to the market economy performance and market structure. Shipping market is to realize the functions of resource allocation, value interchange among different parties, supply, information orientation, competition, adjustment and communication.

(2) Finance environment

Developed finance capability make shipping industry well guaranteed and operate with sound convenience. In the view of international and regional shipping center worldwide, the development of shipping industry need the support from solid finance sector, e.g. Hong Kong is an ocean shipping and finance center. Shipping is a capital-intensive field, and the development of finance capacity will further broaden access to finance for shipping, thus solving the problem of capital-lacking for most

shipping companies and port department. In addition, financial services also play a part in the account clearance of shipping and trading.

Insurance is an indispensible supporting part for shipping industry of high risk. Perfection of insurance system, abundant insurance products, orderliness of shipping market will be a contributable support for shipping.

(3) Information service environment

With the rapid development of market economy, information has become an important element determining the success and failure of an enterprise.

For shipping sector, information is a significant element in promoting shipping market development and enhancing port service quality.

Firstly, shipping exchange information can maintain the stability of shipping market, guarantee the efficiency of price mechanism, specify the market and promote shipping transaction. Secondly, financial, trading information as well as shipping information help port and shipping company get to know the market dynamics and relevant legal and regulation policy. It will improve market clarity and provide customers with market and decision-making information, reducing operation risks. Moreover, unobstructed information helps maintain security and efficiency in shipping. Application of shipping information improves the service quality of shipping industry.

(4) Human resource

On one hand, talents resource can make up to the shortage of physical resource. Labor is the decisive factor in productivity and talents is the group of people with the

highest quality and most advanced knowledge. Hence, talents resource is the most precious and important resource among all the resources. Talents can exploit natural resources as well as create new physical resources via its own high-level initiative to make up to the lack of current physical resources.

On the other hand, talents with high quality bring multiplication to economy growth. Improving labors' quality is actually enhancing science and technology knowledge, improving labor skills. And labor skills enhance will boost economy increase multiply.

3.3 Evaluation index system of developing potential of Shanghai port

In this paper, I am going to evaluate the competitiveness of port of Shanghai from the perspective of developing potential. Only by knowing the developing potential of a port can we expect the growth impetus and future trend of development.

Based on the factors stated earlier that influence port competitiveness, depends on the accessibility of data and information, the evaluation index system of the developing potential of Shanghai port is established as table 3-1. In this evaluation system, there is at least one index under each list of 2nd level indicator so as to make the evaluation result as reasonable as possible. As we can see ,there are in total 30 indicators to be applied to the evaluation model later.

Table 1: Evaluation index system of developing potential of Shanghai port

Indicator of 1st Level	Indicator of 2nd Level	Indicator of 3rd Level
Basic Environment	Natural and Geographical Conditions	Average Depth of Wharf Apron(meter) **X1**

		Quay Length(meter) **X2**
	Production and Technological Level	Number of Container Berth **X3**
		Number of Berth **X4**
		Container Throughput('000 TEU per year) **X5**
		Container Throughput Growth Rate % **X6**
		Cargo Throughput(million ton per year) **X7**
		Transshipment Container Volume('000TEU) **X8**
		Vessel Pilotage **X9**
	Collector-distributor Ability	Efficiency of Collecting and Distributing (1-9） **X10***
	Hinterland Economy of Shanghai City	GDP (RMB billion) **X11**
		Annual Disposable Income per capita of Urban Residents (RMB) **X12**
		Import and Export Trading Volume(billion $) **X13**
		Ratio of Service Sector to GDP (%) **X14**
	Sustainable Development	Energy Consumption (10,000ton of standard coal equivalent) **X15**
Soft Environment	Governmental Environment	Ratio of Local Government Fiscal Revenue to GDP (%) **X16**
		Unemployment Rate (%) **X17**
	Shipping Market Environment	Liner Density(Number per month) **X18**

		Number of New Ship Routes **X19**
		Number of Shipping Company and Auxiliary Companies **X20**
		Expanding Capacity of logistics service(1-9) **X21***
	Finance Environment of Shanghai	Finance Industry Output(RMB billion) **X22**
		Growth of Finance Industry Output (%) **X23**
		Number of Insurance Institution **X24**
		Scale and Power of Financial Institution(1-9) **X25***
	Information Service Environment	Growth of Information Industry Output(RMB billion) **X26**
		Number of Internet User(10,000) **X27**
		E-commerce Transactions(RMB billion) **X28**
	Human Resource Environment	Ratio of High-skilled Talent to Skill Worker (%) **X29**
		Knowledge and Skill Updating(Number of People Getting Professional Training,10,000) **X30**

3.4 Choosing the proper methodology to evaluate port competitiveness

3.4.1 Optional methodologies

Internal and external scholars' researches on port competitiveness have mostly put into practice qualitative methodology; quantitative analysis was often based on AHP method or fuzzy comprehensive evaluation method. Generally speaking, there are several methods which are used most commonly so far when it comes to port competitiveness evaluation.

(1) SWOT analysis

SWOT analysis (alternatively SWOT Matrix) is a structured planning method used to evaluate the Strengths, Weaknesses, Opportunities, and Threats involved in a project or in a business venture. This methodology is a summary of the internal resources and external resources of a corporation through which the enterprise itself will put together all available resources, energy, actions and apply them to the area he can make full use of all the advantages or search for the best opportunities. SWOT analysis is usually applied to analyzing the competitors or formulating policies and strategies of the company itself.

(2)Benchmarking analysis

Benchmarking analysis is a method for corporations to compare its own business activities with the most excellent competitor with the same business activities, hence discover its shortcomings and weaknesses and make changes.

Benchmarking analysis embodies different functions and benefits in different situation of application accordingly. If it is applied to analyzing the top enterprises inside and outside the industry, a corporation can gain advanced experience and methods in corporate operation and management from top enterprises so as to serve

for its progress. If benchmarking is used to analyzing a company and its competitors, the differences in operating strategies, marketing, research and development will be discovered and serve for the company's competing strategy and competitiveness improvement.

Benchmarking analysis is relatively simple to put into application and easy to get the sequence of different competitors' competitiveness. However, it is not easy to distinguish principal factors from minor factors via benchmarking. For an analysis of port competitiveness which is comprehensive and has got quite complex-related factors, analysis result from benchmarking tends to be not objective and accurate.

(3)The analytic hierarchy process

The analytic hierarchy process (AHP) is a method combining qualitative and quantitative analysis, which is quite systematic. AHP is very suited for policy-making problem with multi-objects.

The advantage of AHP is being simple, clear and quantifying some qualitative indicators. It involves many indicators in the process of analyzing which is applicable for port competitiveness analysis since there are quite a number of factors influencing port competitiveness. Plus, those factors have complicated relations. AHP is an effective solution from the aspect. Nevertheless, when assessing the relative importance of all indicators the sequence is always done by subjective estimating and opinion. Besides, AHP is not perfect in selecting indicators and the mutual relations of different indicators cannot be analyzed and discovered effectively. On this level, AHP is not perfect for analyzing port competitiveness.

(4)Fuzzy comprehensive evaluation method (FCEM)

Fuzzy comprehensive evaluation method is suited for those problems with a big number of factors, a high level of uncertainty and difficult to quantify. The most distinctive feature of fuzzy comprehensive evaluation is quantifying a lot of qualitative indicators.

The procedure to put FCEM into practice is as follows: 1. Select the factors to be evaluated. The first step is quite similar to that of AHP. The factors should be classified by different levels. 2. Get the functional relationship between the value of indicators and the evaluation value of indicators. If factors evaluated have concrete number, then we can get the evaluation value of this factor for the correspondent evaluation object by comparing it with most distinctive factor value in all evaluation objects. In this case, the evaluation value we get is quite objective. On the other hand, if the indicators don't have concrete number, the experts or evaluators will firstly give a value to this indicator for the best object evaluated and then give a grade to this indicator for other objects evaluated based on their own judgment. 3. Confirm the weight of indicators for different levels. Normally the sum of factors' value in the first level is 1, and the sum of the values in the sub-level of each first level indicator is also 1. The rest can be done in the same manner. 4. Do the calculation and evaluating.

Fuzzy comprehensive evaluation method enhances the objectiveness but is still subjective when it comes to evaluate factors without concrete value. In addition, the way of putting weight value on indicators is lack of scientificalness. Experts giving values to indicators will affect the evaluation results to a big extent. Even so, quite a lot of researches on port competitiveness have used FCEM.

(5)Other methods of evaluation

There are also some scholars have applied other methods to evaluating port competitiveness, e.g. data envelopment analysis (DEA), rough set theory, artificial neural network model, structural equation model, etc.. But those methods are not used so often.

3.4.2 Factor analysis

(1) Basic idea of factor analysis

Factor analysis method analyzes internal relationship of dependence among different variables, uses a few abstract variables (factor/component) to reflect and represent the main information that observable indicators stand for; explain the mutually dependent relations among observable indicators. Factor analysis compress original data, find the basic structure of data and transform the main information embodied in original information into a few common factor values.

Factor analysis removes the human factor when giving weight to indicators. Non-related common factors are extracted from the big collection of data which reflects the information of original indicators as well as solving the problem of possible overlapping of information. More importantly, this simplifies the indicator structure of original index system.

The biggest advantage of factor analysis method is that the weight value of all common factors is determined by the variance contribution of each factor to the variable instead of subjective assignment by human. In this paper, I am going to use the method of factor analysis to find out the several main factors influencing port

competitiveness from the complex index system in order to get to know about developing potential of shanghai port.

(2) Mathematical model and basic steps of factor analysis application

Hypothetically, the number of original factors is p, and they are indicated as X1, X2, X3 …… Xp respectively. F1, F2, F3 …… Fm represent factor variances respectively with the quantity of m. So, there is m is less than p.

$X1 = a11*F1 + a12*F2 + a13*F3 + \ldots + a1m*Fm + a1*\varepsilon 1$

$X2 = a21*F1 + a22*F2 + a23*F3 + \ldots + a2m*Fm + a2*\varepsilon 2$

……..……

$Xp = ap1*F1 + ap2*F2 + ap3*F3 + \ldots + apm*Fm + ap*\varepsilon p$

In this model, F is the common factor or factor variance. They can be understood as m axis perpendicular to each other in a high-dimensional space. A represent factor loading matrix, aij indicates factor loading, which means the load of the i-th original indicator variables in the j-th common factor variables. If the variable X is regarded as a vector of the m-dimensional factor space, which means that X is in the projection on the axis F, equivalent to the standard regression coefficients of the multivariate regression analysis model; ε stands for a special factor, meaning the original variables cannot be partly explained by the common factor.

There are three basic steps to apply factor analysis.

a. Whether it is suitable to apply factor analysis to original factors

Use KMO (Kaiser-Meyer-Olkin) to test indicators and determine whether the original variables are suitable for factor analysis. According to sampling adequacy test given by statistician Kaiser (1974), KMO is used to compare if correlation coefficient values and the partial correlation coefficient are moderate. The closer its

value comes near to 1, the better applying the factor analysis to these variables. In most cases, if KMO value is greater than 0.5 then the result of factor analysis is acceptable—it is feasible to use factor analysis in this case. Otherwise, the factor analysis results may not be reliable.

b. Confirm factor variances and calculate factor loading matrix.

Constructing factor variables is one of the key steps of factor analysis. There are several methods to determine factor variables in factor analysis, such as principal component analysis based on principal component model, the maximum likelihood method, as well as least squares method. The SPSS software default takes principal component analysis.

Step1: SPSS gives the "total variance explained", the results of which is to determine the number of common factor (principal component) and the contribution rate of the common factor i.e. weight. Step 2: there is "rotated component matrix" given by SPSS, based on which we can get the common factor expression of each original indicator variable meantime provides a reasonable explanation of common factors. Finally, the factor score coefficient matrix is given by SPSS and we can get the expression of the common factors. The factor scores of each year can be calculated in accordance with the standardized value of the original indicator variables.

c. Get the result of factor score.

According to port common factor scores, each factor score is multiplied by its weight and then summed to yield a score of the comprehensive competitiveness of the port, then make the competitiveness rankings and other results regarding port competitiveness.

4 Analysis of developing potential of Shanghai port

4.1 Current developing situation of shanghai port

4.1.1 A brief introduction of Shanghai port

Shanghai Port is located at the meeting point of China's coastline and the Yangtze River "Golden Waterway", adjacent to the international east-west waterway trunk. The port of Shanghai has a wide expanse of fertile Yangtze River Delta and the Yangtze River basin as the main economic hinterland. Shanghai port has got a uniquely advantageous geographical location as well as collection and distribution network extending in all directions. The main business areas include handling and production of port containers, large bulk cargo and general cargo; and production-related port pilotage, towing, tally, barging, warehousing, cargo agent, container truck transportation, international cruise services, port services and port logistics business.

Shanghai International Port (Group) Co., Ltd. (SIPG) is China's largest joint-stock port enterprise; the cargo throughput and container throughput of Shanghai port ranks first in the world at present.

SIPG has opened up all over the world more than 300 international liner routes to Europe, Australia, Africa, and also liner routes in Northeast Asia, Southeast Asia and many other places. Container monthly flight density has reached more than 2700 shipments, among which the number of international shipment is 1300. Shanghai port has the most container routes, highest density shipments and most extensive coverage in mainland China. The world's largest 20 Chinese and foreign shipping companies have been stationed in Shanghai by setting up subsidiaries or offices in Shanghai.

4.1.2 Competition pattern and development trend of port industry

Throughout the international and domestic economic situation, the fact that China's port industry development is still at an important period of strategic opportunities has not changed, but the content and conditions of development are undergone profound changes. Firstly, the international economic situation is complicated and full of variables. Slow world economic growth will continue, port throughput growth will continue to face downside risks. Secondly, shipping market is experiencing the cyclical bottom; shipping companies are subject to the fact of difficult-to-make profit and attempt to pass on the costs. At the same time prices of port production factors have continued to increase rigidly, making it more difficult for the port industry to enhance the quality of economic operation. Thirdly, with the trend of larger-sized ships accelerated, shipping companies will accelerate the route capacity adjustment based on economies of scale and propose higher demands on handling efficiency and the collection and distribution services.

At the same time, there still exist a series of positive factors and favorable conditions in both internal and external development environment. They are mainly embodied

in four aspects: Firstly, despite that the growth of China's foreign trade faces downward pressure, but the traditional comparative advantage of Shanghai port still exists, market diversification strategy is moving forward steadily in global trade. China’s status in the world stage still stands out and the port industry still has a certain foreign stock basis. Secondly, with our efforts to expand domestic demand and expand consumption as well as other strategies are promoted to carry out, foreign trade imports and domestic transport will have the potential for further growth, will continue to harbor a positive impact on local business needs. Furthermore, Yangtze River region accelerates the transfer of industries with its comprehensive cost advantage, foreign trade is still expected to maintain a relatively high growth rate; the Yangtze River Delta ports can continue to provide space expansion of volume. At last, port asset trading in the international market has got more opportunities which provide opportunities for China's port enterprises to expand the international strategy.

4.1.3 Possible risks against port of Shanghai

First of all, it is the risk that cyclical fluctuations of macro-economy impact port industry. Port industry pertains to a basic industry of national economy; the level of port industry development is closely related with the development of the national economy. Macroeconomic situation and development trend have an important influence on the development of port industry.

Next, it is the venture of competition on the position of international container hub port. Considering the global economy, trade and shipping development status and trends, container shipping is developing in the direction of larger-sized ships, business alliances and transport trunk lines. Therefore being the international

container hub port becomes increasingly important. Shanghai port locates in Northeast Asia, and the major competing ports are currently targeting at becoming "Northeast Asia Center". Port corporations are actively expanding production capacity, making the regional hub port status competitive.

Thirdly, it is the risks from natural conditions. Meteorology, hydrology, geology and other natural conditions will affect the normal operation of the port. Due to the fact that Shanghai port is located in the subtropical monsoon climate zone, typhoons, tropical storms and other inclement weather might be an impact to Shanghai vessels, causing the ship not be able to berth, load and unload operations and affect normal port development.

4.2 Apply factor analysis to Shanghai port

4.2.1 Primary data for evaluating developing potential

According to the influencing factors discussed in the third chapter, I collected some original information by referring to Shanghai Statistic Yearbook, China Port Year Book and relevant authoritative websites. Given some information is inaccessible the developing potential calculation of this paper is going to be based on the following indicators and data.

Table 2: Primary data of Shanghai port

Indicators	2011	2010	2009	2008	2007	2006	2005	2004
Average Depth of Wharf Apron(meter) **X1**	13.5	12.5	12	12	11.5	11.5	11	10

Quay Length(meter) **X2**	119700	119200	116800	114900	101500	91600	89500	89000
Number of Container Berth **X3**	43	45	38	42	37	32	28	24
Number of Berth **X4**	1226	1218	1145	1203	1155	1140	1181	1198
Container Throughput('000 TEU per year) **X5**	31739	29069	25002	28006	26152	21719	18080	14554
Container Throughput Growth Rate % **X6**	9.19	16.27	-10.73	7.09	20.40	20.10	24.30	29.00
Cargo Throughput(million ton per year) **X7**	727.58	653.39	592.05	581.7	561.44	537.48	443.2	378.97
Transshipment Container Volume('000TEU) **X8**	1570	1475	1450	1430	1280	785	615	282
Vessel Pilotage **X9**	69345	67260	63150	61876	59753	54945	50000	48700
Efficiency of Collecting and Distributing (1-9） **X10***	7.6	7	6.5	5	5	4.7	4.5	4
GDP (RMB billion) **X11**	1919.57	1687.24	1490.1	1369.82	1218.9	1036.7	916.4	807.283
Annual Disposable Income per capita of Urban Residents (RMB) **X12**	36230	31838	28838	26675	23623	20668	18645	16683

Import and Export Trading Volume(billion $) **X13**	437.436	368.869	277.73	322.138	282.97	227.49	186.4	160.026
Ratio of Service Sector to GDP (%) **X14**	57.88	57.01	59.37	53.66	52.58	50.59	50.42	50.80
Energy Consumption (10,000ton of standard coal equivalent) **X15**	39	35.7	29.5	23	18	15	13	11
Ratio of Local Government Fiscal Revenue to GDP (%) **X16**	17.87	17.03	17.05	17.39	17.25	15.44	15.64	13.87
Unemployment Rate (%) **X17**	4.2	4.2	4.3	4.2	4.3	4.4	4.4	4.5
Liner Density(Number per month) **X18**	2984	2700	2183	2258	2182	2106	1996	1716
Number of New Ship Routes **X19**	40	65	0	0	50	35	32	33
Number of Shipping Company and Auxiliary Companies **X20**	1951	1833	1780	1255	1012	886	846	759
Expanding Capacity of logistics service(1-9)	8	7.8	7.5	7.1	6.9	6.6	6	5

X21*								
Finance Industry Output(RMB billion) **X22**	224.047	193.173	181.79	144.26	120.91	82.52	67.51	61.245
Growth of Finance Industry Output (%) **X23**	8.2	4.9	25.6	15	46.52	22.23	10.23	-1.97
Number of Insurance Institution **X24**	333	320	307	291	261	222	227	168
Scale and Power of Financial Institution(1-9) **X25***	8.5	8	7.6	7.1	6.6	6	5.5	5
Growth of Information Industry Output(RMB billion) **X26**	187.477	164.649	163.24	167.052	163.28	133.79	110	87.399
Number of Internet User(10,000) **X27**	1691	1410	1250	1160	1080	957	803	633
E-commerce Transactions(RMB billion) **X28**	540.1	409.51	325.22	275.817	242.62	208.74	178	144
Ratio of High-skilled Talent to Skill Worker (%) **X29**	26.05	25.1	23.2	22	21.6	21.1	19.5	19

Knowledge and Skill Updating(Number of People Getting Professional Training,10,000) **X30**	47.63	41.13	40.53	43.47	46	41.2	40	39.2

Note: Data source: China Ports Year Book (2004-2012), Shanghai Statistics (http://www.stats-sh.gov.cn), Shanghai Statistical Year Book (2004-2012); the indicator code X with * means the correspondent numerical value is based on score by experts.

As we can see, I collected 30 indicators regarding the developing potential of Shanghai port from the perspective of natural and geographical conditions, production and technological level, collector-distributor ability, hinterland economy, sustainable development, governmental environment, shipping market environment, finance environment, information service environment and human resource environment. At the same time, I make sure that there is the data of at least one indicator under each category so the result can be more objective and closer to reality.

4.2.2 Apply factor analysis to Shanghai port over the year 2004 to 2011

As is indicated in table 4-1, firstly I am going to run the model of factor analysis to make a longitudinal evaluation. In the following part, the developing potential of Shanghai port in eight consecutive years from 2004 to 2011 is going to be calculated. Then we will get to see in detail the growth of Shanghai port in an eight-year

timeline and find out the developing potential of the port of Shanghai in an objective view.

Step1:

Since the indicators are with different measure units and measuring standard, they cannot just be added together without synthesis; they are not with comparability. In this case, we need to transform those indicators into non-dimensional index. This is often done via efficiency coefficient method or standardization. Because I am going to utilize SPSS software to run this evaluation model so I choose to standardize these indicators which can be done through SPSS.

Table 3: Indicators data after standardization (1)

Indicators	**2011**	**2010**	**2009**	**2008**	**2007**	**2006**	**2005**	**2004**
Average Depth of Wharf Apron(meter) **X1**	-0.35228	-0.34418	-0.3361	-0.33705	-0.3408	-0.33724	-0.32876	-0.31845
Quay Length(meter) **X2**	4.31986	4.3933	4.47357	4.467	4.36307	4.36174	4.47507	4.53198
Number of Container Berth **X3**	-0.35113	-0.34289	-0.33503	-0.33579	-0.33962	-0.33619	-0.32784	-0.31769
Number of Berth **X4**	-0.30495	-0.29626	-0.28944	-0.28725	-0.2878	-0.27934	-0.26595	-0.2537
Container Throughput('000 TEU per year) **X5**	0.88617	0.81076	0.69306	0.83352	0.87078	0.77647	0.6412	0.47427
Container Throughput Growth Rate % **X6**	-0.35245	-0.34403	-0.33704	-0.33725	-0.34039	-0.3368	-0.32804	-0.31742

Cargo Throughput(million ton per year) **X7**	-0.3244	-0.31871	-0.31221	-0.31323	-0.31531	-0.31025	-0.30556	-0.29834
Transshipment Container Volume('000TEU) **X8**	-0.29152	-0.28605	-0.27688	-0.27775	-0.282	-0.29755	-0.29633	-0.30363
Vessel Pilotage **X9**	2.35418	2.32878	2.26411	2.2498	2.42815	2.48114	2.35469	2.33541
Efficiency of Collecting and Distributing (1-9） **X10***	-0.35251	-0.3444	-0.33633	-0.33734	-0.3411	-0.33759	-0.32911	-0.31878
GDP (RMB billion) **X11**	-0.27787	-0.27761	-0.27523	-0.28027	-0.28484	-0.28464	-0.28015	-0.275
Annual Disposable Income per capita of Urban Residents (RMB) **X12**	1.06149	0.92082	0.85104	0.77787	0.75357	0.72255	0.67153	0.59031
Import and Export Trading Volume(billion $) **X13**	-0.33573	-0.33002	-0.32516	-0.32408	-0.32822	-0.32616	-0.31934	-0.31028
Ratio of Service Sector to GDP (%) **X14**	-0.35055	-0.34241	-0.33415	-0.33531	-0.33889	-0.33523	-0.32664	-0.31623
Energy Consumption (10,000ton of standard coal equivalent) **X15**	-0.35128	-0.34326	-0.33538	-0.33659	-0.3405	-0.33706	-0.32865	-0.3184

Ratio of Local Government Fiscal Revenue to GDP (%) **X16**	-0.35211	-0.344	-0.33589	-0.33682	-0.34053	-0.33704	-0.32851	-0.31824
Unemployment Rate (%) **X17**	-0.35264	-0.34451	-0.33642	-0.33737	-0.34113	-0.3376	-0.32911	-0.31875
Liner Density(Number per month) **X18**	-0.23632	-0.23736	-0.24669	-0.24313	-0.2402	-0.22978	-0.2222	-0.22547
Number of New Ship Routes **X19**	-0.35125	-0.34209	-0.3366	-0.33755	-0.33901	-0.33603	-0.32763	-0.3172
Number of Shipping Company and Auxiliary Companies **X20**	-0.27665	-0.27182	-0.26329	-0.28507	-0.29443	-0.29237	-0.28393	-0.27763
Expanding Capacity of logistics service(1-9) **X21***	-0.35249	-0.34437	-0.33629	-0.33725	-0.34101	-0.33749	-0.32902	-0.31873
Finance Industry Output(RMB billion) **X22**	-0.34406	-0.337	-0.32911	-0.33152	-0.33573	-0.3336	-0.32572	-0.31566
Growth of Finance Industry Output (%) **X23**	-0.35249	-0.34448	-0.33554	-0.33692	-0.33917	-0.33669	-0.3288	-0.31911
Number of Insurance Institution **X24**	-0.33981	-0.33196	-0.32395	-0.32538	-0.32923	-0.32644	-0.31716	-0.30984

Scale and Power of Financial Institution(1-9) **X25***	-0.35247	-0.34436	-0.33628	-0.33725	-0.34102	-0.33752	-0.32905	-0.31873
Growth of Information Industry Output(RMB billion) **X26**	-0.34549	-0.33813	-0.32987	-0.33057	-0.33376	-0.33097	-0.32344	-0.31423
Number of Internet User(10,000) **X27**	-0.2868	-0.28863	-0.28512	-0.28904	-0.29127	-0.28873	-0.28624	-0.2845
E-commerce Transactions(RMB billion) **X28**	-0.33172	-0.3284	-0.3232	-0.32602	-0.33009	-0.32712	-0.31979	-0.31115
Ratio of High-skilled Talent to Skill Worker (%) **X29**	-0.35179	-0.34368	-0.33564	-0.33663	-0.34033	-0.33675	-0.3283	-0.31796
Knowledge and Skill Updating(Number of People Getting Professional Training,10,000) **X30**	-0.35095	-0.34304	-0.33493	-0.33573	-0.3392	-0.33572	-0.3272	-0.31686

Step2: Apply factor analysis to the indicators system.

(1)Run KMO test to the standardized indicators via SPSS. KMO (Kaiser Meyer Olkin) is an index used to test whether correlation coefficient value and coefficient of partial correlation value are moderate. The closer KMO approaches 1 the better

effect we will get by running factor analysis model. In most cases when KMO > 0.5 then it is feasible to apply factor analysis to evaluating the indicators.

According to the result by running SPSS 21, KMO = 0.776 > 0.5, so the result out of factor analysis is acceptable and it is feasible to use this model.

Table 4: KMO and Bartlett's Test (1)

Kaiser—Meyer-Olkin Measure of Sampling Adequacy.		**0.776**
Bartlett'S Test of Sphericity	Approx. Chi-Square	1764.032
	Df	28
	Sig.	.000

(2)Get the eigenvalues and variance contribution to determine the number of principal component. According to SPSS 21, we get the following table.

Table 5: Total Variance Explained (1)

Component	Initial Eigen values			Extraction sums of squared loadings		
	Total	% of variance	cumulative %	Total	% of variance	cumulative %
1	24.138	80.459	80.459	24.138	80.459	80.459
2	3.687	12.289	92.749	3.687	12.289	92.749
3	1.702	5.672	98.420	1.702	5.672	98.420
4	.268	.895	99.315			
5	.109	.363	99.678			
6	.083	.276	99.954			

7	.014	.046	100.000			

Component	Rotation Sums of Squared Loadings		
	Total	% of variance	cumulative %
1	22.568	75.226	75.226
2	3.885	12.950	88.177
3	3.073	10.244	98.420

There are two ways to determine how many components to extract to be common factors. Firstly, choose the factors that have Eigen values more than 1 to be the main factors; secondly, it can be determined according to the percentage of cumulative contribution for each factor. As we can see from the table4-4 total variance explained, the Eigen values of first component is 24.138, Eigen values of the second component is 3.687 and the third is 1.702. So we choose these three common factors as main components. The contribution proportion of each component is the percent of information it contains out of the entire information base. And contribution proportion is also is the weight of each main component.

The higher the weight, the more a component explains the developing potential. In other words, competiveness depends on the components with big proportion. In this case, the first three components chose as main factors is appropriate since their Eigen values are more than 1 and the cumulative contribution is higher than 98.42% which is more than 85%.

(3) Use the component matrix to explain main components

Table6: Component Matrix (1)

	Component		
	1	2	3
var001	.998	-.020	-.058
var002	.869	.411	-.230
var003	.998	-.020	-.066
var004	.971	-.219	.084
var005	-.940	-.207	-.248
var006	.997	-.057	-.037
var007	.990	-.114	-.019
var008	-.510	.381	-.755
var009	-.103	-.878	.319
var010	.998	-.016	-.058
var011	.279	.899	.294
var012	-.893	.390	.222
var013	.994	.013	-.051
var014	.998	-.024	-.053
var015	.998	.001	-.055
var016	.998	-.022	-.060
var017	.998	-.019	-.059
var018	.571	-.442	.622
var019	.995	-.071	-.015
var020	-.004	.944	.212
var021	.998	-.019	-.060
var022	.991	.108	-.067
var023	.992	-.053	-.101
var024	.995	.009	-.084
var025	.998	-.017	-.059
var026	.994	-.038	-.097
var027	.542	.619	.500
var028	.968	.200	.134
var029	.998	-.021	-.056
var030	.998	-.034	-.056

Note: Zscore(var01)—Zscore(var030) represent the 30 variances stated earlier.

In order to make each variance have as higher loading as possible on each factor, so the variances explain the factors better, we need to get the rotated component matrix, in which the loadings of each factor are reallocated and the loading coefficient of common factors are closer to either 0 or 1, thus a more reasonable explaination of common components is possible to get.

Table7：Rotated Component Matrix

	Component		
	1	2	3
var001	.978	.109	.175
var002	.875	.426	-.174
var003	.980	.107	.167
var004	.926	-.027	.372
var005	-.831	-.419	-.349
var006	.974	.083	.208
var007	.965	.035	.244
var008	-.317	.005	-.936
var009	-.134	-.710	.601
var010	.978	.113	.173
var011	.143	.975	-.021
var012	-.940	.306	-.147
var013	.971	.141	.167
var014	.977	.108	.181
var015	.977	.130	.170
var016	.979	.107	.174
var017	.979	.110	.173
var018	.414	-.100	.853
var019	.967	.077	.231
var020	-.111	.945	-.173
var021	.979	.110	.173
var022	.967	.223	.116
var023	.986	.063	.148

var024	.980	.126	.140
var025	.979	.111	.172
var026	.986	.078	.145
var027	.359	.830	.330
var028	.888	.376	.255
var029	.978	.109	.177
var030	.978	.097	.182

Note: Zscore(var01)—Zscore(var030) refer to the 30 variances that affect port competitiveness; numbers underlined means the variance has obvious correlation with the correspondent component.

According to the rotated component matrix above, the first component has relatively higher loadings on the variances of average depth of wharf apron, quay length, number of container berth, container throughput growth rate, efficiency of collecting and distributing, ratio of service sector to GDP, energy consumption, governmental environment, growth of finance industry output, number of insurance institution, growth of information industry output and human resource environment. While the second component has relatively higher loadings on GDP of hinterland, number of shipping company and auxiliary companies, and the number of internet users. However, the third component has highest loadings on the variance of vessel pilotage and liner density.

(5) Determine the function expression and calculate factor score based on component matrix. Eigen vector matrix needs to be generated before finding the expression of main components. The eigenvector matrix can be generated via SPSS 21.

Table 8: Eigen vector matrix

	Z1	Z2	Z3
Average Depth of Wharf Apron(meter) **X1**	0.20313	-0.01042	-0.04446
Quay Length(meter) **X2**	0.17688	0.21405	-0.1763
Number of Container Berth **X3**	0.20313	-0.01042	-0.05059
Number of Berth **X4**	0.19764	-0.11405	0.06439
Container Throughput('000 TEU per year) **X5**	-0.19133	-0.1078	-0.1901
Container Throughput Growth Rate % **X6**	0.20293	-0.02969	-0.02836
Cargo Throughput(million ton per year) **X7**	0.2015	-0.05937	-0.01456
Transshipment Container Volume('000TEU) **X8**	-0.10381	0.19842	-0.57872
Vessel Pilotage **X9**	-0.02096	-0.45725	0.24452
Efficiency of Collecting and Distributing (1-9） **X10***	0.20313	-0.00833	-0.04446
GDP (RMB billion) **X11**	0.05679	0.46819	0.22536
Annual Disposable Income per capita of Urban Residents (RMB) **X12**	-0.18176	0.20311	0.17017
Import and Export Trading Volume(billion $) **X13**	0.20232	0.00677	-0.03909
Ratio of Service Sector to GDP (%) **X14**	0.20313	-0.0125	-0.04063
Energy Consumption (10,000ton of standard coal equivalent) **X15**	0.20313	0.00052	-0.04216
Ratio of Local Government Fiscal Revenue to GDP (%) **X16**	0.20313	-0.01146	-0.04599
Unemployment Rate (%) **X17**	0.20313	-0.0099	-0.04522
Liner Density(Number per month) **X18**	0.11622	-0.23019	0.47677
Number of New Ship Routes **X19**	0.20252	-0.03698	-0.0115
Number of Shipping Company and Auxiliary Companies **X20**	-0.00081	0.49163	0.1625
Expanding Capacity of logistics service(1-9) **X21***	0.20313	-0.0099	-0.04599

Finance Industry Output(RMB billion) **X22**	0.20171	0.05625	-0.05136
Growth of Finance Industry Output (%) **X23**	0.20191	-0.0276	-0.07742
Number of Insurance Institution **X24**	0.20252	0.00469	-0.06439
Scale and Power of Financial Institution(1-9) **X25***	0.20313	-0.00885	-0.04522
Growth of Information Industry Output(RMB billion) **X26**	0.20232	-0.01979	-0.07435
Number of Internet User(10,000) **X27**	0.11032	0.32237	0.38326
E-commerce Transactions(RMB billion) **X28**	0.19703	0.10416	0.10271
Ratio of High-skilled Talent to Skill Worker (%) **X29**	0.20313	-0.01094	-0.04292
Knowledge and Skill Updating(Number of People Getting Professional Training,10,000) **X30**	0.20313	-0.01771	-0.04292

Based on the Eigen vector matrix table, we can get the function expression of each main component:

Y1 = 0.20313X1 + 0.17688X2 + 0.20313X3 + …… + 0.20313X30

Y2 = - 0.01042X1 + 0.21405X2 - 0.01042X3 + …… - 0.1771X30

Y3 = - 0.04446X1 - 0.1736X2 + 0.05059X3 + …… - 0.04292X30

Through this function and the standardized numerical value of each variance, we can get the evaluation score as well as ranking of each main component for each year.

Table 9: Component score

Year	component1	ranking1	component 2	ranking2	component 3	ranking3
2004	-0.8149674	1	-0.330279	5	-0.1444434	4
2005	-0.9150352	2	-0.35560	6	-0.1464431	5
2006	-1.0095827	4	-0.445069	8	-0.1278359	2
2007	-1.0499811	6	-0.419324	7	-0.1527345	6

2008	-1.0112741	5	-0.297755	2	-0.2064499	8
2009	-0.9929279	3	-0.257144	1	-0.1616696	7
2010	-1.0740587	7	-0.311001	3	-0.1299654	3
2011	-1.1591541	8	-0.318768	4	-0.0919256	1

Step3:

At last, we use contribution proportion (weight) of each main component and get the evaluation function of Shanghai port's comprehensive competitiveness. The function is as follows:

F =0.80459Y1 + 0.12289 Y2 + 0.05672 Y3

The evaluation score of each main component for each year and the comprehensive evaluation score for each year is made into table 4-9.

Table 10: Comprehensive score

Year	component1	component2	component3	comprehensive score	Ranking
2004	-0.81496739	-0.33027895	-0.144443357	-0.704495421	1
2005	-0.91503515	-0.35559967	-0.146443083	-0.788234027	2
2006	-1.00958267	-0.44506852	-0.127835887	-0.874245441	5
2007	-1.04998106	-0.41932438	-0.152734507	-0.904998135	6
2008	-1.01127412	-0.29775464	-0.206449938	-0.861961955	4
2009	-0.99292788	-0.25714391	-0.161669638	-0.839670161	3
2010	-1.0740587	-0.31100055	-0.129965382	-0.909767385	7
2011	-1.15915406	-0.31876761	-0.091925566	-0.977031138	8

As is indicated in the two tables above, we can see that the general trend of Shanghai port comprehensive competitiveness evaluating value is fluctuating. The comprehensive competitiveness decreased from the year 2004 to 2007 and then experienced consecutive two years of increase from the year 2007 to 2009; however,

from year 2009 to 2010 there exist a collapse of the evaluating value. And then in the year 2011, the score keeps falling for a little more.

When it comes to the score of each component, the fluctuating tendency of component 1 is positively correlated to the tendency of comprehensive competitiveness; for component 2 the general trend of the value score change is in accord to the variation tendency of component 1; however, the volatility of component 3 is not positively correlated to the comprehensive competitiveness. More analysis in detail about the results is going to be done in the following section.

4.2.3 Apply factor analysis to Hong Kong port and Shanghai port over the year 2011 and 2010

Port of Hong Kong is a perfect natural harbor and a free port; it is the shipping center in the far east. Port of Hong Kong is the world's busiest and most efficient international container port, one of the main hub ports on the global supply chain as well. It is among the world’s largest ports in the respect of port facilities, vessel tonnage, cargo handling capacity or passenger carrying capacity.

Hong Kong international container yard activities are conducted in an automated system for making plans, coordination and executing supervision. Via the advanced technology, terminal of Hong Kong port shortened ship berthing time and accelerated the turnover of container car in the wharf. In addition, port of Hong Kong has got the flexibility of dealing with customers’ special requirements.

However, shipping industry in Hong Kong has become a heated topic in recent years. Since the year 2005, the top 1 container port position of Hong Kong has been

replaced firstly by port of Singapore and then by port of Shanghai. The year 2005 is also the historic turning point of Hong Kong port. Thereafter the growth of container throughput of Hong Kong has slowed down. The primary reason is the high cost of container terminal. The rapid development of Port of Shenzhen and port of Shanghai has posed threats to the status of port of Hong Kong.

In the following part, I am going to evaluate the comprehensive competitiveness of port of Hong Kong and port of Shanghai during the year 2010 and 2011.

(1) Primary data for evaluating competitiveness of port of Hong Kong and Shanghai

Table 11: Primary data of Hong Kong and Shanghai in year 2011 and 2010

Indicators	**Shanghai2011**	**Shanghai2010**	**Hong Kong2011**	**Hong Kong2010**
Average Depth of Wharf Apron(meter) **P1**	13.5	12.5	15.5	15.5
Number of Container Berth **P2**	43	45	24	24
Container Throughput('000 TEU per year) **P3**	31739	29069	24384	23699
Container Throughput Growth Rate % **P4**	30.16	16.27	2.90	12.6
Cargo Throughput(million ton per year) **P5**	727.58	653.39	277.444	267.815
Efficiency of Collecting and Distributing (1-9） **P6***	7.6	7	8.8	9
GDP (RMB billion) **P7**	1919.569	1687.242	1536.158	1411.154

Import and Export Trading Volume(billion $) **P8**	437.436	368.869	910.493	824.071
Ratio of Local Government Fiscal Revenue to GDP (%) **P9**	17.87	17.03	22.62	21.18
Unemployment Rate (%) **P10**	4.2	4.2	3.4	4.3
Number of Shipping Company and Auxiliary Companies **P11**	1951	1833	26611	28132
Expanding Capacity of logistics service(1-9) **P12***	8	7.8	8.7	9
Growth of Finance Industry Output (%) **P13**	8.2	4.9	-2.1	16.39
Number of Insurance Institution **P14**	333	320	2617	2616
Scale and Power of Financial & insurance Institution(1-9) **P15***	8	7.5	8.7	9
Popolation **P16**	23474600	23026600	7071600	7024200
Labour force **P1**7	8684200	8684900	3703100	3631300

Note: P1-P17 data source are mainly from Census and Statistics Department of the Government of Hong Kong Special Administrative Region(http://www.censtatd.gov.hk/home/index.jsp) and Shanghai Statistical Year Book 2004~2012(http://www.stats-sh.gov.cn); the mark **P** with * means the correspondent numerical value is based on score by experts.

(2) Same with the steps when evaluating time-wise developing potential Shanghai

port, secondly we use SPSS 21 to get the indicators after standardization.

Table 12: Indicator data after standardization (2)

Indicators	Shanghai2011	Shanghai2010	Hong Kong2011	Hong Kong2010
Average Depth of Wharf Apron(meter) **P1**	-0.31856	-0.31956	-0.33808	-0.3375
Number of Container Berth **P2**	-0.31856	-0.31955	-0.33808	-0.33749
Container Throughput('000 TEU per year) **P3**	-0.31323	-0.31458	-0.32515	-0.32481
Container Throughput Growth Rate % **P4**	-0.31856	-0.31956	-0.33809	-0.3375
Cargo Throughput(million ton per year) **P5**	-0.31844	-0.31945	-0.33794	-0.33736
Efficiency of Collecting and Distributing (1-9） **P6***	-0.31856	-0.31956	-0.33808	-0.3375
GDP (RMB billion) **P7**	-0.31824	-0.31927	-0.33727	-0.33675
Import and Export Trading Volume(billion $) **P8**	-0.31849	-0.3195	-0.33761	-0.33706
Ratio of Local Government Fiscal Revenue to GDP (%) **P9**	-0.31856	-0.31956	-0.33808	-0.33749
Unemployment Rate (%) **P10**	-0.31856	-0.31956	-0.33809	-0.3375
Number of Shipping Company and Auxiliary Companies **P11**	-0.31824	-0.31924	-0.32397	-0.32244

Expanding Capacity of logistics service(1-9) **P12***	-0.31856	-0.31956	-0.33808	-0.3375
Growth of Finance Industry Output (%) **P13**	-0.31856	-0.31956	-0.33809	-0.3375
Number of Insurance Institution **P14**	-0.31851	-0.3195	-0.3367	-0.3361
Scale and Power of Financial & insurance Institution(1-9) **P15***	-0.31856	-0.31956	-0.33808	-0.3375
Popolation **P16**	3.63003	3.62089	3.41443	3.4246
Labour force **P1**7	1.14218	1.16665	1.62695	1.60739

(3) Use KMO test via SPSS to see if the index system above is suitable for factor analysis

Table 13: KMO and Bartlett's Test (2)

Kaiser—Meyer-Olkin Measure of Sampling Adequacy.		**0.596**
Bartlett'S Test of Sphericity	Approx. Chi-Square	514.767
	Df	6
	Sig.	.000

Since KMO value = 0.596 > 0.5 based on the result of KMO test above, this indicator system can be applied with factor analysis.

(4) Get the total variance explained

Table 14: Total Variance Explained (2)

Component	Initial Eigen values			Extraction sums of squared loadings		
	Total	% of variance	cumulative %	Total	% of variance	cumulative %

1	16.943	99.667	99.667	16.943	99.667	99.667
2	.055	.322	99.989			
3	.002	.011	100.000			

There is only one component has the eigen value 16.943 which is bigger than1. So in this case the main component we extract is component 1 which contributes 99.667% to the entire competitiveness, which is also the weight of this component.

(5) Use component generated by SPSS to get the eigenvector matrix and then calculate the score of competitiveness of Hong Kong port and Shanghai port.

Table 15: component matrix and eigenvector of component

	Component1	**Eigenvector of Component1**
var001	1	0.243
var002	1	0.243
var003	0.999	0.243
var004	1	0.243
var005	1	0.243
var006	1	0.243
var007	1	0.243
var008	1	0.243
var009	1	0.243
var010	1	0.243
var011	0.974	0.237
var012	1	0.243
var013	1	0.243
var014	1	0.243
var015	1	0.243
var016	1	0.243
var017	-1	-0.243

(6) Same process as earlier that the next step is to utilize eigenvector matrix and indicators value after standardization to calculate the competitiveness of Hong Kong port and Shanghai port over the year 2010 and 2011.

Table 16: competitiveness score of Hong Kong and Shanghai

	Competitiveness Score
SH2011	-0.551343073
SH2010	-0.563202021
HK2011	-0.786129751
HK2010	-0.776664396

As we can see from the table above that the competitiveness score of Hong Kong port is lower than port of Shanghai, which shows that the developing potential of Shanghai port of recent 2 or 3 years was already ahead of port of Hong Kong. Detailed analysis will be made in the next session.

4.3 Evaluation result analysis

4.3.1 Analysis of vertical study result

As we can see from the evaluation result, the growth rate of comprehensive competitiveness in year 2008 is highest, i.e. 2008 is the year when Shanghai port has the highest developing potential; while the year 2006 and 2010 have the biggest decreasing rate of competitiveness evaluating value which implicates that 2006 and 2010 show the least developing potential of Shanghai port.

(1) Component 1 contributes around 80% to the comprehensive competitiveness of Shanghai port, and it is shown in the table of component score that the variation

of component over the years is consistent with the variation trend of comprehensive score. Based on the rotated component matrix, component 1 has the relatively higher loadings on natural and geographical conditions as well as number of container berth, which implies that from the year 2004 to 2007, Shanghai port did not give a lot of effort on port infrastructure construction while since the year 2008 to 2010 Shanghai port attempted to improve the facilities and there is a huge enhancement in evaluating score of 2008 and 2009. Let's recall the original indicator value and there was an obvious construction move on quay length — increased from 114900 meters in 2008 to 119200 meters in 2010, as well as container berths from 38 in 2009 to 45 in 2010. The information stated explains the high evaluation score of the year 2009 from the aspect of port infrastructure.

The indicators with high loadings on component 1 are also container throughput growth rate and efficiency of collecting and distributing. Container throughput growth rate of 2004 is the highest over the eight years and component 1 also has the highest evaluating score in 2004 which means handling efficiency of Shanghai port has the biggest developing potential in 2004. And this get proved via the fact that after year 2005 Shanghai became the port with the highest container throughput in the global domain over consecutive years. Efficiency of collecting and distributing represents port's ability of collecting and distributing cargo. Based on the original indicator value Shanghai port has been keeping the improvement of this ability during these years.

Next there is the governmental environment, finance environment, information service environment and human resource environment having high loadings in component 1. As we can see in the original indicator number table that the ratio

of local government fiscal revenue to GDP is the lowest in the year 2004 and there is a decrease in this ratio in 2009 and the evaluating score of 2004 and 2009 are relatively high. In addition, growth of finance industry output and number of insurance institution has a contribution in component 1. Financial service level plays a very significant role in assisting shipping companies to operate smoothly and efficiently. Over the year financial institutions in Shanghai have become more and more in quantity, better and better in service quality. Plus, information technology has been enhancing as well. Human resource situation also has a big contribution in competitiveness. From year 2009 to 2010 there is a relatively high increase in talent of high-skill, making sure there are talented and skilled people working in shipping.

(2) Component 2 has high loadings in hinterland GDP, number of shipping company and auxiliary companies as well as number of Internet users. Although component 2 only contributes 12.289% to comprehensive competiveness it still shows that GDP and shipping company affect the development of Shanghai port. Number of Internet users shows, to some extent, the popularity of internet which makes it possible the electronic transaction.

(3) The third component has high loadings on vessel pilotage and liner density. Component 3 only contributes 5.672% to the comprehensive evaluating result. Vessel pilotage implies the production level and liner density shows the situation of shipping market. Liner density experienced a huge bouncing up from the year 2009 to 2010 after a decrease in 2009. In this respect it also shows highest developing potential of Shanghai port.

4.3.2 Analysis about result of horizontal study on Shanghai port and Hong Kong port

Being the long-standing hub of international shipping, port of Hong Kong has been famous for her high-efficiency of cargo handling and perfect integrated logistics services, not to mention the advanced financial service system. However, the competitiveness of Hong Kong port has gradually decreased in recent years since ports from mainland started making their presence on stage of international shipping, like port of Shanghai and Shenzhen. Shanghai port has much lower cost in labor, cheaper fee in collecting and distributing, and much less service charge than Hong Kong. Competing advantage of Hong Kong port is disappearing due to her high operation and processing cost.

On one hand, Hong Kong still got the natural advantage in wharf apron depth, but not in constant infrastructure construction —— Shanghai has more than 40 container berths now but Hong Kong only has 24. Shanghai had the largest container throughput globally years ago and Hong Kong is far behind in this respect. Plus, growth rate of container throughput in 2011 of Shanghai is 30.16% while Hong Kong is only 2.9% in 2011, which shows a higher developing potential of Shanghai port.

On the other hand, Hong Kong still shows stiff competitiveness in soft environment. Hong Kong has 26611 shipping relates companies and institutions but Shanghai only has 7.3% of the stated number in Hong Kong. Shipping market in Shanghai is not active and the shipping related business in Shanghai is not rich and variable. The number of insurance company in Shanghai is not in the same level as in Hong Kong but Shanghai has shown a positive increasing potential in finance industry production in the aspect growth of finance industry output ——Hong Kong shows a negative

rising impetus. The labor force in Hong Kong is 43% of the number in Shanghai but GDP in Hong Kong is 80% of GDP in Shanghai, which shows that economic and productive efficiency of Shanghai has huge space to improve to the level of Hong Kong.

5 Conclusion and Suggestions

5.1 Conclusion

Based on the calculation and analysis in chapter 4, conclusion can be drawn as follows.

1. The relative competitiveness of Shanghai port during the eight years from 2004 to 2011 is not steady. In 2004 Shanghai has the most powerful competing momentum but developing potential decreased afterwards; then in 2008 the growth potential start to show again. Until the year 2011 Shanghai did not present a very sound developing potential compared with 7 years ago.

2. The developing target for Shanghai port is Hong Kong since both of them are located in Asia and Hong Kong has been the hub of international shipping in history. At present Shanghai has much higher developing potential than Hong Kong port as is indicated in the competitiveness calculation result especially in port infrastructure construction, container throughput growth and financial industry output. But the weakness of Shanghai is pretty obvious as show in factor analysis that the productive efficiency of the whole society in Shanghai is quite poor compared with Hong Kong.

3. Shipping market of Shanghai is not active and shipping business is not extensive.

The number of shipping related company in Shanghai is a lot less than Hong Kong. And ratio of government fiscal revenue to GDP in Shanghai is higher than that of Hong Kong, which restricts the activity level of shipping companies.

5.2 Suggestions

1. Constantly optimize the construction of port infrastructure.

As is shown in the calculation result in chapter 4, natural conditions of a port contribute to port competitiveness with a big extent. Deeper water is a best guarantee for improving handling efficiency, meantime shortening ship's berthing time. Plus, deep water improves the production capacity. Technological and production level is a direct indicator influencing the port development and construction thus further affecting port competitiveness. If basic facilities are improved and optimized constantly, the efficiency of container handling and cargo transport will be enhanced quite well and container throughput is going to grow with healthy proportion, which is going to definitely help with the general competitiveness of Shanghai port.

2. Improving collecting and distributing capacity.

Collecting and distributing capacity of a port is directly related to whether cargo from hinterland can smoothly pass through a port, and also determine the scope of hinterland. Based on the calculation before, collecting and distributing capacity is a contributive factor in final result. So Shanghai port should not let go the moves on perfection of multi-model transport system.

3. A more open and free environment of governmental policy

With the target of constructing Shanghai into an international shipping center, we

should formulate a set of regulations and policies that suit the regional situation as well as connected to international picture——gradually develop the policy and legal environment suitable for an international shipping center.

Free port policy is a feasible competing solution which is extensively adopted by international container hub port. Hong Kong and Singapore are the most famous free container ports. Port of Hamburg is the most typical free port in Europe. Establishing free port is a crucial step for Shanghai becoming international shipping center.

4. Improve financial services level.

Shanghai is already the most open city in finance industry of mainland China, but compared to the standards of international shipping center like Hong Kong, there still exists a big gap in the following major aspects: the scale and capability of Shanghai finance industry is not comparable with international finance institution; the content and quality of financial service, financial innovation are with a big gap compared with foreign companies; the interaction of shipping market with finance and trading is not active; credit environment is quite poor; the depth and extension of finance market are not enough, hierarchy and structure are not reasonable.

5. Enhance the production efficiency of the whole society.

Optimize enterprise management and operation procedure, providing helpful professional training to human resources effectively. Less bureaucracy, more substantial efforts. Comprehensive quality of human resource in shipping is below the modern demand. There is a lack of versatile talent; talent with comprehensive management ability is short; the updating of talent knowledge is quite slow.

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