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WORLD MARITIME UNIVERSITY

Shanghai, China



**RESEARCH ON THE DEVELOPMENT OF ZHOUSHAN
INTERNATIONAL MARITIME SERVICE BASE**

BY

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Date of Submission: 12th August 2016

ITL

Declaration

I solemnly certify that here is my theses been submitted in the under the guidance of the tutor for the research achievement independently, all the materials in this research paper that doesn't mean my own work has been approved. In addition to the special reference to the content, this paper does not contain any other individual or group has been published . I fully realize the legal consequence of this declaration shall be borne by myself.

The contents of this research paper show my own personal view points only, and are unnecessarily endorsed by the University.

2016-08-12

Supervised by
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Abstracts

Along with the development of global economy, our country has become the world's second-largest economic body, which can provide the continuously increasing international freight market and will further stimulate the development of maritime economy. Thus, it brought the development opportunity and challenge in the aspect of international maritime services quality for those developing ports in the world, as well as put forward higher requirements of individual port development.

To promote the construction of Zhoushan city, analyze the present situation of the development of Zhoushan port, realize the lacking in port maritime service in Zhoushan, through the establishment of port maritime service base, which are needed to develop high-end maritime service industry, improve the level of competitiveness. Take several modern ports for samples, combined with the geographical conditions of Zhoushan, relying on industry cluster theory, from the port maritime service base construction, talent cultivation, soft environment construction, etc, put forward to establish Zhoushan port maritime service base development strategy, and are proposed for the development of auxiliary function of service base.

Keywords: International maritime service base, High-end service quality, Strategy and countermeasures

Content

Declaration.....	I
Abstract	II
Content	III
1. Introduction	1
1.1 Backgrounds and purpose of the dissertation	1
1.2 Literature review	3
1.2.1 Abroad literature overview	3
1.2.2 Domestic literature overview	5
1.3 Research methods	6
1.4 Technical Route.....	7
2. Description of port maritime service industry	7
2.1 Definitions	7
2.1.1 Modern service industry	7
2.1.2 Port industry	8
2.1.3 Port maritime service industry	8
2.2 The composition of port maritime services	9
3. Evaluation of Zhoushan port maritime services	10
3.1 The choice of evaluation methods	10
3.2 The usage of APH method for evaluation of Far-east ports	10
3.2.1 The description of APH	10
3.2.2 The hierarchical structure of the port maritime service evaluation	12
3.2.3 The determination of judgment matrix, single hierarchical arrangement and consistency check	14
3.2.4 The final hierarchical arrangement and consistency check	16
3.2.5 The conclusion of analysis	18
3.3 The existing problems in the development of Zhoushan port international maritime service base	18
3.3.1 The lack of coordination between port operational departments	18
3.3.2 The backward of the concept with low service level	18
3.3.3 The Zhoushan port infrastructure is relatively simple	19
3.3.4 The overall level of the intermediary services is weak	19
3.3.5 The lack of the port information service	19
4. Experience reference in development of domestic and foreign ports' maritime services	20
4.1 Advanced maritime time services of typical ports	20
4.1.1 Singapore	20
4.1.2 Hongkong	23
4.1.3 Shanghai	26
4.1.4 Ningbo	29
4.2 Experience references	32

4.2.1 Maintain efficient operation of the port by the use and popularization of new technology	32
4.2.2 Improve the port degrees freedom by providing port preferential policy ...	32
4.2.3 Promote the port operation efficiency by improving the labors' quality	33
4.2.4 Promote the port operation efficiency with the support of Local city's strong trade and financial function	33
5. The development strategy and countermeasures of Zhoushan port maritime service	
5.1 To strength organizational leadership and enhance organization ability	34
5.2 To intensify efficient policies and promote supporting measures	34
5.3 To perfect the systems and mechanisms	35
5.4 To enhance the fiscal and taxation support and guarantee capital demand.	35
5.5 To strengthen the team construction, improve the structure of talent	36
5.6 To build a maritime service information platform and improve the service quality of informationization	36
6. Conclusion	37
Bibliography.....	38
Appendix 1: Index of correlation of Shanghai, Qingdao, Busan and Ningbo port....	40
Appendix 2: The selected ports for the level of the index sort and consistency check.	41
Appendix 3: The expectation of Zhoushan port throughput.....	45
Appendix 4: The expectation of Zhoushan port transshipment.....	46

1. Introduction

1.1 Background of this dissertation

Traditionally, the role of the port is for transportation of import and export cargoes only. In addition, port also has the function of industrial and maritime service and so on. In the worldwide, with the port transformation from the traditional transportation model to a new generation model of integrated resource allocation, thus, port industrial function and maritime service function is playing a more and more important role in promoting the economic development of particular port. The concentration of great cash flow and talents etc. will be achieved through the port constructing and port throughput growth. Inevitably the higher requirements should be brought out for the port services ability and efficiency, which also causes port maritime service industry to become flourishing and developing.

Zhejiang Zhoushan islands new district was approved by the state council a few years ago, in the subject of marine economy, and the mission of this new district is to explore the way for the scientific development of domestic marine economy. In 2013, the approval of the state council was to implement the Zhejiang zhoushan islands new district development project. This project clearly stated to establish Zhoushan Free Trade Zone and attempt to establish Zhoushan Free Port Zone in the near future. According to the national strategy, Zhoushan islands new district should implement the project of River and Ocean Multi-transportation which was said by prime minister Mr. Li, as well as to be within the Yangtze river economic belt actively and observing the strategy of maritime silk road in the 21st century, therefore, this is a great opportunity for Zhoushan to develop its international maritime services quality level nowadays. Zhoushan port has been opened for international trading since 1987, after almost 30 years of rapidly development, the port opening area has reached 1193m². It has become a national important port maritime service base of strategic materials import, storage, transit shipment and shipbuilding/repair. In recent years, Zhoushan port participated in the international division actively, the certain scale of modern maritime service industry has been formed in the content of fuel oil supply, chemical

shipment, shipbuilding, ship management and seafarers training. Meantime, a LNG supply center has been planned to construct proactively.

Pic 1-1: The geographical location map of Zhoushan



Research Purpose:

Based on the background of port maritime service research, it is very important for Zhoushan port to establish a port International maritime service base, so as to promote the local economic situation through attracting outside investments. The purpose of research is as follows:

- 1). The development of Zhoushan port International maritime service base is an effective way to create a favorable external environment. The convenient port maritime services, completed facilities can leave a deep impression on the shipping company managers, and it will definitely be helpful to increase the popularity and public praise of Zhoushan port in the world.
- 2). The development of Zhoushan port international maritime service base is the important guarantee to strengthen Zhoushan port competitive position with other ports which located within the Yangtze river belt. The marketization degree, management

level and the labor's education level of particular port will be more favorable and advantageous in port competitive position in the shipping market.

3). The development of Zhoushan port maritime service base is the key link to establish the Far-East international shipping center of Zhoushan city. International shipping center is a comprehensive concept of function. It is gathering developed shipping market, abundant logistics as an organic whole, in general, which is based on international trade, financial and economic center of international shipping hub. In accordance with development experience of foreign advanced ports, modernization of Zhoushan port maritime service is an indispensable link for attainment purpose by Zhoushan government.

1.2 Literature review

Recently, there are so many researching literatures in both domestic and foreign countries, however it includes lots of researches regarding the development of port international maritime service, i.e, shipbuilding and repairing market, shipping bonded oil market, LNG supply market, chemical transportation market and seafarers management market, especially for those ports expecting for development purpose. Therefore, more and more professors has been carrying out researches on the port international maritime service construction for the sake of integrating particular port resources and promoting the establishment of particular port international maritime service based on the global status quo and development tendency.

1.2.1 Abroad literature overview:

Firstly, the characteristics and complexity of companies related to port maritime services were preliminarily discussed by the Canadian economic geography scholar Slack (1982) through his questionnaire survey of Montreal Port Department. He considered that the scale of companies related to port maritime services were generally small, and most companies had requirements from external economy, they were quite similar to the feature of "vertical separation" model which was pointed out by Scott. Meanwhile, these companies related to port maritime services had multiple

functions, but some functions were repeated in many business aspects. According to the collected statistical data, the population and statistics department of Hong Kong (1982) put forward that the size of most companies related to port maritime services in Hong Kong also were small. Mr. Seah (1984) studied the Singapore cargo transport industry, and he pointed out that large numbers of smaller local companies in this industry were "highly fragmented structure", he called these companies as "mosquito" due to their limited capacity and operating costs.

Secondly, as for port and city system research, Mr. Slack (1989) pointed out that there were many researches on the internal level of the port maritime service industry in the city, but for the industry in the national geographic distribution of urban system is basically a neglected problem. O 'Connor (1987) conducted a preliminary discussion of the relationship between port maritime service industry distribution and city level by using the great numbers of basic data in USA. After that, he pointed out that relationship was not obvious among the shipping liners, container leasing, shipbuilding/repairing company and shipping transportation mode. Mr. O 'Connor decided that distribution patterns of trade-related maritime services reflects the relationship with other important financial services (especially Banks), as a result, the distribution of port maritime services indicated the association with the advanced producer services of urban system.

Thirdly, with regard to port maritime service economic benefit research, Foster (1979) tried to determine the port standard of the customers' choice based on the investigation of the manufacturing and distribution department. In the end, his research suggested that the transportation cost and the cost of the port itself should be the primary selection criteria, followed by the liner, and the number of available equipment, the services provided, the degree of congestion, customs clearance service factors such as efficiency, the duration of duty-free policies etc. were considered. Wilingale (1981), through the study of England and France coastal shipping services, he pointed out that there were totally 9 factors affecting the shipping company's final decision whether to call this port or not, such as the relative level of port operation cost, the difference between valuation regulations, the accessibility to the port either

from sea or from land etc. Slack (1985), through his detailed observation of north American Midwest and Western Europe container transportation, he brought out that the quality and price provided by port maritime service bases were much more important for shipping managers to making decision if comparison with the differences in import and export customs declaration formalities. Ha (2003), by questionnaire survey, he considered that the container port service quality located in north-east Asia lagged behind those well-developed container ports in the world, based on the evaluation of the availability of port information, port location, port turn-round time, available port facilities, port management, port handling charges, customs conditions.

1.2.2 Domestic literature overview:

The domestic research on port maritime service started later than foreign research. At present, the study of domestic scholars on port maritime services is very limited, and no any scholars dedicated to carry out some in-depth researches for quite a long time, port maritime services is only a passing mentioned in the studies of the port function and preliminary discussions, with any scholar specialized in research on it. This is related to the objective development stage of domestic ports nowadays, owing to the development of port maritime service industry are closely associated with the port function, port development stage. The development of port maritime service industry is relatively limited in the low stage ports, hence, the related research is not much. Only a handful of scholars in the study of the port maritime service industry, including Shu Guang Wang (1992), An Xiao Peng and Zeng Lin Han (2001), Yong Jian Xu (2001), Purdur and Xiao Fen Lu (2002), related studies have shown that the advent of the era of comprehensive logistics plays an important role in the global logistics system of port had a profound impact, it accelerated the ports to the evolution of the third generation ports, so as to increasingly perfect port maritime service function. The function of port maritime service industry development and perfection make the port greatly improve labor productivity, not only plays a basic role service on port operation, but also promote the comprehensive development of

the port maritime service industry function. It is worth mentioning that some scholars like Mr. Yong Jian Xu (2000) study on the abroad port maritime service industry and carry on the preliminary empirical research on the composition, internal relationships, spatial distribution characteristics and so on of Guangzhou port, but rather in the domestic first geographical research of port maritime services. However, the port maritime service is not the research emphasis and the core content, so the result is very superficial. In addition, related research to other subjects of port maritime services is worthy for reference, Ning Tao (2003) studied the port related activities, through which it can be divided into port function related activities, port commercial trade, port industrial activities, and compared with port related economic activities for analysis purpose.

1.3 Research methods:

Research methods:

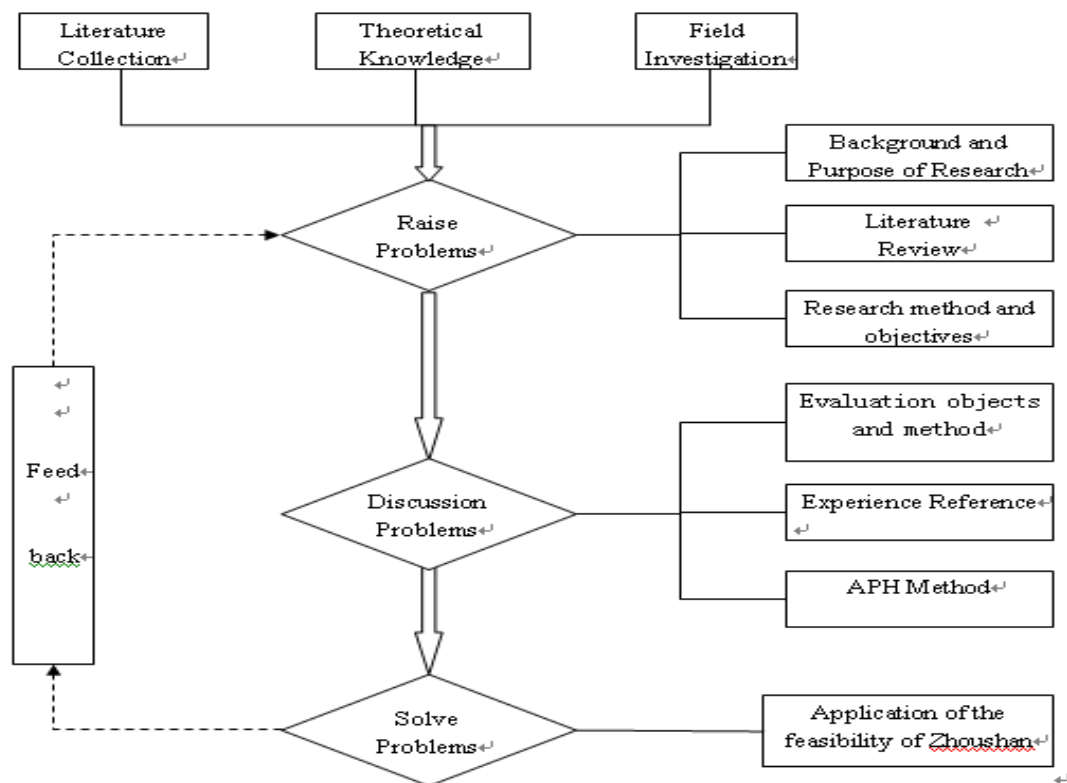
1. This thesis will carry out the typical investigation of the Zhoushan port maritime service base project in Zhoushan city planning administration and port transportation bureau. This thesis will also conduct a questionnaire survey of several shipping enterprises beyond Zhoushan as a factual evidence for related verifications.

2. Analytic Hierarchy Process method. I will utilize the secondary index reflecting objective data for those influencing factors of port maritime services. Then I can obtain judgment matrix between different ports, and recombination of weight matrix to get the final evaluation of each port's maritime services level so as to determine the importance of development of Zhoushan port maritime service industry.

3. Reference of domestic and foreign ports experience method. I will carry on a detailed investigation of maritime service industry level in several typical foreign and domestic ports such as Rotterdam, Singapore, HongKong and ShangHai so as to discover the gap of service level between zhoushan port and them, as well as to achieve the development strategy especially for Zhoushan port maritime service industry.

1.4 Technical Route (see Pic 1-2 below)

Pic 1-2: Technical route



2. Description of port maritime service industry

2.1 Definitions

2.1.1 Modern service industry

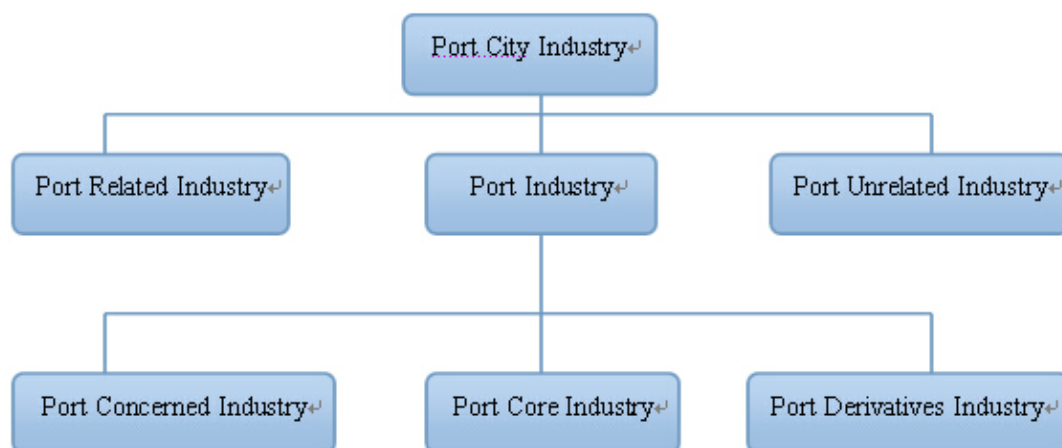
Modern service industry was a concept of new industry which was brought out by our country few years ago, it was usually come into being in high industrialization development stage, and it's mainly based on the electronic information such as technology or modern mode of business operation and organizational form including emerging service industries, such as the Internet based network services, mobile communications, information services, modern logistics and so on, also including the technical transformation and upgrade of traditional service industry, such as telecommunications, finance, intermediary services, and real estate, etc. Its essence is to realize the modernization of service industry. With the improvement of social production and life efficiency, modern service industries became a positive role in the driving of economic growth, expanding employment, improving residents' living

quality. International researches show that the tertiary industry and service industry will have an explosive increase while the average GDP is between 2000\$ to 4000\$. The finance and insurance, transportation logistic etc account for the proportion of service industry began to rise significantly while the average GDP is between 8000\$ to 9000\$.

2.1.2 Port industry

Port industry refers to the industry system which is mainly composed of shipping industrial activities. Port industrial area is based on the local "unmovable" resources. The area can be built based on the reducing or avoiding "the short-distance transport" costs. To determine a port industry is not only depending on whether it is within the range of port or dock, but also on its dependency on port. Therefore, considered from the location of industry, not all the industries in the range of port are referred to the port industry. In other words, some ones beyond port range are also belonging to the port industry due to its various transportation modes.

Pic 2-1: composition of port industry



2.1.3 Port maritime service industry

Port maritime service industry has not formed a clear and accepted definition, neither in its connotation nor in denotation. However, its essence is the port service industry, but more emphasis on maritime characteristics. Canadian economic geography scholars (Mr. Slack) believed that port maritime service was associated

with the port and shipping service industry. It includes pilotage, towage, and vessel berthing operations etc. which are related with shipping services. But most Chinese scholars pointed out that the port maritime service consists of the port cargo transshipment, loading/unloading operation, import/export service and custom/immigration service etc. Obviously, different scholars have different definition about port maritime service.

2.2 The composition of port maritime service

Port business activities are very complex which related to ship, cargo, port authorities and relevant administrative departments etc., hence the port maritime industry has a very wide range of specific categories industry involved. Details as per attached table 2-1 below:

Table 2-1: Category of port maritime industry

Lay	Industry	The main service functions
Base Layer	Ship-Building	New-ship building
	Ship Repair	Ship repair and supporting
	Shipping Service	Cargo transportation
Supplementary Layer	Port Service	Construction of wharf, harbour handling, cargo tallying, tugboat service, pilotage
	Shipping Agency	Shipping agency
	Ship Supply	Replenishment of ship store, fresh water, spare parts, publications and fuel oil etc.
	Management of Seafarers	Seafarers' education and training,
	Ship Management	Navigation safety and machinery management
	Ship Broker	Ship sale and purchase, ship chartering
	Ship Survey	Ship survey, various equipment survey
Extension Layer	Maritime Financial	Ship financing, mortgage, guarantee and accounting
	Ship Insurance	Settlement of insurance claim
	Maritime Information	Information, study, consultation and media

	Maritime Arbitration and Legal Service	Maritime law and maritime arbitration
	Ship Design and Research	Ship design and technology research and development

3. Evaluation of Zhoushan port maritime services

3.1 The choice of evaluation methods

The aim of the port maritime service base is to provide a good external environment for port activities, saving transaction costs. From the point of the effect of service, so as to examine effective port maritime services which would make the various port operation in convenience. Intuitively, if the whole port has better operating environment, it will have much more convenient port operations, meanwhile, the port maritime services will become more advanced. Considering the port maritime service industry categories, the impact factor is various and many influence index is not easy to quantify, thus, can consider from various aspects of port maritime service quality, using the analytic hierarchy process (AHP) method to evaluate the level of development of port maritime service industry.

3.2 The usage of APH method for evaluation of Far-East ports

3.2.1 The description of APH

AHP is a structured technique for organizing and analyzing complex decisions, based on mathematics and psychology. It was developed by Thomas L. Saaty in the 1970s and has been extensively studied and refined since then. It has particular application in group decision making and makes the decisions broke down into various levels, such as: target, principles, scheme, etc.

In the use of APH, mainly according to the following four steps

- (1) To establish the hierarchical structure model. Firstly, we can decompose decision problem into a hierarchy of more easily comprehended sub-problems, each of which can be analyzed independently.

- (2) To construct judgment matrix. Hierarchical structure reflects the relationship between the factors, but the rule layer in the proportion of each criterion in the target measure is not exactly the same, the in the mind of the decision makers, they are all have the certain proportion. Factor to construct judgment matrix can be established by taken to compare two paired comparison matrix method. Where each time takes two factor x_1 and x_2 , a_{12} means the ratio of the effect on Z by both x_1 , and x_2 , all the comparison results expressed in matrix $A(a_{12})_{e \times f}$, Called as a paired comparison judgment matrix between Z to X. On how to determine the value of the a_{12} , Saaty recommends to use the numbers 1 to 9 and its inverse scale as reference. The following table lists the means of 1to 9 scale respectively.

Table 3-1: Means of 1to 9 scale

Degree of Importance	Definition	Explanation
1	Equally Importance	Targets x_1 and x_2 are in same importance
3	Slightly Importance	Target x_1 is slightly important than x_2
5	Fairly Importance	Target x_1 is important than x_2
7	Significantly Importance	Target x_1 is significantly important than x_2
9	Absolutely Importance	Target x_1 is Absolutely important than x_2
2,4,6,8	Between adjacent important degree	
Reciprocal	If the ratio of importance is a_{12} by x_1 and x_2 , then the ratio of importance is a_{21} by x_2 and x_1 .	

- (3) Hierarchical single arrangement and consistency check

The judgment matrix A corresponding to characteristic vector W of the largest eigenvalue of λ_{\max} , after normalization it become a sort weights of the same level relevant factors corresponding to the one of upper level related importance factors, this process known as a single hierarchical arrangement. The steps for consistency check of judgment matrix as following:

- ① calculation of the consistency index CI

$$CI = (\lambda_{\max} - e) / (e - 1)$$

- ② Find the appropriate mean random consistency index RI (refer to $e = 1 \dots 12$, Saaty gave the each values of RI , as shown in table 3-2):

Table3-2: Mean random consistency index RI

	1	2	3	4	5	6	7	8	9	10	11	12	13
RI	0	0	0.58	0.9	1.12	1.24	1.32	1.41	1.45	1.49	1.52	1.54	1.56

- ③ Calculation of the consistency ratio CR

$$CR = CI / RI$$

When $CR < 0.10$, we can consider that the consistency of judgment matrix is acceptable, Otherwise, a correction to be made for the relative judgment matrix.

- (4) Final hierarchy arrangements and consistency check

Assume a hierarchy (A layer) contains A_1, \dots, A_m , A total of m factors, their levels of total weight are from a_1 to a_m respectively, then assume the subsequent hierarchy (B layer) contains B_1, \dots, B_n , their levels of single weight related to A_f are from b_{1f} to b_{nf} respectively (when B_e is no association with A_f , B_{ef} is zero).

Therefore, when $CR < 0.10$, we can consider that hierarchy of total arrangement results with satisfactory consistency and the analysis of the results are acceptable.

3.2.2 The hierarchical structure of the port maritime service evaluation

With regard from economic effects and expression of port maritime services, as well as refer to some related research results, we can reduce the evaluation factors of port maritime services into port cargo handling service, port operations, port logistics services, marine services and information services, but, under each hierarchical indicators consist of several secondary indexes, so as to form the evaluation index system of port maritime service level, details as below attached table(3-3):

Table 3-3: evaluation index system of port maritime service level

Cargo Handling Service (B1)	Channel Depth (C11) Length of Wharf (C12) No. of Gantry Crane (C13) Active Area of Cargo Yard (C14)	Shanghai (P1)
Port Operation (B2)	Average Time of Cargo Custom Clearance (C21) Efficiency of Loading & Unloading (C22) No. of Ship Agencies (C23) Cargo Collection and Distribution (C24) The Coverage of Line Services (C25) Consistency of Liner (C26)	Qingdao (P2)
Port Logistic Services (B3)	Capability of New-Ship Building and Ship Repair (C31) Replenishment of Ship Store (C32) No. of Seaman's Club (C33)	Busan(P3)
Marine Services (B4)	Quality of Port Manger (C41) Port Charges (C42) Freedom of Port (C43)	Ningbo (P4)
Information (B5)	Port Information Platform Construction (C51) Popularizing Rate of Electronic Clearance (C52) Popularizing Rate of Electronic Inspection (C53)	

Some notes for indexes: ① we can obtain the judgment matrixes between each pair of above mentioned four ports through those data of secondary indexes, then to get the results of the each port maritime service quality by combination of those weight matrixes. Due to the port of the judgment matrix is obtained from the comparison of the specific secondary indexes, it can effectively avoid the disadvantages of subjectivity by the use of hierarchical analysis method purely, so as to combine the subjective and the objective, to reflect the port maritime service industry development situation as accurately as possible. ② Some of secondary indexes are qualitative

indexes, such as C41 quality of port manager and C43 freedom of port, etc. Then we should adopt the number of strength to reflect for the evaluation of port, such as freedom of port, which can be achieved by those professionals who are engaged in research or management of port by given scores, that can be shown by digital numbers 1, 3, 5, 7 respectively, it means low degree of freedom, high degree of freedom, fairly high degree of freedom and very high degrees of freedom. ③ Each index has its each different magnitude due to their different units. Hence, before multiplied by weight matrix, we should standardize the port numerical matrix at first.

3.2.3 The determination of judgment matrix, its single hierarchical arrangement and consistency check

The judgment matrix for the goal level is the core content of obtainment of hierarchical analysis. Thus, we can get the influence weight of each index and each level for the goal level, this is the foundation of the analytic hierarchy process. The formation of the judgment matrix is with a larger subjectively because it is based on policymakers' awareness and understanding of specific issues. In order to avoid the subjective role of policy makers on the result of final judgment, hierarchical analysis typically uses the experts' judgment method, and in the detailed importance scores of all levels given by experts in a certain field, and finally to integrate those comments and opinions. This method can also be used in the evaluation of port maritime service. During the process of writing, I conducted successively researches in Zhoushan port administration, Zhoushan port operation department, I have received many point of views and opinions from those professionals and port managers. Based on these points of views and opinions, I have got judgment matrix of each index of port maritime services in this thesis.

(1) First Index for judgment matrix of goal level, single arrangement and consistency check.

Table: 3-5 A-B judgment matrix, single arrangement and consistency check

A	B1	B2	B3	B4	B5	λ_{\max}	CI	CR	W
B1	1	7/9	7/5	7	7/3	5.32	0.0912	0.071	0.27
B2	9/7	1	9/5	9	3				0.32
B3	5/7	5/9	1	5	5/3				0.22
B4	1/7	1/9	1/5	1	1/3				0.05
B5	3/7	1/3	3/5	3	1				0.14

(2) Each index level for the judgment matrix of first index, single hierarchical arrangement and consistency check.

Table: 3-6 B1-C judgment matrix, single hierarchical arrangement and consistency check

B1	C11	C12	C13	C14	λ_{\max}	CI	CR	W
C11	1	3/7	6/5	6/7	4.0	0.0	0.0	0.141
C12	7/3	1	7/5	1				0.322
C13	5/3	5/7	1	5/7				0.231
C14	7/3	1	7/5	1				0.323

Table: 3-7 B2-C judgment matrix, single hierarchical arrangement and consistency check

B2	C21	C22	C23	C24	C25	C26	λ_{\max}	CI	CR	W
C21	1	1	9	9/5	3/2	9/7	7.0	0.0	0.0	0.225
C22	1	1	9	9/5	3/2	9/7				0.225
C23	5/9	1/9	1	1/5	5/6	5/7				0.132
C24	1/9	5/9	5	1	1/6	1/7				0.033
C25	2/3	2/3	6/5	6	1	7/6				0.164
C26	7/9	7/9	7/5	7	7/6	1				0.182

Table: 3-8 B3-C judgment matrix, single hierarchical arrangement and consistency check

B3	C31	C32	C33	λ_{\max}	CI	CR	W
C31	1	9/2	3/2	3.0	0.0	0.0	0.512
C32	2/3	1	1/3				0.321
C33	2/9	1/3	1				0.201

Table: 3-9 B4-C judgment matrix, single hierarchical arrangement and consistency check

B4	C41	C42	C43	λ_{\max}	CI	CR	W
C41	1	2/3	4/9	4.0	0.0	0.0	0.162
C42	3/2	1	2/3				0.228
C43	9/4	3/2	1				0.318

Table: 3-10 B5-C judgment matrix, single hierarchical arrangement and consistency check

B5	C51	C52	C53	λ_{\max}	CI	CR	W
C51	1	3/4	2	3.0	0.0	0.0	0.333
C52	4/3	1	8/3				0.500
C53	1/2	3/8	1				0.167

Eventually, we decide that all single hierarchical arrangements have passed inspection through above calculations.

3.2.4 The final hierarchical arrangement and consistency check

The final hierarchical arrangement is formatted through calculating the arrangement weight of the relative importance of all factors in same level for the goal level. This process is from the highest level of the hierarchy to the lowest level. Therefore, the hierarchy weight of all influence factors for the evaluation of port maritime services can be reached via each same level indexes and individual index.

Table: 3-11 The hierarchy weight of each influence factors for port maritime services

	B1	B2	B3	B4	B5	W
	0.27	0.32	0.22	0.05	0.14	
C11	0.141					0.03807
C12	0.322					0.08694
C13	0.231					0.08694
C14	0.323					0.08721
C21		0.225				0.072
C22		0.225				0.072
C23		0.132				0.04224
C24		0.033				0.01056
C25		0.164				0.05248
C26		0.182				0.05824
C31			0.512			0.11264
C32			0.321			0.07062
C33			0.201			0.04422
C41				0.162		0.0081
C42				0.228		0.0114
C43				0.318		0.0159
C51					0.333	0.04662
C52					0.500	0.07
C53					0.167	0.02338
Subtotal;						1

The CI of final hierarchical arrangement is $CI = \sum W_i CI_i = 0.27 \times 0 + 0.32 \times 0 + 0.22 \times 0 + 0.05 \times 0 + 0.14 \times 0 = 0$, $RI = \sum W_i RI_i = 0.27 \times 1.32 + 0.32 \times 0 + 0.22 \times 0 + 0.05 \times 0 + 0.14 \times 0 = 0.3696$, thus, the final hierarchical arrangement is $CR = CI/RI = 0 < 0.1$, it passed check.

Table: 3-12 The final hierarchical arrangement of each port^o

Port ^o	C11 ^o	C12 ^o	C13 ^o	C14 ^o	C21 ^o	C22 ^o	C23 ^o	C24 ^o	C25 ^o	C26 ^o
	0.03807 ^o	0.08694 ^o	0.08694 ^o	0.08721 ^o	0.072 ^o	0.072 ^o	0.04224 ^o	0.01056 ^o	0.05248 ^o	0.05824 ^o
P1 ^o	0.384 ^o	0.396 ^o	0.392 ^o	0.368 ^o	0.182 ^o	0.259 ^o	0.297 ^o	0.283 ^o	0.115 ^o	0.504 ^o
P2 ^o	0.233 ^o	0.215 ^o	0.218 ^o	0.223 ^o	0.168 ^o	0.198 ^o	0.269 ^o	0.201 ^o	0.097 ^o	0.235 ^o
P3 ^o	0.166 ^o	0.196 ^o	0.178 ^o	0.051 ^o	0.152 ^o	0.128 ^o	0.208 ^o	0.176 ^o	0.051 ^o	0.099 ^o
P4 ^o	0.203 ^o	0.102 ^o	0.182 ^o	0.387 ^o	0.399 ^o	0.167 ^o	0.218 ^o	0.199 ^o	0.078 ^o	0.21 ^o
Port ^o	C31 ^o	C32 ^o	C33 ^o	C41 ^o	C42 ^o	C43 ^o	C51 ^o	C52 ^o	C53 ^o	The final figure ^o
	0.11264 ^o	0.07062 ^o	0.04422 ^o	0.0081 ^o	0.0114 ^o	0.0159 ^o	0.04662 ^o	0.07 ^o	0.02338 ^o	
P1 ^o	0.104 ^o	0.113 ^o	0.163 ^o	0.183 ^o	0.135 ^o	0.127 ^o	0.132 ^o	0.131 ^o	0.173 ^o	4.441 ^o
P2 ^o	0.079 ^o	0.094 ^o	0.156 ^o	0.162 ^o	0.052 ^o	0.102 ^o	0.092 ^o	0.048 ^o	0.261 ^o	3.103 ^o
P3 ^o	0.052 ^o	0.086 ^o	0.103 ^o	0.124 ^o	0.059 ^o	0.078 ^o	0.045 ^o	0.045 ^o	0.036 ^o	2.033 ^o
P4 ^o	0.062 ^o	0.089 ^o	0.135 ^o	0.14 ^o	0.081 ^o	0.082 ^o	0.065 ^o	0.048 ^o	0.106 ^o	2.953 ^o

3.2.5 Conclusion the analysis

With regard to the result of above calculation, the scores for port maritime services of Qingdao, Busan and Ningbo is 2.033,2.953 and 3.103 respectively, they are far behind of Shanghai port 4.441. This means that Shanghai port is an international shipping center already in Far-East Asia. If Zhoushan port compare with its nearest port of Ningbo, Zhoushan is still have a large margin to be improved in port maritime services. Take this opportunity of Zhoushan islands new district, seeking for the government policy supporting to develop the construction of Zhoushan port maritime service base, so as to attract more shipping companies through enhancing its port service quality.

3.3 The existing problems in the development of Zhoushan port international maritime service base

3.3.1 The lack of coordination between port operational departments

The lack of coordination between port operational departments caused low efficiency of port international maritime service. Port operational departments consist of customs, frontier defense, maritime administration, quarantine inspection etc. Despite that government port office is designated for this coordination purpose, it is still very hard to coordinate each other because law enforcement is in vertical management, and some third parties' level is higher. Therefore, the conflicting policies from different departments often happened in the process of administrative,

affecting the whole port administrative system smoothly. At the same time, there are so many departments existing with cross function, this caused much lower efficiency of customs clearance .

3.3.2 The backward of the concept with low service level

Compared with foreign famous ports, the main features of Zhoushan port in international maritime service industry quality is backward, and it stays in the traditional service industry level with low value-added service activities. In contrast, port maritime service activities in many foreign countries have been very perfect already, such as shipping trading market, shipping information counsel etc., however, there is no any sign of development in Zhoushan in the past few years, which means Zhoushan port has a great opportunity to develop this international maritime base to catch up the gap with advanced countries.

3.3.3 The Zhoushan port infrastructure is relatively simple

Port infrastructure level is an important support for the development of maritime service industry, but the development of Zhoushan port infrastructure is very slow in the past decade. One is the lack of large deepwater terminals for Container and LNG/Chemical vessels, even the YongZhou Container terminal located in Jintang island was come into service in July 2010, so far it only have five container wharfs for the container vessel with max. 100,000 tons in gross tonnage, dock equipment seems in short as well. Secondly, the port infrastructure progress is slow, and work ability can not be consolidated as well, as a result, it is very difficult to meet the diversified investment demand under present global economic situation.

3.3.4 The overall level of the intermediary services is weak

Nowadays, port intermediary service is wholly state-owned enterprises in china, due to its main feature of single property right structure, the gap with requirements of economic market in management concept, management mode, management methods still exists, therefore, the enthusiasm of each respect has not been fully mobilized

actively. In addition, there are many small agency companies running in service at present, but the overall level of business and service quality is not satisfied by customers.

3.3.5 The lack of the port information service

The lack of the port information service is still obvious in Zhoushan, even today, the computer system had been widely used in port maritime services. Meantime, due to the lack of relevant information network technology, the port public information platform is still not established currently, it causes its inability to realize the port the service information sharing, furthermore, the efficiency of customs clearance, shipping trade services, financial services operation have been complicated.

4. Experience reference in development of domestic and foreign ports' maritime services

4.1 Advanced maritime time services of typical ports

4.1.1 Singapore

4.1.1.1 The major policy for the development of Singapore port maritime service industry

Singapore government had introduced a maritime enterprise development program, the main purpose is to encourage the maritime enterprises (including shipping companies, the maritime auxiliary service enterprises and maritime nongovernmental organizations) to launch a new maritime services and products in Singapore. The contents of this program as per below attached, but not limited to:

(1) The major policy of the new-ship building and ship repairing industry

① To set up a Singapore maritime funds by joint between government and private shipping interests. Singapore as the most technologically advanced and efficient ship building base at South-East Asia, there are so many ship repairing, shipbuilding, Marine engineering and manufacturing activities in Singapore. The purpose of aforesaid Singapore maritime funds is to elevate the status of Singapore

international maritime centre, so as to draw the attention by the maritime shipping industry in the world. Meantime, this maritime funds is to promote the industry cooperation, and attract the global shipping industry, shipbuilding and ship repairing enterprises from all walks of life to Singapore as the operating base.

② The government is encouraging the local entrepreneurs to invest in small and medium-sized shipyard in Singapore. These businesses will draw some ship's classification society, professional engineering plant, equipment, wholesalers and manufacturers to Singapore.

(2) The major policy of bonded fuel oil

① Through 10 years of efforts by MPA and the relevant government agencies, strengthening marine fuel oil quality standard of the supply chain and the implementation of comprehensive regulation, so as to maintain high reliability of the quality and quantity in Singapore ship fuel oil market. In order to prevent the filling pressure in the fuel gas at the same time, Singapore had adopted new technology to guarantee its fuel supply port status.

② By simplifying the oil supply relevant formalities, set outside anchorage specially for passing vessels, bunkering service became the most convenient and quickest in Singapore.

(3) The major policy of LNG supply market

① MPA will carry out experimental work of the liquefied natural gas (LNG) supply chain begin from early 2017, will provide up to \$2 million at the same time to the support LNG ship six safety rules and standards of test program.

② To build LNG trade center in Asia.

Pic 4-1: The geographical location map of Singapore



4.1.1.2 The lessons from Singapore's maritime services business development experience

Singapore can draw lessons from experience of the development of maritime service industry can be summarized as the following aspects:

(1) Superior business environment

Singapore's government has adopted pro-business policies for a long time, paid great attentions on various services for investors and provided investors with the convenient information system. The government provided a fast speed with low cost in dealing with investment approval, business license, construction permits, labor, taxation, customs clearance service, in the result to greatly reduce the enterprise cost and waiting time. Superior business environment makes the Singapore maritime port cluster can enjoy stable and internationalization operation environment, and thus contribute to Singapore become a leading international shipping and maritime business service center.

(2) Transparent market access system

Transparent and open market access system is also the way to attract many maritime services companies doing business in Singapore. Under this condition of

transparent and open access, considering the huge maritime market in Singapore, all types of maritime services providers gathering at Singapore and forming a fully competitive market, a competitive price and qualified service can be choose by all customers.

(3) Reasonable and efficient supervision

Through supervising service performance of maritime service enterprises, Singapore government encourage enterprises to continuously improve the deficiency, then to establish those perfect and reasonable industry standards. It only takes few minutes to complete customs clearance formalities through the network; it greatly improves the operational efficiency of the maritime services in Singapore.

(4) The positive preferential policy of finance and taxation

Singapore implemented a quite preferential tax policy in the aspect of marine fuel oil supply, shipping finance, maritime insurance etc. Tax incentives include lowering corporate income tax and gain tax of container leasing, caused the Singapore shipping industry, ship leasing credit and shipping trust fund were developed rapidly.

(5) Focusing on talent cultivation and provide practice-based professionals

The Singapore government contribute a \$3 million a year to "maritime foundation", funding for small and medium-sized enterprises to have overseas exhibitions and students to complete navigation training program. Seafarers are from Singapore, they will received a special bonus from the government, as well as for those workers can be exempted from individual income tax if work-period is less than 183 days a year in Singapore. By collaboration with local and international education agencies, MPA has launched a series of maritime degree and diploma programs and professional training courses, so as to enhance the consciousness of the related intellectual property rights, enrich maritime and port specialized knowledge, finally to promote the maritime cluster of human resource development.

(6) Improve informationization degree, and achieve port efficient management

Singapore international shipping center information platform has played a key role for this purpose, and the platform is mainly composed of three electronic information systems including PORTNET, TRADENET and MARINET. Through

transverse joint, it will connect all competent international trade network as a whole system to realize information sharing between departments, Through the vertical joint, to ensure the smoothness of flow of information. Thus, we can say the improvement of Singapore informatization degree is favorable to the efficient management and high-quality service of maritime services.

4.1.2 Hongkong

4.1.2.1 The main models and basic characteristics of Hong Kong maritime services industry

Hong Kong is one of the most freedom of economy and one of the best business environment in the world. Pursuing the policies of free port, individually separate customs territories, low tax rates and free flow of information etc., with which it lays a foundation for the development of maritime services in Hong Kong. Hong Kong's maritime services industry possess complete service network, which can attract many maritime companies around the world to establish business in Hong Kong. Presently, there are about 900 maritime service related companies operating in Hong Kong, providing comprehensive maritime services. Therefore, its main model of HongKong international maritime services base is under the leading of market.

(1) The basic characteristics of Hong Kong maritime services industry as below:

① Maritime service industry was developing rapidly in the past decade in HongKong, many large and famous shipping companies globally have established their offices in Hong Kong and provided comprehensive maritime services, including shipbuilding and ship repairing, bonded fuel oil, the crew and ship management, law assistance, insurance, financing, ship registration etc., the characteristics of Hong Kong is acting as "wholesale experts".

② Observation of the market mechanism

The development of Hong Kong maritime service industry has three major advantages, namely: justice, freedom and the rule of law. The Hong Kong government has committed to create a favorable business environment. The honesty of the government has been achieved by such a stable social and political environment. This

is the leading cause why Hong Kong is the first place to be selected by those famous enterprises. Those enterprises don't have any interference from Hong Kong government at all.

③ Focusing on the high-end maritime service industry

By the end of 2011, there were 1952 vessels which had been flagged at Hong Kong, with 68.33 million gross tonnage in total; Hong Kong is the center of the maritime law and commercial law in Asia as there are lots of large protection and indemnity association established their individual representative office in Hong Kong; There are 85 of 200 major Banks in the world have their branch in Hong Kong; Hong Kong is one of the world's ships business brokerage center, is also the center of transnational trading in Asia; The main classification society in the world with offices in Hong Kong; Through these activities, Hong Kong has reserved a large number of professionals in maritime service industry.

④ Fully use of geographical advantages

From the point of geographical environment, Hong Kong, which is located in the far east trade channel, is a world famous international shipping center and has a natural barrier around the deepwater port and adjacent to the pearl river delta region. As an international port, Hong Kong, which is primarily engaged in transshipment service, becomes a famous logistics hub in Asia, as well as the third largest international financial center in the Asia-Pacific region.

Pic 4-2: The geographical location map of Hongkong



4.1.2.2 The lessons from HongKong maritime services industry development experience

HongKong can draw lessons from experience of the development of maritime service industry as per follows:

(1) Highlighting the comprehensive advantage

Hong Kong has high efficient economic maritime infrastructure, land, convenient sea and air service operation environment, and its logistics services quality ranked among the top of the world; Hong Kong has a sound legal system, a stable financial, supervision mechanism, so as to ensure that activities are fair and open competition in the market; Hong Kong's tax system is simple, low tax rate, implements the management system of freedom for the enterprise; Enterprise capital and labor, production materials supply and distribution, are independent choice by the enterprise.

(2) In line with international standards of law and arbitration system

The legal systems being used in Hong Kong are acceptable and familiar by international community, which promotes the development of maritime arbitration and other high-end maritime services. For example, the terms of "apply English law, London or Hong Kong arbitration" are often used in the charter party, the integrity, professionalism and professional ethics of Hong Kong arbitrators are welcome by

each industry.

(3) To provide Maritime services with high quality

Because Hong Kong maritime service industry maintains the high service quality at all times strictly and adheres to the concept of "win by wisdom" as well, which enables Hong Kong to enjoy a very good reputation in the world. In order to be a competitive ship registry port in the world, Hong Kong marine department began to carry out the quality control system of flag state in 1999, so that it was convenient to monitor and maintain the quality of Hong Kong registered vessels. Since 2004, the Hong Kong government has adopted the quality control system before registry, so as to prevent unsatisfied ships from Hong Kong registered. In addition, the Hong Kong government also regularly publishes notices of newly revised international maritime regulations, as well as latest news of port state control inspection in each region, especially in Tokoy Mou, in order to guarantee the quality of port maritime service.

(4) Focusing on talent cultivation

The Hong Kong government had put forward the navigation training incentive plan, ship's maintenance training incentive plan and careers education plan, through government subsidies, funding and lecture, etc., so as to promote the maritime service related talents cultivation.

4.1.3 Shanghai

4.1.3.1 The main development direction of Shanghai maritime services

In 1995, the state council made major decisions to construct the Shanghai international shipping center, after 20 years of development, Shanghai has become the world's largest cargo port. Details of development as following:

(1) Shanghai has formed relatively completed maritime service industry chain

In 2014, Shanghai container throughput had achieved 35.285 million TEUs, and it became the largest container port in the world for the last 5 years. There were more than 300 liner service routes connected with north/south America, Europe, Australia, Africa and among Asian ports, the density of liners reached 2700 ships. Based on the traditional industry, at present, Shanghai has formed high-end shipping derivatives

from shipbuilding, ship repairing, port machinery manufacturing and maritime insurance. Taking the maritime industry as an example, in 2013, Shanghai annual shipbuilding reached 8.52 million tons in deadweight, which accounts for 18.8% of the proportion in whole China, and equipment for container terminal from the ZhenHua heavy industries occupied about 70% of market share all over the world.

(2) Focusing on the structure optimization in the maritime service chain

In the whole maritime service chain, Shanghai took a goal to create high-end industry, to optimize the structure of the maritime service industry chain as a core. Shanghai had focused on building the biggest and the most advanced fully automated terminal (4th phase of yangshan port). Meanwhile, Shanghai took the initiative to new-buildings, just like LNG tanker, chemical tanker, large container ship, ocean engineering equipment manufacturing, cruise and other high value-added types. In addition, Shanghai also focused on development of the ship registration in China (Shanghai) international free trade zone, allowing it to establish a wholly foreign owned international ship management company. Also, Shanghai had strived to develop the maritime insurance, maritime finance, maritime arbitration etc., so far there are around 10 maritime insurance centers in Shanghai.

(3) Focusing on system innovation and upgrading

The establishment of China (Shanghai) free trade zone (hereafter refers to SFTZ) has the biggest impact on maritime services to provide a excellent experiment system of institutional framework, and the core concept of the SFTZ is to develop the high-end maritime service industry.

Pic 4-3: The geographical location map of Shanghai



4.1.3.2 The lessons from Shanghai maritime services industry development experience

Due to the difference between Shanghai and Zhoushan in resources endowment exists, as the result in difference in focusing on the development of maritime services. Shanghai is focusing on great importance to the knowledge economy as the main characteristics of high-end maritime services, and Zhoushan is more focusing on the way of the development of maritime industry. Therefore, lessons are more focus on the development patterns and some supporting policies for Zhoushan:

(1) Strengthen government guidance, promote industrial concentration

Shanghai has already formed many functional zones of maritime service industry, such as the agglomeration zone of north bund shipping service and Pudong Lujiazui high-end shipping service, Pudong comprehensive experimental zone for international shipping development, Lingang logistics zone etc., and as for each piece of functional areas, the government has issued corresponding support policies to promote the agglomeration of maritime services industry in each functional zone respectively, so as to realize the benign interaction between each maritime services industry.

(2) Strengthen the top-level design and focus on the institutional innovation

The implementation of No. 19 document by state council, marked that the establishment of Shanghai international shipping center has become a national strategy. The establishment of Shanghai international shipping center is a new mission of integration into the global economy by various industries development in Shanghai, so as to service the development of Yangtze River Economic Belt by promotion of urban functions. Therefore, Shanghai will get many support policies from Capital side during the process of construction and development of Shanghai international shipping center, and it is also much easier to seek new breakthroughs in the aspect of systems and mechanisms.

(3) The innovation of government management and focusing on improvement of service level

During the period of establishment of Shanghai international shipping center, The Shanghai government has begun to reduce the barriers to entry, minimize the procedure of administrative review and approval, enhance the monitoring, improve the efficiency and respect marketization operations etc. for the development of maritime service industry.

4.1.4 Ningbo

4.1.4.1 The main development direction of Ningbo maritime services

For Ningbo port, the core is to transform herself into a main part of Shanghai international shipping center, realizing dislocation development:

(1) Ningbo is an important part of Shanghai international shipping center

Chinese government had clearly pointed out the development pattern of Shanghai international shipping center, namely with Shanghai as the center, the Jiangsu and Zhejiang as two wings. The relationship between Shanghai port and Ningbo port is a "reasonable division of labor and close cooperation". The agglomeration and development of Ningbo port maritime service industry is a complementation with Shanghai port each other, so as to have connection with Shanghai international shipping center gradually with an aim to build the system of modern maritime services in customs clearance services, shipping agency, freight

services, shipping information, platform of shipping transaction, shipping finance guarantee services etc, by means of the shipping and port services,

(2) Based on the real economy in the maritime industry chain system, enlarge scale of port maritime service industry

From the dynamic relationship of Ningbo port maritime service industry chain, by optimizing the customs clearance service, the service quality of shipping agency can be improved; the mechanism of port maritime service industry can be enhanced; the scale, efficiency and service quality of port service industry can be promoted.

(3) Focus on the development of high-end maritime services, i.e. maritime trade, shipping, finance, insurance, information

Acting as the southern flank of the Yangtze river delta port system, and an important part of Shanghai international shipping center, Ningbo port is actively integrated into the establishment of Shanghai international shipping center. The supply and demand of Ningbo port high-end maritime service industry is still in a low equilibrium, and the development strategy is to transform from the real logistics competition into the fusion of high-end shipping service industry development. At present, Ningbo, is taking advantage of the abundant Zhejiang private capital to develop the shipping finance, and simultaneously strengthening the cooperation with Shanghai shipping insurance so as to set up the Ningbo shipping exchange in maritime information, shipping trade, maritime services.

Pic 4-4: The geographical location map of Ningbo



4.1.4.2 The lessons from Ningbo maritime services industry development experience

On the experience for reference, Zhoushan should focus on the reference to the development of marine economy mode:

(1) Focus on port and shipping maritime economy as the leading factor, supplemented by supporting maritime services industry

The total cargo throughput of Ningbo port reached 526 million tons in year of 2014, and it's the top one in the world. Container throughput was 18.7 million TEU as well. There were totally 228 container service routes calling Ningbo port, including 113 ocean service routes, 62 regional service routes and 53 coastal service routes. There were totally 16920 container vessels called Ningbo port in whole year of 2014, with an average of 1410 vessels per month. And total 131000 TEUs were achieved by multi-modal transportation, so as to support the development of ports basic industries effectively. Ningbo port put forth efforts to create the high-end maritime service industry, such as maritime transaction, ship building/repairing services, seafarers' training service and shipping information platform etc.

(2) Strengthen the development of high-end port maritime service industry based on the local feature

Considering the competition and cooperation relationship of maritime service among Shanghai, Ningbo and Zhoushan, Shanghai has the absolute superiority in the high-end maritime service industry, but in terms of the port basis service industry it is not so mighty among there three ports. Therefore, Ningbo and Zhoushan should take advantage of the port basis service industry to develop port international maritime services in dislocation with Shanghai.

4.2 Experience references

4.2.1 Maintain efficient operation of the port by the use and popularization of new technology

The wide use of new technology, such as electronic information, will greatly provide convenience for port service activities, so as to improve the efficiency of the port operation, as well as be one of the major factors for the world's major ports to maintain efficient operation. The adoption of electronic customs declaration, inspection declaration and other technology, will greatly improve the efficiency of customs clearance and save the time of the owners. In order to achieve the above-mentioned purposes, most of the world's major maritime centers are focusing on the construction of the port EDI and information network, so as to provide the information exchange platform for the owners of cargo and ships. The great advantage of the widely utilization of information technology is to provide the port information disclosure in most convenience. The port tariff of Rotterdam can be obtained on the specified port network, and the information of each calling vessel and ship schedules of Hamburg can be found on the front page of port web site.

4.2.2 Improve the port degrees freedom by providing port preferential policy

Generally speaking, the main reason for a port to attract many cargo owners and ship owners from world for investment is its openness. In other words, a closed port will not be dynamic at all. Only in open ports, foreign goods can be imported and

domestic raw materials and/or products will be able to be exported as well, there kind logistic will bring the gathering of local port maritime service industry and enhancing local port maritime transportation. The development of Chinese coastal ports after the reform and opening in China proves the importance of this concern.

However, the degrees of freedom in our domestic ports seem not to be sufficient if comparison with those famous foreign ports. This seriously affected the development of local ports. Take the container transshipment as an example, the rate of such transshipment in current domestic coastal ports are generally lower, only more than 30% in Shanghai, but there are around 50% of this transshipment in Busan port. Due to the lack of policy supports in this aspect, it causes the disconnection between preferential policies of the free trade zone and local port, therefore, there are more than 50% of goods from inner china to Europe and the United States are transshipped in Busan. Hence, the government should give more support of various preferential policies in opening port in future.

4.2.3 Promote the port operation efficiency by improving the labors' quality

The promotion of port operation efficiency depends on the utilization of various advanced handling equipment, but it still rely on the labor's quality. Such kind of advanced equipment will be popularized and the whole image of the port can be improved after the strengthening of labor's quality. In Singapore, many port labors can carry out communications in English, this brought much convenience for the ship's crew and owners. According to research of South Korean scholars, it shows that the hardware used in Chinese ports is much more modern, but the gap of labor's quality with foreign ports is still large. After investigation, we found this was caused by the restriction of our country's education level, and it couldn't be changed in the short term, but it should be raised concern by top government.

4.2.4 Promote the port operation efficiency with the support of Local city's strong trade and financial function

Throughout the development history of many ports in the world, it is easy to

discover that development of the central city's trade and finance is based on the ports' development. On the other hand, the prosperous finance of local city will support the development of local port industry. The main function of the port city's trade and finance is as follows:

The development of processing trade, it comes into being the huge demand for port maritime service industry; International logistics will be agglomerated in the local port; it will provide credit, financing conditions for the construction of local port industry infrastructure (waterway, port, warehouse, storage area, communications, transport etc.); meanwhile, it will provide insurance services for the development of ocean shipping industry. Therefore, in the development of international maritime services, the strong finance function of center city is indispensable. New York, Hong Kong and Singapore are world-class international trade and financial center. Rotterdam, although it can not be paralleled with the above three ports, but there are many Banks and trade institutions in Rotterdam, it plays an important supporting roles in the formation and development of the international shipping center.

5. The development strategy and countermeasures of Zhoushan port maritime services

5.1 To strength organizational leadership and enhance organization ability

To establish a leading group of Zhoushan international maritime service base, the group leader should be the municipal government, and the members of group shall include the followings: municipal commercial affairs bureau, management committee of Zhoushan Marine industrial agglomeration, the municipal judicial bureau, municipal finance bureau, port operation bureau, Zhoushan customs, Zhoushan entry-exit inspection and quarantine bureau, Zhoushan maritime safety administration, Zhoushan frontier bureau, Zhejiang Marine university, Zhejiang international maritime college and other department necessary.

5.2 To intensify efficient policies and promote supporting measures

To further strengthen the researches on developing Zhoushan free trade zone, to

begin with, we should pay great efforts to absorb the development experience of Shanghai free trade zone, and draw lessons of port maritime service industry development policy from Singapore, Hong Kong, Shanghai and Ningbo. Secondly we should be endeavored to release the restrictions of bonded fuel supply qualification, so as to enable those domestic and foreign well-known ship fuel supply enterprises to be registered in Zhoushan to do business. In addition we should consolidate the exemption of tonnage dues for vessel bunkering at Zhoushan outer anchorage. We should actively strive for breakthrough crew tax policy, and bring in those related maritime service industry, such as LNG tank trucks, shipping companies, international ship management companies etc., establish and improve the port international maritime service industry chain. Last but not least, we should seek for the supports from top government for achievement of Zhoushan port international maritime service industry project.

5.3 To perfect the systems and mechanisms

In line with international advanced theories and practices, and combining with the reality of Zhoushan port, we should research the development mechanism of the Zhoushan international maritime service base, with an aim to create the efficient and transparent competition market of Zhoushan port. In view of the bonded fuel and LNG fuel supply in Zhoushan, the base should innovate port supervision model, reform the overall customs clearance process, shorten the customs clearance time, provide efficient and convenient services, so as to improve the efficiency of customs clearance.

By the establishment of Zhoushan international maritime service base, it will integrate those custom, inspections and other port departments, to achieve the modern administrative system of Zhoushan international maritime services industry, and get the result of the efficiency of government services.

5.4 To enhance the fiscal and taxation support and guarantee capital demand

The government should integrate those various fiscal subsidy fund, and set up a

specialized construction fund for the Zhoushan international maritime service base. This fund shall be utilized to support the development of maritime service base, speed up the construction of major projects and strengthen the supports for key enterprises. In order to encourage those supported enterprises for innovation and upgrading, the government can set up a research fund in the above mentioned specialized base fund. The government should ensure that the funds are in place at all times, so as to meet all the requirements of capital demand by those major projects and key enterprises.

5.5 To strengthen the team construction, improve the structure of talent

Zhoushan government should set up the mechanism of introducing talents and training which are used specially for the development of Zhoushan international maritime service base. Meantime, the government should establish a professional training center with universities jointly. Also it should set up a fund independently for talent training purpose in the base fund, in order to encourage overseas students to start up a business in Zhoushan, especially those overseas students who are Zhoushan citizens. As well as the government should provide support for professional technical and vocational skills training to create a professional team specially for the development of Zhoushan international maritime service base in the near future.

5.6 To build a maritime service information platform and improve the service quality of informationization

In order to promote the development of Zhoushan international maritime service base, the government should persist in the promotion of informationization, and enhance the port information infrastructure, hardware configuration, establishment of information system applications. The government should also build an information platform of Zhoushan international maritime service base. By integration of maritime service functions of various departments, the information sharing purpose can be ultimately realized. At the same time, the Zhoushan pro-business environment can be formed by dissemination of the establishment of Zhoushan international maritime service base in the world.

6. Conclusions

This thesis takes the development of Zhoushan port international maritime service base as the research object, and based on the division of Zhoushan maritime service industry, puts forward the development strategy and countermeasures of Zhoushan international maritime service base through the comparison among those classic ports in north-east Asia, named: Qingdao, Pusan, Shanghai and Ningbo by the use of analytic hierarchy process (APH) method. It aims to enhance the development of Zhoushan ocean economy as per the plan which was issued by state council couple years ago, as well as promote the competition position within Yangtze River Delta.

However, this thesis still remains some deficiencies for subsequent research. The domestic research of port international maritime service industry has just started not far ago, with thin results in the subject researches at present. Meanwhile, because I am not familiar with the port operation process, to some degree it is very limited for me to carry out this research deeply. In addition, the current statistical system only involves the port throughput and passengers, but some indicators and data of port maritime service industry are in exception, therefore, I encountered some difficulties in data accumulation during this research.

There will be a promising prospective about the future research on this subject. The main concern of Zhoushan international maritime service base is the service quality. In the future study, we should utilize the characteristics of the individual port, put those research results of service economy and industry economics into the use of port maritime service industry. Research can involve the characteristics of port economic and interaction between port services industry and city services industry, so as to improve the theoretical system of port maritime service industry in future.

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APPENDIX 1

Appendix 1: Index of correlation of Shanghai, Qingdao, Busan and Ningbo port

	Shanghai	Qingdao	Busan	Ningbo
Channel Depth (m)	20	18.2	15.6	18.6
Length of Wharf (m)	7590.6	3032.5	2552	2658
No. of Gantry Crane (Pcs)	57	35	26	21
Active Area of Cargo Yard (10000m ²)	163.5	20.534	30.6	10.94
Average Time of Cargo Custom Clearance (Hour)	1	2.2	2	2.5
Efficiency of Loading & Unloading (TET/Hour)	880	565	420	385
No. of Ship Agencies	78	70	42	28
Cargo Collection and Distribution	2300	2000	600	550
The Coverage of Line Services (Routes)	230	92	182	125
Consistency of Liner (Calls/Month)	2106	520	1250	1020
Capability of Ship Building and Repairing (10000t)	435	210	820	280
Replenishment of Ship Store (10000t)	10	6.6	8	7
No. of Seaman's Club	6	1	12	1
Quality of Port Manger (1-5)	4	3	5	3
Port Charges (RMB/TEU)	110	35	182	42
Freedom of Port (1-7)	6	3	6	3
Port Information Platform Construction (1-10)	9	7	8.4	7.5
Popularizing Rate of Electronic Clearance (%)	80	35	82	45
Popularizing Rate of Electronic Inspection (%)	90	70	100	80

Information mainly comes from << Profiles of world container terminal>>

APPENDIX 2

Appendix 2: The selected ports for the level of the index sort and consistency check

C11 _φ	P1 _φ	P2 _φ	P3 _φ	P4 _φ	$\lambda_{\max\phi}$	CI _φ	CR _φ	W _φ
P1 _φ	1 _φ	5/4 _φ	4/3 _φ	5/4 _φ	5.003 _φ	0.002 _φ	0.003 _φ	0.152 _φ
P2 _φ	4/5 _φ	1 _φ	3/2 _φ	1 _φ				0.307 _φ
P3 _φ	3/4 _φ	2/3 _φ	1 _φ	2/3 _φ				0.124 _φ
P4 _φ	4/5 _φ	1 _φ	3/2 _φ	1 _φ				0.198 _φ

C12 _φ	P1 _φ	P2 _φ	P3 _φ	P4 _φ	$\lambda_{\max\phi}$	CI _φ	CR _φ	W _φ
P1 _φ	1 _φ	5/2 _φ	3 _φ	3 _φ	5.026 _φ	0.011 _φ	0.009 _φ	0.212 _φ
P2 _φ	2/5 _φ	1 _φ	6/5 _φ	6/5 _φ				0.305 _φ
P3 _φ	1/3 _φ	5/6 _φ	1 _φ	1 _φ				0.212 _φ
P4 _φ	1/3 _φ	5/6 _φ	1 _φ	1 _φ				0.062 _φ

C13 _φ	P1 _φ	P2 _φ	P3 _φ	P4 _φ	$\lambda_{\max\phi}$	CI _φ	CR _φ	W _φ
P1 _φ	1 _φ	2 _φ	2 _φ	3 _φ	5.018 _φ	0.005 _φ	0.004 _φ	0.089 _φ
P2 _φ	1/2 _φ	1 _φ	3/2 _φ	3/2 _φ				0.327 _φ
P3 _φ	1/2 _φ	2/3 _φ	1 _φ	1 _φ				0.201 _φ
P4 _φ	1/3 _φ	2/3 _φ	1 _φ	1 _φ				0.172 _φ

C14 _φ	P1 _φ	P2 _φ	P3 _φ	P4 _φ	$\lambda_{\max\phi}$	CI _φ	CR _φ	W _φ
P1 _φ	1 _φ	8 _φ	5 _φ	8 _φ	5.002 _φ	0.003 _φ	0 _φ	0.052 _φ
P2 _φ	1/8 _φ	1 _φ	5/8 _φ	1 _φ				0.289 _φ
P3 _φ	1/5 _φ	8/5 _φ	1 _φ	8/5 _φ				0.065 _φ
P4 _φ	1/8 _φ	1 _φ	5/8 _φ	1 _φ				0.412 _φ

C21 _ϕ	P1 _ϕ	P2 _ϕ	P3 _ϕ	P4 _ϕ	$\lambda \max_{\phi}$	CI _ϕ	CR _ϕ	W _ϕ
P1 _ϕ	1 _ϕ	1/2 _ϕ	1/2 _ϕ	1/3 _ϕ	5.001 _ϕ	0.001 _ϕ	0 _ϕ	0.142 _ϕ
P2 _ϕ	2 _ϕ	1 _ϕ	1 _ϕ	2/3 _ϕ				0.148 _ϕ
P3 _ϕ	2 _ϕ	1 _ϕ	1 _ϕ	2/3 _ϕ				0.421 _ϕ
P4 _ϕ	3 _ϕ	3/2 _ϕ	3/2 _ϕ	1 _ϕ				0.294 _ϕ

ϕ

C22 _ϕ	P1 _ϕ	P2 _ϕ	P3 _ϕ	P4 _ϕ	$\lambda \max_{\phi}$	CI _ϕ	CR _ϕ	W _ϕ
P1 _ϕ	1 _ϕ	3/2 _ϕ	2 _ϕ	9/4 _ϕ	5.03 _ϕ	0.02 _ϕ	0.012 _ϕ	0.120 _ϕ
P2 _ϕ	2/3 _ϕ	1 _ϕ	4/3 _ϕ	3/2 _ϕ				0.236 _ϕ
P3 _ϕ	1/2 _ϕ	3/4 _ϕ	1 _ϕ	1 _ϕ				0.122 _ϕ
P4 _ϕ	4/9 _ϕ	2/3 _ϕ	1 _ϕ	1 _ϕ				0.436 _ϕ

C23 _ϕ	P1 _ϕ	P2 _ϕ	P3 _ϕ	P4 _ϕ	$\lambda \max_{\phi}$	CI _ϕ	CR _ϕ	W _ϕ
P1 _ϕ	1 _ϕ	9/8 _ϕ	2 _ϕ	3 _ϕ	5.001 _ϕ	0.001 _ϕ	0 _ϕ	0.210 _ϕ
P2 _ϕ	8/9 _ϕ	1 _ϕ	5/3 _ϕ	5/2 _ϕ				0.212 _ϕ
P3 _ϕ	1/2 _ϕ	3/5 _ϕ	1 _ϕ	3/2 _ϕ				0.295 _ϕ
P4 _ϕ	1/3 _ϕ	2/5 _ϕ	2/3 _ϕ	1 _ϕ				0.212 _ϕ

ϕ

C24 _ϕ	P1 _ϕ	P2 _ϕ	P3 _ϕ	P4 _ϕ	$\lambda \max_{\phi}$	CI _ϕ	CR _ϕ	W _ϕ
P1 _ϕ	1 _ϕ	9/8 _ϕ	4 _ϕ	4 _ϕ	5.001 _ϕ	0.001 _ϕ	0.002 _ϕ	0.234 _ϕ
P2 _ϕ	8/9 _ϕ	1 _ϕ	10/3 _ϕ	10/3 _ϕ				0.221 _ϕ
P3 _ϕ	1/4 _ϕ	3/10 _ϕ	1 _ϕ	1 _ϕ				0.213 _ϕ
P4 _ϕ	1/4 _ϕ	3/10 _ϕ	1 _ϕ	1 _ϕ				0.204 _ϕ

C25 _ϕ	P1 _ϕ	P2 _ϕ	P3 _ϕ	P4 _ϕ	$\lambda \max_{\phi}$	CI _ϕ	CR _ϕ	W _ϕ
P1 _ϕ	1 _ϕ	5/2 _ϕ	5/4 _ϕ	2 _ϕ	5.001 _ϕ	0 _ϕ	0 _ϕ	0.061 _ϕ
P2 _ϕ	2/5 _ϕ	1 _ϕ	1/2 _ϕ	2/3 _ϕ				0.524 _ϕ
P3 _ϕ	4/5 _ϕ	2 _ϕ	1 _ϕ	3/2 _ϕ				0.165 _ϕ
P4 _ϕ	1/2 _ϕ	3/2 _ϕ	2/3 _ϕ	1 _ϕ				0.385 _ϕ

C26 ^o	P1 ^o	P2 ^o	P3 ^o	P4 ^o	λ_{\max} ^o	CI ^o	CR ^o	W ^o
P1 ^o	1 ^o	4 ^o	2 ^o	2 ^o	5.001 ^o	0.001 ^o	0 ^o	0.061 ^o
P2 ^o	1/4 ^o	1 ^o	1/2 ^o	1/2 ^o				0.121 ^o
P3 ^o	1/2 ^o	2 ^o	1 ^o	1 ^o				0.084 ^o
P4 ^o	1/2 ^o	2 ^o	1 ^o	1 ^o				0.431 ^o

C31 ^o	P1 ^o	P2 ^o	P3 ^o	P4 ^o	λ_{\max} ^o	CI ^o	CR ^o	W ^o
P1 ^o	1 ^o	2 ^o	1/2 ^o	3/2 ^o	5.001 ^o	0 ^o	0 ^o	0.053 ^o
P2 ^o	1/2 ^o	1 ^o	1/4 ^o	3/4 ^o				0.112 ^o
P3 ^o	2 ^o	4 ^o	1 ^o	3 ^o				0.072 ^o
P4 ^o	2/3 ^o	4/3 ^o	1/3 ^o	1 ^o				0.291 ^o

C32 ^o	P1 ^o	P2 ^o	P3 ^o	P4 ^o	λ_{\max} ^o	CI ^o	CR ^o	W ^o
P1 ^o	1 ^o	3/2 ^o	5/4 ^o	3/2 ^o	4 ^o	0 ^o	0 ^o	0.093 ^o
P2 ^o	2/3 ^o	1 ^o	7/8 ^o	1 ^o				0.075 ^o
P3 ^o	4/5 ^o	8/7 ^o	1 ^o	8/7 ^o				0.132 ^o
P4 ^o	2/3 ^o	1 ^o	7/8 ^o	1 ^o				0.194 ^o

C33 ^o	P1 ^o	P2 ^o	P3 ^o	P4 ^o	λ_{\max} ^o	CI ^o	CR ^o	W ^o
P1 ^o	1 ^o	6 ^o	1/2 ^o	6 ^o	5.001 ^o	0.001 ^o	0.001 ^o	0.102 ^o
P2 ^o	1/6 ^o	1 ^o	1/12 ^o	1 ^o				0.039 ^o
P3 ^o	2 ^o	12 ^o	1 ^o	12 ^o				0.176 ^o
P4 ^o	1/6 ^o	1 ^o	1/12 ^o	1 ^o				0.364 ^o

C41 ^o	P1 ^o	P2 ^o	P3 ^o	P4 ^o	λ_{\max} ^o	CI ^o	CR ^o	W ^o
P1 ^o	1 ^o	4/3 ^o	4/5 ^o	4/3 ^o	5.002 ^o	0.002 ^o	0.001 ^o	0.062 ^o
P2 ^o	3/4 ^o	1 ^o	3/5 ^o	1 ^o				0.069 ^o
P3 ^o	5/4 ^o	5/3 ^o	1 ^o	5/3 ^o				0.081 ^o
P4 ^o	3/4 ^o	1 ^o	3/5 ^o	1 ^o				0.285 ^o

C42 _o	P1 _o	P2 _o	P3 _o	P4 _o	$\lambda \max_o$	CI _o	CR _o	W _o
P1 _o	1 _o	3 _o	1/2 _o	3 _o	5.001 _o	0 _o	0 _o	0.108 _o
P2 _o	1/3 _o	1 _o	1/6 _o	3/4 _o				0.069 _o
P3 _o	2 _o	6 _o	1 _o	4 _o				0.113 _o
P4 _o	1/3 _o	4/3 _o	1/4 _o	1 _o				0.221 _o

o

C43 _o	P1 _o	P2 _o	P3 _o	P4 _o	$\lambda \max_o$	CI _o	CR _o	W _o
P1 _o	1 _o	2 _o	1 _o	2 _o	4 _o	0 _o	0 _o	0.071 _o
P2 _o	1/2 _o	1 _o	1/2 _o	1/2 _o				0.120 _o
P3 _o	1 _o	2 _o	1 _o	2 _o				0.075 _o
P4 _o	1/2 _o	1 _o	1/2 _o	1 _o				0.321 _o

o

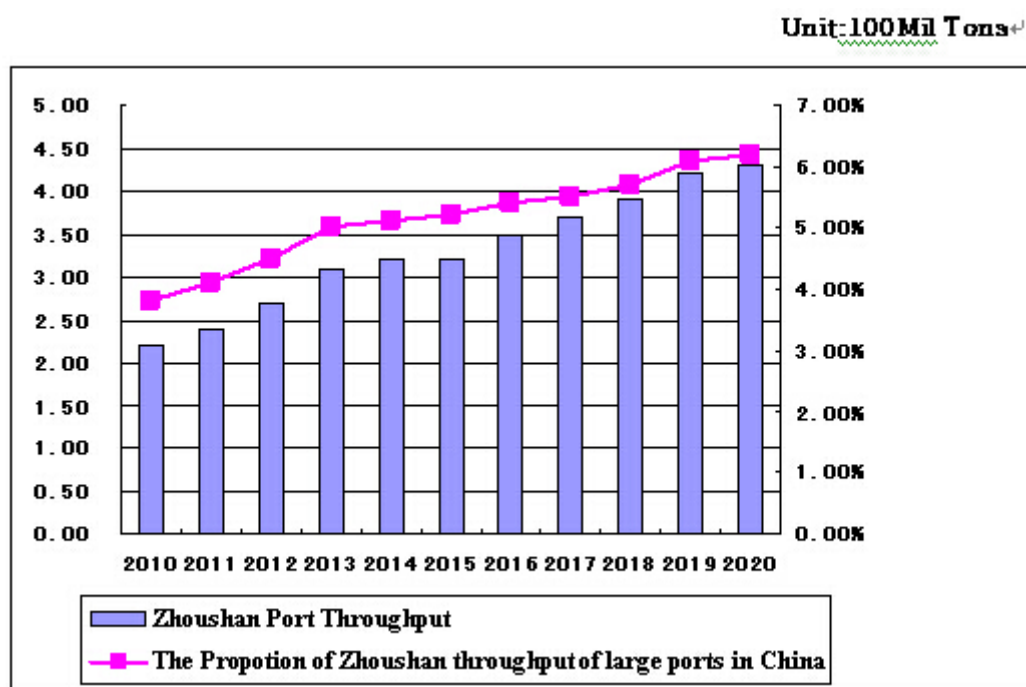
C51 _o	P1 _o	P2 _o	P3 _o	P4 _o	$\lambda \max_o$	CI _o	CR _o	W _o
P1 _o	1 _o	9/7 _o	9/8 _o	9/8 _o	5.001 _o	0 _o	0 _o	0.142 _o
P2 _o	7/9 _o	1 _o	7/8 _o	7/8 _o				0.045 _o
P3 _o	8/9 _o	8/7 _o	1 _o	1 _o				0.046 _o
P4 _o	8/9 _o	8/7 _o	1 _o	1 _o				0.382 _o

o

C52 _o	P1 _o	P2 _o	P3 _o	P4 _o	$\lambda \max_o$	CI _o	CR _o	W _o
P1 _o	1 _o	7/3 _o	1 _o	2 _o	5 _o	0 _o	0 _o	0.125 _o
P2 _o	3/7 _o	1 _o	3/7 _o	4/5 _o				0.045 _o
P3 _o	1 _o	7/3 _o	1 _o	2 _o				0.045 _o
P4 _o	1/2 _o	5/4 _o	1/2 _o	1 _o				0.372 _o

APPENDIX 3

Appendix 3: The expectation of Zhoushan port throughput



This information was from Zhoushan port authority.

APPENDIX 4

Appendix 4: The expectation of Zhoushan port transshipment

This expectation is based on the Zhoushan ShuLangHu ore transshipment terminal (400 thousands grade) that was come into service in January 2016. And same class terminal of SheYiMen will be put in service soon by Zhoushan port authority..

