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WORLD MARITIME UNIVERSITY

Shanghai, China

**INTERNATIONAL CONTAINER LOGISTICS
TRANSHIPMENT SERVICE:**

Comparison Between Shanghai Port And Singapore Port

By

HAN TINGYU

The People's Republic of China

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

MASTER OF SCIENCE

(INTERNATIONAL TRANSPORT AND LOGISTICS)

2018

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DECLARATION

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

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

Signature:

Date:

Supervised by: Chen Jihong Professor

Shanghai Maritime University

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ABSTRACT

Title of Research paper: International Container Logistics Transshipment Service:

Comparison Between Shanghai Port And Singapore Port

Degree: **M.Sc.**

In 2014, Shanghai, an international shipping metropolis, initially identified the overall thinking of Shanghai's international shipping center during the “13th Five-Year Plan” period. Shanghai International Shipping Center covers a wide field, industry span, associated with many departments, first of all to focus on the national strategy, will be basically completed by 2020, an international shipping center has a global shipping resource allocation ability as the goal. But the container transshipment is lower the Singapore and other port city. So the research is to analyze the strength of Singapore port and the weakness of shanghai port, so that with reference to the port of singapore, shanghai port proposals to improve the international transshipment and shanghai port could do better to build the center of shipping.

KEY WORDS: container transshipment , shanghai port , Singapore port, yangshan port

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CHAPTER 1 INTRODUCTION

1.1 Background of the Research

In 2014, Shanghai, an international shipping metropolis, initially identified the overall thinking of Shanghai's international shipping center during the “13th Five-Year Plan” period. Shanghai International Shipping Center covers a wide field, industry span, associated with many departments, first of all to focus on the national strategy, will be basically completed by 2020, an international shipping center has a global shipping resource allocation ability as the goal.

First, fully embodies the "One belt one road ""Yangtze River Economic Belt" strategic layout requirements, the implementation of the national strategy and the construction of Shanghai international shipping center closely. Second, fully embodies innovation, relying on reform and innovation pilot area of free trade platform for Shanghai, accelerate the improvement of shipping development environment, shipping gather elements to enhance the Shanghai international shipping center of radiation service capabilities.

The third is to strengthen the interface with the Ministry of Communications and Shanghai-related planning to ensure the unity of goals in the operation process. Fourth, to handle their own development and the relationship between Shanghai, while Shanghai-based shipping center proposed objectives and measures, fully reflects the mutual cooperation and common development of China and the Yangtze River Delta and other urban centers.

1.2 Motivation of the Research

During the 12th Five-Year Plan period, Shanghai International Shipping Center has made a series of new achievements, but at the same time there are still some outstanding conflicts.

In the logistics consolidation and transportation system, shipping service system, and shipping development soft environment, there are still roads for transportation and collection methods, and the development of airspace resources and airport ground support capabilities are not synchronized. The degree of aggregation of key service elements and business scale is not high. The financial supervision, tax support, legal system, and personnel policy factors that affect the allocation of shipping resources need to be improved.

Therefore, it is very necessary to draw lessons from Singapore, which has a very mature shipping business. Singapore Port is located on the southern coast of Singapore Island. The strategic position between the Pacific and Indian Ocean is very important. Since the 13th century, it has become an international trading port. It has now developed into an internationally renowned transshipment port and is one of the largest container ports in the world. Based on this, the Singapore government has positioned its maritime development goal as a "strategic center for the shipping industry", aiming to develop into an important international maritime center, shipping hub port, and shipping trade, logistics and service center. Singapore Port's logistics operation efficiency can be rated as world class. Most of the container cargoes are stored in the port for only 3 to 5 days, of which 20% of the cargo is stored for only 1 day. In the world's top 25 multinational logistics companies, 17 companies have set up headquarters or regional headquarters in Singapore, which provides a solid foundation for Singapore's logistics service industry in terms of capital, transportation, and management.

Therefore, I would like to focus on the exploration of Shanghai Port and Singapore Port

from a perspective of container international transit, so that we can get some conclusions and lessons learned.

1.3 Methodology of the research

Multi-factor, multi-target, multi-port dynamic process analysis can be a good competition to exclude elements of ambiguity between enterprises, detailed analysis, the method is beneficial to guide the actual management. Research Methods in Game Theory, research competition between ports is also suitable for. The competition between ports is actually a game between ports. Because of the large number of ports, the competition between ports involves multiple factors, so the competition between ports is a multi-factor and multi-competitive game. The theory of game theory is applied. And methods. To analyze the process of international competition between ports. To seek new methods for the theoretical research of international competition between ports and conduct quantitative analysis so as to better guide the port to achieve optimal efficiency and profit maximization. The theoretical and practical is significant. This method makes the port management add a new quantitative analysis method. Change the port competition analysis method based on qualitative analysis. Make the theory and practice of port-related management more persuasive.

This article will use game theory ideas and methods. It will mainly study the "international transfer" competition issues in Shanghai and its surrounding ports, as well as the international transit competitive advantage of Singapore Port and its surrounding ports.

In addition, the amount of data on the transit of Shanghai Port Container, by way of linear regression to analyze and predict the future development of Shanghai Port Container transfer amount.

1.4 Structure of the Paper

The thesis consists of 8 chapters and the construction organized is for the purpose of using Linear Regression Analysis and Game Theory approach to address what kinds of advantages and challenges about shanghai port and through the comparing with Singapore port, I put up with some suggestion to improve the transshipment of shanghai port. **Chapter 1** summarizes the research background, objective, organization, methodology and new ideas of this dissertation;

Chapter 2 firstly introduces the category of the International transshipment port. Then in this framework, I used the Game Theory to build up a system about port analysis which is International Transshipment Comprehensive Evaluation Index System;

Based on the brief introduction of International Transshipment Comprehensive Evaluation Index System, in **Chapter 3**, I mainly introduce and analyze the status of shanghai container international transshipment. Further, research the other port which threat Shanghai transshipment;

Chapter 4 is the most important part which calculate the relationship between volume of shanghai port transshipment and shanghai yangshan port transshipment with the time going by. I used the linear regression analysis to analyze and also do the prediction in this year 2018 and prediction for 2020 year.

Chapter 5 comprehensively expounds the strength, opportunity of Singapore port. So that ,we could use the experience of the success of Singapore. And the **chapter 6** mainly introduces the advanced practices and lessons of transshipment of shanghai port according to the success of Singapore. Also, I put up with some suggestions to improve the threat and weakness.

Based on the analysis above, **Chapter 7** is the conclusion summarizing the whole study. And the last is the **Reference**.

1.5 Literature Review

According ‘the development trend of shanghai port international container transshipment’ for Container transport report by Xu Jianhua and CheLliang. The author studies the state situation and Reasons and the benchmark. Then it can be drawn that the prospect is not good enough. In addition to continuing to expand intra-regional and intra-regional trade transfer boxes, it is also necessary to expand the international transit box for the center of the pendulum. In view of the different measures taken in the region and outside the region, the international transit box volume of Shanghai port will be greatly improved by taking advantage of the increasing influence of yangshan port.

Du Xufeng and ivy in CHINA PORTS container transport sector, published "on the Yangshan port international container terminal capacity increased", for Yu Yangshan port international container transshipment ability put forward some opinions. First of all, in order to break the bottleneck, it is necessary to adapt to the development trend of container transportation and improve the transport capacity of its international container otherwise it cannot participate in the competition of the surrounding container hub ports. Second, promoting the international transit capacity of Yangshan port is the inevitable choice of development strategy of Shanghai international shipping center, this will be in Shanghai and China's integration into the world economy better play a positive role. The author gives a more detailed description of the bottlenecks encountered by Yangshan port in the process of improving international transit capacity. The first is the competition from the surrounding ports. The second is the lack of concentration in the route arrangement. The third is the low efficiency of the port clearance, the fourth is the unreasonable port charges, and the fifth is the restrictions on the right of coastal

transportation. Through the analysis of these problems, the author puts forward some detailed Suggestions: first, the system reform should be carried out to improve the freedom of port. Second, we should give full play to the political advantages of bonded port area and vigorously develop the processing trade business. Third, innovate the inspection method, improve the port link circulation speed; fourth is to set the loyalty award, attract the international main trunk line, the fifth is to comprehensively upgrade the existing shuttle bus mode, and improve the transfer efficiency between the port area. Through the above discussion, the author elaborates the current situation and changes of the international container transfer capacity of Yangshan port.

The author describes Singapore's international competitiveness in a more detailed account of the success of the Singapore Freeport in the 7th issue of the economic report of China in 2014. First began in 1819, Singapore port has the concept of a free port, autonomous state in Singapore in 1959 set up, completely free port status facing the severe test, gradually began to reform is a limited free port. The success of Singapore Freeport is no accident. First, location advantages and exclusivity make it strategically located in the international strategic gateway and the eastern end of the strait of Malacca. Secondly, the open economic system, the free port policy, and the active government have provided the space for improvement. Third is the information construction of port and commerce, good service environment. In the end, the outstanding leaders, the uncorrupt and efficient civil service system, and the strict rule of law are the leading factors for the development of Singapore port. Singapore has not only the world-class infrastructure, but also the Singapore free port economy, which has become an important financial center in the world.

CHAPTER 2 INTERNATIONAL CONTAINER TRANSHIPMENT

2.1 Category of the International Transshipment Port

2.1.1 Definition of international transshipment port

The current transshipment cargo is mainly container transit. The transit of the container mainly includes domestic transfer and international transfer.

Container domestic transshipment refers to the container that is transferred to a domestic or other port after being unloaded at a domestic port after being loaded at a port of loading outside the country: or it has gone through the customs clearance procedures at the domestic port of loading. The shipping company issues a full bill of lading and is transferred domestically. Transshipment of containers to destination ports abroad.

Container international transfer (hereinafter referred to as international transfer) refers to international containers and their cargos that are shipped from overseas shipments and are shipped to third countries or regional designated ports after being reloaded with international shipping ships through transshipment ports in the second country or region. In the Far East and Southeast Asia, the proportion of international transshipment is relatively high. The terminal has a full-time transit salesman who is responsible for the container management of the transfer box inside the terminal, masters the dynamics of the international transfer box, and does a good job in the transfer management of the international transfer box document data.

Such as export to South Korea from Wuhan China container cargo, from Wuhan, China shipped by barge to China Shanghai, in Shanghai mounted on the trunk liner shipped to the port of Busan, South Korea, this is called domestic transshipment in Shanghai Port.

For example, container goods exported from Vietnam to South Korea are transported by barge from the Vietnam port to Shenzhen Port. They are loaded on a trunk line in Shenzhen Port and transported to Busan, South Korea. The transfer in Shenzhen Port is called domestic transfer. The transit port is called International transshipment port.

The trade between mainland China and our country's Hong Kong Special Administrative Region, Macao Special Administrative Region, and Taiwan are all treated with foreign trade. Transportation is also treated as foreign trade transport. Therefore, the transit between each other is also an international transshipment.

The important sign of the international hub port is the amount of international container transfer. Usually this proportion is at least 20%. Internationally recognized transshipment ports such as Hong Kong, Singapore, Busan, Kaohsiung, and their container transship rates exceed 40%

2.1.2 characteristics of international transshipment port

Looking at the international transshipment port, there are four major characteristics: The strong economy in the hinterland; The second is on the main waterway route; Third, the implementation of Freeport or basic policy: Fourth is the excellent port facilities.

Currently, the world truly can be called international container transshipment port has three ports, namely Hong Kong, Singapore and Rotterdam. Busan is the second level of this regional transshipment port. If the above four conditions to visit mainland China coastal ports With the rapid development of China's foreign trade economy and the transfer of shipping centers to the Asia Pacific region in recent years, China's Shanghai, Shenzhen and Qingdao are expected to become international transshipment ports.

The formation of international transshipment ports is conditional. The choice of major airline firms, the economic hinterland of ports, the water depth and equipment conditions of ports, the degree of freedom of ports, the geographical location of ports, and the operating costs and efficiency of ports are all in turn The important factors affecting the formation of international transshipment ports.

2.1.3 Causes of international transshipment port

1) Axle spoke transport system. In this system, large-scale trunk liners are only connected to a limited number of large ports while the remaining small and medium-sized ports are connected by feeder services. The goods must be transferred from the main line to the feeder ship or from the feeder line to the main line. This situation is often due to the lack of cargo in small and medium-sized ports, the fact that the mainline liners are not worth relying on, or that the dock depth limits the anchoring of large-scale liners.

2) For the purpose of realizing <just-in-time>, transship occur between large hubs. For example, a vessel docks A, B, C and D in four ports in Northeast Asia. Then it transports North America. The ship, after the ship left port A, had a batch of cargo that had to be rushed to North America. The cargo could be sent directly to D by other ships, and then to D on this vessel again. In this case, For shipments, the transit time between ports A, B, and C can be saved.

3) The strategic alliance between shipping companies has led to the rise of transshipment. The joint collection of closed-up pursuits of rationalized shipping systems, each of which has its own interests, has always resulted in a partial exchange of shipments between members of the joint system.

4) Some ports, although their cargo is large enough, their port facilities are not sufficient to accommodate large ships, and the goods at these ports must be transferred at nearby hubs. In the past, due to this reason, cargo in northern China is often transported in ports in South Korea or Japan.

5) Countries or regions that are prohibited from direct access due to political reasons, etc., also need to transfer goods by transit mode. For example, most of the cargo transportation between mainland China and Taiwan Province needs transit through ports in Hong Kong, Japan, or South Korea, and only a small portion is transported through the "mini three links" or "direct pilot flights."

2.1.4 The importance of attracting international transshipment

Judging from the hub port, the development of container transshipment does bring many direct and indirect benefits. For the same shipment, the size of its handling does not change for the direct port or branch port: but for the transshipment port, the loading and discharging volume is increased: it is generally a discharging and a loading of export goods.

The imported goods are discharged and loaded in order to be delivered to the consignee. Same shipment increased the number of transshipment port loading and discharging, the port also increased revenues. The benefit is very clear and directly.

Moreover, the development of international development can also bring various benefits to the related industries of the port. For example, it can increase services for shipping agents, ship repairs, financial insurance, and shipping suppliers, even for harbor cities and even the ports they rely on. The economic hinterland has benefits. Taking the Port of Algeciras, a coastal city in the southern part of Spain, as an example, the development of

transshipment in Hong Kong has not only driven the development of business service companies in the port area, but also increased the competitiveness of agricultural products in the surrounding areas in the international market.

2.2 International Transshipment Comprehensive Evaluation Index System

2.2.1 Establishment of port international transshipment comprehensive evaluation index system

In the "International Competitive Advantage," a book, Porter competitiveness that is the definition of productivity. He defines competitive advantage comes from the excess value. The most influential and direct factors include the following four factors: factors of production, demand situation, relevant supporting industries and competition of strategic enterprises.

Therefore, after the breakdown of the four points, the same applies to the analysis of the port international transshipment comprehensive evaluation index system of Shanghai Port and Singapore Port. This article detailed to 20 indicators to build port international transshipment competitiveness evaluation index system:

- (1) City Support System (p1);
- (2) Economic output in the hinterland (P2);
- (3) Hinterland Industrial Structure (p3);
- (4) Degree of foreign trade contact (P4);
- (5) Distance to international waterway (p5);

- (6) Trunk liner route number (p6);
- (7) Terminal water depth (P7);
- (8) Inland smooth flow of traffic (p8);
- (9) Connectivity of the port (p9);
- (10) Handling equipment capacity (p10);
- (11) Shipping company investment terminal (p11);
- (12) Large container berths (p12);
- (13) Degree of terminal automation (p13);
- (14) Port handling capacity (p14);
- (15) Clearance efficiency (p15);
- (16) Holiday harbor break (p16);
- (17) Port congestion (p17);
- (18) The degree of informatization (p18);
- (19) Charges (p19);
- (20) Preferential policies (p20).

According to the meaning of these indicators, these indicators are divided into four categories,

(1) - (4) are the economic hinterland factors,

(5) - (9) are the geographical location of the port,

(10) - (14) are the hard harbor environmental factors,

(15) - (20) are the soft harbor environmental factors.

Accordingly, draw the decision tree, Singapore and Shanghai port international transshipment competitiveness evaluation index Results:

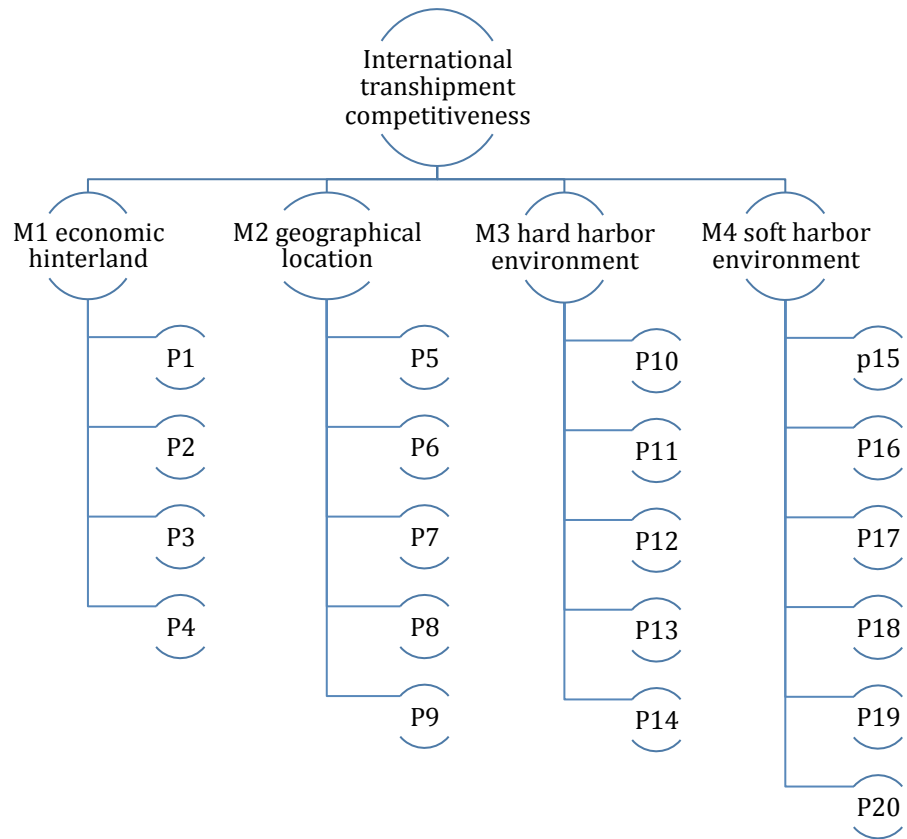


Figure 1- International transshipment competitiveness system

According to the International transshipment competitiveness system, it can be easily distinguished how the port belongs to M1 or M2 or M3 or M4. So that the port can get more information about its strength and weakness and more to get itself strong.

And using the International transshipment competitiveness system, I would like to analyze the transshipment differences between Shanghai port and Singapore port.

CHAPTER 3 THE STATUS OF SINGAPORE'S PORT

3.1 Transshipment Goods Through Singapore

Transshipment means that goods or containers are transported to the intermediate destination, and then transported to another destination. The reason for transshipment may be change the way of transportation, for instance, change from ship transportation to road transportation. Another reason is to merge small quantities of goods into a large quantity, or to split large goods. Transshipment generally occurs in the transport center, and most of the international transshipment takes place in specific customs areas to avoid the risk of customs inspection or payment of customs duties. Otherwise, transshipment is a major obstacle to improve transport efficiency.

- 1) Goods are transferred from one country to another, but not imported to this country.
- 2) The goods transferred in Singapore are generally not subject to import tariffs.

3.1.1 Kind of Goods can be Transshipped

- 1) Goods that are not within the scope of control can be transhipped in Singapore without permit.
- 2) The transfer of part of the goods is controlled by the competent authorities (controlled goods).
- 3) Traders with controlled commodities must have a permit before transshipment.

4) Strategic arms, such as ammunition and biochemical products, must be specially licensed for export, re-export, transshipment and transportation.

Strategic goods are subject to the control of strategic goods (control) act, which involves all goods and technologies that attempt or may produce weapons of mass destruction.

3.1.2 Free Trade Zones (FTZs) of Singapore

Free Trade Zones, in fact, refers to the abolition of normal trade barriers, but the requirements of the bureaucracy have been greatly reduced, so we hope to get new business investment. Goods stored in a free trade area are not required to pay tariffs or taxes, but when they leave the FTZs and enter the customs area for local consumption, they need to pay the corresponding tariff.

3.1.3 Reason to Use Singapore for Transshipping

As the largest transshipment center in the world, Singapore can accelerate the efficiency of transshipment, reduce the cost of transshipment, and enable it to carry out the corresponding transshipment in an efficient way.

3.2 Features of Singapore's International Shipping Center Development

3.2.1 Singapore is located at the southern tip of the Malay Peninsula, adjacent to the Malacca Straits. It is a key hub linking Asia, Europe and Africa. Most of the container cargo in the port can only be stored for three to five days, and 1/5 of the goods can only be stored for one day, and its logistics and transportation efficiency can be ranked the world's first class level. Among the top 25 multinational logistics companies in the world, the headquarters of 17 companies are set in Singapore, which largely lays the foundation for the capital and management of the Singapore logistics service industry.

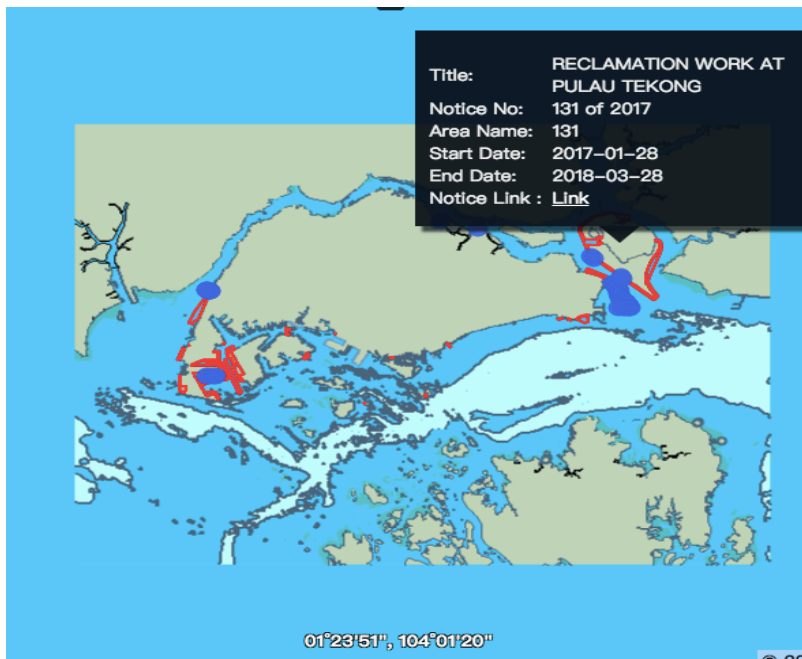


Figure 2 – Some adjacent ports which are close to Singapore

3.2.2 The rapid development of Singapore's marine economy is closely related to the government's policy support. In order to effectively guide the development of the large marine industry, the Singapore government has specially formulated a detailed plan for it, and introduced corresponding policies and regulations to create an excellent environment for industrial development and attract a great deal of overseas investment. In addition, the Singapore maritime bureau and the port authority will open public bidding for global R & D projects each year. The government has increased the support for these projects and provided up to billions of dollars in financial support.

3.2.3 Singapore port area implements the policy of free port, low tax rate and preferential tax, so as to attract overseas enterprises to settle down. In detail, the

enterprise income tax and the business tax account for only 17% and 7% of the registered ships in Singapore, and do not collect the economic income of international shipping. The tax exemption policy for foreign registered ships is also carried out in Singapore. A more flexible tax system is introduced for the marine economy and finance, which not only eliminates the income tax revenue of the maritime Trust Fund for five to ten years, but also exempted all Maritime Arbitrators from the tax.

3.2.4 Singapore port is not only the world's first container technology port, but also one of the busiest ports in the world. However, with the increasing competition for shipping hub in various countries, the Singapore port has to strengthen its connectivity and productivity among its ports in order to attract more international airlines, to store more goods and to reach more destinations within.

4.3 Fuel management performance.

3.3 Volume Of Singapore Throughput And Container International Transshipment

Table 1 – Volume Of Singapore Throughput And Container International Transshipment

Year	Unit	2010	2011	2012	2013	2014	2015	2016
Total Container Throughput	'000 TEUs	28,431	29,938	31,649	32,579	33,869	30,922	30,904
Ratio of transshipment	80-85%							

Despite that Singapore's container throughput is not comparable to that of Shanghai, its international container traffic accounts for 85%.

From the chart, we can know that the shipping industry in Singapore is not developed. 25% to 30% of the total import and export volume in Malaysia is transferred to the port of Singapore. This has led to a loss of up to \$one billion a year (Note: 3.4 ringgit equals \$1), and there are many intangible losses, such as customs declaration, insurance, consulting and banking, which lead to considerable capital outflow.

Based on this, 25%-30% of the import and export goods in Malaysia are transshipped in Singapore port, while in Indonesia, 60% of it is transshipped in Singapore. All of these have fully explained that the transport volume of Singapore port is great and its core lies in the international transportation business.

CHAPTER 4 STATUS OF SHANGHAI CONTAINER INTERNATIONAL TRANSHIPMENT

Shanghai Container Terminals mainly in Yangshan, Waigaoqiao, three Wusong Port, a total of 46 container berths, container gantry crane 155, 463 sets of tires scene, container yard total area of 6.34 million square meters.

4.1 International transshipment competitiveness system to analyze Shanghai port

(1) In the ocean-going lines of transshipment operations of Shanghai Yangshan that based on the principles, the short sea shipping occupies a small proportion, some Waigaoqiao foreign main lines, and ocean-going line also accounts for a small amount. Therefore, the two big ports cannot have the expecting density with the state, which leads to some routes all gather in Yangshan, and in some cases all gather in Waigaoqiao. It is not a idealistic situation for the international transshipment industry, the routes need to be gathered to take a larger amount of goods, the "Shuttle" plays the role between Yangshan Port and Waigaoqiao Port Area, but "shuttle bus" from Waigaoqiao to Yangshan exclude the waste time in loading and discharging goods. Besides, the problems the shortage of shuttle bus capacity and the high transfer charges also needs to solve, which hinder the development of international transshipment in Shanghai.

(2) Plus, the integrated support environment for the customs clearance in Shanghai still has a big space to improve. First, the legislative level for the special customs supervision area needs to be improved, the fragmented, cognitive differences and insufficient policy coordination results in some difficulties for the operation and future development for special customs supervision area. Besides, there are also some problems in the

management system of the special supervisory district of the Customs. Some ideas and concepts need future deepening, for example, the concept of "opening up" ranks the first, which means that opening attitude is the most important aspect, but the concept has not been realized in practice, the cost of goods circulation is still high, and the procedure of customs clearance is still complex and inefficient.

(3) The cost of cargo handling in Yangshan Port is not high, but the high management cost is a problem, which attracts attention in the industry. It is an important factor that influences the shipping companies in the Yangshan Bonded Port Area. Plus, according to the regulation and law, the Chinese customs shall perform random inspection on the goods that entered the bonded port area, and the auxiliary inspection also needs a high cost. For example, the inspection for a container in the Yangshan Bonded Port Area generally needs the up and down fares, consignments, seal fees, dig container costs, inspection agency fees and some other costs. The whole inspection process generally needs dollars, or even higher. Unreasonable fees impede the development of transship business in Yangshan Port seriously.

4.2 Volume Of Shanghai Container International Transshipment

Table 2 - Volume Of Shanghai Container International Transshipment

Year	Shanghai port			Yangshan port		
	Container throughput (0000 TEUs)	International container transshipment (0000 TEUs)	Take the percentage	Container throughput (0000 TEUs)	International container transshipment (0000 TEUs)	Take the percentage
2010	2906.9	147.5	5.1%	1010.8	83.57	8.3%
2011	3173.9	157	4.9%	1309.9	92.99	7.1%
2012	3252.9	178	5.5%	1415.0	120.26	8.5%
2013	3361.7	236.4	7%	1436.5	158.92	11.1%
2014	3528.5	250.4	7.1%	1520.2	166.94	10.98%
2015	3653.7	252.9	6.9%	1540.7	148.95	9.67%
2016	3713.3			1561	167.5	10.69%

source: Wind Information, Shanghai Local Records Office (www.shtong.gov.cn)

From 2010 to 2016, the international container throughput of Shanghai Yangshan Port tends to increase. However, the proportion of total container throughput across the port has not increased much. Shanghai Port accounts for about 7% of total container throughput. The international transshipment volume of Yangshan Port accounts for about 10% of the container throughput of Yangshan Port. The fluctuations in recent years have been declining.

The opening of Yangshan Deepwater Port has indeed greatly helped the development of

Shanghai International Container Transshipment. But in fact, the proportion of international transport to the Yangshan port is still at a low level, remained at about 10%. Therefore, it still lags behind the world-famous container hub port, which is inconsistent with Shanghai's status as an international transshipment huge port.

Table 3 -2006 - 2016 Yangshan Port Water To Water transshipment and transshipment ratio

Year	Volume of water to water transshipment (0000 TEUs)	Ratio of water to water transshipment
2006	102.70	31.70%
2007	287.11	47.00%
2008	398.33	48.40%
2009	401.10	51.10%
2010	435.34	43.30%
2011	601.47	45.90%
2012	660.79	46.70%
2013	715.03	49.80%
2014	715.54	47.06%
2015	763.70	49.57%
2016	804.80	51.39%

It can be analyzed which from the above table that the volume of water and water transferred and the proportion of its transit have been increasing year by year.

which fully shows the potential for the development of Yangshan Port. The reason for the rapid development of water to water transshipment is that on the one hand, the water

depth advantage and route advantage of Shanghai Port are gradually deepening, the supporting services are continuously optimized, and the attractiveness of transit continues to rise. For example, on October 15, 2013, the two-way navigation of the main waterway at Yangshan Port was formally implemented. The average waiting time for ships entering and leaving Yangshan Port will be shortened from 3.5 hours to 1.75 hours and the utilization rate of berths has risen sharply. On the other hand, due to the high quality of service and the transit cost of the economy, the international shipping and cargo are constantly being attracted to transit through Shanghai and the proportion of international transshipment containers is increasing every year.

However, Yangshan Port container water transshipment by the following ways: international transshipment, coastal transshipment and the Yangtze River branch transit. Among them, the proportion of the branch transfer in the Yangtze River is the largest, reaching 75% of the total water transfer, while the international transfer only accounts for 5% of the total water transfer. This ratio distribution shows that the current water and water transshipment in Yangshan Port is mostly derived from the hinterland and the volume of international transshipment that better reflects the role of the hub port is small.

4.3 Situation Around Shanghai Port

Ningbo Port is a main port which is not far from Yangshan Port, the main port area of Shanghai. 2017 first quarter, Ningbo, Zhoushan Port container throughput reached 5.88 million TEU, for the first time over the port of Shenzhen, China's second largest and the world's three major container ports.

Ningbo Zhoushan Port cargo throughput has been for eight consecutive years as the world's largest port. By 2016, it became the world's first port throughput of over 900

million tons.

Table 4 -2016 Transportation and Throughput in Ningbo Zhoushan port

Ningbo Zhoushan Port throughput	December	Whole year
Port cargo throughput (10000 tons)	7306.4	92209.2
# Ningbo sea Port	3817.3	49618.8
Container throughput (10000 TEUs)	160.1	2156.1
# Ningbo sea Port	155.5	2069.6
Growth(%)		
Port cargo throughput	10.1	3.7
# Ningbo sea Port	-0.9	-2.7
Container throughput	9.7	4.5
# Ningbo sea Port	10.4	4.4

Table 5 -2015 Transportation and Throughput in Ningbo Zhoushan port

Ningbo Zhoushan Port throughput	December	Whole year
Port cargo throughput (10000 tons)	3850.8	51004.5
Container throughput (10000 TEUs)	140.8	1982.4
Growth(%)		
Port Cargo throughput	-8.6	-3.1
Container throughput	0.6	6.0

Taking Ningbo Port as an example, most of the ports with good surrounding conditions do not need to carry out international transshipment operations in Shanghai. This is also a major factor.

CHAPTER 5 REGRESSION ANALYSIS AND PREDICTION OF SHANGHAI

PORT

5.1 Theoretical Model (LINEAR)

Give a random sample $(X_{i1}, \dots, X_{ip}), i=1, \dots, n$, A linear regression model assumes that the relationship between the regression component Y_i and the regression quantity X_{i1}, \dots, X_{ip} is that there are other variables besides the influence of X . We add an error term:

ε_i (also a random variable) to capture any influence on Y_i other than X_{i1}, \dots, X_{ip} . So a multivariate linear regression model is expressed as the following form:

$$Y_i = \beta_0 + \beta_1 X_{i1} + \beta_2 X_{i2} + \dots + \beta_p X_{ip} + \varepsilon_i, \quad i = 1, \dots, n.$$

5.1.1 Data and Estimates

It is important to distinguish between random variables and observations of these variables. In general, observations or data (in lowercase letters) include n values

$$(y_i, x_{i1}, \dots, x_{ip}), i = 1, \dots, n$$

We have $P+1$ parameters β_0, \dots, β_p need to be decided. In order to estimate these parameters, it is very useful to use matrix notation.

$$Y = X\beta + \varepsilon.$$

Where Y_1, \dots, Y_n is a column vector that includes the observation, which includes the

unobserved random component $\varepsilon_1, \dots, \varepsilon_n$ and the observation matrix of the regression X :

$$X = \begin{pmatrix} 1 & x_{11} & \cdots & x_{1p} \\ 1 & x_{21} & \cdots & x_{2p} \\ \vdots & \vdots & \ddots & \vdots \\ 1 & x_{n1} & \cdots & x_{np} \end{pmatrix},$$

X usually includes a constant term.

If there is a linear correlation between the X columns, then the parameter vector β cannot be estimated by least squares unless the β is limited, such as the sum of some elements requiring it is zero.

5.1.2 Regression inference

For each $i = 1, \dots, n$, we use σ^2 to represent the Variance of the error term ε . An unbiased estimate is:

$$\hat{\sigma}^2 = \frac{S}{n-p},$$

Amount them, $S := \sum_{i=1}^n \hat{\varepsilon}_i^2$ It is the sum of squared errors (sum of squared residuals).

The relationship between the estimated and actual values is: $\hat{\sigma}^2 \cdot \frac{n-p}{\sigma^2} \sim \chi_{n-p}^2$

Amount them, χ^2_{n-p} Obey Chi-square distribution, degrees of freedom are $n-p$.

The solution to the ordinary equation can be:

$$\hat{\beta} = (\mathbf{X}^T \mathbf{X})^{-1} \mathbf{X}^T \mathbf{y}.$$

This means that the estimation term is a linear combination of dependent variables. Further, if the observed error follows a normal distribution. The estimated value of the parameter will follow the joint normal distribution. Under the current assumptions, the estimated parameter vectors are precisely distributed.

$$\hat{\beta} \sim N(\beta, \sigma^2 (\mathbf{X}^T \mathbf{X})^{-1}).$$

5.1.3 Variance Analysis

In analysis of variance, the total sum of squares is broken down into two or more parts.

the total sum of squares and SST (sum of squares for total) is:

$$\text{SST} = \sum_{i=1}^n (y_i - \bar{y})^2,$$

In it:

$$\bar{y} = \frac{1}{n} \sum_i y_i$$

Equally:

$$\text{SST} = \sum_{i=1}^n y_i^2 - \frac{1}{n} \left(\sum_i y_i \right)^2.$$

SSR (sum of squares for regression), also is SSM(sum of squares for model):

$$\text{SSReg} = \sum (\hat{y}_i - \bar{y})^2 = \hat{\beta}^T \mathbf{X}^T \mathbf{y} - \frac{1}{n} (\mathbf{y}^T \mathbf{u} \mathbf{u}^T \mathbf{y}).$$

Residual square sum and SSE (sum of squares for error) is:

$$\text{SSE} = \sum_i (y_i - \hat{y}_i)^2 = \mathbf{y}^T \mathbf{y} - \hat{\beta}^T \mathbf{X}^T \mathbf{y}.$$

Total square sum and SST also can be written as:

$$\text{SST} = \sum_i (y_i - \bar{y})^2 = \mathbf{y}^T \mathbf{y} - \frac{1}{n} (\mathbf{y}^T \mathbf{u} \mathbf{u}^T \mathbf{y}) = \text{SSReg} + \text{SSE}.$$

Regression coefficients R^2 :

$$R^2 = \frac{\text{SSReg}}{\text{SST}} = 1 - \frac{\text{SSE}}{\text{SST}}.$$

5.2 Original data of Shanghai port and Shanghai Yangshan port

Table 5 - volume of transshipment about Shanghai port and Yangshan port

	Shanghai port			Yangshan port		
Year	Container throughput (0000 TEUs)	International container transshipment (0000 TEUs)	Take the percentage	Container throughput (0000 TEUs)	International container transshipment (0000 TEUs)	Take the percentage
2010	2906.9	147.5	5.1%	1010.8	83.57	8.3%
2011	3173.9	157	4.9%	1309.9	92.99	7.1%
2012	3252.9	178	5.5%	1415.0	120.26	8.5%
2013	3361.7	236.4	7%	1436.5	158.92	11.1%
2014	3528.5	250.4	7.1%	1520.2	166.94	10.98%
2015	3653.7	252.9	6.9%	1540.7	148.95	9.67%
2016	3713.3			1561	167.5	10.69%

According the time and transshipment, then do the regression.

5.3 Regression and Prediction for Shanghai Port International Transshipment

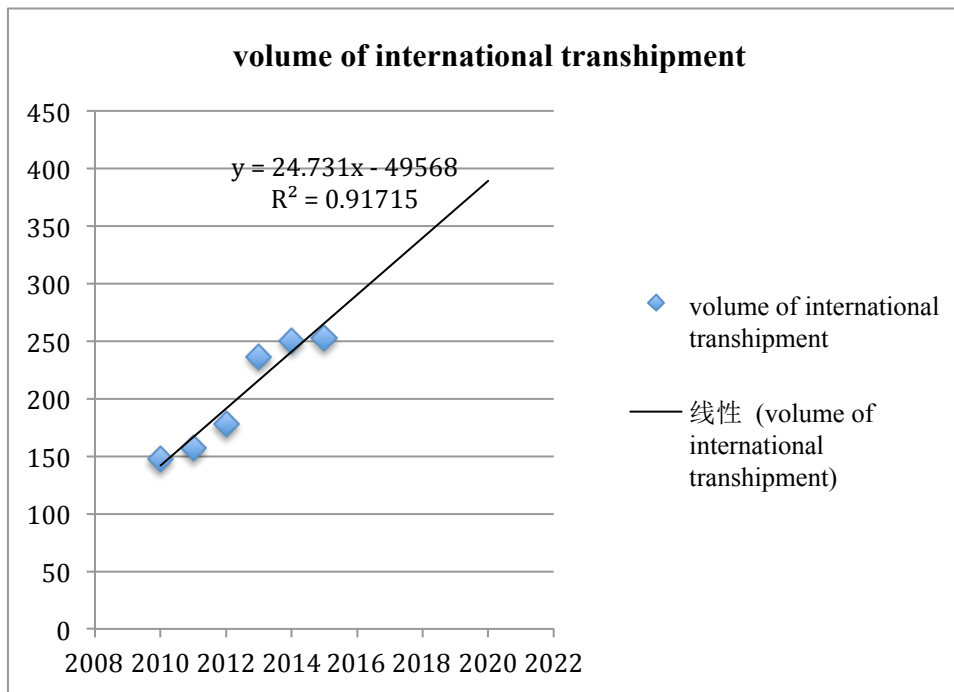


Figure 3- Linear of the Volume of shanghai port international transshipment

Using the year as an independent variable and the volume of Container transshipment of shanghai port as the dependent variable into the regression equation, we can see through the model fitting that the linear function has the highest degree of fitting to 0.9172, so we choose the linear function.

Table 6 – Regression summary output of shanghai port international transshipment

SUMMARY OUTPUT

Regression statistics

Multiple R	0.96
R Square	0.92
Adjusted R Square	0.90
Standard error	15.55
Observation	6.00

Variance Analysis

	df	SS	MS	F	Significance F
Regression analysis	1.00	10703.76	10703.76	44.28	0.00
Residual	4.00	966.88	241.72		
Total	5.00	11670.64			

	Coefficients	Standard error	t Stat	P-value	Lower 95%	Upper 95%
Intercept	-49568.30	7479.50	-6.63	0.00	-70334.73	-28801.87
X Variable 1	24.73	3.72	6.65	0.00	14.41	35.05

RESIDUAL OUTPUT

Observation	Predict Y	Residual
1.00	141.87	5.63
2.00	166.60	-9.60

3.00	191.33	-13.33
4.00	216.07	20.33
5.00	240.80	9.60
6.00	265.53	-12.63

Substituting coefficients into the available regression equation is as follows:

$$y = 24.731x - 49568 \quad (R^2 = 0.91715),$$

x:year y: volume of Container transshipment of shanghai port

Also, according the trend and formula we predict this 2018 year the volume of Container transshipment of shanghai port will be 3,391,580 TEUs.

Further, according the trend and formula we do the prediction that about 2020 year the volume of Container transshipment of shanghai port will be about 3,886,200 TEUs.

That's really a great progress for shanghai transshipment.

5.4 Regression and Prediction for Yangshan Port International Transshipment

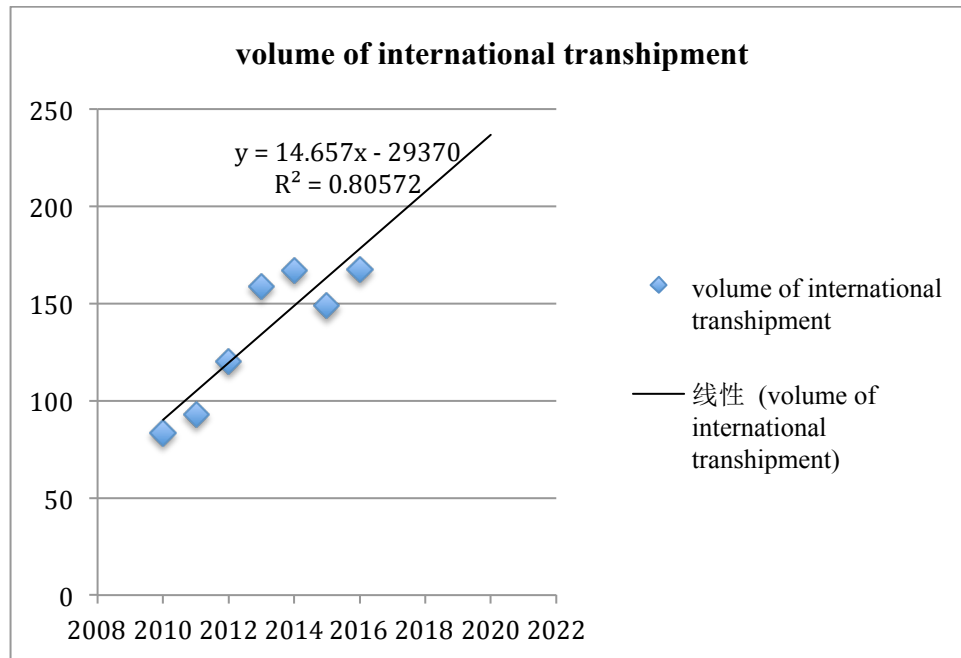


Figure 4 – Linear of the Volume of Yangshan port international transshipment

Using the year as an independent variable and the volume of Container transshipment of shanghai YANGSHAN port as the dependent variable into the regression equation, we can see through the model fitting that the linear function has the highest degree of fitting to 0.80572, so we choose the linear function.

Table 7 – Regression summary output of Yangshan port international transshipment

SUMMARY OUTPUT

Regression statistics

Multiple R	0.90
------------	------

R Square	0.81
Adjusted R Square	0.77
Standard error	17.03
Observation	7.00

Variance Analysis

	df	SS	MS	F	Significance F
Regression	1.00	6015.00	6015.00	20.74	0.01
Residual	5.00	1450.41	290.08		
Total	6.00	7465.41			

	Coefficients	Standard error	t Stat	P-value	Lower 95%	Upper 95%
Intercept	-29369.95	6479.27	-4.53	0.01	-46025.44	-12714.46
X Variable 1	14.66	3.22	4.55	0.01	6.38	22.93

RESIDUAL OUTPUT

Observation	Predict Y	Residual
-------------	-----------	----------

1.00	90.19	-6.62
2.00	104.85	-11.86
3.00	119.50	0.76
4.00	134.16	24.76
5.00	148.82	18.12
6.00	163.47	-14.52
7.00	178.13	-10.63

Substituting coefficients into the available regression equation is as follows:

$$y = 14.657x - 29370 \quad (R^2 = 0.80572)$$

x:year y: volume of Container transshipment of shanghai YANGSHAN port

Also, according the trend and formula we predict this 2018 year the volume of Container transshipment of shanghai YANGSHAN port will be 2,078,260 TEUs.

Further, according the trend and formula we do the prediction that about 2020 year the volume of Container transshipment of shanghai port will be about 2,371,400 TEUs.

CHAPTER 6 WITH REFERENCE TO THE PORT OF SINGAPORE, SHANGHAI PORT PROPOSALS TO IMPROVE THE INTERNATIONAL TRANSHIPMENT

6.1 Innovate inspection methods to improve the speed of the transfer of ports

Currently, Yangshan Bonded Port not only has a complicated regulatory process, but also has relatively high service charges, which need to improve and perfect in a short time. In this regard, Yangshan port can study the innovation inspection mode of Singapore port, adopt the "unsupervised" mode, carry out the two strategies of loose supervision and high-tech supervision. If the port inspection party meets the attack, once the report is true, it should be punished severely and the corresponding legal responsibility should be investigated. In this way, the test does not require any cost, it is the reason why the method is so popular, and it is the key factor for the development of Singapore port to become a world transport center. It can be seen that innovation of existing services can not only speed up the flow of ports, but also attract more liner companies and increase business volume.

6.2 To upgrade the existing "shuttle bus" mode in an all-round way so as to enhance the efficiency of inter-port transfer

To sum up, the "shuttle bus", which is responsible for transporting the goods of the Yangshan Port and the Waigaoqiao port area, is very inefficient, it is a bottleneck for the Yangshan port to improve its transport capacity. Based on this, the Shanghai municipal government should improve the efficiency of shuttle buses in all directions. First,

increase the number of shuttle buses at Waigaoqiao No. 2, No. 4 and Yangshan port, so as to cope with the shortage of shuttle buses. Secondly, it can try to create a special pier in Yangshan port area, which is dedicated to transfer buses to berth. Thirdly, the government should insist on expanding the transport scope of shuttle buses and allowing them to transport bonded goods, and enhance the synergy of them. The development of some industries has provided reliable sales channels for transshipment business and increased market efficiency. Also, the international transport of Yangshan port is increasingly scattered, thus, its necessary to optimize its functional layout, integrate all kinds of resources, and promote the interaction and development of port cities.

6.3 Expand the comprehensive protection zone function, carry out the second set fight

For the moment, the core of the Asian international transport business lies in the international container terminals like Singapore port. But, the impact of China's ports is increasing, its factors include frequent flight, transport mode, transportation policy and so on. Yangshan Port should give full play to its policy advantages, expand the functions of the comprehensive protected areas, and actively conduct the second set fight. This will contribute to the development of logistics value-added services such as international procurement and distribution, what's more, it can drive economic development and provide quality services to all parts of the country. At the meantime, it should carry out the spirit of documentary evidence advocated by the State Council, and insist on exploring and establishing a way of practice that conform to the trend of international shipping development, and understand the significance of the innovation of regional supervision mechanism. To a large extent, customs can strengthen the core competitiveness of Shanghai international shipping center and reduce its gap with Singapore port and other international ports.

CHAPTER 7 CONCLUSION

According the 8 chapters and the construction organized is for the purpose of using Linear Regression Analysis and Game Theory approach to address what kinds of advantages and challenges about shanghai port and through the comparing with Singapore port, I put up with some suggestion to improve the transshipment of shanghai port. Chapter 1 summarizes the research background, objective, organization, methodology and new ideas of this dissertation; Chapter 2 firstly introduces the category of the International transshipment port. Then in this framework, I used the Game Theory to build up a system about port analysis which is International Transshipment Comprehensive Evaluation Index System; Based on the brief introduction of International Transshipment Comprehensive Evaluation Index System, in Chapter 3, I mainly introduce and analyze the status of shanghai container international transshipment. Further, research the other port which threat Shanghai transshipment;

Chapter 4 is the most important part which calculate the relationship between volume of shanghai port transshipment and shanghai yangshan port transshipment with the time going by. I used the linear regression analysis to analyze and also do the prediction in this year 2018 and prediction for 2020 year. Chapter 5 comprehensively expounds the strength, opportunity of Singapore port. So that ,we could use the experience of the success of Singapore. And the chapter 6 mainly introduces the advanced practices and lessons of transshipment of shanghai port according to the success of Singapore. Also, I put up with some suggestions to improve the threat and weakness.

Based on the analysis above, the suggestions for example Innovate inspection methods to improve the speed of the transfer of ports, To upgrade the existing "shuttle bus" mode in an all-round way so as to enhance the efficiency of inter-port transfer, ect which I put up with can really good for ameliorate the problem the shanghai port is. So after the

whole chapters researching, I believe this article is a great contribution to Shanghai port which can give more comments to improve the container transshipment of Shanghai port.

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