7-20-2013

The market analysis and fleet deployment in Asian area of COSCON

Yiran Zhang

SHANGHAI MARITIME UNIVERSITY

WORLD MARITIME UNIVERSITY

Shanghai, China

Fleet deployment optimization of COSCON in southeast Asia

By

Zhang YiRan

China

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

MASTER OF SCIENCE

In

INTERNATIOANL TRANSPORT AND LOGISTICS

2013

DECLARATION

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

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

Zhang Yiran

……

Supervised by

Professor Zhao Gang

Shanghai Maritime University

ACKNOWLEDGEMENT

Firstly I want to express my deepest thankfulness to Professor Ma Shuo, who gave me an offer for postgraduate learning in last 2 years, as a representative of World Maritime University. Also, I want to thank to Ms. Jiang Zhengfei and Hu Fangfang, who are in charge of this postgraduate program on behalf of Shanghai Maritime University. Their continuous support and timely notification during my study in Shanghai Maritime University have helped me a lot in study of logistics.

Secondly I want to express profound gratitude to my supervisor professor Zhao Gang for supporting me throughout my dissertation with his patience and knowledge and this dissertation could not have been possibly finished without his academic support.

Thirdly I am deeply thankful to Shanghai Customs offering the necessary data and information to me. And also thanks to all professors for teaching me good knowledge. The wonderful lessons gave me inspiration for my final dissertation, especially the course of “Finance And Investment Appraisal In Transport/ Logistics” Prof. Pierre Cariou, “Decision Making Technology” Prof. Yuan Qun and the course of “Maritime Logistics” Prof. Dr. Theo Notteboom.

Finally, I would like to show my classmates who encourage me to finish the paper successfully. To all of my classmates I would like to express my gratitude for their support and cooperation during my study in last 2 years.

ABSTRACT

Title of research paper: **Fleet deployment optimization of COSCON in Southeast Asia area**

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

Fleet deployment is the science to distribute the different tonnage, type of ship to the appropriate route. The aim is not only to ensure that each route to meet technical, operational requirements, and enable shipping companies to get the best economic value.

The dissertation is mainly focus on the fleet deployment optimization in the Southeast Asia area under the circumstance of the shipping industry downturn and the ocean routes facing a serious loss. The downturn will lasted more than 3 years and the most effective way to get over the downturn is to increase capacity in the route with larger container volume and offset the loss in the depressed routes.

However Southeast Asia area is an emerging market with cheap labor cost and vast resource. Its trade volume with other countries will increase day by day. Therefore, we must strive to develop the shipping capacity and optimize the fleet application in Southeast Asia area.

The author will use the comparative analysis, forecasting and programming solver these three methods to forecast the cargo volume, remedy the drawback of current routes and achieve the fleet deployment in the next 3 years.

To achieve this purpose, the dissertation will first introduce the conception and requirement of fleet deployment in Chapter 2. Second, use market concentration degree theory to deduce the market share of COSCON. Then forecast the maximum, average and minimum container volume in the Southeast Asia in the next 3 years respectively. Third, combine the actual situation of COSCON; make horizontal

comparison with other companies outstanding in Southeast Asia route and make suggestion to the existing route. Fourth, draw new route according to the predicted cargo volume and determine the base port. Fifth, use linear programming in EXCEL and find out the optimal solution of the fleet deployment. Finally, put forward solution measures to solve the excess capacity according to the seasonal factors of the container volume.

COSCON own a large number of spare capacities because of purchasing too much ship in 2008. If we can utilize the listed spare capacity reasonably, realize the optimization of the fleet programming. It can also offset the great loss in ocean route and help COSCON to pull through in next 3 years.

KEYWORDS: Fleet deployment, cargo volume forecasting, optimization

Table of Contents

List of Tables

List of Figures

List of Abbreviations

SHPP	Shanghai—Ho Chi Minh—Phnom Phenh—Penang Port Route
SP	Shanghai—Penang Route
SLCB	Shanghai—Laem ChaBang Route
CSE	China/Southeast Asia Express
SM	Shanghai—Manila Route

Chapter One: Introduction

1.1Research Background and purpose：

Research background：

After the financial crisis erupted in second half of 2008, shipping industry is facing an unprecedented disaster especially in the bulk cargo transportation. Most of the shipping company suffered great loss and collapse in bulk carrier until today ----5 year after the crisis which seems to be too long in the shipping cycle (7-12years). However, the container shipping is wandering in the edge of the profit and loss. The CCFI (China Container Freight Index) has behaved well in the past half year and located a little beyond the border (1000point) of the profit and loss.

No one knows whether and when the inflection point will appear in shipping market. Most of the pessimists think shipping market need more than 3 years to recover. But, one view is sure; the container shipping this year is more likely to be better than the last year as the European debt crisis's harm has gradually released.

Another problem is Diaoyu Island Issue's impact on China-Japan shipping market. The upgrade of Diaoyu Island Issue has made the zero freight occur in China-Japan route frequently and greatly influence the turnover of it. Japanese line is used to become the major component of the routes in Asia area and the advantage route of COSCON. Diaoyu Island Issue inflicts heavy losses on COSCON's performance in Asia area.

In such an urgent situation, COSCON Container Lines. CO., LTD is now facing the problem of the fleet capacity redundancy which make its' bulk cargo transportation endure great loss. Through the container shipping doesn't take a larger percentage of the total shipping market, the profit the container shipping market earn is relatively stable and it can offset some of the loss in bulk shipping market. Moreover, the gaining in container shipping will help the company survive in the winter of bulk cargo transportation.

Hence, how to use the fleet resource and cash resource reasonably to develop the new market is the shipping company's primary task. Develop a new market is the first important step for the company because the right market positioning for the company is the prerequisite of rational allocation of existing resources. It's the certain position of the company's future development goal. The economic development in Southeast Asia is just beginning, the world now notice the area with so much advantage: rich material resource and cheap labor. Especially in Indonesia's Jakarta, Bangkok, Thailand,(development of the 3 country is earlier and faster than other northeast Asia country). The cargo export and import volume will rise sharply in the future with the economic development.

Fleet deployment is such a kind of science to help the shipping company to realize the maximize profit or the lowest cost. It us the center link during formulating shipping production plan and also a more complicated system optimization problem with multi-factors whose purpose is to make full use of the present conditions and resources to make the least investment and input, for the largest benefit and output. Liner shipping route deployments mainly solve the different type, different tonnage ship of the fleet in different route and earn the maximum profit in the configuration.

COSCON is the largest shipping company in China. But its' deployment method is lag behind relatively. The competition between each shipping company lies in the service quality and the freight advantage. That is mean the company should do his best to

save the voyage cost and increase net profit under the premise of schedule integrity. Then we find the cargo volume in Asia area increase in the lowest volume which maybe caused by the downturn in Japan and South market. So my research paper focuses the research scope in southeast Asia area.

Research Purpose:

Analyze the export and import cargo trend in southeast Asia in the future. Solve route deployment of COSCON in the southeast Asian area under the influence of European debt crisis and which aim to make the profit optimization and control the cost within a reasonable range. Using the quantitative analyze to make the result more realistic and effective. The dissertation is also combined with the company's real situation to ensure the result more timeliness and operability.

1.2literature review：

Since the scientists abroad study on the first in the fleet deployment optimization models, Chinese scientists have done quantity of research on this project in the past 20 years.

First, research on basic theory of resource allocation at fleet deployment project is abundant. Fleet deployment is to configure different ton (TEU), type of ship to the right route. The purpose of it is not only to meet the requirements of the technical, operational aspects of each route, but to get the best economic benefits. Fleet deployment is an essential work during both the new routes arrangement and the allocation on the original route.

Anastassios N. & Nikiforos P (1987) firstly comes up with the solution of fleet deployment with the computer program for the transportation of a given amount of cargo within a given period for one origin，on destination and fixed-price. [1]

[1] Anastassios N.& Nikiforos P,(1987)，《Fleet deployment optimization models》Part1[J]. Maritime Policy and Management, 1987, 14(2):127-144.

In the past 20 years, Chinese scientists forcus on the computer methodology of Matlab program and Visual Basic program. TU QunFang and BAI JiPin (2007) use MATLAB programming to optimize the liner fleet deployment system with the ship model applies to different types of ships, different tonnages in different routes on the basis of linear programming to maximize the economic benefits.[2] JIN Yan, CHENG ShunHuai, WANG LiZheng (2006) use OLE automation technology to realize the fleet deployment with Matlab functions in Visual Basic, with the arrangement of barge to prove the effectiveness of this method, combined with Visual Basic and Matlab function to provide an effective means for the shipping arrangement.[3] ZHANG HaiJian (2007) in his dissertation analyzes the current container liner market and its difference with the fleet deployment of tramp market.[4] Cite the actual situation of COSCON container lines co. with two-level optimization to establish the one-level optimization and two-level optimization model of a container liner shipping arrangement. Then make amendments and adjustments to the lack of the model. Use VB language to solve the model and link with the instance, to change the vacancies of liner shipping deployment model.

In recent years, some new method appears, such as CHEN AiGuo (2010) study on the LCL route development on the basis of analytic hierarchy process.[5] YANG Qiuping, XIE Xinlian, SU Chen (2009) Use an optimization deployment model to achieve the maximum total operation profit. Which combine the shorter scheduling and long-term planning of fleet with a simplex algorithm designed. Then achieve the quantitative analysis through the numerous VB program and simulation by FORTRAN.[6] CHENG Kang and YANG ZhongZheng (2011) utilize the equilibrium principle; establish the short-term liner route optimization model base on the

[2] TU Qun-feng，BAI Ji-ping（2007），《Liner Routing Design Based on MATLAB》，JOURNAL OF ZHEJIANG INSTITUTE OF COMMUNICATIONS，2007，8（4）

[3] JIN Yan, CHEN Shun-huai, WANG Li-zheng(2006),《Application of M ATLAB in ship routing》,Coastal Engineering,2006.5

[4] Zhang HaiJian, (2007)《Research of Fleet Management in Liner Shipping Company》

[5] Chen Ai Guo,(2010), Research on the Key Factors for LCL in the Perspective of Analytic Hierarchy Process----Based on a Survey of China Shipping Logistics》

[6] YANG Qiuping, XIE Xinlian, SU Chen,(2009),《Model of Ship Routing and Fleet Planning and Its Algorithm》, Journal of Shanghai Maritime University,2009；32（1）

relationship between airline operators, shippers, and the government. Then calculate the suitable government subsidies and optimize the short-haul route in western Bohai.[7]

Zhang WeiYing and her partners proposed decomposition algorithm to solve the problems of the airline stowage, which is to decompose the stowage problem for the Bay-bit select and sort of container in the Bay-bit. Make the Optimal packing and minimum down box quantity as the objective to finish the general stowage arrangement.[8]

Most of the reference resources establish the algorithm model to make the maximum total operating profit or minimize total operating cost as the objective function. Combine and coordinate analyze the short-term fleet deployment with long-term development plan to solve and analyze the linear programming simplex algorithm, and verify the model and result's validity by application examples.

But the computer module can only solve the common case. If the there're something urgent like the political change and natural disaster, it also need some remedy. LiMin in his article《RESEARCH ON SHIPPING ROUTE SCHEDULING FOR CONTAINER LINER UNDER EMERGENCY SITUATION》 set cost-income model, take the voyage schedule, voyage freight revenues and voyage costs into account and use the particle swarm optimization algorithm to solve the problem. It give response to the sudden partially damage of routes.[9]

[7] CHEN Kang, YANG Zhong-zhen ,(2011),《Optimization Model of Short-distance Liner Ship Route based on Tri-partite Game》，Journal of Traffic and Transportation Engineering,2011.11(6)
[8] ZHANG Weiying, LIN Yan, Ji Zhuoshang, SUN Wenzhi ,YU Baochu，（2008），《Optimum model and algorithm of containership's pre-stowage planning in full routes》，Journal of Dalian University of Technology，2008.48（5）
[9] Li Min，（2012），《RESEARCH ON SHIPPING ROUTE SCHEDULING FOR CONTAINER LINER UNDER EMERGENCY SITUATION》

1.3 Research Methodology:

Operational research theory with Excel tool

Using regression statistics and the trend line function of Excel and adjust the result according to the influence of international shipping economic , policy and other various aspects and concluded container exports. Calculate the cargo volume according to the market share of COSCON. Then combine the existing route in southeast Asia and determine how much shipping capacity each port still need. According to the required call port and preliminary draw the route. Establish the linear programming in solver program which set the minimize cost of the route combinations as the target function target. Next step is to combine the loading and discharging cargo quantity in each calling port and each ship's tonnage as the constraint condition to ensure the fleet capacity exceed the cargo volume. As a result, we can work out how much capacity in each line.

1.4 existing problem in recent research

The existing literature focus on this question is numerous, but there are still something deficiency as they can rarely solve this question both in the mathematic model and the fact argument. And the reference papers often analyze the impact of each fact in apart, without taking them together and giving a total opinion on the general impact. Moreover, the reference resource lack of the reaction of the capacity to the cargo volume and it will be a case to explore.

1. Mainly of the existing literatures are written in the booming period of the shipping market. However, since the 2008 financial crisis, owing to the redundancy of the new-built ship entering into the market gradually while cargo volume decline all the way with the debt crisis in Europe, the shipping industry is so depressed that shipping index are all below the position at the beginning.

Too much remaining capacity in the market make the fleet deployment can't be completely according to the previous algorithm. This must take idle capacity maintenance costs into account. To COSCON, the abundant new-built boat purchase a few years ago will hamper the decisions when the inflexion point appears because the excess capacity will make the fiscal expenditure powerless.

2. The existing literature always use the more complex and advanced programming software such as Visual Basic, Matlab, or without the aid of computers, with original hand count which make the question too difficult to understand. Moreover the existing papers only been able to solve this problem with discuss the impact of various factors apart, but did not study how much their impact of the fleet deployment result. Too simple the maximum profit solver model is created with no transportation cost factors, slack season and boom season factors, political factors.

The regression statistics in decision-making technology courses to, Solver in Excel and other technology are simple and effective for this problem.
My thesis will combined with the world economic situation, the volume trends, and other influencing factors, making regression analysis of each southeast Asia port's export and import cargo volume to Shanghai, draw the marketing forecast trend in the next three years with Excel tool, then derived sensitivity report to analyzes the impact of each variable on the export total.

3. Existing literature only discuss the cargo volume's impact on capacity without the capacity's affect on the volume. In fact, the relationship between the volume and capacity is reversible. Shipping companies' act to reduce capacity on certain routes will cut down the cargo volume because the capacity reduction can be divided into 2 types: big ship converted into a small one and reduce the voyage.

Use the small ship instead of the big one will not be reduced the waiting time or the barge time in the port, but the cargo volume will be greatly reduced. The same cargo

volume by a small ship will cost more time than the big ship once the cargo volume is more than the small ship's volume. Reduce voyage widen the gap between two voyage, the owner's cargo can not be delivered to the port of destination in a timely manner. Therefore cutting the capacity will directly influence the quality of services of shipping companies and reduce the acceptance of the existing customers, then losing customer and reduce the cargo volume as a result. The route which have been input more capacity will attract customers of other shipping companies with the capacity advantages which directly result in the volume increase.

Hence, Capacity's effect on cargo volume also need algorithm models to find the algorithm relationship between them. It should be seen a point of reference in the optimal route system model modification.

However, if we cut down the shipping route, it will directly lead to the uncertain of the shipping capacity. How to solve this problem is also an essential question.

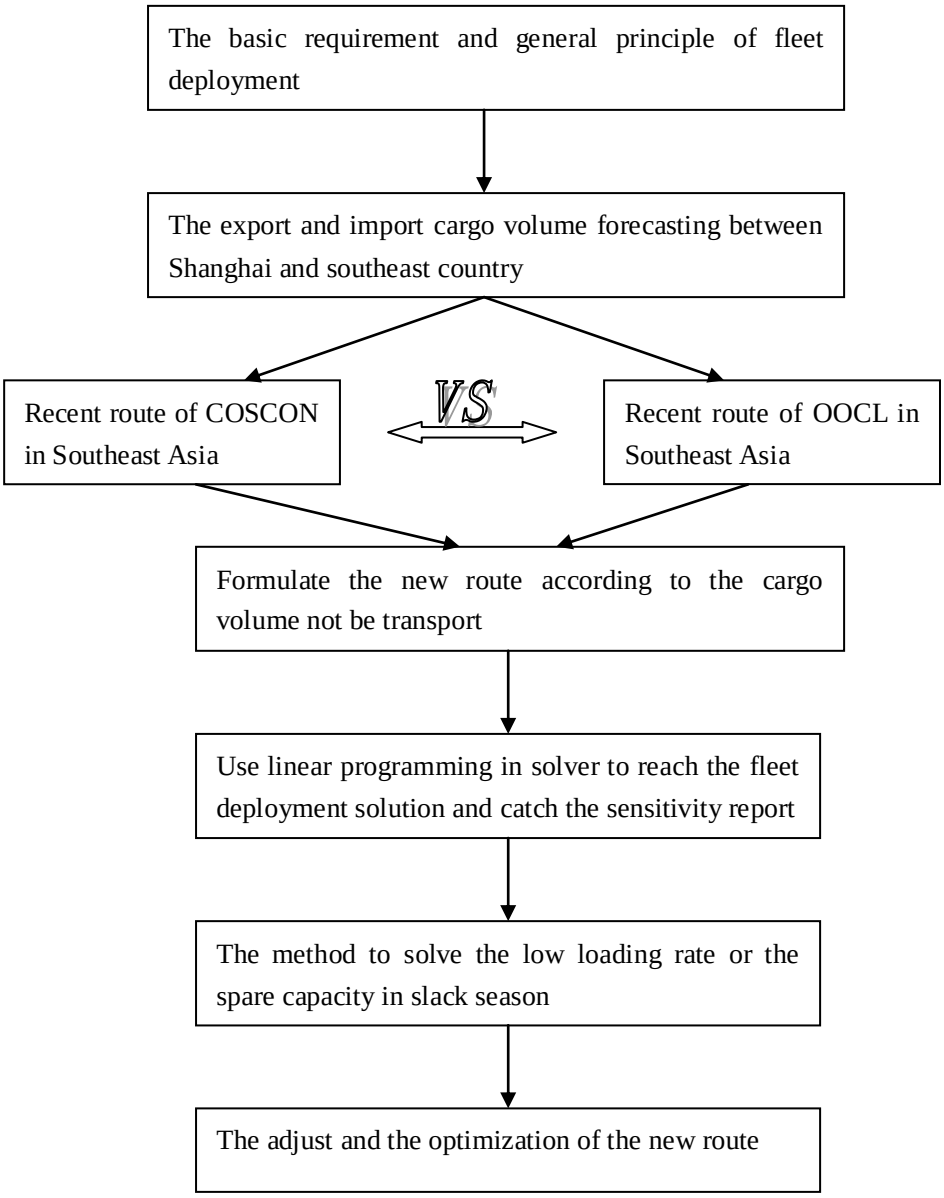
4. The optimize model is based on the cargo volume data but the cargo volume performance these years is less than satisfactory. The most important thing is the container cargo volume changes with seasonal factors. During the Chinese spring festival, the volume used to be very low while the cargo volume during peak season is extraordinary high. If mix up the volume of 12 month but not distinguish the peak season and slack season, it will cause the affect the prediction of the cargo volume in these ports.

All in all, fleet deployment optimization of liner container shipping still have a lot of areas to explore with the variable of the global economy. The research of the certain route or the certain area of certain company is far less and has a long way to go.

1.5The framework and content of the dissertation

The dissertation focus on the existing resource and route of COSCON. After the

introduction of container liner service and the matters when we optimize the fleet deployment，the dissertation stated the reason for select port in southeast Asia and use trend line in EXCEL 2000 to forecast the export and import cargo volume between Shanghai and these country .Distinguish them with peak season, slack season and average season, obtain the maximum cargo volume, minimize cargo volume and average cargo volume in 2015 to determine how much shipping capacity need to add in southeast Asia. Compared southeast Asia route of COSCON with OOCL and find the shortage in COSCON's fleet deployment. Formulate the reasonable routes with the cargo volume in the future and use linear programming in EXCEL2003 and solve the problem.


The basic requirement and general principle of fleet deployment
The export and import cargo volume forecasting between Shanghai and southeast country
Recent route of COSCON in Southeast Asia
VS
Recent route of OOCL in Southeast Asia
Formulate the new route according to the cargo volume not be transport
Use linear programming in solver to reach the fleet deployment solution and catch the sensitivity report
The method to solve the low loading rate or the spare capacity in slack season
The adjust and the optimization of the new route

Chapter Two: Preliminary cognitive of the fleet deployment system

2.1The basic concept of fleet deployment system model：

Total global container fleet capacity is 16 million TEU, 269 of which the idle capacity, reached 830,000 TEU, accounting for 5% of capacity.
The existing of idle capacity indicate the shipping company still can use the existing resources to change the current structure of the shipping capacity on each route.

Fleet deployment is the science to distribute the different tonnage, type of ship to the appropriate route. The aim is not only to ensure that each route to meet technical, operational requirements, and enable shipping companies to get the best economic value. Whether launch a new route or amend the original route, fleet deployment is an essential task.[10]

In my dissertation, I use fleet deployment to launch new routes make up for the inadequacy of existing routes. As the economic of southeast Asia is enduring a rapid development, entering the southeast Asia route and become the leading enterprise in southeast Asia route will be the opportunity in the future. Fleet deployment is to achieve the minimize cost on the premise of shipping capacity is greater than the cargo volume.

10 http://wiki.mbalib.com

Establish the linear programming in solver program which set the minimize cost of the route combinations as the target function target. Next step is to combine the loading and discharging cargo quantity in each calling port and each ship's tonnage as the constraint condition to ensure the fleet capacity exceed the cargo volume. As a result, we can work out how much capacity in each line.

2.2 The basic requirement and principle of fleet deployment

Fleet deployment should fully consider not only the ship's performance on technical and operational feasibility, but also whether it's reasonable in economic.
There are 4 basic principle lie in fleet deployment:

(1) Special Purpose Ships, such as oil tankers, reefers, bulk chemical tankers and liquefied gas tankers, etc., should be configured in a special route.

(2) Ship with large tonnage and high speed should be configured in a long voyage with more efficient handling machinery.
Ship with smaller tonnage, lower speed should be configured in a shorter route.

(3)Handling efficiency of near-sea shipping line is low and the moor waiting time is long, so we should configured low maintaining cost ships.

(4)Liner ship route is usually linked with more call ports and have high requirements in speed and departure time. It pay more attention to the business reputation. So we should use ship with better mechanical performance.

Combined with the characteristics of container shipping market, we can conclude 5 points in the fleet deployment of COSCON:

1. Punctual and low risk: It is the premise of liner shipping company to maintain a

good reputation. So we should focus on the schedule punctual as to create better customer service to attract more new customer and retain existing customer.

2. Ensure all of the cargo delivered to the terminal port. So the shipping capacity must larger than the cargo volume.

3. The speed is fixed and can't be easily changed.

4. The call port of each route is fixed and can't be easily added or reduced.

5. The routed already established is fixed and can't be changed or cancelled with no reason.

Under these premises can we formulate the route or deploy the fleet to maximize the profit or minimize the cost.

Chapter Three: The forecasting of the cargo volume in Southeast Asia

3.1 Speculation of COSCON's market share

3.11 The concepts and application field of market concentration degree theory

Market concentration, is dominance degree to the industry of a few companies' production capacity, sales volume, total assets and other aspects in the market. It is usually expressed as how much percentage a certain indicators of these companies (in most cases using sales targets) occupy the total industry. Market concentration is also called industrial concentration.[11]

The theory of Market concentration is used to be applied in monopoly industries. Generally speaking, the top few companies in monopoly industries are able to occupy most of the market share.

Container transport is such an industry. Top 20 container shipping companies control nearly 76% market share and expanded with an annual rate of 4% -5%, ultimately reach the top 20 companies and control 90% of market share.

There are mainly six methods to measure the degree of market concentration, but

[11] 《Industrial concentration degree measure》

only 2 is suitable for container transport company. They are

1. Concentration ration of industry: Divided Several companies with the largest share of sales by the entire industry freight cargo volume. The formula is:

$$CR_n = \frac{\sum_{i=1}^{n} X_i}{\sum_{i=1}^{N} X_i}$$

CR_n represent concentration ration of container shipping industry;

$\sum_{i=1}^{n} X_i$ represent the cargo volume, shipping capacity and sales income of the biggest shipping company;

$\sum_{i=1}^{N} X_i$ represent the total shipping capacity, total cargo volume and sales income of all container shipping company.

2. Herfindahl-Hirschman index

The index was originally proposed by the A. Hirschman, then it was improved by the Columbia University O. Hirschman, is an important indicator to measure industrial agglomeration degree. Which is calculated as:

$$H = \sum_{j=1}^{N} Z_j^2 = \sum_{j=1}^{N} (X_j / X)^2 (j = 1, 2, 3..., n)$$

X represent the total scale of the shipping market.

X_j represent the scale of company j.

Z_j represent the market share of j company.

N represent the total quantity of container shipping company.

Advantages: First is to reflect the industry or enterprise market concentration accurately, because it takes the number of enterprises and enterprise scale two

factors into account; second is the ability to reflect changes in market monopoly and competition degree; third is make the mergers and decomposition of enterprises in the industry more responsive and the calculation method relatively easy.
Disadvantages: relatively poor intuitive.[12]

3.1.2 The application of market concentration degree theory in container shipping market

Here, through the market share of container carriers in the end of 2012, the top twenty\ container shipping company occupies 76% market share.

Their total capacity reached around 14 million TEU with a year on year growth of 8%, significantly ahead of the 2012 cargo growth rate of 4% -5%."Top 20" also controls the number of new shipbuilding market, the volume of booking orders they owned is 2.78 million TEU, occupy 76% of the total world volume which is 3.7 million TEU orders.
In very large container ship orders (8,000 TEU and above), "top 20" completely dominate with 2.45 million TEU, 88% of the market share, (see Table 2). In addition, the top five container shipping companies, including AP Moller - Maersk Group (APMM), Mediterranean Shipping, French CMA CGM, COSCO, Evergreen, master 50 percent of the total 1.4 million TEU shipping capacity orders.

As the largest shipping company in China, COSCON should use the earnings in container shipping to reverse the loss in bulk cargo shipping under the circumstances of the bulk cargo shipping is no better than before.

In addition, in terms of shipping capacity, COSCON built a large number of boats when the prosperity period of shipping industry in 2007-2008, so the shipping capacity scale of COSCON has the ability to promote to world's top three levels from the world's top five level.

[12] 《Industrial concentration degree measure》

According to market concentration degree theory, the container shipping industry will eventually reach the top 20 companies and account for 90% of the market share, so we can infer from the present market share of the top three container shipping companies, COSCON will occupy 14.8 -19.2% of the market share.

3.13 New method to enlarge the cargo volume

To reach the top three market share, fleet size alone is not enough completely. Because shipping alliance regulations comply with the minimum freight has the effect of preventing bidding each other which will lead to vicious competition, container liner shipping market prices are relatively stable and container shipping company can't attract customers by low freight. Customer loyalty is higher, more stable, customer generally won't change the shipping company to transport their goods once they decided the carrier. To attract customers of other shipping companies to COSCON is relatively difficult. Therefore, in practice, COSCON must seek some new approaches to open up new markets and gain more new customers.

There are many methods to get more customers, but the best method is cooperation and alliance, cooperating with the largest electronic trading platform earlier than other shipping companies and transports all the cargo of the owners in that trading platform. As securities companies cooperate and share customer resources with Banks, various clubs, companies. Not of the same industry company Shared clients is a win-win situation with the companies which are not in the same industry and shipping company can get customer information more comprehensive, finding customers who need their service more directional. Cargo owner in trading platform also can find a carrier with better quality of service, lower prices, more convenient link.

Taobao has set up for many years, the number of buyers and sellers increase with geometric ratio every year, it has become the largest electric business platform in

China. over the years the size and variety of the express companies cooperate with Taobao also increased year by year, from the initial Yuan tong, Shen tong, EMS, Shunfeng Express develop to more than 30 express companies Alibaba have cooperative relations nowadays. But the Courier company each have their own advantages and disadvantages. Domestic express delivery companies, represented by Yuan tong have low freight rate, medium speed, but can only finished transportation in most of the domestic urban villages and towns except Hong Kong, Macao and Taiwan. Shunfeng Express provide faster speed, higher safety service, favored by the cargo owner with higher cargo value, it also launches the international business now, but the delivery scope is not comprehensive and the freight is also very expensive. Freight of EMS is high, delivery speed is slow, but can finish the international transport to almost all the destination.

All in all, in international edition of Taobao and Alibaba, the seller can only use four major express delivery (EMS, DHL, UPS and FEDEX) and Shunfeng Express to send cargo to overseas buyers, the former need freight forwarders' help. But many customers choose online shopping mainly focuses on its low price, high postage always loss interest of international shopping.

However, people who shopping in eBay international know, eBay's logistics speed can be divided into three levels: fast: delivery within 7 working days, but often costs about $38. Medium: 14 days or so, costs only half of the price of fast speed. Low: within 21 days, often charge low cost, about $8 can complete transport in Asia area.
Medium speed and low speed online logistics can be the position COSCON set in the future, COSCON should take advantage of the domestic electricity service internationalization still in its' initial stage of development and seize the chance and cooperate with Taobao electric business platform. As container transportation has better punctuality, and COSCON directly cooperate with electricity can save the component of freight forwarders. These characteristics are in accordance with the relatively fast and inexpensive needs of e-commerce logistics.Hence， share

customer with the e-business will certainly improve the market share.

Another way to cooperate with electrical shopping platform is to display the liner service as commodity on Taobao, Alibaba and other platforms for more customers to understand to COSCON's services. People's working pressure today is very high, so except the necessary websites and commonly used websites associated with their work and life, very few people would be willing to memory some websites not familiar with. So even if COSCON is one of the largest and the most famous domestic shipping companies, but the consignor not familiar with sea transport will not think of clicking the home page to COSCON booking a shipping space, but choosing intermediary services such as freight company to finish goods transport. But shopping website as most people's life essential website, as long as young people need to buy something , they will search in Taobao, whether physical or virtual items.

If COSCON can display all the shipping routes and use the weibo (micro logging) service, Taobao promotion and other marketing tools in such a comprehensive shopping platform like Taobao, it can certainly catch the attention of more customers; China is the largest market with a population of 1.3 billion. therefore get ahead in the Taobao platform will surely win the Chinese market and win the world.

As China's largest shipping companies, it isn't difficult for COSCON to use its nationality advantage and monopoly ocean transportation in electric business platform ahead of other shipping company, finally become one of the largest international online shopping platform partners.

3.2 The forecasting of cargo volume in Southeast Asia ports

3.2.1 The current cargo volume of Southeast Asia ports

Although the shipping companies has to depend on the profit of container shipping to offset the loss in bulk cargo shipping ,the container shipping market is undesirable in

2012, Facing the greatly shrunk of Chinese export trade volume, COSCON container are exposed to loss. Ocean transportation in the second quarter crash with the summer the freight fell again.

The advantage routes of COSCON are ocean routes such as North American routes and European routes, the capacity mainly concentrated in ocean shipping, and profit or loss depends on cargo volume of ocean shipping. But due to the restriction of Chinese exports in trade barriers, COSCON ocean transportation suffered heavy losses. Therefore, COSCON should change business model and identify new markets according to its own condition.

With the development of the port market competition is becoming increasingly intensified, Southeast Asia port gradually reflect its emerging developing competitive advantage. Rely on the port of freight demand and the geographical position, resulting in the situation Southeast Asia area competing for transit hub port. Singapore, Klang, Dan Rong Parra Paz port have formed a situation of tripartite confrontation trend in Southeast asia.

Southeast Asia route is a new field for COSCON. COSCON only have CNP, CPX, CSE, AGI, etc 5 routes in Southeast Asia currently.

CNP route is a butterfly route, Taking Xiamen port as the midpoint, two circular mode. The call port are: Dalian Port -- Tianjin Port -- Yingkou port -- Ningbo port -- Xiamen port -- Hong Kong -- North Philippines Manila port-- South Manila port -- Xiamen port-- Dalian Port

Figure 1

CPX route is interlining route:

The call ports are: Shanghai port -- Ningbo port -- Shekou Port -- Singapore Port -- Karachi port -- Nava Sheva port -- Penang port -- Singapore Port -- Hongkong -- Shanghai port.

Figure 2

CSE route set the Pearl River Delta region as the center, Back and forth between Shanghai and Southeast Asian ports.

The call ports are: Shanghai port -- Qingdao port -- Ningbo port -- Nansha port -- Hongkong -- Shekou Port -- Jakarta -- Port Kelang -- Singapore Port -- Hongkong --

Shanghai port.

Figure 3

The traditional Southeast Asia countries are: Singapore, Thailand, Malaysia, Indonesia, Philippines, Vietnam, Cambodia, Burma, Laos, East Timor, Laos and Brunei.

The main port in Southeast Asia route are: Hong Kong、Belawan、Surabaya、Penang、Port Kelang 、Cebu、Singapore、Haiphong、Hochiminh 、Manila、Jakarta. Combine with the actual situation of COSCON, largest trade relation countries are the top seven countries. The cargo Volume forecast in the dissertation mainly research the 7 countries.

The domestic cargo volume mainly statistic the port appears most frequently in the companies who hold the biggest market share of Southeast Asia.

We can conclude the call port of COSCON, SITC and CSCL in Southeast Asia routes and find: Shanghai port, Ningbo port, Dalian Port, Qingdao Port, Shekou port, Hongkong port, Xiamen Tianjin port are the common ports in Southeast Asia routes.

Shanghai Import cargo volume form Southeast Asia port

	Cambodia	Indonesia	Malaysia	Vietnam	Thailand	Philippines	Singapore
2011/7/1	10707	87476	89197	67185	93812	33499	108627
2011/8/1	8086	68255	75343	53966	64088	33348	91998
2011/9/1	8368	94540	88179	70033	86056	30411	110110
2011/10/1	9411	72364	80876	72326	74274	29562	100500
2011/11/1	10598	99210	90644	77387	74129	34482	128601
2011/12/1	24914	89314	93142	74355	81375	27493	105055
2012/1/1	12507	92624	81572	65000	85957	28065	116888
2012/2/1	4987	51956	62258	44062	73671	19265	89310
2012/3/1	14058	93774	95827	75931	99096	35016	119375
2012/4/1	12842	92336	82583	78289	96567	27434	97791
2012/5/1	18110	99037	117873	92288	108962	36893	115176
2012/6/1	12839	94939	90131	76028	102371	30270	122067
2012/7/1	19378	97367	79500	80228	91799	31749	132118
2012/8/1	17128	59004	77525	68216	87295	31756	115881
2012/9/1	12807	90255	88094	87115	95624	33168	118637
2012/10/1	10139	88602	74250	75060	91294	33041	110889
2012/11/1	12425	98184	100104	82497	99882	34117	124973
2012/12/1	14185	87311	83595	81988	91982	29906	132895
2013/1/1	17072	90144	93549	80435	88615	36266	121273
2013/2/1	8399	65419	71651	50114	74053	24939	85937
2013/3/1	12205	93602	89095	85769	99001	35896	126531

Table 1

Shanghai Export cargo volume form Southeast Asia port:

	Cambodia	Indonesia	Malaysia	Vietnam	Thailand	Philippines	Singapore
2011/7/1	1361	29049	181594	16939	84900	46522	64792
2011/8/1	475	23768	149136	18142	82867	47164	60751
2011/9/1	882	35265	187083	22506	98194	50007	81454
2011/10/1	596	31519	166791	20946	66890	46391	77881
2011/11/1	1005	42226	131462	21511	54834	45107	60147
2011/12/1	1035	42099	152968	25468	60001	54490	75205
2012/1/1	859	26137	118904	16176	44484	47285	49050
2012/2/1	1149	33204	144809	25376	62108	54775	69851
2012/3/1	1249	39900	211384	46557	82011	65850	72625
2012/4/1	898	36087	119920	42094	61551	36308	58880
2012/5/1	653	37768	158282	51721	72210	42187	79400
2012/6/1	705	33639	212759	47794	68732	56780	66785

2012/7/1	1147	34507	163708	47771	69013	48854	72836
2012/8/1	1497	38146	200084	45404	76660	42790	61678
2012/9/1	1407	32123	247152	38871	78164	62903	79763
2012/10/1	1037	38893	145879	48918	68827	47203	70451
2012/11/1	949	37540	145252	48280	62372	46403	63016
2012/12/1	1942	43902	216094	52679	71290	40513	67229
2013/1/1	1667	41998	170889	51036	69626	30145	84051
2013/2/1	1179	27315	148810	20706	46591	23229	57083
2013/3/1	1584	38368	175571	47933	69675	41043	63768

Table 2

Through the Shanghai --Southeast Asian import and export volume statistics form July 2011 to March 2013, it is not difficult to find the regularity and periodicity of the container volume change. Most of the container volume increased with the southeast trade port volume year by year, although the decline or the fluctuation situation of minority

But the overall container volume changes should be analyzed with the change of each month and find the combination and regulation of month and cargo volume change.
For import container volume of Shanghai Port, it is not difficult to find import container volume reach the lowest point every February. This is because the traditional Chinese Lunar New Year is coming in February, the cargo owner recoup funds and prepare for the Spring Festival in advance, many maritime industry companies also pause service.

However March is the beginning month of a year, although March has not yet reached the traditional construction season, the backlog of orders during the Spring Festival digest in March and gradually sent to the customers. Therefore import and export volume will have a small outbreak compared to the previous two months.

After the orders before Spring Festival absorbed in March, container volume in April and May slide down slightly compared with March. But with the arrival of manufacturing peak season, container transport also meet the peak season in June,

and the conventional sense of the peak season will last until October.

With the beginning of western festivals at the end of November, the cargo volume gradually falls into the off-season. In December, cargo owner want hasten the production before the Christmas to avoid the traffic is blocked for Western holiday. so the volume of December will reach peak. But after the cargo owner finish the shipmen in December, the cargo volume continued to decline until the traditional lunar new year. After the lunar new year, the owner began to reopen.

3.2.2 The forecasting of cargo volume

In actual operation, if the trend line is directly added to the existing data, no matter what kind of function, R square value cannot be larger than 0.1, which means the function error is great, the conclusion has no reliability and the future volume forecasting is meaningless.

But according to periodicity of volume change, first work out the Month-on-month variation curve. Taking the container volume data of 1-12 months of 2012 alone and add the trend line can reach a function with a large value of R square variance (which means the fitting degree of the estimated value in trend line and the actual data is very high). Then we can accurately draw the greatest amount of goods in each year and arrive at the function diagram when volume begins to decline or when it begins to rise. Moreover, in the format options of the trend line, the cycle can not be pulled forward or pushed back because 12 months is a complete cycle. If we pull forward the cycle, the computer will consider the peak to trough distance as a complete cycle. The next cycle increase or decrease the amplitude based on the previous cycle. It will easily cause the off-season volume in the second years is based on the previous peak volume and the peak-season volume is superimposed the previous trough volume. Thus generate the problem of the peak-season with a relatively lower volume and the off-season with an abnormally higher volume which eventually ignoring the peak and

off- season in each year.

In addition, apply the function obtained by the Month-on-month variation curve in 2012 to each month 2011, the gap of predicted value and the actual value is small. Except some abnormal situations happen individual months lead to the gap, the volume is similar in most of the month. The months the maximum import and export volume appear are basically similar and the largest container volume can be reached by this function.

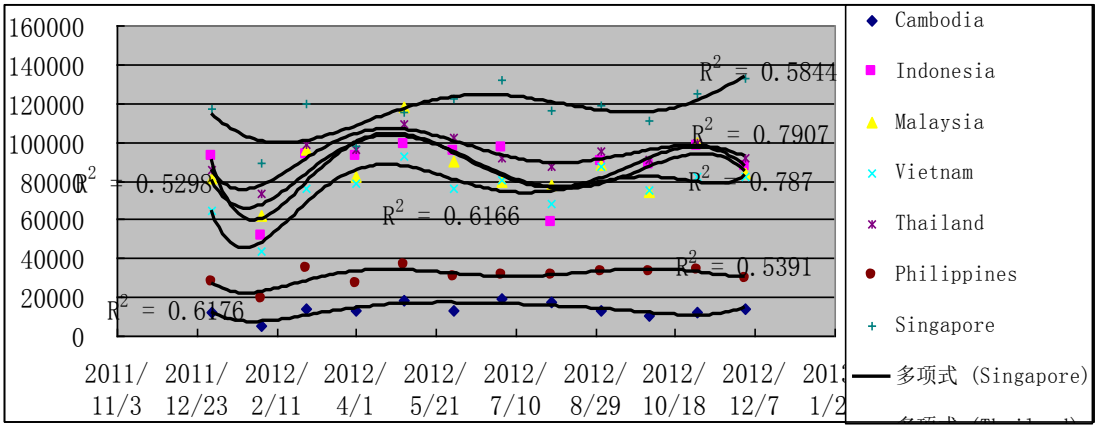


Figure 4

Take Singapore port to Shanghai port export volume as an example: the choice of six polynomial can result in the R square value reaches the maximum value of 0.5844, which illustrate the accuracy of six polynomial is higher.

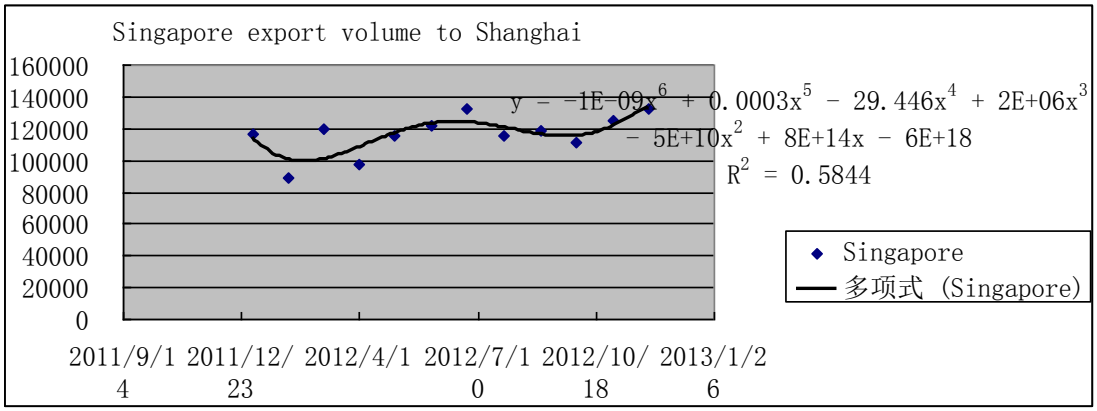


Figure 5

The forecasting function is: y = -1E-09x^6 + 0.0003x^5 - 29.446x^4 + 2E+06x^3 - 5E+10x^2 + 8E+14x - 6E+18

After get the Month-on-month periodic function, using the moving average method to forecast the year-on-year growth rate of the same month in several years can we know how much each month will grow in the future compared to the same month in the previous year. Because of the month-on-month growth rate and year-on-year growth rate is not fixed to up or down, the month-on-month growth represents the seasonal effect while the year-on-year growth represents the international economic situation. Combining the two change curves with EXCEL can we predicted a more accurately container volume in the next three years.

But this prediction method has many limitations and shortcomings. Such as the prediction of the maximum and minimum volume size and time will have great error. Because the trend line usually try it's best to be suitable for most point near mean value, which makes the most points are met to the trend line and the maximum R square.

If the trend line conform to the most extreme point will cause the mean value does not meet, even lead to amplitude in future is more and more large, result in the situation less than 0 or infinity which does not conform to the reality. Secondly, the workload is too heavy, and produces too many invalid data. The result data still need to be select for the maximum volume of each port and result in the shipping capacity. And effective data can't truly reflect the seasonal characteristics of container transport.

Moving average method also has shortcoming to neutralize maximum and minimum volume. This will cause year-on-year growth a similar figure. And if the variation trend is obvious increase or decrease, the forecasting results will have a high or low lag deviation; lag deviation will become larger and larger with the number of term K. Hence the forecasting maximum volume is deviated from the actual values to some extent.

But in actual situation, the cargo capacity is varied with the cargo volume.As a global top 10 container liner company, COSCON should meet the cargo volume demand, shipping out all the customers' cargo which means the shipping capacity is greater than cargo volume. Only in this way can COSCON grow the market share continuously and achieve the market share requirement in chapter 3.1.

Therefore, the extreme situation must be considered. When the maximum value appear in cargo volume, the shipping company should add the shipping capacity to transport the extra cargo while the company cut the capacity when minimize volume appears. The capacity of each month isn't fixed but could be changed by the cargo volume.

We can use EXCEL to select the maximum, minimize and average volume of 12 month in each year. Then predict the future trend.

Through the following form, we sign the month with minimize and maximize cargo volume. We can clearly know that in more than 90% situation, minimize cargo volume happen in February. Which means Chinese New Year has a obviously impact on the export and import of goods. In addition to China and Vietnam pay great attention to New Year, Cambodia, Thailand, Singapore, Malaysia, and Indonesia also considers it as an important holiday.

The peak season in each year is different, is no specific month. But the peak season basically concentrated in 5-7 months, 10-12 months in the past five years.

In recent years because of China's foreign trade exports encounter trade barriers and the impact of the international financial crisis, foreign trade dropped substantially, caused the peak season is not prosperous. It also needs to pay attention to selection of original data and adjustment of final data in volume prediction.

	Cambodia	Indonesia	Malaysia	Vietnam	Thailand	Philippines	Singapore
2012/1/1	12507	92624	81572	65000	85957	28065	116888
2012/2/1	4987	51956	62258	44062	73671	19265	89310
2012/3/1	14058	93774	95827	75931	99096	35016	119375
2012/4/1	12842	92336	82583	78289	96567	27434	97791
2012/5/1	18110	99037	117873	92288	108962	36893	115176
2012/6/1	12839	94939	90131	76028	102371	30270	122067
2012/7/1	19378	97367	79500	80228	91799	31749	132118
2012/8/1	17128	59004	77525	68216	87295	31756	115881
2012/9/1	12807	90255	88094	87115	95624	33168	118637
2012/10/1	10139	88602	74250	75060	91294	33041	110889
2012/11/1	12425	98184	100104	82497	99882	34117	124973
2012/12/1	14185	87311	83595	81988	91982	29906	132895
MAX	19378	99037	117873	92288	108962	36893	132895
MIN	4987	51956	62258	44062	73671	19265	89310
AVERAGE	13451	87116	86109	75558	93708	30890	116333

Table 3

Analyze in the long term, China's exports still will go well with the improvement of global economy, and will be linear upward in the long-term trend. Therefore, select the trend line with positive function slope will get more reliable predicted value.

What's more, the adding of the trend line to forecast the maximum, minimize and mean value of Shanghai port to southeast Asia port export and import container should follow the following 3 principle:

（1） $Max_{volume} \geq Average_{volume} \geq Min_{volume}$

（2） $Max_{volume} \geq 0$， $Average_{volume} \geq 0$， $Min_{volume} \geq 0$

（3）Trend line of Max_{volume}， Min_{volume}， $Average_{volume}$ can't tend to infinity.

Added trend line under the constraints of the conditions above and make R^2 maximize.

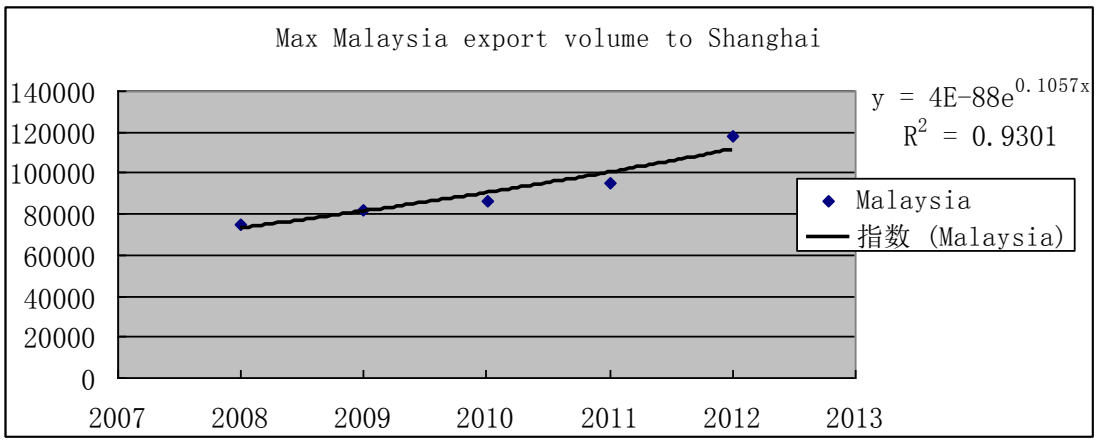


Figure 6

Take Malaysia's maximum export container volume trends for example, after add the exponential function trend line, its variance reaches 0.9301, so the predicted and actual values are very close.

Forecast Cambodia, Indonesia, Vietnam, Singapore, Philippines, Thailand's maximum export container volume in the next three years with the same method and substitute the formulation. Then we calculate the maximum volume and prepare for the ship assignment in Chapter IV.

After the calculation of the maximum export container volume, the average volume, the minimum volume and that of import indicators could be measured in the same way. The dissertation will not say more about it.

Therefore we can work out Shanghai export container volume in the following three years:

2015 export volume	max	Min	average
Cambodia	26782	11391	20543
Indonesia	152484	76101	100063
Malaysia	152882	82793	91932
Vietnam	153194	60897	82961
Thailand	195662	94979	97853
Philippines	48328	26177	40391
Singapore	144123	108926	137199

Table 4

From forecasting results of 2015 export container volume, we can find growth of Indonesia, Vietnam, and Thailand is the fastest. This also indicates COSCON should take more attention to the future shipping capacity assignment in the 3 ports of Southeast Asia route.

In addition, box volume change doesn't have completely correlation with the forecasting function curve. Forecasting function curve is just the forecasting, but not the directly influence and the guide of actual cargo volume. While the SCFI (Shanghai exports Containerized Freight Index) is the leading index to really reflect the international trade the situation. Which has a certain degree of correlation with export container volume.

If this exponent continued to rise smoothly, it illustrate international trade thriving and countries economic in good condition; on the contrary, the decreasing of SCFI illustrate the global market demand weakened which means that the world economy in poor condition, or herald the upcoming economic recession.

Therefore, do regression analyses with export container volume to SCFI can also increase the accuracy of the year on year growth rate.

In reality, China's import and export container volume changes also affected by the following three factors.

1. World situation factors: economic, military, and climate and other factors' influence on the import and export volume. When the world economic boom, the trade between countries become busy, import and export of cargo increase, the export and import volume rise. Otherwise it will decline. SCFI change indirectly reflects the fluctuation of world economy. War factors and climatic factors are force majeure. When the bilateral

relations of two countries deteriorate, trade between 2 countries will be prohibited.

Recently China's sovereignty over the Diaoyu Islands issue prohibits the import and immigration of many Japanese goods, also prohibits the Sino-Japanese tourism to create profits for Japan. This will greatly affect the cargo volume on the Sino-Japanese route, resulting in abnormal data deviate from the predicted value. Endlessly civil war in Myanmar is also an uncertainty factor, war affected not only policy-oriented injunction to export and import, but also lead to terminal port can't operate and the ship can’t work properly. Then resulting in of products accumulation and can not successfully transported to other Asian countries. Climate issues are also very important, such as the 2004 tsunami in Indonesia had a devastating impact on the Indonesian port. It also led to a dilemma that cargo of other country undeliverable, domestic goods can not be exported.

2. Policy factors: here mainly refers to China import and export policies. Since China joined in the WTO organization in 2002, import and export products between China and the WTO Member States become more frequent. In the first half of the past decade, China's foreign trade industry was pulled with a trade surplus of export volume larger than import volume, meanwhile development and prosperity of domestic manufacturing industry was being promoted.

However, the 2008 financial crisis result in Western countries developed trade barriers, anti-dumping regulations and other restrictions on export of manufactured products made in China, causing a great amount of Chinese-made products be returned back to the domestic market and waiting for domestic digestion.

The newly emerging Southeast Asian countries just like China 10 years ago. Because of cheap labor and abundant natural resources, Southeast Asian countries have also import products to China and other Asian countries. But the products also affect sales of similar China-made products. so when the similar domestic product inventory is too

large, too many imported products cause too much pressure on domestic products, the associated trade protection policies will be introduced, which also affect import volume of the country to domestic.

In addition, Acceleration of urbanization process is also the hot topic of Chinese economic development in this year. The final result of urbanization is to make each small city match the international metropolis like Beijing, Shanghai and Guangzhou, developing public utilities and convenient transportation. Urbanization will realize the cargo diversion; cargo of Shanghai will be absorbed by the Ningbo Port and Zhou Shan Port to a certain extent.

3. Port factors: here can be divided into internal and external factors:

External factors refer to the impact from neighboring ports and land transportation convenience. Generally speaking, ports of call in routes are more competitive ports, its amount of freight is relatively higher than peripheral ports, or port facility is most suitable for docking. However, the development of ports is always radioactively spreading around the core hub port, which finally shapes the delta ports linkage.

For Shanghai Port, the nearby Zhou Shan Port, Ningbo Port as the important ports in the Yangtze River Delta region have competitive advantage and have been growing fast in recent years, even catch up with the growth rate of Shanghai in October last year. Therefore, there will be diversion of goods, there may be trade-off and take turns, cargo of Shanghai port reduced and cargo of Ningbo port increased, the total volume unchanged.

Convenience of land transportation can attract cargo docked at the port, rather than dock in the surrounding feeder ports.

Internal factors refer to the harbor's water depth, channel width and climate etc. Water depth and channel width issues have no effect on the volume but depend whether the ship can dock in the port. And the climate is still a major factor in restricting the ship docking at the pier and a normal operation of the port handling machinery. The awful

weather will lead ships cannot dock, which caused the decline in the volume of import and export.

So we can import a function $Y_t = T_t \bullet I_t$

Y_t is the prediction volume of Shanghai port to Southeast Asia ports in t months, T_t is the long-term trend of cargo volume in t month——that is the value the function evaluated already in the first half of 3.2.2, I_t is the irregular change after t months——that is the influence of world pattern, policy, port factors on predicted values.

In summary, adjust the 2013 -2015 volume predicted before.

The obtained import and export volume of Shanghai to the southeast Asia port is the total volume of the entire market, the cargo volume of COSCON can get should be combined with COSCON's market share.

The finally data after adjustment is:

2015 export volume	max	Min	average
Cambodia	24893	11038	20543
Indonesia	141484	72301	95287
Malaysia	152882	827934	91932
Vietnam	139817	57082	73897
Thailand	165329	86826	109264
Philippines	43962	25908	39782
Singapore	139288	103954	129007

Table 5

Chapter Four: The fleet deployment of COSCON in Southeast Asia area

4.1 The introduction of Southeast Asia market and COSCON

4.1.1 The introduction of Southeast Asia market

The main products imported to China from Southeast Asia:

Singapore and Indonesia: mechanical and electrical products, chemical products, textiles and raw materials and transportation equipment.

Thailand: freezer, fruit, fish, chemical products, textiles and raw materials, waste paper, waste plastics and rubber.

Malaysia: mechanical and electrical products, chemical products, plastics, rubber, textiles and raw materials.

Philippines: Cereal, fish, fruit and steel.

The main products exported to Southeast Asia from china:

Indonesia: mainly mineral products, in the second place are plant and animal oils and fats, plastic, rubber, chemical products, cellulose pulp and paper.

Thailand: mainly plastic and rubber, supplemented by mechanical and electrical products, chemical products, plant products and mineral products.

Malaysia: mainly mechanical and electrical products, the rest is similar to Thailand.

Singapore: mainly mechanical and electrical products, supplemented by mineral products, chemical products, plastic, rubber, metal products.

So, China mainly export manufacturing industry products like electromechanical

products, metal products, chemical products industry to Southeast Asia while China mainly import mineral products, animal husbandry and fishery products, plant and animal oils and fats, plastic, rubber, chemical products and electrical products from Southeast Asia. Except contribution of Singapore in electromechanical products, agricultural products may still be the most important product.

4.1.2 The existing shipping capacity of COSCON

COSCON ranks sixth in total number of existing ship. The company posses 74 super Panama container vessels, 37 Panama container vessels, 5 sub-Panama type boat, 31 handy size container vessels, 30 other type of container ships. In the past year, the total capacity of COSCON reached 756979TEU, freight volume reached 8016241TEU and turnover exceeded 48000000000 RMB.

Branch companies spread throughout all the important ports in China, freight agencies of COSCON are equipped in Shenzhen, Hong Kong, Shanghai, Xiamen, Qingdao, Guangzhou, Dalian, Tianjin, Wuhan, Beijing and other coastal and inland ports in order to guarantee For collect the cargo at any time, transport cargo timely, arrive at port on schedule

In the special cargo transportation capacity, COSCON own the advantage of refrigerated cargo transportation. It is one of the companies transporting the largest refrigerated capacity. At present, COSCON operate a more than 22000TEU cold storage capacity fleet in the world. COSCON carry - everything from ice cream to chicken, from apples to flower bulbs, from vegetable to fish - all require different specialist refrigerated care. Its advanced technology and reefer container can keep the temperature of each container at the level specific goods need. A large part of the cargo from Southeast Asia is fresh fruit, wood, dried fish, and other agricultural products, which all need strict control of temperature and humidity. Too cold or too hot will affect its freshness and quality. Therefore COSCON are fully capable of putting

the idle capacity into Southeast Asia routes and transporting these products need keep in cold storage.[13]

In the route distribution, COSCON operating totally 60 routes, 47 routes are ocean route, covering variety of goods in Americas, Europe, Africa, Australia, Asia and the Far East. 11 routes of which are in Asia, mostly of which are transportation between Asian countries with close distance to each other. 3 routes are domestic trade routes, mainly for the Inland route.

4.2 The contrast of COSCON and some advanced shipping company in Southeast Asia area

4.2.1 The existing problem in recent route

In recent years, cargo volume of ocean routes is fewer and fewer, 0 freight often happen in Sino-Japanese route. However COSCON invest a lot of capacity on these routes.

Southeast Asia is a rising star, and their economic development has only just started, especially in Indonesia, Jakarta, Bangkok, Thailand, the future will become a substantial increase trend in the volume. But now COSCON routes in Southeast Asia are more Chaos and complicated. Most routes through ports in Southeast Asia share the same route with other South Asian ports, which lead to low efficiency.

Secondly, the capacity arranged in Southeast Asia route is also less, in three major Southeast Asian routes, COSCON arranged only three 1700-1900TEU handysize container ship in CNP route, five 4200TEU Panamax ship in CPX route, four 3500TEU Panamax ship in CSE routes.

[13] http://www.coscon.com

Putting more capacity into the Southeast Asian routes and optimization of existing routes in Southeast Asia will be the major business strategy in the future.

4.2.2 Comparation of COSCON and OOCL in Southeast Asia area

Many shipping companies have Southeast Asia routes, such as: COSCON, APL, OOCL, ZIM, NORASIA (freight is lower), WANHAI (price is higher, the fastest), SITC. Though COSCON ranked sixth of shipping companies in the world, the competitiveness of COSCON in Southeast Asia routes are far less than the OOCL, CSCL who ranked after COSCON. COSCON is not as good as some private enterprises in many respects that opened the route in this area later than COSCON. Here take the OOCL as an example, research and analysis of its characteristics. And take it compared with COSCON.

OOCL is the wholly-owned subsidiary of Orient Overseas (International) Limited (OOIL), launched by Dong Jianhua family. It is one of the largest global integrated international container transportation, logistics and terminal companies. The provision of logistics and transportation services for customers, including Asia, Europe, North America routes, the Mediterranean, the India subcontinent, the Middle East and Australia, New Zealand etc.

At present, Orient Overseas (OOCL) has a fleet made up of different levels container ships ranging from 2500 to 8063TEU. It also has the ice-strengthened ship suitable for cold area. As a member of the world's largest professional freight alliance, Orient Overseas (OOCL) shipping has a powerful fleet with more than 150 ships. Ships owned and leased by Orient Overseas (OOCL) can transport ordinary, frozen and DG cargo according to the needs of customers.[14]

[14] http://www.oocl.com/schi/aboutoocl

In Southeast Asia route configuration, OOCL has 37 routes in Southeast Asia; combine the long routes with the short routes. The routes include the “Relay route” with more call port, more complex and longer route, such as AGI, LCS route. “Interlining route”, such as MAX, CIX, CPX, MSS, CMX route. As well as a lot of “shuttle bus route” which transport the cargo Point-to-Point and directly carried from beginning port to the destination, such as: BLW, MFS, CSX, HHK2 and HPH.

Long shipping line has the advantages that the goods in each call port of the route can be carried to, the loading rate of each ship can be increased and the probability of ballast trip can be reduced. But if the route is too long, it will also bring many disadvantages, such as finish an entire trip need too much time. And delay between each port will be accumulated by too many call ports, resulting in serious decline in the schedule integrity. Moreover, too much call ports will lead to the goods damage and loss during loading and unloading, which will increase the transportation risk.

Therefore OOCL launched much direct business between two ports. The advantages of direct business is, the voyage time is short, so the standard shipping schedule rate is high, it will slightly affected by the call port. In addition, short voyage time can bring direct safeguard to the cargo owners, reduce the probability of the occurrence of the damage and loss. The disadvantage of shuttle bus business is to increase the operating risk of the company, which is increased by the increasing of cargo volume volatility.

Compared with the configuration of OOCL Southeast Asia routes, COSCON’s performance is not just as good as expected. The COSCON only has 5 routes in Southeast Asia. Besides, a total distance of each Southeast Asia routes are very long, as well as the number of the call ports. It takes 20 days to a month to finish a complete voyage. Each port has effect to others. The schedule integrity from the POL to POD will be affected by the cumulatived short delay. Transport inefficiency, inaccurate shipping lines, high risk, these three factors led so many owners have to give up

COSCON, seeking other ship companies who do better in Southeast Asia routes .

In addition, since Southeast Asia routes of COSCON are connected with some South Asian countries, the number of routes is already less and it will cause the route distance too long, the call port too much, the route too complex as it still need to add some countries out of Southeast Asia. Because of the disadvantages above, thus lead to poor flexibility, the needs of management personnel, each port would need an import and export container manager which increases the cost of hiring employees. Once the accident happens, because of the large number of process, prone to the condition that shirking responsibility or wasting more time checking out who is responsible before problem solving. Which lead to poor communication effect of shipping company relevant personnel to customers, the shipping company is difficult to get good feedback, so it is difficult to help customers solve problems in the first time.

Container transport is famous for timely, fast, safe. If these can't guarantee, only the pursuit of the the maximum loading rate, the quality of service can not meet customer satisfaction, the current cargo volume will be lost to other shipping companies.

COSCON’s fleet size ranked first in China and sixth in the world. The listed ships exceed that of OOCL. Therefore COSCON has the strength to be the leader shipping company in the port of Thailand, Indonesia port, Malaysia port and Singapore port who has the most potential market. It can put the spare capacity to launch point-to-point type direct navigation routes in Southeast Asia to realize direct transport from port to port, shorten the delivery time, improve the route flexibility, increase the shipping schedule integrity and improve customer service quality.

4.3 Fleet deployment optimization

4.3.1The fleet size COSCON should possess in the future

According to the forecast of Southeast Asian market volume in Chapter 3 and the market share COSCON should reach in the future, we can basically use COSCON's expected average market share of 17% multiplied by the estimated market container volume and calculate the container volume of COSCON handling in each southeast Asia port, thus indirectly calculate the capacity should be assigned in each line.

2015 COSCON export volume/month	max	min	average	2015COSCON import volume/month	max	min	average
Cambodia	4232	1876	3492	Cambodia	355	192	276
Indonesia	24052	12291	16199	Indonesia	7234	5780	6599
Malaysia	25990	14749	15628	Malaysia	56812	43687	50933
Vietnam	23769	9704	12562	Vietnam	7592	5829	6901
Thailand	28106	14760	18575	Thailand	23803	12074	18453
Philippines	7474	4404	6763	Philippines	18790	10920	13520
Singapore	23679	17672	21931	Singapore	22077	13845	17218

Table 6

Existing routes include Southeast Asia and Shanghai port only have CPX route and CSE route, CSE routes call in Shanghai and Southeast Asia Jakarta, Singapore and Port Kelang, the capacity is four 3500TEU container ships. CPX routes call in Shanghai, Penang, and Singapore port, the capacity is five 4200TEU Panamax container ships. But the predicted average export container value of COSCON reached 96924TEU, capacity needed to add is 96924-3500 * 30 / (23/4) -4200 * 30 / (35/5) = 96924-36261 = 60663TEU, 36261TEU of which is the existing capacity in Southeast Asia routes. COSCON import container volume will reach 114068TEU in 2015, so 114068-36261 = 77807TEU is still required.

The current route arrangements and capacity arrangements haven't completely reach the requirement of the predicted volume in 2015. Many important ports have no route to contact directly with the Shanghai port, such as Laem Chabang port in Thailand, Haiphong in Vietnam have no direct route for transporting goods between Shanghai and the South-East Asia ports.

4.3.2 The selection of base port and formulation of the route in Southeast Asia

It is necessary to open up new routes to solve these problems to win more TEU. What can be basically determined is the minimum volume of Cambodia, So we consider to merge Cambodia port to the direct route of other southeast Asia country. Through the Map of Southeast Asia, we find Cambodia is sandwiched between Thailand and Vietnam. Phnom Penh of Cambodia is 250km apart from Ho Chi Minh of Vietnam, 535 km apart from Bangkok in Thailand. So it's more suitable to combine Phnom Penh and Ho Chi Minh into a route. But in the return voyage, the import volume from Phnom Penh is less than one-tenth of exports that from Vietnam imported to is also only half of exports. It will easily lead to a ballast trip in return voyage which makes the low loading rate and low profit.

The only solution is passing around to Malaysia who import exceed export. Penang Port is located in northern Malaysia, is Malaysia's second largest port, it is also the geographically nearest port to Cambodia.

Figure 7

Hence, the first line can be defined as an asymmetric line bundling network route. It covers: Vietnam, Cambodia and Malaysia.

The sequence of the call port is : Shanghai Port——Ho Chi Minh Port——Phnom Phenh Port——Penang Port——（Ho Chi Minh Port）——Shanghai Port

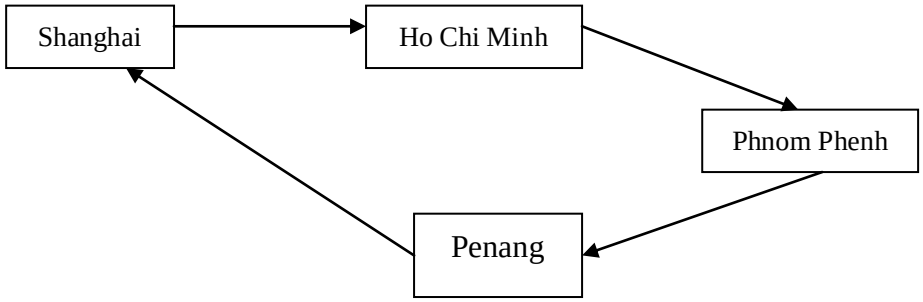


Figure 8

（asymmetric line bundling network）

* Note: Shanghai port don't load cargo exporting to Malaysia in the route, The route only responsible for sharing Malaysia imports cargo to Shanghai. In addition, the route mainly solve all cargo in Ho Chi Minh, Vietnamese and Phnom Penh, Kampuchea, therefore it should finish all the cargo in Ho Chi Minh port and Phnom Penh port first before use the remaining empty container to transport the cargo in Penang port. We call it SHPP route

Shanghai port is 2750 km apart from Ho Chi Minh port in Vietnam, or 1485 nautical mile. Navigating with the economic speed (14 knot / hour) need 4 days and 10 hours to arrive Ho Chi Minh port. Ho Chi Minh port is 450 km apart from Phnom Penh port, or 243 nautical miles, which takes 18 hours to reach Phnom Penh. Kampuchea is 854 kilometers apart from Penang port (which means 462 miles), the voyage need 1 day and 9 hours. The return trip of Penang port is 605 nautical mile to Ho Chi Minh port 605, need 1 day and 20 hours. The whole voyage time is approximately 14 days.

Port loading and unloading time can be calculated with the efficiency of 100TEU/h as average efficiency of loading and unloading. It requires a total loading time about 2 days. Then the complete voyage needs 16 days.

Dispatching frequency is： $$t_{dsipatching} = \frac{\alpha \bullet D_{netload} \bullet t}{\sum Q}$$

α is the dispatch loading rate in the direction with larger freight volume;

$D_{netload}$ is the net load weight of the ship (t, TEU);

t is the time to finish an entire voyage;

$\sum Q$ is the sum volume of different kind of cargo from departure port to destination port (t, TEU)

In this route, α needn't be considered because the return trip detour to Penang port does not exist the situation that voyage volume to Southeast Asia greater than the return trip. Therefore, $\sum Q$ and t is given in the existing data, $D_{netload}$ and the frequency is also determined by the volume. Volume directly determines capacity size. Thus determines how many ships equipped on the route. The fleet deployment will be illustrated in detail in the next section.

After finished the route of Kampuchea and Vietnam, we can look for COSCON original route with Shanghai and Southeast Asia. Then add capacity and new route for the port lack of capacity. Because we can't cancel and change call ports in the existing route at will, we can only discover problems in the existing routes and use new routes and add capacity to solve problems in the existing route. **CSE** route has already call in Jakarta, Singapore and Port Kelang these ports with larger volume. But because the route is too long, the transportation time is long.

In addition, COSCON capacity configured in the two route can not reach the requirement of Singapore and Jakarta. Take Jakarta port as an example, the export volume prediction is 16199TEU, and capacity in the route is only 14000TEU, still short of 2199TEU capacity, directly to the cargo export to Singapore can't be load. So improvement suggestion for CSE route is to increase capacity. Because Jakarta has speed advantage on the route, we should first ensure the container export to Jakarta all arrived in Indonesia, then we needn't launch other Indonesia route.

Singapore has no speed advantage on this route, so we can complete the cargo volume of Singapore through CPX route. Penang port is also used to share volume in return trip. Since CPX line has speed advantage on Singapore port, capacity is also adequate with five 4200TEU Panama container ships, cargo from Singapore can be assigned to the two routes, then tentative capacity for two 3400-3500TEU Panama container ships increased in CSE routes.

Considering the large cargo volume from Malaysia return trip, Malaysia must offer point-to-point route direct business process cargo imported from Malaysia. So we needn't added capacity in CPX route because it already can complete the volume from Shanghai and Singapore.

Thailand's import and export volume is extremely close. With the development trend of Thailand, Thailand's trade with China is increasing day by day. So we considered establishing shuttle-bus direct business or shuttle-bus direct business with a little hub/feeder port to improve transportation speed, make the Shanghai——Bangkok and Bible transportation become more competitive. For short we call it **SLCB route.**

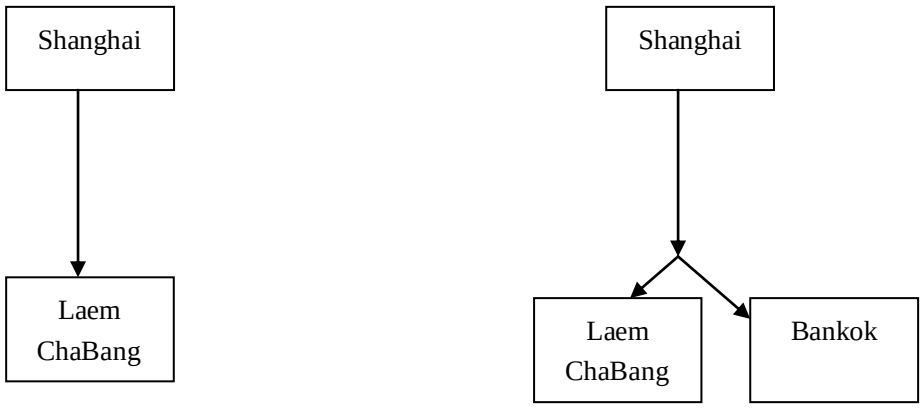


Figure 9

Point-to-point route hub-and-spoke network

Shanghai is 2900 km apart from Thailand, then the single trip need 4 days and 16 hours, added the lay time and the entire trip needs 12 days. It is very competitive in transport speed.

So we need two 3400TEU Panama size container ship to finish the 18575 TEU capacity, the redundant positions can solve temporary peak season goods.
CNP route is about Philippines, but it can't realize the direct link of Shanghai and Philippines Port. The route can't directly arrive in Shanghai. Hence it is necessary to launch direct flights to the Philippines in Shanghai.

In the return trip, because Manila is far from Malaysia, the ship needn't go around to Malaysia to share the import cargo and realize the true sense of shuttle bus service.
Shanghai is 1500 km apart from Philippines, then the round voyage need 4 days and 16 hours, the lay time need one and a half days. Thus the entire trip needs 7 days. We just allocate one 3400TEU handy size container ship. We call it **SM route** in short.

Expect the cargo share by other route, the rest amount of container import to Shanghai port still need be transport. So we need to establish point-to-point route or Hub-and-spoke route between Shanghai and Malaysia. Just define the shuttle bus service between Shanghai and Penang as **SP route**.

Through the cargo volume share by SHPP route and CSE route evaluated, we can reach out the cargo volume of Malaysia is 27773 TEU. As the distance between Shanghai and Malaysia is 3650 km, the voyage time is 12 days and the lay time is 3 days, then we can got the time to finish the entire voyage is 15 days.

4.3.3 Allocation of the fleet in new route

The previous section mainly determines the base port and route pattern. So we can confirm the capacity, voyage time of each route, and tentatively confirm the shipping capacity of Thailand, Indonesia, Philippines and Singapore. But we have missed the variable cost, fixed cost, port charges and the opportunity cost of each TEU when finish an entire voyage. We should in order to optimize the fleet deployment of SHPP,

SP, SLCB, CSE and SM after take all these factors into consideration.

Hence, we use linear programming in EXCEL to find out the optimal solution fleet in these new routes. As there are 5 uncertain routes, the dissertation's aim is to solve the problem of multiple route deployment.

Because freight of container shipping is basically confirmed, we don't need to consider the profit maximization problem, only consider making the cost lowest is enough. According to the forecast in 2015, apply different type of ships to the most appropriate routes.

Establish the fleet deployment model:

$$\text{Min} \sum_{i=1}^{n} \sum_{j=1}^{m} C_{ij} x_{ij} + \sum_{j=1}^{m} P_j \bullet Y_j$$

$$\text{S.T. constraints } \begin{cases} \sum (X_{ij} / a_{ij}) \le S_i \\ \sum b_i X_{ij} + Y_j = T_j \\ X_{ij} \ge 0, Y_{ij} \ge 0 \end{cases}$$

X_{ij} is the number of round trips for ship I finishes monthly on route j

Y_j is the number of uncarriered containers on route j

C_{ij} is the cost of each ship i completing a round trip on route j

P_j is the opportunity cost of each TEU on routes j

a_{ij} is the maximum number of round trip ship i can finish in route j monthly

b_i is the loading capacity of container ship i

S_i is the total number of container ship i

T_j is the container volume of route j

Voyage cost = Sailing cost + berthing cost + port charges + load and unload cost

Idle cost is the cost when the ship is not assigned to transport cargo and berth in the port.

Opportunity cost is the net profit of this type of ship carrying the each TEU of cargo in other routes before.

Reach the voyage cost and idle cost according to the coefficient of the listed ship in COSCON; calculated maximum voyage number through voyage time. Because of the speed is unified as the economic speed, so the maximum voyage number of the same route won't be any different when the ship size is different.

(In addition, this paper also tried the circumstance when maximum voyage number is different. But we found that even different types of ships sailing in the same route lead to different maximum voyage number, it will not have an impact on the minimum cost. Because the constraints is the planning capacity transport all the cargo volume in all routes, the minimum capacity achieved by different fleet deployment will not changed with the maximum voyage number. Therefore, the change of maximum voyage number does not affect the results.)

	SHPP	SP	SLCB	CSE	SM	Quantity of different ship	ship spare cost/day
ship type	voyage cost						
4500	1782920	1701800	1458440	2756360	1052840	5	66438.36
4200	1677368	1592729	1388776	2693144	1015536	19	61643
3400	1548832	1479280	1270624	2383456	922864	4	59726.03
2700	1230096	1176840	1017072	1869168	750792	5	51780.82

Table 7

	SHPP	SP	SLCB	CSE	SM
Cargo volume	16064	27773	18575	20912	13520
ship type	Maximum voyage number				
4500	2	2	2	1	4
4200	2	2	2	1	4
3400	2	2	2	1	4
2700	2	2	2	1	4
Opportunity cost	100	200	130	90	180

Table 8

Establish minimum total cost of each voyage as the objective function, As the selected ships are idle ships, so we do not need to consider the opportunity cost of the other routes. Set constraints as the completion of all cargo volume and the number of ships is a natural number. Therefore, the objective function can be simplified as

$$\text{Min} \sum_{i=1}^{n} \sum_{j=1}^{m} C_{ij} x_{ij}$$

The sum of ship assignment should be less than or equal to the sum of idle ship = ∑ (voyage number of this type of ship in each route/ the ship's maximum voyage number in various routes).

decision variable

	SHPP	SP	SLCB	CSE	SM				
ship type	number of round trip						number of ship		
4500	1	0	5	2	0	=	5	<=	5
4200	2	6	0	0	0	=	4	<=	19
3400	1	0	0	2	4	=	4	<=	4
2700	0	1	0	2	0	=	3	<=	5

min	24186702				
s.t.	16300	27900	22500	21200	13600
	>=	>=	>=	>=	>=
	16064	27773	18575	20912	13520

Table 9

The optimal solution is five 4500TEU container ships, four 4200TEU container ships, four 3400TEU container ships and three 2700TEU container ships.

But EXCEL also has defects: it is unable to set the ship number in each route a positive integer which is not a decision variable. So the sum of ships assigned in various routes is an integer, but the number of ships assigned in each route is not an integer when divide voyage number by the maximum voyage number.

So we need to make adjustment to the results. To ensure that number of different ship

in all routes are all integer: (voyage number / maximum voyage number) as integer.

	SHPP	SP	SLCB	CSE	SM
ship type	number of ship				
4500	1	0	3	2	0
4200	1	3	0	0	0
3400	1	0	0	2	1
2700	0	1	0	2	0

Table 10

Therefore, the optimal solution is assign SHPP route with one 4500TEU, one 4200 TEU container ship. The largest monthly container capacity is 4500*2+4200*2=17400 TEU.

Allocate three 4200TEU and one 2700TEU container ship in SP routes. The largest monthly capacity is 4200*6+2700*3=33300TEU

Allocate three 4500TEU container ships in SLCB routes. The largest monthly capacity is 4500*6=27000TEU

Allocate two 4500TEU, two 3400TEU and two 2700TEU container ships in CSE routes. The largest monthly capacity is 4500*2+3400*2+2700*2=21200TEU

SM routes need only one 3400TEU container ship. The biggest monthly capacity is 3400*6=20400TEU

That is the optimal solution to fleet deployment. After the roundness of ship number assigned in each route we can find we need six 4500TEU Panama container ships, larger than the existing idle capacity of 5 ships. Therefore we need to buy one ship more to maintain the general cargo volume requirement of Southeast Asia route.

Moreover, due to the constraint of the flight times of different ships in each route as integer, we can’t carry out sensitivity analysis report.

When the port volume reaches the maximum value, the volume of each route also change:

	SHPP	SP	SLCB	CSE	SM
Cargo volume	28001	25990	28106	25654	18790

Table 11

The voyage number of different ships in different route is：

	SHPP	SP	SLCB	CSE	SM	Number of ship		
ship type	number of round trip							
4500	0	0	7	1	2	5	<=	5
4200	7	5	0	0	0	6	<=	19
3400	0	0	0	4	0	4	<=	4
2700	0	2	0	3	4	5	<=	5
Min cost	31298901							
	29400	26400	31500	26200	19800			
	>=	>=	>=	>=	>=			
	28001	25990	28106	25654	18790			

Table 12

SHPP route needs four 4200TEU Panama container ships. SP route needs three 4200TEU and one 2700TEU container ships. SLCB route needs four 4500TEU container ships. CSE route needs one 4500TEU, four 3400TEU and three 2700TEU container ships. SM route needs one 4500TEU and one 2700TEU container ships. Although the fleet deployment is totally different in the prediction of the largest cargo volume, the absence condition of capacity is similar to the average prediction result: a 4500TEU container ship is still lack of.

When the port volume reaches the maximum value, the volume of each route is:

	SHPP	SP	SLCB	CSE	SM
Cargo volume	11580	27790	14760	16118	10920

Table 13

The voyage number of different ships for different routes：

	SHPP	SP	SLCB	CSE	SM			
ship type	number of round trip					Number of ship		
4500	2	0	4	1	2	5	<=	5
4200	0	6	0	0	0	3	<=	19

3400	0	0	0	2	0	2	<=	4
2700	1	1	0	2	1	3	<=	5
Min cost	20930150							
	11700	27900	18000	16700	11700			
	>=	>=	>=	>=	>=			
	11580	27790	14760	16118	10920			

Table 14

So SHPP route requires one 4500TEU Panamax container ship and one 2700TEU handy size container ship. SP routes need three 4200TEU and one 2700TEU container ships. SLCB route need two 4500TEU container ships. CSE routes need one 4500TEU, two 3400TEU and two 2700TEU container ships. SM routes need one 4500TEU and one 2700TEU container ships.

A total of five 4500TEU container ships, three 4200TEU container ships, two 3400TEU container ships and five 2700TEU container ships are required in southeast Asia routes. The total capacity isn't exceed the existing spare capacity and we don't need to add new capacity.

But considering 4500TEU container ship are not enough in the general situation and the peak season, we can consider adding a 4500TEU container ship into Southeast Asia routes.

4.4 The method to solve the spare capacity in slack season.

Shipping arrangement combination predicted in Section 4.3 has great difference in the off-season and peak season, completely rely on the change to fleet allocation method will lead to the change on other existing routes arrangement and cause trouble to the overall operation of fleet. So we must reduce the change of the identified ship model to search a solution to the problem of off-season.

Although the volume of the off-season is low, the shipping company can't exit route or reduce port at will, so we must take measure to ensure both tightening capacity, and not loss old customers for the short trough.

The method is summed up as follows:

(1) VSA, Vessel Sharing Agreement: two shipping company share the same line, or three ~ four. Even a shipping alliance share for the same line, 2 shipping alliances . Sharing agreement means participants shall input ships of similar capacity in the route. COSCON should share a part of the slot with other participants while other participants share some of the slot with COSCON. The benefit of VSA is to apply fewer ships on a route on the ship. Because of the alliance, it guarantees the ship's dispatch interval and use large container ship in VSA can greatly reduce the cost.

But VSA also has his shortcomings, the biggest difficulty lies in the wharf and port selection, such as terminal freight problem. As a ship company has cooperation with the port, but other shipping companies without preferential have to call in the port because the VSA alliance. It leads to the loss of other shipping companies. Another shortcoming is because the VSA ship should call in all the relevant port of the shipping company union, which led to the route too long, make the overtime in the shipping schedule.

(2)Replacement: changing small ship to big ship or big ship to small reasonably is capacity tighten. The larger the ship is, the lower the cost per unit is. so with the permission of the port conditions, try to use a larger ship to replace several small ships. A larger ship's capacity is equal to that of several small ships, larger ship's cost per unit is much cheaper than the small one. If the cargo volume is too few to fill the larger ship, we should use VSA to share the capacity in a route. If the volume is still too few, replace the big ship with small ship.

(3)Swap Slot: similar to VSA but still has some different, for the relevant ship company

has independent operation route, exchange slots on this basis. Eg: A and B have common intermediate ports and different starting port, A allows B load some containers on the ship of A to the intermediate ports. Meanwhile, B also has the same power. This method can help to reduce capacity.

(4)Slot Charter: when the existing route has to be removed, the shipping company has to perform the contract of the agreed containers by hiring slots of other companies in order to keep old customers. Once the market turn good and restore this line, these customers are likely to continue. But it also has risk that the customer may be poached by the leased liner companies.

(5) Ships being laid up: seal up the redundant ships which can be enabled at any time. But in this way its variable cost reduces greatly. Reducing supply when the supply exceeds demand can stable the freight.

(6)Engine Slow Down: Enable the idle capacity slowly, reduce costs by slow steaming. Slow steaming will result in the increase of sailing time, so it is necessary to put idle capacity into the route to maintain the original dispatch interval not be changed. But it also has a speed limit, slow down too much will damage the internal combustion engine hosts. So the owners added relevant terms in the hire contract recently in order to control the time charterer slow down excessively.

4.5 Conclusion

Southeast Asian countries are developing countries with the greatest potential. The trade volume is bound to rise year by year. Therefore COSCON must develop Southeast Asia routes, using their own advantages in reefer, putting more capacity in Southeast Asia area, digesting excess capacity caused by purchase surplus several years ago.

The deployment results basically conform to the principle of arranging larger ship by longer course. because the port charges, fees, the crew wages of big ship is similar to that of small ship, the capacity of it is much more than that of the small one. So the average cost of each box can be reduced a lot. What's more, if we combine the big ship and small ship in the same port can better cope with the volume change.

There are also some certain limitation in the research of fleet deployment in this paper. Because of missing data, this paper does not consider water depth, channel width of Southeast Asian ports. Thus we are unable to select which ship can be docked, which ships cannot dock in the given port. In addition, the loading and unloading efficiency are all calculated by 100TEU per hour, not make a difference calculation according to the different loading and unloading facilities, which also may have an impact on the results.

In addition, all of the fleet deployment is assumed with full load, but in actual process of loading the ship can't be completely filled, the volume is not completely consistent every weekly, There must be some cargo to surpass or shortage, The exceed part can not be completely carried away and still need to wait for the next ship .

Therefore, in the actual operation, changed dispatch interval according to the instant container volume change and the use fleet combination to control ship capacity of each freight.

Reference

http://www.cei.gov.cn/

http://ebusiness.coscon.com/wps/portal

http://www.chinaports.com/containerprice

http://www.ssefc.com/

[1] A N PERAKIS.D, I JARAMILLO,(1991),《Fleet deployment optimization for liner shipping Part 2. Implementation and Results》, Maritime Policy and Management,1991,18(4):235-262

[2] Anastassios N.& Nikiforos P,(1987) ,《Fleet deployment optimization models》Part1[J]. Maritime Policy and Management, 1987, 14(2):127-144.

[3] Powell B.J.& Perakis A.N.,(1997) ,《Fleet deployment optimization for liner shipping:an integer programming model》, Maritime Policy And Management,1997, 123(4):34-35

[4] LI Jia，XU Qi，YING XiangYu，LUAN WeiXin，(2010),《Optimization of fleet deployment based on bi-objective programming and genetic algorithm》， Journal of Dalian Maritime University, 2010, 36(4)

[5] Li Min，（2012），《RESEARCH ON SHIPPING ROUTE SCHEDULING FOR CONTAINER LINER UNDER EMERGENCY SITUATION》

[6] YANG Qiuping, XIE Xinlian, SU Chen,(2009),《Model of Ship Routing and Fleet Planning and Its Algorithm》, Journal of Shanghai Maritime University,2009；32（1）

[7] YANG Qiuping, XIE Xinlian, SU Chen,(2010),《Fleet planning model based on multi-type of investment》Journal of Shanghai Maritime University,2010,31(1)

[8]TU Qun-feng，BAI Ji-ping（2007），《Liner Routing Design Based on MATLAB》，JOURNAL OF ZHEJIANG INSTITUTE OF COMMUNICATIONS，2007，8（4）

《Global Shipping Route Chart》&《Shipping Route System Planning And Ship Distribution》

[9]ZHANG Weiying, LIN Yan, Ji Zhuoshang, SUN Wenzhi ,YU Baochu，（2008），《Optimum model and algorithm of containership′s pre-stowage planning in full

routes》，Journal of Dalian University of Technology，2008.48（5）

[10] ZhaoGang .（1996），《International shipping management》

[11]ChengBing.（2005），《Research On Liner Fleet Deployment Optimization of COSCON》 ，Chinese Library Classification：F55

[12] Zhong Peng.《Linear Programming in Fleet Configuration Application》

[13]Zhang HaiJian.(2007)《Research of Fleet Management in Liner Shipping Company》

[14]Chen Ai Guo,(2010), Research on the Key Factors for LCL in the Perspective of Analytic Hierarchy Process----Based on a Survey of China Shipping Logistics》 ，

[15]JIN Yan, CHEN Shun-huai, WANG Li-zheng(2006),《Application of M ATLAB in ship routing》,Coastal Engineering,2006.5

[16]XU Tian-fang, HU Li-na，（2000）《Research on Assignment of Domestic Liners》,Journal of Dalian Maritime University,2000.26（2）

[17]QI Bin,(2003),《Research on Optimization deployment of Shanghai Yangtze River Electric-Coal Transportation System》, Shipping Management,2003.10

[18]Han Zunliang ,(2009),《The Pricing Strategy of The International Container Liner Transportation Enterprise Based on the Competitive Game》，Port Economy,2009(1)

[19]CHEN Kang, YANG Zhong-zhen ,(2011),《Optimization Model of Short-distance Liner Ship Route based on Tri-partite Game》，Journal of Traffic and Transportation Engineering,2011.11(6)

[20]SHI Dongmei,(2010), 《Research on Optimization About Ship Assignment By China—South Korea route For K Shipping Co. Ltd》, Journal of Dalian Maritime University

[21]ZHANG Yisheng, LIU Fei,(2006), 《Stochastic dynamic programming model of route optimization》, Mathematics in Practice and Theory, 2006.2（36）

[22]PENG Geng, LIU Fang,《A Review of the Research on the Measurement of Industrial Agglomeration Degree》，(2010.3) Business School, Jishou University, Jishou 416000, China