8-30-2008

The cost analysis of liner shipping business

Yue Huang

WORLD MARITIME UNIVERSITY

Shanghai, China

THE COST ANALYSIS OF LINER SHIPPING BUSINESS

By

Huang Yue

China

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

MASTER OF SCIENCE

In

INTERNATIONAL TRANSPORT AND LOGISTICS

2008

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.

Supervised by

Professor Zou Junshan

Shanghai Maritime University

Assessor

World Maritime University

Co-Assessor

Shanghai Maritime University

Acknowledgement

I am thankful to World Maritime University and Shanghai Maritime University for providing me with the precious opportunity to study in this program.

I am profoundly grateful to my supervisor Professor Zou Junshan for guiding me through this dissertation and providing me with invaluable advice and insight into the subject matter.

I am also thankful to the whole faculty, especially to Mr. Ma Shuo, Mr. Shi Xin, Mr. Xu Dazhen, Mr Liu Tongan, Ms. Zhou Yingchun, and Ms Huang Yin, who have made great effort to ensure the superior quality of the program. And I am grateful to all the overseas professors who traveled a long way to China to share their profound knowledge and creative ideas with us.

Sincerely thanks to my friends for helping me during the studies.

Last but not least, I wish to extend my indebtedness to my beloved parents, who offered me full support and encouragement during the past two years studies in Shanghai.

Abstract

The cost control issue has been one of the core tasks for shipping lines since long time ago, while along with the booming of world economies and trends of globalize trade, it has becoming of more importance. And under this situation, the cost reducing thought is impossible, the only way left to shipping lines is to control the cost increasing ratio or cover the cost by rationalized strategies..

This paper has dealt with different measures to control the cost increase problem facing by shipping lines. With the starting point of the analysis on some main cost items basing on their proportions on the total cost, namely fuel cost, port cost, stevedoring cost and land transport cost, and their influential factors under current globalize situations, this paper then concludes some comprehensive measures by four categories, namely deployment, management, procurement and cooperation from a macroscopic point of view, these described measures are not only according to these listed main cost items but also other important factors, specific cases according to each solution are illustrated so as to make the introduction more clearly.

KEYWORDS: Liner shipping business, Cost control, Case study

Table of content

List of Tables

List of Figures

List of Abbreviations

APL	American President Lines
COSCO	China Ocean Shipping (Group) Company
CSCL	China Shipping Container Lines
EDI	Electronic Data Interchange
EMC	Evergreen Marine Corp. Ltd
FEU	Fourty-foot Equivalent Unit
GA	Grand Alliance
GDP	Gross Domestic Product
GIS	Geographical Information System
GPS	Navigation Satellite Timing and Ranging/Global Positioning System.
GSM	The Global System for Mobile Communications
HMM	Hyundai Merchant Marine CO.,LTD
IP problem	Integer Irogramming Iroblem
ISO	International Standard Organization
MIS	Management Information System
MISC	Malaysia International Shipping CORP.
MOL	Mitsui O.S.K. Lines
MSC	Mediterranean Shipping Company
MSL	Maersk Shipping Co,.Ltd
NYK	Nippon Yusen Kaisha Line Ltd
OOCL	Orient Overseas Container Lines Ltd.
OPEC	Organization of Petroleum Exporting Countries
PIL	Pacific International Lines
RFID	Radio Frequency Identification
TEU	Twenty-foot Equivalent Unit
UASC	United Arab Shipping Co.
YML	Yang Ming Marine Transport Corp
ZIM	ZIM Israel Navigation Co

Chapter 1 Introduction

1.1 Background and objective of this study

Globalization has made economy change from full regional coverage to focus global coverage and more integrated. Over the past 20 years, with the booming of international trade, the maritime transport business developed rapidly, liner shipping is well aware of the growing importance of global business networks.

About 90% of the world total trades of goods are moved by sea when measured in tons, while only about 40% of world total trade is moved by sea in value terms. The demand of world container shipping has a strong positive relationship with world economy and trade situations. It can be seen from table 1 that, along with each one percent increase of world economy (GDP), there will be an increase of 1,6 percent of world maritime transport volume, and the container shipping volume will increase by more than 2 percent. In the year 2003, world maritime container transport volume is 84 million TEU, with an increase of 10.5 percent compare to 2002; in 2004, the volume came to 96 million TEU, with a ratio of 14.3 percent compare to 2003; and it was over 100 million by 10.8 percent increase.

Table 1.1 The relationship between world economy increase and world maritime container transport demand

YEAR	GDP Growth (%)	Container Transport Volume Growth (%)	Container Growth VS GDP Growth (%)
2003	3.9	10.5	2.69
2004	5.1	14.3	2.80
2005	4.3	10.8	2.51
2006	5.1	11.5	2.25
2007	4.9	13.6	2.78

Source: www.jctrans.com

Under the driven of world economy increase, the general situation of liner industry moves toward a positive direction. Figure 1 shows the container transport volume changes in Atlantic line from 1995 to 2007. From this figure, it can be clear that though there was a little fluctuation during 2000 to 2007, the total container transport volume still shows a trend of increase.

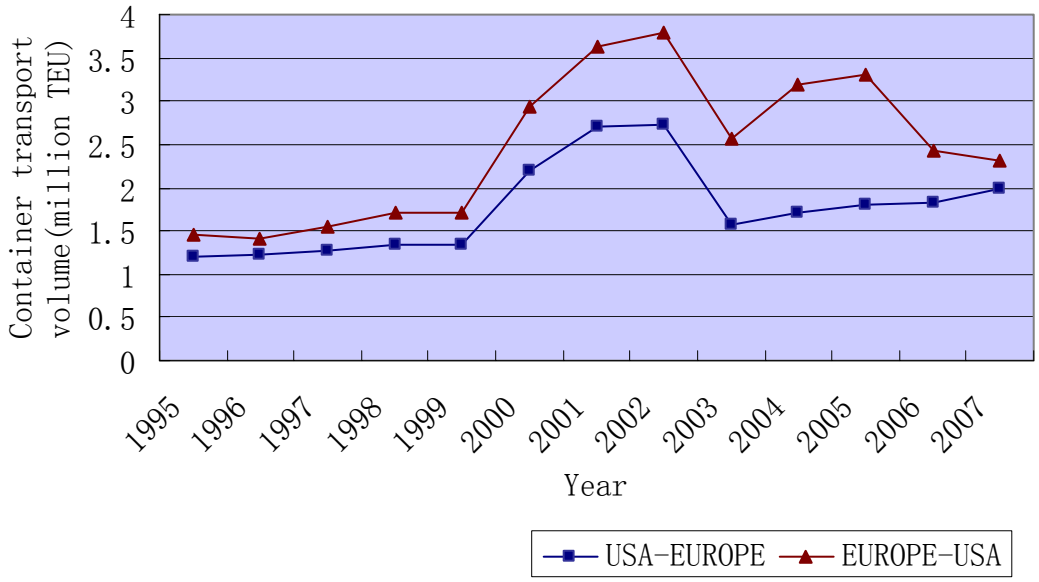

Figure 1.1 The container transport volume changes in Atlantic line from 1995 to 2007

Source: Review of Maritime Transport 1995-2007

And along with the increase of container transport volume, liner companies keep contributing their fleet to increase their transport capability. Figure 2 shows the growth of Atlantic line container transport capability.

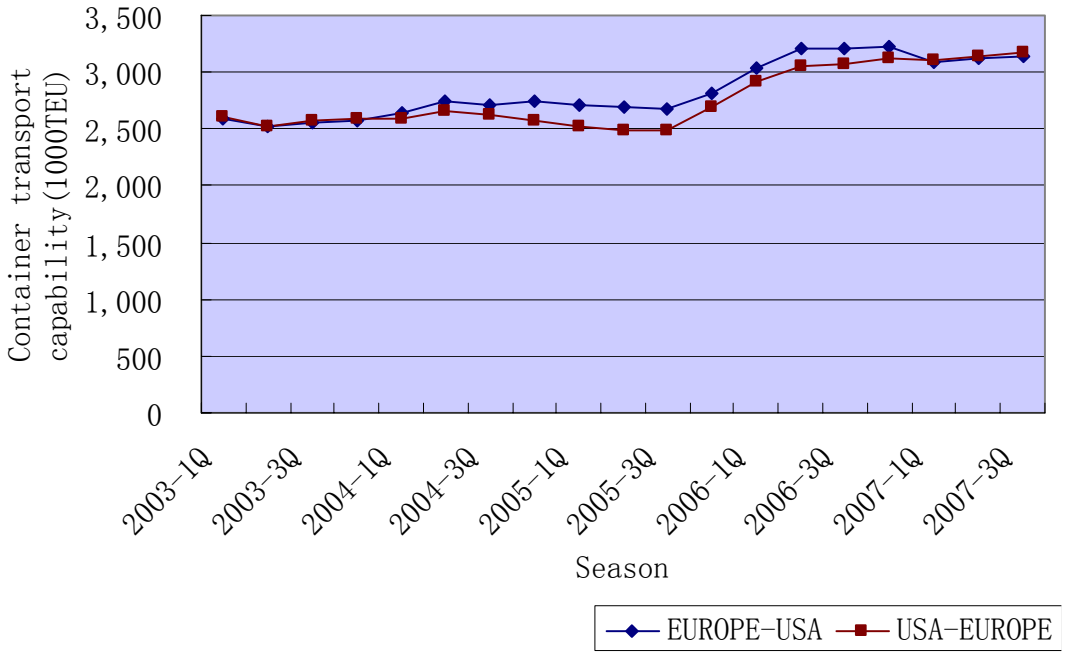

Figure 1.2 The growth of Atlantic line container transport capability

Source: Drewry Seasonal Report

From the information all above, one general conclusion can be made as: along with the growth of world economy and maritime businesses, the competition between liner shipping companies becomes even more serious.

In order to maintain their market shares, shipping lines have to try their best to provide optimal services to customers within limited revenue margin. However, because of the inflation in recent decades, the skyrocketing of the crude oil price and other influential factors, it has become more and more difficult for shipping lines to find balance in costs, price and services.

Under this situation, after generally analysis some main cost items of liner shipping industry, this paper introduces some measures to control the increasing costs, but not simply reduce them, for under the trend of world economic booming, it is impossible to simply reduce the cost and meanwhile maintain the service level. The introductions of each method are illustrated from a macroscopic point of view, since specific situations for each liner shipping companies are of variety while the general

problems facing by them are of similarity. Specific cases according to each solution are illustrated as well.

1.2 Approach and structure of this paper

The booming of world maritime market makes itself moving to a more effective and efficient way via technology development. While the development of world economic makes the competition within or around the marine industry more fierce, and energy crisis has become a serious problem for many industries especially for transportation industry. Under such conditions, the cost problem has become harder and harder to settle. Presently, the cost management is vital for the shipping companies, while it is impossible to reduce the cost, the only way left to control it. The controlling method can be of two ways, cover the cost by other profit or make some progress to fight against the cost increase.

On the base of introducing the general environment of the world wide economic and marine market, this paper describe and analyze the cost items and their influential factor, then classified the cost covering and overcoming methods into four categories, namely measures on deployment, management, procurement, and cooperation, and then gives brief introductions on each methods on both positive and negative sides, and trade-off within each of them.

The first chapter gives some introduction on the back ground of the world trade market developments, together with the development of world maritime industry, as well as the threat facing by liner shipping companies, and then introduces the approach and structure of this paper.

The second chapter reviews the related studies and researches of liner shipping business.

In the third chapter, after a brief introduction of relevant cost items of liner companies, as ship cost, container cost, stevedoring cost and inland transportation cost, as well as administration cost, some main cost items that should be taken

considerations by liner companies for their cost control are picked up for further analysis, as fuel cost, port cost, stevedoring cost and land cost, then some influential factors related to cost increase are illustrated.

The fourth chapter introduces some measures against cost increase from three aspects: measures on deployment, in the form of rationalize shipping routes and economies of scale in large containerships; measures on management, in the form of utilization of information management system, manning cost management; measures on procurement, in the form of port investment, land logistics cost control by intermodal transportation, bunker future market investment and ship leasing.

The fifth chapter introduces the cost management measure by cooperation between maritime companies in forms of strategic alliances, slot charter, slot co-charter and vessel sharing agreement.

And the last chapter draws a general conclusion for the whole paper.

Chapter 2 Review of related studies and researches of liner shipping business

Relative studies and researches relating to the cost management of liner shipping business illustrated are divided into four categories, being studies on deployment, management, procurement and cooperation between maritime companies, in the form of deciding optimal route, economy of scale in vessel size, influence of information management system, stevedoring management, intermodal transportation and strategic alliance evaluation.

Deciding optimal routes for liner shipping companies are very important. In the research of 'Deciding an optimal route in a liner shipping problem' a real liner shipping problem of deciding optimal weekly routes for a given fleet of ships is considered and a solution method for solving the problem is proposed. During this research, all feasible routes for each ship are generated together with the cost and the duration for each route. The routes are given as input to an integer programming (IP) problem. By solving the IP problem, routes for each ship are selected such that total transportation costs are minimized and the demand at each port is satisfied. The real liner shipping problem is solved together with four randomly generated test problems. The computational results show that proposed solution method is suitable for designing optimal routes in several liner shipping problems.

In recent years, liner shipping has experienced an explosion in containership size. This is explained as the economy of scale in utilizing such ships and is a paper presents a model which quantities the economies of scale in operating large containerships. A sensitivity analysis is conducted to test the effect of various input scenarios and the results analyzed to determine optimal vessel size with respect to different operational scenarios. Inferences are then drawn concerning the optimal deployment of the existing feet of large containerships, as future trends in containership size and deployment and the impacts these trends will have upon

container operations, logistical systems and ports.

The utilization of information systems has been a feature of maritime industry in recent decades. The research of ‘Powerful triangle of marketing data-decision-support’ conceptualizes the impact of information technology on marketing decision-making. It is described in the research that decision-makers now have the availability and accessibility of more and better data because of the globalization, however, more data will not unconditionally lead to better decisions; data explosions have both benefits and costs. They are beneficial for marketers who are able to derive insights from these data and who are not vulnerable to decision biases. However, marketers without these capacities can also benefit from more data if they are equipped with the right type(s) of marketing management support system(s) marketers. Marketing management support systems can be effective both by reinforcing strengths of marketers and by compensating for their weaknesses.

The relationships with stevedore companies cannot be neglected by shipping companies, for the stevedoring cost take an important part in their total costs. There is an article focuses on vertical integration between global carriers and terminal operators. The researchers address two key current issues: 1. dedicated terminals as a strategy for cutting costs and controlling integrated transport chains; 2. the struggle for supply chain control, involving global carriers versus global terminal operators, driven by financial power and technical and managerial capability. Then they close analyzing one of the core problems of the market, namely the evolving role of the dedicated terminals. For the pure stevedores they represent an opportunity to secure a cargo, while in the hands of the liners they enable cost stability and the possibility to put pressure on pure terminal operators.

Because of its importance, another research also focus on the relationship between carrier and stevedore, according to this research, strategic directions of liner market include the pursuit of economies of scale and the supply of services using faster vessels in order to offer either new services or additional loops (scope). The stevedoring industries exploited the worldwide process of privatization or

liberalization, which has led to an increasingly aggressive and internationally oriented involvement of private companies. The evolution of the two industries is highly correlated. Shippers required higher operational flexibility together with wider geographical coverage as well as considerable financial resources. The stevedoring market is facing a more competitive environment: the trade-off between flexibility and firm size, involving economies of scale but also managerial complexity, is becoming a critical factor.

As one of the vital cost player in marine industry namely land transport, studies of modal transport (overland versus maritime) and their differential characteristics are of relevant interest for maritime economists and are taken into account in economic policy-making. A research used regression model to analysis the impact of transport costs on international trade. The researchers choose a port in Span to do the research. The results show that higher distance and poor partner infrastructure lead to a notable increase in transport costs. There are some other issues that affecting transportation cost, including environmental issues, customer and cargo security, and carrier safety.

Besides of many other methods that used for cost control, cooperation between shipping companies shows its specific advantages as well. After considering the key profiles of strategic alliances in liner shipping, the article of ‘A critical evaluation of strategic alliances in liner shipping’ argues that their current structure may prove inherently inadequate to deliver an acceptable level of stability. The main factors driving such instability can be found in the increased organizational complexity of the alliance as well as in the establishment of a certain degree of intra-alliance competition, whose effects are likely to undermine the level of mutual trust between partner companies. Causes and effects of such factors are investigated and some measures aimed at controlling alliance instability are also suggested.

Chapter 3 Cost items and their influential factors

3.1 Relevant cost items of liner companies

Because the features of the transport service provided by liner shipping companies are fixed sailing schedules, fixed ports of call, named vessels, and in most cases fixed freight, the main costs for container liner shipping could be classified as ship cost, container cost, stevedoring cost and administration cost, by its origins and destinations.

Table 2 illustrates the classification of cost of liner shipping companies and major items each includes, as well as the proportion each takes on the total cost.

Table 3.1 classification of total cost of liner companies

Cost classification	Major cost items	Proportion of the total cost estimated
1. Ship Cost	Depreciation cost, fuel cost, port cost, husbanding cost, ship maintenance cost, etc	30%~40%
2.Container Cost	Capital cost, rent of container, maintenance and repair cost, empty container repositioning cost	15%~20%
3.Stevedoring Cost and Inland Transportation Cost	Stevedoring cost, inland transportation cost, cargo counterclaim	40%~50%
4.Administration Cost	Staff wages and welfare, management costs, etc	5%~10%

Source: Martin Stopford. (1997). *Maritime Economics.* Routledge

From the table above, it can be known that among total cost, stevedoring cost and ship cost weight larger, together accounted for about 70%~80%, specifically, capital cost of both vessels and containers, fuel cost, port cost, stevedoring cost, inland transport cost and container repositioning cost consist of the key indicators of total cost of liner transportation. So the main items chosen to be analyzed in this paper are fuel cost, port cost, stevedoring cost and inland transportation cost.

3.2 Influential factors of main cost items

3.2.1 Fuel cost

The oil-based marine fuels are generally referred to as bunkers[1]. Bunkers are one of the biggest items of a ship's total cost. Their proportion can typically be in the region of 40 % to 60% depending on specific voyages and the fuel price at the time.

Fuel costs consist of two parts, as bunker costs and surcharges. Bunker costs refer to the price of the oil, which can be influenced by politics, war, economy, natural disaster, and activities of Organization of Petroleum Exporting Countries. Surcharges include carriages, call-back pays on holidays and at night, stand-by charges, and some other costs. Carriage is generally calculated by tonnage. The holidays are for the local holidays of the port arrived, the call-back pays are notified to shipowners by local oil suppliers in advance. Stand-by charge is required when the vessel does not arrive at the appointed place within the set time period and makes tank ship waiting; generally it is charged by hour. In a general way, the quoted price by oil suppliers only refers to oil price, and some other surcharges are calculated after their occurred.

Generally, influential factor of fuel cost for liner shipping companies can be as follows:

1 Ma Shuo, (2005), Maritime Economics, Unpublished lecture handout, World Maritime University, Malmo, Sweden, PP91

1. The cost of bunkers depends directly on international oil market. Figue3 shows a trend of oil price in Singapore. From this figure, it can be clear that the fuel price rise dramatically within these years, which had been big problems to shipping lines on the cost control.

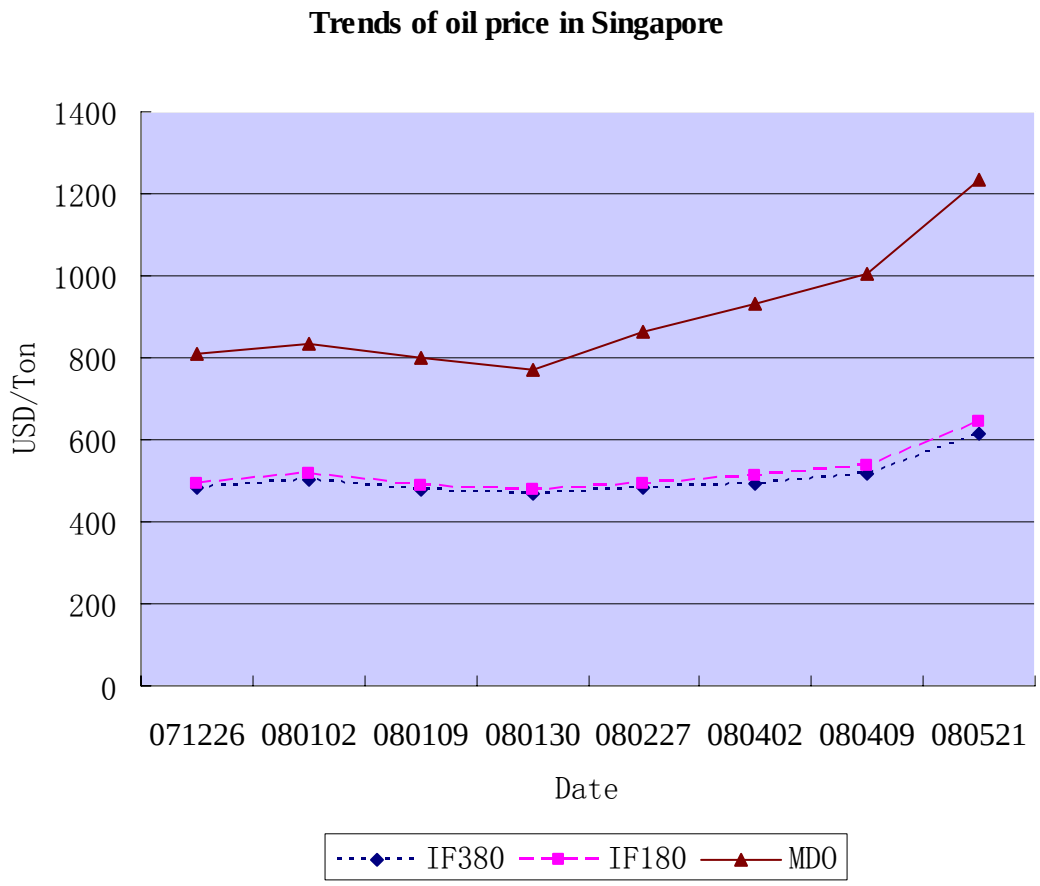

Figure 3.1 Trends of oil price in Singapore

Source: www.jctrans.com

2. However, bunker's prices are of difference in various ports influenced by factors such as local demand, refining capacity and competition between suppliers. It is not uncommon that the price differences are as high as 50 % for the same type and amount of fuel at the same time but from different places which can be seen from Table 3 which illustrates oil prices at word main ports. Generally, marine bunkering services are provided by four types of suppliers: big multinational oil

corporations, national oil companies, trading companies and bunker agents[2]. The big multinational oil corporations used to dominate the market in the past, but their part decreased due to economic control by government, it is now closed to about one third of the total market. The market share of state-owned national companies has been growing steadily.

Table 3.2 Oil prices at word main ports, 2008 04 09

Place	IF380	IF180	MDO
Japan	600-602	611-613	889-891
Singapore	517-518	537.5-539.5	1006-1008
Korea	569-570	603-604	994-996
Hong Kong	539-541	549-551	1002-1004
Sydney	NA-NA	618-620	1066-1068
Melbourne	615-617	618-620	1066-1068
Rotterdam	494-498	532-536	945-950
Antwerp	489-494	525-530	915-920
Hamburg	492-495	520-525	930-935
Malta	512-514	539-541	1029-1031
Istanbul	510-515	553-555	1075-1080
Port Suez	507-509	532-535	955-958
Dakar	NA-NA	NA-NA	1035-1090
Kuwait	509-510	523-525	980-982
New York	501-505	564-565	1025-1030
Philadelphia	509-511	539-540	1025-1030
Houston	492-495	530-535	1015-1020
New Orleans	500-502	516-518	1019-1021
Los Angeles	525-534	539-541	1050-1055

Source: Marine Transport

3. Vessels' sailing speed often has intensive relationship with fuel cost since high

2 Ma Shuo, (2005), Maritime Economics, Unpublished lecture handout, World Maritime University, Malmo, Sweden, PP92

sailing speed leads to high fuel consumption. Figure 4 shows an example curve of daily fuel consumption for four types of container ships at different service speeds; as the fuel consumption of vessels is the cube of the sailing speed, it can be clear from this curve that the higher the sailing speed is, the more consumption of fuel occurs. The keeping increasing price of fuels from 2007 has become a great problem to some shipping companies to maintain their service standards. With high proportion of fuel cost in total cost, ship operators are always trying to find the optimal speed. So it is mainly an issue of making a trade-off between reduced bunker consumption and loss of time.

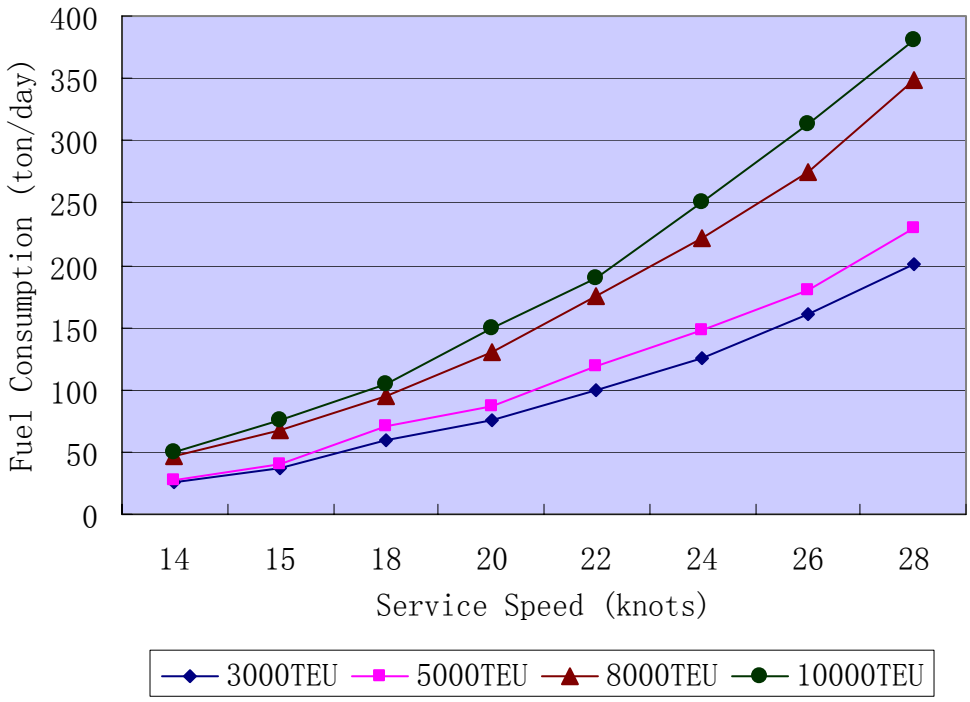

Figure 3.2 An example curve of daily fuel consumption for four types of container ships at different service speeds

Source: Theo Notteboom. (2006). *Liner shipping economics*, Unpublished lecture handout, World Maritime University, Malmo, Sweden

4. The fuel consumption of vessels varies enormously according to the efficiency of vessels' engines. Newly built vessels are in general equipped with more efficient engines with low fuel consumption and thus more economical to operate.

Moreover, further advances in technology could lead engines being more efficient than the old generations. Table 4 demonstrates this big difference in efficiency between ships built in the 1970's and those built in the 1990's. From this table, the recently built vessels have much higher engine efficiencies than the 1970 built ones, and the efficiency gap could even as much as 47 percent.

Table 3.3 Representative fuel consumption for selected vessels

	Tons of hfo/day (at 14 k)	**Efficiency improvement (compared with 1970)**
Recently built 120,000 bulk carrier	39	34%
1970's built 120,000 bulk carrier	59	
Recently built Panamax	30	44%
1970's built Panamax	54	
Recently built Handymax	18	47%
1970's built Handymax	34	

Source: Theo Notteboom. (2006). *Liner shipping economics*, Unpublished lecture handout, World Maritime University, Malmo, Sweden

5. The variety of vessel types also leads to the variation of the consumption of fuel. Figure 5 illustrates the fuel costs for three types of container vessels and different service speeds (TEU per day) at end July 2006 bunker prices. Under the same service speed, for example 14 knot, a 12000TEU vessel consumes fuel of 20,700 USD, while the 8000 TEU and 5000 TEU vessels' fuel cost is 16,000 USD and 12,200 USD each. And vessels that use their own gears or other equipments at ports consume more than vessels that do not use them.

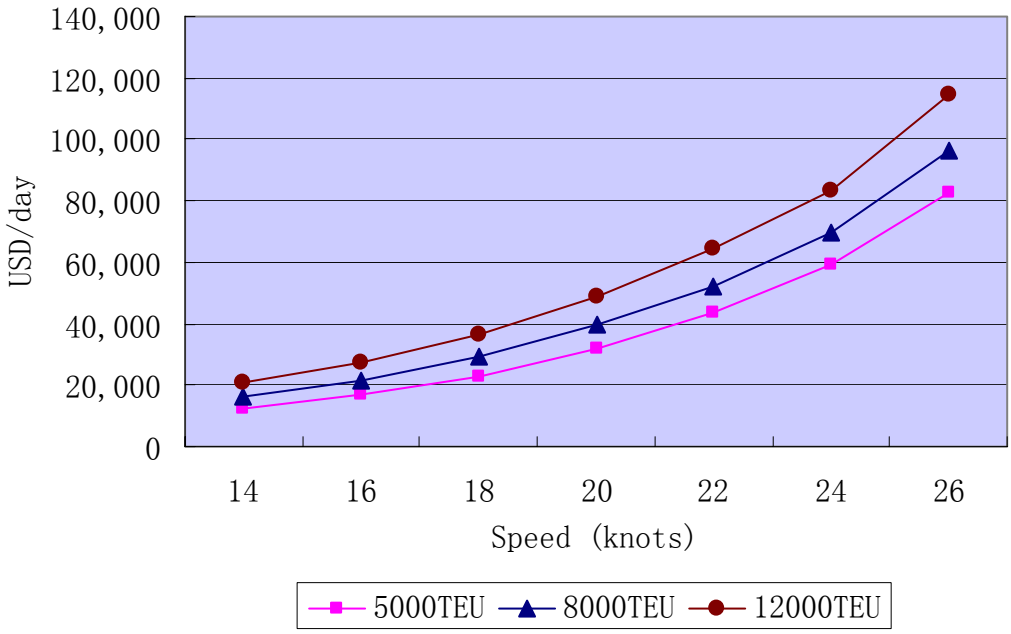

Figure 3.3 Fuel costs for three types of container vessels and different service speeds (TEU per day) at end July 2006 bunker prices
Source: Germanischer Lloyd

3.2.2 Port cost

Port costs constitute an important part of ship's voyage costs, about 50% of variable cost. These costs can be classified into costs incurred by the vessel itself and cargo handling, they are identified as ship related costs, cargo related cost, and other costs. These costs vary dramatically from one port to another.

Ship related costs in a port include pilot fees, towage, berthage, mooring and unmooring charge, harbor dues, light dues, berthing fee (dockage and anchorage included), line handling charges, quarantine, cost for disposal of slops and waste oil, and other charges. Cargo related costs include container loading and discharging cost. Canal dues can also be classified in the category of port cost, though they are paid exclusively. The canal charges are paid based on particular tonnage measurement standards set up by the canal authorities.

Port charges are items over which ship-owners have less control since they vary considerably around the word. Table 5 illustrates the port cost index in the 36 main

ports in the world. From this table, the highest port cost with an index of 194 which is Rotterdam in Netherlands compare with the lowest cost index of 33 which is Penang in Malaysia results a proportion of about 6 times. Even in the same country or same area, port cost can be of difference.

Factors related to port cost are as the rationalization of shipping routes, as well as port-call decisions, since the competition between neighborhood ports and the different handling equipment levels of the ports would lead to different port costs

Another factor could be fleet vessels' DWT for port charges are generally levied on the base of ships' tonnage, the additional element of economics of scale is introduced for the port cost per TEU reduces as the ship gets bigger.

Table 3.4 The port cost index in the 36 main ports in the world.

Port	Cost Index	Port	Cost Index	Port	Cost Index
Penang	33	Seattle	79	Norfolk	106
Burnie	35	Fremantle	82	Yokohama	111
Lyttelton	40	Los Angeles	89	Oakland	113
Singapore	47	La Spezia	90	Keelung	115
Wellington	49	Kaohsiung	77	Nagoya	117
Auckland	59	Adelaide	99	New York	118
Busan	62	Melbourne	100	Hongkong	118
Jakarta	65	Shimizu	104	Osaka	122
Savannah	74	Brisbane	104	Le Havre	130
Barcelona	75	Yokkaichi	105	Marseilles	144
Port Chalmers	75	Sydney	106	Portland	166
Rotterdam	194	Hakata	106	Hamburg	174

Source: www.jctrans.com

3.2.3 Stevedoring cost

Stevedoring costs refer to container handling cost, stevedoring, tallying charges,

machinery charge, tax dues, stand by fee, pays for winchman, watchman and foreman, special handling charges, storage cost, and a allowance for the cost of any claims that may arise. These charges are calculated on the base of the specification or quantity of the containers, as well as taken times such as days for hiring machinery, stand by and storages. Table 3.5 listed the stevedoring costs on Lianyungang port in China.

Table 3.5 Stevedoring cost on Lianyungang port

Unit: RMB per box

Container Type		Loading/Unloading Fee	Transit Fee
TEU	General cargo box	425.5	659.5
	Empty box	294.1	503
	Dangerous cargo box	467.9	725.2
	Heavy reefer box	467.9	725.2
	Empty reefer box	324.1	502.4
FEU	General cargo box	638.3	1000.2
	Empty box	441.1	768.6
	Dangerous cargo box	702	1088.2
	Heavy reefer box	702	1088.2
	Empty reefer box	486.1	753.4

Source: www.jctrans.com

Influential factors for stevedoring cost can be classified into structure investment factor and management factor. Though the differences of structure and machinery construction level, and labor price make the stevedoring charges vary around the world, the variety of stevedoring process and management level among ports are of significance when contribute to the price gap.

1. Capital investment gaps. Containers are handled and transmitted by large scale machinery. The developed industry countries have technical and monetary advantages in investing the latest handling and stevedoring machinery, but the capital investment in purchasing such large machinery, as well as the higher expenses on spare parts storage, machinery maintenance, transportation and insurance than developed countries, raises the running expenses of ports much higher for some developing countries. While labor cost in some developing countries are much lower than developed countries which provide a little

trade-off for the high machinery cost.

2. Operating process and management level differences. Though terminal operators pay much attention on equipping the machinery and infrastructure and there are general standards made by ISO for containers which make it much convenient for the design and communication of handling programs among countries, the actual conditions for operating and process design, as well as management level of the port between countries represented by operating efficiency and expenditure have been considerably gaps on the pricing problems. Highly efficient operating and managing process would lead to low cost and high service efficiency, while the lower ones would expense more, which cause the price gaps around the stevedoring industry.

3.2.4 Land cost

Hinterland transport costs are consisted by the costs of inland transportation, loading and unloading, inland container yard costs and some empty container repositioning cost. Since liner companies is expanding their services from sea transport only to wider areas such as hinterland transport, then inland transportation costs compose a significant part in the total transportation cost of liner companies, generally a ratio of 30%. The forms for inland transport include air, rail, road and barge and the costs are influenced by transitions of modes of containers.

There are three factors relate to inland transport cost, namely transport scale, distance and ratio of carriage.

1. Transport scale. The transport scale will have direct influence on the cost of the transport company. Generally, costs are divided into fixed cost and variable cost, the more one produces the cheaper the unit cost will be, as the fixed cost do not increase. Such effect that reflects the positive relationship between scope of the enterprise and operating cost is called economic of scale. While diseconomy of scale is along to the increasing of the production scale, the unit cost also increase.

As for transportation industry, large conveyances would have cost advantages than general ones, as well as large transport companies would take advantages in cost competition.

2. Transport distance. Each transport modal has its own optimal transport distance. Generally, air and sea transport are suitable for long distance transport; rail and barge are for mid-long distance; while road transport has advantage in short distance transport. Within rational transport distance ranges for each transport modal, the longer distance the cheaper it will be for each ton-kilometer. As for shipping companies who expand their business to inland transport services, the distance issue is of two parts, one is to choose a suitable transport modal or an integration of the modals to optimal their inland transportation cost, another is to rationalize their cargo structure between seashore and inland, because no matter how optimal the transport modal they integrated and how economic of scale it will be, the transport cost of the cargo from a far inland place is much higher than the cost of seashore ones. Figure 6 shows the cost structure of unimodal road haulage versus rail and multimodal transport. From this figure, it can be clear that road transit cost is lower than intermodal transport within a limited distance; while along with the distance increase intermodal transport shows its advance in cost expenditure.

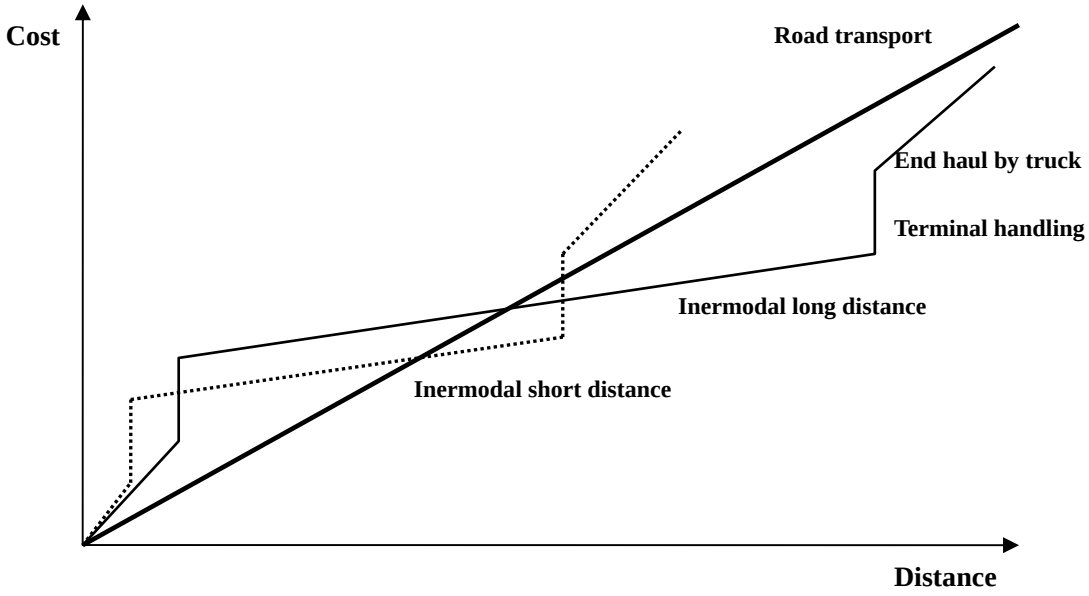

Figure 3.4 Cost structure of unimodal road haulage versus rail and multimodal transport

Source: Konings. Integrated centers for transshipment

3. Ratio of carriage. The ratio of carriage includes loading density and transport density. Loading density is the ratio of actual load and rating load. Under the condition of fixed distance and transport density, the transport cost will decrease along with the increase of the loading density. While there is not enough cargo to load, the cost issue can be settled by increased transport density. Trade-off should be considered between carriage ratio and total cost.

Chapter 4 Measures against cost increase

4.1 Introductions

The former chapters describe some main cost items in liner shipping business and their influential factors accordingly, while this chapter and the next chapter illustrate some solutions to control the increasing of these costs. Details of these solutions are introduced with the considerations of not only the advantages but also their inconsistencies, and during the introduction of these methods specific cases are illustrated accordingly as well.

4.2 Measures on deployment

4.2.1 Rationalize shipping routes

Significant savings can be achieved with efficient fleet routing and scheduling for the market situation plays an important role in shipping lines' profit, as well as cost.

Before an operator can start with the actual design of a regular container liner service he should assess the market to be served and the distribution of service demand. The variables need to be considered include the number and dispersion of final destinations, the density of cargo flows to/from these inland destinations and the existence of trade imbalances. The imbalance of cargo flows between two sides of a designed route would cause high costs on container reposition. The strategic decision that made by OOCL to take the Inside-Asia route and Pacific route as their key developing routes is on the base of the great potential of economic development of these two areas. Table 7 show the imbalance of the trade between Atlantic lines vie the space utilization ratio. In the past, the routing strategies were made by decision makers mainly by their past experience. However, with the expansion of the companies, decision makers need to consider more complex factors which make the

decision making process become harder. Fortunately, with the development of computer software technology, establishing a mathematical optimization models via related software can be of a great help for making route decisions.

Table 4.1 The space utilization ratio of Atlantic line

Year	USA-EUROPE	EUROPE-USA
2001	85.90%	58.60%
2002	88.50%	58.50%
2003	85.90%	61.80%
2004	87.80%	66.50%
2005	88.90%	72.10%
2006	81%	63.50%
2007	74.30%	63.40%

Source: Drewry

There are three highly interrelated key decisions for service planners to put into considerations when scheduling shipping routes, being the service frequency, fleet size, vessel size and fleet mix, and the number of port calls.

Usually, Weekly call is required on major routes; and Weekly call, but sometimes one calls every two weeks on secondary routes, because marginal utility to customer reduces when frequency is very high, and the trade-off between operating costs and customer focus must be considered by the planner. The high frequency of a port relates to different shipping lines, not only one shipping line.

The fleet size to be deployed depends on the time needed for roundtrip and desired frequency. More vessels are needed in order to maintain weekly frequency on long distance route than short one. But in a desired route, the size of the fleet can be influenced by other issues such as sailing speed, vessel size and port time. Sailing speed often depends on fuel cost since high sailing speed leads to high fuel consumption. Figure 7 shows an example curve of daily fuel consumption vs. vessel speed. It can be clear from this curve, it can be seen that fuel consumption increase along with the raising of the sailing speed. The trend of growing vessel size is

another issue that influences the fleet size, because the bigger the vessel is, the longer port time it takes, which would extend the time need for roundtrip. As a result, some shipping lines have reduced their sailing speed to 20-21 knots to save bunkers or increased number of vessels on the route services, for example, the typically number of vessels on Europe – Far East had increased from 8 to 9 in order to maintain a weekly call.

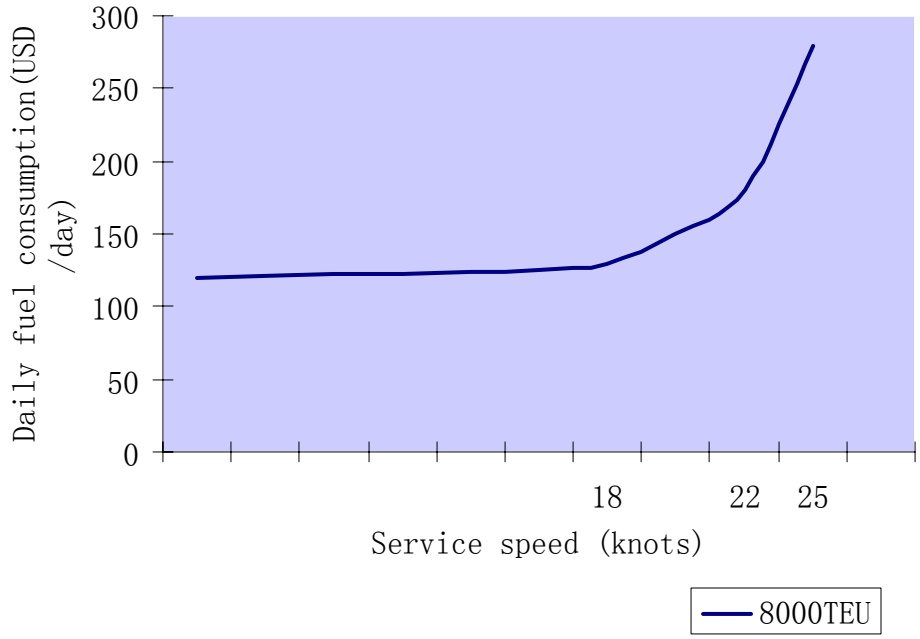

Figure 4.1 An example curve of daily fuel consumption vs. vessel speed

Source: Theo Notteboom. (2006). *Liner shipping economics*, Unpublished lecture handout, World Maritime University, Malmo, Sweden

Number of port calls is one of the key factors that influence the roundtrip time, as well as the business strategies. Multi-porting could make shipping companies get closer to the markets and the customers which could increase business opportunities in the areas, and could make their transport distances shorter. While on the other hand, multi-porting would lead to smaller bargaining power vis-à-vis ports and would increase additional costs for stowage and re-handles to shipping company. Moreover shipping companies would have less opportunity to benefit from economic of scale in hinterland transport because of multi-porting. So the decision of port call

should make under the consideration of the trade-off between marginal costs.

4.2.2 Economies of scale in large containerships

Liner companies can achieve economy of scale by configuring high capacity vessels, because though larger vessel leads to higher total cost, the volume of containers taken by the vessel would increase as well, which lead to even lower unit cost per TEU. For example, the unit cost of an 8000 TEU new-built vessel can be lower than a 5000 TEU vessel for about 5% to 10%. Table 8 shows the operational cost of container vessels. From this table, it can be seen that along with the growth of the carrying capacity of containerships, though each cost item has raised, the unit cost decrease. Another benefit for large vessels is that large ships are much more environmental friendly than small ones because unit pollution caused by large ship when fully loaded is much lower than small ship.

Table 4.2 the operational cost of container vessels.

Cost item	**4000TEU**	**6000TEU**	**10000TEU**
Manning	850	850	850
Repair and maintenance	900	1025	1150
Insurance	800	1000	1700
Stores and lubes	250	300	350
Administration	175	175	175
Fuel	4284	5772	7269
Port charges	2000	2700	3000
Total operational cost	9259	11822	14494
Cost/Slot/annum	2315	1970	1449

Source: Theo Notteboom. (2006). *Economies of scale in vessel size*, Unpublished lecture handout, World Maritime University, Malmo, Sweden.

However comparing with the advanced economy of scale the large vessels have, there are many other issues need to be considered.

Though there are not many technology difficulties in building ever larger vessels for shipyards, the limitation of container ships' carrying capacity does not lie on the engineering level, but the infrastructure level on shore. Presently, the shipyard is fully capable of building Malacca size ship of 18000 TEU; however, without the support of advanced shore cranes and hinterland transportation there would not be any battlefield for this vessel, and the loading technology at present does not achieve that level. Also, larger ships will have access to fewer ports due to the water depth limitation of the ports, and this reduction in the number of port calls is quite the opposite of the preferences of shippers who favor more ports, more routes, shorter transits, greater frequency and all this at a low freight rate. Moreover, containerships with higher container capacities have to sail at higher speeds than those ships with lower capacity, because of more harbor time, and an hour time loss in port would require a four knot increase in transit speed to meet the scheduled arrival time[3]. This will logically increase maintenance and the fuel consumption. Complex stowage plans are needed to avoid repositioning cost of containers on the ship as well.

The Maersk Line is the world's largest container shipping company, and is the pioneer of building large container vessels in the world. It took the lead in launching the world's first vessel of more than 6,000 TEU container ship " Regina Maersk" , and the word's biggest container ship at present "Emma Maersk" is owned by it. The general way for ports to respond the growing capacity of container ships is to increase the number of shore cranes. A 1970s built container ship of 2000 TEU need two shore cranes for unloading containers with the total handling rate of 50 TEU per hour; in such circumstances, six cranes are needed for "Emma Maersk" with the highest total handling rate of 170 TEU per hour; then the port time for a fully capacity Malacca size ship could be five days at least in berth. As a result, the time factor could be a good reason for shippers to shift back to not so large vessels.

So, though the economy of scale can be achieved by using larger container ships, the how big is too big problem due to limitations that large vessels have should be taken

3 Theo Notteboom, (2007), Container shipping and ports. Unpublished lecture handout, World Maritime University, Malmo, Sweden

into consideration by liner companies.

4.3 Measures on management

4.3.1 Utilization of information management system

Along with the development of information technology, electronic business has been widely used in modern enterprises. International container shipping industry is one of the fast growing industries that have been significantly influenced by such development. And the developments of internet in recent years continually change business patterns in the sense of operation and management mode, which made the competition between shipping enterprises even more fierce. Under this circumstance, it is a strategic long term decision for shipping companies to invest information systems so as to optimize companies' resources, exceed response to customers and make contribution to their competitive advantage. Though the capital investment seems to be a great amount at first, the benefital of such system would come up during the long term utilization via management advantage and cost reduction for it reduces repetitive working and makes the handling of the data more directly.

A management information system (MIS) provides managers with information that supports effective decision making and provides feedback on daily operations. Presently, the generally used information management systems include Electronic Data Interchange, Global Position System, and Tracking and Tracing System.

EDI stands for Electronic Data Interchange. It is a standard communication protocol for system-to-system integration. Companies in a variety of industries use EDI to transmit business information electronically, organizations that handle large volumes of data often use EDI to minimize data entry and share information with other systems within their organization. In the shipping industry, customers can set up EDI with their carriers to submit and receive shipment information, while shipping companies use EDI for business applications and shipment data management. Under the utilization of EDI, shipping companies can experience fewer submission errors

and faster document turnaround time. Operations are improved for EDI integration eliminates the need for double input. Managing shipment information by EDI can help companies minimize phone, fax, and courier charges by submitting documents electronically. Moreover, efforts can be saved with proven and efficient implementation process for standardized integrations can be implemented quickly.

GPS stands for Navigation Satellite Timing and Ranging/Global Positioning System. In the shipping industry, GPS is mainly used for navigation, other than logistics functions. Under the utilization of GPS, specific shipping positions on the routes can be pinpointed, which, to a great extent, ensured the vessel safety at sea. While from the logistics point of view, GPS has wider application foreground, for it is not only a navigation positioning technical, but also a link for information transformation which collects, records and transfers both vessel navigating and positioning information and dependable vessel and cargo situations, as well as reference information for dispatchers, real time. Combined with other technologies, namely GSM (The Global System for Mobile Communications), RFID (Radio Frequency Identification) and GIS (Geographical Information System), GPS can contribute more to shipping transport.

Tracking and tracing is linking up an entity, traveling from a consigner (A) to a consignee (B) through public space, with an information system. It constitutes the interface between a physical transportation system and an information system[4]. The data provide by a tracking and tracing system are centralized or shared by multiple participants who follow the cargo information when transporting. Main information offered may include the identity of the entity, the current location and the current time, additional information may be recorded include the quantity, the quality and the states at lower hierarchical packing levels. Real time information from the tracking and tracing system make the control of transportation process easier.

4 Gunnar Stefansson and Bernhard Tilanus, (1998), Tracking and tracing: Principles and practice. Center for Transport and Traffic, Chalmer University of Technology and Gothenburg University, p7

4.3.2 Manning cost management

Government rules on labor management establish a series of criterions to effectively regulate enterprises' inner regulations. On one hand, these rules allow the power for employers to establish enterprises' inner regulations independently, on the other hand, they also set up some limitations on the exertion of such power, such as the content and process, meanwhile, administration and judiciary supervise measures has been set up to make sure such power not abuse.

The recently acting New Labor Law in China is stricter than the old law, for it ordains a wider area for the protection of employees' profit and set up more restrictions on employers' activities, such as, specific partition on probation period and pays on that period, call-back pay, compensation, claim on written contract and contract term. So it turns out to be a problem faced by many enterprises that the New Labor Law would cause an increase on their labor cost. Though several researches in the world have proved that labor cost is not the initial factor that influences enterprises' investment strategy but the market scale and its potential growth, the labor factor is still important for the strategic development of an enterprise for the relationship between employees and enterprises is interdependent, a enterprise cannot exist without employees and vice versa. So it is a must for enterprisers to be good at analyzing their inner employees' requirements and set up a master policy accordingly.

The master policy should be built on the base of concentration on improving labors' self development, living standard and working standard. Generally, there are three categories of master policy, namely Japanese modal, counterwork modal and cooperation modal. Japanese modal stands for household management modal, the employees are treated as family members; enterprises regulate them strictly on the job development while good living and working welfare are also paid; employees' career development and enterprises' development are closely related. A counterwork modal is to manage the employees without labor union. And cooperation modal

refers to the cooperation between the enterprise and the labor union to contribute labors' profit.

Optimal choice should be made according to each enterprise's specific situation so as to against the raising of labor cost.

4.4 Measures on procurement

4.4.1 Port cost control

The growing word East-West trade implies a deployment of bigger and bigger vessels, which require proper port facilities and optimal ship-to-shore performances so as to improve their efficiency and control expenditures. A need for customized terminal services and, sometimes, dedicated terminal facilities is now dramatically emerging in the world range. These are due to many different reasons: financial, economic, strategic, operational , such as cost stabilization, economies of scope, new barriers to entry, lower co-ordination cost in the transport chain, better productivity and schedule reliability.

Liner companies adopt different strategies to obtain dedicated handling services. Some acquire terminal facilities and act as stevedoring companies, some make investment in terminals and outsource the stevedore issues to local or global pure stevedore companies without being involved in the day-to-day operations, and others just sign special contracts with stevedore companies for customized or semi-customized services.

The degree of involvement of liner companies in terminal handling varies, which can be divided into four categories, ranging from contractual agreements to direct investments of carriers in port facilities:

1. A special contractual agreement between the terminal operator and the carrier on the base of TEU throughput. The terminal operator agrees to provide berthing and crane priority to the liner company and in some case allows a discount of port

charges base on cargo volume.

2. The liner company holds minority share in the terminal, usually less than 20%, but has not part in the revenue created, except through dividends[5]. The carrier is involved in mid to long-term planning, but not in the short-term management and terminal operations.

3. A fifty-to-fifty percent joint venture between the liner company and the terminal operator. The terminal can be managed either by the terminal operator or by a third-party stevedore company.

4. For a dedicated terminal, the liner company owns the share of 51 percent or more and operates as a stevedore company, which can even attempt to provide third-party traffic.

Maersk is used to take control of the terminal by majority ownership and to operate it as stevedores in Algeciras, Los Angeles and Rotterdam, as well as the Evergreen terminals in Taranto and Coco Solo. MSC usually has a minority share in the terminal but does not directly manage the facility; it prefers to outsource the day-to-day operations to a local or global stevedore company, because it does not have enough skills in this field and prefers to concentrate on the core business. Other liners are also used to be involved in a minority share or in a fifty-to-fifty percent joint venture, and they usually do not dedicate the terminal capacity to their own vessels only, but to their global alliance. Clearly, the different agreements have a different impact on pure stevedoring companies which act as counterpart of carriers.

4.4.2 Land logistics cost control by intermodal transportation

Since inland logistics cost takes about 30-40 percent of shipping lines' total cost, and this part of cost keep rising along with the inflation of the world economy, it is vital for shipping lines to pay attention to it and try hard to control it.

5 Francesco Parola and Enrico Musso, (2007), Market structures and competitive strategies: the carrier-stevedore arm-wrestling in northern European ports, Maritime Policy & Management, 34(3), p268

A decision for many liner companies is to outsource the inland logistics transport to some large-scale logistics service providers for these third parties have technological advantages and more experiences on management and scheduling services. And, by integrated cooperate with these logistics third parties, seamless and comprehensive logistics services called as intermodal transportation not only improve the service level but also accordingly reduce unit cost.

Called as the third revolution in the transport industry, International intermodal transportation is an advanced form of transportation organization that rises with the development of the container transportation. America is the first country which introduced intermodal into their transport service early in the 1860s, and soon the intermodal transport was put into use in North America, Europe and Far East, then in the 1980s, international intermodal transport became popular in the developing countries.

Associated with all the activities it performs, intermodal transportation can be defined as the concept of transporting passengers and freight on two or more different modes in such a way that all part of the transportation process, including the exchange of information, are efficiently connected and coordinated[6]. The goal of intermodal freight transportation is to provide a coordinated, seamless, flexible, and continuous service.

As the future direction of the development of international transport, advanced features of international intermodal transport can be illustrated as following:

1. Simplify the procedures, save related expenditure on manpower and material: under the form of intermidal transport, the carrier only needs to sign contract with the consigner once regardless transport distance, modals transitions and transshipment frequencies for the cargoes. Moreover, instead of various kinds of and volume of documents, intermodal transport use only one document during the whole transport process—Intermodal Bill of Lading, and with unified charge

[6] Gerbardt Muller, (1999), *Intermodal freight transportation* 4th Edition, by Eno Transportation Foundation, Inc, and Intermodal Association of North America, [1999], PP1

system, which can made document and charge process more convenient, the cost on manpower and equipment handling can be saved as well.

2. Shorten cargo transportation time, reduce inventory, and improve freight quality: one of the most important characteristic of intermodal transport is the seamless cooperation between transport modals which ensure timely cargo transfer and reduce storage time in the procedure, which guarantee a safe, speedy, accurate and timely cargo arrival. Cargo storage quantity and cost can be reduced as well. Meanwhile, though there are many transitions during the transport process, by using container as transport unit and the using of its professional loading and unloading machinery, lost on cargo damage during stevedoring are reduced which improve transport quality in a great extent.

3. Improve transport management standards, lower transportation costs: Because it is a huge investment for shipping lines to have their own inland transport companies both in forms of capital cost and management issue, and the cargo quantity influenced by market fluctuations make it a huge risk， while third parties who have professional technology and machinery, as well as advanced management experiences can help shipping lines carrying out their inland intermodal service, or moreover improve their inland service quality. So, in recent years, many shipping lines out source their inland logistic services to third parties. And by effectively cooperate and coordinate with these third parties shipping lines even can extend their services range and optimize their inland transport routes, unit transport costs are reduced accordingly as well.

The forms for intermodal transport include sea, air, rail, road and barge, each form of transport has its own features. Inland transports are mainly by rail and road. Compare with rail transport, road transport has shorter transit time and flexible schedule within specific transport distance, but along with the increase of distance it becomes uncompetitive for much higher price. While railway is competitive for long distance transport for the longer distance it is the lower unit cost it will be and the day and night limitation can be regardless, but rail service have bad service image

for its fixed and inflexible servicing schedules. As for barge transport, the biggest advance is its low cost while considered its long transit time it is usually used for less time sensitive cargo transport. Air transport has the shortest transit time but is the most expensive transport form among these forms, so it usually for cargoes of high time sensitivity.

So the decision of modals mix for container cargo transport should be based on cargo features whether it is cost origin, or time origin, or others.

4.4.3 Bunker future market investment

For liner shipping companies, future market investment is one of the measures that could be used for fuel cost management besides speed down, vessel volume increase and own bunkering companies investment since the bunkering price factor contributes an important part in operating cost management. Because the bunkering market fluctuates dramatically, and it is influenced greatly by political, economical, natural disaster, war factor and activities of Organization of Petroleum Exporting Countries, during the pasted decades, bunker price has changed from 21 USD per pail to 100 USD, with an average increasing ratio of 500%, if managed unsuitably, operating cost would raise much. Then, shipping companies can sign hedging contracts contain fixed price and quantity in future market. Under these contracts, shipping companies can maintain their bunkering cost on a rational level in a specific time period, namely season, half a year, or one year. Moreover, they can have an advantage of economic of scale on bunkering procurement, and the signed hedging contracts have no impact on companies' bunker purchase on spot market with contracted period.

4.4.4 Ship leasing

The capital investment on ships is very huge for shipping companies and it cannot be taken back within few years，high risk is along with that as well, so lease ships to operate could be a suitable decision. When making a strategic decision of whether

to buy a ship or not, many issues should be taken into considerations, including the market forecast, return on investment, vessel depreciation and other related market forecast information, and so on. Especially for the years when shipping is not so booming, even though the vessels are stay in dock, the fixed costs are still of big amount. So the selection between buy or lease vessels are put onto some shipping companies' desks and some take ship leasing as their competitive fundamental.

The American President Lines (APL) is an international container liner shipping company. From a loss of 56 million US dollars 2001 to a net profit of 9.43 million 2004, and then to the position of the most profitable company in the year 2007, the innovative management approach of the company made great contribution to its development, its strategy on vessel ownership construction also play an important role. Unlike some international container liner companies which pay much attention on the investment on increasing the size of container ships or their own container fleet contribution. APL constructs its great container fleet with the least cost and lowest risk vie shipping leasing. There are not so many vessels of its own in APL's fleet, most of the container ships are leasing ships of long term contract, which include ten Panamax ships of 55000 TEU built in 2001-2004, three 4890 TEU container ships and three with capacity of 4038 TEU built in 2000-2001. And because of the long term contract, APL gains much through the low charter.

Besides APL, many other big shipping lines also take ship leasing as their strategies to extend their fleets. Table 33 shows the ship leasing situations of the top 20 shipping lines in the world.

Table 4.3 The ship leasing situations of the top 20 shipping lines in the world

Company	Range	Capacity proportion (%)	Total TEU	Total vessel	Vessel owned	Chartered vessels	Vessels on booking
MSL	1	16.1%	1,774,800	528	173	355	98
MSC	2	10.2%	1,119,720	343	209	134	37
CMA-CGM	3	7.1%	787,341	336	93	243	76
EMC	4	5.4%	589,716	171	103	68	15

HAPAG-LLOYD	5	4.4%	486,348	142	60	82	11
CSCL	6	3.9%	426,963	136	82	54	34
COSCO	7	3.7%	408,198	141	97	44	35
NYK	8	3.3%	363,094	127	46	81	36
APL	9	3.2%	357,600	110	37	73	26
HJS/SENATOR	10	3.1%	341,433	82	20	62	30
OOCL	11	2.9%	320,061	75	32	43	22
K LINE	12	2.7%	295,655	89	34	55	21
MOL	13	2.7%	293,665	98	33	65	23
ZIM	14	2.4%	268,290	111	45	66	30
YML	15	2.3%	255,912	78	48	30	22
CSAV	16	2.2%	240,580	81	4	77	11
Hamburg Sud	17	2.0%	224,464	94	30	64	39
HMM	18	1.6%	171,551	41	12	29	19
PIL	19	1.4%	151,332	104	70	34	20
WANHAI	20	1.1%	123,487	76	48	28	17

Source: www.jctrans.com

Chapter 5 Cost management by cooperation between maritime companies

5.1 Motives of maritime cooperation

Co-operation is likely to be advantageous when the combined costs of operations or buying transactions, such as negotiating and contracting, are lower than the cost of operating alone. Co-operation between carriers serves as a means to secure economies of scale, to achieve critical mass in the scale of operation and to spread the high level of risk associated with investments in ships[7].

The motives, or say the driving force behind the moves, for the liner companies to have partnerships with others are multiple by nature. Political consideration sometimes can be a major original reason for going into cooperation. While other reasons can be analyzed in forms of economic, commercial, operational and

7 D. K. Ryoo and H. A .Thanopoulou, (1999), Liner alliances in the globalization era: a strategic tool for Asian container carriers, Maritime Policy & Management, 26(4), p350

technical.

5.1.1 Economic considerations

Ocean-going vessels are becoming more and more expensive. The need of economic of scale in international liner shipping prevents a lot of ship owners from entering the market. A modern container ship of the fifty generation may cost about 80 million USD, and in order to offer a liner service on a specific liner route, vessels required to constitute a container fleet should be identical or of the similar size, which implies a huge investment in ship acquisition, and only a few companies who are financially and commercially strong can afford such program.

Though, smaller ships of lower price can be an option to some shipping companies that do not have the financial capability to afford the big and expensive ships, fierce competition on liner transport, as well as comparatively poor freight market during the last decades slim the profit margin, that made operators of old and small vessels suffered a great disadvantage of high operating cost which may off-set or even over-weight their advantages in the capital cost. It is estimated that the economic advantage to be gained by a wide-beam post-Panama container ship as compared with a Panama ship are two-fold: a reduction of about 43% in daily consumption per TEU and of approximately 23% in construction costs per TEU[8].

So, as the trend of growing average size of container ships in the development of world container fleet, liner shipping companies have little choice but to invest in bigger and newer vessels so as to survive in such highly competitive market.

Because of the inconsistency between operation capacity of economy of scale and financial problem facing by shipping lines, a solution of international cooperation consideration comes to be a suitable form.

8 Ma Shuo, (2005), Maritime Economics, Unpublished lecture handout, World Maritime University, Malmo, Sweden, p54

5.1.2 Commercial arrangements

Market coverage: Since the world economy becomes more and more integrated through an accelerated process of globalization of production, consumption and services, the concept of market-place for an increasing number of shippers is now simply meant to be the entire globe. The global shipping comes into being with the global shipper[9]. Instead of contacting different shipping companies for the transport, the global shippers prefer to select one maritime transport supplier who has a world –wide coverage transport service system. While the world-wide service for a shipping company means a huge capability in investment, administration and management, which cannot be afforded individually, therefore, partnership and cooperation turns to be a valuable solution to the problem.

Service frequency: The age for old fashioned liner services of un-fixed-day service and long roundtrip has passed, and a fixed-day weekly service has become the standard form today. Shippers driven by competitions in their own field are becoming ever more demanding and difficult to please to marine transportation suppliers. More and more shippers today are expecting to have higher frequency weekly services on some selected routes. So, in order to offer such high frequency services with valuable cost, liner shipping companies need cooperation.

Marketing capability: Marketing in liner shipping often includes sales such as cargo booking and consolidation. Since competition has intensified, liner shipping companies are putting greater efforts on marketing in order to differentiate themselves from competitors and to keep or even increase their marker shares. Nowadays, there are very few shipping companies who can afford to generate enlarged market coverage such as world-wide services individually. This is not only because of the financial constraints but also the lack of marketing knowledge and capabilities of one single company. The market penetration capability of each company in different parts of the world is far from the same. This can also be said

9 Ma Shuo, (2005), Maritime Economics, Unpublished lecture handout, World Maritime University, Malmo, Sweden, p55

with regard to different clients in the same market[10]. By operating together, marketing resources can be saved and improved; time can also be saved, as well as the holding of opportunities

Freight stabilization: Freight stabilization is the origin of traditional shipping cooperation, known as liner conference, which is in fact a kind of cartel formed by ship owners for the effective control of supply of carrying capacity and then the price of the shipping market because of the high risk of the volatile freight market.

Cost control: Liner shipping services rely very much on the inputs from third parties such as bunkering services, ports and cargo handling services, vessel maintenance and container repair, etc. Cost spent on those issues has big impacts on the competitiveness of a shipping company. Big liner shipping companies sometimes invest in container terminal facilities and set up their own bunkering companies for priority and economic of scale. However, the problem is the executive-use terminals are not available everywhere for sale and lease, and once built the utilization ratio could be another problem. Moreover, these self owned facilities cannot be built at all of their ports of call. So, the form of cooperation modal can help enhance the utilization of the owned facilities and strengthen the negotiation conditions with third parties.

5.1.3 Operational and technical arrangements

Vessel space utilization: The trends in today's liner shipping are economic of scale of large ships to bring unit cost down and big fleet size to provide world-wide coverage and high frequency services. However, under the condition of fluctuated market demand, maintaining the space utilization ratio of the big fleet is not an easy task. Wide market coverage allows shipping companies to deploy ships more effectively among different lines. A company may obtain or lose an important business chance all of a sudden but can not make the corresponding adjustment in its carrying capacity, while partnership can be an optimal solution to handle such problems by

10 Ma Shuo, (2005), Maritime Economics, Unpublished lecture handout, World Maritime University, Malmo, Sweden, p55

sharing vessel space with each other.

Container deployment: The empty container deployment problems are vital to liner shipping companies for billions of dollars are spent on it every year. The imbalance of traffic may make the running short of empty containers for one company and meanwhile the pilling up of empty containers for another company in ports. Then the empty container interchange between companies could be an effective way to save the cost for it will reduce the deployment of containers volumes.

Operational know-how: The technical and operational know-how could be a link between the cooperation partners. For shipping companies who have financial capabilities on ships or market access to particular markets but lack of other prerequisites for effectively operating the liner services can get the necessary specialized management and operational knowledge from their partnerships, while the counterparts who have operational knowledge but not capital or market access can also gain from the cooperation.

5.2 Cooperation forms and their features

According to their cooperated dimensions, cooperation forms can be classified as strategic alliance, slot charter, slot co-charter and vessel sharing agreement.

5.2.1 Strategic alliances

Alliance is a form of long term cooperation between shipping lines with the main objective based on technical agreements and strategic considerations. They are mostly groupings of big shipping lines with similar philosophies and scale of operations which trade on the main world maritime routes. In order to improve service quality and reduce cost, alliances are not so restrictive and more oriented to technical sharing of resources, such as increase utilization ratio of container vessels and containers, and improve empty container reposition situations. Moreover, under the form of alliance, advances as resources configuration, infrastructure utilization,

intermodal transport and comprehensive logistics had played important roles on the improvement of liner shipping services, as well as economies of scale which reduce unit operating cost and improve group competitive capability.

Main advantages of shipping alliance can be illustrated as following:

1. Advantage on shipping capacity configuration and lane services: since alliance members share their vessels and coordinative distribute slots in specific lanes while provide one sailing schedule to their customers which is more available to party members than traditional form of capacity quota provided by liner conference, for this form of cooperation strengthen the relationships with members. Moreover, because alliances are grouping of big shipping lines which have the abilities to invest large and high speed vessels on lanes and develop more feeder port on the base of pivot port which lead to high frequency, short transit time and more ports of calls, as well as the utilization of self owned ports and stevedoring companies, and high technology which reduce their operating cost, members of shipping alliances display more advantages on their services providing.

2. Flexible quotations: So far, the coordination of alliance members is generally on shipping capability, sailing schedule and ports of calls, but not the pricing part, so the alliance members can establish their own policies on prices and surcharges which can be adjusted flexibly according to market situations. Compare with formalistic pricing policies by liner conference, the alliance mode enable shipping lines reduce their risk of lost on fluctuated market situations.

3. Improve operation scope and reduce operating cost: Because shipping alliances schedule their lanes and vessels unitively, large shipping lines can get in some remote lanes via relative smaller companies, while not so large companies can enter into trunk lines via large companies, which make every member of the alliances global carriers regardless their scales, which improve their services capacity and competitive capability. Meanwhile, alliances strengthen shipping lines' barging power with ports. For example, after annex with Sea-Land, Maersk turn its container

yard from Port Tacoma to Sea-Land's yard which lead 150 thousand US dollars lost to Port Tacoma. So, in order to do business with shipping alliances, port authorities have to low down their terminal handling charges, improve port infrastructure, establish sea-rail transport interfaces and improve yard services. Under this condition, shipping alliances can be at a positive situation when barging with ports.

By the end of 2002, large maritime companies formed as three alliances with two Groups, namely A.P. Moller-Maersk Group and Evergreen Group. Table 10 shows the 3 main strategic alliances in the world.

Table 5.1 Main alliances in the world.

NAME	MEMBERS
Grand Alliance	HAPAG-LLOYD, NYK, MISC, OOCL
TNWA	MOL, APL, HMM
CKYH	COSCO, K-Line, Yangming, Hanjin

Source: www.jctrans.com

5.2.2 Slot charter

Slot charter is to operating on specific lanes by chartering slots from other shipping lines that have already had slots on such lanes other than put their own vessels on that lane. Charterers have no right to interfere slots supplier's general operating activities on that lanes, however, if slots supplier make changes on that lanes, such as ports of call adjustment and liner schedule, and such changes would have negative impacts on charterers' expected profits, slots charterers have the right to stop the chartering contract partially or totally. Under the slot charter contract, slots supplier provides containers to charterer and the latter makes its own operating business independently and pays the rent periodically no matter whether put these slots into utilizations or not.

Among all of these cooperation modes, slot charter is the most practical one for its flexibility and easily handling. The chartered slots can fulfill the running short

problems caused by midseason and slot lacking problems caused by unexpected broke down and maintenance. And the long term slot charter agreement with partners can increase liner companies' carrying capacity in specific routes.

Table 11 shows an example of the cooperation of H Shipping with other shipping companies under the form of slot charter. It can be seen from the table, the BKS lane with ports of calls as USN-PUS-HKG-SGN-BKK-LMH-HKG-PUS-USN is operated by three vessels, in this lane, H Shipping charters slots from H-A with 100TEU in West Bound and 70TEU in East Bound each schedule.

Table 5.2 Slot charter by H Shipping with H-A in the BKS lane

Lane	Ports of Calls	Vessel	Ship Owner	Total Slot (TEU)	BSA(H Shipping: OTHER)	
					West Bound	East Bound
BKS	USN-PUS-HKG-SGN-BKK-LMH-HKG-PUS-USN	A	H-A	924	100:824	70:854
		B	H-A	920	100:820	70:850
		C	H-A	920	100:820	70:850

Source: The author compiled based on various information sources

Though the slot charter mode can avoid large expenditure and high risk to investment on the lane by companies of their own, it is not a low cost operating strategy for shipping lines, and it is not an optimal choice for shipping companies who have low turnover efficiencies.

5.2.3 Slot Co-charter

Slot co-charter is for the operation partners to co-charter each others' slots on some routes on the base of operating their own routes individually. Under this mode, cooperation partners can increase their liner density, as well as broaden their services coverage, without making additional investments. Under the trends of world wide services coverage, it is of a great difficulty for individual shipping line to meet every requests from shippers alone, such as frequent schedule and services coverage, so, the slots co-charter mode turns to be an important form in some shipping lines'

operating strategies, for instance, COSCO, Kawasaki Kisen Kaisha and maritime Yangming have had slot co-charter contracts on the Atlantic route and Asia-Europe route and have gain much from such contracts.

5.2.4 Vessel sharing agreement

Vessel sharing agreement refers to the sharing of vessels on specific routes by two or more agreement partners. General schedule of specific routes, ports of call, vessels invested by each shipping lines, as well as slot quantities possessed by each member according to their vessels holding, are set in the agreement. This agreement can be constituted by one or many routes, and not all of the party members have to take responsibilities on vessel operating issues, while each member can hold their agreed slots on each specific lane. Table 12 shows the vessel sharing agreement signed by H Shipping and H-A in the NIS lane. It can be seen that, the ports of calls of he BKS lane are XGG-TAO-PUS-HKG-JKT-SIN-HKG-PUS-INC-XGG, it is operated by four vessels and of which one is from H Shipping and three from H-A , this two shipping lines share the slots in each schedule.

Table 5.3 Vessel sharing agreement by H Shipping with H-A in the NIS lane

Lane	Ports of Calls	Vessel	Ship Owner	Total Slot (TEU)	NIS(H Shipping: OTHER)	
					West Bound	East Bound
NIS	XGG-TAO-PUS-HKG-JKT-SIN-HKG-PUS-INC-XGG	A	H Shipping	1230	330:900	330:900
		B	H-A	1200	300:900	300:900
		C	H-A	1200	300:900	300:900
		D	H-A	1200	300:900	300:900

Source: The author compiled based on various information sources

Vessel sharing agreement is generally a cooperation agreement with the main objective on the base of technical operating agreement regardless of any coordination about price issues and there won’t be any freight agreement either. The price situations are decided by general market factors and some specific freight and surcharges are made under the negotiation between shipping lines and their

respective customers, which lead to a fair competition within shipping lines.

By signing the vessel sharing agreement, shipping lines can provide some lane services that they may not be able to offer in the past without facing huge investment and high risk in the lane development individually. Meanwhile, the saving cost from the sharing agreement can improve the persistent development for shipping lines' long term strategy which would lead them facing more opportunities in the global business circumstance.

Chapter 6 Conclusion

Shipping is one of the major transportation modes of international trade, and this trade is expected to increase with the continuous growth of the world population, combined with depletion of local resources, and liner shipping contributes a vital part in general shipping industry. However, from the economical point of view, cost management has always been the core issue for liner transport management. And because of its feature of regularization and cargo multiformity, as well as huge capital investment, liner shipping business has less flexibility and need more complicated management systems compare with tramp shipping. Moreover, because of the fluctuation of world economy, seasonal cargo flow, as well as market imbalance between lanes, liner shipping companies' revenue stability has been seriously challenged. Under these situations, cost management should be paid more attentions by shipping lines.

This paper has dealt with different measures for controlling the increasing cost of liner shipping businesses. The starting point was the analysis of main cost items that have impact on shipping lines basing on their proportions on the total cost, namely fuel cost, port cost, stevedoring cost and land transport cost, and their influential factors under current globalize situations. After that, comprehensive measures with specific cases which are classified into four categories, namely deployment, management, procurement and cooperation, are described not only according to these listed main cost items but also other important factors. The basic point of these measures is to control the cost increase, for under the situation of the booming of the global economy and the inflation behind the surface, it is impossible to simply reduce the cost without any other lost, and the only way for shipping lines to defend their profit is to control the cost increasing ratio or cover the cost by rationalized strategies.

The measurements listed in this paper are some main solutions against cost increasing that adopted by some main shipping lines in the world, because the particular working modes and techniques for each liner shipping company are of variety, so these

mentioned measures would not be suitable for every shipping line. But for shipping lines of different dimensions and under different circumstances, the importance of cost control issue is of similarity, so, companies should innovate and explore optimal methods according to their own situations so as to position themselves in advanced conditions in the ever more fierce competitive market.

Reference

Bin Jian and E Prate, (2002), Distribution and logistics development in China, *International Journal of Physical Distribution and Logistics Management.* 32 (9), PP 783-798

Brian Slack, Claude Comtois, Robert Mccalla, (2002), Strategic alliances in the container shipping industry: a global perspective, *Maritime Policy and Management*, 29(1), PP 65-76

Chao Lee, (2004), Analysis on the Cost Management of Container Liner Shipping Company, *World Shipping*, 27, PP 33-34

Chuda Peng, (2003), The saving of terminal handling charges, *China water transport*, [2003], PP 27-28

David R Anderson, *et al Contemporary Management Science*

Francesco Parola and Enrico Musso, (2007), Market structures and competitive strategies: the carrier-stevedore arm-wrestling in northern European ports, *Maritime Policy & Management*, *34(3)*, PP 259-278

Gerbardt Muller, (1999), *Intermodal freight transportation 4th Edition*, by Eno Transportation Foundation, Inc, and Intermodal Association of North America, [1999]

Gerrit H. van Bruggen, Ale Smidts, and Berend Wierenga, (2000), *The Powerful Triangle of Marketing Data, Managerial Judgment, and Marketing Management Support Systems,* Erasmus Research Institute of Management (ERIM), [2001]

Hong Ye, (2004), *Study on logistics strategy alliance of shipping enterprises*, Unpublished Master's thesis, Haihe University, Nanjin, China

I Marti´Nez-Zarzoso, L Garci´ A-Mene´ Ndez & C Sua´ Rez-Burguet, (2003),

Impact of Transport Costs on International Trade: The Case of Spanish Ceramic Exports, Maritime Economics & Logistics, [2003.5]

Jie Chen, (2005), China containerization development-Port servicet, *Container transport*,43, PP 24-28

Kent N. Gourdin, (2003), *Global Logistics Management: a competitive advantage for the new millennium*, Blackwell Publishing Ltd, [2003]

Kevin Cullinane, Mahim Khanna, (2000), *Economies of scale in large containerships: optimal size and geographical implications*, Journal of Transport Geography [2000.8]

Kjetil Fagerholt, (2004), Designing optimal routes in a liner shipping problem, *Maritime Policy and Management*, 31(4), PP 259-268

Lan Wang, (2007), Trends of Liner shipping of China, *Container transport*

Lumby S, Jones C, (2002), *Investment Appraisal & Financial Decision*, Thomson,Six Edition

Marek Dubovec, (2006), The problems and possibilities for using electronic bills of lading as collateral, *Arizona Journal of International & Comparative Law* Vol. 23, No. 2 [2006]

Marielle Christiansen and Bjørn Nygreen, (1998) A method for solving ship routing problems with inventory constraints, *Annals of Operations Research* 81(1998), PP357 – 378

Martin Stopford, (1997), *Maritime Economics*, Routledge, Second Edition

Ma Shuo, (2005), *Maritime Economics*, Unpublished lecture handout, World Maritime University, Malmo, Sweden

Oil prices at word main ports, (2008.Apr 09), retrieved from the World Wide Web: *www.cnki.net*

OOCL e-Services, retrieved from the World Wide Web: *www.oocl.com*

Patrick Donner (2007), *Bill of Lading,* Unpublished lecture handout, World Maritime University, Malmo, Sweden [2007]

Pierre CARIOU, (2002), *Finance and Risk Management in Transport and Logistics*

R. G. McLellan, (1997), Bigger vessels: How big is too big, *Maritime Policy and Management*. 24(2), PP 193-211

R. Midoro, E. Musso and F. Parola, (2005), Maritime liner shipping and the stevedoring industry: market structure and competition strategies, *Maritime Policy and Management*, 32(2), PP 89-106

Renato Midoro, Alessandro Pitto, (2000), A critical evaluation of strategic alliances in liner shipping, *Maritime Policy and Management*, 27(1), PP 31-40

Teleroute, (2005), *Cost of Collaborative Logistics,* Teleroute Integrated Solutions, [2005.11]

Theo Notteboom and Filip Merckx, (2006), *Freight Integration in Liner Shipping: A Strategy Serving Global Production Networks*, Growth and Change, [2006.12]

Theo Notteboom, (2006), *Economies of scale in vessel size,* Unpublished lecture handout, World Maritime University, Malmo, Sweden

Theo Notteboom, (2006), *Liner shipping economics,* Unpublished lecture handout, World Maritime University, Malmo, Sweden.

Theo Notteboom, (2006), *The Time Factor in Liner Shipping Services*. Unpublished lecture handout, World Maritime University, Malmo, Sweden.

Theo Notteboom, (2007). *Container shipping and ports,* Unpublished lecture handout, World Maritime University, Malmo, Sweden

Theo Notteboom, (2007), *Shipping lines' environment: Globalization and logistics,* Unpublished lecture handout, World Maritime University, Malmo, Sweden.

Warren H. Hausman, Hau L. Lee, Uma Subramanian, (2005), *Global Logistics Indicators, Supply Chain Metrics, and Bilateral Trade Patterns,* World Bank Policy

Research Working Paper 3773, [2005.11]

World Liner Shipping Report, (Jan. 2006), retrieved from the World Wide Web: *www.alphaliner.com*

Yue Ma, （2000）， *Research on coalition of container liner*, Unpublished Master's thesis, Dalian Maritime University, Dalian, China