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WORLD MARITIME UNIVERSITY

Shanghai, China

**Study on Modern Port Logistics (MPL) and
forecasting container throughput of Shanghai port**

By

LI JING YE

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

(INTERNATIONAL TRANSPORTATION AND LOGISTICS)

2007

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DECLARATION

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Title of Research Paper: **Study on Modern Port Logistics (MPL) and forecasting container throughput of Shanghai port**

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Abstract

Modern logistics has become a fast-developing new industry in our country in recent years. And it is growing into an important pillar of the national economy. The port modern logistics system occupies an extremely important position in the port, such as the important node in the transportation system. The modernized port is no longer a place where is in charge of goods exchange, but clicking as the best combination of production, gathering the stream of people, logistics and information flow, which attract investment eyesight in the port, and hurry the regional economics development. MPL represents a core network among regional industry economics, business centre and global logistic chain.

Shanghai port is the biggest port in china, which has best-developed economic and most fast-booming port logistic background. Many of the scholars have researched and studied about it and solve lots of problem of Yang Shan deep-water terminal in Shanghai port, but it is still very little data output about Modern port logistics (MPL) in shanghai Yang Shan deep-water terminal. So it is necessary to discuss about Modern port logistics (MPL) in shanghai Yang Shan deep-water terminal and using forecasting methods to calculate its container throughput in the few years later, which demonstrates the MPL is meaningful and necessary to the port development.

KEYWORDS: MPL, Throughput

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Abbreviations

MPL: MORDERN PORT LOGISTICS

GDP: GROSS DOMESTICS PRODUCTION

PD: PHYSICAL DISTRIBUTION

Chapter 1 introduction

1.1 Background and review

Port, is the only connection between ship and land. A ship from entry into the port to leave the port must work a serial process as below: a) the organization, builds by the Customer Office, Frontier Defense, Health Service and Port Examination checks for the ship and cargos. b) Entry into channel guiding by port navigation aid. c) Waiting at anchorage ground for guiding to berth. d) Entry into berth after confirmation. e) Port workers band the ship on pile by rope. f) Loading and unloading. g) Feeding the ship. h) Moving, if loading and unloading are in different berths. I) After inspection is granted, the ship can leave the port. j) Depart from channel guiding by port navigation aid. For this process, the port should prepare the loading and unloading service and equipments, cargo or containers storage service and space, on-land cargo transportation service, lay service and so on. If one service is not available or slow-speed, it will disturb all port service efficient.

The points I mentioned above is the software of the port logistics service. We can re-new the machinery and update the data. The hardware, construction of the port is also one of absolutely necessary consideration requirement for the port logistics service quality. Such as, nowadays, the post-panama container ships become more and more popular. This kind of ship should berth at the 14.5-meter depth location. But the depth of old generation port is around 12-meter. So this kind of port can not satisfy the demands of the new development tendency. It is obviously that this kind of port market share will become lower due to its out of service.

1.2 The tendency of international shipping industry development

The fast growth of globalization has became the main characteristic and tendency of world economic after the end of 20 century, which has made great effects of almost every country's economy. The tendency of economic globalization also influence the world shipping and port industry, such as in manufacturing ships, in operation and management model, in logistics service and network, in information technology, and how to make development

strategies. The international container transportation industry has followed the world economics new tendency.

1.2.1 Economics globalization boost the container transportation

Beginning from 1980, lots of multination corporations changed their original identity, inter-company integration development to a global range. It is the reason for boosting the economics globalization. Expanding of market economics and the network of information technology fasten the economics globalization process. Economic globalization accelerates the international container transportation globalization. Due to strong market competition and the needs from international trade transportation service, the shipping companies operate integration strategy. The competition among the shipping companies promotes the multimodal transportation development, which consolidate the position of top global carrier in the new century. "Door to door" service accelerates forming synthetical logistics system. At the same time, the shipping companies choose the trunk line to transport cargos facilitate strategical adjustment of the choice of terminal port.

1.2.2 World liner service tend to centralization and monopolization

The explosive growth of Joint Management changed the world container transportation market competition pattern, tremendously. No matter trunk line or lateral, even inter-area transportation, the shipping companies realize that there is only one way to be successful in the competition market, that is joint management and optimal resource distribution. It means cooperate to deliver cargos through using comparative advantage principle. The benefits of it is to reduce transshipment, share information, and easy to reach target of the economic of scale. Until the end of 2000, the top 6 Shipping Unions in the world have occupied the leading position in 3 main trunk lines. They have used above 560 ships and the total container capability get to 1,830,000 TEU, which occupied respectively by 25% and 50% in the world. In the comparison, when in the beginning of 2001, the same 6 Shipping Unions reduced to use the ships, 545 ships, but total capability amount to 2,180,000 TEU.

Meanwhile, consolidation and merger among the liner shipping companies has become an important tendency, which is developing in-phase with Shipping Union. In the past few years, there are above 20 big activities about re-structure, merge, and joint management in the global shipping industry. Thereinto, Maersk purchase American Sea-Land influenced greatest, which led to new development direction in liner shipping market. Due to the combination of container shipping companies, the liner shipping industry will tend to centralization and monopolization. The result would be few shipping carriers in charge of world container transportation, which makes the whole container transportation market become altitude stabilization and reasonable competition.

1.2.3 World containerization stride forward to logistics era

Because port logistics service can provide customers a composite service system, such as package, deliver, store, warehouse, distribution etc. The port can save the cost, reduce deliver time, expand businesses range, plus get value-added service by using good port logistics system. So establish the logistics service become a core strategy and target in both port and first class liner shipping companies. Nowadays, a large number of liner shipping companies adapt their operation methods and development strategies. The main essence is to emphasize on promoting the service quality and be more competitive. Some big liner shipping companies claim that in the future, it is not so important that how many ships will one company use, but logistics development level is key point. This is very clear to show that the shipping companies have changed their minds, and focus on how to invest and operate, which will lead a following great changing in the port industry.

1.2.4 Ship size become bigger and bigger, speed move faster and faster

Nowadays, it is very normal to see above 5,000 TEU size ships, but only saw 3,000-TEU-ship 5 years ago. By statistics, until 2000, there were 420 ships above 3,000-TEU, whose total capability was 1,770,000 TEU and occupied 40% of total capability. Above 4500 TEU was 109 ships, total capacity was 610,000 TEU, which occupied 35% of total capacity of above 3000 TEU. It is calculated

by August 2000, reserved container ships had above 1,500,000 TEU capacity, occupied 32.6% of world existed total capacity.

It is reported that the 5th and 6th generation container ships will increase tremendously, which will become the mainstream type. Indications point toward, in the next 10 years, container ship size will become bigger and bigger. The percentage of post-PANAMA used on 3 main East- West trunk lines will reach 55%--60%, 65%--70%, respectively in 2010 and 2020. It is proof by facts that cost strategy leads to container ship become bigger and bigger, leading quality policy leads to joint operation. The huge ship size tendency boosts the world port technology revolution, which requires much higher standards in international container terminals. The port competition needs modern logistics system support.

1.3 innovation of port function

Due to huge increase in container capacity, liner shipping companies make union in global range and liner shipping companies transfer the role into the 3rd party logistics supplier, the container port operation entry into internationalization phase. Lot of multinational port operators appear, and focus on transfer containers. The international container terminal innovates as following those changes in transportation needs.

1.3.1 Deepen water-depth in terminal

The basic method is to deepen the water-depth in the terminal to adapt Post-PANAMA. The container liner ships is the style to fixed line, fixed port, and fixed schedule to transport cargos. So ensure the on-time rate is the essential requirement of container transportation service. Nowadays, most of Post-Panama container ships draw 14 meters. To consider about the sufficient draft, it was required to build port navigation channel above 15 meters, which ensure the container ship can entry and exit terminal anytime without wasting time on tide. If the terminal can not meet the needs of ship full-loading drawing, it will lead to the liner shipping companies lose security sense, and reduce port competitive.

In 1997, RIEGINA MAERSK made maiden voyage, which had 6674 TEU capacity shook the whole port industry. The industry began to conscious that without berth fit for Post-Panama, the port will lose in tussle terminal port and trunk line transportation. Actually, many international container terminals make the plan for deepening the draw at least to 15 meters. Such as New Jersey, to satisfy the demand of Maersk Sea-Land, deepen the channel depth from 12.2 meters to 15 meters. It leads to New Jersey becomes the king terminal of East of American, defeat BALTIMORE and HARIFASEY.

Lot of ports choose to move exterior to reduce the cost of deepen the channel. It means transfer port from near sea to in land place. Though shift exterior will increase the cost of in land transportation, Post-Panama size ship can reduce the waiting time for berth, which can attract transfer containers.

Many ports successfully shift exterior. Such as Rotterdam, it moved the container loading and unloading work from downtown to Delta area, where is 30-km far from original place. Another example, Vancouver made Delta container port in Rovens Bank, where connects the mainland 5 kilometers far. And train directly moves between port and mainland. Hamburg terminal wants to meet the demand of Post-Panama ship, then it plan building a deep water terminal in CUXHAFEN, which is lay on the table around about 20 years. Great minds think alike. In China, Nin Bo port chooses Bei Lun as container terminal, and Shen Zhen port is the exterior of Guangzhou.

1.3.2 Expand land range in the port

Expand land range in the port is another important act, it includes expand the berth length and enlarge the space.

Loading or unloading containers simultaneity increase sharply after container ship become Post-Panama size, and port need more space for storage yard. Every storage yard ability and berth capability are different, we can increase the number of gantry crane to improve the speed, but don't need to expand the

coastline. But there is only one way to fasten the storage turnover speed, which is to enlarge the yard space. In the modern port system, there is train service to make cargo deliver rapidly. So it is required to leave space for train station. Such as Seattle, APL invested in 276,000,000 USD for enlarge NO.5 port, which will expand to 64.2 hectare. The train can stop next to the ship for loading and unloading.

1.3.3 Improve the loading and unloading efficiency

It will increase loading and unloading quantity after the ship size become macro-scale. The port must improve the loading and unloading efficiency to maintain the unchangeable berth time and schedule. Normally, we add more gantry cranes to fasten the loading speed. The second method is to improve the van speed on transferring containers. In the modern container port, using 2 vans serve for 1 gantry crane. The van near to the sea is in charge of loading and unloading containers, and the van near to the land is in charge of transport containers. It is an efficient way to save loading and unloading time. Each gantry crane can transfer container 60 pieces per hour.

The container railway system, terminal ship-van system, dock style port are in the research.

1.3.4 Transportation diversification

It is not enough to depend on highway transportation only. Highway is convenient than railway and sea, but it makes more pollution and consume more natural resource. To think of continuable development requirement, almost every modern port uses the multimodal transportation. And the port focus more on the methods expects the highway. Belgium government repairs the railway between Antwerp and German Ruhr industry area to increase highway percentage of whole transportation. It is same situation in the North America, 2 of national rail companies' joint work to expand their service range to Vancouver port. It leads the port improve their position in container transportation. Nowadays, railway transportation has become more and more important for containers in the multimodal transportation. In Bremen, the percentage of container rail transportation is 60% of total. Highway transportation of container

in Rotterdam has fall down to 50%, but rail and in-land river transportation has increased to 14% and 36%, respectively.

1.3.5 Develop modern logistic system

Taking advantage of the port, specially, the container terminal advantage, we should re-enforcing develop logistics service. It is a tendency to develop logistics industry, which will become a core service of port.

To build port as a logistics centre is the best choice to meet the needs of the clients. And it improves port competitive. The second benefit is to boost the port city economics and increase the job opportunities.

1.3.6 Informalization

Port use information system to strengthen the internal management and improve the port efficiency. They share information, improve communication, and decision. Port should improve information skills to meet the need of JIT, what required by customers to reduce the berth time, which is non-value added time. Infomationization ensures a good connection in the logistics chain. Such as typing the serial number into website, the client can inform the detail condition of cargos.

Chapter 2 refer international and domestic port operation

2.1 Asian ports comparison

2.1.1 Basic situation of ports in Hong Kong & Singapore

There are several successful experiences to make Hong Kong and Singapore to be No 1 and 2 container throughput ports in the world.

a) Focus on construction container deep-water terminal

In Singapore port, the 3 original container docks load and unload 12,820,000 TEU, which is 99% of total container capacity. Those 3 docks occupy 259 hectares, and deal 100 containers per hour. The entrance channel depth is above 15 meter. 18 trunk line berths of total 31 container berths in the original

dock are from 12.5 to 15 meters. The new containers docks are above 15 meters totally, which can be deepened to 16 meters if necessary.

There are 97 gantry cranes serving for 31 berths. The longest extension of gantry crane can get to 50 meters, which can serve for 18-rows-containers ship. 323 rail gantry cranes can lay 6 containers height. Those container docks can deal with 16,000,000 to 18,000,000 TEU per year. The new built dock can lay 9-container height. And the auto-loading method is researching. Everyday, Singapore terminal load or unload 40,000 TEU. The average loading quantity is 4,610,000 TEU each berth. The annually loading quantity is 1,430,000 TEU per gantry crane. The average loading rate is 100 containers / ship/hour. The top record is 229 containers/ship/hour.

There are 8 docks and 18 berths in Kwai Chung terminal in Hong Kong, MTL, SEALAND, HIT and COSCO-HIT operate Kwai Chung. The water depth of entrance channel is 15 meters, and the depth of Ramble Channel is 12.2 meters. The depth of all 11 berths reaches 14.5 meters. To meet the needs to post-panama ship, the port will deepen the depth of the entire container berth to 15 meters. Kwai Chung is one of the most busy container terminals in the world. 64-gantry crane serve for 18 berths. Advanced computer controls every corner. The average loading quantity is 5,500,000 TEU each berth. The annually loading quantity is 1,540,000 TEU per gantry crane.

b) Separate governmental functions from enterprise management

Singapore begins port revolution in 1997, and implements port privatizing. The original harbor bureau separates into MPA and PSA Corporation Ltd. MPA is in charge of management and technology issue of port. Such as port layout, port management, check and grant license. PSA change the role from legal organization to a commercial company, which is in charge of investment, production operation etc commercial functions. The advantages of port privatization are the staff in the port improve their work attitude and enhance a strong service consciousness. More and more enterprises are willing to invest in

oversea ports, so It is beneficial to improve management and efficiency, and reduce the cost.

Hong Kong is the only one privatization port from birth in the world. It is not controlled by harbor bureau. Hong Kong Port Development Council established in 1990. It provides suggestion to Hong Kong Government directly. 1998, it changed name into Hong Kong Port and Shipping Bureau. Hong Kong port operates by privatization, which means enterprise do financing, building, production, pricing and management in port, but not government.

c) Modern logistics centre

It is a tendency to build the modern logistics centre. Lots of distribution centers established in the south coastline of Singapore, which can satisfy the demands of producers, cargo forwarders, trade companies, transportation dealer and warehouse owners. Such as Jurong Districentre Pte.Ltd, which has 25500 square meters for warehouse, 4500 square meters air-conditioned space, in which can lay 4000 TEU. They also provide packing, separate package, tag services that are value added. They call it all-direction service. There are more than 30 logistics centers like Jurong in Singapore, which lead Singapore become a global compositive logistics centre. The local harbor bureau has 580,000 square meters for warehouse. Keppel Distripark, the most modern distribution centre, has four double-stairs distribution centers. The container van can park in front of the building to load and unload. In the distribution center, the client can enjoy the favorable “personal one-stop service”, which includes purchase, storage, transport and all service in the supply chain. They develop logistics software to link the producer, supplier, distribution centre and clients, which can provide on-time communication service.

The international forwarding centre and Asian logistics centre established in Kwai Chung. There are 9 floors in the international forwarding centre building. Container van can park to any floor to load and unload. Warehouse contract with privatization companies.

2.1.2 use for reference

1. Shanghai should study how to follow the global tendency, ship macro-scale style, and build deep-water terminal as soon as possible.
2. Following the successful experience from Hong Kong and Singapore, Shanghai should separate the government and enterprise functions.
3. Building the distribution centre is the global development direction, expand the single storage service to logistics and distribution service, and open one-stop service.
4. We can see in Hong Kong and Singapore examples, the port development speed is so fast. The new ideas, theories and practices appear persistently. Shanghai should train the staff and send them abroad to learn advanced knowledge.

2.2 inter-China ports comparison

2.2.1 Basic situation of ports in both container ports of Shanghai & Shenzhen

a) The situation of shanghai and status quo of Shanghai container terminal

The GDP was 2,094,000 billions, increase by 10.7% comparison with last year in shanghai. The total export trade gets to 176,000 billions USD, which increase by 23.8% comparing with 2005. Use direct foreign investment 69,500 millions USD. In Oct 2006, the total container throughput is 1,900,000 TEU, and the trade cargo throughput is 18,360,000 TON.

In 2006, Shenzhen did total trade 126.5 billions USD. In Oct 2006, the total container throughput is 1,735,200 TEU, and the trade cargo throughput is 11,410,000 TON.

b) Comparison between Shanghai & Shenzhen container transportation

ZhuJiang Delta is the main economic hinterland of Shenzhen, the whole Guangdong province, even Guangxi, Hainan, Hunan, Jiangxi are Shenzhen's

wider economics hinterland. Its GDP occupied 20% of the whole China, the total industrial output value and the total export quantity occupied 17% and 42% of total, respectively. Nowadays, Shenzhen is forced by ASEAN, such as Vietnam, Thailand, the containers have tendency shifting to ASEAN. But Shanghai get the benefit from Yangtze River Delta. After Shanghai constructs the deep water terminal, it will be a vital requirement to competitor.

Shenzhen invested 1,100,000 RMB for expanding the land range, and build 6 deep water berths, in the 2006, September, the first berth began to be used. Shanghai is building Yang Shan terminal, in which, there are 50 berths above 15-meter-deep. The annual throughput will reach to 15,000,000 containers. The first phase in Yang Shan had invested about 1,4010,000 RMB for building five 5th and 6th generation of container berths, and the total throughput will reach to 2,200,000 TEU.

Until the end of 2005, the global 50 shipping companies opened 154 routes. And more than 10 shipping enterprises open 21 inter-China river lines. The international container transportation was occupied 94.9% of the total throughput, which is 153,740,000TEU.

Table 1 top 10 container terminals in the world in 2005

rank	port	Throughput (10,000 TEU)	growth rate %
1	Singapore	2,320	8.7
2	Hong Kong	2,260	3
3	Shanghai	1,808	24.3
4	Shenzhen	1,616	18.6
5	Pushan	1,184	3
6	Kaohsiung	947	-2.5
7	Rotterdam	930	12
8	Hamburg	810	15.5
9	Dubai	760	18.1
10	Los Angles	749	2.2

It shows top 10 container ports in 2005 of the world. In 2005, Singapore is no 1 of container transportation. But Shanghai grew most fast, whose growth rate is

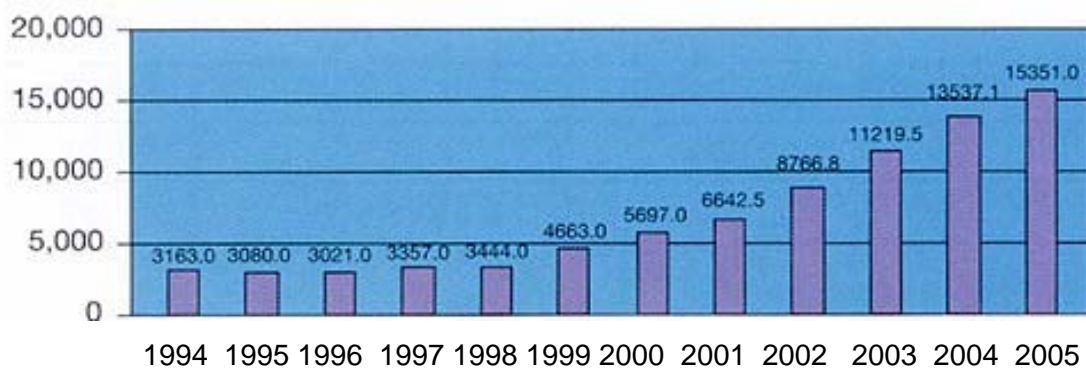
24.3 %. It means Shanghai has a developing tendency in the container transportation.

Shenzhen is no 4 in the container throughput in the world, but the growth rate is fast, 18.6% annually.

2.2.2 Analysis data

Figure 1 Cargo throughput in Shenzhen port from 1994 to 2005

(Unit 10,000 ton)



In Figure 1, the data show us the annual cargo throughput in Shenzhen port from 1994 to 2005. There is very big difference, 121,880,000 TEU from the beginning time 1994 to 2005. And from 2001 to 2005, the growth rate is stable and positively.

Table 2 difference between cargo capacity and real throughput in Shenzhen port from 2001 to 2005. (Unit 10,000Ton)

year	cargo capacity	cargo throughput	difference
2001	5861.0	6642.5	781.5
2002	6421.0	8766.8	2345.8
2003	7313.4	11219.5	3906.1
2004	8316.4	13537.1	5220.7
2005	10692.0	15351.3	4659.3

From Table 2, the cargo capacity means the planned transportation cargo quantity. The third row of the table, cargo throughput means the real annual cargo transportation number. During these 5 years, the differences are bigger and bigger. It means the port supply didn't change too much, but the demands are growing fast.

Figure 2 Container throughputs in Shenzhen port from 1994 to 2005
(Unit 10,000 ton)

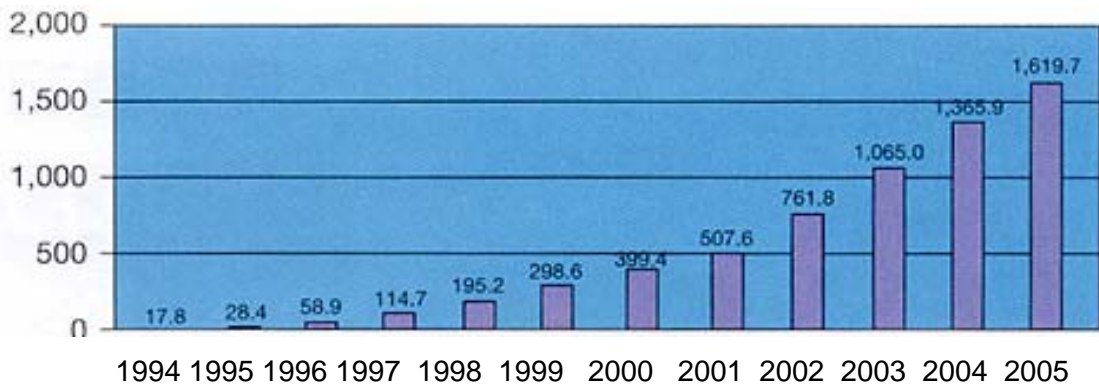
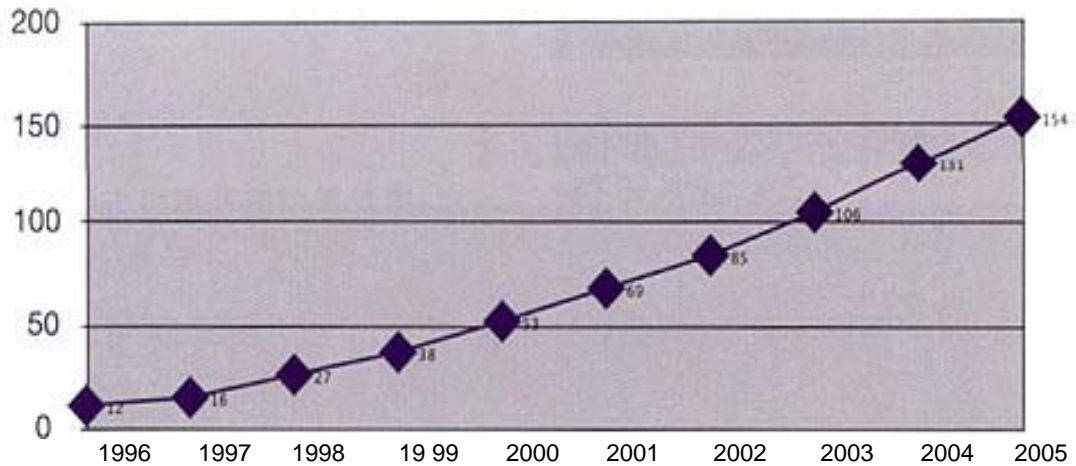


Table 3 difference between container capacity and container throughput in Shenzhen port from 1999 to 2005.
(Unit 10,000 TEU)

year	container capacity	container throughput	difference
1999	290.0	298.6	8.6
2000	320.0	399.4	79.4
2001	320.0	507.6	187.6
2002	320.0	761.8	441.8
2003	495.0	1065.1	570.1
2004	620.0	1365.8	745.8
2005	912.0	1619.6	707.6

From Figure 2 and Table 3, it is shown that the condition of container throughputs is similar as the normal cargo transportation. After 2001, the container throughput quantity increases fast.

**Figure 3 international container routes in Shenzhen port from 1996 to 2005
(Unit routes)**



Shenzhen port will increase around about 10 international routes for transport containers.

Shanghai terminal new open 32 international liner routes in 2005, amount that, shanghai to Europe, to North America, to Middle East, to Australia are total 21 lines, and less 11 lines are inter-Asia. More than 70 shipping companies alliance in Shanghai terminal's container operation. It transfers ships 1996 times monthly. 971 ships are international lines.

Professor Huang You Fang, come from Shanghai Maritime University developed "Modern Container dock production technology", which can be ordered by computers. Such as the container van empty drives above 50% times, the usage rate is very low. But after use the modern technology, the computer can arrange the van. And let different equipment serve for different work in different time, which make loading and unloading work more efficiency. In first phase of YanTian. 6 gantry cranes serve for 2 berths, in the 3rd period,

12 gantry cranes serve for 3 berths. Later add 2 post- Panama gantry cranes, the throughput increases to 800,000 TEU.

In Shenzhen port, the management invests for “port management system” to control Zhakou auto system, auto record, setting container position and on-time show container location. “Berth planning system” arranges the rank for loading and unloading container. “Operation monitoring system” controls the all activities on the dock and maneuver the human and equipment resource at the right time. In shanghai, port organization equips the NAVIS port management system, which is benefit for on-time operation. If anything changes in the dock, it will be show on the whole system. It includes EXPRESS and SPARCS systems. Data operators just enter the information of container in EXPRESS, and then SPARCS can decide where is the optimal place for this container. The new system makes the container movement more smoothly and efficiently, which can improve customers’ satisfaction. And it is 24-hour service.

Chapter 3 Modern logistics definition and tendency of port logistics development

3.1 Logistics meaning

3.1.1 Innovation of logistics’ definition

The definition of logistics formed in the development. In fact, when the product exchange existed, the following logistics activities were existence.

At the beginning of human society, the human being was under natural economic, the production level was very low. They produce for their consumption, so don’t need to consider about deliver cargo and storage issue. So it was no logistics concept. When the machinery appeared, it improve people’s productivity. But from the whole society, the total products are still few. In general, the products can be distributed, so people just focus on how to improve production skills, and be more efficient on production. So this is the reason why no logistics definition existed in that period

Until to the beginning of 20 century, some developed countries produce more than their demand. The society gets a saturated state. The competition among the companies became more and more strong. Not every commodity can be sold out. And it is difficult to improve production skills when it gets to an enough high level. Then, people begin to care about “distribution”, they hope to expand market by improving distribution skills. It is a big issue to reduce the distribution cost and improve efficiency for the companies. It is the beginning for people to really care distribution logistics. The concept of logistics begins to bud. Under this background, in 1915, Argichao put forward the concept of “physical distribution” in <several problems in distribution market>, which is the earliest explanation of logistics. In 1935, ASC explain further about “physical distribution”.

In the World War II, the American Army used a scientific method to successfully deliver strategic goods, which guarantee for American army implement globalization strategy. This method is called “Logistics” in the military. After the War, the developed countries improve their production level, expand the demand scale, then it entry into macro-scale production and sales times. The companies want to expand more market share, and reduce the circulation cost, so they pay more attention on “Logistics”, which makes “PD” concept more systemic and normalization. At the end of 1980, people realize more deeply about “logistics”, and they thought put “PD” as the explanation for “logistics” is not precise. Because “PD” means distribution only, but in the reality, “logistics” also includes purchasing, production, recycling, disusing, and reclaim. It is a cycling process, same as logistic management in the army. So at the end of 1980 to beginning of 1990, people fix “logistics” as the explanation of “PD”. This is a mature symbol of logistics science.

3.1.2 Logistics and its structure

Under the natural economics situation, production tightly band with consumption. Different roles in society change from natural economic to commercial economic. It is the basic reason to make products exchange, product circulate and commodity market.

The earliest realization of logistics came from circulate field. If we want to clearly explain about logistics, we must talk about circulate. Logistics come from production to circulate and then get to consumer's hand. There is gap between production and consumption due to the producer is not consumer. And the location gap because production place is not consumption place. And also time gap, the production time is not consumption time. It is circulating that connects these gaps.

The consumers use money to get the commodity property right, which is equal to the value of the commodity, it is called "purchase and sale process". Logistics is the parts after commercial circulate finish, such as deliver the cargo to the consumer. Logistics begin from packing, then loading, unloading, transportation and storage. When the consumers get the commodity at the safety style, the logistics process is end.

Expect commercial and logistics process, in the circulate, there is information transfer activities, which is including commercial information and logistics information, such as market status quo, demand and supply of logistics, policies and legal, market environment and so on. Information activities are information production, fabrication, transportation and storage. Another circulate is capital, such as credit, draft, cash is using by bank to bank. Commercial, logistics, information and capital circulate are main 4 parts of commodity circulate.

"Physical" in the "Physical Distribution" means anything can be physically moved, such as material, cargo, commodity and broken issue.

"Distribution" in "PD" means changing, which is meaningful in circulate field, production field, consumption field, military field.

In general, "PD" means material move from supplier to the demander by physical transfer and time-space change. The main duty is to create time value, place value and production value.

3.2 Modern port logistics (MPL) form

3.2.1 MPL developing process

Port logistics activities follow the development of port economics and also depend on trade and technology development. Before 1950, the whole national economics establish on the heavy industry. It is imbalance to distribute and produce the industry resource that leads the main function of the port is big amount bulk cargo, such as ore, coal and liquid product.

The traditional heavy industry became more and weak in the national economic. From 1950 to 1970, the bulk cargo and liquid cargo stop growth in transportation in global shipping. At the same time, the demands of ready or half-done product have increased, so the container appears. It improved the traditional transportation service quality and get high efficient. Transportation, loading and unloading, storage, movement and information circulate is step-by-step forming in the logistics.

From 1980, the speed of global economic integration has fasten, the modern technology development and net economics appear, which made higher requirement for transportation. It requires that meet the demander's needs is the starting point. The port functions shift from single product manufacturing to compositive logistics. It is an integration of cargo, commercial, financial, technology and information flow. And the transportation methods changed from van-ship to multimodal transportation and joint management. The loading and unloading skills shift from traditional to international "door to door" style. The modern port logistics becomes mature.

3.2.2 Inevitability of MPL form

a) The modern logistics industry accelerates the port logistics industry forming.

With the development of global economics, trade freedomlization and integration of international transportation market, specially after the modern logistics developing, the port has not only traditional loading and storage function, which

is little value industry, knocked off by the production, trade, transportation industries, but it is activator for the economic growth and trade increase. Port radiates in huge range in the hinterland, which promote the domestic and international economics development. Because of that, the modern logistics system has been attached importance by every country's government levels in the global range. It is a newborn industry and develops so fast in the global range. More and more ports want to become the logistics centers.

Logistics is a system, which includes by transportation, storage, package, loading and unloading, circulate, manufacture, deliver and information several parts. The purpose is to deliver the right products to the right place at the right time with right condition. And minimize the whole supply chain cost. So the modern logistics is a compositive service system with main transportation target. The transportation is the core part in the logistics system. And it is also the 3rd profit source of enterprisers.

From the industry view, logistics is belonging to circulate field. Physical distribution includes cargo distribution, information and capital activities. And the main part in cargo transportation is movement activities. The modern logistics supply chain includes material purchase, production, package, transportation, loading, warehouse, distribution, and transportation. It is not difficult to see that almost every part becomes modernization transportation.

Port is the connection between land and sea, in where, cargo transfer, change packing, loading and unloading. Port is the connection of transportation network. It means port has very close relationship with producers, transportation companies, warehouse and sales enterprises. Lots of actions happened in the ports. Without port, the functions cannot become true.

b) Requirement for ports after ship macro-size

To meet the needs of economics scales, the shipping companies use the post-Panama size ship to transport the containers, which requires the port making the deeper water terminals. It also requires for the loading and unloading equipment,

service levels and hinterland cargo resource. To satisfy the demands of saving cost for the shippers, save ship berth time and improve the cargo transfer time is the first choice for the port to improve.

c) Port changes to modernization logistics terminal

Material and skills are the base of modern logistics system. It includes hinterland economic of the big range of sea and on-land, which is enough cargo resource, specially, container recourse; Advanced sea-air-land transportation net, which can make multimodal transportation; High-technology hardware and equipment, advanced management skills for the international trade port service; The modernization information network; The cargo forwarding companies and custom office. The requirements above only exist in port.

Because port has good basic equipment, such as dock, warehouse, yard, preparation space, the path, and the experience for loading, lay, storage, and multimodal transportation. Port also should have lot of relationships with transportation companies, agents, manufacturers, circulate companies. Nowadays, port becomes the connection among the sea, rail, highway and air. It serves for value-added service space, such as catalog for stock products, packing, put tag, re-new, product re-structure, distribution, agent and forwarding, calculation, logistics and insurance.

So, the development of modern logistics promotes port logistics service.

Modern logistics development is the important choice for improves our city competitive. Now, main ports in China are planning to construct the port logistics centre.

Lots of multimodal companies, shipping companies and the logistics companies put investment in the place near to the port to build manufacture factories, logistics centre, and distribution centre. Such as Antwerp, Rotterdam, Singapore, Hong Kong. They are not only traditional, but serve circulate, information transfer, sales, exhibition functions and all-direction services.

3.3 Concept of MPL

3.3.1 MPL definition

Port logistics means base on the port, and provide composite multi-function service.

“Logistics” comes from America. In general, logistics consists several compulsory items as below:

1. The objects of logistics activities are material flow and information flow, what work through production field and circulation field. The purpose is to making scientific planning, management and control.
2. The meaning of logistics is to transfer the material from the supplier to the demander, which creates the time value and the space value.
3. Logistics consists transportation, safe-storage, loading and unloading, transferring moving, packing, circulate manufacture and distribution activities.

Port logistics has 3 basic elements, fluid, carrier and direction.

Fluid is the cargos in or out of the port, the purpose of port logistics is transfer cargo from the supplier to the demander. During this period, some parts of cargos should be stored in the warehouse in port. But all of the cargos should be loading and unloading, moving process to implement the movement of space. So, in general, the cargos in the port are continually moving. Following the natural attribute and social attribute, we can calculate the value coefficient of fluid, means the value of this cargo per stere. This data can show the gentle and simple of cargo. This data is bigger, so cargo value is bigger. It is meaningful for the port management to arrange the logistics work for different cargos.

Carrier means the equipment for the fluid to move. Carrier divides 2 kinds, one is basic equipment, such as channel, dock, road on the dock and so on. Another is the machinery for moving fluid, such as loading and unloading machinery, moving equipment. The condition of port carriers, are directly

relating to the port logistics quality and efficiency.

Direction means the moving direction from beginning point to the ending point in the port. There are 4 kinds of logistics direction: first, natural direction, it decided by the export or import, then arranges the reasonable route to move the cargo in the port. Secondly, order direction, it is decided by the personal order to meet the needs of balance port task. Thirdly, market direction, it is decided by the cargo owner or carrier, such as the cargo owner can point loading on one berth. Fourth, practical direction means real happen direction in the port.

3.3.2 Basic characteristics of MPL

There are 3 core products in the modern port system, core product (loading and unloading, transportation), formal product (transportation tools, equipments), and extension product (value-added service). The core and formal products are widespread emphasis, but the value-added service is being looked down. Modern port logistics competition focuses on extension service quality.

1. Characteristics of port logistics.

It relates closely between development of port logistics and hinterland economics. Modern logistics is a composite logistics. Port is a centre of modern logistics industry, which is a component of international supply chain, depends on the whole logistics development surroundings. In port logistics, the economics development level of the hinterland, economics scales and domestic population will influence the throughput of port logistics. The transportation system of hinterland is another important element for port logistics. Almost every port city are emphasis on port development, and take advantage of port to boost the city economics. Nowadays, port has become the new economic growth point in the city.

Port logistics development is affected by the national policy and international surroundings. Port logistics service includes the normal logistics service, and customer checking, salvage and maritime court special service.

The port competition has become more and more strong. Due to booming of international trade development and the ship become macro-size, the port face the inter-country competition and neighbor countries ports' competition.

Port logistics is the centre position in the international supply chain. In the modern logistics development, there are lots of advantages for port. Port logistics has non-replaceable economics transportation functions. Such as port is the connection between sea and land, and also is the distribution centre of cargo delivered by sea. Port is the beginning and the end of the maritime transportation. Port uses its big quantity advantage to import and export cargos, which becomes the dominant point.

Port logistics development shows the national logistics development level. Port works as the centre of international supply chain, leads those advanced skills and management sink into hinterland by supply chain. It makes the leading function for the hinterland and whole countries logistics.

Port logistics has distribution function. port is the connection of international transportation system. Due to loading and unloading, we have loading companies, shipping companies and on-land transportation companies. Due to ship berthing, we can see the fuel suppliers, ship repair companies and maritime insurance. There is Non-vessel operation carrier, cargo forwarding, agent between cargo owner and the shipping company. Following the modern logistics forming, the new-style companies, which serve for the port, are focusing on value-added service. Lot of manufactures build near to the port under the port logistics development effect. Then the tendency becomes a manufacturing district around the port, which promotes the region economics growth. The port logistics development brings capital flow, human recourse flow and information flow to form the regional financial centre, tourism industry and information industry. Lot of cities use their port advantages become global industry centre and trade centre. Port has non-replaceable meaning for a district or a city to become export-oriented economics.

2. Modern port logistics developing characteristic:

a) Internationalization. The tendency of trade globalization and economics integration shows the port trade functions much clearly.

b) Multi-functional. The port provides integration logistics service, such as warehouse, transportation, distribution service.

c) Systematically. Port extends two-way service to both producer and consumer. It expands service items, which coordinate by the systematical computer.

d) Informational. Application of data exchange skill and internet meet the needs of changing requirements from the customers.

e) Standardization. The standard package, container standard size, standard data are easy for port to join to the global logistic system.

3.3.3 Basal functions of MPL

1. The position of MPL in logistics system

a) The leading function in logistics circulation. Port is the beginning and ending of the maritime transportation. Modern Port works as logistics centre. It has not only old functions, but also collects the information in the whole logistics chain.

b) Optimal center of production factors. Due to the natural resource for the port, lot of ports builds as “front port, factory back” structure. The modern port assembles human recourse, material recourse and financial recourse, which can make $1+1>2$.

c) Information centre. Cargo owner, cargo forwarding, ship owner, shipping agent, commodity wholesaler, retailer, packing companies, advertisement companies, on-land transportation companies, customer office, banks, insurance companies and other organizations stay in the port working for same purpose but using their own information. So, port is also cargo information, technology information and service information centre.

d) Human resource centre. It provides human resource working in trade fields, maritime transportation fields, and so on.

2. Basal functions of MPL

Modern port logistics functions have changed to more efficient, with lower cost and providing personal service. It includes several functions as below:

- a) Transfer and transport. They are the first importance for the port logistics. In the modern port logistics activities, transportation is not the single, separation activities from other services. Transportation is a part of supply chain. It is including by rail, highway, sea, air and multimodal transportation network.
- b) Loading and moving. They are 2 basic elements to influence the cargo transfer speed. The profession loading, unloading, moving, laying equipments can improve works' efficient and reduce the damage.
- c) Storing. Due to different cargo require for different storage, such as air-condition, protect for fire. The modern port should provide every equipment and machinery to meet the demands of what customers want.
- d) Manufacturing and packing. There are 2 kinds of manufacturing. One is to put the tag or add sales package. Second is assemble packing depend on customers' special requirement. These functions can reduce the damage risk in the transportation and decrease the transportation cost.
- e) Distribution. It is the logistics of storage and on-time deliver the material or parts to the companies. It is necessary to equip a strong function distribution system due to distribution range is big, transportation route is long and business is different kinds.
- f) Deal with information. It is an essential part of the port logistics system. Due to port need to manage big amount data, such as different kinds of cargos, different customers, different direction, different demand. To take advantage of port information resource and EDI net help customers' decision. It includes the logistics information, trade information, financial information and policy information. The better informationlization in the port, the more efficient the port logistics.
- g) Port function. Setting customer office to check and clear customer tax.
- h) Others. Such as feed for fuel. Provide the daily accessory for the seafarer. Repair for ships. Salvage and so on.

In general, MPL becomes more and more important in the modern logistics system. MPL simplifies the port process and improves the multimodal transportation and global supply chain position, which contributes to the national economics and international economics.

Chapter 4 Forecasting Container Throughput in Shanghai port under MPL

4.1 Economic hinterland of Shanghai port and its transportation situation

4.1.1 Economics hinterland of Shanghai port

The direct hinterland of Shanghai port includes the Yangtze River Delta region, such as Shanghai, Jiangsu Province, and Zhejiang Province. The indirect hinterland of Shanghai port includes the Middle West of China, such as Anhui, Jiangxi, Hubei, Hunan, Sichuan, and Chongqing, 6 provinces. The population of Yangtze River regions is 38% of the whole Chinese. And the national productivity is 40% of total. The industry productivity is 43% of total. The export quantity is a quarter of the total.

After 1990, Pudong new area brings the Yangtze River region becomes the fastest growth economic place. The area is 1% of the China, but contributes the 1/6 in economics.

4.1.2 Transportation situation and equipments

- a) **Situation of transportation infrastructure.** The transportation infrastructures are advanced in Yangtze River region. There are railway, highway, channel, and air multimodal modern transportation methods. And the transportation network is in a big range. Until 2003, the railway length is 1811.6 kms, takes 3.1% of total China railway. The highway is 722,460 kms, occupies 5.3% of total. The internal channel is 364,470 kms, takes 31.3% of total. There are 25 airports, 20.3% of all numbers in China. The main ports are 9 pieces and berth 220 pieces.
- b) **Assessment of transportation infrastructure.** It is very clear to show that the highway construction speed and quality are improving. Lots of first-class highways are in use, which solve highway traffic jam problems. About the

railway, the government increases the speed and expands the stations. Enlarge the scale of ports. And build several international airports, such as Pudong airport and re-build the domestic airport for the in-china usage.

4.1.3 Status quo in Yangtze River Delta container transportation

Table 4 main ports and their container throughput in 2000

port	berth	planned containers (10,000 TEU)	finish in 2000 (10,000TEU)
Nanjing	2	15	20.3
Zhenjiang	1	8	5.7
Zhangjiagang	2	25	14
Nantong	2	16	18.2
Taicang	2	25	3.6
Ningbo	3	50	90.2
Shanghai	16	290	561.2

In table, it describes 7 ports in Yangtze River region and how many berths, planned container throughput and real throughput in 2000.

Table 5 container throughput in main ports of Shanghai hinterland in 1991 and 2000

(unit 10,000TEU)

port	1991	2000
Nanjing	5.21	20.3
Zhenjiang	0.18	5.7
Zhangjiagang	6.04	14
Nantong	2	18.2
Taicang	0	3.6
Ningbo	3.6	90.2
Shanghai	57.7	561.2
Total	74.73	713.2

In Table, it shows that from 1991 to 2000, how big quantity of container transport does different port improved.

The percentage of container throughput in shanghai port has increased from 77.2% (57.7/74.73) in 1991 to 78.7% (561.2/713.2) in 2000. It obviously show that shanghai is the leading port in the Yangtze River regions, due to shanghai occupied 78.7% of total container throughput.

4.2 Forecasting containers throughput in shanghai port

4.2.1 Status quo in shanghai port container transportation

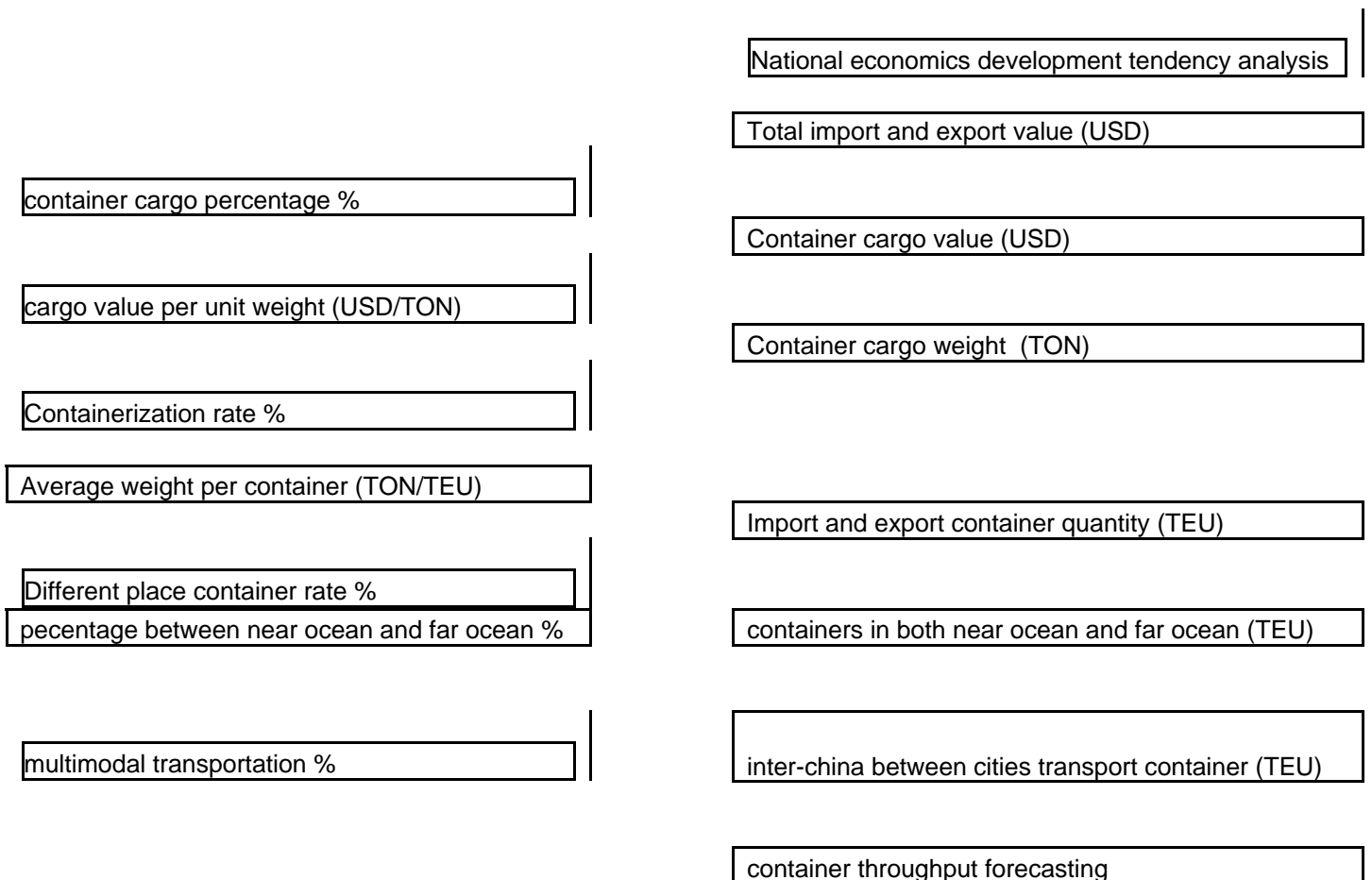
It is reported that the throughput gets to 537,000,000 TEU in 2006. It is higher than the No 2nd Singapore, 90,000,000 TEU. And shanghai becomes No 1 port in the world. It increases 21.2% of 2005. And it occupied 12% of total container throughput in China.

4.2.2 Container throughput development level forecasting

a) Basic throughput forecasting method introduction.

The throughput forecasting range includes import and export container quantity, inter-china transport container numbers plus the transfer container from both domestics and abroad.

Figure 4 framework of container throughput forecasting in shanghai port



b) Forecasting for the hinterland import and export TEU

Table 6 (unit 10,000TEU)

No	Location	2010	2020
1	Shanghai	389-450	530-640
2	Jiang su province (8 ports)	415-490	660-785
3	Zhejiang province (11 ports)	291-320	501-550
4	others	301-331	612-674
5	Total	1396-1591	2303-2646

In Table 6, it describes the economic hinterland forecasting container throughput in 2010 and 2020.

Shanghai can use highway to transport the containers to the hinterland.

In the Jiang su Province, the international container should be delivering by highway to shanghai port, maritime use less. But the near sea container can be transported by Yangtze River to the nearest port and then distribute.

In Zhe jiang province, it can transport container by highway to shanghai port then export. After building Yang Shan, it is benefit for the north of Hang Zhou. The container can be transported by sea. But the container in south of Hang Zhou should transport to Ning bo port is much reasonable choice.

The forecasting of hinterland import and export container throughput are 13,960,000 to 15,910,000 TEU and 23,030,000 to 26,460,000 TEU, respectively in 2010 and 2020.

c). Forecasting export containers throughput in Shanghai port

Table 7 exports container in shanghai port transported by different ways**(Unit 10,000TEU)**

year	container catalog	total	by ocean	by highway	by railway
2010	far ocean container	460-523	131-144	311-356	18-23
	near ocean container	334-390	27-32	298-346	12-Sep
	total	794-913	158-176	609-702	27-35
	total (including empty containers)	993-1141	198-220	761-877	34-44
2020	far ocean container	754-871	243-262	467-558	44-51
	near ocean container	487-597	41-55	431-524	15-18
	total	1241-1468	284-317	898-1082	59-69
	total (including empty containers)	1551-1834	355-396	1122-1352	74-86

Following the forecasting of hinterland import and export container throughput and the different ways for transport containers, we can predict the container quantity delivered by different ways. Due to we should consider the real number of trade and how many cargos are suitable for the container transport, so we should add some percentage of empty containers. Calculated by the last 5 years data, the empty container rate is about 25%.

Through the analysis, add some uncertainty factors, the export and import containers throughput in Shanghai port will be 9, 930,000 to 11,410,000 TEU in 2010. And in 2020, the throughput will increase to 15,510,000 to 18,340,000 TEU.

d). Forecasting inter-China containers throughput in Shanghai port

In 1996, Shanghai-Xiamen is the first inter-China containerization route. From the beginning, there was only 1 ship transport. But now, shanghai has become a inter-China trade centre. The inter-China container transportation is about 1,100,000 TEU in 2005. The inter-China container transportation grows so fast due to it use the international standard container size. We should refer for data of containerization rate and container cargo percentage, then forecast in 2010, the inter-china container throughput is 1,000,000 to 1,200,000 TEU. And in 2020, the number will grow up to 3,400,000 to 3,600,000 TEU.

e) Forecasting for international and domestic transfer container throughput

in Shanghai port

i. following the analysis of historic data, we suppose the domestic transfer container throughput will get to 1,300,000 to 1,650,000 and 2,200,000 to 2,500,000, respectively in 2010 and 2020.

ii. After shanghai build the deep water terminal, shanghai international shipping centre will attract 50% speed for the international transfer container throughput. Under a conservation estimate, in 2010, the international transfer container throughput will reach to 1,450,000 TEU.

f) Gathering of the forecasting

**Table 8 gathering of forecasting of container throughput in 2010 and 2020
(Unit 10,000 TEU)**

	2010	2020
export containers	993-1141	1551-1834
in-China trade containers	180-200	330-360
international transfer containers	145-155	300-320
domestic transfer containers	130-165	220-250
Total	1448-1661	2401-2764

The container throughput will be around about 1500 in 2010, and 2500 in 2020.

4.2.3 Yang Shan deep water port's throughput scale

Table 9 Forecasting Yang Shan's container throughput scale

	2010	2020
forecasting container throughput	1500	2500
other ports	900	1100
Yang Shan	600	1400

The forecast of Yang Shan depends on the container throughput (the data we calculated above) minus the throughput in other ports in Shanghai. So we predict that Yang Shan should serve above 6,000,000 TEU in 2010. And above 14,000,000 TEU in 2020.

Chapter 5 Economics benefits analysis of -Shanghai Deep water terminal under MPL

5.1 major economics benefits

Yang Shan, the deep-water terminal of Shanghai, is a huge investment project, in which the preliminary cost estimation is about 40 billions RMB. But this investment will promote a serial of industries growth, which can pull the national economics going up. The contribution can be calculated by "OPEN-ECONIMY MULTIPLIER". Suppose the data is 2.0, that mean Yang Shan deep-water terminal contributes 80 billions RMB for the GDP. (2.0*40 billions investment)

The construction of Yang Shan is benefit for development in Pu dong area and islands nearby. It is not only the direct economics benefits, but also brings developing in this area. In 1998, Shensi, a fishing village contributed 1.195 billions RMB for GDP. The first phase of the construction in Yang Shan returned back 0.967 billions as the port profit.

5.2 Estimate in national economy and financial profits.

The Port can improve the region's tourism industry. It is forecasted that Nanhui, Chongming and Fengxian 3 districts near to the Yang Shan terminal will contribute 1.35% growth of the total GDP in Shanghai.

The construction of Yang Shan also will bring the indirect economic benefits, which is 3-4 times up than the direct economic benefits. Such as, in Rotterdam, the rate between indirect benefits to direct benefits is 4:1. And in Seattle, the rate becomes 6:1. In Japan, the rate is round about 3:1.

5.3 Analyze integrative advantages

a) Attract international transfer containers. Following the standard charger, the international transfer containers will increase port net profit for 550 RMB/ TEU.

b) Attract domestic transfer containers. The nearby ports can reduce cost on transfer container to abroad, such as transfer to Pushan, Kobe or Singapore. It

will decrease cost for the cargo owner around about 65 USD/TEU, and add port profit 69.4 USD/TEU.

c) Save cost of transportation and loading for transfer hinterland containers. The containers come from hinterland can save 350 USD/ TEU by reducing transportation and loading in abroad ports. Normally, we can save 1 day by reducing 1 time for transferring, and it is benefit for 80 USD/ TEU for transportation fees.

d) Land added-value. After building Yang Shan terminal, it will increase 10 square kilometers for the space, which increase 1.5 billions RMB for benefit.

e) Save and create foreign currency. After building the first phase Yang Shan, it creates and saves 301,840,000 USD per year. After the entire Yang Shan project ready, the annual saving and new creating will reach to 929,910,000 USD.

5.4 competitive power and city position

From China's trade condition, we can find that 90% cargos are transported by ocean. And the sea transportation rate of Shanghai is higher than other cities. The transportation fee is much higher than export directly from Shanghai port, If the export containers transfer to PuShan, or Kaohsiung first. And everyday there are huge amount of export containers. Without modern logistics system working in the port, the picture of loss can be imagined. In 2006, Shanghai becomes No 1 container transportation port in the world. After building the modern port logistics, the weakness of original Shanghai port has disappeared.

Shanghai uses its economics advantages, financing power, trade stability and international port dominance to attract more and more investments. Using port advantage, Shanghai is the head of Yangtze River in every field. After Yang Shan deep water terminal construction, Shanghai creates stronger competitive, which is nobody else could defeat.

Chapter 6 Summary and Conclusion

Port is the necessary connection between ship and land. And the industry realizes that a modern logistic system in the port can provide all kinds of value-added service and bring more business opportunities for the port and nearby industry.

The economics globalization is existing in every place, which leads to more fluently commercial intercourse. This means in the global macro surroundings, transport cargos is necessary. So the transportation quality and efficiency become very significant. It is the reason to use modern logistics system in the port. And this is what I will demonstrate in the dissertation.

In the chapter 2 of this article, I introduced the international advanced port in the world. You can see how can Singapore and Hong Kong port run their business and maintain their “king of hill” position in the container transportation. Secondly, describe the success secret of Shenzhen and Shanghai. Compare the difference of before and after use modern logistic port system. The data of increase productivities and promote efficiency proof the port logistics functions.

In Chapter3, I have depicted the meaning of the logistics, the structure of the logistics. And then, I introduce the working process of the modern port logistics. I use historic store to explain why “logistics” will instead of “physical distribution”. After forming the logistics, so what are the characteristics of the MPL.

In Chapter 4, I use forecasting model to predict the container throughput in the Shanghai port in 2010 and 2020. Because Shanghai port is not small and separates in the different place in Shanghai, so the prediction is theoretical. I separately calculate “the inter-China trade container transportation”, which means transport container in the different cities in China, what we also call “inter-trade”. Secondly, I measure the export containers. And the third part, transfer containers, which is a hot spot attract people’s eyesight. Nowadays, more and more shipping companies and port industry emphasis on this part of profits. The sum of the 3 data is the result of forecasting container throughput in 2010 and

2020 for the Shanghai Port. It is obviously clear that the container throughput will continuously increase in the next few years in Shanghai port.

In Chapter 5, I use calculation of economic benefits to make people be sure that the MPL is really meaningful system for port improves the efficiency.

However, limited by time, the data and methods I used is consideration, but may not rigid. The world is always changeable, maybe the data is meaningful this time, but not comparable in several years later. There's still a long way for study and research advanced knowledge. My dissertation just only describes some foundation for the port industry.

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