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Research on river-sea transport for the Heilong river

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RESEARCH ON RIVER-SEA TRANSPORT FOR THE HEILONG RIVER

By

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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.

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ABSTRACT

Title of Dissertation: **Research on River-Sea Transport for the Heilong River**

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River-sea transport is a kind of intramodal transport and stands for the transport with both inland river and sea routes. River-sea transport is a practical task, being used overseas and within China broadly. The dissertation is a study of one of these, River-sea transport for the Heilong River.

It starts with looking at basic theories on intermodal and intramodal. An overview of the notion of river-sea transport and its position in the field of integrated transport is provided. Practical cases on river-sea transport within China and overseas are summarized and analyzed systematically. Indicate that some successful experiences can be used for reference on River-sea transport for the Heilong River.

The Heilong River is in crucial geographical location, which is a boundary river between China and Russia. Developing river-sea transport is significant to trade, transport and logistics. It is noteworthy and has superiority in certain situation. River-sea transport for the Heilong River has large potential to develop not only because there has support of government but also has demand of internal and international trade.

Recent years, River-sea transport for the Heilong River has already obtained some achievements, but it just in beginning and some problems needed to be settled. General situation of the Heilong River shipping as well as actuality and prospect of

River-sea transport for the Heilong River are examined in contextual detail. It does research on necessity, significance and finds new shipping lines for River-sea transport for the Heilong River and puts forwards some ideas and possible ways to solve problems in course of developing River-sea transport for the Heilong River to reach a large-scale.

The concluding chapters give a number of recommendations concerning the need for further investigation in the subject.

KEYWORDS: Intramodalism, Intermodalism, River-sea transport for the Heilong River, Integrated network of transportation, Integrated waterway transport, River-sea ship.

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LIST OF ABBREVIATIONS

DWT	Deadweight Tonnage
DWCT	Deadweight Cargo Tonnage
TEU	Twenty Foot Equipment Unit
RMB	Ren Min Bi
USD	US. Dollar
WTO	World Tread Organization
FOB	Free on Board

CHAPTER 1

INTRODUCTION

River-sea transport is a kind of intramodal transport and stands for the transport with both inland waterways and sea routes. Compared with intermodal transport, river-sea transport has its own advantages in certain situations, in which it has competitiveness with regard to a number of alternative transport modes. River-sea transport is a practical task and being used overseas and within China broadly. This dissertation is concerned with one of these cases: River-sea transport for the Heilong River.

River-sea transport for the Heilong River stands for that the cargos are loaded in inland water ports of China Heilongjiang province and transported by lower reaches of the Heilong River within the boundary of Russian then transshipped on sea ships to transport to ports of destination by the seaway.[1] Here, the water carriage is restricted to certain geographic areas and is generally used for general cargos, commodities moving in bulk and containers. Shipping lines of River-sea transport for the Heilong River includes the international shipping line with the destination of ports in Japan and South Korea and the internal shipping line with the destination of ports in Southeast of China along the sea.

Developing River-sea transport for the Heilong River is significant to practical trade,

[1] This concept is acquired from China Heilongjiang Transport Administration.

transportation and logistics. The Heilong River is in crucial geographical location. It is a boundary river between China and Russia. It is noteworthy and has superiorities in certain situations of River-sea transport for the Heilong River.

Prospect of River-sea transport for the Heilong River is good: first, many years ago, some scholars had already put forward the strategy of “Border-opening” and the strategy of “Unite with the South and Open to the North” for Heilongjiang province. In the course of developing economy of Heilongjiang province, putting strategies of “Border-opening” and “Unite with the South and Open to the North” into practice is the result of geography location, traditional economy and trade relationship with the neighbor countries. Second, there is much superiority for developing economy of Heilongjiang province, such as geography factors between port-group and river-sea transport, natural resources, bases of agricultural and industrial production as well as the function of the city’s integrated service.

River-sea transport for the Heilong River has large potential to develop not only because these high demand of internal and international trade but also because there have supports of governments. Because of these, research on River-sea transport for the Heilong River is vital to practice and is worth to go deep into.

In 1992, Ministry of Communications of the People’s Republic of China and Transportation Ministry of Russia subscribed “Treaty on the Heilong River and the Songhua River utilize ships of China and Russia to organize cargo transportation for foreign trade” in Beijing. It then opened the shipping line of river-sea transport from Heilongjiang province to Japan. Recent years, River-sea transport for the Heilong River has already obtained some achievements. It had already opened internal route of river-sea transport in June of 2004, with the first ship of river-sea

transport for special line to transport internal provisions from Heilongjiang province to the city of Wenzhou, which signs northern provisions can transport to the south of China and it have settled bottleneck in provisions transport as well as signs new development in the River-sea transport for the Heilong River.

However, compared with other river-sea transport, such as for the Rhine River, for the Yangtze River, River-sea transport for the Heilong River is just in the beginning of development and some problems are needed to settle. These problems exist and restrain the further development of River-sea transport for the Heilong River, such as being short of return cargos, short of infrastructures fitted and short of shipping channels rationalized. So, it's worth to systematically summarize and analyses successful experience on river-sea transport within China and overseas and use them for reference on River-sea transport for the Heilong River.

It starts with looking at basic theories on intermodal and intramodal transportation. An overview of the notion of river-sea transport and its position in the field of integrated transport is provided. Practical cases on river-sea transport within China and overseas are summarized and analyzed systematically. Examine modes and experience of these cases, including the Yangtze River, the Pearl River, the Rhine River and the Mississippi River. Indicate that some successful experiences can be used for reference on River-sea transport for the Heilong River. Of course, finding its characteristic is crucial for development.

Introduce the shipping situation of the Heilong River generally. Do research on actuality and existing problems in River-sea transport for the Heilong River on aspects of routes, capability of transportation, resource of cargo, etc. As well as

prospect of River-sea transport for the Heilong River are examined in contextual detail.

Do research on necessity and significance of developing River-sea transport for the Heilong River. Compare in aspects of cost and time of river-sea transport with other modes or routes of transport for the same purpose. Analyze integrated benefit combined with society, voyage and marketing benefits on internal shipping line of River-sea transport for the Heilong River.

Give basic ideas of developing River-sea transport for the Heilong River to realize a large-scale. Find deficiencies in River-sea transport for the Heilong River and give corresponding suggestions to existing problems, such as find solutions of being short of return cargos, short of infrastructures fitted, the problem of seasonal nature of vessels' operation, etc. In addition, it put forward some proposals on necessary conditions and reasonable modes to organize the River-sea transport for the Heilong River to realize a large-scaled transportation. It also gives opinions on exploiting new shipping lines of container transportation with the River-sea transport for the Heilong River.

Through the whole research, it uses analytical methods, including qualitative and quantitative analysis.

Wish all of these efforts could dedicate to River-sea transport for the Heilong River in some extent. In addition, wish the dissertation can give some help to relevant studies.

CHAPTER 2

BASIC ISSUES OF RIVER-SEA TRANSPORT

2.1 INTRODUCTORY REMARKS

From an overview of the notion of intermodalism and intramodalism as well as find their different characters. Find superiority of river-sea transport in the point of trade, transportation and logistics as well as its position in the field of the integrated network of transportation.

River-sea transport is a practical task and being used overseas and within China broadly. Researching on their experiences is useful to develop River-sea transport for the Heilong River. This chapter will summarize and analyze relevant studies, ideas, practices and experiences on river-sea transport within China and overseas systematically.

General situations about transportation of the Heilong River including basic status about shipping of the Heilong River and actuality of River-sea transport for the Heilong River are provided.

2.2 INTERMODALISM AND INTRAMODALISM

2.2.1 Intermodalism

Intermodal transportation stands for transport using multiple (two or more) modes for the shipment of freight from origin to destination (Muller, lecture handout). What does intermodal mean to you? Real competition, it seems. Because the goal of an intermodal transfer is provide intermodal freight transportation, which is coordinated, seamless, flexible, and continuous from door-to-door on two or more transportation modes (Muller, 2005, p.3). In addition, intermodal transportation is prevailing increasingly due to the development of technology and management. River-sea transport sometimes acts as a part of intermodal transport and provided functions in the field of the integrated network of transportation.

The system of the integrated network of transportation in China evolved gradually from monotonous system that transported mainly by railway or waterways to the integrated network of transportation in which the five modes[2] can well-balanced develop.

In addition, growth of economy turns the requirement on transport increasingly to aspect of efficiency, not just satisfying the cargos' moving. What's more, the division of labor in internal and international accelerates the development of united market with internal and international trade. All of these increase the complication of the course of transporting cargos. One should mention as well, the enlargement of the place for transport makes that some single mode of transport can not complete the whole course of transporting cargos independently.

2.2.2 Intramodalism

In a wide sense and in some scholars' opinions, river-sea transport is pertained as a

[2] The five modes of transport include transport by air, by water, by road, by rail and by pipe.

kind of intermodalism. It may because that nevertheless the river-sea transport is not using single manner to complete the whole transportation. From that point of view, saying that intramodaslism is a kind of intermodalism is not without of any rationalization. But in order to expound issues simply and explicitly, it takes intermodalism and intramodalism as two different and independent concepts in the dissertation.

River-sea transport acts as a kind of intramodal transportation and also can be regarded as a part of integrated waterway transport. The possibility of using other water transport systems adjacent to seaports should be considered to get more efficiency. Further potential could be unlocked by making greater use of channels, coastal routes and national waterways, including those that cannot be brought into line with international standards.

An intramodal transfer usually is easier to manage than an intermodal transfer (Muller, 2005, p.3). It main because that intramodal transportation transships between the same mode of transport. Other than river-sea transport, intramodal transport also exists between railways, roads, etc. Compared with intermodal transportation, intramodal water route, such as river-sea transport, will provide for connection with countries that have no direct access to the sea and will connect the largest inland water arteries. In addition, intramodal transport has its own advantage and competitiveness in certain situations and in aspects of cost, time, etc. That will be proved in the following chapters.

2.3 PRACTICAL CASES OF RIVER-SEA TRANSPORT

2.3.1 The Rhine River

The Rhine River is the greatest river in Western Europe. It originates from Alps in Switzerland, flow via Liechtenstein, Austria, France, Germany and Netherlands, then from west of Rotterdam to the North Sea.

Two biggest characters of the channel of the Rhine River are internationalism and standardization. Annual capacity of cargo transport is about 0.3 billion, which is nearly equal to 20 items of railway.

The whole long of the Rhine River is 1320 kilometers, whose water amount is abundance. From Basel in Switzerland, its mileage of navigation is 886 kilometers. Many branches flowing along banks relate to the Danube River, the Rhone River and other water system through a serious of channels. It constitutes a shipping net widely to the world outside.

The Rhine River flows through main zones of industry in Europe. Ruhr, the modern zone of industry in Germany, is between the Ruhr River and Lippe River, which are both branches of the Rhine River and unite with the Rhine River through four manual gouged cannels and seventy-four river ports. From Ruhr, sea ships of seven thousand tons can transport to the North Sea without any stop. Depending on the convenient transportation there, multitude iron ore and other mineral material can transport to Ruhr from foreign countries continually.

2.3.2 The Mississippi River

The length of the Mississippi River is 6262 kilometers. It is the backbone of inland water system of American and the artery of its transportation. The Mississippi River is one of the most developed water systems, whose capacities of the cargo

carrying and turnover are all in the first place of the world. Also, the capacity of cargo carrying is account for 60% of that of the whole inland water in America. In addition, cargo carrying capacity of the Mississippi River is nearly equal to 19 items of railway. Annual cargo transport density of the Mississippi River reaches 10.27 million tons per kilometer.

The upper reaches of main distributaries and tributaries of the Mississippi River except the Missouri River have already realized channelization and channels' unification and standardization basically. At present, navigation mileage of the Mississippi River is about 20 million kilometers, among which channels with water depth over 2.74 meters is account for nearly 2/3. The whole length of navigation channel is 25 thousand kilometers. The whole length of main distributaries of the Mississippi River is 3766 kilometers and the water depth of main channels is 3.65 meters, in which barge-combination with DWT between 1350 and 2720 tons can navigate through. The dimension of the navigation channel and ship-lock of the Mississippi River have also realized standardization basically.

The average tonnage of ships in the Mississippi River is 1149 tons. The mode of transport is mainly using pusher fleet, which are all adopting barges with no person and the degree of automation of the tugs is really high.

The degree of mechanization of harbors along the Mississippi River is basically reaching one hundred percent. A fleet with 20 thousand tons can finish operation of load and discharge in 8 hours. The throughput capability of wharfs is high and some can even reach 9 million tons (LiuJun, 2005).

The developing of River-sea transport for the Mississippi River would not happen

without governmental support of countries that the river flows through. There is an example. In order to decrease the influence to ecological environment and decrease excess possess to resources from land transportation, government of American prescripts many kinds of policies to support inland water shipping. In order to accelerate the development of inland water transport, government of American prescript that funds for channels' construction and maintenance are all from national treasury and need not to repay.

2.3.3 The Yangtze River

Many cities along the Yangtze River take into account that the developments of river-sea transport. For example, from the governmental web of Chongqing, it seems that river-sea transport there is developing really well. Chongqing is a city with the largest inland port on the upper reaches of the Yangtze River. The Yangtze River, the Jialing River and their distributaries form the water carriage network of Chongqing. There are tens of ports and wharfs along the Yangtze River in Wanzhou, Fuling, etc. River-sea transport is available via Shanghai to offshore destinations. The waterway is navigable for 1,000-tonne ships to reach Chongqing, and the mileage is over 4,000 km. Chongqing Port is a Category-1 port in China. The annual freight transportation of the new Chongqing Port will be 10 million tonnes. After the Three Gorges Project is completed, 10,000-tonne fleets can sail upstream to Chongqing Port from Wuhan. In recent years, high-speed hovercrafts have been in service to increase economic benefits and competitiveness of water carriage. By 2003, there are 134 navigable rivers, and total open mileage for navigation reached 4,086 km. On May 18th 2005, city of Chongqing opened the first straight shipping line of internal container transportation using river-sea transport. Cargo vessels

departed from Chongqing can arrive straightly to cities of Dalian, Tianjin, Guangzhou, etc.

The Yangtze River is an integrated system. Except for Chongqing, each province or city has already taken action and give governmental support in order to develop river-sea transport for the Yangtze River. HuangQiang, director general of The Yangtze River Transport Administration which is governed by the Ministry of Communications of the people's republic of China, pointed out that developing shipping of the Yangtze River and accelerating construction of the River-sea transport for the Yangtze River need positive participations and great supports from each province or city along the Yangtze River, from relevant departments of management and from corporations and other aspects in society. He also advised to found a coordination mechanism to unite legislation, policy and management.

It forecasts that the shipping industry for the Yangtze River after applying the river-sea transport can increase transport capacity and utility. It also can increase income and has other interlock effect. What cannot neglect is that the strategy of river-sea transport for is certainly radiated by the construction of the shipping center of Shanghai. The profits not only to inland water shipping of Shanghai but also to areas along the Yangtze River are cannot estimated.

2.3.4 The Pearl River

The Pearl River is a natural district with good ports for river and sea vessels' transshipment. Water system of the Pearl River has eight accesses to the sea. Channel of Humen in the east and channel of Yamen in the west are the best accesses to the sea. Channel of Humen is exploited early in eighteenth century and ports of

Huangpu and Nansha along the banks are in crucial status in Pearl Delta. Channel of Yamen in west by far has the depth of shipping channel of 6 meters at present and navigation capability is 3000 tons and a sea vessel with 5000 tons can enter and exit by tide, which indicate that it possesses conditions to build into the top-first port and freight harbor. The Yinhu Lake, connecting with the channel of Yamen, has a main channel for shipping with depth of 13 meters through the whole year and can be navigated by a cargo vessel with 10 thousand tons.

Accompany with the completion of the first forum on cooperation and development for the Pearl-Delta-Zone, in order to coordinate needs of shipping construction in Pearl Delta, from year 2004 to 2010, China Guangdong province will invest more than 4.6 billion RMB into construction of shipping channels and the emphasis is to insure that the Pearl Delta and main channels in the West River can realize channel modernization.

From China Economic News-base, published in November 2005, inland river transport in Guangdong would go to emphasize on developing river-sea transport in the period of "Eleven Five-year Plan[3]". The new project of channel scheme indicated that province of Guangdong, acting as main access to the sea in Pearl-Delta-Zone, should better construct main channel in water system of the West River, better construct net of channel with high grade in Pearl-Delta in emphasis and better build channels for large vessels' access to the sea. At the same time, it should build an inland water shipping system of the Pearl River. Let this net as a core and connect with the North River, the East River and other branches of channels, together with river-road transport, and collaborate to develop ports, channels and vessels.

[3] Five-year Plan of national economy and social development is a part of planning for national economy of China. It began in year 1953 and takes fiver-year as a period. It mainly plans for nationally important construction projects, distribution of production power, important proportion of national economy, etc.

Through constructing in emphasis seventeen projects of high grade channels, net of main channels in Guangdong province will receive essential extent, thickness and improvement, net of high grade channels will basically form and it will form sea vessels to the river and accelerate river-sea transport increasingly.

2.4 GENERAL SITUATION OF THE HEILONG RIVER TRANSPORT

2.4.1 Basic Status of the Heilong River Shipping

The Heilong River is one of the most important rivers for inland shipping in China and is the largest main access of shipping in north of China. Including the Heilong River, the Songhua River, the Nen River and the Wusuli River, mileage preserved for shipping channels as the trunk line is 4228 kilometers. Among them, mileage of shipping channels above the third category is more than 1700 kilometers. The number of ports is 82, among which there is 16 ports belong to first category opened by China. Ships' capability of transport is about 0.3 million tons and annual capacity of transport is about 10 million tons. Capacity of turnover completed is 2.5 billion ton-kilometers.

The Heilong River is a boundary river between China and Russia and it is an international river with significance. Shipping line of the Heilong River opened to other countries is above 3 thousand kilometers.

2.4.2 Actuality of River-sea transport for the Heilong River

2.4.2.1 International Shipping Line

River-sea transport for the Heilong River opened in year 1992. According to "Treaty on the Heilong River and the Songhua River utilize ships of China and Russia to organize cargo transportation for foreign trade" signed by Ministry of Communications of the People's Republic of China and Transportation Ministry of Russia in Beijing, Chinese traders have rights to exit to sea or enter into river, through lower reaches of the Heilong River in Russia, then through Strait of Tartary[4]. It finished the history of closed transport of the Heilong River for more than 130 years[5].

Aspect of Japan named this shipping line as Eastern Silky Road on Water and established relationship of cooperation on international produce and sale with The General Bureau of State Farms of Heilongjiang Province from year 2001. Farms in Heilongjiang province cultivate 40 thousand tons of corns with no gene transfer every year for Japan and these corns transport to Japan through water channel of the Heilong River. It had opened shipping line from Heilongjiang province to Niigata and other ports in Japan. To the end of year 2005, it had already transported 55 thousand tons of cargo using this shipping line from Heilongjiang province to ports in north of Japan.

2.4.2.2 Internal Shipping Line

It had already opened a special shipping line using river-sea transport for internal provisions from Heilongjiang province to the city of Wenzhou in June of 2004. It

[4] Also named Gulf of Tartary, Gulf of Tatary, Tatar Strait, Tartar Strait, Strait of Tartar, also Chinese: 韃靼海峽, Japanese: 間宮海峡, Mamiya Strait and Strait of Nevelskoi. It is a strait in the Pacific Ocean dividing the Russian island of Sakhalin from mainland Asia (South-East Russia), connecting the Sea of Okhotsk on the north with the Sea of Japan on the south. It is 900 km long, 4-20 m deep and 7.3 km wide at the narrowest point.

[5] Ruled by Treaty of Aigun in 1858.

signs that northern provisions can transport to the south of China and it has settled the bottleneck in exportation and transportation of the commodity provisions. As well, it resolves the problem of lacking provisions in south of China and signs new development in River-sea transport for the Heilong River.

The special shipping line, used to transport internal provisions from Heilongjiang province to Wenzhou, shipped from city of Dongan in the farming district of Jiansanjiang, through Fuyuan, flowing by Amur River in Russia, then through Strait of Tartary, flowing by the Japanese Sea, Strait of North Korea and the East Sea, arrive in areas in southeast of China along the sea ultimately.

New development of the River-sea transport for the Heilong River improves access of trade on water, strengthens relationship between Heilongjiang province and economically developed areas. It promotes economic cooperation and exportation of Heilongjiang province as well.

2.4.2.3 Governments' Supports on River-sea Transport for The Heilong River

River-sea transport for the Heilong River has been taken into account and received supports by governments of China, Japan and Russia. On the 16th China Harbin International Fair Trade and Economic Cooperation, governments of China, Japan and Russia decided that they would use methods to further large the scale of this shipping line, such as support with privilege policies, accelerate construction of infrastructures along banks, construct vessels of sea worthy, increase cargo capacity and stable sources of cargos, etc.

At present, Ministry of Communication of the people's republic of China had already

put the River-sea transport for the Heilong River, channelization for the Songhua River and construction of trading ports into schemes of booming aged industry base in northeast of China. Making the most of superiority of water transportation and accelerating the River-sea transport for the Heilong River will supply important supports in the course of applying strategy of booming aged industry base in northeast of China.

River-sea transport for the Heilong River acquires strong supports from governments of Japan and Russia as well. In order to accelerate the development of river-sea transport, Japan specially founded "Trade-promoting Association for Eastern Silky Road on Water". The director general of Russia Amur River[6] Shipping Administration indicated that in order to support this shipping line, Russia would enlarge the scale of ports' construction, increase efficiency of checking in custom, decrease cost of pilot, transshipment and think about abolishing cost for watching cargos.

2.5 CONCLUDING REMARKS

Both intermodal transport and intramodal transport are modern modes of transportation and can act as a segment of logistics. However, they have different characters and have different impacts on the whole integrated network of transportation. Refer to China, coping with competitions after China entered into WTO and accompanying the enlargement of market opening degree, mode of divided transportation can not satisfy increasingly needs of shippers who want entire service and less transport cost.

[6] Russia names the Heilong River as the Amur River.

Inland water transport, so as river-sea transport, have both economic and ecological advantages as compared with other modes of transport. There are many practices of the river-sea transportation in the world. Comparing with the Rhine River and the Mississippi River, we can see the distance existed in the development of the inland water in China. For example, shipping channels in China are having distance to realize standardization.

There are some practices in River-sea transport for the Heilong River. But comparing with the developed cases, the degree of development is relatively low. Many valuable experiences can be taken into reference for river-sea transport for the Heilong River.

However, River-sea transport for the Heilong River has its own advantages and great potentiality to develop not only because it has sufficient resource of cargo and has strong demand for river-sea transport but also because it has governments' supports from China, Russia and Japan as well as their sincere cooperation.

River–sea transport is an intramodal transport concept by definition, because seaport transshipment is avoided. Nevertheless, the concept has not been widely developed in China. Many problems: ship designed, river conditions and draft restrictions in particular, generally form a major impediment. This restricts physical opportunities for this concept to a very limited number of transport corridors, and even then it is faced by limitations influencing the economic attractiveness of such a concept. The following chapter will discuss existing problems in the course of developing River-sea transport for the Heilong River.

CHAPTER 3
EXISTING PROBLEMS IN RIVER-SEA TRANSPORT FOR THE HEILONG RIVER

3.1 INTRODUCTORY REMARKS

Compared with cases of successful experiences on river-sea transport in the world, River-sea transport for the Heilong River is falling behind. Opened for 14 years already, transport capacity is still few and the shipping lines have not been used sufficiently. These phenomena are resulted from some problems existing in the course of developing River-sea transport for the Heilong River and so restrain its further development.

3.2 MAIN PROBLEMS EXISTING IN THE COURSE OF DEVELOPING RIVER-SEA TRANSPORT FOR THE HEILONG RIVER

3.2.1 Short of Cargos for river-sea transport

Compared with railway transport, cargos for River-sea transport for the Heilong River is short. That resulted from some relevant policies. At present, provisions for exportation execute united price of FOB. The transport distance on water of this shipping line is farther than that from port of Dalian to ports in north of Japan. However, foreign traders do not pay out freight for railway transport from

Heilongjiang province to Dalian. In other words, compared with the traditional transport route through rail-sea transport through Dalian, foreign traders need to pay out more freight themselves. So, many traders do not want to transport using river-sea transport, which leads to short of the cargos for river-sea transport. In addition, at present, it is difficult to find and organize backhaul cargos and it has not formed shipping line of timed-regular, which also lead to that the transport cost is difficult to further decrease.

3.2.2 Short of Basic Infrastructures Fitted and Deficiency of Capability

It is short of investment of fund and privilege policy as supporting. That leads to deficiency in infrastructures' capability. The channel from Tongjiang to Fuyuan is 275 kilometers and had been already marked by China as 2-Category channel. However, it has not been received integrated regulation yet. What's more, the capabilities of transshipment in ports of Tongjiang, Fuyuan, Luobei, etc. are deficient almost due to less of infrastructures fitted and it has not rebuilt the sea-worthy capability of the inland ship for the river-sea transport. All of these restrain the development of River-sea transport for the Heilong River.

3.2.3 Seasonal Nature of Vessels' Operation

Due to the limitation of natural condition: character of seasonal production in shipping industry of the Heilong River, the channel for river-sea transport can not realize well-balanced supply in the whole year. It cannot navigate for almost half a year, which decreases the benefit heavily. Because of that, it cannot help but make use of rail-sea transport as supplement in winter and it crucial to connect with other transport modes.

3.2.4 Existing Structure of Carrying Capability Not Fit Transport Requirement of Principal Kinds of Cargos.

First of all, it is short of river-sea ships fitted whose type is shallow draught and full-formed. At present, Heilongjiang Shipping Company[7] only has a river-sea ship of 1800 tons, which can reach ports along the Heilong River in the period of high-flow, but can only reach port of Nikolayevsk-on-Amure in the period low-flow due to the limitation of draft. It restrains the river-sea transport with nonstop. Second, it is short of tank barge fitted for cargo transport of provisions, forage, etc. At present, the shipping companies in Heilongjiang province only have four tank barges of four thousand tons. It is difficult to realize a large-scale transportation. Third, it is short of large tug needed for transport in low reaches of the Heilong River. At present, the shipping companies only have two tugs of 60 horsepowers, which can operate in low reaches of the Heilong River.

3.2.5 Need to Choose New Ports for Transshipment in Russia

At present, the main port for transshipment in Russia is Nikolayevsk-on-Amure. It acts as the access of the Heilong River. Due to there is a port bar of 12 kilometers between port of Nikolayevsk-on-Amure and its access of sea, the depth of water is only 4.3 kilometers, which limits transshipment of large vessel in this port. In order to realize the river-sea transport to a large-scale transportation, it must choose other ports that have better water circumstance for transshipment. In the appendix B, a table of ports' characters is developed basing on data investigated from China Heilongjiang Transport Administration. It can be used as a tool to determine the optimal choice of ports for transshipment or supply other services. It should be

[7] Heilongjiang Shipping Company was founded specially for River-sea transport for the Heilong River.

considers the transport qualities and available transport volume collectively in order to determine the most interesting transport service.

3.3 CONCLUDING REMARKS

This chapter points out some problems in the course of developing River-sea transport for the Heilong River. Noting the important role of inland water transport and river-sea transport which have both economic and ecological advantages as compared with other modes of transport, one should mention, however, the fact that the volume of cargo movement by inland waterway and river-sea transport is far from being sufficient. Same phenomenon happened in the course of developing River-sea transport for the Heilong River and restrains its development. Especially, it is short of return cargos in River-sea transport for the Heilong River.

Rates of growth of River-sea transport for the Heilong River are restrained by a number of obstacles other than short of cargos, such as the seasonal nature of vessels' operation and multiple bottlenecks in the network of waterways, such as shorting of basic infrastructures fitted, existing structure of carrying capability not fit transport requirement of principal kinds of cargos and it need to find new ports for transshipment. All of these lead to deficiency of capability.

It calls for the development of a modern, environmentally friendly and effective integrated waterway network as prerequisites for elimination of bottlenecks and for further development of River-sea transport for the Heilong River.

CHAPTER 4

NECESSITY AND SIGNIFICANCE OF DEVELOPING RIVER-SEA TRANSPORT FOR THE HEILONG RIVER

4.1 INTRODUCTORY REMARKS

Professor XuJianhua, head of Institute of Modern Logistics Planning of Shanghai Maritime University, pointed that, because the river-sea transport in economy not only can reduce the cost and decrease the consumption but also can extend the hinterland of ports and attract lots of cargo resources as well as in operation can through lessening transport circle, frequency of transshipment to save powers of men and other things for repetitive and senseless loading and discharging, river-sea transport will become to basis and trend of developing Chinese inland water transportation.

At the same time, River-sea transport for the Heilong River has its own characters and so of the necessity and significance in existing situation and for the further development.

This chapter analyses necessity of opening shipping lines of River-sea transport for the Heilong River and demonstrates its significance through comparisons between river-sea transport and other modes or routes of transportation from the same starting point to the same destination and for the same purpose.

This chapter also analyses the integrated benefit of River-sea transport for the Heilong River on the shipping line that from Heilongjiang province to the city of Wenzhou.

4.2 NECESSITY OF OPENING SHIPPING LINES OF RIVER-SEA TRANSPORT FOR THE HEILONG RIVER

4.2.1 Need for Solving the Bottleneck in Rail Transportation when Developing Economy of Heilongjiang Province

According to the statistics, in Heilongjiang province, annual output for just coal, wood, provisions, and oil is above 0.1 billion tons. However, cargos transported by rail are accounting for 80% of the total cargos. Main channels of output are through ports of Dalian and Yingkou, transshipping by sea or transporting directly to other places by rail. Due to much material within Heilongjiang province needs to transport outside and the material imported from Russia needs to transship from ports of Manzhouli and Suifenhe which are managed by Harbin Railway Ministry, in general, daily demand for transport falling within the region of Harbin Railway Ministry is more than 10 thousand vehicles, the most achieved to 30 thousand vehicles. However, Harbin Railway Ministry can only satisfy 49.6% of that on average. From year 2004, China presents policy of tax-free in agriculture for Heilongjiang and Jilin provinces, which excite more growth of provisions. In addition, Russia already decided to increase output of petroleum to China through railway and also would increase the quantity to above 15 million tons within 3 years. That gives more pressure to railway transport which has operated going beyond the burden yet.

Basic method for solving the bottlenecks in railway transport is to diffluent to other modes of transport. The capacity of water transport in Heilongjiang province is relatively smaller compared to that of the rail and road transport. However, in aspect of freight, transport by water is much lower than that of by railway. So, in aspect of solving bottleneck of railway transport, water transport has certain superiority.

4.2.2 Need for Speeding the Bloom of Aged Industry in Northeast of China

Heilongjiang province is applying strategy of development through catching hold preferential policy of government closely to support restructuring the Aged Industry in Northeast of China. Channelizing the Songhua River; constructing the ports for importation in Heilongjiang province and constructing the infrastructures for River-sea transport for the Heilong River had already placed on the scheme of Ministry of communications of the people's republic of China in order to speed the bloom of Aged Industry in Northeast of China. At present, in port of Tongjiang, three river-sea berths of 3000 tons are being built. It is no doubt that the bloom of Aged Industry in Northeast of China gives opportunity to River-sea transport for the Heilong River and development of shipping industry will accelerate the bloom of Aged Industry in Northeast of China further.

4.2.3 Need for Enlarging Exportation and Uniting Economically Developed Areas

Heilongjiang province had decided to increase the level of opening to Russia in a faster speed and accelerate economical cooperation to a deeper development. It also tables a proposal of uniting economically developed areas to build a base for exportation to Russia. Shipping line of the river-sea transport relates closely the

developed area in southeast of China along the sea through opened ports along the Heilong River. Export resource from south of China to Russia using traditional rail or road transport and through port of Suifenhe or Manzhouli are already unbearable the heavy transport demand. However, it can use river-sea ship with nonstop to transport resources to Russia with lower cost. So, it can not only avoid limitation of bottlenecks in railway transportation and lessen pressure in port of road when exporting the cargos but also export from port of waterway with lower shipping cost. On the basis of shipping line of river-sea transport for the Heilong River to exploit transport market of areas in southeast of China along the sea, it can further related Hong Kong, Taiwan, Macau to accelerate the strategy of "Relate the South and Open to the North" of Heilongjiang province. Shipping lines to Japan, Korea, etc. also accelerate trade and communication with the world outside, which correspond to the trend at present.

4.2.4 Need for Extending Construction of the Commodity-Provisions-Base and for Developing the Green-Agriculture of Heilongjiang Province

Proportion of the commodity-provision in total provision produced in Heilongjiang province is high to 64% and the Sanjiang Plain is one of the most important commodity-provisions-base and green-food-base in China. At present, soybean, corn, rice and other green agricultural product with none gene transfer have strong competition in both internal and international markets.

Merchants in Japan and South Korea are contesting the sale right of proprietary kind of green agricultural product in Heilongjiang province. Sale capacity exported from the Sangjiang Plain to Russia, Japan and South Korea is increasing year by year. At the same time, demand for these commodities from economically developed areas in

southeast of China along the sea is increasing. It can foresee that the contradiction between warehousing and transportation in commodity-provisions-base of the Shanjiang Plain will be obvious day by day. Demands for green provisions in internal and international markets are calling green cannel of transportation: river-sea transport.

4.3 COMPARISON BETWEEN RIVER-SEA TRANSPORT WITH OTHER FORMS OF TRANSPORTATION

In order to demonstrate the necessity and significance of the River-sea transport for the Heilong River deeply, in this part, some comparisons will be done between river-sea transport and other modes or routes of transportation from the same starting point to the same destination and for the same purpose.

As shown in table 1, basing on the data investigated from China Heilongjiang Transport Administration, it does comparison between distances, freights and times between rail-sea transport and river-sea transport. Table 1 compares the distances in detail. In conclusion, the route of river-sea transport from Heilongjiang province in China to Hokkaido in Japan is with more competitiveness on transport cost and time than the route of rail-sea transport for the same purpose.

Table 1 - Comparison of rail-sea transport with river-sea transport from Heilongjiang province in China to Hokkaido in Japan (Ⅰ)

Mode of Transport	Distance of Land or Inland Waterway Transport	Shipping Line Distance on Sea (Nautical Mile) from Dalian or Nikolayevsk-on-Amure to cities of	Freight (RMB per ton)	Turnover Time (Include time for transshipment)
Rail-Sea Transport	Rail Jiamusi→Dalian 1450 kilometers	Wakkanai:1519 Otaru:1371 Hakodate:1219 Niigata:1045	260-300 (Include rail transport)	40-50 days
River-Sea transport	River Jiamusi→Nikolayevsk-on-Amure 1495 kilometers	Wakkanai:485 Otaru:620 Hakodate:776 Niigata:936	200-250 (Include river transport)	20-25 days

Source: the data in this table are investigated from China Heilongjiang Transport Administration.

Note:

1. Sea ships with 2000 to 3000 tonnage and can load both bulk cargos and containers are used in shipping line on sea.
2. Returned from Japan to China can transport containers.
3. All calculations above are in regard to cargos of provisions.

Table 2 - Comparison of rail-sea transport with river-sea transport from Heilongjiang province in China to Hokkaido in Japan (Ⅱ)

Comparison of transport routes (Kilometer)		Time of turnover (day)	Freight (RMB)
From Tongjiang to Wakkanai	River-sea transport:2101 Land-sea transport:4523	20 50	180-220 330-350
From Tongjiang to Otaru	River-sea transport:2352 Land-sea transport:4249	22 45	200-260 320-350
From Tongjiang to Hakodate	River-sea transport:2640 Land-sea transport:3968	23 45	230-260 280-300
From Tongjiang to Niigata	River-sea transport:2640 Land-sea transport:3648	25 40	240-280 260-300

Source: the data in this table are investigated from China Heilongjiang Transport Administration.

Note:

1. Tongjiang is a country-level city governed by the city of Jiamusi of Heilongjiang province.
2. Length of river transport from Tongjiang to Nikolayevsk-on-Amure is 1205 kilometers.
3. Length of land transport from Tongjiang to Dalian is 1713 kilometers.
4. Sea ships with 2000 to 3000 tonnage and can load both bulk cargos and containers are used in shipping line on sea

5. Tongjiang as the starting port in Heilongjiang province is a base port and has the same character in point of distance with other loading ports.
6. The time of land-sea transport includes time for transshipment. Annual lay time in port is 45 days averagely.
7. All calculations above are in regard to cargos of provisions.

Different from table 1, table 2 compares the freight and time more detailed. As shown in table 2, basing on the data investigated from China Heilongjiang Transport Administration, it does comparisons of distances, freights and times between rail-sea transport and river-sea transport. In conclusion, the route of river-sea transport from Tongjiang in Heilongjiang province to Hokkaido in Japan is with more competitiveness on transport cost and time than that of the route of land-sea transport with the same origin and destination for the same purpose.

As shown in table 3, basing on the data investigated from China Heilongjiang Transport Administration, it does integrated comparisons and analysis between distances, freights and turnover times on the projects of land-sea transport, road-rail transport, river-sea transport and road transport. We can see that river-sea transport is one of projects can be chosen. What is more important is that the river-sea transport here is with more reasonable aspects on cost and time and that give the river-sea transport more competitiveness than other transport modes and routes shown in table 3.

Table 3 - Comparison of transport projects from Fuyuan, a production area in Sanjiang Plain, to the city of Wenzhou

Mode	Main circles	Distance (kilometers)	Freight (RMB per ton)	Turnover time for a single voyage
Land-sea transport (Transship in Dalian)	Fuyuan (road)→ Qianjin (rail)→ Dalian (sea)→ Wenzhou	Road: 165 Rail: 1744 Sea: 1630 Total: 3539	Road transport: 65 Rail transport: 150 Transship: 55 Total: 390	18 days
Road-rail transport	Fuyuan (road)→ Qianjin (rail)→ Jinhua (road)→ Wenzhou	Road: 165 Rail: 3842 Road: 200 Total: 4042	Road transport: 65 Rail transport: 288 Road transport: 58 Total: 401	12 days
River-Sea transport (transship in Nikolayevsk-on-Amure)	Fuyuan (river)→ Nikolayevs-on-Amure (sea)→ Wenzhou	River: 1000 Sea: 3426 Total: 4426	River transport: 110 Sea transport: 279 Total: 390	15 days
Transport by road	Fuyuan→ Wenzhou	4042	808	7 days

Source: the data in this table are investigated from China Heilongjiang Transport Administration.

Note:

1. Qianjin is an area in China Heilongjiang province that has a railway station.
2. Jinhua is area in China Zhejiang province that has a railway station.

4.4 INTEGRATED BENEFIT ANALYSIS ON RIVER-SEA TRANSPORT FOR THE HEILONG RIVER, TAKING INTERNAL SHIPPING LINE AS AN EXAMPLE

4.4.1 Social Benefit Analysis

Benefit of exploiting shipping lines of River-sea transport for the Heilong River is enormous. First, it accelerates the development of green-food production in Heilongjiang province. Second, it benefits Heilongjiang province to expand the opening to foreign countries and developed areas. Shipping line of river-sea transport to areas in southeast of China along the sea links together Russia and economically developed areas of China, which makes convenient the exportation from areas in south of China to foreign counties. Third, it gives benefit to shipping industry. Investigated from China Heilongjiang Transport Administration, if increase carrying capacity of 0.2 million tons' green food to south of China, just increased earnings for inland river shipping is 2.4 million RMB and earnings for sea shipping is 5.79 million RMB, which can in real realize the strategy of "Make River Leaded by Sea".

4.4.2 Voyage Benefit Analysis

According to the test by researchers in shipping industry, from Heilongjiang province to areas in southeast of China along the sea, Wenzhou in particular, the freight for river-sea transport is 500 RMB per ton, which is much lower than road-rail transport through Shanhaiguan and more or less the same with road-sea transport through Dalian.

In order to make the test more convenient, in the following part, it will compute voyage benefit according to time-charter transport. According to market investigation, at present, in shipping market, rent for a time-charter ship between 3000 and 3500 tons is 2500 USD per day. From the test, each voyage in shipping line of river-sea transport from areas in Heilongjiang province to areas in southeast of China along the sea needs 25 days on average, including the time for berthing and shipping-stop.

The party of charter needs to pay integrated cost for the voyage, which includes:

(1) Rent for time-charter:

2500 USD*25 days=62500 USD

(2) Bunkers:

Fuel (4 tons*25 days=100 tons): 380 USD*100 tons = 38000 USD

Diesel (0.6 tons*25 days=15 tons)[8]: 660 USD[9]*15 tons = 9900 USD

Total: 47900 USD

(3) Cost in port (including cost of piloting):

Russian port: 5000 USD

Wenzhou Port: 2000 USD[10]

Total: 7000 USD.

[8] The figure of 4 tons and 0.6 tons are investigated from China Heilongjiang Transport Administration.
[9] The figure of 380 USD and 660 USD are investigated from market at present.
[10] The figure of 5000 USD and 2000 USD are investigated from China Heilongjiang Transport Administration.

(4) Other costs (sailor earnings, etc.): 1000USD[11]

Total cost for chartering transport of sea ship:

62500 USD+47900 USD+7000 USD+1000 USD=118400 USD

Cost per ton for tugging transport in river is 14 USD (including transshipment cost)[12]

Total: 3000 tons*14 USD=42000 USD

Total cost of each voyage for river-sea transport:

118400 USD+42000 USD=160400 USD

Voyage Revenue:

500 RMB*3000 tons =1500000 RMB=187500 USD[13]

Voyage Income:

187500 USD-160400 USD=27100 USD

Through the computation above approximately, each voyage can give income of 27100 USD. And if there has cargos backhaul, the income will be even more attractive.

[11] This figure is investigated from China Heilongjiang Transport Administration.
[12] This figure is investigated from China Heilongjiang Transport Administration.
[13] Taking 8 RMB=1 USD as the exchange rate.

4.4.3 Integrated Marketing Benefit Analysis

The price of buying one kilogram of rice in producing area is 2.4 RMB, fright of river-sea transport is 0.5 RMB, and cost of tax, marketing and miscellaneous is totally 0.2 RMB[14].

Wholesaling price of rice in Wenzhou market is 3.6 RMB and for sale is 4 RMB[15].

If each voyage takes 3000 tons of produced rice, the income is:

1000*3000 tons*(3.6 RMB-2.4 RMB-0.5 RMB-0.2 RMB) =1500000 RMB

If every year transport and sale 60 thousand tons (equal to 20 voyages), the income is 30 million RMB.

It is just a sketchy calculation above to demonstrate that river-sea transport can give benefits.

4.5 CONCLUDING REMARKS

This chapter analyzes the necessity and significance of developing River-sea transport for the Heilong River. Opening shipping lines of River-sea transport for the Heilong River is need for settling the bottleneck in rail transportation when developing economy of Heilongjiang province; is need for speeding the bloom of aged industry in northeast of China; is need for uniting economically developed areas to enlarge exportation; is need for extending construction of the base of

[14] These three figures are investigated from China Heilongjiang Transport Administration.
[15] These two figures are investigated from China Heilongjiang Transport Administration.

Commodity-Provisions and is need for developing Green-Agricultural in Heilongjiang province.

The evidence required to demonstrate effective competition between land and water alternatives or with other modes or routes includes the number of alternatives; the feasibility of each alternative evidenced by pertinent physical characteristics, the transportation or routing associated with each alternative and by the access of both the shipper and receiver to each alternative; the transport time and cost of each alternative are also required to compare. Basing on these requirements, in this chapter, some comparisons had been done between river-sea transport and other modes and routes of transport from the same origin to the same destination for the same purpose. From all of these comparisons, we can see that river-sea transport has competitiveness on cost and time of transport and is a good choose for transportation.

Through an integrated benefit analysis, including social benefit analysis, voyage benefit analysis and integrated marketing benefit analysis, we can see the rationalization of River-sea transport for the Heilong River. Because there are so many benefits, developing River-sea transport for the Heilong River is really rational and should to a further degree to realize a large-scale transportation. What's more, Ministry of agriculture can cooperate with the shipping department to make use river-sea transport to obtain these benefits and through their close cooperation can further enlarge these benefits.

CHAPTER 5

BASIC PROJECTS, NECESSARY CONDITIONS AND POSSIBLE WAYS TO SOLVING THE PROBLEMS IN THE COURSE OF DEVELOPPING RIVER-SEA TRANSPORT FOR THE HEILONG RIVER

5.1 INTRODUCTORY REMARKS

In order to develop River-sea transport for the Heilong River and further reveal its superiorities in aspects of transport and logistics, it must reach a large-scale. This chapter proposes basic ideas on accelerating River-sea transport for the Heilong River in order to reach a large-scale.

According to the demand of cargo kinds, the carrying capacity and the direction of river-sea transport, there are basically 4 kinds of modes in organizing the River-sea transport for the Heilong River, including river-sea transportation with nonstop, river-sea transport transshipped in Russian port of Nikolayevsk-on-Amure, river-sea transport transshipped in Russian port of Vennica as well as river-sea transport for projects cargo.

This chapter also proposes possible ways to solving problems in the course of developing River-sea transport for the Heilong River. All of these problems have been mentioned in front chapters, which restrain the development of River-sea transport for the Heilong River. Such as settle the problem of being short of return

cargos, settle the problem of seasonal nature of vessels' operation and increase investment to establish basic infrastructure in port, channels' construction, river-sea ship's building to realize the river-sea transport to a large-scale.

What's more, this chapter gives a proposal on exploiting new shipping lines of container transportation using River-sea transport for the Heilong River, including shipping line of Harbin-Jiamusi-Tongjiang-Fuyuan- Khabarovsk, shipping line of Harbin-Jiamusi- Khabarovsk-Europe and shipping line of Harbin- Khabarovsk (Komsomal'sk-na-Amure) - Vennica- West Coast of North America.

5.2 BASIC IDEAS OF ACCELERATING RIVER-SEA TRANSPORT IN ORDER TO REACH A LARGE-SCALE

5.2.1 Kind of Cargos, Carrying Capacity and Direction of Transport of River-sea Transport

At present, there are basically three kinds of cargos by River- sea transport for the Heilong River, including corn, grain and hull in bulk; charcoal, provisions and forage in packet; project cargos over 50 tons and under 500 tons.

According to investigation from China Heilongjiang Transport Administration, in the point of carrying capacity, to the year 2010, corn, grain in bulk will be yearly between 0.5 to 1 million tons; charcoal and other cargos in packet will be yearly between 0.1 to 0.2 million tons; project cargos will be yearly between 10 to 20 thousand tons. To the year 2020, corn, grain in bulk will achieve yearly 3 million tons; charcoal and other cargos in packet will achieve yearly above 1 million tons.

In the point of cargos' direction, corn, charcoal, forage and hull are mainly cargos for exportation transported to Japan or South Korea. The project cargos are mainly using internal transportation to the areas in southeast of China along the sea.

In the point of the status each kind of cargos in shipping line of River-sea transport for the Heilong River, due to the large carrying capacity of the grain in bulk and its relationship to the safety of country' s provisions, it should adopt special line of transport according to the yearly scheme. Exported cargos transported to Japan or South Korea should adopt the method of charter with transport bill. Transportation of the project cargo is a superiority of River-sea transport for the Heilong River. At the same time, it is related to the transport safety closely, in the issues of pack, fixture and the type of ship are all have special requirement. So, it should adopt the method of chartering ships.

5.2.2 Basic Modes in Organizing River-sea Transport for the Heilong River

5.2.2.1 River-sea Transportation with Nonstop

Making use of river-sea ships whose draft are not bigger than 3 meters and with 1500 DWT, load directly in Tongjiang, Mingshan, Qindeli or other ports along the Heilong River and directly transport to Japan, South Korea or other destinations to complete the transportation of corn, charcoal, forage or other cargos not suitable to transship in ports of Russian.

5.2.2.2 River-sea Transport Transshipped in Russian Port of Nikolayevsk-on-Amure

Making use of tank barges, load in ports along the Heilong River and transport to

Russian port of Nikolayevsk-on-Amure, transship to sea ships whose draft are not bigger than 4.5 meters and with between 3000 to 5000 DWT, and then transport to areas in southeast of China along the sea to complete the transportation of grain.

5.2.2.3 River-sea Transport Transshipped in Russian Port of Vennica

Making use of river-sea ships with 1500 DWT or river-sea tank barges with 3000 DWT in ports along the Heilong River, load and transport to Russian Port of Vennica, transship to sea ships with over 10 thousand DWT, and then transport to ports in areas in southeast of China along the sea to complete the transportation of massive grain in bulk.

5.2.2.4 River-sea Transport for Projects Cargo

Projects cargo transportation is with character of having superiority in River-sea transport for the Heilong River, which includes massive machinery equipment, heavy lifts and long lengths. Projects cargo transportation is a part of river-sea transport that rail, road or other transport modes cannot compare with.

Making use of river-sea tank ships whose light load draft are about 0.5 meters and with 3000 DWT, load in projects cargo dock of Harbin, transport using river tug to Russian port of Nikolayevsk-on-Amure, and then transport using sea tug to ports of destination along the river or sea.

According to sketchy calculation, projects cargo, loaded in Harbin, transported to Tongjiang port, transshipped to river-sea ships, and then transported to coastal ports in southeast of China or to ports of inland river in south of China, the total cost for

transport is less by 20%-30% of that transporting with railway or road through the port of Dalian. As well, the river-sea transport can insure security and rapidity much more.

5.3 SETTLE THE PROBLEM OF BEING SHORT OF RETURN CARGOS

The increasing importance of the river-sea transport will require significant redistribution of cargo flows. In order to attract new cargo flows, the industry has to offer services of at least the same quality as that of other modes of transport and with significantly lower rates. The advantages of river-sea transport as the most environmentally friendly mode of transport nowadays should be used on a full scale. However, waterway transport is not competitive as compared with railway transport in some directions.

Through the investigation on the source of return cargos, cargos returned from Japan Sakata to China Fuyuan are steel, machine, container, etc. and annual quantity is above one million tons. It will have some source of cargos in this shipping line if open some regular ocean liners. In order to attract return cargos, it can make freight lower than practicable price that is for cargos in going-haul.

Using sea ships with large tonnage, it can transport containers from south of China by the returned voyage from Wenzhou to Europe through Russian port and then through Siberian Railways. That in the same time makes waterway transport in boundary areas of China and Russia integrate into the transportation system of the Asia Pacific region. There is good news that China Zhejiang Province Port and Channel Administration and China Heilongjiang Province Transport Administration will collaborate on project of river-sea transport, which will help to attract source of

return cargos evidently. In addition, exploiting new shipping lines of container transportation using the River-sea transport for the Heilong River can also enlarge the source of return cargos. In addition, it can through the market and make use of freight forward to secure cargos.

5.4 SETTLE THE PROBLEM OF SEASONAL NATURE OF VESSELS' OPERATION

The River-sea transport for the Heilong River has defect that cannot solve by itself. That is the character of seasonal production in shipping industry. The shipping time is only 6 or 7 months in a year. It leads to the result of can not guarantee well-balanced supply. In order to make up for this defect, it must draw up projects for transportation in winter. It needs land-sea transport as supplement. See from the geographical location of the exported sources from Sanjing Plain in Heilongjiang province, the most convenient access is transshipment from sea ports in Far East of Russia: Vladivostok, Nakhodka, etc.

5.5 INCREASE INVESTMENT FOR RIVER-SEA TRANSPORT TO REALIZE A LARGE-SCALE

5.5.1 Establish Basic Infrastructure in Port

As the hub of the comprehensive transportation and the distributing center of cargos, a port plays a very important role in the integrated network of transport. Port cannot only promote the rapid development of economy of the city where port is located, but also urge its hinterland to develop economy. Because the important connection exists between port and hinterland, developing the single base of port into

an intramodal transport freight hub and distribution center is very significant. It is with necessity for reconstructing the ports into logistics centers with comprehensive development of terminals. There is also a need to establish information and reference system on cargo flows and organizing continued monitoring of the cargo base available.

However, in current situation of River-sea transport for the Heilong River, functions of ports mentioned above are not workable due to shorting of basic infrastructure fitted to river-sea transport. Such as deficiency of up-to-date cargo handling systems and port terminals together with the excess of old-fashioned and inefficient cargo handling machinery and equipment hamper the development of river-sea transport and other transport integrated.

Because of current situation of River-sea transport for the Heilong River and in order to develop it further, there are mainly two kinds of infrastructures deficient need to be built or purchased. One is cargo handling systems for bulk cargo of provisions when transshipment in order to gain more efficiency. The other one is gantry crane for projects cargo and spreader bar supporting for uneven weight distribution. According to investigation, the first infrastructure will spend 15 million RMB and the other will spend 20 million RMB. Establishing infrastructures needs governments' fund to support. There is good news that Ministry of communications of the people's republic of China has already agreed to support with fund on these two infrastructures. In addition, China Heilongjiang Province Transport Administration and China Zhejiang Province Port and Channel Administration will collaborate on project of river-sea transport, which will help to increase fund for infrastructures.

What's more, establishing infrastructures need examine the situations of ports. Appendix B is a table of situations of transshipment ports in lower reaches of the Heilong River. It can be used to acquaint situations of ports and determine the optimal choice of ports to transshipment and other serves in practice of demand of trade and other certain situation.

5.5.2 Channels Construction

In China, at present, the degree of exploiting transport channels is not good and the grade is low. Big difference existing between channels of main flows and branches leads to that the ships and transport modes are less the unification. That restrains the ships' development, nonstop transport between main flows and branches as well as restrains the river-sea transport to realize a large-scale.

The situations above that the degree of exploiting transport channels is not good and the grade of that is low are general phenomena in China compared with developed areas having successful practices on river-sea transport.

Some researchers think that, take the Yangtze River as an example, if channels of seventy thousand kilometers are all exploited, its transport function will be equal to the rail of one hundred thousand kilometers. However, its carrying capability is utilized for only about 1/15 and this carrying capacity of 0.195 billion tons is only equal to annual carrying capacity of a double-track rail. The Mississippi River in America whole length is 6362 kilometers; the flowing capacity is just an half of that of the Yangtze River. However, annual carrying capacity is ten times of that of the Yangtze River. The Rhine River in Europe is just like a branch of the Yangtze River; its annual carrying capacity is two times of that of the Yangtze River.("Integrated

transport system construction on the Yangtze River" 1999, chapter 6).

From these we can see that the transportation value of the Yangtze River is far from sufficient bringing into play. This phenomenon is even worse in the Heilong River. Presently, many channels still exist in natural condition and do not open to navigation. The course of channelization will be together with the course of developing River-sea transport for the Heilong River.

5.5.3 Ship Building

A big problem of river-sea transport is difficult to find ships fitted. There are many deficiencies of inland river ships in their structures and the safe equipments. In addition, the cost of rebuilding these ships is very high. When designing new types of vessels, particular attention should be given to special-purpose vessels for the river-sea transport. Along with the development of ability in shipbuilding and extensive demand for river-sea transport, building river-sea ship is coming to be a trend.

River-sea ships are able to operate not only on inland waterways and lakes but also at sea areas. The fleet of such vessels made it possible to organize the international carriage of goods directly to foreign sea and river ports and vice versa. At the present time, more than 700 river-sea ships are used for international cargo transportation. They make 14 thousand calls a year at some 670 ports of 46 countries of Europe, Asia, Northern Africa, Middle East and the Far East. International trade by mixed river-sea ships amounts yearly to 30 million tons; it is cost-effective and there is a clear demand for that sort of trade at the market. ("Main Problems of Inland Navigation,"2005, pp. 22-23) River-sea transport provides for a

greater competitiveness of water transport enterprises. It will also afford the most extensive opportunities to develop new transport systems.

However, river-sea ships should be not only convenient but also with notably benefit.

Table 4 and table 5 calculated the incomes on single voyage with a River-Sea Ship of 3000 tons and 5000 tons respectively from China Fuyuan to Japan Sakata. Yearly incomes are 4.74 million RMB and 9.74 million RMB respectively, which are really notably and can be used to demonstrate the rationality to build river-sea ships. If there are more returned cargos and more revenue of back-haul, the income will be more notably.

One should mention that it should adopt ships of multi-purpose in economy using in River-sea transport for the Heilong River. That kind of ships will have very high capability for securing cargos, fitting in with several cargos and using mainly to load provisions in bulk and general cargo bound in sack and also can load containers in a certain quantity.

In addition, the trend of more river-sea ships' building and operating need more support given by governments. Such as some privileged policies: less taxation rate, less channel dues, pilot dues and other dues. As well, more access to easy terms credits is really useful.

Table 4 - Benefit Analysis on Single Voyage with a River-Sea Ship of 3000 Tons from China Fuyuan to Japan Sakata

Item		Quantity		Interpretation
Transport Capacity		*2850* tons (DWCT)		95% as loading rate of DWT
Revenue		RMB	USD	Freight:37USD/ton
		84.4	*10.55*	Exchange Rate:8 RMB/USD
Voyage Cost	Fuel	*24.75*	*3.09*	75 tons; 3300 RMB/ton
	Port Charge	*9.28*	*1.16*	Japan:5600USD; Russian:6000USD
	Transshipment	4.16	0.52	
	Total	*38.19*	*4.77*	
Fixed Costs	Wages	*3.9*	*0.49*	Crew:26 persons; 1500 RMB/person
	Fund of welfare	0.56	0.07	
	Lubrication	1.28	0.16	
	Depreciation	*20*	*2.5*	Build Cost:2200;Complete:14 years
	Reparation	*1.32*	*0.17*	0.6% of building cost
	Insurance	0.56	0.07	
	Tax for the vehicle	0.28	0.035	According to tonnage of the ship
	Total	*27.9*	*3.5*	
Other Cost	Fee of Management	*1.28*	*0.16*	1.5% of the revenue
	Tax (operating)	*2.72*	*0.34*	3.27% of the revenue
Total Cost		*66.09*	*8.27*	
Income		*14.31*	*1.78*	
Back-haul Cargos	Transport Quantity	*1050* tons		Calculated as 35% of going-haul
	Income	*25.2*	*3.15*	30 USD/ton
Total Income		*39.51*	*4.93*	

Source: data not inclined in the table are investigated from China Heilongjiang Transport Administration.

Table 5 - Benefit Analysis on Single Voyage with a River-Sea Ship of 5000 Tons from China Fuyuan to Japan Sakata

Item		Quantity		Interpretation
Transport Capacity		*4750* tons (DWCT)		95% as loading rate of DWT
Revenue		RMB	USD	37 USD/ton
		140.6	*17.58*	8 RMB/USD
Voyage Cost	Fuel	*36.3*	*4.54*	110 tons, 3300RMB/ton
	Port Charge	*16*	*2*	Japan & Russian: both 10000 USD
	Transshipment	1.36	0.17	
	Total	*53.66*	*6.71*	
Fixed Costs	Wages	*5.22*	*0.65*	Crew:29 persons;1800 RMB/person
	Fund of welfare	0.56	0.07	
	Lubrication	1.36	0.17	
	Depreciation	*30*	*3.75*	Build Cost:3500;Complete: 14 years
	Reparation	*2.1*	*0.26*	0.6% of building cost
	Insurance	1.12	0.14	
	Tax for the vehicle	0.72	0.09	According to tonnage of the ship
	Total	*41.08*	*5.13*	
Other Cost	Fee of Management	*2.1*	*0.26*	1.5% of the revenue
	Tax (operating)	*4.6*	*0.57*	3.27% of the revenue
Total Cost		*94.74*	*11.84*	
Income		*39.16*	*4.91*	
Back-haul Cargos	Transport Quantity	1750 tons		Calculated as 35% of going-haul
	Income	42	5.25	30 USD/ton
Total Income		*81.16*	*10.16*	

Source: data not inclined in the table are investigated from China Heilongjiang Transport Administration.

Note:

1. The figures inclined in table 4 and in table 5 are results calculated basing on other data in table 4 and in table 5 which are investigated from China Heilongjiang Transport Administration.
2. Units of the figures that have no unit in table 4 and in table 5 are all ten thousand.
3. Each voyage of the river-sea transport is 25 days on average in summer and can have 6 voyages altogether.
4. Each voyage of the river-sea transport is 25 days on average in winter and can have 6 voyages altogether.
5. In winter, it transports from Dalian to Japan or by the Yangtze River to Guangzhou, Hong Kong, etc.
6. On the whole year, there can be 12 voyages and totally 300 days. So, the yearly rate of operating is about 82%.
7. Basing on the result on table 4, income of each voyage is 39.51 ten thousand RMB. So, yearly income of 12 voyages is about 4.74 million RMB.
8. Basing on the result on table 5, income of each voyage is 81.16 ten thousand RMB. So, yearly income of 12 voyages is about 9.74 million RMB.

5.6 EXPLOIT NEW SHIPPING LINES OF CONTAINER TRANSPORTATION USING RIVER-SEA TRANSPORT FOR THE HEILONG RIVER

5.6.1 Shipping Line of Harbin-Jiamusi-Tongjiang-Fuyuan- Khabarovsk

In fact, it had already used this shipping line to transport cargos in the history of River-sea transport for the Heilong River. In aspects of ships as well as loading and discharging in ports, exploiting this shipping line of container transport meets

demand of ports and transportation corporations in both China and Russia. According to investigation, in aspect of cargo resource, cargos that are worthy to put into containers are 100 thousand tons exported from China to Khabarovsk every year.

5.6.2 Shipping Line of Harbin-Jiamusi- Khabarovsk-Europe

Utilizing the superiority of Russia Trans-Siberian Railroad and taking Khabarovsk as a hinge port for transshipment, it can exploit an international shipping line of container transportation. According to investigation, the sum of commodities imported and exported between Heilongjiang province to European Union and Germany is about 0.7 billion USD each year, among which commodities imported accounts for about 30 percents and exported accounts for about 70 percents. The transport capacity of container can reach 34 thousand TEU every year. Transporting cargos from Heilongjiang province to Europe through Siberian Land Bridge is an half shorter in distance than transshipping in Dalian then transport to Europe by sea. It has advantages of shorter transport time of about 20 days and faster speed as well as so better benefit there can be obtain.

5.6.3 Shipping Line of Harbin- Khabarovsk (Komsomal'sk-na-Amure) – Vennica- West Coast of North America

At present, the development of transportation using containers is very fast in the world. With the amelioration of Russian railways, roads, inland waterways and basic infrastructures in ports, superiorities of container transportation in the area of northeast Asia will be into play sufficiently and the markets of container transportation in the area of Russia Far-east will develop notably.

Cargos exported from Heilongjiang province to west coast of American and Canadian can be transported by inland water and river-sea transport to Khabarovsk or to Komsomol'sk-na-Amure and then transported by railway or road to Vennica. According investigation, this shipping line is shorter by 1/3 in distance than transporting by road then transshipping to sea in Dalian to transport to west coast of American. Sum of commodities imported and exported between Heilongjiang province to America and to Canada is about 0.45 billion USD every year, among which commodities imported accounts for about 60 percents and exported accounts for about 40 percents. The transport capacity of container can reach 17 thousand TEU every year.

5.7 CONCLUDING REMARKS

This chapter deals with basic projects, necessary conditions and possible ways to solving the problems in development River-sea transport for the Heilong River and proposes basic ideas on accelerating River-sea transport for the Heilong River in order to reach a large-scale.

Although the main subject we discuss here is the river-sea transport, if even channel, port or other infrastructures can not be satisfied at least, the river-sea transport is just a kind of palette. A satisfactory river-sea transport needs a serious of support that is supplied by integrated and fitted infrastructures and so as certain policies.

Ma Zhi, the deputy Director General of China Heilongjiang Transport Administration said that nothing but realizing large-scale transportation can effectively lessen the difficulties of provisions transport outside due to the limitation of land resource and in particular solve the problem of complicated circle transportation in Jiansanjiang,

Hongxinglong, and other main provisions production area along banks of the Heilong River and the Wusuli River; nothing but realizing large-scale transportation can reduce transport cost, enlarge impact and increase the competitiveness of the river-sea transport; by the time the river-sea transport come into rudimental scale and then the freight of transport has competition, it can finally attract fund from society to develop the river-sea transport and realize transshipment the bulk cargo through Russia Vennica which is 500 nautical mile away from the access to the sea of the Heilong River and complete the planning target of breaking through 5 million tons of transport capacity.

The trend toward containers began as soon as the first vessel carrying containerized cargo from New York was offloaded at the port of Houston nearly 50 years ago. It has been gaining steam ever since. Over the last 15 years, container volume as a percentage of intermodal loads has grown from 45 percent to 80 percent. (John Gallagher, 2005, p.24). Container transportation is a kind of progressive modes for transport and is an importation single of transport modernization. The superiority of the container transportation had already taken on widely by the society and containers transport more and more cargos. Because of that, container transport by water in the area of China-Russia boundary should develop speedily. What's more, container transportation supplies an important opportunity to the River-sea transport for the Heilong River, through exploiting new shipping lines.

However, exploiting new shipping lines must consider its closed connection with issues: ships fitted, return cargos, etc. For example, container transport, from west coast in North America to areas in Far East, the quantity of the return cargos is not sufficient. So, new shipping lines should be researched further and it needs fully develop with ships, channels, and other infrastructures' construction.

CHAPTER 6

SUMMARY AND CONCLUTIONS

This dissertation does research on River-sea transport for the Heilong River. From looking at basic theories on intermodal and intramodal transportation, we can see that they have different characters and different impacts on the whole integrated network of transportation whose great necessity is resulted from the development of trade and economy.

The Heilong River is in crucial geographical location, which is a boundary river between China and Russia. Developing river-sea transport is significant to trade, transport and logistics. It is noteworthy and has superiority in certain situation. River-sea transport for the Heilong River has large potential to develop not only because there has support of government but also has demand of internal and international trade. General situation of the Heilong River shipping as well as actuality and prospect of River-sea transport for the Heilong River are also showing that opinion. It should promote River-sea transport for the Heilong River. The potential of the River-sea transport for the Heilong River is to build an integrated logistic network. The development of a ring of transport arteries will stimulate the use of the river-sea transport and improve the economic situation of the outlying regions of relevant countries.

River-sea transport is a kind of intramodal transport and takes an important position

in the field of integrated transport. Compared with intermodal transport, river-sea transport has its own advantage in certain situation. In addition, it will be necessary to agree on reciprocal access to the international transport services market involving mixed sea-river transport. In the dissertation, to through carrying out feasibility studies to indicate the different projects of River-sea transport for the Heilong River and determine which option would best serve market requirements: the use river vessels and river-sea vessels only, or by combined transport (rail and water transport). Applying these notions into the practices and certain situations of River-sea transport for the Heilong River, this dissertation envisages services on the internal and international lines of River-sea transport for the Heilong River and examines its competitiveness with regard to a number of alternative transport modes, such as land-sea transport, rail-road transport, etc.

River-sea transport is a practical task, being used overseas and within China broadly. Practical cases on river-sea transport within China and overseas are summarized and analyzed systematically. Some successful experiences can be used for reference on river-sea transport for the Heilong River, such as the Rhine River, the Mississippi River, the Yangtze River, etc.; even the Heilong River has its own characteristics, it can learn their successful experiences, especially on governing the channels and the policies of the government.

The establishment of a market for river-sea transport serves purposes of setting up a broad-based internal market and strengthening economic ties with international market, primarily with the Russian Federation and Japan, South Korea, and ensuring the uninterrupted flow of freight transport. River-sea transport as a component of inland and coastal shipping could promote the transfer of foreign-trade freight traffic to river shipping. This enables freight to be transported directly from seaports to

the hinterland, thereby rendering such transport more environmentally friendly and economically advantageous and enhancing its mobility. Basing on the benefit model results, it is recommended to further develop River-sea transport for the Heilong River.

Noting the important roles of inland water transport and river-sea transport which have both economic and ecological advantages as compared with other modes of inland transport, one should mention, however, the fact that the volume of cargo movement by inland waterway and river-sea transport is far from being sufficient. Rates of growth of river-sea transport are also restrained by a number of obstacles such as the seasonal nature of vessels' operation and multiple bottlenecks in the network of inland waterways. It calls for the development of a modern, environmentally friendly and effective waterway network as a prerequisite for the further development of inland water transport, elimination of bottlenecks with due regard to the development of the river-sea ship as well as economic and ecological aspects.

Recent years, River-sea transport for the Heilong River has already obtained some achievements, but it still just in the beginning of development and some problems needed to be settled. Because there are crucial necessities and significances of River-sea transport for the Heilong River, which have been researched in the dissertation, it needs to put forwards possible ways to solve these problems in the course of developing River-sea transport for the Heilong River to reach a large-scale. What's more, finding new shipping lines of container transportation using River-sea transport for the Heilong River is really beneficial.

The river-sea transport is hungry for intermodal and intramodal equipments to

increase the carrying capability. What's more, a specialized system of river-sea transport must take into account the technical aspects of navigation and some modern transport technology. With respect to River-sea transport for the Heilong River, in order to obtain further development as well in accordance with the existing carrying capacity, it should provide some new technologies to incorporate river transport and sea transport.

There is a need, therefore, to supplement with a network of internal and international routes for river-sea transport. In order to put plans of new shipping lines into effect and further developing river-sea transport, it will design and construct new types of vessels. The dissertation evaluates the practices and opportunities of a river-sea transport concept, in which specially designed river-sea ships of 3000 tons and 5000 tons are being used to face the limitations happened in the course of developing River-sea transport for the Heilong River. In the dissertation, it certified the benefit and rationalization of river-sea transport with ships of 3000 tons and 5000 tons through calculations. The classification of this network should, among other things, specify the appropriate bridge clearance for the transport of bulk cargos, general cargos and containers, the infrastructure operating requirements at the level of international standards and other aspects; and include the network of the most important intramodal ports functioning as hubs and logistics centers. There are also some priorities should be borne in mind: one is that repair, modernization and refurbishment take precedence over the construction of new vessels; the other is the elimination of bottlenecks and other infrastructure problems, as well as ensuring that ports are equipped to transship freight on to land transport modes, are the priority areas.

Of course, the creation of the transport network must stay within available funding.

It should be requested to review the issue of possible funding for economic studies based on substantiated analyses of goods flows. What's more, it needs more support from government for funds and policies.

With all of these aspects mentioned in the dissertation develop efficiently and balanced. Believe that the River-sea transport for the Heilong River has a bright further.

The developments of intermodal and intramodal transport in China are falling behind developed countries and scholar researches in these fields are not very much, so as that of the river-sea transport. Wish that this dissertation can dedicate to River-sea transport for the Heilong River in some extent and in addition, can give some help in relevant studies.

However, river-sea transport for the Heilong River is in its beginning of development and is a practical project, having progresses all the time and relating closely with some responsive issues, such as market, policy, etc. So, detailed data needed to be collected in the whole course of writing the dissertation and many issues need to study. However, because my ability has limitation, this dissertation can only deal with some of these issues and probably has some insufficiency. Welcome criticism and correction kindly.

References

[1] Anon (2002, September). Valday-class cargo ships launch new era for Russian shipbuilding. *Naval Architect*, 27-29.

[2] Boardman, Bonnie Sue. Real-time routing of shipments considering transfer costs and shipment characteristics. *Dissertation Abstracts International, 59(1), Section: B,* 0369.

[3] C. Cinquini, P. Venini, R. Nascimbene & A. Tiano (2001, October). Design of a river-sea ship by optimization. *Structural and Multidisciplinary Optimization, 22(3),* 240-247.

[4] ChenDebin(2006). *Research on shipping development of boundary river between Russia and China.* Paper presented at the Seminar on Transport Cooperation in Boundary Areas between Russia and China, arranged by China Heilongjiang Transport Administration.

[5] ChenXuele (2006). *Extend transport cooperation between Russia and China to accelerate River-sea transport for the Heilong River.* Paper presented at the Seminar on Transport Cooperation in Boundary Areas between Russia and China, arranged by China Heilongjiang Transport Administration.

[6] Comparison and Research on Development of Chinese Integrated transportation System. *Science Academe in Ministry of Communication, (2003, January).* Retrieved from the World Wide Web: http://www.ccic.cn:8080/jszc/jszc-6.jsp.

[7] Daijun & Wangqi (2003). Comparison and consideration of the inland river transport in China with in the overseas. *Ship and Sea Engineering, (2)*, 43-44.

[8] DaiXiukai (2005). Exploit Long River Transport Operation, Enjoy Benefits of Golden WaterRoute. *Zhoushan Social Science.*

[9] de Ruiter M.B., Kok A, van der Schoot M. (1998, November). Effects of inter- and intramodal selective attention to non-spatial visual stimuli: an event-related potential analysis. *Biological Psychology, 49(3),* 269-294.

[10] Economic impacts of transportation network changes: Implement of a combined

transportation network and input-output model. *Papers Regional Science, 81*(2) 223-246, retrieved from the World Wide Web: http://maint.blackwell-synergy.com.

[11] Eric Klusch (2005). Going against the grain. *American Shipper*, (7), 97-98.

[12] FangFang, ZhangTao (2002). Structure Adjustment of Cargo Transportation in Inland Waters. *Journal of Wuhan University of Technology (Transportation Science & Engineering), 26 (6),* 725-728.

[13] Integrated develop the economic belt of the Yangtze River in 21 century. (1999, February) *Integrated transport system construction on the economic belt of the Yangtze River (chapter 6).* China-Plan publishing house.

[14] John Gallagher (2005, December5). Infrastructure Funding Contrasts with Expected Growth in Intermodal Demand. *Commonwealth Business Media, Pacific Shipper, Domestic and Regional*.

[15] John Gallagher (2005, November14) Stacking the deck; Railroads' push to drive more freight into containers is redefining the intermodal market. *Commonwealth Business Media Journal of Commerc*, 24.

[16] Johnson, D. and G. Whelan (2003). "Modeling the Impact of Alternative Fare Structures", Institute of Transport Studies, University of Leeds.

[17] John J. Coyle, Edward J. Bardi, Robert A. Novack, translated by ZhangJianfei, YuanYu, ZhuZiqi, (2004, June). *Transportation*. (5^{th} ed). China Machine Press.

[18] Lanzhou to Invest in Renovating Yellow River Sea-route. (2005, March15). *China Construction Project Net,* 1.

[19] Leland S. Case, Lester B. Lave (1977, April). Tolls: Efficiency and Equity Issues for Inland Waterways, *Management Scienc*e, *23(8),* 811-819.

[20] LiuHongyou, WangXuenong, YinXilin (2004). Talk about Superiority of Economy Development in Heilongjiang. *Water Conservancy Science and Technology and Economy, 10(3),* 135-137.

[21] LiuJun (2005, October9), River-sea-transport: Inspire on Rhine and Mississippi. *Weekly of China and foreign countries Logistics.*

[22] Lu, Xiankun; Yang, Min; Shi, Jiande; Feng, Xiaoju (1990). The effect of the Huanghe River runoff on the occurrence, transportation, speciation and fate of mercury in the Huanghe estuary and adjacent sea. *Journal of Ocean University of Qingdao, 20(*1*),* 59-72.

[23] Main Problems of Inland Navigation and Possible Ways of their Solution. *Pan-European Cooperation towards a Strong Inland Waterway Transport: On the Move.* ECMT/UNECE/CCNR/DC Workshop, Paris, 22-23 September 2005.

[24] Muller, G. (2005). *Intermodal Transportation.* Unpublished lecture handout, World Maritime University, Malmo, Sweden.

[25] Muller, G. (2005). *International Freight Transportation* (5th Ed.). Eno Transportation Foundation, Inc, Intermodal Association of North America.

[26] Qianxutao (2002). Some opinions on constructing inland river transport. *Ship Design and Technique Communication, (1),* 10-13.

[27] Rob Konings & Marcel Ludema (2000, September). The competitiveness of the river–sea transport system: market perspectives on the United Kingdom–Germany corridor. *Journal of Transport Geography, 8(3),* 221-228.

[28] ShuZhan (1994). Theoretical Consideration on border opening strategy of Heilongjiang. *Longjiang Social Science, 6,* 38-40.

[29] Songhaiqing. Dynamic flow management problems in logistics networks. *Dissertation Abstracts International, 66(02), Section: B,* 1111.

[30] Stopford M. (1997). *Maritime Economics*. (2nd ed). Routledge, London.

[31] SunYueping (2003). Strategic Research on Development and construction YangShan port and River-Sea Linkage. *Protection of water resource, 6,* 12-18.

[32] TaoChengyi (2002). Some understanding on developing inland water transport. *China water transport, (5),* 8-9.

[33] Towards a European Intermodal Transport Network: Lessons from History. (2004, July), retrieved from World Wide Web: http://www.cordis.lu/cost-transport.

[34] Transport Carriers Opens Nanjing-Shanghai River-sea Routes. (2005, December

14). *Comtex News Network, Inc.*

[35] WangJiaqiong (1995). A Few Great Periods in Development of International Modern Combined Transport, Integrated transportation, (6), 29-31.

[36] Waterway III to take on river and sea. (2005). *Lloyd's List International, (58847), Special Report-Zeebrugge*, 11.

[37] Water linkage in the Yangtze River. (2005). Unpublished master's thesis, Shanghai Maritime University, China, Shanghai.

[38] What does intermodal mean to you? Real competition, it seems. (2005, September19). *Energy Publishing, LLC, The U.S. Coal Review.*

[39] XuMinghui, ChenXiangling, LiuChengbin. (2003). Talk about river-sea ship. *China Port, 5*, 35-36.

[40] YunJun (2001). Integrated application to optimized methods of transportation. *Newapaper of WuHan University of Technology, 25(3),* 323-325.

[41] YinChangan (2002). Comparison and Consideration on Inland River Transport between China and Occident Countries. *Water transport management, (4),* 32-34.

[42] ZhouWangjun (1997). Talk about evolvement and developing trend of Chinese integrated transport system. *Water transport management, (1),* 38-41.

APPENDIX 1 Some issues about Inland Water Transport of Russia

The Russian Federation possesses a well-developed inland waterway network of over 101.7 thousand km. Transport activities are performed by 1,675 shipping companies and individual entrepreneurs possessing some 10 thousand cargo vessels. The absolute majority of the companies are joint stock companies. The State owns a controlling share of 25.5 per cent in 23 of them. 126 river ports carry out cargo handling activities on inland waterways. All the ports are joint stock companies; the State owns a controlling share and non-privatized property in the form of quays and water areas that are rented long-term by joint stock companies. The Association of Ports and Ship-owners of Water Transport unites 190 ports and shipping companies. In 2005, the Association celebrated its 10th anniversary. The main reason for uniting river enterprises in the Association is the coordination of their activities aimed at solving general transport-related problems of production, scientific and research, social and economic nature, representation of interests of the industry at the State instances of legislative and executive power, legal protection of their interests.

The Concept for Development of Inland Water Transport of Russia that was approved by the Government in July 2003, defines the main trends of its development and tasks and methods of governmental regulation in this field.

Source: Main Problems of Inland Navigation and Possible Ways of their Solution. *Pan-European Cooperation towards a Strong Inland Waterway Transport: On the Move.* ECMT/UNECE/CCNR/DC Workshop, Paris, 22-23 September 2005.

APPENDIX 2

Table of situations of transshipment ports in lower reaches of the Heilong River

Port	Location	Throughout Capability	Condition of Water (Draft)	General Situation of Nature
Chabarovsk	Intercourse of middle and low reaches of the Heilong River	18 million tons	5 meters at least	City population is 650 thousand; Center of Far East
Komsomol'sk-na-Amure	Point of 570 meters in the low reaches of the Heilong River	1 million tons	4.5 meters	City population is 100 thousand
Mago	Distance to the estuary of the Heilong River is 40 meters	(Wood port) 0.5 million tons	5 meters	City population is 10 thousand
Nikolayevsk-on-Amure	At the estuary of the Heilong River	1 million tons	5.5 meters	City population is 50 thousand
Lazarev	Inland sea of the Strait of Tartary; Distance to the estuary is 97 kilometers	(Wood port) 0.3 million tons	6.5 meters	City population is 20 thousand

Source: the data in this table are investigated from China Heilongjiang Transport Administration.

Note:

1. All ports figured into the table of appendix B, the conditions of operation are mechanization.
2. Inland ship rebuilt can reach the port of Lazarev.