

Countermeasures and Measures for Optimizing the Collection and Distribution System of Coastal Container Ports under the Background of Yangtze River Delta Integration

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Abstract

The collection and distribution system is an important hardware foundation for the survival and development of the port, and together with the port service industry, it has become an important pillar of the construction of the shipping center. As the "artery" connecting the port and the hinterland, the collection and distribution system has become an important part of port construction. In recent years, the integration strategy of the Yangtze River Delta is becoming more and more important and has gradually become a national strategy. Port collection and distribution should also take this opportunity to speed up the construction of the collection and distribution network between major ports. In terms of port transportation organization, it is proposed to adjust transportation management. The transportation efficiency in the Yangtze River Delta has been greatly improved by the optimization strategies of authority, strengthening the cooperation between road and land, strengthening the cooperation between road and enterprise, and releasing the channel capacity.

Keywords

Yangtze River Delta integration, Container port, Collection and distribution.

1. Introduction

The function of the collection and distribution system is to realize the interaction between the shipping center and its hinterland economy. The organization and operation management and information construction of the collection and distribution system can improve the economic efficiency of cargo transportation [1]. The developed collection and distribution system can accelerate the modernization of port transportation, promote the development of port multimodal transport, organically connect various modes of transportation, and realize "door-to-door" transportation. In the specific environment of port collection and distribution, the collection and distribution system emphasizes the coordinated operation among the three basic components of collection, distribution and transportation. According to the regional economic and social development conditions and production and living needs, combined with the characteristics of natural conditions, natural resources and economic layout, the overall efficiency, flexibility and continuity can be realized. The system mainly includes two aspects of coordination: (1) the internal coordination of the collection and distribution links is mainly based on the synergy effect of each link, so that the components of the system are coordinated in the total amount ratio, spatial layout, technical level, organization and management, measures and policies. (2) The collection, distribution and transportation links are coordinated with the total external demand and regional spatial distribution.

2. Development status of main ports in Yangtze River Delta

According to the port circle data, there are 16 ports with 100 million tons in the Yangtze River Delta port group in 2018, including Ningbo Zhoushan port, Shanghai port, Suzhou Port, Nantong port, Nanjing port, Taizhou port, Lianyungang port, Jiangyin port, Zhenjiang port, Wuhu port, Hangzhou port, Jiaxing neihe port, Huzhou port, Ma'anshan port, Yangzhou port and Tongling port. In 2018, the cargo throughput of 16 ports reached 4.363 billion tons, accounting for 32.69% of the national port cargo throughput. As one of the most powerful port groups in China, the Yangtze River Delta port group has a long history of collaborative cooperation in development. In this article, we mainly list the development status of the collection and distribution of Shanghai port, Ningbo port and Lianyungang port.

2.1 Development status of Shanghai port's collection and distribution

Shanghai port is an international shipping center. Shanghai port has the advantages of economic hinterland and port. Its container throughput ranks first in the world and cargo throughput ranks second in the world. In terms of the number of routes, coverage and density of container flights, Shanghai port is in the leading position in the world. The construction and operation of Yangshan automatic terminal also makes its future development more remarkable.

Shanghai port is a hinterland type world-class international container handling port. Its container collection and distribution system is mainly highway, accounting for more than 62% of the traffic volume, followed by waterway, accounting for about 37%. The railway is extremely weak, less than 1% [2]. The highway collection and distribution channels of Shanghai Port mainly include Shanghai Nanjing Expressway, Shanghai Hangzhou Expressway, Hujia highway and national highway 204, 312, 318 and 320. The highway transportation of port areas is mainly connected with expressways and trunk highways leading to Jiangsu and Zhejiang through outer ring road and suburban Ring Road [3]. The Yangtze River is the main waterway, mainly concentrated in Jiangsu, Zhejiang, Hubei, Hunan and Chongqing provinces and cities along the Yangtze River. The railway corridor is connected by Pudong Railway with Shanghai Nanjing and Shanghai Hangzhou railway trunk lines, and then connected with the national railway network.

The following problems exist in the collection and distribution of Shanghai Port: (1) the road collection and distribution is nearly saturated, and the urban traffic pressure is great. Due to the lack of container railway collection and distribution conditions in Shanghai port, the level of inland waterway in Shanghai is relatively low, and the development of inland river collection and distribution is slow. The railway and waterway collection and distribution of Shanghai port are still subject to certain constraints, so the current collection and distribution system of Shanghai port is still dominated by highway. However, the external expressway system of the port area is extremely weak. At present, there are few external expressways in the land area of the port area. Only S2, G1501, S20 and A30 are connected to the trans Provincial Expressway Network of the Yangtze River Delta through the urban expressway network. Moreover, S2 and A30 are toll roads, which increases the transportation cost of enterprises and affects the agglomeration and development of enterprises. (2) There is a serious shortage of infrastructure in inland rivers, and there is a large space for improvement. Shanghai Waterway collection and distribution channel conditions are insufficient, most of them are low-grade channels, and the channel above grade three is only 175 km; channel regulation projects such as Hang Shen line and Dalu line phase II, as well as Changhu Shenzhou line, Pingshen line, Dapu line and Youdun. The construction progress of high-grade inland waterways, such as Hong Kong, Suzhou Shenzhen inner port line and Zhaojiagou east section, needs to be accelerated; the construction progress of inland container port area does not match the construction of inland waterway. (3) The railway is separated from the wharf, and the proportion of sea rail intermodal transport is too small. There are too few container terminals connecting the railway in Shanghai port. At present, only 2 container berths at Jungong road terminal are equipped with railway lines. The 16 container berths and 6 branch berths of Waigaoqiao port and the large container berths of Yangshan deep water port are not directly connected by railway. The construction of Pudong Railway lags

behind and the development of Shanghai port container terminal is out of step and does not match each other. As a result, the total cost of short barge charges is higher than that of domestic surrounding ports. (4) The development of railway container transport lags behind, and the service level of sea rail intermodal transport is low. In the development process of container sea rail intermodal transport, the service quality provided by railway directly affects the overall service level of sea rail intermodal transport. One of the important reasons why the overall development of China's container sea rail intermodal transport is stagnant is the lagging development of railway container transportation. (5) The Yangtze River main line and small inland river ship types are disordered and lack of standards. The bad consequences caused by the lack of standards are, first of all, affecting the utilization rate of infrastructure such as waterway and lock, which is not conducive to improving the efficiency of infrastructure such as waterway and lock, thus affecting the efficiency of inland waterway. Secondly, the overall technical level of inland river ships is not high, the age of vessels is too old, the operation performance is poor, and there are hidden dangers in shipping safety.

2.2 Development status of Ningbo Zhoushan Port

Ningbo Zhoushan port, the largest cargo throughput port in China, has developed rapidly in recent years. In January 2018, Ningbo Zhoushan port completed a cargo throughput of 90.25 million tons, with a year-on-year increase of 11.7%; the container throughput reached 2.377 million TEU, with a year-on-year increase of 12.3%. Cargo and container throughput reached a new high in the same period of the previous year [4]. At present, there are 246 routes in Zhoushan port of Ningbo, among which more than 130 ocean routes are connected with more than 600 ports in more than 100 countries and regions. In order to meet the needs of port logistics development under the new situation, Ningbo Zhoushan port has actively developed sea rail intermodal transport business. In early 2018, the international rail sea intermodal trains along Chongqing Ningbo River were officially opened, and the number of sea rail intermodal trains increased to 12. But on the whole, the collection and distribution system is not perfect. It can be seen from Figure 1 that the main mode of freight transportation in Ningbo is highway transportation, supplemented by waterway transportation, and the proportion of railway transportation is small.

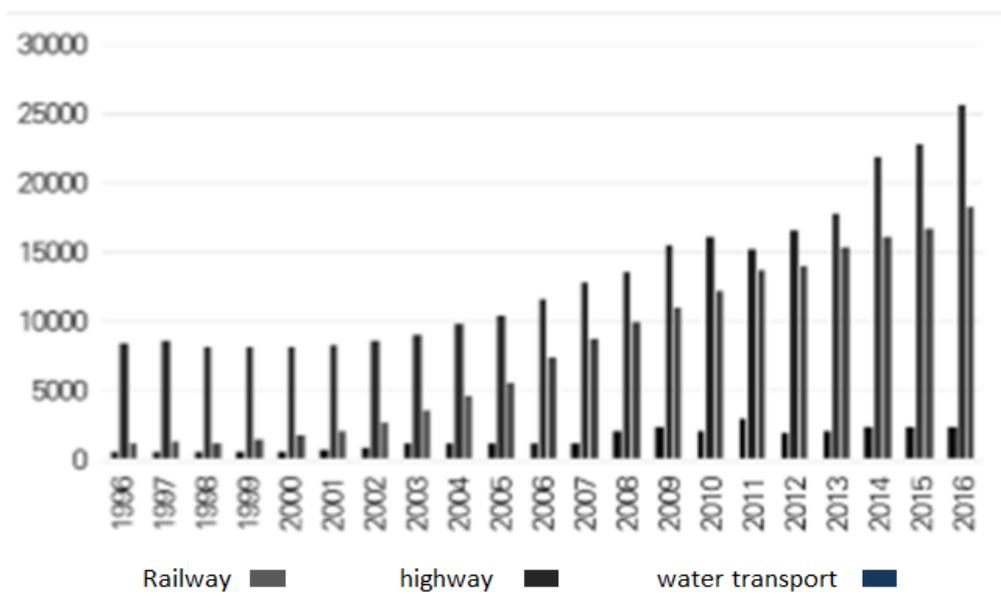


Figure 1. Main transport modes and freight volume of Ningbo goods (unit: 10000 tons)

The problems of Ningbo Zhoushan port can be seen from the above figure 1. From the annual change trend of freight volume carried by various transportation modes, highway transportation will still be the main mode of transportation, and its freight volume may continue to rise. The railway freight

volume is quite small, and the growth rate and growth rate are quite small. Single mode of transportation is vulnerable to various adverse factors. For example, highway transportation and water transportation are easy to be affected by bad weather, and the timeliness of goods transportation is difficult to guarantee. At the same time, there are few freight railway lines in Zhoushan port of Ningbo. There are only railway lines connecting Beilun port and Zhenhai port. There are no railway transportation routes in other port operation areas. The comprehensive advantages of railway transportation do not match with the freight demand of Ningbo Zhoushan port, and can not achieve efficient collection and distribution.

2.3 Development status of Lianyungang port collection and distribution

Lianyungang port is dominated by bulk cargo and container transportation. In recent years, the cargo throughput and container throughput have shown a continuous growth trend. In 2013, the cargo throughput exceeded 200 million tons, and the container throughput exceeded 5 million TEU for two consecutive years. The port has a rapid development momentum. Lianyungang port is located in China's traffic T-shaped position, and relies on Longhai Lanxin railway [5]. As one of the important railway trunk lines in mainland China, Longhai Lanxin line is connected with Xinchang line, Beijing Shanghai line and Beijing Jiulong line, connecting Lianyungang port with all parts of the country. The new Eurasian Continental Bridge has superior geographical location and natural conditions. It not only has a wide radiation area, short transportation distance, but also has large throughput capacity and strong container fleet capacity. Lianyungang is the east bridgehead of the new Eurasian Continental Bridge. In recent years, the volume of rail water intermodal transport has been increasing, but compared with the highway collection and distribution system, the rail water intermodal transport volume is very general. Lianyungang inland river transportation is mainly through Yanhe River, linked by Tongyu River, Huaihe River, Guanhe River, etc., and connected with Beijing Hangzhou Grand Canal, Yangtze River and other important water systems. It has 1138.48km long waterway, and the carrying capacity of inland port reaches 11.54 million tons [6]. By 2015, the inland river of Lianyungang will be built with 168.5 km class IV and above high-grade waterway, 26 1000 ton berths, 52 500 ton berths and 199 productive berths. The annual cargo handling capacity of the inland river port will reach 25 million tons, including 150000 TEU of containers. The road collection and distribution table of Lianyungang port is shown in Table 1 below.

Table 1 transportation volume of Lianyungang port from 2010 to 2013

year	the volume of freight transport		Cargo turnover	
	Quantity / 100 million tons	Year on year growth /%	Quantity / 100 million tons * km	Year on year growth /%
2010	0.97	25.8	67.58	21.4
2011	1.12	15.6	77.82	15.2
2012	1.31	17	88.93	14.3
2013	1.41	7.6	94.63	6.4

The existing problems of Lianyungang port are as follows: in terms of railway, the trunk line of Lianyungang port railway transportation is single, and the railway network is not dense enough. Longhai railway is the only railway trunk line running in Lianyungang. The singleness of railway trunk line will reduce the efficiency of cargo collection and distribution in port. In addition, the number of railway loading and unloading lines in the port area is limited, the effective length of most loading and unloading lines is insufficient, and the number of cargo spaces is low, which reduces the loading and unloading efficiency. The amount of compressed boxes transported by land bridge is large. Due to the lack of routes, insufficient frequency and limited railway transportation capacity, the problem of container pressing has been existed for a long time. The maximum amount of container pressing reaches 8000 TEU, which increases the pressure of port storage. In railway transportation, the procedures of cargo shipment are complicated, and the procedures of cargo damage claim are also

more complicated. In terms of highway, the highway transportation information system needs to be improved. The relevant departments or enterprises failed to upload the dynamic information of vehicle transportation to the corresponding information platform in time, resulting in traffic information communication being hindered, which is not conducive to transportation management. The function of highway freight station is relatively single. Due to the small scale and backward facilities, most highway freight stations can only be used for simple storage, storage, loading and unloading. There are some problems in highway transportation, such as high rate of empty vehicles and high energy consumption, which lead to low efficiency and high cost. There are many operators who participate in highway freight transportation, and lack of unified and efficient management. In terms of water transportation, the infrastructure construction of inland water transportation is relatively backward and the utilization rate is low. In 1138.48km channel, only 102km channel reaches grade III or above, and the channel grade is relatively low. Some channels are blocked and silted seriously, and the cargo carrying capacity is not high. Lianyungang port's collection and distribution system management is backward, and the order of inland shipping is chaotic. The preferential policies for inland water transportation have not been issued in time, which reduces the enthusiasm of the main body of inland water transportation operation and is not conducive to the development of inland water transportation.

3. Optimization measures of main ports' collection and distribution under the integration of Yangtze River Delta

3.1 We will improve the construction of railway, highway and port facilities

"13th five year plan" port collection and distribution system construction plan mentioned that for the problems existing in port collection and distribution, we should make up for the shortcomings of collection and distribution facilities, create the "last kilometer" of railway and highway entering the port, and develop port multimodal transport. Therefore, it is necessary to speed up the construction of accessible railway and highway networks, form systematic network channels, and carry out regular inspection and maintenance of facilities in the port area. According to the development needs of port logistics, we can do a good job in top-level planning and design, build railway branch lines or special lines, and deepen the railway lines into the port operation area, so as to achieve efficient collection and distribution.

3.2 Improve the inland river shipping infrastructure and build the water highway

To study the widening project of the navigation width of the deep water channel in the Yangtze Estuary, Shanghai port has carried out the waterway regulation works of the second phase of Dalu line (Dazhi River Section), pingshen line, Changhu Shenxian line and Zhaojiagou east section, and started to construct the high-grade inland waterway such as Youdun port, the eastern section of Sushen inner port and Luoyun River, completed the circular structure of "one ring and ten shoots", and opened up the connecting area between Jiangsu, Wuxi and Changzhi High grade inland waterway, accelerate the connection with the Yangtze River Delta inland river network, realize the high standard connection of inland river collection and distribution channels leading to Waigaoqiao port area and Yangshan deep water port area, and build a high-level inland river container collection and distribution network connecting the Yangtze River Delta region. We will accelerate the standardization of specialized inland river transport ships, and strengthen the R & D and application of low-carbon green technology in key areas of inland rivers. We should attach importance to the connection between inland river port area and seaport port area, solve the problem of short barge transshipment, realize the effective connection between inland water transportation and other modes of transportation, and enhance the competitiveness of inland water transportation.

3.3 Carry out multimodal transport and optimize operation links

To implement the guiding ideology of "strengthening railways, improving highways and developing inland rivers", we can learn from the experience of developed countries such as Europe and the United

States in multimodal transport development, and explore multimodal transport modes suitable for their own needs. The first is to have standardized transport units, such as standardized containers, semi trailers, drop trailers and detachable containers. As long as there are standardized transport units, the containers can be quickly transferred, and the goods of various ports can be quickly transported to all parts of the Yangtze River Delta; the second is to implement modular transportation, through the cooperation of various departments, various modes of transportation, such as highway, railway and water Road and aviation are combined to realize seamless connection and efficient operation of collection and distribution.

3.4 Build a fair market competition system for road container collection and distribution

The main task of highway container collection and distribution system should be to build a fair competition system of container collection and distribution market. The specific measures include: to speed up the formulation of laws and regulations on container road transportation, clearly define the illegal and illegal behaviors of container road transportation, determine the corresponding law enforcement subjects and punishment measures in the form of laws and regulations, and severely crack down on them To regulate the market environment of road container transportation by cracking down on unfair competition means such as overloading and escaping highway fees; to restrict and eliminate a batch of container vehicles with serious backward technical status, potential safety hazards and low operational efficiency by economic or administrative means to ensure the efficiency and safety of highway container transportation.

3.5 Support the development of inland river shipping and improve the water to water system

Accelerate the formation of inland waterway maintenance mechanism, promote the standardization of inland river specialized transport ship types, and strengthen the research and application of low-carbon green technology in key areas of inland rivers. We should attach importance to the connection between inland river port area and seaport port area, solve the problem of short barge transshipment, realize the effective connection between inland water transportation and other modes of transportation, and enhance the competitiveness of inland water transportation. Encourage enterprises to develop inland river shipping, and give certain policy support and economic subsidies to enterprises engaged in inland river shipping. In order to further support the development of inland river container transport enterprises and comprehensively optimize the collection and distribution system of coastal ports in the Yangtze River Delta region, specific preferential measures such as reducing charges, providing financial subsidies and interest free loans for inland river shipping enterprises are adopted.

3.6 Speed up the development of new transportation mode through Haihe River

The direct transportation mode of Haihe River is proposed based on the following considerations: 1) in the transportation chain, efforts should be made to avoid the "water land and water transfer" with the ports along the coast of Shanghai, so as to effectively reduce the operating costs of Shanghai port, and to curb the ships in the waters of Yangshan Port and Waigaoqiao In order to create a good production environment and reasonable operation conditions for Yangshan "island" port, and improve the competitiveness of Shanghai port; 2 In the layout of port transportation structure, efforts should be made to expand the proportion of water transportation, make full use of the advantages of the Yangtze River, especially the Grand Canal, in the vertical and horizontal water transportation network, reduce the freight rate, benefit the cargo owners, and effectively improve the port's cargo collection capacity and expand the container source share in the hinterland. The emergence and gradual expansion of the "sea river direct" water transportation mode is a necessary step for the improvement of the hub port collection and distribution system. The canal collecting and discharging channel, which runs through the place where the container sources are concentrated, is a kind of water transportation resource which has not been fully utilized, the water transportation density is low, the direct transportation mode is blank, but the transportation capacity potential is huge. Breaking through the bottleneck of "transit barrier" between "Haihe" through the new ship type, a new transportation

mode with huge potential, remarkable economy and sound development of traffic layout will be formed, which is an indispensable important link in the port collection and distribution system.

3.7 Optimize transportation organization and improve management service

In the aspect of sea rail intermodal transportation, we should optimize the whole process logistics transportation organization service, improve the transportation efficiency, shorten the transportation time, and reduce the transportation cost. Firstly, we should encourage the railway departments to run "five fixed trains" or through trains to serve the container transportation between the main inland container sources and Shanghai port, and flexibly adopt double deck container transportation, Y-type marshalling and high-frequency In order to meet the needs of different transportation, priority should be given to sea rail intermodal business, the connection between trains and shipping schedule should be strengthened, and preferential policies for sea rail intermodal transportation should be implemented in linkage with shipping companies and ports. For lines with container source potential but insufficient container source, the government can give some support policies in the initial stage of operation. Secondly, shipping companies are encouraged to set up pick-up and return points in inland container source areas, with the cooperation of railway departments, so as to realize the "exchange of boxes" between ocean and railway containers, and reduce the time and cost of empty container transfer. Third, the port authorities should be encouraged to give priority to the sea rail intermodal transport business, and preferential treatment should be given to the loading and unloading expenses.

3.8 Encourage road port cooperation and cultivate market players

A joint venture or joint venture company jointly participated by railway and port parties shall be established as a public service platform for sea rail intermodal transportation. At the same time, it is necessary to establish cooperation with inland railway dry port and expand the source of sea rail intermodal container. Through the opportunity of Yangtze River Delta integration, we will rely on Beijing Shanghai line to develop Jiangsu and Anhui markets; in the long term, we will gradually develop the markets in central and Northern Jiangsu in combination with Shanghai Shanghai Shanghai railway; and strengthen cooperation with Anhui Railway Port Alliance.

3.9 Build information sharing platform by comprehensively using modern logistics information technology

Under the background of Yangtze River Delta integration, modern technology such as RFID, GIS, EDI and GPS can be used to obtain logistics information of port area quickly. Through the establishment of information sharing platform, all departments can cooperate with each other to build a modern, intelligent and information-based collection and distribution system.

3.10 Promote the construction of inland port (dry port)

We will promote the construction of inland ports (dry ports), improve the construction of inland ports and related service facilities, attach importance to and extend the radiation and services of the middle and upper reaches of the Yangtze River and inland ports, and better connect the cargo distribution and distribution of various coastal ports through the construction of inland ports.

4. Conclusion

This paper analyzes the three main coastal ports in the Yangtze River Delta. Although the shipping network of Shanghai port is developed, it has long relied on the highway collection and distribution system, and the construction of sea rail and sea river collection and distribution system is very weak; Ningbo Zhoushan port has a large throughput of container cargo, but it is similar to Shanghai port, which mainly focuses on highway collection and distribution, while the construction of railway and inland river shipping collection and distribution system is still in progress However, Lianyungang port is a relatively perfect port in the Yangtze River Delta area, bearing the main pressure of collecting and evacuating, and its highway collection and distribution construction is relatively backward.

Because the radiation areas of the three main ports are relatively narrow, the advantages of sea rail intermodal transport and inland river shipping can not be shown. After the country puts forward the Yangtze River Delta integration strategy, coastal ports can rely on the national strategy to open up the collection and distribution market, improve the transportation system, make the port construction more perfect, accelerate the construction of sea rail intermodal transport, and make the port better. And with the collection and distribution center has become more closely linked.

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