

## Research on the Collaborative Development Strategy of Port Logistics System Based on Port Area Linkage

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**Keywords:** Port logistics system, Port area linkage, The main body of the alliance, Collaborative development.

**Abstract.** Port systems and urban systems influenced each other, and these two systems would promote or restrict the development of one side of the inevitable impact on the other side. Therefore, through research on the degree of collaboration between port economic and urban economic development, it was found out whether the port system was adapted to the needs of urban economic development. The current problems were analyzed such as the unbalanced and the excess production capacity of the port logistics system. This paper finally proposed the collaborative development strategy influencing factors of the port logistics system and the collaborative development strategies of the port logistics system. An important basis was provided for decision-making for China's port logistics system collaborative development by researching in the port logistics system, port logistics system integration strategy, information system integration evaluation, government support, security strategy and other aspects of in-depth study.

### Introduction

From the overall development of the world port, in the economic globalization situation, the competitions between the ports become gradually intense, and tend to co-development trend. China's coastal ports have grown rapidly of international trade demand under the stimulation of the rapid development. China has become the country with the largest and the fastest growing port throughput and container throughput in the world, and has formed five large-scale, intensive and modern port groups such as the Bohai Sea, the Yangtze River Delta, the southeast coast, the Pearl River Delta and the southwest coast. However, the overall competitiveness of coastal ports in China is weak, and the regional economy and port development are not enough. The reason is due to the division of administrative regions, the lack of cooperation between regions, the repeated construction of ports, vicious competitions and so on.

Gilbert R. Yochum and Vinod B. Agarwal<sup>[1]</sup> (1987) analyzed the economic impact of the Hampton Port Logistics System on port area linkage by analyzing the impact of the port on the regional economy. Weigend<sup>[2]</sup> (1956) proposed the concept of "sea to hinterland", introducing the concept of "land-to-hinterland" linkage and "sea-to-hinterland" collaboration in the study of Hamburg, Germany. Patton<sup>[3]</sup> (1958) focused on the impact of the port logistics system on the hinterland and the traffic construction in the inland hinterland in the port area of New York, Philadelphia, Baltimore and New Orleans. Gilbert R. Yochum and Vinod B. Agarwal<sup>[1]</sup> (1987) proposed a new technological approach to the impact of port logistics on regional economies and applied this approach to the analysis of Hampton's port and port area linkage. Dong-Wook Song<sup>[4]</sup> (2002) explored the competition and cooperation of container ports near Hong Kong and southern China from a strategic perspective, and studied the port area linkage and co-competition strategy between Hong Kong and Shenzhen Port.

Zhao Yanjun<sup>[5]</sup> (2006) pointed out that the port enterprises can implement the tight integration of resources to cultivate the overall advantages of Shandong port. Zhu Huilan<sup>[6]</sup> (2010) proposed the port logistics system to form a highly integrated supply chain channel relationship to further reduce logistics costs and improve the efficiency of the port logistics system through the land and air logistics all-round cooperation. Jiang Dongming (2010) analyzed the effect of port growth point by interpreting the effect of port economy on the economic mechanism of coastal economic

development, and revealed that there was a close relationship about economic development between port and coastal areas from both theoretical and empirical perspectives.

### **Indicator Cluster of Constituent Elements of Port Logistics System**

Port logistics system is composed of port logistics elements with organic connection, and these elements include people, financial, material, information, technology and so on. Putting decentralized functional elements of port logistics into a system for integrated management, so as to rationalize the logistics function as a whole. The port logistics system mainly includes the port sub-systems reflecting logistics resource agglomeration capability, the shipping operation sub-system reflecting the logistics operational concentration, the sub-system of shipping service reflecting the pooling of logistics capabilities and the hinterland environment sub-system reflecting the logistics agglomeration environment.

#### **Port Subsystem**

Port subsystem includes infrastructure index cluster, port logistics scale index cluster, port operations index cluster, port service index cluster, collecting and distributing index cluster, logistics information and technology index cluster and growth and development ability index cluster.

(1) Infrastructure index cluster - channel water depth, port berth number, port terminal length, cargo yard area, container site area.

(2) Port logistics scale index cluster - port throughput, port route coverage, port delivery capacity. Port operations indicators cluster - cost, quality, flexibility, human resources.

(3) Port service index cluster - port berth capacity, harbor pool facilities area capacity, circulation processing capacity and logistics machinery and equipment operating capacity.

(4) Collecting and distributing indicators - inland waterway, sea feeder transport, cross the port railway, sea and railway transport.

(5) Logistics information and technology indicators cluster - EDI technology applications, GPS technology applications, GIS technology applications, RFID technology applications.

(6) Growth and development capability index cluster - port liberalization, lagging port, port rate policy and green port logistics development level.

#### **Shipping Operation Subsystem**

The shipping operation subsystem includes shipping goods index cluster, coordination and support indicators cluster, ship management index cluster and ship operating index cluster. Shipping goods index cluster - berth structure, cargo structure, cargo flow. Coordination and support indicators cluster - government supervision and coordination departments, port administrative departments, customs inspection departments, trade associations. Ship management index cluster - owner (repair shipyard), leasing side. Ship operating index cluster - ship update speed, the proportion of its own fleet, the average age of ship, fleet structure, the total capacity of the ship.

#### **Shipping Service Subsystem**

Shipping service subsystem includes financial support index cluster, logistics operation index cluster and logistics services index cluster.

(1) Financial support index cluster - bank, insurance.

(2) Logistics operation index cluster - library management, logistics management innovation, human resources management, logistics information management.

(3) Logistics services index cluster - freight forwarding, third-party logistics (such as transited).

(4) Logistics information collaborative platform indicators cluster - port operations, electronic commerce, electronic government.

#### **Hinterland Environment Subsystem**

Hinterland environment subsystem includes economic and geographical conditions indicators cluster

and hinterland industry indicators cluster. Economic and geographical conditions indicators cluster - the world economy and international trade, socio - economic basic conditions, the natural environment and geographical conditions, national policy and international environment, the domestic economic environment. Hinterland industry indicators cluster (industrial chain) - hinterland comprehensive strength, hinterland pillar industry, hinterland administrative attribution.

### **Analysis on the Development Trend of Port Area Linkage**

Systematic development process of port and regional linkage can be explored from two aspects, which are port internal logistics system and external regional logistics system.

### **Composition of Port Logistics System**

Resource allocation of port and regional logistics system is carried out on a global scale, and it will have a significant impact on the regional economy and the global economy. Port is the core node of resource allocation and transfer. From the port logistics system, the port area linkage implementation and implementation of the internal system performance of the port, the cost of the best between the interdependent relationships, to achieve port area linkage can increase the efficiency of the port within the logistics system. In view of the internal logistics system of the port, there is usually an interdependent relationship between the implementation of the port area linkage and the performance of the internal system of the port. There is also interdependence between the port implementation and the optimal cost. To achieve port area linkage can increase the efficiency of the port within the logistics system.

The port logistics system is a huge system composed of transportation, storage station, packaging, loading and unloading, circulation processing, distribution and information. It is required that the port must cooperate with the operators of its external logistics system to realize the linkage mechanism. Each part of the logistics system within and outside the port must be closely connected. Due to the presence of many operators in the logistics system outside the port, the logistics links are closely linked to the final delivery of the goods and value delivery chain to meet the needs of the final cargo owners. Therefore, the external regional logistics system actually constitutes a complex multi-node network. There is a greater risk, and the implementation of integrated management is very difficult.

The various sub-systems of port logistics system complement each other and support each other. If only to establish a good internal mechanism with the lack of external system support, then the internal performance of the achievement is not long. Therefore, the external regional logistics system is the focus on port to build its upstream and downstream logistics linkage. This linkage includes both the port and the external logistics system in the upstream and downstream logistics node linkage, but also includes the port and the final owner of the linkage.

### **Systematic Development Trend of Port Area Linkage**

Port logistics systematization regards port logistics service system as an integral part of the whole system. In the development of logistics systems, the use of scientific logistics planning, management tools and modern information network technology is to build an economic, efficient and sustainable development of the port area linkage logistics system. Ports and other logistics departments in the region will create an optimized port logistics system with unified economic and social interests.

### **The Main Body of Port Logistics System**

Port logistics emphasizes the coordination of business models, and the process will be mainly by the carrier to organize and complete. When the port logistics enterprises embark on developing logistics value chain, they need to establish close relations of cooperation to customers, traders, agents, other transport enterprises, so that providing customers with full transport and one-stop logistics services.<sup>[7]</sup> As the provider of port logistics, the related enterprises mainly include transportation enterprises, related business enterprises and enterprises of port and transport combined.

### **Transportation as the Main Business**

Such enterprises are maritime carriers in the system and may also be involved in transmodality of rail carriers, road carriers and air carriers. The various modes of transport can provide transportation, storage, packaging and handling and other logistics services. Therefore, from the origin to the manufacturers and manufacturers to consumer markets, raw materials can achieve door to door transport, which is the main business of the maritime carriers. At home and abroad, many shipping companies began to invest in the construction of terminals, yard and inland freight stations in order to realize the transition from maritime carriers to multimodal transport operators.

### **Transportation and Related Business as the Main Business**

Such enterprises are agents of various modes of transport industry, transport brokerage, warehousing and other transport services represented by ports. These enterprises strengthen the port logistics process in all aspects of the effective cooperation and management, and choose the appropriate transport routes and ways for the user. In that case, these enterprises don't only make logistics services more efficient, but also reduce the total cost of logistics and shorten the total logistics time. Besides, the whole process of logistics is safe and smooth. For all those reasons, the economic benefits of logistics increase.

### **Port and Transport Co-operation**

Port is characterized by large investment, long payback period. As a result, in order to accelerate the development of port enterprises in the modern logistics industry, port enterprises must be timely and practicable to broaden the channels of funding, such as cooperating with the world famous shipping companies, shippers and other logistics enterprises. Not only can port enterprises achieve a win-win situation by participating in port construction and management, but it can also produce synergies with shipping companies, shippers or other logistics enterprises, of which economic benefits are more significant than the economies of scale. Those co-operations include:

**Cooperation with the Cargo Owners.** The traditional port hinterland needs a new differentiation and combination. Therefore, the port should go out as a strategy, and have a wide range of links with the hinterland supply of cargos, and participate in hinterland logistics system construction, so that to establish space network in the hinterland. When the port and the owner operate together, the port will be able to take full advantage of the entire supply chain of the owner, and then can get a stable, adequate supply.

**Cooperation with the Shipping Enterprises.** Port and shipping enterprises will gradually become a comprehensive cooperation in a trend. Liner companies as a port of the most important customers get the most satisfaction from many ports through co-operative manner. After the port and shipping companies operate together, it can be a wide range of investment and financing programs as a means to develop the port logistics industry. Only when the port attaches great value to famous shipping enterprises, and leads them to set up logistics distribution center in the port logistics center, can the supply chain management be efficient. As a result, logistics costs will be reduced, while the status of the port in the logistics service has also been strengthened.

**Cooperation with Roads, Railways and Warehousing Enterprises.** In cooperation with other modes of transport, the port can take a different approach. The ultimate goal is to establish a multimodal transport logistics system to adapt to modern logistics. In one respect, port and road traffic authorities can co-operate to expand port throughput. In another respect, in order to alleviate the possible congestion in the development of the port, the port can co-operate with the inland logistics center. In addition, in conjunction with the warehousing enterprises, in order to give full play to its role, the port should make full use of the library resources of the adjacent ports and revitalize the stock by dividing the work.<sup>[8]</sup>

## Collaborative Development Strategy of Port Logistics System

Port logistics system is composed of logistics, capital flow, information flow and other elements. Through the integration of various elements, the functional elements of decentralized port logistics can become an organic whole, making logistics functions rationalized. Based on the analysis for the co-competition of the main body of the port, this paper makes port logistics cooperation alliance strategy, port logistics system integration strategy, port logistics information collaboration strategy and port logistics support and security strategy, composing the collaborative development strategy of China's port logistics system.

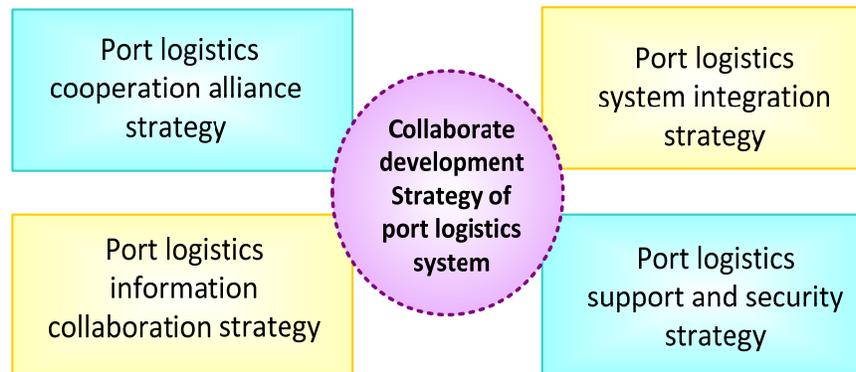


Figure1. Collaborative development Strategy of port logistics system.

### Port Logistics Cooperation Alliance Strategy

**Major Port Industries Should be Based on Reality, and Form a Strategic Alliance.** The development direction between the ports should focus on port group, making the competition fair. Besides, Ports in the cooperation should share their resources and make common development. Port logistics system in the cooperation will inevitably produce competition, but the strategic alliance will emphasize both competition and cooperation. Co-competition is not to eliminate competition, but in order to make more effective competition to maximize their own advantages and continuously improve production efficiency and operational efficiency. Ensuring their own excellent competitiveness while strengthening cooperation can achieve a win-win situation, and get the most benefits.

**Cooperation Alliance Should Base on Business Relationship.** Investment and construction management can solve the shortage of funds in the construction of the port, but it can also introduce advanced terminal construction experience from transnational operators of port investment. There are also some differences in the business situations of the port logistics system, including: the geographical location, natural conditions, hinterland development and route development of the port. These differences provide a prerequisite for the port logistics system to achieve a strategic alliance based on business relationship. Those port logistics systems can form a strategic alliance in business operations to strengthen deepening cooperation between each other.

**The Necessary Competition Can Provide Customers with Better Service.** Each port enterprise must ensure that it has its own unique competitive advantage. Otherwise it may be excluded, because the premise of cooperation alliance strategy is able to achieve a win-win situation. First of all, each port logistics system should strive for excellent dock hydrological conditions. Second, it should improve production efficiency and shorten the park time. For large container ships, the daily cost of capital is up to tens of thousands of dollars, and the turnover rate of goods is put forward higher and higher requirements by the owner. In order to enhance their competitiveness and get more supply, port managers should continue to improve the efficiency of loading and unloading for reducing the

time in the port and saving time costs. Finally, the government should create a fair competitive environment to ensure fair competition between ports.

**The Alliance Needs to Be Based on the Government's Macro-control.** The government should take effective policies as a lever to avoid repetitive construction and structural contradictions. First, through the SWOT analyze, the government should be based on the characteristics of the port to develop industrial policy to foster the development of the port industry and planning the port layout scientifically and rationally. Second, through legal and administrative means, port managers should control the competitive relationship of the port in order to prevent monopoly, while ensuring that competition is carried out in an orderly manner, which is to create a fair market competition environment for the development of the port.<sup>[9]</sup> Third, standardize the port charges, and reduce cost of berthing and clearing the port, road and bridge, then the port in the service price is competitive.

### **Port Logistics System Integration Strategy**

**Transport Integration Strategy.** Collecting and distributing is an important factor in port logistics, which plays a decisive role in transport. Mainline haulage and delivery are the two modes of transport for goods process in port logistics system. Mainline haulage refers to large-scale and efficient long-distance transport. Under normal circumstances, the use of the form is the whole railway, vehicle transport and ship transport. Delivery is also known as secondary transport or terminal transport. Different from the mainline haulage, it is a small-scale and multi-customer mode of transport, which delivers the goods to the customers according to the different requirements of many users. Delivery has the characteristics of small volume, short distance and dispersed delivery location. When organizing the port logistics, port managers often need to combine the two models to play the better role of transport and achieve better economic benefits. Port logistics system has some inefficient transport, resulting in the waste of transport capacity, excess cost of freight, and increasing the transport time. In order to overcome the unreasonable transport, port managers should take appropriate measures, the use of efficient and effective means of transport, while using systems engineering methods and mathematical models for scientific optimization.

**Loading and Unloading Integration Strategy.** Loading and unloading affects the economic efficiency of key areas by influencing the operational efficiency of port logistics. It is an important part of port logistics system optimization to optimize the loading and unloading. Managers should try to reduce the intermediate steps and make the loading and unloading procedurally. In fact, loading and unloading activity will not increase the value and use value, but it increases the possibility of material costs and damage. This risk is also points to the port logistics. The port should concentrate materials appropriately to a certain amount of operation, according to the principle of economic rationality, to realize mechanization and automation conditions for loading and unloading operations. Conditions permitting, the loading point and the unloading point in the circulation should be concentrated as much as possible.

### **Port Logistics Information Collaboration Strategy**

Port logistics system consists of operating system, information system and support system, which mainly includes four levels of business, namely the basic business layer, standard business layer, value-added business layer and senior business layer. Business flow, logistics and information flow are integrated in the port logistics system. In the process of the operation of the port logistics system, these three are closely linked and indispensable. They improve the efficiency of port logistics, and enhance the competitiveness of the port. Port logistics system information integration strategy shows in Figure 2.

Port information resources are the basis of port logistics information integration platform. The port managers make full use of information resources to and integrate them, finally establishing a port logistics information collaborative integration platform by the use of advanced information technology and modern logistics technology.

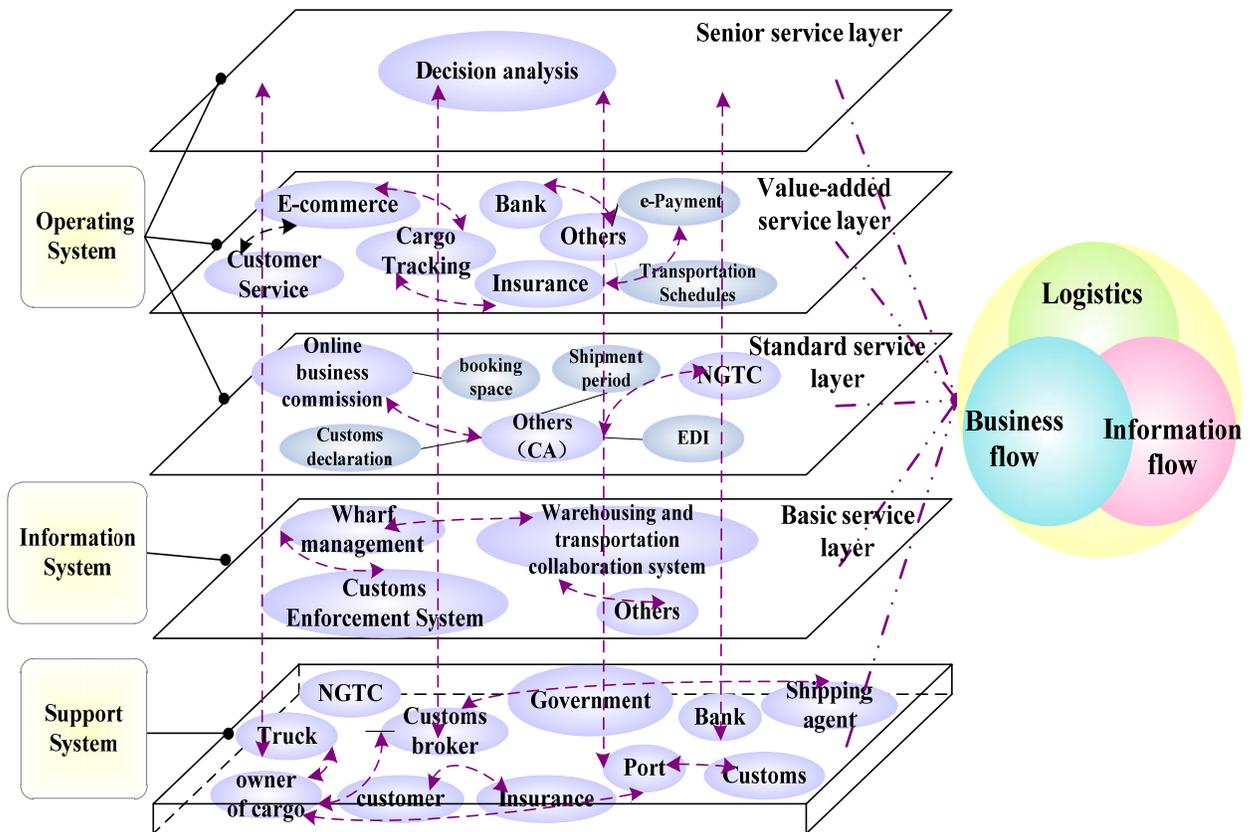


Figure 2. Integration of logistics, business flow and information flow in port logistics system.

Port logistics information collaborative integration platform connects the information of following parts, including government agencies (such as customs, taxation, inspection and quarantine, Maritime Bureau, foreign exchange management, the Ministry of Transport, etc.), social financial service institutions (such as banks, insurance, etc.), logistics industry (such as shipping enterprise, shipping agents, freight forwarders, shippers, terminals, stations, etc.), a variety of freight companies (such as production enterprises, business enterprises) and other information resources. The platform will carry out a variety of e-commerce functions of the service, and provide information sharing by different part and personalized services, so to improve the level of information services, service quality and radiation range. At the same time the platform will effectively interface with China's electronic port, and expand the international trade market extensively. The platform includes basic functions (data exchange, information dissemination services, and transaction functions) and extended functions (distribution functions, cargo tracking, inventory management, decision analysis, financial services).

Port logistics information collaborative integration platform interconnects enterprises, customers and related regulatory agencies fully. The platform will form a network information logistics open system which facing the owner, consists of the trade, port and shipping, making it become a strong support for port logistics. In the whole process of logistics, the platform will achieve visualization, automation, paperless and intelligent, packaging, transportation, loading and unloading, warehousing, delivery, distribution and logistics information processing organically integrated as a system to manage and improve the efficiency of the port.

### Port Logistics Support and Security Strategy

**The Government Plays a Leading Role in Optimizing the Structure.** For the port planning, the Government should be scientific and rational to adjust the industrial structure, and speed up the

construction of competitive industries, the port orderly and efficient development, so that the port development will be orderly and efficient. Port logistics system and the country's transportation system coordinate with each other to complete the port planning. They complete the port planning, then give full play to port transport function and promote the rapid development of trans modality. The cooperation within the port group is deepening, and public facilities in the port like the railway, bridges and tunnels gradually improve. Ports are capital-intensive industries, so government departments play a major role in investing.<sup>[10]</sup> Port construction requires a flexible access system to provide a basis for diversified financing. Different regions of the port sector should establish a dialogue mechanism, which will carry out timely communication for the strategic plans of different ports and resolve the conflict of different ports. The form of the dialogue mechanism can be a regional trade association that is a loose union of organizations.

**The Government Should Strengthen Planning Guidance and Policy Support.** Through policy guidance, institutional construction and other means, the government should develop the port logistics actively to create a good macro environment, where port logistics center will have a good development potential. These policies include land policy, business and urban management policies, policies that encourage the development of enterprises, industrial policies, regulations and guidance. If the government provides a more relaxed environment, port logistics development will have more opportunities.

**Broaden the Port Logistics Service Function, and Improve the Port Area Linkage Mode.** Port competition is not only the competition of costs. It gradually transferred to the competition of quality and further transferred to the competition of service. Logistics services are the most important part of the competition as the core of the service. Port enterprises should be based on customer needs to develop modern logistics industry. Firstly, port enterprises, through the direction of positioning, improve the core quality of service and enhance service functions. Finally, port enterprises will win the trust of customers, and establish the brand image which is beyond the general.

**The Talent Strategy of Port Logistics System Development.** At present, most of the port logistics service enterprises concentrated in the low-end services like forwarder, warehousing and other. There are still inadequate for shipping finance and other high-end services. Gathering the high-end talents vigorously in port logistics can change this situation. For the port logistics system, high-level and middle-level management personnel and professional personnel need to be actively supported. They're from five types of enterprises, including priority shipping service enterprises, shipping manufacturing and maintenance enterprises with large-scale, high-growth shipping enterprises, premium shipping service enterprises and well-known shipping agencies from domestic and foreign. The government should set up preferential policies to support these talents, such as giving subsidies to the newly introduced business talents or executives.

## Conclusion

Following the corresponding strategies is important for the development of port logistics system. Based on the analysis for the co-competition of the main body of the port logistics system, this paper makes port logistics cooperation alliance strategy, port logistics system integration strategy, port logistics information collaboration strategy and port logistics support and security strategy.

The aim of the collaborative development strategy of port logistics is to conform the development trend of economic globalization, and meet the needs of China's modernization. China should take the international and domestic shipping market as the guide, building a modern port system, providing the rational structure, distinct administrative levels, perfect function, unimpeded information, safeguards, convenient services, and civilized and environmental protection.

In the case of the competition of the port logistics industry, through the research on the linkage strategy of the port logistics system for the range of the world, Northeast Asia, the scope China and the Bohai Sea area, according to the collaborative development situation and of China's port logistics, this paper tries to build and improve the collaborative development system of China's port logistics

system, which provides some inspiration and reference for the further development and improvement of China's port logistics market. It has certain theoretical and practical significance for the theoretical research of port logistics in China.

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