

## **Dynamic Evolution Mechanism of the Location Value of the Ningbo–Zhoushan Port: A Competition Perspective**

**Tang Liansheng, Cui Ping, Liu Yuan, Qiao Wen, Liu Tieli**

*School of Economics and Management, Ningbo University of Technology*

### **Abstract**

This study discusses the dynamic evolution of Ningbo–Zhoushan Port’s location value from the perspective of competition. Considering Ningbo–Zhoushan Port’s construction of a free trade port (FTP) against the background of trade liberalization, this study summarizes the experience and laws of the dynamic evolution of the location value of well-known FTPs in China and abroad. It also investigates the dynamic evolution mechanism of Ningbo–Zhoushan Port’s location value and how it leverages its location value in port competition. Finally, this study proposes five aspects to improve location value: driving subject and natural location value, port capacity location value, economic hinterland location value, science and technology location value, and policy location value.

**Keywords:** free trade port, dynamic evolution, location value, port competition, location advantage

China has established “comprehensive experimental zones” under its Belt and Road Initiative, including the establishment of free trade ports (FTPs) [1]. Moving beyond the functions of traditional transportation hubs, ports have become increasingly prominent in the global economy. Well-known ports such as the Port of Rotterdam, Singapore Port, Hong Kong Port, and Shanghai Port are all FTPs. In China, Dalian, Shenzhen, and Qingdao Ports have all become free trade zones. With regard to the Ningbo–Zhoushan Port, however, only Zhoushan Port has set up a free trade zone

while Ningbo Port has not, thus missing out on an opportunity for FTP development. To establish Ningbo–Zhoushan Port as an FTP, it is necessary to analyze the evolution mechanism of its location value advantage, clarify its function orientation, determine the direction and path of FTP construction, and focus on the port competition aspect.

## **1 Research reference**

In location theory, location relates to placing and marking areas for specific purposes [2]. Location value refers to a region's comparative advantage over other regions, which can promote economic development and improve regional competitiveness [10]. Port location value is a comparative advantage [7] of a port compared to other ports. In the process of port development, its location value will evolve and develop as a result of various factors.

Research on port location value has mainly analyzed the geographical location conditions of port formation, the factors affecting port location development, and port location evolution. Maritime distance, logistics transportation, labor resources, and construction costs determine the optimal location for port construction [17]. Morgan proposes that a port's economic hinterland determines port development [18]. Developing an "arbitrary port" model, Berd [8] divides port development into four stages—the traditional, port logistics, related development, and professional development stages—and puts forward the view of port–city separation [13].

Investigating the factors affecting the evolution of port location value, Dong et al. [12] find that port location changes depend on changes in natural, socioeconomic, scientific, and technological factors. On that basis, they propose the concept of port location potential [9] and develop a related theoretical framework and basic model. Bloom [4] further refines the concept of port location based on an analysis of the new location of the Port of Zhoushan. Location value reflects comparative advantages and resource advantages in the economic space of a port [3] [14]; on that basis, the factors affecting port location value can be established [5]. Applying the study of port location value to the theory of free trade area construction, Chen et al. [6] investigate the factors affecting the location value of a free trade area using a logit model. They find that location value advantages associated with the hinterland's economic level, infrastructure construction, government policy, and foreign investment positively affect FTP construction [11].

Existing research on port location value has proposed various methods and models, providing a good theoretical and methodological basis for subsequent work. Few studies, however, have considered the dynamic development of location value, and there is a lack of discussion of the law of location value. This study, therefore, investigates the dynamic evolution mechanism of the location value of Ningbo–

Zhoushan Port in the context of port competition. It also analyzes the factors affecting changes in Ningbo–Zhoushan Port’s location value and proposes a development direction for the construction of the Ningbo–Zhoushan FTP.

## **2 Dynamic evolution of the location value of free trade ports**

The evolution of a port’s location value can be divided into several stages based on physical location, changes in function, competitive advantage, economic development level, government policy, and other factors. According to the development characteristics of each stage, the general development law is investigated, and the dynamic evolution law and the main factors affecting FTP location value are summarized.

### **2.1 Dynamic evolution of the location value of foreign free trade ports**

#### **2.1.1 Port of Rotterdam, Netherlands**

The Port of Rotterdam is located in South Holland, Netherlands, at the confluence of the Rhine and Nieuwe Maas Rivers. The eastern part connects the Rhine and the Danube with the Caspian Sea, and the western part is on the North Sea. The economic hinterland includes half of Europe. The ports are not frozen and silted, wind and waves are small, and shipping conditions are excellent. The area of the Port of Rotterdam is about 126.06 square kilometers, with a total length of 89 kilometers and a water depth of 6.1–24 meters. It has 656 berths and has opened more than 500 routes to connect with more than 1,000 ports worldwide. The largest port in Europe, it is known as the “European Portal.” In 2018, the cargo throughput of the Port of Rotterdam reached a record high of 469 million tons, and its container throughput ranked 11 among the world’s 1.45 million standard containers. It is the most important import and export cargo transport hub in Europe, a global logistics center, and one of the world’s largest container ports. Its development process can be recognized as evolution of its port function orientation and the changes in its location value.

#### **2.1.2 Port of Singapore**

The Port of Singapore is located on the southern coast of Singapore, close to the Strait of Malacca and the Strait of Singapore. The port area is 5.38 million square meters, with eight free trade parks and more than 30 industrial parks. It has one 400,000 ton and two 300,000 ton dry docks and has opened up more than 250 routes to connect 130 countries and regions. Its transit trade is developed, and it is one of the most well-known transit ports, as well as one of Asia’s largest ship repair bases.

## **2.2 Dynamic evolution of the location value of domestic free trade ports**

### **2.2.1 Port of Hong Kong**

The Port of Hong Kong is close to the Pearl River Delta region, with all of mainland China as the economic hinterland. It faces Southeast Asia and the Asia-Pacific region from east to south. The deep-water channel conditions in the port are good, and its equipment is advanced. More than 20 routes have been opened. The port is internationally well-known for its facilities, cabin tonnage, cargo throughput, container throughput, and efficiency. Such excellent foundations are part of the important conditions for the development of Hong Kong's FTP. Hong Kong has a high degree of trade freedom, causing the port to be known as the most free port in the world. Moreover, Hong Kong is an important center of international finance, trade, shipping, and technological innovation, as well as one of the world's most competitive cities. The development time of the Port of Hong Kong has been shorter than that of other well-known ports. In terms of function, the Port of Hong Kong transformed from a single port to a processing trade port, and then to a comprehensive cross-regional FTP. The high degree of trade freedom is its most prominent factor. Its location value forms a dynamic evolution pattern of "natural condition advantage—national policy advantage—economic hinterland advantage."

### **2.2.2 Port of Shanghai**

The Port of Shanghai has four main port areas, a deep water channel, a water depth of 7–15 meters, a land area of 7.2 square kilometers, a water area of 3620.2 square kilometers, and a wharf line length of 87.6 kilometers with 1202 berths, 164 of which are over 10,000 tons. It has opened up more than 80 international routes and more than 500 ports in 215 countries. The port's throughput capacity has been the highest in the world.

Based on geographical location, port location, political factors, changes in port conditions, port logistics, and national policies, the Port of Shanghai developed from an ordinary foreign trade port to an international economic, financial, and logistic center. The dynamic evolution of its location value follows a pattern of "natural condition advantage—national policy influence—port capacity advantage—national policy advantage."

The above discussion of the location value evolution of well-known ports shows that in different development stages, owing to the influence of different factors, the function orientations of port continue to change, and their location value continues to develop and evolve.

### **2.3 Dynamic evolution of the location value of Ningbo–Zhoushan Port**

Among well-known FTPs, regardless of the length of the development process or differences in location value, they have multifunctional orientations that focus on port resource endowment and can meet various needs. Therefore, to promote FTP development, it is necessary to focus on port capacity, location resource endowment, functional orientation, and multifunctional FTP development. Additionally, the development of FTP should focus on port trade development, logistics hub development, the prosperity of international financial trade, high-level science and technology, and sustainable development, in order to maximize the advantages of an FTP hub.

Based on the above, developing a traffic logistics hub and a comprehensive, efficient collection and distribution system are prerequisites for FTP establishment. Ningbo has developed its maritime transport, but the development of its air transport and land transport is unbalanced.

## **3 Location value evolution of Ningbo–Zhoushan Port**

### **3.1 Longitudinal analysis**

Ningbo–Zhoushan Port was divided into Ningbo Port and Zhoushan Port in 2006. Since the location conditions and development history of the two ports are very similar, this study analyzes the evolution of Ningbo–Zhoushan Port's location value. Specifically, its evolution is analyzed longitudinally, and the evolution law of location value is investigated.

### **3.2 Horizontal analysis**

#### **3.2.1 Factors affecting port location value**

Based on the analysis thus far, location value is considered to affect the evolution of ports mainly in terms of natural conditions, port capacity, economic hinterland, government policy, and science and technology.

#### **3.2.2 Horizontal comparative analysis**

Port location and resources are the prerequisites for port development and utilization. According to the optimal distribution theory of regional economic layout [15], regional investment and factor distribution should prioritize investing in places with comparative advantages. The water depth of Ningbo–Zhoushan Port is 22 metres deep, and the deep-water coastline is more than 300 kilometers above 15 meters. The

climate is warm throughout the year, without freezing or silting. There are rich nonmetallic mineral resources and oil and gas resources in the port area. Natural and marine tourism resources are also very rich. It connects the north-south water system, the Yangtze River water system, the Zhejiang inland river, and the Taihu Lake water system inward; outward, it connects with the Pacific Ocean. Ningbo–Zhoushan Port has comparative advantages in all aspects of its natural conditions, and its advantages of natural location are more prominent.

Port capacity is the foundation of port development. Regional economic theory suggests that optimizing the allocation and combination of existing production resources in a certain space can maximize output [16]. Port capacity is the main embodiment of port function, and its size is mainly affected by port infrastructure construction, throughput, logistics, and industrial systems.

Ningbo–Zhoushan Port is divided into 19 port areas, with 19 straight wharves and 723 berths, of which 28 are more than 10,000 tons, and the yard area is 520.3 million square meters. It also has advanced loading and unloading equipment, such as remote-control intelligent bridge cranes and gantry cranes, and it has opened 246 routes. The port equipment is advanced, information management has been adopted, and its infrastructure is advanced. Meanwhile, the area of the Port of Shanghai is 3620.2 square kilometers, and the wharf line is 87.6 kilometers long, with 1202 berths, of which 160 are 10,000 tons or above. It is 1.776 million square kilometer yards and has 3256 various types of handling equipment; more than 80 routes have been opened to connect 215 countries and regions. Thus, the Port of Shanghai has the most prominent advantages in terms of port conditions and infrastructure. The Port of Singapore's conditions are slightly poor, but its infrastructure is advanced. Ningbo–Zhoushan Port has excellent port conditions, but its development is not complete, and its infrastructure construction is at a disadvantage.

#### **4 Dynamic evolution mechanism of Ningbo–Zhoushan Port**

As an important strategic resource of a country and an important way to optimize global resource allocation, port development directly reflects local and regional economic development, and it can even affect national economic development. Competition among ports in China is becoming increasingly fierce. Competition in terms of resources, sources of goods, the hinterland economy, and port freight volume has entered the global level, and competition has intensified.

##### **4.1 Drivers of the location value evolution of Ningbo–Zhoushan Port**

Multiple subjects are involved in the evolution of port location value, such as

governments, enterprises, science and technology R&D centers, and financial and trade institutions. These subjects may have close or loose relationships. In the context of port competition, they exchange resources, technology, information, and personnel, among other things. The combined effect of these relationships promotes optimal port development, thereby promoting the evolution of port location value and competitiveness. Given the different resource endowments, characteristics, effects, and functions of each subject, they will have unique positioning and have different effects on the whole port location value system. Therefore, to study the evolution of location value, it is necessary to understand the relationships between subjects.

Enterprises will be the main players in the development of port location value. Enterprises will participate in economic activities and promote trade development and the hinterland's economic development, thus further promoting port development and port location value. In the whole process of port development, enterprises can determine a reasonable position from customer needs, guide the development of natural location, and provide financial support for port infrastructure. Financial institutions generally do not directly participate in port activities, but enterprises can provide information, platforms, and financial support for other subjects to promote the evolution of port location value.

#### **4.2 Dynamic evolution mechanism of Ningbo–Zhoushan Port's location value**

Natural location differences and resource endowments are the basis for promoting port development. Ningbo's government has assumed the role of resource development leader. It has introduced many resource development support policies and has developed the rich regional resources, nonmetallic mineral resources, oil and gas resources, and coastal tourism resources in the port area. It has also guided the development of the Chunxiao oil and gas field, East Sea continental shelf oil and gas resource development zone, and Zhoushan coastal tourism development zone. Financial institutions, represented by banks, insurance, and intermediaries, do not directly participate in the development of location resources, but they provide some financial support and resource development innovation platforms for port resource development. Scientific research institutions provide R&D technologies for resource development, improve the utilization of port resources, and maximize the value of natural location resource advantages.

### **5 Suggestions**

Port resource development and port capacity building are the conditions and foundation for FTP development. It is necessary to develop the superior geographical

locations and natural resources of ports to provide a resource basis for development. First, it is urgent to develop the long coastline and deep-water coastline resources of Ningbo–Zhoushan Port, strengthen the construction of deep-water ports in Beilun Port and Zhoushan Port, increase the number of large port terminals, and improve the tonnage of port ships. Second, the investment of capital, technology, and personnel input should be increased. Zhenhai refining, as well as chemical energy enterprises, should be supported to develop oil and gas resources. Efforts should be made to develop nonmineral resources in the port area, especially the Chunxiao oil and gas field, whose natural gas reserves are more than 70 billion cubic meters. Effective development can meet the needs of the port and further promote energy industry development. Improving port capacity is also an important measure for enhancing port competitiveness. The Ningbo railway and the high-speed and maritime systems should be combined to strengthen the transport network through coordinated development.

Hinterland economic development is crucial for promoting FTP construction. Building the Ningbo FTP requires optimizing the industrial structure, promoting the transformation and upgrading of the port industry, strengthening port radiation, and promoting the development of the port economy. Relatedly, it is necessary to transform and upgrade traditional labor-intensive garment-textile industries into knowledge- and technology-intensive industries and improve their industrial added value. By promoting the transformation and upgrading of the port industry, we can improve the level of hinterland economic development, enhance location value advantages, and further promote the construction of the Ningbo–Zhoushan FTP.

China's government should improve laws related to FTPs and provide a legal framework supporting the construction of the Ningbo–Zhoushan FTP. Then, based on national law, according to the location value and characteristics of Ningbo–Zhoushan Port, the Ningbo government can refine and improve policies and regulations according to local conditions, so that the construction of the Ningbo–Zhoushan FTP can be governed by law.

Technological innovation capability is the catalyst of port development and FTP construction. It is necessary to increase investment in capital, technology, and talent; promote the development of science and technology; introduce scientific and technological factors into FTP management and operation; build the Ningbo Electronic Data Switching Center; promote the construction of intelligent FTPs based on information and automation; and promote paperless processes.

Sustainable development is the inevitable trend in FTP development. The construction of the Ningbo–Zhoushan FTP must adhere to the principles of sustainable development. In port construction, strict pollution detection standards should be

followed. Environmental monitoring and pollution detection equipment must be updated, and the environmental protection of port equipment should be increased to meet the requirements of sustainable development. For coal, iron ore, and other seriously polluted goods transported by the port, it is necessary to strengthen transportation management and supervision, strictly control transportation links, and reduce effects on the environment in transportation and processing. Strengthening the education of people and enterprises with regard to environmental protection, improving their awareness of sustainable development, adhering to simultaneous economic development and environmental protection, improving the sustainability of port development, and enhancing the development potential of ports are all also important.

## **6 Conclusion**

Port location value has become a focus of port development research in recent years. The intensification of port competition has directed attention to the dynamic evolution mechanism of port location value. This study refers to the experience of well-known international ports to study the dynamic evolution mechanism of port location value. Moreover, it analyzes the location value of four driving subjects: government, enterprises, financial institutions, and scientific research institutions. In addition, it considers five aspects: natural location value, port capacity location value, economic hinterland location value, science and technology location value, and policy location value. This study summarizes the dynamic evolution mechanism of port location value, which can promote port development via the interaction of driving subjects and location value. This can shift port location value from being unitary to diversified, and change a weak location value to an advantageous value. This study can provide a theoretical reference for the construction of the Ningbo–Zhoushan FTP. At present, the dynamic evolution mechanism of the location value of the Ningbo–Zhoushan FTP is still in the stage of theoretical exploration. It will be necessary to continuously combine the construction of the Ningbo–Zhoushan FTP with empirical research to improve its dynamic evolution mechanism.

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