



Empirical Analysis of Competitiveness of Qingdao International Container Hub Port

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Abstract. With the accelerated process of economic globalization, global and inter-regional ties are closer, which also makes the competitive relationship between ports in the region more intense, so it is necessary to analyse the competitiveness of ports. This paper takes Qingdao Port as the research object and analyses the competitiveness from the viewpoint of container transport. This paper first discusses the status quo of Qingdao Port's development. Then we analyse the competitiveness situation from the three dimensions of the global ports, China's eight major trunkline ports, and Bohai Sea Rim and North East Asian ports. Finally, we put forward countermeasures and proposals to provide methodological references for the competitiveness analysis of the port container transport and to assist the port enterprise in making a rational and ideal decision employing the research of this paper.

Keywords: Qingdao Port; International Container Hub Port; Container Transport; Competitiveness Analysis

1 Introduction

In 2021, the Central Committee of the Communist Party of China and the State Council issued the Outline of the National Comprehensive Three-dimensional Transportation Network Plan, which delineated 11 international hub seaports. And Qingdao Port was successfully selected as China's international hub seaport. Qingdao Port completed cargo throughput of 630 million tons and container throughput of 23,710,000 TEUs in 2021, which makes it the 4th largest port in China, and the 6th largest container port in the world. As a result, Qingdao port plays an important hub role in the transportation of containers, bulk energy, and raw materials.

At present, with the acceleration of economic globalization and the proposal of the "Belt and Road" initiative, the comprehensive competitiveness of ports is destined to affect the development of the radiation region and even the economy of the country [1]. Qingdao Port now becomes China's main coastal port, the important hub of the comprehensive transport system and the gateway port for the Yellow River Basin open to the outside world, its development of international trade and the hinterland economy can play an extremely important role [2]. In addition, in recent years, the rapid development of ports and related industries in Shandong Province has intensified the

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G. Zhao et al. (eds.), *Proceedings of the 2024 7th International Symposium on Traffic Transportation and Civil Architecture (ISTTCA 2024)*, Advances in Engineering Research 241,

https://doi.org/10.2991/978-94-6463-514-0_3

competition between ports in the region, and the competition between domestic and international ports is inevitable [3]. Therefore, the evaluation study of comprehensive competitiveness of Qingdao Port can have an objective understanding of the comprehensive competitiveness of the port.

Currently, there is a wealth of research around the competitiveness analysis of Qingdao Port. Li concluded that Qingdao Port's international shipping hub competitiveness index ranked first in Northeast Asia based on the "International Shipping Hub Competitiveness Index - Northeast Asia Report (2021)" [4]. Jiang [5] systematically analyzed the development status of Qingdao international dry ports and used SWOT matrix analysis to sort out the development of Qingdao international dry ports and evaluated and analyzed Qingdao international dry ports. Zeng [6] studied the competitiveness of China's coastal ports in the context of "Belt and Road" from three dimensions of transport capacity, financial indicators, and non-financial indicators, and evaluated the competitiveness of the ports and summarized the enhancement strategies. Niu [7] used the factor analysis model to evaluate and analyze the competitiveness of 16 ports along the coast of China, and then made a quantitative evaluation of Qingdao Port and Rizhao Port. In addition, many scholars analyzed the competitiveness of Qingdao Port from the perspective of promoting the development of the port city and industry. Chen [8] took Qingdao as the object of research, and carries out systematic and in-depth research on the synergy between the port logistics of Qingdao Port and the high-quality development of the city's economy and put forward the relevant suggestions and strategies to enhance the synergy. Chen and Xu [9] constructed a port comprehensive competitiveness evaluation model under the background of FTZ construction by entropy weight TOPSIS method, and introduced the evaluation results into the VAR model to investigate the impact of port competitiveness on Qingdao's industrial structure from the static and dynamic perspectives respectively. Xu and Zheng [10] analyzed the connotation characteristics of China's green and low-carbon ports and their development status quo, and constructed a multidimensional competitiveness evaluation index system suitable for the coordinated analysis of China's ports' economic benefits and environmental impacts.

It can be seen that the current study mainly evaluates the competitiveness of Qingdao Port by constructing the indicator system and adopting the multi-attribute decision-making method, but both the indicators and the evaluation method involve more human factors. Thus, it is necessary to analyze the competitiveness evaluation of Qingdao Port based on the collection of the actual infrastructure data and the operation data of Qingdao Port in various aspects.

2 Analysis of Qingdao Port Development Status

Qingdao Port is located in the south of the Shandong Peninsula and located in the Bohai Rim port group, the Yangtze River Delta port group, the center of Japan and South Korea port group, and the crossroads of "One Belt, One Road". Qingdao Port is an important hub of the national comprehensive transport system, one of the 11 major international hub seaports, 24 major ports, and 8 major container ports in China. It's the

core of the Shandong coastal port group. At present, Qingdao Port has formed a spatial pattern of "one bay, two wings, and six districts", which mainly consists of six harbor districts and the name is Old Harbor District, Huangdao Harbor District, Qianwan Harbor District, Dongjiakou Harbor District, Haixi Bay Harbor District, and Aoshan Bay Harbor District respectively.

2.1 Status of Infrastructure

As described in Table 1, by the end of 2021, Qingdao Port has built 118 productive berths, including 93 10,000-tonne berths and 30 berths above 100,000 tons, with a designed annual throughput capacity of 381 million tons, including a container throughput capacity of 11.56 million TEU, as shown in the table below.

Table 1. Status of Terminal Berths in the Qingdao Port (Until 2021)

Harbor District	Number of productive berths	Design Year Adoption Capacity
	Total	Total
	(scale)	(10 thousand ton)
Qingdao Port	118	38163
Among: Old Harbor District	29	1447
Huangdao Harbor District	17	7274
Qianwan Harbor District	42	15183
Dongjiakou Harbor District	22	12862
Aoshan Bay Harbor District	3	90
Others	5	1307

2.2 Current Status of Production Operations

As described in Table 2, in 2021, Qingdao Port will have a cargo throughput of 630 million tons and a container throughput of 23.71 million TEUs, making it the 4th largest port in China and the 6th largest container port in the world.

Table 2. Throughput of Qingdao Port by Cargo Category in 2021

Cargo type	Total	Outbound	Inbound
Total	63029	24604	38426
1. Coal & Products	2309	1599	710
2. Oil & Products	12563	2541	10022
3. Metal ore	17044	3584	13460
4. Iron and steel	510	359	152
5. Mining and construction materials	1250	567	684
6. Container weights	25074	14763	10311
Container volume	2371	1212	1160

3 Competitiveness Analysis of Qingdao Port International Container Hub Port

3.1 Formatting Author Affiliations

This paper mainly adopts the comparison of container hubs based on the spatial dimension. This study collates the route settings of six major international liner shipping companies, namely MARSEK, MSC, COSCO, Hapag-Lloyd, ONE, and EMC.

The range of ports analyzed includes three perspectives: global ports, eight major domestic trunk ports, Northeast Asia and Bohai Rim, and finally this paper proposes the development characteristics of Qingdao Port in building an international container hub in Northeast Asia, namely, "development conditions - market demand".

Comparative Analysis of Global Container Ports.

Firstly, Qingdao Port has a higher capacity of route density, but there is still a big gap compared with Shanghai Port and other ports. Based on the analysis of the global container ship AIS calling trajectory in 2019, Qingdao Port is located in the 8th place in the world, but its calling density still has a big gap compared with Shanghai, Ningbo Zhoushan, Singapore, Busan, and other ports. Among the top ten liner companies, COSCO Shipping has a higher dependence on Qingdao Port.

Secondly, Qingdao Port is generally at the second level of port connectivity. According to the World Bank's Container Connectivity Index status report in Figure 1, the port of Qingdao is in sixth place globally in terms of connectivity, after the ports of Shanghai, Singapore, Ningbo Zhoushan, Busan and Hong Kong. However, since 2014, the growth of the connectivity index of Qingdao Port has slowed down, while Rotterdam Port, Kaohsiung Port and Antwerp Port have grown faster.

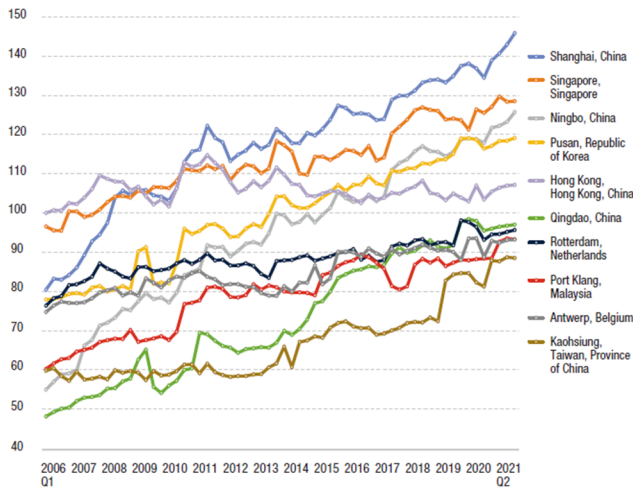


Fig. 1. World Bank Container Port Connectivity Index Ranking

Thirdly, Qingdao Port's international transshipment is far away from Singapore, Busan, etc. According to Figure 2. in 2021, among the container throughput of Qingdao Port's international routes, there are 3.5 million TEUs for international transshipment containers, and the international transshipment container volume accounts for about 15%.

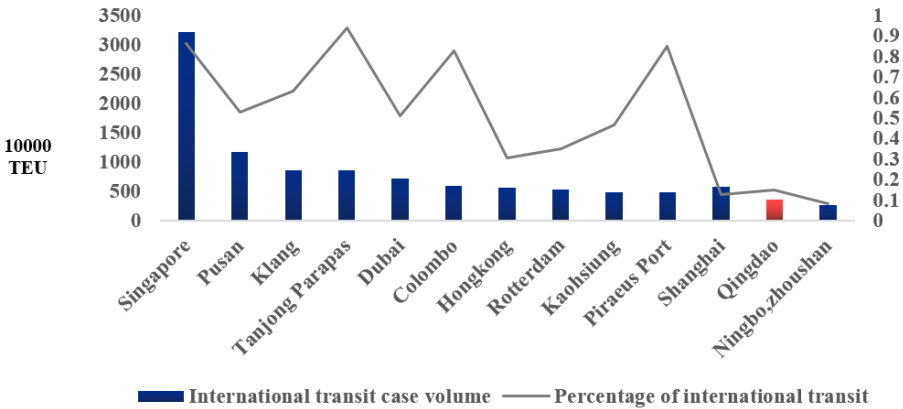


Fig. 2. Global International Container Transshipment Ranking

Comparative Analysis of the Eight Major Trunk Ports.

Firstly, the total volume of cargo transport and incremental growth rate of Qingdao Port are among the top in the country. According to Figure 3, Qingdao Port completed the throughput of 15.86 million TEU of containerized international routes in 2021, ranking fourth in the country. And Qingdao Port is in the third echelon of China's eight major trunk ports. From the point of view of the incremental-growth matrix since 2010, Qingdao Port also ranked in the top three, showing a better growth momentum.

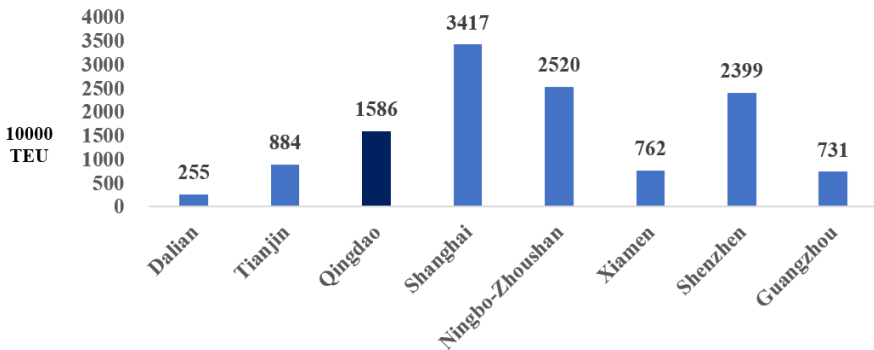


Fig. 3. Throughput of international routes of the eight major trunk ports

Secondly, the total scale of Qingdao Port's shipping routes ranks in the second echelon of the country. Qingdao Port opened a total of 128 foreign trade routes (weekly) in

2021, which is in the second echelon of the country, and is the port with the highest density of routes in the north.

Comparative Analysis of Northeast Asia and Bohai Rim.

Firstly, from the perspective of Northeast Asia, the total pivot degree of Qingdao Port is not as good as that of Shanghai Port and Busan Port. According to the World Bank's AIS-based analysis of the number of foreign trade container ship calls, Qingdao Port's hub degree of call is about 50 percent of that of Pusan Port and 40 percent of that of Shanghai Port, but it is much higher than that of relevant ports in Japan and the domestic ports of Tianjin and Dalian.

Secondly, from the perspective of the Bohai rim, Qingdao Port is the leader in regional container development according to Figure 4. Since 2013, the growth rate of Qingdao Port international routes is much higher than that of Tianjin Port and Dalian Port. At present Qingdao Port has 54 oceanic trunk lines and 74 near-ocean routes, the number of routes in the northern coastal ports in the leading position.

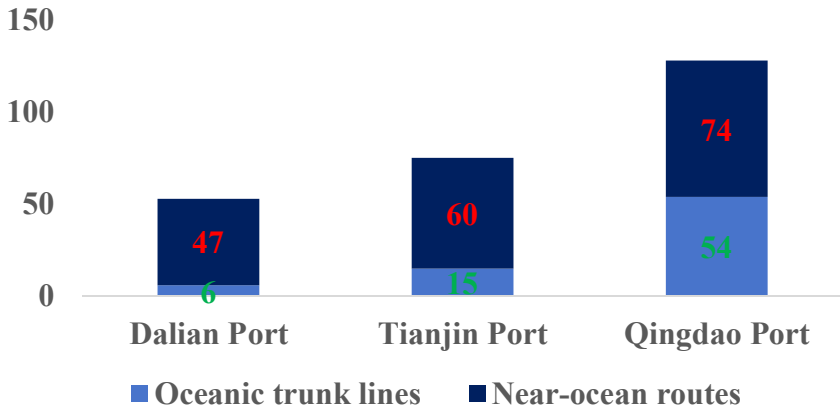


Fig. 4. Number of routes of the three major trunk ports in the Bohai Rim

Third, from the perspective of the Shandong coastal view, Qingdao Port is the core of regional development. Shandong coastal port's international route container throughput is 17.09 million TEU in 2021, and Qingdao Port accounted for about 93%, which is the core of regional development.

Above all, Qingdao Port is the leader of container transport in the Bohai Rim, second only to Busan Port in Northeast Asia, and ranks behind Shanghai Port, Ningbo Zhoushan Port, and Shenzhen Port in terms of national hub. From the point of view of "development conditions and market demand", the present situation and potential of Qingdao Port's future routes to ASEAN, the United States, Europe and Northeast Asia are at a high level, and there is also more room for development of international transshipment.

4 Countermeasures and Recommendations

(1) Improve the port infrastructure construction and enhance the port's comprehensive competitiveness

Infrastructure is the foundation of port operation, only with a perfect infrastructure port can serve the shipping company better and achieve certain production purposes. The large-scale specialization of port infrastructure can enhance the operational efficiency of the port. There is no lack of relatively perfect port infrastructure in China's major ports, the coastal ports of Shandong Peninsula should seize the policy opportunity to continuously improve infrastructure to enhance the comprehensive competitiveness of a solid material foundation.

(2) Improve the railway collection and transportation system and promote the integrated construction of port areas

Usually, the transportation conditions of the world's strong ports are more excellent performance. And it has convenient traffic, a wide hinterland, and perfect and reasonable railway equipment. To make the traffic between the port and the surrounding areas in Shandong Province smoother, it is necessary to continuously improve the railway collection and transportation system and focus on regional integration.

5 Conclusion

This paper takes Qingdao Port as the research object and proposes to take the basic research data as the support, starting from the perspective of development conditions - market demand by sorting out the deficiencies of the existing methods, and analyses the competitiveness of Qingdao Port containers through the perspective of the global container trunk ports, China's eight trunk ports and Northeast Asia and Bohai Ri. Then this paper obtains the ranking distribution of Qingdao Port container transport in Bohai Rim and Northeast Asia, national hub degree, and global container hub port, and Finally it puts forward relevant countermeasures and suggestions. In addition, this paper analyzes different indicators and does not carry out comprehensive evaluation, as a result, it is necessary to carry out comprehensive evaluation based on analytic hierarchy process or other methods in the future. And the competitiveness of Qingdao Port container transport can be analyzed from other perspectives and other related research can be carried out around Qingdao Port container transport.

Acknowledgement

Funding Information: Study on Qingdao International Hub Harbour Development Planning under New Circumstances. Horizontal projects. 032207-200; Development of Algorithms and Visualisation Models for Container Transportation Network Analysis Based on Multivariate Data. Science and technology development projects. 092307-117.

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