Analysis of Shenzhen Port Container Development Countermeasures under the Background of Guangdong-Hong Kong-Macao Greater Bay Area

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Abstract. The construction of the Guangdong-Hong Kong-Macao Greater Bay Area brings new opportunities for the future development of Shenzhen Port, but it also faces many challenges. Due to the large number of ports in the Bay Area, large and small, rich port resources, leading to increasingly fierce competition between ports. Therefore, the article mainly to Hong Kong and Macao Grand Bay Area as the research of environment, analyzes the status quo of Shenzhen Port Container development, followed by The exponential smoothing model is used to predict the container throughput of Shenzhen Port, finally, on the basis of the prediction results, relevant countermeasures are put forward for the better development of container transportation in Shenzhen Port, and the development path of Shenzhen Port in the context of the Greater Bay Area is sought.

1. Introduction

The Guangdong-Hong Kong-Macao Greater Bay Area is the world’s fourth largest bay area after the world’s three major bay areas. It has rivers and seas, dense river networks, backed by the mainland and facing the south my country sea. It is located in the hub of my country’s international shipping routes and has superior geographical conditions. With the globalization of economy and trade, my country needs to further increase its foreign trade exchanges and build a highly internationalized platform for opening up. The Guangdong-Hong Kong-Macao Greater Bay Area has a large number of ports and abundant port resources. It has three major ports ranked among the top ten in the world in terms of container throughput, as well as many small and medium ports such as Zhuhai Port and Dongguan Port. With limited cargo resources and excessive port resources, the imbalance between port resources and cargo resources in the bay will cause fierce competition between ports. Therefore, how to help Shenzhen Port stand out in many ports has important research significance.

2. Analysis of the status quo of Shenzhen Port’s container development

2.1. Current status of container transportation

Prior to 2018, Shenzhen port had been ranked third in the world's container throughput, but by 2018, Ningbo Zhoushan port leaped to the top, surpassing Shenzhen port to become the world's third largest port in terms of container throughput, while Shenzhen port declined for the fourth place. The container throughput data of Shenzhen port from 2002 to 2018 is shown in the figure below:
Figure 1. Line chart of the container throughput of Shenzhen Port from 2002 to 2018.

It can be seen from the figure that from 2002 to 2010, the container throughput of Shenzhen Port has grown rapidly, and the overall trend has been sharply rising. The container throughput has increased by 2.95 times in eight years. However, since 2010, the development of the port's container transportation industry has begun to take a turn. By 2018, although the overall container throughput of Shenzhen Port is still on the rise, the growth rate has slowed down compared with the past, and even has a trend of stagnation.

Based on the analysis of the future development plan of Shenzhen Port, Shenzhen Port Future plans to invest a large amount of funds in the development and construction of Nanshan Port Area and Yantian Port Area. As the largest container throughput port in my country's coastal areas, Shenzhen Port will continue to increase its competitiveness and service level, and give play to its advantages in the container transportation industry to consolidate its position in the container transportation industry. In addition, Shenzhen Port has set clear goals for future development. In the future, it hopes to build Shenzhen Port into an international comprehensive transportation port. It is committed to the construction and improvement of port infrastructure, improving the port’s service quality, and building a good reputation and reputation. Brand awareness.

2.2. Container liner routes

According to data, Shenzhen Port has a total of 26 international friendly ports. The three major alliances of global container liner transportation "2M+ Hyundai", "OCEAN Alliance" and "THE Alliance" have more than 100 routes calling in Shenzhen Port. It is currently the port with the most calls in the world. In addition, Shenzhen Port is dominated by foreign trade transportation, and its foreign trade container throughput is as high as 93% of the port. There are a total of 239 international container shipping routes, of which Europe, America and Asia are the main ones, followed by the Mediterranean and Australia.

3. Forecast of container throughput of Shenzhen Port

Commonly used to predict there are many ways, this paper according to Shenzhen to Hong Kong in the past few years, the container throughput changes, by screening, intended for use exponential smoothing to the future of the port container throughput of Shenzhen Port transport to explore predict.

3.1. Exponential smoothing method

Exponential smoothing method is one kind based on the past actual value and the predicted value, by exponentially weighted prediction method, a method derived from the evolution of the weighted moving average method, the advantage of saving time, as long as the period the actual number and the forecast value of the previous period can be used to calculate the forecast value of the next period,
which is a practical forecasting method. The exponential smoothing method can also be divided into
the first exponential smoothing method, the second exponential smoothing method and the third
exponential smoothing method according to the different smoothing times. This article will use the
method to predict the future container throughput of Shenzhen Port.

3.2. The establishment of the three-time exponential smoothing prediction model
Suppose the time series composed of n original data is: \( y_1, y_2, y_3, ... y_t \), then the three-time exponential
smoothing model is

\[
\hat{y}_{t+T} = a_t + b_t T + c_t T^2
\]

among them:

\[
a_t = 3S_t^{(1)} - 3S_t^{(2)} + S_t^{(3)}
\]

\[
b_t = \frac{\alpha}{2(1-\alpha)^3} \left[ (6 - 5\alpha)S_t^{(1)} - 2(5 - 4\alpha)S_t^{(2)} + (4 - 3\alpha)S_t^{(3)} \right]
\]

\[
c_t = \frac{\alpha^2}{2(1-\alpha)^2} [S_t^{(1)} - 2S_t^{(2)} + S_t^{(3)}]
\]

\[
S_t^{(1)} = \alpha y_t + (1 - \alpha) S_t^{(1)}
\]

\[
S_t^{(2)} = \alpha S_t^{(1)} + (1 - \alpha) S_{t-1}^{(2)}
\]

\[
S_t^{(3)} = \alpha S_t^{(2)} + (1 - \alpha) S_{t-1}^{(3)}
\]

\( S_t^{(1)} \) is the first exponential smoothing value at time \( t \), \( S_t^{(2)} \) is the second exponential smoothing
value at time \( t \), \( S_t^{(3)} \) is the third exponential smoothing value at time \( t \), and \( \alpha \) is the weighting
coefficient, and \( \alpha \in (0,1] \). The choice of \( \alpha \) has a key influence on the accuracy of the prediction results.
The greater the value of \( \alpha \), the greater the proportion of \( y_t \) in the forecast, and vice versa.

3.3. Forecast of container throughput

3.3.1. Determination of container throughput prediction model

| Years | Container throughput (ten thousand standard containers) |
|-------|---------------------------------------------------------|
| 2009  | 1825                                                   |
| 2010  | 2251                                                   |
| 2011  | 2257                                                   |
| 2012  | 2294                                                   |
| 2013  | 2328                                                   |
| 2014  | 2404                                                   |
| 2015  | 2420                                                   |
| 2016  | 2398                                                   |
| 2017  | 2521                                                   |
| 2018  | 2574                                                   |

According to the above table, the container throughput scatter chart of Shenzhen Port from 2009 to
2018 is obtained:

![Scatter chart of Shenzhen Port container throughput from 2009 to 2018.](image)

Based on the 2009-2018 data, the container throughput forecast model is as follows:

$$\hat{y}_{t+T} = 2570.17 + 60.62T + 1.69T^2$$  \hspace{1cm} (8)

### 3.3.2. Container throughput forecast

According to the forecast model, the container throughput of Shenzhen Port from 2020 to 2025 is predicted. The forecast value is shown in the following table.

| Years | Container throughput (ten thousand standard containers) |
|-------|---------------------------------------------------------|
| 2020  | 2698.19                                                 |
| 2021  | 2767.28                                                 |
| 2022  | 2839.75                                                 |
| 2023  | 2915.62                                                 |
| 2024  | 2994.73                                                 |
| 2025  | 3077.32                                                 |

Observing the prediction results above, we can find that the container throughput of Shenzhen Port will exceed the 3000 TEU mark in 2025. Therefore, the following will study the future development direction and countermeasures of the container transportation industry in Shenzhen Port based on the prediction results in this chapter.
4. Measures for the development of Shenzhen Port in the context of the Guangdong-Hong Kong-Macao Greater Bay Area

4.1. Optimize the collection and distribution system of the port
Since the collection and distribution system of Shenzhen Port cannot adapt to the increasing volume of cargo transportation, in order to relieve the traffic pressure of the port and solve the problem of port congestion, Shenzhen Port can use rail and water transportation to replace the original road transportation and share the road. Give full play to the advantages of railway transportation in distance, attract goods from inland areas, and solve the problem of fierce competition for goods in the Bay Area. Strengthen the investment in supporting facilities of railway transportation services, increase the proportion of railway transportation in the overall transportation mode, invest in the construction of more dry ports in inland areas, so that cargo owners can handle the import and export procedures of goods locally, and further promote sea rail Union transport development.

4.2. Improve port infrastructure
Due to limited cargo resources and fierce competition among ports, Shenzhen Port should speed up the construction and improvement of port infrastructure to improve its competitiveness. By increasing the number of berths to deepen the waterway, increasing the tonnage of navigable ships, and building large container terminals, it can attract large ships to call and attract more sources of goods for the port. Broadening the width of the channel can speed up the speed of ships entering and leaving the port, increase the number of container ship pilotages in the port, and thereby increase the throughput of containers.

4.3. Establish cooperative relations with surrounding ports
In the face of limited resources and fierce competition from surrounding ports, Shenzhen Port should continue to improve its overall strength on the one hand, and on the other hand, it should increase cooperation with surrounding ports to establish a win-win partnership. First of all, according to the different advantages of each port, the same type of supply can be allocated to a port through a reasonable distribution of supply to solve the problem of shortage of supply. Second, ports can obtain shares in other ports through investment, so that ports can achieve deeper cooperation and achieve a win-win situation of cooperation. Third, to further enhance the cooperation between Hong Kong, Shenzhen and Hong Kong in Hong Kong, Hong Kong Hong Kong to play its advantages of modern logistics and international aviation in the port of Hong Kong and Shenzhen as its cost to play on the strengths, weaknesses of both, win-win cooperation, To achieve the goal of an international shipping center in the Asia-Pacific region.

5. Conclusion
This article is based on the background of the Guangdong-Hong Kong-Macao Greater Bay Area. By analyzing the current status of the development of Shenzhen Port's existing container transportation, and using the exponential smoothing method to predict Shenzhen Port's container throughput in the next five years. Through forecasting, it is found that the container throughput of Shenzhen Port is expected to reach 30,773,200 TEUs in 2025. It can be seen that Shenzhen Port has great potential for the development of the container transportation industry in the future.

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