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The Influence of Large Ships on Port Development

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Abstract

In recent decades, driven by various factors, the vast majority of ship types in the shipping market are developing towards the trend of large-scale, in which the development of oil tankers and bulk carriers is relatively stable, while container ships are still developing rapidly. Ships are closely related to ports. The development of large-scale ships has a great impact on port berths, channels, handling efficiency, collection and distribution system, etc. In the face of the problems caused by the large-scale ships, the port should formulate strategies in time to actively deal with them. This paper first introduces the history and current situation of large-scale ship, analyzes its driving factors, then gives an example of the impact of large-scale ship on the port, as well as the port's coping strategies, and finally gives its own suggestions to deal with large-scale ship.

Keywords

Large Scale Ships; Port Impact; Suggestions.

1. Introduction

With the deepening of international economic exchanges, the rapid growth of world import and export trade business and the continuous development of shipping technology, maritime transportation has become the main mode of global cargo transportation. In order to compete for the source of goods, shipping companies objectively require lower transportation costs, and are keen to order large tonnage ships. The development of science and technology also makes the shipbuilding technology continuously improve, which provides technical support for the effective operation of large tonnage ships. At present, the three mainstream ship types in the shipping market, namely bulk carriers, oil tankers and container ships, are developing towards large scale in varying degrees.

The relationship between large-scale ships and port reconstruction is very close. The capacity of the port restricts the scale of large-scale ships, because ships need to dock with the port to unload. The relationship between them is like shoes and feet. Large scale ships will certainly affect the development of the port, and even determine the direction of port reform. The trend of large-scale ship development will inevitably make relevant enterprises make decisions Corresponding response, formulate relevant strategies to enhance the competitiveness of the port, and solve the impact of large-scale ships on the port.

2. Development history and current situation of large scale ships

2.1 Bulk carriers

The development of bulk carriers has gone through the following three stages: in the first stage, since the 1950s, the large-scale bulk carriers have entered a rapid development stage. In 1986, Korea heavy industry built a 360000 DWT large bulk carrier; in the second stage, 1986-2010, there has been no larger ship in the 20 years, and the ships built are basically 300000 DWT In the third stage, in 2011, with the rapid growth of China's import of iron ore, Vale launched a 400000 DWT super large ore

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carrier, with a length of 362 m, a width of 65 m and a full draft of 23 M. Up to now, there are 57 large 400000 DWT ore carriers in the world, mainly operating in Brazil China routes. Since 2011, the largest tonnage of bulk carriers has remained at 400000 tons, with no new breakthrough.

2.2 Oil tankers

Throughout the history of world oil tanker development, it has been entangled with the situation in the Middle East. The Suez Canal War in 1956 and the third Middle East war in 1967 led to the suspension of the Suez Canal and promoted the development of large oil tankers. The fourth Middle East War, which broke out in October 1973, played the opposite role. It triggered the first world oil crisis. After the crisis, a large number of VLCC orders were cancelled due to the significant inhibition of oil demand and the impact of the resumption of navigation of the Suez Canal.

After the mid-1980s, with the recovery of the world economy and the low price of oil caused by the decline of demand, Western European countries began to interest in oil again. Due to a large number of VLCC dismantling due to losses, resulting in a decline in transport capacity, and the gradual aging of oil tankers built in the 1970s, the global super tanker market has entered a rising period again. Since the 1990s, VLCC's ship price has been gradually rising, and it has become one of the main forces of offshore oil transportation. But since then, the giant oil tankers with a capacity of more than 500000 tons have never been built again due to the problems of economy and airworthiness. At present, 200000-320000 DWT oil tankers are the main ship type for offshore oil transportation.

2.3 Container ships

Container transportation mode does not first appear at sea, but on land. However, the rapid development is due to the maritime transportation, especially the land sea combined transportation. On April 26, 1956, the world's first container ship, ideal x, set sail with 58 containers. In April this year, HMM, which launched a new container ship as "Hmm altheras", said that "Hmm St. Petersburg" was officially put into use, with a capacity of about 2396400 TEUs, making it the largest container ship in the world at present. From the first container ship to now, the container capacity of container ship has increased by hundreds of times in more than 60 years. With the development of shipbuilding technology and shipping industry, large-scale ships become more and more intense. More and more shipping companies order large container ships. Shipping companies make use of the advantages of large-scale ships to make shipping enterprises realize economies of scale, so as to adapt to the development of shipping market.

In October 2014, Lloyd's register of shipping announced that the large-scale container ships are still going on, and 24000 TEU large-scale ships may be built in the world. However, many years ago, people still debated whether 18000 TEU ships are feasible, and now 24000 TEU Container Ships have been realized. Because the global economic situation is not optimistic, the economy affects trade. If trade is not good, there will be no freight, and shipping companies will earn less, which makes shipping companies more eager to pursue scale effect. Scale effect will lead to large-scale ships, so the large-scale container ships continue.

Table 1. Main parameters of six generation container ships

Generation	Container load/ TEU	Load/ ten thousand ton	Length /m	Width /m	Draft/m
First generation	<700	<4	<156	<23	<9
Second generation	701-2300	1.0-3.9	129.8-261.0	20.8-32.3	7.5-12.0
Third Generation	2301-4400	3.0-6.8	202.0-294.1	30.7-32.3	10.0-13.5
Fourth Generation	4200-5000	5.0-6.8	275.0-299.9	37.2-40.0	12.2-14.0
Fifth generation	5001-8000	6.5-8.5	275-320	40-43	13.5-14.0
Sixth generation	>8000	>8.5	>330	>45	>14

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3. The driving factors for the development of large-scale ships

3.1 Economies of scale and cost reduction

In recent years, the speed of large-scale ships has been accelerating. There are some reasons for the rapid development of large-scale ships, such as the pursuit of economies of scale by shipping companies, the increase of international trade demand by multinational companies, the proposal of shipping alliance and relevant environmental protection law. Among them, economies of scale are the main factors. Before the economic crisis, the main reason for large-scale ships is China With the rapid development of international trade, but after the economic crisis, the reason for the development of large-scale ships is that the economic situation of shipping companies continues to be depressed, which increases the pursuit of scale economy of shipping companies, and large-scale ships just meet their needs.

Nowadays, large-scale ships have become the main trend of ship development. The reason why ship owners choose to order large-scale ships is that large-scale ships have considerable economies of scale, in addition to high-quality energy-saving and environmental protection performance and strong cargo loading capacity. From the perspective of economies of scale, the larger the size of a ship, the lower the cost per unit of cargo transportation. For global carriers, they will benefit from the improvement of ship efficiency and the continuous development of new kinetic energy. At the same time, the fuel consumption per unit weight of cargo transportation is only half of that of the old ships. In addition, the cost of insurance and labor is also reduced by more than half. Compared with the traditional smaller container ships, a huge container ship needs more than 20 crew members, but its transport capacity is only three times that of a small ship. This obvious scale economy effect is also the main reason why shipping companies continue to invest heavily in the construction of super large container ships in recent years.

3.2 The increasing demand of transnational corporations in international trade

Since China's accession to the world economic and Trade Organization, China's overseas trade has been developing rapidly, and many multinational companies have come to China to invest and build factories, which plays a very important role in international trade. At present, there are more than ten thousand multinational companies in the world. The goods and services in world trade are very important to multinational companies. The international trade volume involved by multinational companies with a certain proportion has occupied a large proportion in their international trade flow, especially in the container trade of goods transportation. Today, multinational companies have become the main source of demand for goods, and play an important role in the shipping industry and shipping industry chain. Most of the goods of multinational companies are transported by sea. Due to the nature of most products, the speed of transportation is required to be fast, and it can not be transported by sea for too long. The larger the ship, the more goods will be transported at one time, so as to ensure the efficient transportation from door to door. Therefore, this is a very important factor affecting the development of large container ships.

3.3 Shipping alliance promotes large scale ships

Due to the integration of the world economy, many shipping companies have formed a shipping alliance, which can effectively relieve the pressure of liner shipping companies. At the same time, this group development mode can also ensure that each shipping alliance has enough funds to purchase and build large container ships. In addition, the operation of this mode can also plan the routes systematically, and the shipping alliance can also plan the best route configuration. This mode can also provide financial support to ensure the shipping companies' demand for large-scale ships. In fact, the shipping alliance makes better use of the role of economies of scale, because the shipping alliance composed of shipping companies has a greater demand for cargo transportation, and they need more investment Ships help them transport. The development of shipping alliance promotes the development of large-scale ships. The alliance can share containers, information, and funds, which improves the utilization rate of ship's container space, expands their service scope, and better realizes

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global transportation, thus driving the development of large-scale container ships, which is also an important reason for the large-scale ships One of the elements.

4. The influence of large ships on ports

4.1 Port berth

4.1.1 Berth water depth

Large ships call at ports with higher requirements for water depth. However, it is a big challenge for the coastal areas which do not have a good natural deep-water port. At present, many large ports are speeding up the construction of port water depth and improving the capacity of receiving ships from all over the world. The higher the requirement of water depth, the higher the requirement of waterway and wharf water depth. But looking at the situation of each port, only a few ports can meet the requirement of 15 meters. As far as the current situation of the world's ports is concerned, except for Rotterdam, Antwerp, Hamburg, Southampton, Felix, long beach, Singapore, Hong Kong, Shanghai Yangshan and other international hub ports where the water depth can reach more than 15 meters, the water depth conditions of other ports are difficult to meet the requirements of 14.5-16.0 meters for super large container ships.

4.1.2 Berth length

In order to adapt to the development of the trend of large-scale ships, the ports are facing great pressure of reform. At the beginning of construction, most wharves did not take the problem of large-scale ships into consideration. This means that the wharf will either be reconstructed on a large scale, or the quay wall will be temporarily raised, lengthened and reinforced, so that large ships can dock at the wharf.

In the design of wharf, the length of berth will be one of the very important factors, because the length of berth is an important factor that affects whether large ships can dock. The length of berth generally includes two points, one is the length of ship. So the bigger the ship is, the longer the berth is designed. The other is the necessary safety interval between ships. The size of the safety interval varies with the size of the ship. The larger the ship is, the greater the safety interval is required. For example, the length of a 10000 DWT berth is 15 to 20 meters. It can be seen that the length of berth is of great significance for the development of large-scale ships.

4.2 Port and waterway

If the water depth of the channel can not make the super large ships pass freely, then the development of large ships will naturally be limited by the water depth of the channel. In addition, the large-scale ship reduces the channel capacity, causes channel congestion, and reduces the efficiency of ship navigation. Therefore, in order to make the Panama Canal meet the traffic conditions of large ships, the whole canal was expanded. At present, the whole Panama Canal expansion project has been completed. Now super Panamax ships can easily pass through the Panama Canal, and the freight volume of the canal has doubled. On the other hand, the second phase expansion plan of Suez canal also widens the river surface and deepens the water depth of the channel. After this expansion, 250000 ton oil tankers can also pass smoothly, saving the sailing time of ships and promoting the development of trade.

4.3 Port infrastructure

The pace of large-scale container ships is faster and faster, but the improvement of port infrastructure takes a long time, and the adaptation of port infrastructure to large-scale is lagging behind. The large-scale ships and deep-water berths require large-scale and efficient port handling system. Due to the larger width of large container ship and more containers loaded side by side, the port is required to have corresponding large shore cranes. For example, a 9000teu container ship is 45.6m wide and can load 18 containers side by side. It needs a large crane to load and unload 18 containers. The replacement of large crane, the logistic supply of chassis truck and the improvement of computer system need more money and longer time.

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4.4 Handling efficiency

The larger the ship is, the more cargo will be loaded. After more cargo, there will be higher requirements on the efficiency of loading and unloading, which will promote the large ships to have higher requirements on the efficiency of port loading and unloading. Take the 70000teu container ship for example, it requires at least 300 containers per hour. With the acceleration of large-scale ships, the larger the ships are, the more containers are loaded, and a large number of containers have higher requirements for operation efficiency. Low loading and unloading efficiency means that the cost rises, and it is impossible to create scale effect for the operation of ship transportation in economy, which will naturally limit the development of large-scale ships. The main factor of the development of large-scale ships is to save costs. If the cost is increased because of the operational efficiency, it will limit the development of large-scale ships.

In order to meet the needs of large-scale development of container ships. In terms of operation efficiency, the loading and unloading equipment of many ports are being upgraded. For example, Auckland port ordered seven shore cranes with a forward distance of 65 meters from Zhenhua Heavy Industry Co., Ltd., and Amsterdam port adopted the method of leading large container ships into the dig in basin, which speeds up the loading and unloading efficiency and saves loading and unloading costs Unloading time.

4.5 Port collection and distribution conditions

The large-scale container ships bring huge container volume to the major container hub ports, but also bring great challenges. The lack of port collection and distribution capacity will lead to a large number of containers overstocking in the port, thus causing great pressure on the inland transportation system. The transfer capacity of containers such as highway, railway and waterway branch lines is hardware, while the expansion of computer management system and inland evacuation network is software. Any deficiency in both aspects will lead to delayed delivery of goods, thus affecting the service quality of shipping companies to cargo owners. If containers often encounter obstacles in transit evacuation and the delivery time of goods is often delayed, the advantage of fast sailing of super large container ship will no longer exist and its attraction to cargo owners will disappear.

5. Strategies for port to cope with large ships

In the face of large-scale ships, the port should take positive countermeasures, which is very important for the development of the port. The port can develop new deep-water port, update the port infrastructure, speed up channel dredging, improve the transportation efficiency of wharf and yard, and establish a more perfect collection and distribution system. In order to gain an advantage in the port competition, we must adapt to the development of large-scale ships. Port enterprises should adopt more than these strategies in the face of large-scale ships. They should also take positive strategies in the preparation of cargo sources and market network. The trend of large-scale ships has been clear. Port enterprises should predict the future development degree and actively respond.

5.1 Improvement of deepwater port construction

The larger the ship is, the greater the full load draught of the ship is. With the large-scale of the ship, the greater the depth of the port channel and berth is needed. In order to adapt to large ships, the port must have enough depth. Although ship designers are also studying the length and width of potential ships when designing ships, this is to improve the ship's loading capacity. For example, Oscar of mediterranean shipping company's container capacity is 12000teu higher than that of six generation container ships, but the draught increase is not more than 2m. At present, the potential length and width of ships are close to the limit, and the draught must be increased. In order to adapt to the large-scale ships, the coping strategy of port enterprises is to develop new deep water areas and speed up channel dredging. For example, the water area of Hamburg Port has been deepened to 16.5 meters, and the channel has been dredged to 15 meters. The Yangtze River channel built by Yangshan Port

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in Shanghai, China is 12.5 meters deep-water channel. Tianjin port, Guangzhou port and the Yangtze River estuary are also developing deep-water ports and speeding up channel dredging.

5.2 Upgrading the port infrastructure

In the face of large-scale ships, we need to update the port infrastructure, the main reasons are as follows. First, after large container ships arrive at the port, there are great requirements for the handling equipment of the port. For example, the width of 18000teu container ships is 60m, which requires the port to purchase a 18000teu container ship large loading and unloading bridge with a longer extension and a width of 60m for loading and unloading. Second, the yard must also be upgraded. Third, large container ships also put forward certain requirements for the height of the bridge. With the large-scale ships, large ships load more goods. With the increase of cargo loading capacity, container ships will increase after loading. Therefore, it is required that the bridge should not be lower than the height of container ships after loading. It is very important to update the port infrastructure for the strategy of large-scale ships, and each port should also pay attention to it.

5.3 Improve the transportation efficiency of wharf and yard

In the face of large-scale ships, large-scale ports need to improve the transportation efficiency between the wharf and yard. They can adopt new operation system, because the large-scale ships require the wharf yard to adapt to the high efficiency of productivity. In order to meet the requirements of large-scale container ships in the future, a new method and a new handling system are adopted in port operations at home and abroad. For example, Amsterdam port in the Netherlands has adopted positive strategies in the face of large-scale ships. In addition to the development of new port area and berth depth, the port has also updated the infrastructure of the port. They use large container ships to import into the dig in basin. This operation mode is to load and unload ships from both sides of the ship at the same time, using this new type of container ship Container loading and unloading operation mode will greatly improve the efficiency of loading and unloading. One side of the excavated basin is 380 meters, the other side is 330 meters long and the width is 53 meters. This new type of basin makes the 50.4-meter-wide container ships berthing without any problem. By using this method, Amsterdam port solves the problem that the crane arm is not long enough, which obviously improves the handling efficiency of the terminal.

Hamburg Port in Germany and Yangshan Port in Shanghai have also taken positive measures to cope with the large-scale ships. Their practice is different from Amsterdam port in the Netherlands. Instead, they choose the fully automated container terminal handling system. Through this method, the two ports greatly improve the handling efficiency. Singapore's strategy of large-scale ships is different from them. Singapore wants to build a new wharf. The length of the coastline of the wharf should not exceed 6 km, the land area of the new wharf should not exceed 2500 square meters, and the total area of water and land should not exceed 7500 square meters. A container wharf with an annual processing capacity of 20 million TEU should be designed in this given area. A given port area should include not only the loading and unloading area of the wharf front, but also the space for goods circulation, which requires the port to achieve a substantial increase in capacity under the condition of limited resources.

5.4 Establish a more perfect collection and distribution system

The port should actively adopt coping strategies with the process of large-scale ships, which brings great pressure to the port, including the collection and distribution system. Therefore, the port should pay attention to the planning and construction of a better collection and distribution system in the face of large-scale ships, and adopt such strategies to adapt to the large-scale container ships. To establish a perfect port container distribution system, we should pay attention to the following points. First, we should make full use of the advantages of coastal and inland rivers; second, we should pay attention to the air transportation of Civil Aviation Department, because to build and develop a good container port logistics center, we need the assistance of civil aviation department. With the large-scale container ships, the freight volume is also increasing, which also provides airlines with a large air

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freight business, especially high-level emergency logistics Capital. The third is to speed up the construction of ports and transport networks, such as the connection of ports with railway networks and highway networks, and improve land and water combined transport, so as to strengthen the connection between coastal container hub ports, trunk ports and their hinterland. Fourth, on the basis of establishing a perfect collection and distribution system, the port should apply both software and hardware, both software and hardware should be strengthened and improved, and the development of comprehensive logistics service system should be accelerated, so as to adapt to the development trend of large ships. A perfect collection and distribution system is very important for the port, which is related to the circulation of port goods, and is very important for the development of the port.

6. Conclusion

6.1 Summary

One of the most important driving forces of large-scale ships is economies of scale, because from the cost point of view, the larger the ships, the lower the average transportation cost, and will not increase other costs such as port charges too much. This effect is more obvious in the larger container ships. Not only that, larger container ships can also attract more sources of goods and produce greater influence radiation, making shipping companies more competitive. As a result, modern merchant ships ordered 13 23000teu container ships and 8 150000teu container ships in June 2018; and according to fearnleys, France's Dafei has ordered 10 super large container ships in China; alphaliner, a French maritime consulting agency, also said that although the problem of excess capacity still exists, sea carriers prefer large ships.

But there are also many people who say that it is impossible for the ship to be large-scale all the time, and it is coming to an end. In recent years, more and more scholars support this view. This is because the larger the container ship is, the larger the shipping volume is. It is a difficult problem for the major shipping enterprises to solve so many cargo requirements. Especially in recent years, the instability of the shipping industry makes the competition among shipping groups more intense. At the same time, due to the constraints of natural geographical conditions, such as the requirement of channel depth for larger container ships, and the number of ports that can supply such a huge number of container ships, the super large container ships can only stop at some trunk ports, so they can not exert their great influence. As a result, the CEO of Maersk, the world's largest shipping company, said at the company's financial reporting meeting in the third quarter of 2018 that Maersk does not intend to order any large ships until 2020. In addition, Nicholas Bohr, Herbert's chief financial officer, told the company's third quarter financial reporting meeting that there is no need for Herbert to order a new ship at present. Therefore, there is still some uncertainty about the future development of large-scale ships.

6.2 Suggestions

The following are some suggestions for shipping departments based on the above research: first, for liner companies, we should pay more attention to the selection of berthing ports for large ships. Route selection will occupy a more important position in the future shipping market competition, because the fleet size between big companies is basically balanced, and the hardware facilities are almost the same. How to allocate these big ships to each suitable route is particularly important. How to generate less empty containers and empty container dispatching scale has become an important issue, and the operation efficiency is also improved It often depends on the final ship allocation plan. If the cost advantage of large ships is to be fully released, it needs a higher space utilization rate. Only when the utilization rate of container space is improved, it is possible to reduce and control the cost, so as to benefit all parties concerned.

Secondly, for the port, we should keep up with the pace of the times, cooperate with the development of large-scale container ships, improve the loading and unloading efficiency, increase the water depth of the terminal, and prepare for the coming larger containers in advance. If you want to compete with other large ports in the same hinterland for the berthing of large container ships, the terminal operators

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have to realize the importance of the water depth of the port and channel. Even if the basic port conditions are not satisfied, large container ships can not be berthed. In particular, ports such as Shanghai, China, which compete with international shipping centers or regional shipping centers, need to ensure the depth of the wharf and dredge the waterway regularly.

Finally, the suggestions for China's water management department are to strengthen the service function and make positive contributions to China's shipping market from the perspective of macro-control. Government departments should also scientifically predict the future development of the shipping industry according to the current world economic form, and scientifically predict the medium and long-term development trend of supply and demand changes in the shipping market, such as the total supply and demand, structural changes, and distribution, and publish them through appropriate channels to provide scientific decision support for liner enterprises.

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