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Paths and modes of port enterprises'global operation

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PATHS AND MODES OF PORT ENTERPRISES' GLOBAL OPERATION

by

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I certify that all the material in this dissertation that is not my own work has been identified, and that no material is included for which a degree has previously been conferred on me.

The contents of this dissertation reflect my own personal views, and are not necessarily endorsed by the University.

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Title of Dissertation: **Paths and Modes of Port Enterprises' Global Operation**

Degree: **Master of Science**

In recent years, the competition of the port industry has taken on a global trend, the traditional port development has been difficult to meet the needs of the times, and port enterprises are actively promoting and expanding their global operation strategy.

The dissertation based on the theoretical framework of the paths and modes of port enterprises' global operation, analyses and compares the current situation and characteristics of foreign and Chinese first-class port enterprises global operation through collecting data, uses quantitative analysis and qualitative analysis to summarize the paths and modes of port enterprises' global operation. Then, the dissertation analyses the risks and advantages of port enterprises' global operation. Based on the cooperative game theory, the dissertation uses the Shapley value method, which is the classical method of income distribution in the cooperative game theory, to build the model. It carries on numerical analysis of the income distribution of the port and shipping enterprises' cooperative alliance, and proves that Shapley value method is fair in income distribution among partners of port and shipping enterprises and effective in maintaining the stability of the alliance. Finally, combined with the current situation of the global operation of Chinese port enterprises and the successful experience of the global port enterprises, some recommendations are put forward for Chinese port enterprises' global operation.

KEY WORDS : Port enterprises, Global operation, Cooperative game, Shapley value method

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LIST OF ABBREVIATIONS

M&A	Mergers and Acquisitions
SWOT	Strengths Weaknesses Opportunities Threats
SIPG	Shanghai International Port (Group) Co., Ltd.
PSA	PSA International Pte Ltd.
HPH	Hutchison Ports Holdings Limited.
EBITDA	Earnings Before Interest, Taxes, Depreciation and Amortization

1 Introduction

1.1 Research background

Economic globalization is one of the significant characteristics of the contemporary world economy so far, and it is also an essential trend in world economic development. In the current era of economic globalization, the implementation of a global operation strategy has become an essential condition for enterprises to develop into world-class enterprises.

As the hub of the global maritime supply chain and the gathering point of transportation, ports take responsibility for the international circulation of resources and play a significant role in international trade and transportation. Port has an essential position in the development of international trade and has an essential correlation with economic growth. Port has become a key performance indicator that shows the national economic development of a particular country. The development of economic globalization not only promotes the development of modern port enterprises, but also puts forward higher requirements for port enterprises. All states pay attention to the development of the port industry, make full use of the opportunity brought by economic globalization, take adequate measures to improve the development level and comprehensive strength of the port. In recent years, the competition of the port industry has been a global trend. The traditional port development has been challenging to meet the needs of the times, and port enterprises are actively promoting and expanding their global operation strategy.

Global operation strategy is not that far away from Chinese port enterprises. In 2015, Chinese development and reform commission, the ministry of foreign affairs and the ministry of commerce jointly announced “the vision and action to promote the joint construction of the Silk Road Economic Belt and the 21st century Maritime Silk Road”, which emphasized that: strengthen the construction of ports in coastal cities such as Shanghai and Tianjin; build unobstructed, safe and efficient transport corridors with key ports as nodes; and vigorously promote port cooperation. It points out the direction for the implementation of the port enterprises’ global operation strategy. Therefore, Chinese port enterprises, especially the first-tier Chinese port enterprises, should initiatively become the main body of globalization through the implementation of the globalization strategy, the transformation and upgrading of the Chinese port enterprises will be realized, which significantly enhances the economic strength and influence throughout the world. For the past few years, Chinese port industry has developed rapidly. Its scale ranks first in the world. East Asia, which is led by China, has become the global shipping industry development center following Europe and the United States. With the facilitation of " The Belt and Road Initiative " national strategy, the global operation strategy is being adopted by more and more Chinese port enterprises, and Chinese port enterprises have gained unprecedented opportunities. At present, the global development of Chinese port enterprises is in the investment-oriented stage, and the biggest challenge is moving forward to the innovation-oriented stage.

1.2 Research significance

It has excellent theoretical and practical significance to sort out the theory of port enterprises' global operation and make a systematic and thorough analysis of the paths and modes of port enterprises' global operation.

1.2.1 Practical significance

Under the pattern of economic globalization, significant changes have taken place in the Chinese port industry. Most ports have formed a modern system and made significant progress. The ports' infrastructure is gradually improved, the overall layout of the port is becoming more reasonable, the port structure is upgrading, and the port logistics scale is gradually expanding. The number of ports and berths in China are both at the top of the world. Five port groups, which are the Pearl River Delta, the Yangtze River Delta, the Bohai Bay area, the southeast coast and the southwest coast, have been formed. China's port and container throughput consecutively ranked the first place globally for eight years, with 20 large ports of 2 billion tons. The rapid growth of port logistics has led to the rapid development of the Chinese economy. Chinese leading port enterprises expand their business scale, improve their core competitiveness, participate in the global port market competition, and seek new development.

Although the Chinese port industry has made remarkable achievements, there is still a particular gap between Chinese port enterprises and foreign first-tier port enterprises due to the late commencement. In the long-term international economic activities, most of Chinese port enterprises are still in the single regional operation phase. However, the depth of cross-regional and global operation is still at a low level.

Therefore, through researching the paths and modes of port enterprises' global operation and combining with the analysis of foreign and Chinese port enterprises' global operation strategy, it can put forward feasible suggestions for the paths and modes of Chinese port enterprises in the process of implementing the strategy of global operation, and provides necessary guidance and research and experience for

reference. It can offer necessary instruction and directions for Chinese port enterprises to implement global layout under the "new normal" as well.

1.2.2 Theoretical significance

There are many achievements in the research of port enterprises' operation strategy in the aspects of internationalization development strategy, transnational mergers and acquisitions, diversification operation strategy. Most of the researches are less related to the paths and modes of port enterprises' global operation.

Therefore, researching and analyzing the paths and modes of port enterprises' global operation is a benefit to enrich further the existing research content of "port enterprises' global operation".

1.3 Research status

1.3.1 Theoretical status in China

Chen Yi (2005), in "Research on the international operation strategy of SIPG", analyzed the current situation of the container port industry global operation, and made a thorough research on the selection of the international operation strategy of SIPG by using the SWOT analysis method.

Sun Yuquan (2019), in "Research on regional layout strategy of Dalian Port Group", analyzed the main problems and reasons of Dalian Port Group's regional layout through the comparative analysis of the situation of goods and surrounding competition, and put forward the improvement suggestions and guarantee measures of Dalian Port Group's regional layout.

Xiao Zhongxi (2003), in "Thinking about Chinese port enterprises "going out" to

enter the international port investment market", studied and analyzed the causes and ways of the rapid development of the transnational investment market of the port industry.

Xiao Keping (2005), in "Foreign investment: the strategic choice for the development of large port enterprises", expounded that foreign investment is the strategic choice of Chinese port enterprises from the aspects of the timing, direction, and mode of foreign investment.

Li Zhenfen (2014), in "Research on transnational merger and acquisition strategy of Ningbo port", analyzed the merger and acquisition practice of HPH and PSA which are two leading port operators in the world, and concluded that they followed the global development path of "first homeport, then regional operators, and finally global operators".

Liu Xing (2017), in "Analysis of transnational merger and acquisition of China's port enterprises", analyzed the implementation and characteristics of transnational merger and acquisition of China's port enterprises, and expounded the internal and external conditions of transnational merger and acquisition of China's port enterprises.

Li Guofeng (2010), in "Research on transnational merger and acquisition of port industry", studied the motives and performance of multinational merger and acquisition of the port industry.

Huang Jianhua (2005), in "Research on human resource integration of port merger and acquisition", studied the integration of human resources in port M & A, and pointed out that it should be supplemented by cultural integration to succeed in M & A.

Wu Shaoqun (2012), in "Financial risk analysis and preventive measures for port enterprises merger and acquisition", analyzed the global port industry merger and acquisition process and the financial risk in the merger and acquisition, and put forward the corresponding preventive measures.

Hua Chenyi (2019), in “Research on the strategy choice of the diversified operation of port enterprises”, analyzed the strategy choice of diversified operation of port enterprises, concluded that port enterprises must give full play to the synergistic effect and scale effect of diversified operation.

Wang Zhe (2018), in “Research on the development strategy of J terminal company in Tianjin port”, took J terminal company in Tianjin port as the research object, constructed SWOT matrix, determined that J terminal company must adopt SO diversified development strategy, made a clear direction for the future development of J terminal company in Tianjin port.

Liu Lin (2018), in “Research on the implementation strategy of diversification strategy of W company”, analyzed the problems and causes in the implementation of the W company's diversification strategy, and put forward countermeasures and improvement measures.

Zhou Xinyi (2002), in “Analysis of diversification of port enterprises”, thought that the diversification of port enterprises could disperse business risks and improve the profit value of enterprises.

Xie Aihua (2006), in “Research on the performance of the diversified operation of Port Enterprises”, pointed out that diversified operation can effectively avoid the excessive competition among port industries.

Deng Lintong (2010), in “Analysis of diversified development trend of port enterprises”, proposed that the fields suitable for port enterprises' diversified development are port logistics industry, real estate industry, and shipping finance industry.

Zhang Lulu and Tao Li (2006), in “Analysis of port diversification”, get the conclusions: diversification is the inevitable strategy of port enterprise development, but only large port enterprises with the stable main business and distinct advantages can get better revenue from diversification strategy and reduce business risk.

1.3.2 Theoretical status abroad

Takayuki Mori (2006), studied and analyzed the strategic problems of global port enterprises under the background of oligopoly. He found that global port enterprises are actively expanding their investment and pointed out their expansion mode.

Francesco Parol (2007) found that the choice of the internationalization strategy of port enterprises is primarily determined by the conditions of policies and regulations.

Geraldine Knatz (2016) summed up the practical experience of the development of U.S. east and west coast port enterprises from 2007 to 2016. He found that since 2007, U.S. east coast port enterprises have paid more attention to the diversified development of finance and real estate, while west coast port enterprises have paid more attention to the strengthening of the central business, both of them have finally achieved the strategic goal of improving the market operation strength.

Nuria Nebo (2017) found that tourism development along the Mediterranean coast triggered an upsurge of diversification of many port enterprises in Spain, France, and Italy. The study pointed out that the result of the port industry market environment

change will dynamically affect the future development of diversified port enterprises.

1.3.3 Comments on the current study

From the current foreign and Chinese research status, the research on the paths and modes of port enterprises' global operation mainly includes the following three aspects: internationalization development strategy, transnational mergers and acquisitions, and diversification operation strategy. Most of them use a SWOT analysis to provide strategic choice reference for specific port enterprises. Still, most of them are less involved in the paths and modes of port enterprises' global operation.

Therefore, researching and analyzing the paths and modes of port enterprises' global operation is a benefit to enrich further the existing research content of "port enterprises' global operation", and provide feasible suggestions, necessary guidance, necessary research, and experience reference for the paths and modes of Chinese port enterprises in the process of implementing the global operation strategy.

1.4 Research contents and methodologies

The dissertation is mainly about the research on the paths and modes of port enterprises' global operation. It is divided into six chapters. The research contents and methodologies are as follows:

The first chapter introduces the background and significance of the research on the paths and modes of port enterprises' global operation. It summarizes the foreign and Chinese research status, and expounds on the research content and methodology of this dissertation.

The second chapter establishes the theoretical framework of the paths and modes of port enterprises' global operation.

The third chapter is based on the theoretical framework established in the second chapter. It analyses and compares the current situation and characteristics of foreign and Chinese first-class port enterprises global operation through collecting data. It uses quantitative analysis and qualitative analysis to explore the paths and modes of port enterprises' global operation.

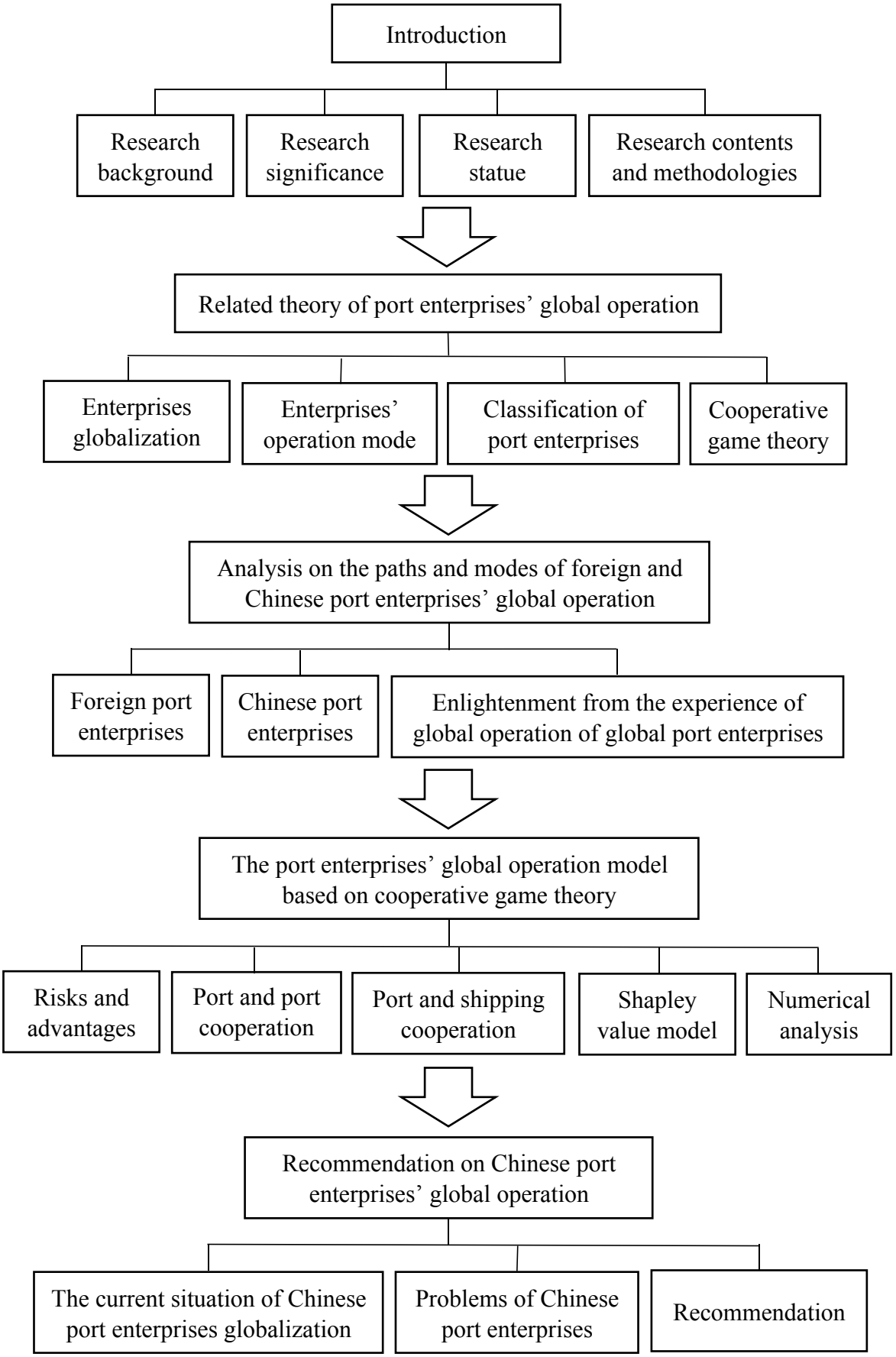
The fourth chapter analyses the risks and advantages of port enterprises' global operation. Based on the cooperative game theory, the dissertation uses the Shapley value method, which is the classical method of income distribution in the cooperative game theory, to build the model. It carries on numerical analysis of the income distribution of the port and shipping enterprises' cooperative alliance. It proves that the Shapley value method is fair in income distribution among partners of port and shipping enterprises and effective in maintaining the stability of the alliance.

The fifth chapter analyzes the current situation and existing problems of Chinese port enterprises' global operation. It puts forward some suggestions on the paths and modes of Chinese port enterprises' global operation.

The sixth chapter summarizes the conclusion.

The structure of this dissertation is shown in Figure 1.

Figure 1 Structure of this dissertation



2 Related theory of port enterprises' global operation

2.1 Concept of enterprises globalization

As the highest stage of enterprise internationalization, enterprise globalization means that enterprises consider the market and resource distribution from a global perspective to improve their competitiveness, enhance their competitive position, and maximize their overall interests. Specifically, enterprises allocate their production resources around the world and regard the global market as the target market for the products or services they provide according to the enterprises' planning, competitive advantages and disadvantages, as well as the characteristics of the products or services they provide.

The advantages of enterprise globalization are that enterprises can concentrate on the establishment of scale economy advantage and efficiency, and share the cost based on larger sales volume, to obtain the resources that are not easy to find in the broad and scattered market, and seek new opportunities to improve the operation efficiency.

Enterprise globalization is based on the complex and changing global market competition environment. The enterprises must look at the world in the operation process, adapt to the changes of the situation, improve performance and advantages as a whole, and reform the backward company structure and management system, so that the organization function can be sufficiently enhanced to adapt to the new

challenges.

2.2 Connotation of enterprises' operation mode

Enterprises' operation mode is the general term of a certain kind of way and method adopted by an enterprise to realize its value orientation according to the operation purpose. It includes the business scope stipulated by the enterprise, the position of the enterprise in the industrial chain, and the ways and methods to realize the value under such situation.

In short, enterprises' operation mode is the mode that enterprises gain profits by providing products or services. Specifically, it refers to the way that enterprises organize and integrate various resources involved in their production and operation. Resources not only refer to internal resources of enterprises, such as production and operation resources, internal logistics resources, and marketing resources, but also include external resources, market platforms, public service centers, etc.

In addition, there are a variety of descriptions about enterprises' operation mode, such as it refers to the quantity of the management methods adopted in production and operation according to different economic conditions, the sum of the products or services that enterprises provide to customers and the ways and means they offer, and the specific operation methods of production and operation activities based on a specific property relationship.

The general principles of operation mode are as follows: the first is the profit principle. The primary motivation of enterprise management is to invest capital, carry out business activities, and obtain profits. Profit is the measure of efficiency and soundness of enterprise management and the source of an enterprise's continuous

maintenance and development. The second is the development principle. It is a principle of taking internal management as the center and considering the development environment. By strengthening the interior planning, organization, command, leadership, and control, enterprises can pursue the short-term profit goal while considering the long-term development goal. The third is the innovation principle. The enterprises must have the spirit of creation and the thought of innovation. In the process of survival and development, the enterprise's management thought, as same as the products and services, need to innovate constantly to adapt to the changes in the market.

2.3 Classification of port enterprises

Port enterprises are market-oriented, profit-making economic organizations engaged in port production, operation, and service activities by using modern science and technology, management methods, and financial means to achieve business objectives.

According to their characteristics, port enterprises can be roughly divided into the following categories: the first category is with professional port operation background. It is transformed from the state-owned port authority and continuously expanded by relying on their homeport, such as PSA, DP world, SIPG, etc.. The second category is developed from private port handling enterprises, such as HPH. The third category is to expand the port coverage with the background of the shipping company, such as APM Terminals, COSCO Pacific, etc.. APM Terminals makes a useful distinction between its port operation business and the liner business of its parent company. The fourth category is the local port enterprise. Their business scope is mainly limited to the local range, such as Guangzhou Port Group, Xiamen Port Group, etc.

2.4 Cooperative game theory

Game theory mainly studies the decision-making and equilibrium problems when the behavior of decision-makers interact directly. It is divided into two directions: non-cooperative game and cooperative game. The cooperative game, also known as positive-sum game, is a kind of game activity. It means that the income of both sides of the game have increased, or at least the income of one party have increased, while the income of the other party are not damaged.

The cooperative game mainly focuses on the allocation of benefits under a win-win situation. It focuses on the reasonable and appropriate allocation of the enormous benefits generated by cooperation when the participants enter into the alliance, to ensure the interests of each participant.

The two primary conditions of the cooperative game are: (1) Firstly, after the formation of cooperative alliance, the utility value of each participant must not be less than the utility value before the cooperation. (2) Secondly, after forming the cooperative alliance, the overall utility of the whole cooperative alliance must be increased,.Otherwise, the formation of the alliance will be uneconomical and meaningless.

3 Analysis of the paths and modes of foreign and Chinese port enterprises' global operation

3.1 Foreign port enterprises

3.1.1 PSA International

PSA International Pte Ltd. (PSA) was founded in 1997, and the mother company is Temasek holding company. PSA is a leading global port group, and it operates the world's largest container hub in Singapore. PSA is known as "The World's Port of Call" and won the "best container terminal award" in Asia Maritime Service Award for two consecutive years in 2001.

(1) Container terminals

PSA is based on the local market of Singapore port and continues to expand its overseas port business. For the offshore container terminals operated by PSA, considering the strategic significance of the ports, PSA participated in these offshore container terminals through investment, human capital, and joint venture. At present, PSA has operated terminal business in 28 ports of 16 countries. Among them, PSA has 9 container terminals in Tanjong Pagar, Keppel, Brani, and PasirPanjang, with 67 dedicated container berths, a total quay length of 21033 meters, a total area of 8.17 million square meters, 200 quay cranes and designed capacity of 45 million TEU. (Table 1)

PSA terminals outside Singapore are located in Vietnam, Thailand, Indonesia, China, South Korea, Japan, India, Saudi, Belgium, Italy, Portugal, Turkey, Poland, Argentina, Panama, Colombia, Canada, and the United States. There are 160 container berths overseas, with a quay length of 49524 meters, a total area of 29.673 million square meters, 423 quay cranes, and a designed capacity of 78.62 million TEU. (Table 2)

Table 1 PSA Singapore container terminals

Terminal	Container berths	Quay length (m)	Area (ha)	Max depth at Chart Datum (m)	Quay cranes	Designed capacity (’000 TEU)
Tanjong pagar	7	2097	79.5	14.8	0	
Keppel	14	3164	102.5	15.5	27	
Brani	8	2325	84	15	26	
Pasir panjang	38	13447	551	101	147	
Total	**67**	**21033**	**817**	**18**	**200**	**45000**

Source: www.globalpsa.com/portsworldwide

Table 2 PSA container terminals outside Singapore

Country	Terminal	Container berths	Quay length (m)	Area (ha)	Max depth at Chart Datum (m)	Quay cranes	Designed capacity (‘000 TEU)
Vietnam	Vung Tau	4	1200	54	14.5	12	2200
Thailand	Bankok	2	275	9.5	8.5	3	239
	Laem Chabang	4	1250	49	15	13	2200
Indonesia	Jakarta	3	850	32	16	8	1500

China	Dalian	18	5700	411	17.8	47	8400
	Fuzhou	8	2169	194.9	17.5	22	3680
	Guangzhou	4	810	28	12.5	7	1300
	Tianjin	10	3400	281	16	34	5850
	Dongguan	2	678	48.5	14.3	6	1400
	Qinzhou	5	1700	83	16.5	14	2800
	Qinzhou	6	1533	151	15	15	3000
South Korea	Incheon	3	900	35.5	14	9	1500
	Busan	6	2350	139	17	23	4900
Japan	Hibiki	4	1225	43	15	4	1100
India	Tuticorin	1	370	10	11.9	3	450
	Chennai	3	832	35.8	15.5	9	1500
	Bharat Mumbai	6	2000	200	16.5	24	4800
	Bharat Kolkata	5	812	13.3	9	4	850
Saudi	Dammam	4	1200	75	16	12	1800
Belgium	Antwerp	15	6005	393	17	61	13400
	Zeebrugge	5	1000	50	13	0	
Italy	Genova	6	1959	135.2	15	17	2550
	Venice	5	852	28.3	11.5	5	430
Portugal	Sines	4	1140	50	16.5	9	2100
Turkey	Mersin	9	3370	112.8	15.8	11	2600
Poland	Gdansbk	4	1300	88	17	14	3000
Argentina	Buenos Aires	3	1144	54.5	10	10	1100
Panama	Panama City	3	1140	40	16.3	11	2000
Colombia	Buenaventura	3	830	58	16.5	6	1000
Canada	Halifax	3	1180	32	16.5	6	550
USA	Philadelphia	2	350	32	11.3	4	421
Total		**160**	**49524**	**2967.3**		**423**	**78620**

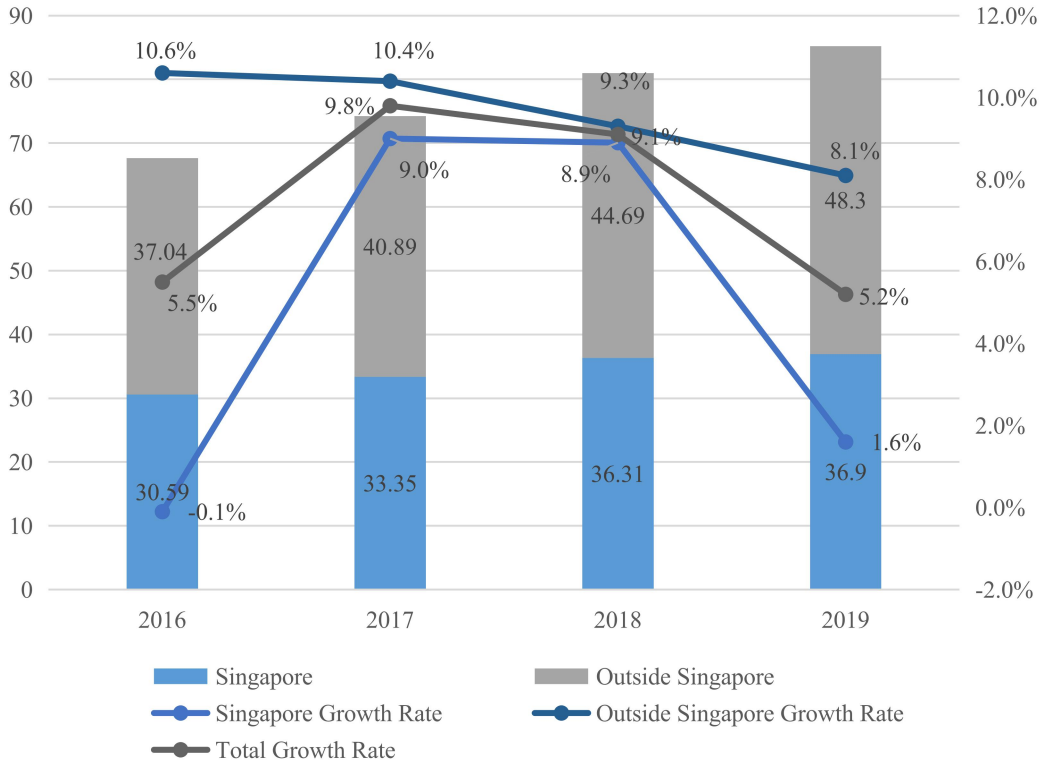
Source: www.globalpsa.com/portsworldwide

(2) Container throughput

PSA handled 85.20 million TEU in 2019, representing an increase of 5.2% from the previous year. PSA Singapore contributed 36.89 million TEU, increasing 1.6% year-on-year. PSA terminals outside Singapore delivered a total throughput of 48.32 million TEU, rising 8.1% over 2018. (Figure 2) Therefore, PSA strengthens the investment in Singapore and overseas, expanded the wharf and storage yard, and added mechanical equipment.

Figure 2　2016-2019 PSA container throughput & growth rate

Unit: million TEU



Source: 2016-2019 PSA container throughput performance

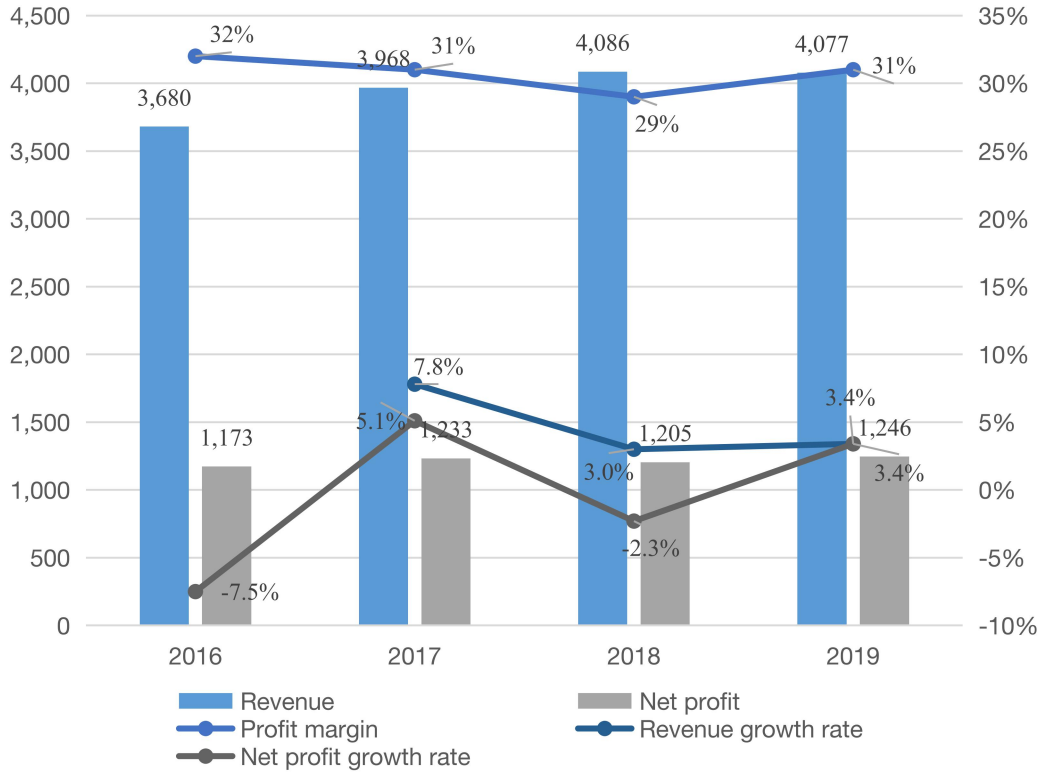
(3) Business composition and financial revenue

PSA's main business includes port business and maritime service business. Port business revenue accounting for more than 90% of the total revenue. In addition to the main port handling business, PSA also provides maritime transportation, logistics, information technology, etc. The maritime service business is mainly provided by PSA's wholly-owned subsidiary PSA Marine for shipping and fleet, including pilotage, tugboat, maritime consultation, and marine education. In terms of port business, PSA is based on Singapore's local market and mainly invests in ports along the routes between Asia and Europe. Therefore, port revenue of Southeast Asia region and Euro Mediterranean region respectively accounts for 60% and 25% of the total revenue, while the revenue from other areas only accounts for about 15%.

PSA revenue in 2019 was S$4.077 billion, which was lower by 0.2% partly due to the consolidation of a subsidiary. Overall net profit in 2019 was 3.4% higher at S$1.246 billion. The profit margin was stably around 30% from 2016 to 2019. (Figure 3)

Figure 3 2016-2019 PSA financial results & growth rate

Unit: US$'million



Source: 2016-2019 PSA container throughput performance

(4) Global operation mode

Firstly, PSA adopts the centralized and specialized development strategy, focuses on the container business, and improves its industry concentration with the level integration mode of global port acquisition. PSA focuses on deep-water berths and developing economies. Port and terminal investments are mainly concentrated in third-world countries, and its layout focuses on deep-water container berths. As it caters to the development trend of large-scale ships, port, and terminal investments have become a new profit growth point of PSA.

Secondly, PSA focuses on the local market and continues to expand outward. PSA always regards Singapore as the core of its development, and continuously carry out transformation and construction. In 2008, PSA and Ocean Network Express joined hands to form a joint-venture container terminal in Singapore. PSA has been actively engaged in multinational operations since 1996. Its first overseas investment is in a joint venture with Dalian Port Group to build a Dalian container terminal. In July 2018, PSA Canada Holdings, a subsidiary of the group, acquired 60% of the equity of Ashcroft Terminal, which provides the group with an entry point into the inland supply chain of North American market. Besides, in December, PSA and COSCO Shipping Port signed a memorandum of cooperation on new berths of COSCO port. Under the situation of continuous market fluctuation, PSA adopts the strategy of focusing on the local market and expanding investment to the world. With Southeast Asia as the center, PSA focuses on the three routes of Northeast Asia, South Asia, and Europe to form a global terminal operation network. PSA adopts a variety of methods such as wholly-owned, joint and joint control to carry out the global port layout.

Thirdly, PSA is committed to building a world-class information system to improve port operation efficiency. PSA began to develop information technology in the 1980s. The current PORTNET system has been widely used in the world. It will continue to extend and improve the functions of PORTNET and establish more computer communication lines.

Fourthly, PSA is committed to maritime innovation, information development, and build automated terminals. In recent years, PSA focuses on the construction of port automation, intelligent planning, and control systems. In 2009, PSA cooperated with Tuas Port, building an Ecosystem to port operations and signed a memorandum of

understanding with Envision to collaborate in knowledge sharing and capability transfer for development in the fields of engineering, technology, artificial intelligence and internet of things. It commits to growing new capabilities and leverage leading-edge technologies to create intelligent and energy-efficient port systems.

Finally, PSA develops third-party logistics services and enhance profitability. PSA has set up a series of logistics subsidiaries, such as PSA-APP Distribution Co., Ltd., and China Merchants-PSA Logistics Co., Ltd., to promote the integration of enterprise warehousing and distribution, and develop the third-party management of preserved goods. PSA uses the government's various supporting policies in finance, tax, land and other aspects for the development of commercial logistics, uses the policy of halving the land tax for bulk commodity storage facilities of logistics enterprises, and the logistics production facilities such as storage facilities, storage yards, truck passages, turning yards and parking lots are taken as the center of the engineering construction.

3.1.2 APM Terminals

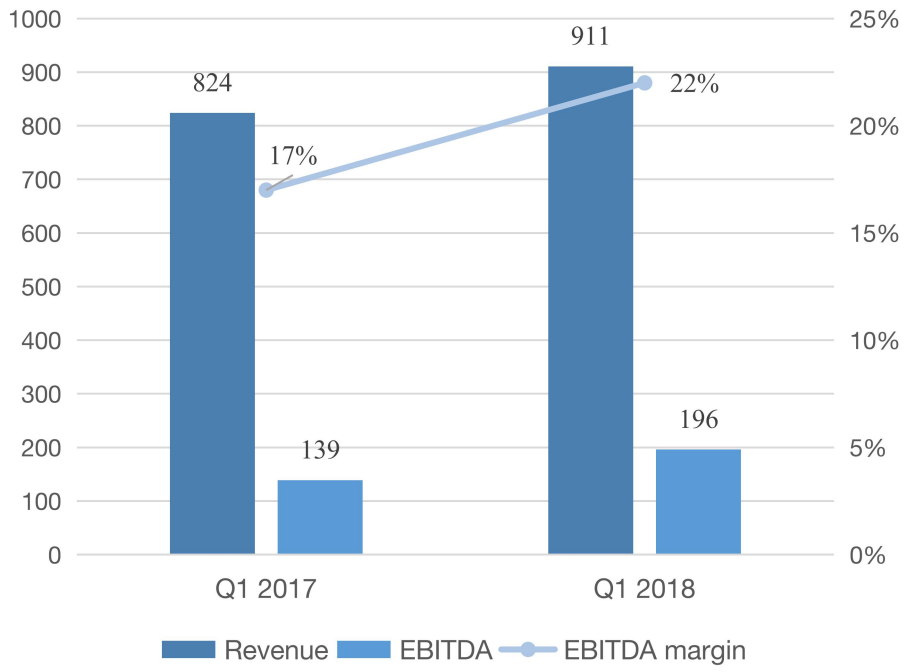
APM Terminals is a company of Maersk Group, which is mainly in terminal business and operation management. It is a part of A.P. Moller-Maersk, the world’s largest integrator of container and ports logistics. APM Terminals operates one of the world’s most comprehensive port and integrated inland service networks, provides quay and marine, reefer services, transport, storage and warehousing, container services and repair, gate services, etc.

In the first quarter of 2018, the revenue of APM Terminals was US$911 million, an increase of 10.5% compared with the same period in 2017. EBITDA was US$196

million, an increase of 41% compared with the same period in 2017. EBITDA margin increased to 22% from 17% in the first quarter of 2017. (Figure 4)

Figure 4　2017-2018 APM Terminals financial figures

Unit: USD million



Source: 2017-2018 APM Terminals annual report

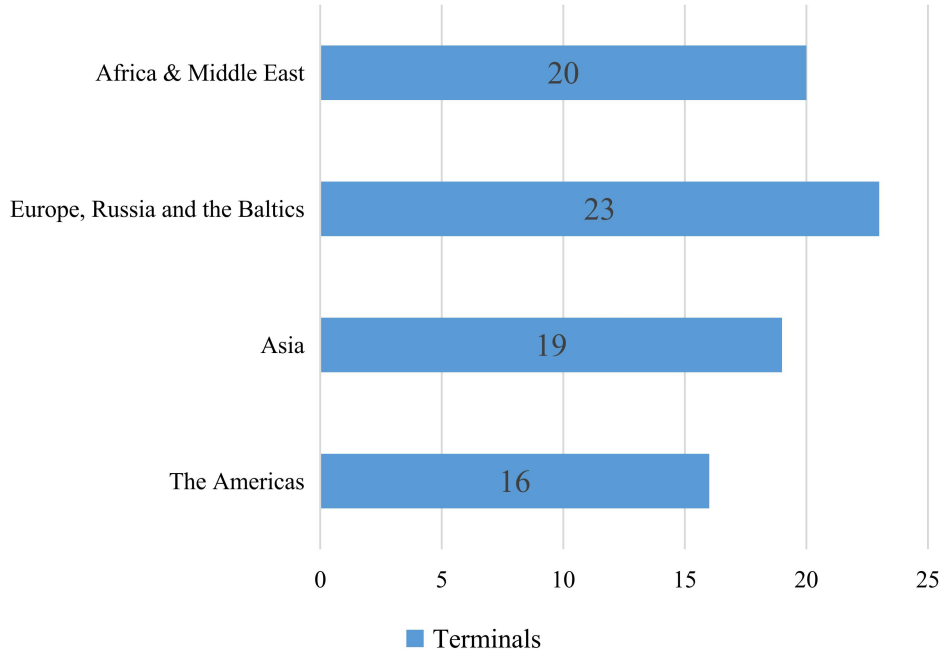
(1) The network of ports and throughput

APM Terminals has a global port terminal transportation network, and the port layout of APM Terminals occupies an important strategic position. As APM Terminals is a terminal operator with the background of a shipping company, the choice of its port location is complementary to Maersk's global container route layout and logistics service network. At the same time, APM Terminals believes that more

ports mean that liner companies have more route choice and more flexibility in the decision-making of route choice. Therefore, with its efficient port throughput capacity and broad port layout, it forms a robust global network of ports, which plays a vital role in the global supply chain and provides more liner companies with high-quality services.

By the end of 2019, APM Terminals has invested 78 terminals in the world. There are 20 terminals in Africa and the Middle East, 23 terminals in Europe, Russia, and the Baltics, 19 terminals in Asia, and 16 terminals in the Americas. (Figure 5)

Figure 5 Number of APMT terminals



Source: www.apmterminals.com/en/about/our-company

In 2017, APM Terminals completed a total throughput of 39.7 million TEU, an increase of 6.4% year-on-year. Among them, the terminals invested in Asia have completed a throughput of 13.6 million TEU, accounting for 34.3% of the total

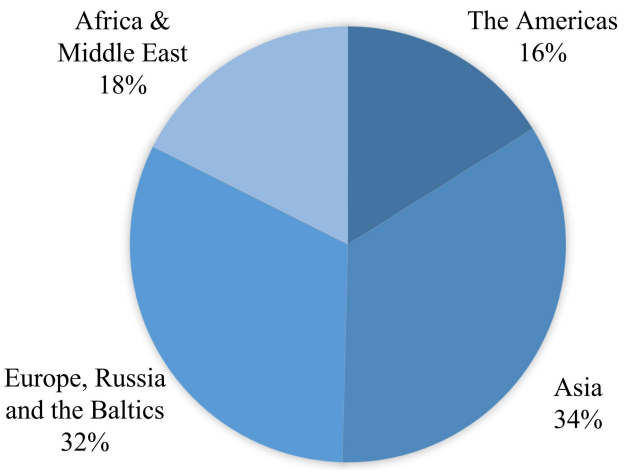
throughput. The throughput of the terminals invested in Europe, Russia, and the Baltics region was12.7 million TEU, accounting for 32% of the total throughput. The throughput of the terminals invested in Africa and the Middle East were 7 million TEU, accounting for 17.6% of the total throughput. The throughput of the terminals invested in the Americas was 6.4 million TEU, accounting for 16.1% of the total throughput. (Table 3 and Figure 6)

Table 3　2016-2017 APM Terminals throughput

(Million TEU)	2017	2016
The Americas	6.4	6.4
Asia	12.7	11.8
Europe, Russia and the Baltics	13.6	12.5
Africa & Middle East	7	6.6
Total	**39.7**	**37.3**

Source: 2016-2017 APM Terminals annual report

Figure 6　2017 APM Terminals throughput composition



Source: 2017 APM Terminals annual report

(2) Global operation mode

From the perspective of global operation model, APM Terminals focuses on acquisition and merger. Nearly half of APM Terminals' terminal investments are wholly owned. In the rest of the investment projects, APM Terminals holds 20% to 90% of the shares. Even in the case of minority shareholders, the operation and management rights of those terminals are under its control. Since 1996, APM Terminals has acquired stakes in more than 40 terminals around the world.

APM Terminals also expands its territory by franchising on the premise of fully considering market conditions, economic environment, and return opportunities. APM Terminals has obtained concessions for terminal development and operation from many emerging countries, such as Nigeria, Ghana, Morocco, and Bahrain, to maximize the benefits of terminal operation growth brought by the new usual trend of large-scale shipping and alliance shipping.

The key to the rapid growth of APM Terminals' performance is the rational investment terminal strategy. The terminal business is the core business of APM Terminals and plays an essential role in its global development. With the overall goal of improving the global network of port service, APM Terminals determines the terminal investment project and coordinates with the comprehensive implementation of the shipping route layout of Maersk Group. Most of the terminals invested by APM Terminals are hub ports or trunk ports in global or regional international shipping routes, with tremendous throughput. In addition, the fleet affiliation and route coverage of Maersk Group ensure the implementation of investment and stable return of projects. For APM Terminals, investment in terminals can not only bring more convenience to Maersk Group, but also disperse the operational risk of the shipping sector.

3.1.3 DP World

DP World, founded in September 2005, is a subsidiary of Dubai World Group and is wholly owned by the Dubai government. DP World is committed to the global development of container terminals with the famous Dubai artificial deep-water port as its homeport and the unique advantages of the Jabel Ali free trade zone.

(1) Business scope and throughput

DP World takes Jabel Ali port as its homeport, focuses on the source of goods in the hinterland of the port, and comprehensively expands its business in emerging markets and developed regions. It has the most comprehensive business coverage among port enterprises. At present, it is one of the global multinational port enterprises with the most significant number of terminal projects, occupying a particular market share in all regions of the world. The port business covers 78 ports

in 40 countries, with a portfolio of over 150 operations. In the wave of integration of the global port industry, DP World has expanded and consolidated its position as a multinational port enterprise. It has been the top five port operators in the world.

DP World generates more than 75% of its throughput in faster-growing markets and 70% of its volumes in higher-margin origin and destination cargo. DP World handled 71.2 million TEU across its global portfolio of container terminals in 2019. Asia Pacific and Indian Subcontinent handled 31.76 million TEU, accounting for 45% of the total throughput. Europe, Middle East, and Africa handled 30.04 million TEU, accounting for 42% of the total throughput. America and Australia handled 9.45 million TEU, accounting for 13% of the total throughput. (Table 4)

Table 4　2017-2019 DP World financial figures

Gross Volume　'000 TEU	2019	2018	2017
Asia Pacific & Indian Subcontinent	31,763	31,696	31,924
Europe, Middle East and Africa	30,039	30,684	29,358
Americas & Australia	9,446	9,040	8,798
Total	**71,248**	**71,419**	**70,079**

Source: 2017-2019 DP World annual report

(2) Financial performance

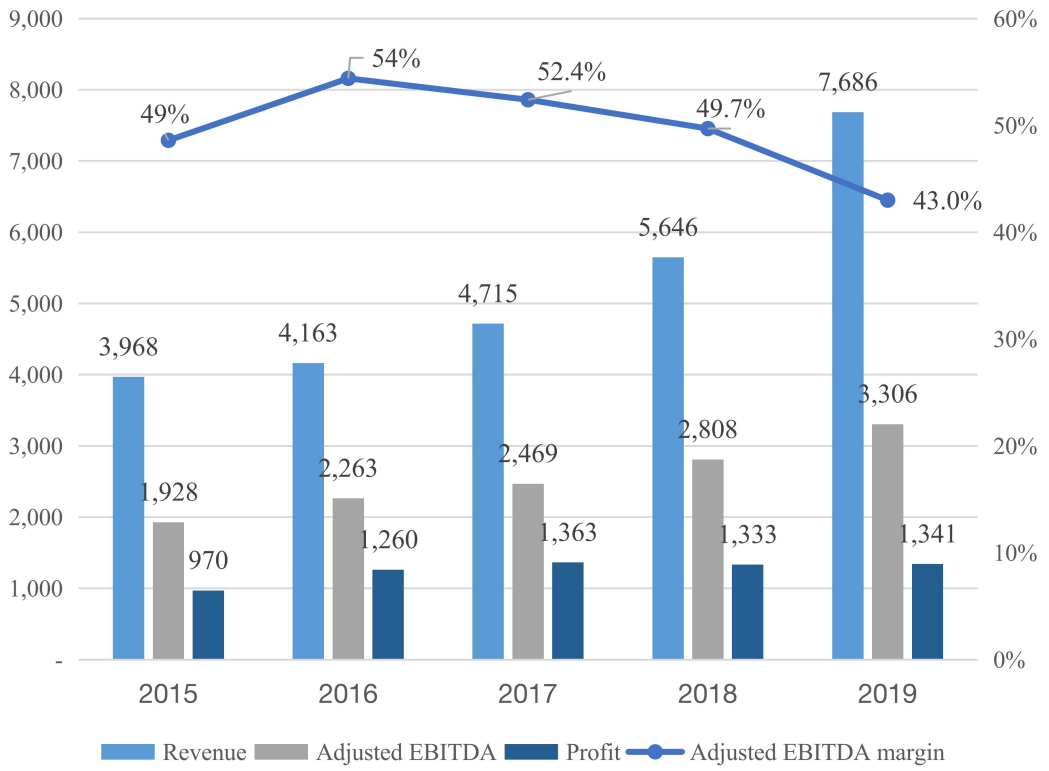
DP World's core business is ports and terminals handling business, which generates approximately 70% of revenues. In addition, DP World also provides a comprehensive range of logistics services that encompasses a broad spectrum of

integrated supply chain segments – from maritime and overland terminals to marine, logistics, and ancillary services, as well as technology-driven commercial solutions.

In 2019, the revenue from operations of DP World was US$7.686 billion, an increase of 36% over the previous year. Adjusted EBITDA grew 17.7% to US$3.306 billion and achieved an EBITDA margin for the full year of 43%. Europe, Middle East, and Africa have the most operating revenue of US$5.668 billion. Asia Pacific and Indian Subcontinent have the highest adjusted EBITDA margin at 56%. (Figure 7 and Figure 8)

Figure 7 2015-2019 DP World financial figures

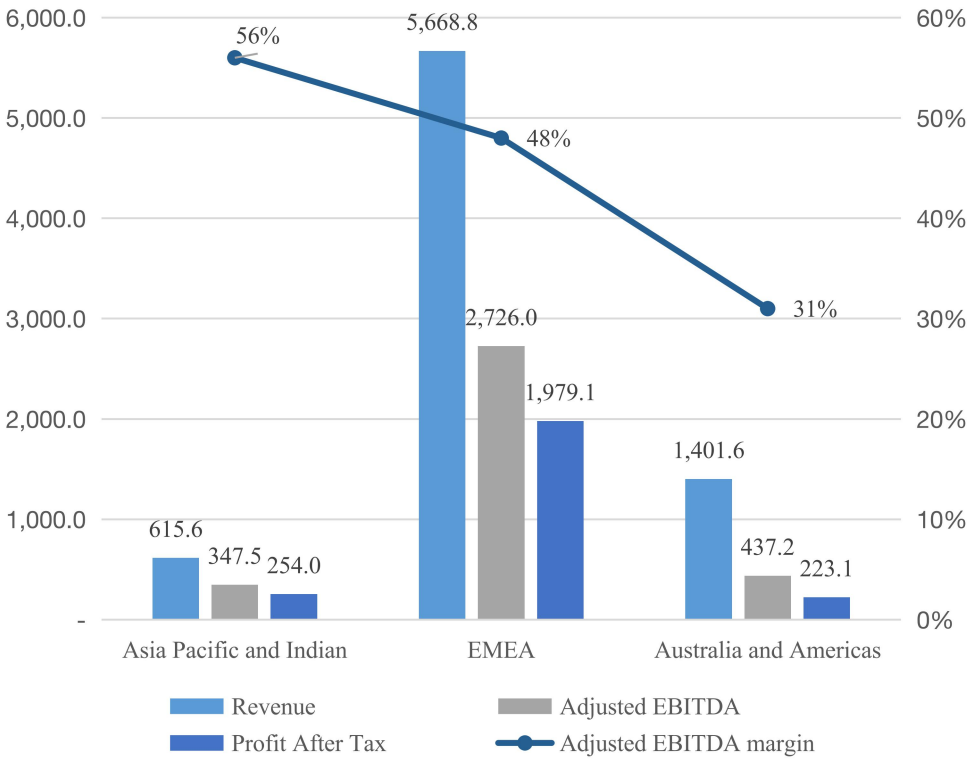
Unit: USD million



Source: www.dpworld.com/investors/financials-and-Presentations/key-figures

Figure 8　2019 DP World financial composition

Unit: USD million



Source: 2019 DP World annual report

(3) Global operation mode

From the perspective of investment mode, since the 2000s, DP World has gradually expanded this global network of port mainly through a combination of acquisitions and concession agreements. For example, DP World successfully acquired CSX in 2005 and P & O, the world's third-largest terminal operator at that time, in 2006, and indirectly owned the rights and interests of its ports in China, including 29% shares of OQCT. DP World, as a way of terminal acquisition, can quickly gain market share and save the tedious project in the early stage of terminal construction. At the same

time, it does not directly participate in port operation after obtaining port equity, but employs the original port operation team to operate, to earn the corresponding capital investment income. In February 2020, DP World has completed the acquisition of Fraser Surrey Docks from Macquarie Infrastructure Partners (MIP) alongside its partner CDPQ. This acquisition complements DP World's footprint in Canada, which includes terminal operations in Vancouver, Nanaimo, Prince Rupert, and Saint John.

DP World also invests in smart technologies and innovation, provide customers the best experience, build differentiated capabilities, and optimize operations. DP World focuses on applying cutting edge technologies that will transform performance such as hyperloop technology, big data and analytics, robotics, and artificial intelligence. These smart technologies could significantly enhance the efficiency of terminal operation, to develop remote control rooms, maintain the most advanced security measures, diversify the teams, and reduce risk on site.

3.2 Chinese port enterprises

3.2.1 SIPG

Shanghai International Port (Group) Co., Ltd. (SIPG) is the largest joint-stock port enterprise in mainland China. In terms of domestic port investment, SIPG has completed the strategic layout of seven ports along the Yangtze River Delta, including Jiangyin, Nanjing, Yibin, and Chongqing. In terms of overseas investment, SIPG has invested in Zeebrugge port in Belgium, and Haifa port in Israel. In 2018, the operating revenue of SPIG was 38.04 billion RMB, representing an increase of 1.65% from the previous year, and the net profit was 10.28 billion RMB.

In 2019, SIPG took multiple measures to achieve sustained and stable growth of production and operation. SIPG homeport cargo throughput was 538 million tons and

container throughput was 43.303 million TEU, increasing 3.1% over 2018. (Table 5)

Table 5 SIPG homeport throughput

Cargo throughput unit: million TON Container volume unit: million TEU

	Cargo Throughput	Growth Rate	Container volume	Growth Rate
2019	538.317	-4.1%	43.303	3.1%
2018	561.293	0.1%	42.01	4.4%
2017	560.874	9.1%	40.233	8.3%
2016	514.066	0.1%	37.133	1.6%

Source: 2016-2019 SIPG annual report

(1) Container terminal and bulk cargo wharf

The container terminals of Shanghai port are mainly distributed in Yangshan, Waigaoqiao, and Wusong port areas. There are 39 container berths, 142 quay cranes, 440 RTG, and a total area of 6.352 million square meters of container yard. (Table 6) SIPG actively promotes the shipping collection and distribution optimization system, and integrates the three major ports by providing fast water and land container transportation services.

Table 6 Container terminals of Shanghai Port

Quay length (m)	12067
Container berths	39
Quay cranes	142
RTG	440
Reach stacker	27
Yard area ($million$ m^2)	6.352
Warehouse area ($thousand$ m^2)	34.4
Throughput capacity / year	1745

Source: www.portshanghai.com.cn/jtwbs/webpages/about_yw_jzx.jsp

Bulk cargo wharf business is one of the vital business sectors of SIPG. It mainly distributed in Luojing, Wusong, and Longwu port areas. (Table 7)

Table 7 Bulk cargo wharf of Shanghai Port

Quay length (m)	12248
Container berths	57
Yard area ($million$ m^2)	1.269
Warehouse area ($thousand$ m^2)	121.8
Throughput capacity / year	6935

Source: www.portshanghai.com.cn/jtwbs/webpages/about_yw_zh.jsp

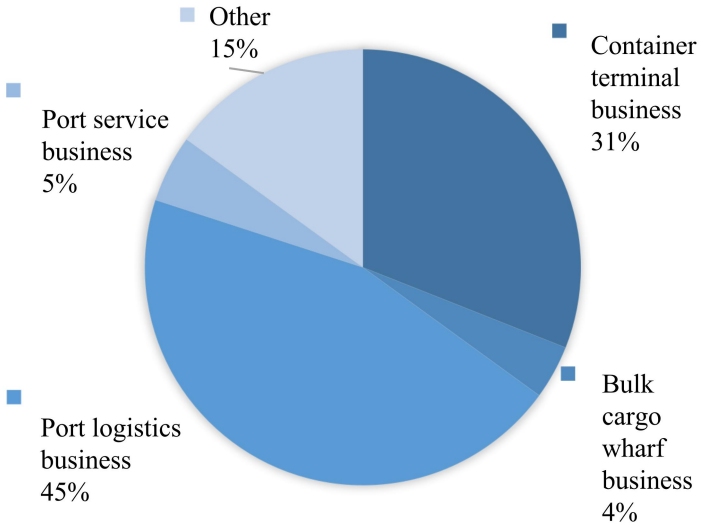
(2) Business composition

SIPG's primary business is divided into four parts: container terminal business, bulk cargo wharf business, port logistics business, and port service business. At present, SPIG has formed a port logistics industry chain including terminal loading and unloading, storage, shipping, land transportation, agency, and other services.

According to the annual report in 2018, the total revenue of SIPG is 38.15 billion RMB, an increase of 2% year-on-year The revenue of container terminal business accounted for 31% of the total revenue, and the revenue of bulk cargo wharf business accounted for 4% of the total revenue. Port logistics business includes international freight forwarding, ship agency, inner branch shipping agency, storage, logistics management software development, and other comprehensive logistics business, accounted for 45% of the total revenue. Port service business includes pilotage, tugboat, and tally, which plays an essential supporting role in the development of container, bulk cargo, and logistics industries, accounted for 5% of the total revenue.

The revenue of other businesses accounted for 15% of total revenue. (Figure 9)

Figure 9 SIPG business composition



Source: 2018 SIPG annual report

(3) Global operation mode

Firstly, SIPG deepened the Yangtze River strategy and promoted the Northeast Asia strategy. SIPG believes that the Yangtze River Delta, as the hinterland of SIPG's direct source of goods, is the foundation of the development of SIPG's homeport and the core area to maintain the growth of port cargo volume. For a long time, to maintain and improve the share of container market in the Yangtze River Delta, SIPG has strengthened cooperation with ports in the Yangtze River Delta through a joint venture, equity participation and signing cooperation framework agreement, forming a new pattern of integrated services of terminals, transportation, logistics points, lines and areas along the Yangtze River. Northeast Asia area is the hinterland of SIPG's indirect source of goods. It is the incremental space for SIPG to develop

homeport. Therefore, SIPG has played an important role in the competition of Northeast Asian ports through the efficient operation of the Yangshan terminal.

Secondly, SIPG continues to innovation-driven, transformation, and upgrading. SIPG takes the development of port logistics service chain as the core, develops the third-party logistics and logistics value-added business, integrates the regional scattered logistics industry resources, accelerates the transformation from traditional logistics to modern logistics, extends the port logistics industry chain, strives to create modern comprehensive logistics service function, improves the integrated service capacity in engineering logistics, third-party logistics, automobile logistics, and other fields, forms a logistics service network with Shanghai Port as the hub.

Thirdly, SIPG keeps the steady growth trend of its main business and actively develops its diversified development strategy, tries to find opportunities from the market through merger, joint venture, investment, and other forms. On the one hand, SIPG adjusts resources combined with the needs of urban development to promote the development of port commercial real estate business. On the other hand, SIPG leads more financial elements to integrate with the port logistics industry, and continues to focus on the development of the shipping service industry in Shanghai free trade zone. By the end of 2018, SIPG had a total of 57 holding and participating enterprises, 24 of which involved diversified development, covering catering, warehousing, trade, culture and sports, real estate, and other industries.

Finally, SIPG develops overseas markets, steadily promotes its global strategy, and gradually forms a trans-regional and transnational business pattern. SIPG is committed to becoming a global excellent port enterprise. As early as 2006, SIPG invested 45 million euros, in cooperation with APM Terminals, to acquire 40% shares of a container terminal in Zeebrugge Port. In 2010, SIPG acquired 25% of

APM Terminals' shares in Zeebrugge Port container terminals. In March 2015, SIPG successfully won the bid for the 25-year wharf operation right of Haifa Port in Israel since 2021.

3.2.2 China Merchants Port

China Merchants port Holding Co., Ltd., listed on the Hong Kong Stock Exchange in 1992, is an essential subsidiary of China Merchants Group. Nowadays, it is the world's leading port developer, investor, and operator.

(1) Business scope and throughput

CM Port is a typical global port enterprise. CM Port focuses on the three strategic directions of "homeport construction, overseas expansion, and innovative development" to promote the development of various businesses steadily .

CM Port has established a relatively complete network of ports network in the central hub ports along the coast of China. The main controlled or invested terminals covers Hong Kong, Taiwan, Shenzhen, Ningbo, Shanghai, Qingdao, Tianjin, Dalian, Zhangzhou, Zhanjiang, Shantou, and other container hub ports. The port business of CM Port covers three regions with the most vigorous economic development in China: the Pearl River Delta, the Yangtze River Delta, and the Bohai Bay area.

CM Port is committed to becoming the world's leading port enterprise. Since 2008, CM Port has arranged overseas ports. In recent years, CM Port consistently implements the "one belt, one road" national initiative and accelerates the pace of globalization. Up to June 2018, CM Port has successfully invested in 36 ports in 18 countries and regions, including India, South Korea, Africa, South America, Europe, and Mediterranean.

Continue the upward trend in 2018, the throughput of the container terminals invested by CM Port in 2019 was 111.721 million TEU. The terminals in China achieved 90.878 million TEU. The bulk cargo throughput was 449.241 million tonnes. Among them, the terminals invested in China completed 442.956 million tonnes. (Table 8)

Table 8 2017-2019 CM Port throughput

Container Terminal Volume ('000 TEU)	2019	2018	2017
Mainland China, HK and Taiwan	90,878	88,403	84,599
Others	20,843	20,657	18,303
CM Port Total	111,721	109,060	102,903
Bulk Cargo Volume ('000 Tonnes)	2019	2018	2017
Mainland China	442,956	497,050	501,864
Others	6,285	4,986	5,402
CM Port Total	449,241	502,036	507,266

Source: 2017-2019 CM Port annual report

(2) Business composition

The core business of CM Port is port business and bonded logistics business, including container and bulk cargo handling, tugboat service, land transportation, airport cargo station, and container manufacturing.

In 2018, the revenue of CM Port reached HK$10.16 billion, an increase of 16.9% over the previous year. Among them, the revenue of port business increased by

16.6% to HK $9.544 billion from HK$8.185 billion in 2017, the revenue of bonded logistics business increased by 12% to HK$459 million from HK$410 million in 2017, and the revenue of other businesses increased by 61.9% to HK$157 million from HK$97 million in 2017. The revenue of port business accounted for 93.9% of the total revenue of CM port.

In 2018, CM Port realized EBITDA of HK$4.258 billion, an increase of 7.6% over the previous year. Among them, EBITDA of port business was HK $3.638 billion, EBITDA of bonded logistics was HK$204 million, EBITDA of other business was HK$416 million. EBITDA of port business accounted for 85.4% of the total EBITDA of CM Port. (Table 9)

Table 9 2017-2018 CM Port financial summary

Unit: HK$'million

	2018	2017	Growth rate
Revenue			
Port business	9,544	8,185	16.6%
Bonded logistics business	459	410	12.0%
Other business	157	97	61.9%
Total	10,160	8,692	16.9%
EBITDA			
Port business	3,638	3,428	6.1%
Bonded logistics business	204	223	-8.5%
Other business	416	306	35.9%
Total	4,258	3,957	7.6%

Source: 2017-2018 CM Port annual report

(3) Global operation mode

CM Port, based on the adjustment of international industrial pattern, focuses on overseas port layout, accelerates the internal integration and development, strengthens cooperation with foreign countries, improves professional capabilities, and maintains the stable growth of port business and business performance.

In terms of homeport construction, CM Port actively promotes the integration of resources. It strengthens the dominant position of homeport in the hub ports of Guangdong, Hong Kong, and Macao. CM Port realized the flow of goods from the Pearl River Delta to the homeport and promotes the integration of barge branch line and customs clearance. It promotes the construction of "PRD NETWORK" platform, improves the overall competitiveness of Shenzhen's western homeport, and actively promotes the deep cooperation with international partners.

In terms of overseas expansion, CM Port focuses on the layout of major global hub ports and regions with high market potential, rapid economic growth, and proper development prospects. CM Port captures investment opportunities in ports, logistics and related infrastructure, and further improves the global network of ports. In February 2018, CM Port acquired 90% equity of the TCP project in Brazil. In June 2018, CM Port acquired 50% equity of the port of Newcastle project in Australia.

In terms of innovation and development, CM Port adopts the innovative industry finance cooperation mode and promotes the construction of a comprehensive port ecosystem with port business as the core. It strengthens cooperation with port partners and actively promotes enterprise to "port integrated service provider". In addition, CM Port accelerates the promotion of innovative applications, implements RTG remote control, digital port, visualization platform, global container big data

analysis, etc., to improve the information management level and business technology of global ports.

In terms of operation management, CM Port adopts the whole process operation management system. Based on the strategic position of each subordinate company, make targeted investment plans to promote the sustainable and efficient development of each subordinate company. CM Port establishes quality and efficiency improvement organizations in the headquarters and subsidiaries, optimizes the internal management and control process, improves the cooperation mechanism among enterprises at all levels, releases the corresponding decision-making momentum for enterprises through differentiated management based on improving operational efficiency.

3.2.3 Hutchison Ports

Hutchison Ports Holdings Limited. (HPH) was founded in 1994, it is one of the world's top five port operators. Its parent company is CK Hutchison Holdings Limited. HPH holds and manages ports and related services of Hutchison Group around the world, and engages in port investment, development and operation.

(1) The network of ports and throughput

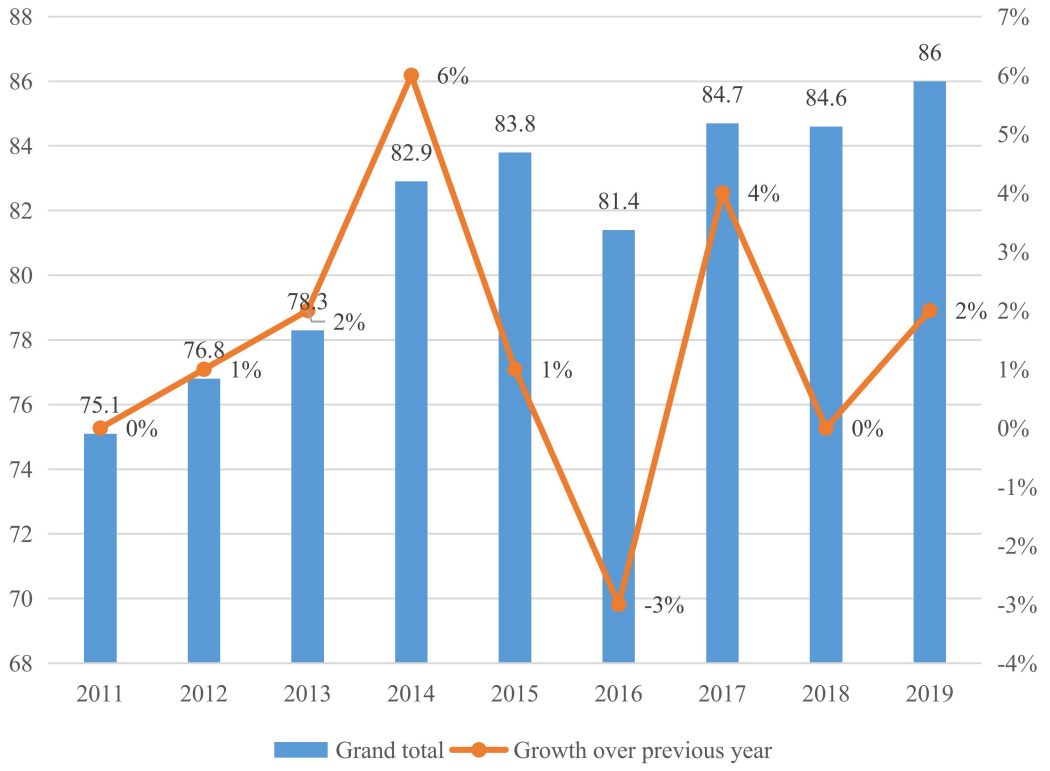
HPH‘s port business covers 27 countries including Asia, the Middle East, Africa, Europe, Australia and the Americas, with 52 invested and operated ports.

In 2019, HPH’s terminals completed 86 million TEU of container throughput, an increase of 2% over the previous year. (Figure 10) Among them, the container throughput of HPH Trust and terminals in mainland China is 23.5 million TEU and 13.5 million TEU, accounting for 43% of total container throughput. 16.2 million

TEU of container throughput has been completed in the terminals invested in Europe, an increase of 2% over the previous year. The container throughput of other terminals was 32.8 million TEU, an increase of 7% from a year earlier.

Figure 10　2019 HPH throughput

Unit: million TEU



Source: hutchisonports.com/en/about-us/throughput/

(2) Business composition

Port business is the core business of HPH. In addition to the main port businesses, HPH has expanded internationally into other logistics and transportation-related industries. These include cruise ship terminals, airport operations, distribution

centers, rail services, and ship repair facilities. In the port business in Hong Kong, to cope with the fierce competition of the port enterprises, HPH has set up its subsidiary River Trade Terminal Co., Ltd. to provide the maritime trade services between Kwai Chung Terminal in Hong Kong and the ports in southern China, and has set up Hutchison Logistics Co., Ltd. to provide customized logistics services including various multimodal transport.

(3) Global operation mode

Firstly, HPH grasps the new focus of investment, decentralizes investment, and reduces risk. From the perspective of investment mode, HPH is more focused on merger and acquisition, sole financing, or joint venture. It has the control and management rights of most of the terminals that HPH invests.

HPH decentralizes investment risks and maintains profit growth through business globalization. In the past ten years, HPH has invested heavily in new projects and mergers and acquisitions, but its financial situation is still very stable. The main reason is that its port business is scattered in different regions, which makes the investment risk disperse and ensures the overall profit of the port business keeps positive growth.

Secondly, HPH has established a vast global network of ports. In recent years, the investment layout of HPH is mainly in the Far East and northwest Europe, as well as ports in America and Africa. Most of the investment objects are the central hub ports on the main channel and the second-class ports with an excellent deepwater coastline and abundant port resources. In May 2019, HPH signed a long-term commercial agreement with the Québec Port Authority and Canadian National Railway to build and operate the new container terminal, known as project Laurentia. In October 2019,

HPH invested a port expansion project in Pakistan with US$240 million.

Thirdly, HPH takes the terminal as its capital to earn high profits. HPH maintains a high profit because of its strict control of the investment in terminal assets and its timely sale policy. Unless there are a high profit and value strategy, HPH will not deviate from the main business of terminal operation. In the history of HPH, adjustment is not uncommon, but "asset sale" is always a part of strategic layout adjustment. Therefore, as port enterprises without a sister shipping company, HPH's purpose is to obtain the most profits through the terminal business.

Finally, HPH improves logistics supporting services and efficiency through innovation. HPH provides the connection logistics service between the southern port in China and Hong Kong, as well as the intermodal service connecting the inland center, and develops various logistics services supporting the terminal operation. Moreover, HPH created the next generation terminal management system, automated equipment control system, radio data system. It provides electronic payment service, online E-tracking services to increase efficiency, service, and profitability. On the one hand, they can further improve the overall service level of the port and increase the attractiveness of the port to customers. On the other hand, they can also provide better logistics services for customers through information sharing with terminal operations and port resource integration.

3.3 Enlightenment from the experience of global operation of global port enterprises

The global operation of global port enterprises has experienced a long-term development process. Global port enterprises have determined the development direction of globalization. After successfully carrying out the operation of

corporatization, commercialization, and regionalization, they expanded by utilizing their management and capital advantages, invested and operated terminals, acquired large enterprises, and formed a global port network.

Traditional professional port enterprises have plenty of terminal construction funds and professional terminal management teams, but they have weak control over the source of goods and lack of control over the whole supply chain. Shipping enterprises' terminal operators have a professional terminal management team and a reliable source control ability, which can provide value-added services in the logistics supply chain, but the terminal investment is greatly affected by the shipping business and lacks stability.

Most of the global port enterprises have a strong parent company as the support of development. For example, Hutchison Port's parent company, CK Hutchison Holdings Limited, is one of the world's top 500 companies and one of the largest listed companies on the Hong Kong stock exchange. The parent company of PSA is the Temasek holding company, which almost dominates the economic lifeline of Singapore. The parent company of APM Terminals is Maersk Group, the world's largest container shipping company. In terms of controlling shareholders, most of the controlling shareholders of traditional professional port enterprises have government background. In contrast, the controlling shareholders of shipping enterprises' terminal operators are mainly private enterprises. This determines that the investment activities of traditional professional port enterprises often have political factors. In contrast, shipping enterprises' terminal operators consider much more about the needs of the market layout.

In terms of investment layout, traditional professional port enterprises have their homeport. While shipping enterprises' terminal operators follow the route layout.

Traditional professional port enterprises attach great importance to the development and growth of the local homeport. They all regard the local homeport as the foundation of their steady progress. Traditional professional port enterprises have achieved outstanding results in homeport operation, with high efficiency and efficiency, advanced port technology, and rich operation experience. For example, as the homeport of Hutchison Ports, the Hong Kong International Container Terminal has developed and grown by the location advantages of Hong Kong free trade port, and its throughput ranks first in the global port network of HPH. PSA, which takes Singapore port as its homeport, relies on Singapore Port's advantages in international container transit transportation to develop itself and give full play to Singapore Port's advantages in providing value-added services, so that PSA has a diversified development platform. The primary purpose of shipping enterprises' terminal operators is to guarantee the development of shipping and disperse the risk of the operation. For example, Maersk usually invests in the ports in their main routes to form a systematic transportation network. This can not only guarantee the priority and fast completion of operations after the ships arrive at the port, but also disperse the operational risks brought by the significant fluctuation of the shipping market.

There are various modes for global port enterprises to expand. The traditional professional port enterprises pursue control and management rights. While, shipping enterprises' terminal operators try to influence the terminals through equity participation. The main modes for global port enterprises to expand are: port project consultation, renting terminals or acquiring development and operation rights, direct investment in terminals, share participation and expansion or share exchange, merger and acquisition, etc. At the same time of investment in terminals, global port enterprises also carry out diversified operations in ports such as infrastructure, real estate, finance, insurance, etc., such as SIPG, etc. The modes of global expansion are

not unique and static. There are many options. The two essential criteria for global port enterprises to choose the right mode of global expansion are to improve capabilities and reduce investment risks.

The port network layout of the most of global port enterprises focus on Asia and Europe. After the financial crisis, port investment in developing countries has become a hot spot. As the main container produce or transit place, the Far East, Southeast Asia, Suez Canal, and other regions are the most concerning areas of global port enterprises. In recent years, Hutchison Ports and APM Terminals have increased their investment in the Far East. At the same time, African ports have begun to be favored by global port enterprises. For example, APM Terminals has invested and built 13 terminals in Africa, mainly in West Africa. In the future, APM Terminals will increase its investment in East Africa and South Africa.

Global port enterprises all set up international investment companies to specially responsible for developing the international market. Such companies are specialized in international port business, to ensure the success of the global business from personnel and system, and also to ensure the continued stability of homeport business. When the development of globalization is more mature, global port enterprises have established a global management structure. Through the business management mode of "vertical classification and horizontal division", global ports are integrated into a unified and global management structure. Besides, global port enterprises actively raise international port development, and operation funds through the overseas listing, bond issuance and other channels. They have strong profitability and control ability, and they pay great attention to improving profits. Their financial management level is at the forefront of the world. The system, organization, expertise and talent matching with globalization are the guarantee for the success of global port

enterprises’ global operation.

4 The port enterprises' global operation model based on cooperative game theory

4.1 Analysis of the risks and advantages of port enterprises' global operation

4.1.1 The risk of port enterprises' global operation

As a typical capital intensive industry, port enterprises have the characteristics of massive investment and long payback periods. The global operation risks faced by port enterprises are also complicated and changeable. It mainly includes: financial risks, operational risks, strategic risks, etc.

(1) Financial risks

At present, global economic growth slows down. In 2019, the global commercial growth rate dropped to 2.3%, which is the lowest level in nearly a decade. International trade and cross-border investments have declined significantly compared with the past. In 2018, the global trade volume dropped by 0.1%, the import and export demand of some western developed countries has weakened, and the throughput of some regional ports has declined. The severe global economic environment leads to significant risks in the global operation of port enterprises, such as profit level, total asset turnover rate, and solvency. In addition, the fluctuation of the exchange rate will bring transaction risk to the business which uses foreign

currency for collection and payment, and ultimately affect the report results of assets and liabilities, making port enterprises suffer economic losses.

(2) Operational risks

In the process of global operation of port enterprises, due to the different reputations of the company's customers, it will bring a particular risk of business income recovery to the operation of the investment department and the business department. Because of the difficulty of marginal cost pricing operation and the volatility of the port market, it is easy to emerge that the price is too high due to the lack of market understanding, or the price is too low due to the vicious competition among port enterprises, resulting in the pricing risk. In the cost control activities of port enterprises, cost control risks may occur due to the failure of cost control or other uncertain factors. In addition, the illegal operation of port workers, the lack of security facilities, and the threat of terrorism will bring operational security risks.

(3) Strategic risks

The strategic decision-making has not been scientifically and rigorously analyzed, has not been adjusted based on environmental changes, and lacks organizational structure and management mode matching with the strategic development. It will be challenging to play the advantages of internal resources and ensure the implementation of strategic objectives, and affect the healthy and sustainable development of the company. During the implementation of the strategy, various factors such as national policies and local protection awareness are not taken into account, investment decisions are not correct, and the monitoring of investment projects is insufficient, which will lead to strategic risks. In recent years, with the increase of investment and construction projects of port enterprises, the investment

risks is also increasing, which has a particular impact on the global operation of port enterprises.

4.1.2 The advantages of port enterprises' global operation

(1) Improve the competitiveness of port enterprises

Global operation has become the key to enhance the competitiveness of port enterprises. Only by adopting the global operation mode, the port enterprises can stand out from many competitors and grasp the competitive advantage for a long time. At present, port is not only the place of handling and stacking in the traditional sense, and its connotation has changed radically. The functions of port are more extensive and the service scope is further expanded. It will gradually be built as a logistics service center and industrial center. Adopting the global operation mode, port enterprises can meet the different needs of customers from all aspects and multiple angles, establish a good reputation, and create the service brand.

(2)Disperse the operation risk of port enterprises

Port is a high-risk industry, because the investment of port operation is massive and professional. Besides, there is a high correlation between the port industry and the national economy. Changes in the industrial structure, foreign trade policies, and regional economy will have a more significant impact on the port business and seriously affect the income of port enterprises. Therefore, the port enterprises adopt the global operation mode, which can improve the anti-risk ability and reduce the loss as much as possible. For example, HPH, DP World and other global port enterprises usually invest in different regions to avoid the impact of regional economic changes and industrial structure changes on port business. They also invest in different countries to prevent the effects of changes in national economy,

industrial structure ,and foreign trade policies.

(3) Improve the network of port and guarantee the demand of shipping development

With the background of shipping companies, the global operation of port enterprises can form a port network to meet the needs of shipping development. For example, APM Terminals usually tend to invest in terminals in the ports where their main routes are linked, and form a systematic port network through the connection between the main routes and terminals. On the one hand, it can ensure that ships can finish loading and unloading preferentially and quickly when they arrive at the port. On the other hand, the terminals will also give shipping companies more favorable internal prices.

(4) Realize the full utilization and sharing of resources

Global operation can make port enterprises make full use of the resources of the global network of the port, improve the efficiency of resource utilization, and help to reduce transaction costs, share costs, and fixed costs.

4.2 Port and port cooperation

Port and port cooperation has gradually become an important way for port enterprises to communicate with each other. It is a "win-win" global way developed by port enterprises according to their current needs. Port and port cooperation includes direct port business and indirect business, as well as the derived technology exchange, natural person flow, port financial capital cooperation, etc. Port and port cooperation is not only the international collaboration of the industrial manufacturing industry, but also the international cooperation of the service industry.

Through port and port cooperation, which is a win-win operation model, it can expand the hinterland of cargo sources, expand port business areas, carry out port extension services, comprehensively strengthen technical exchanges, give full play to their respective resource advantages, improve the overall level of ports, establish a new pattern of regional maritime transportation, generate the overall effect due to the synergy effect, form the internal driving force of the port system, and promote the high-quality development of ports. At the same time, these ports can also facilitate host countries and the international community. Port enterprises not only gain benefits, but also make contributions.

4.3 Port and shipping cooperation

Port and shipping cooperation is the primary trend under the current global operation, which is very important for global trade and industry development. No matter in macro-economy, micro-economy, industry perspective, technological innovation, and capital level, port and shipping cooperation has particular importance.

From the perspective of macro-economy, port and shipping cooperation can promote global trade facilitation and affect market trends. About 90% of global cargo trade is done through international shipping transportation. International shipping continually promotes the development of international trade, through mode change and technological innovation, primarily through port and shipping cooperation. It builds the integration of ship, port, storage, logistics, inland transportation and other nodes. It can improve the service capacity of the integrated logistics supply chain and promote new trade path, to promote the growth of global economic and trade. Taking the ‘China Europe land sea express line’ opened by COSCO Shipping Group as an example. COSCO took Piraeus port in Greece as the hub port and built the third trade channel from the Far East to Europe through port and shipping cooperation, which

reduces the delivery time by 7-11 days compared with the traditional shipping routes. It dramatically reduces the cost of the whole railway freight mode, and takes into account the timeliness and economy.

From the perspective of microeconomics, the cooperation and development of port and shipping will help to drive the local economy, attract the concentration of capital flow, people flow and cargo flow, and bring new sources of goods. Simultaneously, the agglomeration of cargo sources will change the direction of cargo flow, drive the change of regional market supply and demand, and affect the trend of the shipping market.

From the perspective of industry, port and shipping cooperation can promote the revision of rules and affect the pattern of port and shipping industry. In recent years, economic globalization and intelligent technology have brought significant changes to the port and shipping industry. The port and shipping industry has met the challenges through shipping alliance, port and shipping equity cooperation, merger and reorganization, building a fully automated terminal and other measures, and promoted the revision of industry rules. Taking the large-scale ships as an example, the mainstream super large container ships have been upgraded from 18,000 TEU to 21,000 TEU. The large-scale ships bring enormous pressure to the development of the port industry.

From the perspective of technological innovation, it is an inevitable requirement of the global digital trends for port enterprises and shipping enterprises to actively connect technological innovation. Digitalization, intellectualization, and platformization are breaking the business barriers between port and shipping, which also brings a perspective for the technical changes of port and shipping integration. Both GSBN, a blockchain alliance established by COSCO Shipping, and TradeLens,

a blockchain platform jointly developed by Maersk and IBM, are inseparable from the participation of port enterprises.

4.4 Shapley value model

When the development of globalization is mature, the global port enterprises all integrate the global ports into a unified whole through the "vertical integration and horizontal integration" operation strategy mode. With the global operation of enterprises, cooperation has become an important way for port and shipping enterprises to innovate and maintain competitiveness. Port and shipping cooperation not only significantly improve cargo throughput, realize complementary advantages of resources, but also reduce investment risks, to a certain extent, realize diversified operation, and improve the overall strength of enterprises.

However, as an individual of interest, the fundamental purpose of joining the alliance is to obtain better economic benefits. Therefore, how to evaluate the contribution of member enterprises to the alliance and how to distribute the income based on this determines the stability of the alliance cooperation to some extent. Therefore, the following issues need to be considered: if port and shipping enterprises are allowed to cooperate freely, how to distribute the income is conducive to the stability of the alliance?

To answer the above question, this dissertation assumes that every port enterprise can freely join or leave an alliance, or cooperate with other enterprises to form a new alliance. The dissertation will use the Shapley value method in the cooperative game to obtain the income distribution of the port enterprises under the global operation and cooperation, then discussing the effectiveness of the Shapley income distribution method for the stability of the alliance.

The Shapley value method is a mathematical method proposed by Shapley LS in 1953 to solve the problem of income distribution in a cooperative game. When n individuals engage in a particular economic activity, for each form of cooperation of several of them, they will get certain benefits. When the interest activities among people are non-confrontational, the increase in the number of people in the cooperation will not cause the reduction of benefits. In this way, the collaboration of all n individuals will bring maximum benefits. The Shapley value method is a scheme to distribute the maximum benefits.

Suppose I is a cooperative alliance set, $I = \{1, 2, 3, \cdots, n\}$, n is the number of participating members.

S is an alliance subset of I, $S \in I$, s is the number of participating members of subset S.

$v(S)$ is the characteristic function of a subset and represents the income of subset, which must satisfy the following conditions:

$$V(\emptyset) = 0 \qquad ①$$

$$v(S_1 \cup S_2) > v(S_1) + v(S_2),\ S_1 \cap S_2 = \emptyset \qquad ②$$

$v(S - i)$ is the income that the subset can get after removing member i.

$x_i = \{x_1, x_2, x_3, \cdots, x_n\}$ indicates income distribution of cooperation , which must satisfy the following conditions:

$$\sum n_i = 1,\ x_i = v(i),\ i = 1,2, \cdots, n \qquad ③$$

$$x_i > v(i), \quad i = 1,2,\cdots,n \qquad ④$$

$\varphi_i(v)$ is the Shapley value of alliance members i and represents the income of number i. The Shapley value model is as follows:

$$\varphi_i(v) = \sum_{i \in s \in I} \frac{(|s|-1)!\,(n-|s|)!}{n!}[v(S) - v(S-i)] \qquad ⑤$$

Among it, $\omega(S) = \frac{(|s|-1)!(n-|s|)!}{n!}$ is the weighting factor.

4.5 Numerical analysis

There are a port enterprise A, a shipping enterprise B, and a freight forwarding enterprise C. Suppose the cooperative alliance of the three enterprises is $I = \{A, B, C\}$. The subsets include $S\{\emptyset\}$, $S\{A\}$, $S\{B\}$, $S\{C\}$, $S\{A, B\}$, $S\{B, C\}$, $S\{A, C\}$, $S\{A, B, C\}$. $v(s)$ is the largest profits of any subsets in alliance N. $S\{A\}$, $S\{B\}$, $S\{C\}$ represent port enterprise, shipping enterprise and freight forwarding enterprise operate independently. $\{A, B\}$, $S\{B, C\}$, $S\{A, C\}$ respectively represent the cooperative relationship between port enterprise and shipping enterprise, shipping enterprise and freight forwarding enterprise, port enterprise and freight forwarding enterprise, and$S\{A, B, C\}$ represents three enterprises reach a cooperative relationship.

According to the data in the list of Chinese port and shipping enterprises profitability in the first half of 2018 released by the shipping industry network, the individual income of port enterprise A $v(a) = US\$59$ million, the individual income of shipping enterprise B $v(b) = US\$85$ million, and the individual income of freight forwarding enterprise C $v(c) = US\$42$ million.

Since the Shapley value model needs to use the data of alliance subset income, but the overall income of this kind of future alliance cannot be obtained through research, so this dissertation tries to find the critical point of income, so as to determine the alliance subset income.

If port enterprise A and shipping enterprise B form an alliance, the income they get must be greater than the income when they operate independently, that is, when $v(A,B) > [v(A) + v(B)]$ and $x_A > v(A)$, $x_B > v(B)$, they can reach a cooperation relationship, which must satisfy the following conditions:

$$\frac{59 + (59 + 85)y - 85}{2} > 59 \qquad ⑥$$

$$\frac{85 + (59 + 85)y - 59}{2} > 85 \qquad ⑦$$

Thus, $y > 1$. $v(A,B) = 1.1[v(A) + v(B)] = \text{US\$158.4 million}$. For the same reason, when port enterprise A and freight forwarding enterprise C form an alliance, $v(A,C) = 1.1[v(A) + v(C)] = US\$111.1 \text{ million}$. When shipping enterprise B and freight forwarding enterprise C form an alliance, $v(B,C) = 1.1[v(B) + v(C)] = \text{US\$139.7 million}$.

When port enterprise A, shipping enterprise B and freight forwarding enterprise C form an alliance, it should satisfy the following conditions:

$$\frac{59 + (59 + 85 + 42)y - 85 - 42}{3} > 59 \qquad ⑧$$

$$\frac{85 + (59 + 85 + 42)y - 59 - 42}{3} > 85 \qquad ⑨$$

$$\frac{42 + (59 + 85 + 42)y - 59 - 85}{3} > 42 \qquad ⑩$$

Thus, $y > 1.378$. $v(A, B, C) = 1.379[v(A) + v(B) + v(C)] = \text{US\$256.49 million}$. (Table 10)

Table 10 Cooperation income of alliance subset

Unit: USD million

	A ∪ B	A ∪ C	B ∪ C	A ∪ B ∪ C
Income	158.4	111.1	139.7	256.494

According to Shapley value model, the income of port enterprise A in the alliance can be calculated. $\varphi_{\mathrm{A}}(\mathrm{v}) = \text{US\$82.35 million}$. (Table 11)

Table 11 Port enterprise A's income distribution based on Shapley value

Unit: USD million

	A	A ∪ B	A ∪ C	A ∪ B ∪ C
$v(S)$	59	158.4	111.1	256.494
$v(S-A)$	0	85	42	139.7
$v(S)-v(S-A)$	59	73.4	69.1	116.794
s	1	2	2	3
$\omega(S)$	1/3	1/6	1/6	1/3
x_A	19.67	12.23	11.52	38.93
$\varphi_A(v)$	79.95			

For the same reason, the income of shipping enterprise B and freight forwarding enterprise C in the alliance can also be calculated. $\varphi_B(v) = US\$109.65$ million and $\varphi_c(v) = US\$64.5$ million. (Table 12 and Table 13)

Table 12 Shipping enterprise B's profit distribution based on Shapley value

Unit: USD million

	B	A ∪ B	B ∪ C	A ∪ B ∪ C
v(S)	85	158.4	139.7	256.494
v(S − B)	0	59	42	111.1
v(S) − v(S − B)	85	99.4	97.7	145.394
s	1	2	2	3
ω(S)	1/3	1/6	1/6	1/3
x_B	28.33	16.57	16.28	48.46
$\varphi_B(v)$	109.65			

Table 13 Freight forwarding enterprise C's profit distribution based on Shapley value

Unit: USD million

	C	A ∪ C	B ∪ C	A ∪ B ∪ C
v(S)	42	111.1	139.7	256.494
v(S − C)	0	59	85	158.4
v(S) − v(S − C)	42	52.1	54.7	98.094
s	1	2	2	3
ω(S)	1/3	1/6	1/6	1/3
x_C	14	8.68	9.12	32.7
$\varphi_C(v)$	64.5			

The income growth rate of port enterprise A is 39.6%, that of shipping enterprise B is 29%, and that of freight forwarding enterprise C is 43.6%. (Table 14) It can be seen that Shapley value method is reasonable to distribute the income among the partners of port enterprises, and the income after cooperation is more than that of their own independent operation. It is conducive to the stability of the alliance.

Table 14 Income growth rate of A, B and C

Unit: USD million

	Original income	Cooperation income	Growth rate
A	59	82.35	39.6%
B	85	109.65	29%
C	42	64.5	53.6%

5 Recommendations on Chinese port enterprises' global operation

5.1 The current situation of Chinese port enterprises globalization

China's port operation capacity is leading in the world. Since Hutchison Port invests in Yantian port, the operation ability of Chinese port enterprises has made some progress. According to relevant research, the terminal operation capacity of Chinese port enterprises has begun to reach the boundary of overseas management output.

Some Chinese port enterprises have begun to formulate and implement the globalization strategy. SIPG has already had specific projects in the aspect of globalization. As early as 2006, SIPG invested 45 million euros, in cooperation with APM Terminals, to acquire 40% shares of a container terminal in Zeebrugge Port. SIPG and Maersk jointly carried out the operation and management of the terminal. In 2010, SIPG acquired 25% of APM Terminals' shares in Zeebrugge Port container terminals. This acquisition has realized the first step of SIPG's globalization strategy and is also the first overseas investment project of Chinese port enterprises. With the proposal of China's globalization strategy, some major port enterprises began to plan and implement the globalization strategy. Chinese port enterprises carry out the global strategy utilizing transnational acquisition of shares, the establishment of overseas investment and operation companies, listing abroad, and establishment of strategic alliances. But on the whole, the implementation of globalization strategy of port enterprises in China is still in the initial stage.

At present, the globalization of Chinese port enterprises is still in the stage of "introduction". The main ways for Chinese port enterprises to implement the globalization strategy include developing international shipping routes, introducing famous international ports, establishing friendly relations with foreign ports, and developing global cooperation network of ports. International port operators and shipping companies are the main force to invest in China's port industry. Chinese port enterprises have accumulated preliminary experience in global management and operation through the introduction of foreign capital. For example, Shanghai Pudong international container terminal, Hutchison Port accounts for 30% of shares, COSCO Pacific accounts for 20% of shares. Dalian port container terminal is a joint venture of Dalian Port Group and PSA.

In terms of overseas investment, Chinese port enterprises gradually carry out transformation and upgrading. They mainly focus on the integration of regional port resources. In recent years, some port enterprises have been accelerating their actions in regional port investment. For example, Qingdao Port Group and Weihai Port have jointly invested to establish Qingwei Container Terminal Company and unified operation and management of Weihai port container terminal, with Qingdao Port Group holding 49%. Qingdao Port Group and Rizhao Port Group has jointly invested and operated Rizhao Port Container Terminal Project, with Qingdao Port Group holding 50%. Hebei Port Group implements the resource integration of specialized ports mainly for coal transportation, develops three strategic bases of Qinhuangdao port area, Tangshan port area, and Huanghua port area, expands new coal loading and unloading terminals in the Pearl River Delta and Yangtze River Delta, and operates two strategic areas. Shenzhen Yantian Port Group invested in the construction of Tangshan Caofeidian Port Company with a capital injection of 1.355 billion RMB, holding 35% of the company's equity. The "Yangtze River strategy"

put forward by SIPG means that Shanghai port extends the hinterland of Shanghai port from the Yangtze River Delta to the whole Yangtze River Basin through investment, share participation, export management, cooperation and alliance, comprehensively improves the container throughput of the Yangtze River port, cultivates its system, and can also be seen as its integration of regional port resources.

5.2 Problems of Chinese port enterprises

Although the development of Chinese port enterprises is positive in recent years, there are still some development problems and difficulties.

1. China's port has excess capacity and a high degree of homogeneity in competition.

Since the boom of port construction in China in the early 21st century, the operation capacity of the port enterprises in warehousing, transportation, handling has reached a high level. It has brought the result of excess capacity of the port. However, some Chinese port enterprises still rely on the advantages of terminal nodes to gain benefits through handling services, so the degree of homogenization of competition is high. There are also problems with hinterland overlapping and cargo convergence between adjacent ports.

2. High pressure on capital.

When Chinese port enterprises invest in the construction of a new terminal or purchase port assets, it needs a large amount of capital investment. They generally bear enormous capital pressure. In recent years, the growth of revenue and profit of Chinese port enterprises has slowed down. The proportion of handling and stacking

revenue of large port enterprises has gradually decreased. The overall level of return on net assets of the port industry is low, and the return on net assets of some port enterprises is even smaller than the bank loan interest rate in the same period.

3. Lack of professional talents

The lack of specialized talents in port logistics, insufficient investment in personnel training and the general scarcity of modern logistics awareness lead to the limited-service mode of specialized logistics. The management level of Chinese port enterprises, as well as the recognition of decision-makers and management on modern logistics, need to be further improved.

4. Low level of alliance

Due to the influence of traditional operation ideas, some Chinese port enterprises are limited to the conventional port handling and warehousing business for a long time, so it is difficult to carry out the port logistics business effectively. Therefore, it is challenging to form a strategic alliance with related large-scale enterprises such as shipping, railway, highway, etc.. They lack long-term and close partnership, and difficult to give full play to the fast and accurate connection of port logistics services. The connection with industrial enterprises and processing enterprises is less, and the extension service of the port is greatly restricted.

In addition, Chinese port enterprises still have the problems of lack of modern enterprise management system, insufficient investment in production process transformation, technical equipment research and development, the low utilization rate of resources, poor internal and external cooperation, etc.

5.3 Recommendations

Compared with global port enterprises, Chinese port enterprises still have a considerable gap in governance globalization, organization globalization, asset globalization, talent globalization, brand globalization, transportation network globalization, and management globalization. It needs Chinese port enterprises to make continuous efforts in practice and improve their management level to adapt to the development trend of constant integration of global port resources and take the substantial step of globalization.

1. Flexible choice of operation model

In the face of fierce international competition, Chinese port enterprises must think about their own way of transformation and upgrading. An enterprise without progress will eventually be eliminated by the times. Therefore, whether in management or the operation model, Chinese port enterprises must continuously improve them to meet the needs of the market. China's port has excess capacity and a high degree of homogeneity in competition. Chinese port enterprises can choose to extend their business or adopt a diversified operation model to reduce competitive pressure when necessary. For example, they can build industrial parks in port cities, make full use of local natural and human resources, promote the development of industrial parks with port trade, and feed port construction with the benefits brought by the development of industrial parks. They can also choose to cooperate with some foreign enterprises to reduce the pressure of capital turnover. In a word, Chinese port enterprises need to choose their development and operation mode flexibly when facing a fast-changing competitive environment.

2. Choose the most appropriate financing means

Chinese port enterprise should choose financing means according to the specific situation and different factors. In addition to credit financing and bond financing, equity financing and equity swap are often used in international mergers and acquisitions cases. In addition, listed companies can increase capital by issuing additional shares. Considering that it takes a long time for Chinese port enterprises to make profits after completing their investment in the early stage of overseas expansion, port enterprises should try to choose equity financing, long-term debt, and other long-term financing means. In Ningbo Zhoushan Port and Tangshan port, which have low asset-liability ratio, a bank loan is the primary type of debt financing mean.

3. Training and introduction of overseas management talents

The globalization of Chinese port enterprises needs talents with overseas enterprise management experience and ability. For the training of such talents, managers or interns can be sent to the foreign partners of port enterprises. They can have the experience, working ability, and experience through a period of work and exercise and form the talent reserve for the global operation of Chinese port enterprises. At the same time, Chinese port enterprises should also establish incentive and restraint mechanisms to widely attract excellent domestic talents, overseas Chinese, and talents from target countries or regions to join the team of Chinese port enterprises in a global operation.

4. Cooperate with shipping enterprises, resource-based enterprises, port construction enterprises, etc

Chinese port enterprises can support each other to invest in overseas port terminals with the help of good cooperation foundation with large shipping enterprises.

Through the joint operation, strengthen the alliance relationship between the two sides, complement each other's advantages in the operation of overseas ports and terminals, jointly develop offshore business, and develop an international logistics service provider with global distribution together. Chinese resource-based enterprises are expanding in an all-round way in the world. With the increasing demand for resources, this kind of acquisition of overseas resources will continue to increase, and develop from purchasing resources to building the whole supply chain. Chinese resource-based enterprises have begun to invest and build overseas ports. Chinese port enterprises should keep a cooperative relationship with resource and energy customers in the aspect of bulk cargo terminals, and provide logistics services for them. Chinese port enterprises can also strengthen union with port construction enterprises such as China Communications Construction Group and adopt BOT mode to build and operate terminals for those developing countries. The port construction enterprise is responsible for the construction. While the port enterprise is responsible for the operation of the terminal within a particular period, with complementary advantages and shared interests.

5. Reform and innovate in terms of enterprise system according to globalization requirements

According to the experience of global port enterprises, the improvement of globalization in the system is the key to win the competitive advantage in the global market. According to the requirements of the market economy, the governance structure of Chinese port enterprises should optimize the ownership structure, coordinate the relationship among management, shareholders, the board of directors, and various stakeholders, and try to introduce people with an overseas background and international experience into the board of directors. The decision-making process

of Chinese port enterprises should be further open and transparent by the requirements of globalization. Scientific and democratic decision-making mechanisms should be realized in accordance with the provisions of modern decision-making mechanisms. Simultaneously, port enterprises with offshore-listed companies can build their offshore-listed companies into international investment companies, which are specially responsible for the development of global markets.

6. Obtain support from national industrial development policies

In any country or region, ports and terminals are regarded as strategic resources, the importance of which has gradually emerged with the rapid growth of international trade. It is very tough for Chinese port enterprises to carry out the global operation completely, relying on their business behavior. The state can give specific policy support at the macro level. To encourage Chinese port enterprises and all kinds of capital to invest in overseas port terminals, the relevant departments can consider listing port and terminals as an encouraging offshore investment project, which will be conducive to driving all kinds of capital, especially the investment of Chinese port enterprises in offshore port terminals. The foreign direct investment of Chinese port enterprises started late, has the relatively insufficient experience, and lacks overall supporting policies. Therefore, we can learn from the experience of South Korea, Japan, and other countries, as well as Singapore's management of overseas investment port terminals. We can give preferential policies to Chinese port enterprises' global operation in terms of credit policies, personnel training policies, fiscal and tax policies, foreign exchange supervision policies, international financing policies and entry-exit management of relevant personnel, to ensure the success of Chinese port enterprises' global operation.

7. Take emerging economies and developing countries as the direction of

globalization

According to the experience of global port operators, the globalization of Chinese port enterprises in location selection, container terminals should be mainly located in developing countries such as Asia, Middle East, and Latin America, especially those countries with development potential but insufficient port capacity, significant logistics demand and stable politics. Bulk cargo terminals should be mainly located in South Asia, Australia, Latin America, western and southern Africa and other regions with abundant mineral resources; to improve the logistics network and meet the needs of global logistics, it can also be properly involved in the development of terminals in developed countries.

6 Conclusion

This dissertation analyzes and compares the invested and operated terminals, throughput, business composition, business income, and global operation model of foreign and Chinese first-class port enterprises. It concludes that the global operation model of foreign and Chinese first-class port enterprises mostly have a strong parent company as the support of development. Traditional professional port enterprises attach great importance to the development and growth of local homeport. While, shipping enterprises' terminal operators follow the route layout. Foreign and Chinese first-class port enterprises have various modes to expand. Their global port network focuses on Asia and Europe. They also set up international investment companies to specially responsible for developing the international market.

This dissertation analyzes and concludes that port enterprises' global operation has financial risk, business income recovery risk, pricing risk, cost control risk, strategic risk, investment risk, etc., and has the advantages such as improving the competitiveness, dispersing the operation risk, improving the network of port and guarantee the demand of shipping development, realizing the full utilization and sharing of resources. Based on the cooperative game theory, the dissertation uses the Shapley value method, which is the classical method of income distribution in the cooperative game theory, to build the model, and carries on numerical analysis of the income distribution of the port and shipping enterprises' cooperative alliance. It concludes that cooperation plays a great role in the global operation of port enterprises, which can reduce costs and maximize income. It is fair and effective to

use Shapley value method to distribute the income among the partners of port and shipping enterprises, which is helpful to the success of the whole cooperation.

Analyzes and concludes that Chinese port enterprises' global operation is still in the initial stage. Some Chinese port enterprises have begun to formulate and implement the global strategy, and gradually carry out the transformation and upgrading. They mainly focus on the integration of regional port resources. At present, Chinese port enterprises still have problems such as excess capacity, a high degree of homogeneity in competition, high pressure on capital, lack of professional talents, low level of alliance, lack of modern enterprise management system, insufficient investment in production process transformation, technical equipment research and development, low utilization rate of resources, and poor internal and external cooperation. Finally, this dissertation puts forward some recommendations on the paths and modes of Chinese port enterprises' global operation. For example, Chinese port enterprises should flexibly choose the operation model, choose the most appropriate financing means, train and introduce overseas management talents, cooperate with shipping enterprises, resource-based enterprises, port construction enterprises, reform and innovate in terms of enterprise system according to globalization requirements, obtain support from national industrial development policies, take emerging economies and developing countries as the direction of globalization, etc.

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