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Synergistic development of shipping center and technological innovation

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Synergistic Development of Shipping Center and Technological Innovation

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FORMAT OF THE DECLARATION

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Abstract

With the changes of the times and the development of science and technology, the society has made constant progress. People move from land to sea, slowly touching the sky and outer space. The development of navigation technology shows the epitome of the progress of science and technology. The outbreak of the two industrial revolutions has promoted significant changes in the means of navigation technology. Due to the over-development of shipping industry and neglect of economic efficiency and environmental protection, society is now working to solve these two problems.

In this paper, some challenges and improvement measures faced by shipping centers are discussed from two aspects of energy development and information technology by means of example analysis. Firstly, the general situation of shipping center is introduced. Then, the challenges faced by the development of shipping center in history are analyzed and summarized. Finally, the improvement methods are discussed from the perspective of information technology and energy.

Key Words: shipping center; energy; information technology;

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1. Introduction

1.1 Research Background

Shipping center is not only the window of international trade opening, but also the core area of national economic agglomeration and development and radiation diffusion center. At present, the construction of international shipping centers is vigorously carried out in various countries. Facing the fierce competition situation of international shipping centers and the situation of competition and cooperation among domestic shipping centers, shipping centers of all countries need to improve their comprehensive strength in an all-round way.

1.2 Research significance

The development trend of economic globalization has brought about profound changes in the role and status of ports in social and economic development. As a major link in the comprehensive transportation chain, the port has become increasingly strategic and has become an important support for effectively maintaining its leading position in international competition. Since the early 1990s, the United Nations Conference on Trade and Development (UNCTAD) has put forward the concept of intergenerational Ports - first, second, third and fourth generation ports. Domestic and foreign scholars have done a lot of research on the intergenerational division of ports, but mainly from the perspective of port function,

or from the perspective of port economic development to study the development model of ports. At present, there is little literature on technology development and the relationship between innovation and port development.

1.3 Research Objective

There are many theoretical problems to be summarized in the formation and development of shipping centers. As an independent thing, shipping center has its own unique operation law, its own development, improvement and even decline process, scientific and information technology revolution, which further changes the development track of international shipping center, directly related to the operation mechanism and function evolution of international shipping center. Just like the truth that babies grow up, the growth process of international shipping centers is not smooth, but full of twists and turns, which also leads to different times and regions of international shipping centers with different characteristics.

1.4 Dissertation Structure

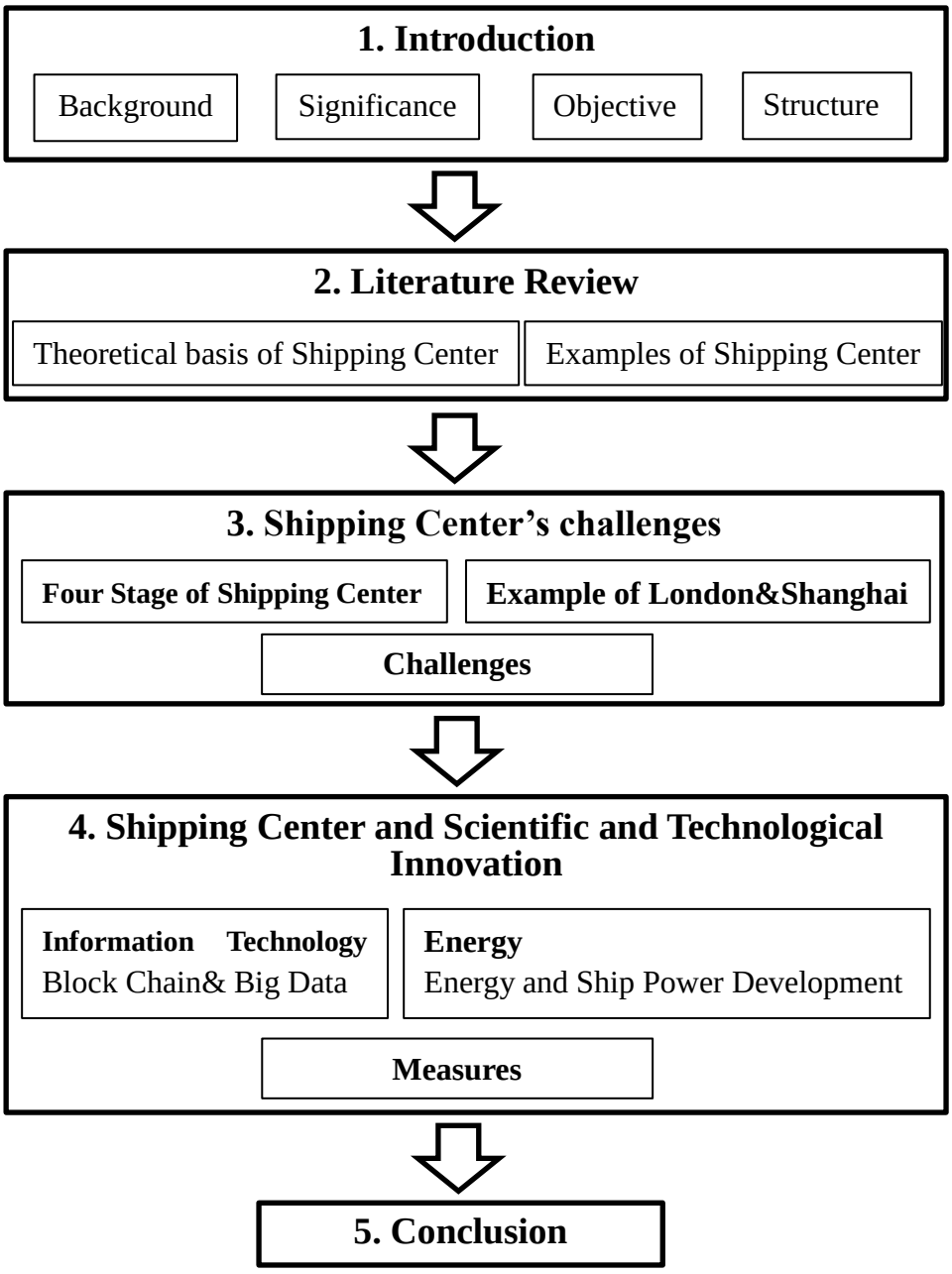

Figure 1 Dissertation Structure

2. Literature Review

2.1 Theoretical basis of International Shipping Center

International scholars' research on international shipping centers is not as extensive as that of domestic scholars. Luo Ping and Yin Zhen define the International Shipping Center as "an international shipping hub with developed shipping market, abundant logistics and numerous routes, flights and ships. It is composed of deep water channel, port wharf, unobstructed collection and distribution conditions and other hardware. It is guaranteed by perfect service and management software.

Zhou Lingyuan defines the international shipping center as "a shipping hub in a port group of an international economic region with complete shipping elements and scale, advanced times and relying on the regional economic center city, which is the core of the international economic region"

Professor Ma Shuo of the World Maritime University believes that "the International Shipping Center is a world-wide competitive city for service-oriented and knowledge-based shipping businesses characterized by international liquidity, thus having a large market share and leading international rankings in these areas."

Overall, International shipping center is a comprehensive concept of functionality. It is an international shipping hub based on the developed shipping market, abundant logistics and numerous airline flights, which is generally relying on international trade, finance and economic centers.

It has the following characteristics. First, the international shipping center is a port group with a large and modern deep-water port as the hub. It is not a general port. That is to say, the port is not necessarily an international shipping center, but the international shipping center must include a strong shipping service system. Second, it refers to a wide and global network of international routes, or ports that mobilize global routes, with a wide range of global routes and service coverage. Third, the international shipping center supports not only the global shipping industry, but more importantly, the powerful modern logistics system that supports the shipping industry, forming value-added services, processing services, multimodal transport and distribution services, and door-to-door services. Fourth, the international shipping center has the role of industry. The operation of the international shipping center is not only the development of the shipping industry itself, but also the multiplier effect of the advanced manufacturing industry and the modern service industry driven by the shipping industry.

There are three major international shipping center modes in the world. The first one is to provide market transactions and shipping services, whose representing the port is London. The second type is the transit mode of the main function represented by Hong Kong and Singapore in China. The third type is mainly for the distribution of goods in the hinterland, representing the port is Rotterdam and New York.

2.2 Examples of shipping centers

2.1.1 London's maritime center

As an old shipping center, London has good cultural and historical conditions. London's shipping service industry is highly developed, with thousands of large-scale shipping service enterprises, providing all-round modern shipping services, including ship registration and trading, shipping transactions, maritime financing, maritime litigation and arbitration, training of shipping personnel, and the exchange of shipping industry, firmly occupying the dominant position of the international shipping center. At present, more than 1,750 shipping companies and institutions worldwide have offices in London. Among them, the value created by shipping services alone is 2 billion a year.

2.1.2 Hong Kong's maritime center

Hong Kong is not only the international financial, commercial and trade center of the Asia-Pacific region, but also the most important international shipping center of the Asia-Pacific region. Since the return of Hong Kong in 1997, the volume of Hong Kong's international hub port and international aviation center, which constitute the international shipping center of Hong Kong, has continued to show a steady growth trend. What’s more, the reform and opening-up of the Mainland and the development of export-oriented economy in the Pearl River Delta region play a vital role in the growth of the volume of Hong Kong's international hub port and international aviation center.

2.1.3 Singapore's maritime center

Singapore Port is located in the Malacca Strait, known as the "Oriental Crossroads". It has a very advantageous geographical position and is a natural deep-water shelter port. Because of its small economic hinterland, Singapore does not have much direct foreign trade transportation, but takes the overseas hinterland as its main economic hinterland, and takes the international trade goods of other countries or regions as its main object of service. Like Hong Kong, Singapore, as an emerging international shipping center in Asia, implements the world's most open free trade policy, owns

large-scale machinery and equipment, advanced electronic technology, advanced management technology and high-quality personnel, as well as a unique deep-water port, highlights transit trade and its transit transport, making its container throughput rank third in the world. Now the Singapore Port has established business links with more than 600 ports in more than 120 countries and regions in the world. About 430 flights are sent to all parts of the world every week, providing cargo owners with a variety of routes.

2.1.4 Rotterdam's maritime center

Rotterdam, the Netherlands, is located in the delta formed by the confluence of the Rhine and Maas rivers. It is backed by the Netherlands, Germany, Switzerland and other developed countries in the Rhine Valley, with a population of 150 million in the surrounding 500km. Rotterdam is a global economic hinterland-type international shipping center. 43% of US exports to Europe and 34% of Japan's exports to Western Europe are transited through Rotterdam [8]. The volume of goods handled by Rotterdam in Germany exceeds the total throughput of its domestic ports.

2.1.5 Shanghai's maritime center

Shanghai is located in the center of China's north-south coastline and the throat of the Yangtze River entering the sea. Shanghai Port is committed to building an international hub port linking rivers and seas and radiating the whole world. Its position as the main force in the construction of Shanghai International Shipping Center has been further highlighted and its status has been continuously consolidated. Shanghai Port has become the port with the most container routes, the densest flights and the widest coverage in China. It has trade with more than 500 ports in more than 200 countries (regions) of the world. At present, there are more than 260 international liner routes and more than 1200 international flights per month. The container throughput of Shanghai Port has remained the first in the world for eight consecutive years, reaching 40.23 million TEUs in 2017.

2.3 Summary

With the development of globalization, the role and position of shipping industry in technological and economic development has undergone profound changes. As a key link in the comprehensive transport chain, shipping center has been playing a more and more important role in strategy. It has become an important support to effectively maintain the dominant position of international competition. Science and technology

are the first productive forces, which play an extremely important role in the development of shipping centers.

The port is the core carrier and driving force of the shipping center, and it also enhances the core competitiveness. Since the early 1990s, the United Nations Conference on Trade and Development (UNCTAD) has put forward the concept of intergenerational ports - the first, second, third and fourth generation ports. Wang Nuo and others compiled and published together. This article describes the basic characteristics and development progress of intergenerational ports, and deeply analyses the laws and essential characteristics of the evolution of different generations of ports. Liu Yangyang and others systematically discussed the intergenerational division of ports, emphatically analyzed the influencing factors of intergenerational division of ports, and based on the analysis of Qingdao Port as a realistic basis, put forward the development strategy for Qingdao Port. Huang Qiaomei believes that the logistics center is the carrier of the third generation of ports, and the industrial base is its support. The third generation of ports is a new type of port which integrates technology, information, international commodities and capital. Wu Penghua believes that the fourth generation port should be a port integrating science and technology, supply chain logistics, collaborative competition, green and so on. Li Xiangwen put forward the development model of the fifth generation port,

which is a collection of various innovative technologies and can reflect the brand-new port logistics service model. He pointed that the fifth generation port is an intelligent port of the Internet of Things, and at the same time incorporates the modern concept of energy-saving, low-carbon, green and environmental protection, so that the resources involved in port logistics can form a state of interconnection, which forms a new port development mode, which can integrate logistics, environmental wisdom, port Internet of Things and so on.

The shipping center can not only confine itself to the perception of container deep-water ports, but also pay attention to the changes of port throughput. It is generally a carrier of cities or urban agglomerations, representing the agglomeration of shipping-related industries. It is the most effective way to speed up technological innovation and improve the competitiveness of shipping centers.

3. Shipping Center’s challenges

3.1 Introduction

With the development of world economy and international trade, the progress of science and technology and the development and change of information technology, the connotation and function of international shipping center are also adjusted and

changed accordingly. Generally speaking, after three stages of development, i.e. transitional shipping, value-added processing and integrated resource allocation, the international shipping center should develop to a higher level. And every shipping center presents various opportunities and challenges at every stage.

3.2 The Development of Shipping Center

3.2.1 First Stage

The earliest international shipping centers were formed in the early nineteenth century and lasted until the middle of the twentieth century, such as London, England, Rotterdam, Netherlands and so on. At that time, the geographical location of the international shipping center mainly distributed in the European continent, because the geographical location of the European continent is quite superior, rich in marine resources. And it was also the economic, cultural, political and military gathering area in the world at that time, which had a dense urban population and labor force, which created conditions for its development into a hub area of international freight transport and distribution. Therefore, the transformation of international shipping centers in transportation is one of the most important characteristics of the first generation of international shipping centers, so the international shipping centers are passive when they are engaged in the distribution and transfer of international goods.

During this period, the construction and development of shipping centers had been strongly colonized by Western powers. On the one hand, the early international shipping centers such as London, New York and the United States all developed on the basis of colonies and spheres of influence controlled by their own countries. Through a series of direct and indirect means, European and American powers closely linked the trade and shipping between overseas colonies and suzerain countries, and then developed an international shipping center on this basis, which served as the starting point for colonial control and plunder. On the other hand, in order to plunder and control the overseas colonies and spheres of influence in the early colonial process, the Western powers also preferred to choose important overseas transportation routes for development and construction. For example, Britain chose Singapore (Strait Colony) and Hong Kong in Asia as bases for Southeast Asia and East Asia, and endowed them with a free port policy.

In this stage, the main functions of the shipping center are ship transfer and cargo distribution, mainly through the provision of cargo storage sites, port transshipment equipment and distribution channels to play its role. At that time, it was greatly influenced by nature, relying on terrain to build ports, human resources could not resist the power of nature, social and industrial development was expanding, and the scale of economy was increasing day by day, but the rapid increase of population

also increased the pressure on the city.

3.2.2 Second Stage

With the end of World War II, international shipping centers have risen rapidly. From the 1950s to the 1980s, the U.S. economy continued to prosper, the European economy recovered markedly, and the rapid economic development of East Asia. In such an international environment, the mode of container transportation by sea has gradually begun to rise. With the development of the times, the development of international shipping center has entered a new course. The second generation of international shipping centers appeared, such as New York, Tokyo, Hong Kong, Singapore, Rotterdam and so on.

During this period, the whole world is basically in a state of peaceful development and comprehensive economic construction. Global economic development also needs international production, trade, processing and cooperation. Therefore, processing value-added international shipping center is an important feature of the second generation international shipping center.

Due to the change of world economic structure and the rapid development of air transport industry, major shipping centers need to carry out functional transformation

urgently. In order to meet the market demand and economic development, product processing, packaging classification and marketing are gradually emerging. As a result, a large number of factories flooded into the city, further threatening the environment.

3.2.3 Third Stage

Subsequently, due to the gradual prosperity of the Asian economy, especially the rise of the four Asian dragons and the vigorous development of China's economy, the development direction and geographical location of international shipping centers are changing. Hong Kong, Singapore, Pusan, Shanghai, Kaohsiung and other large port cities belonging to Asia are obviously transforming into international shipping centers marked by international container transport. Of course, the development and growth rate of old port cities such as New York in the United States and Rotterdam in Europe have not weakened. In addition, London in Britain still occupies an important place because of its unique role in world shipping history. In this way, on the basis of continuous development and improvement, the third generation of international shipping center has gradually formed. From the distribution of geographical location and the development of the times, it can be seen that since the 1980s, due to the development of global economic integration and the rapid formation of market integration, multinational enterprise groups represented by the world's top 500 have

been widely organized to produce, sell and transport products around the world.

This stage is mainly based on modern information and globalized international services. It requires shipping centers not only to pay attention to the distribution of goods, but also to cooperate with international production allocation. Due to the influx of a large number of data from various aspects, shipping centers should not only maintain their own production efficiency, but also adapt to the trend of information revolution and production integration.

3.2.4 Forth Stage

The fourth stage started in the 21st century and has been developing up to now. It is characterized by taking the port as the center, the city as the main body, relying on the policy of free trade, and developing into the gathering place of economic and trade activities. It is a brand-new model facing the future of the 21st century, with the key features of low-carbon environmental protection and intelligent development.

It means not only to save energy and protect the environment in the port city, to have clean fuel fleet, but also to become the trading center of marine carbon emission resources in the region.

3.3 Introduction of London and Shanghai Shipping Center

3.3.1 London

London is the capital of Britain, the largest city in Britain, and the earliest international shipping center in the world. It was the largest city in the world in the 18th and 19th centuries. London has been the political center of England since the 7th century. In the mid-17th century, after England and Scotland merged into one country, London rapidly developed into the capital and the largest trade center in Britain, the service trade center and the handicraft production center, which laid a solid foundation for becoming an international shipping center. At the end of the 18th century, the textile industry and mining industry were the leading industries in Britain after the first industrial revolution. A large number of industrial cities, such as Birmingham and Manchester, have risen rapidly with London as the center, providing a reliable hinterland supply guarantee for London to develop into an international shipping center. The transformation of urban economic growth mode from traditional industry and commerce to mass production of machines has directly brought explosive growth of urban population and improvement of employment rate. In the 1930s, Britain entered the era of railways. Railway transportation replaced waterway transportation as the main mode of domestic transportation in Britain. As London is located at the intersection of the domestic railway network and ocean

transportation network, its hinterland has been greatly expanded. London has become the gateway of Britain to connect the two markets at home and abroad. London Port has developed rapidly and has become the largest port in the world. In order to maintain the activity of shipping transaction information, London established the famous Baltic Shipping Exchange. Over a long period of time, the rapid development and construction has brought great changes to London. The rapid expansion of population has led to the disorder of urban order, which is very crowded and noisy. In order to maximize economic benefits, the government has continuously increased investment in industry, discharged wastewater and polluting gases, and neglected the protection of the environment. At the same time, the influx of a large number of data has made the relevant personnel in the cumbersome paperwork, information delays and losses occur from time to time.

Since the mid-1970s, the volume of shipping business in London has declined. After the ranking of cargo throughput has fallen to 30 in the world, the ranking of container throughput has hovered between 25 and 30 in the world. But London's shipping service industry is developing very fast, with thousands of large-scale shipping service enterprises. These enterprises can provide all-round modern shipping services, including ship registration and sale, shipping transaction, maritime insurance, maritime litigation and arbitration, shipping information consultation, training of

shipping personnel and exchange of shipping industry, thus successfully transforming London into a shipping service center.

3.3.2 Shanghai

The main port of Shanghai is located in Qinglong Town (today's Qingpu District), then turned to Shanghai Town, Liuhe Town. Because of the serious problem of sediment blockage in the harbor and the difficulty of ships' entry and exit, Shanghai Port has become the main port, built on both sides of the Huangpu River. According to the data, before the Opium War, the throughput of Shanghai Port had reached 1.2 million tons to 1.5 million tons, which not only enhanced the economic development, but also enhanced the exchange of advanced science and technology between countries. In the late 1970s and early 1980s, China implemented the policy of reform and opening up, which promoted economic development and foreign trade growth. At this time, Shanghai port area mainly distributes on both sides of Huangpu River. Its actual capacity is only about 80 million tons. Shanghai's container transport industry is in its infancy stage. The surge of port business demand has led to port overload operation. Problems such as fewer berths, fewer warehouses, and inadequate operational capacity of ports and pressure of ships are gradually emerging. In order to solve these problems, Shanghai Port has also constructed operation areas such as Guangang in Wujing section of Huangpu River, rebuilt wharfs such as

Xinhua and Yangjing, and upgraded cargo handling capacity.

Until December 1995, the Chinese government made a strategic decision to build an international shipping center in Shanghai, shifting the focus of the port from the Huangpu River to the suburbs of Shanghai. The Huangpu River has gradually developed from a single port function to a diversified one, developing science, technology, finance and tourism in an all-round way. The key to the government's planning and construction of Shanghai International Shipping Center is to build an international container hub port, which requires the construction of a deep-water port area with a depth of 15 meters. According to the basic characteristics and construction conditions of the new deep-water port site, relying on the international economic center city, good location advantages and economic hinterland, water depth conditions and considerable container throughput, the location of the deep-water port area of Shanghai International Shipping Center is determined in Yangshan port through scientific demonstration of various schemes.

Later, Yangshan Deep-water Port Area and Yangshan Bonded Port Area were opened at the same time, indicating that Shanghai International Shipping Center has achieved important stage results. Yangshan Deep water Port was completed by four phases of the project. The first three phases were divided into three phases from 2002

to 2012, with a total investment of 70 billion yuan, most of which were used for reclamation and land-making. The fourth phase wharf of Yangshan Port realizes the functions of full-site unmanned, full-system intelligence, 24-hour and all-weather work, and has become the largest single automation intelligent Wharf in the world, realizing the maximum development of shipping technology.

At present, Shanghai can only say that it has a weak global shipping resource allocation capacity initially, and how to enhance the relevant capacity will be an important issue requiring continuous innovation and breakthroughs. Although the Shanghai Shipping Exchange has been formally put into use and has established a shipping futures index, there is still a big gap between the Shanghai Shipping Exchange and the Baltic Shipping Exchange in terms of information quantity, electronic informatization and popularity. What’s more, the industrial enterprises brought by the port also have a great impact on the environment and people's lives. Environmental problems cannot be ignored.

3.4 Challenges

The early London international shipping center city has not yet developed into a certain scale, land is abundant, port and wharf construction is arbitrary, lack of consideration of environmental factors. Later, Shanghai was preparing to build an international shipping center. Human beings have begun to realize that the

transportation activities of shipping centers have a negative impact on human society. However, the construction of port terminals still pays attention to economic benefits, ignores economic efficiency and environmental protection, and lacks the consciousness of harmonious development.

On the issue of sustainable development, all walks of life in today's society attach great importance to sustainable development, pay attention to scientific and rational planning of infrastructure, and advocate the development of shipping centers without destroying human living environment. It can be said that the deferred transformation of international shipping centers in different periods will bring about changes in their connotations and denotations, thus making the international shipping centers more colorful, which is also the result of the shipping centers keeping pace with the times.

Shipping center industry develops rapidly, data is miscellaneous, and urban environment is also damaged and polluted. In short, how to use scientific and technological means to improve the economic benefits of ports and build green low-carbon ports are still hot issues of concern.

After describing the four stages of shipping center and two examples of London and Shanghai, it can be concluded that the greatest challenge of shipping center is

efficiency and sustainable development.

A large number of paper documents and materials increase a lot of unnecessary workload, and the paper plate is easy to be damaged or lost, resulting in incomplete or lost data. A large amount of data in shipping needs to be saved as a source of analysis and prediction, and miscellaneous data will increase workload and error rate. In addition, paper vouchers need human transmission, which can easily lead to delays and loss of information. A large number of data need to be processed and analyzed by gong, which greatly reduces the efficiency of work and increases the error rate of work.

In the past, people only paid attention to improving economic interests, developing energy, developing industry and building equipment, but neglected these practices to the environment. Ships may unintentionally discharge some pollutants into the ocean during their operation, which will seriously affect the harbor seabed environment and deep-sea biological communities. The waste and gas generated during the operation of ships will have a significant impact on the water and air quality of ports, and will damage the human body and the ecological environment. These problems are inherent in the traditional problems of each generation of shipping centers, and are the most direct pollution to the environment. At present, most ships still use diesel as

power fuel, which means excessive emissions of carbon dioxide and sulfides, thus polluting the atmospheric environment. The incomplete use of energy by ships can lead to the emission of harmful gases, which poses a threat to the air quality of shipping centers and people's lives.

Table 1 Some Challenges

	Challenges
Efficient	Paper Bill are Easily Lost or Counterfeit
	Too Much Historical Data to Seek
	Delayed Transmission of Data in Each Link or Department Affects the Working Process
Sustainable	Traditional Energy has a Negative Impact on the Environment
	Existing Ships Emit Excessive Harmful Gases from Their Energy Sources

4. Shipping Center and Scientific and Technological Innovation

4.1 Information Technology

4.1.1 Introduction

Since the establishment of human society, information has also come into being. The connection of all things is essentially the transmission of information, and the driving

force is information technology. About 300,000 years ago, language has become an indispensable tool for people to exchange ideas and disseminate information. Subsequently, the emergence of paper and printing set off a revolution in information technology, symbolizing the preservation and transmission of information. In the 19th century, the emergence of telephone, radio, and television enabled humans to enter an era of using electromagnetic waves to spread information. It has improved the speed and accuracy of information collection, processing and dissemination in various fields of society, and directly accelerated the pace of human progress to the information society. It is a milestone in the history of science and technology development. In the 1960s, the use of computers and Internet marked the popularization and application of computers and the organic combination of computers and modern communication technologies. Computer simulation experiments have replaced part of the brain's thinking function and improved human's ability to deal with things. The emergence of the Internet has brought information exchange into full play. With the continuous development of science and technology, there are various ways of information transmission and storage. The following two kinds of information technology will be elaborated.

With the progress of navigation science and technology, navigation has gradually developed from technology to science and technology, from geographic and

astronomical navigation era to electronic navigation era. Ship automation has developed from engine room automation to driving automation. In recent years, the new type of ships built can basically be called automated ships, some of which are called "high-tech ships". Traditional landmark and astronomical positioning methods have also been transformed into radio navigation positioning and high precision satellite navigation positioning.

Now people have entered the Internet era, that is to use information and communication technology and Internet platform, so that the Internet and traditional industries are deeply integrated to create a new development ecology. It represents a new social form, that is, to give full play to the optimization and integration role of the Internet in the allocation of social resources, to integrate the innovative achievements of the Internet deeply into all areas of society, to enhance the productivity of the whole society and the ability of scientific and technological innovation, and to form a broader new form of economic development based on the Internet as the basic facilities and tools.

Big data and cyberspace form a digital world, interacting with the real world, triggering and causing changes and innovations in social and trading systems and related rules. In this brand-new era, whoever has grasped the valuable new

generation of information technology such as Internet, big data, artificial intelligence and block chain, will have the differentiated competitiveness and competitive advantage of the market. With the emergence of new information technology, ocean shipping industry, as a traditional industry with a long history, is bound to enter a new era of digital shipping. Nowadays, the competition among the world's major shipping centers is becoming fiercer, sprinting into the leading position of global shipping and expanding the share of shipping business. As a result, leading shipping giants have accelerated the integration of industry and technology in order to enhance their comprehensive strength and competitiveness in the international shipping field. The in-depth analysis and study of the contemporary information technology and social environment represented by big data and block chains is an important basis for ocean shipping enterprises to formulate their development strategies, and also an important basis for ocean shipping enterprises to think about the future.

4.1.2 Block Chain

Block chain is an accounting mechanism based on chain data structure and distributed computing architecture. Compared with the traditional centralized system with single core, tampering and hard to prove, block chain has many advantages. The system uses peer-to-peer network and peer-to-peer status of each node in the chain.

The interactive use of data is realized through distributed consensus mechanism. In addition, block chains form a consensus among nodes through mathematical algorithms. New data need to be agreed by more than 50% of nodes before it can be written into block chains and tampered with, so it is extremely difficult to tamper with and forge. Block chain system is built on the basis of privacy protection, open and transparent data access mode, accounting data to all nodes at zero cost to open queries, thereby reducing the trust cost of nodes and system uncertainty. Based on the supervision of intelligent contracts, block chains coordinate the data exchange of each node through a fixed mechanism. Because nodes adopt the same network, both sides of the transaction do not need the endorsement trust of the third party, and realize the data exchange without providing privacy data, which greatly protects the privacy of users.

Because of its advantages, block chain technology has been widely used in the field of financial security, such as the Nasdaq Exchange LINQ trading platform based on block chain technology and the LINUX Foundation Hyperledger project.

In logistics supply chain, all parties in the block chain can obtain a transparent and reliable unified information platform, which can view the status in real time, reduce logistics costs, trace the whole process of production and delivery of goods, and thus

improve the efficiency of supply chain management. When disputes arise, proof and tracing become clearer and easier.

4.1.3 Big Data

Big data is a data processing and application model based on cloud computing. It is a data set composed of huge amount, complex structure and many types of data. It forms intellectual resources and knowledge service capabilities through data integration and sharing, cross-multiplexing.

In recent years, the story of big data effects overturning traditional business models has been repeated, and new business models have emerged: from the success of Uber and Alibaba to the current integration with emerging technologies, such as industrial 4.0, intelligent manufacturing and driverless technology. It can be said that big data has become another active factor in the global economic transformation.

Big data has a wide range of influence in the shipping industry. Relevant parties in the whole industry chain, from shipyards, ship-owners, brokers, cargo owners, even banks and insurance, are gradually exploring the use of big data products to improve their decision-making and management systems. However, it is worth noting that

these applications are not all realized at present, only some are skilled applications, and a considerable part of them are only at the beginning and not yet at the foot stage.

4.1.4 Some Measures

Nowadays, with the rapid development of information technology, the shipping market has gradually integrated information technology to form an information shipping pattern. The development of information technology not only liberates human resources, but also greatly improves work efficiency.

With the rapid development of information technology, the work of shipping center is more and more rigorous and efficient. Paperless office has made outstanding contributions to environmental protection. The emergence of block chains and large data solves the problems of shipping data transmission, storage and analysis.

Table 2 Shipping Center Change

	Before Informatization	After Informatization
Shipping Center Status	Large workload, high data error rate and easy to lose, slow update of ship status, etc.	Paperless office, timely and reliable data sharing, high efficiency, etc.

Data Source: Self-summary

In the shipping industry, block chain has great application. There are some intermediaries between shipping enterprises and end users, such as freight forwarders and non-vessel carriers. After gradually opening up the multimodal transport logistics industry, shipping enterprises can use block chain technology to provide personalized services to actual customers, reducing the profit earned by middlemen or hiding some facts.

Block chains allow their users to update transaction records at any time. Since this is a decentralized record, there may be no delay in updating the ledger on the real-time location of the goods and the expected time of arrival at the destination. Traditional documentation methods require that copies be sent to multiple parties, such as the captain and the party receiving the goods. This is a costly and time-consuming task, as documents must be delivered manually to the place concerned before the date of receipt of the goods. Using block chains, you can simply create a digital ledger loaded into the shipment and all relevant information. Then, all relevant departments can easily access the public ledger. Since there is no paperwork to be done, the block chain eliminates delays and discrepancies associated with paperwork records. Once data is added to the block chain as a record, it cannot be modified, deleted or misplaced. Therefore, there will be no unnecessary delays that may disrupt freight transport.

Associated British Ports (ABP), a leading British port operator, signed a cooperation agreement with Marine Transport International (MTI), a digital logistics provider, to develop block chain technology for port logistics and enhance port efficiency and cohesion. ABP operates 21 ports in the UK, undertakes 25% of the UK's sea cargo handling capacity, and has business contacts with many ports and logistics companies around the world. Therefore, it is very important for the goods to flow quickly and smoothly. Participants in each link of the shipping supply chain, such as cargo owners, port operators and carriers, have their own systems. However, it is difficult to share all the data among these systems, so the relevant participants have to re-enter the data at each stage. MTI will provide a secure link between all different systems through block chain technology, thus changing the original inefficiency and realizing the sharing of "unique facts" among all participants.

Big data shipping applications can be divided into three categories: the first is real-time data applications, such as real-time data fusion calculation through navigation planning, ship real-time situation, meteorology and other aspects of data, real-time energy saving and emission reduction for the captain of the economic speed proposals. In addition, through the statistics of the passage volume, the congestion situation of the channel is calculated in real time, and the possible maritime risks are forewarned. It can also assess the supply and demand relationship of shipping market

and trade data of bulk commodities, and evaluate the health of the market in the industry. The second is the application of historical data analysis, such as shipping business and operation data mining, which provides good services for shipping enterprise market prediction, risk control, rental structure cost and benefit analysis. Through the analysis of production and operation data in shipping e-commerce platform, new business opportunities can be excavated and new industrial value created. It can also use the historical information related to maritime accidents to analyze the main factors that may cause the high incidence of accidents. The third category is the application of forecasting and analysis for future development. For example, based on the existing historical data and real-time data, it can forecast the distribution of transportation capacity in each trading region, the inventory situation of cargo in major ports, the trend of trade flow of major commodities, and the early warning of delayed arrival of ships.

Information promotes the shipping market and improves the level of port services. First of all, shipping transaction information can accurately grasp the law of price fluctuation and maintain the stability of shipping market. To a certain extent, it standardizes the shipping market, regulates and controls the irrationality of the operation of shipping enterprises, and promotes the development of shipping transactions. Shipping information enables port and shipping enterprises to grasp the

law of market changes in real time and understand relevant laws and policies, which is conducive to enterprises' decision-making. At the same time, it provides customers with market and decision-making information, improves market transparency and reduces business risks. In addition, the smooth flow of shipping information ensures the safety of shipping, improves the efficiency of shipping, and promotes better and faster operation of shipping. Shipping information promotes the improvement of service quality in shipping industry. At present, some foreign shipping companies have established management information system by means of information technology. Each branch has integrated network, grasped the company's production dynamics in time, and communicated with branches around the world in business information, statistical planning and decision-making analysis. This not only improves the level of shipping service, but also strengthens the dynamic monitoring of shipping production and operation activities, and promotes the coordinated development of shipping industry.

Strengthening the construction of information technology can effectively improve the soft power and operational efficiency of international shipping centers, thereby reducing costs, increasing the competitiveness of international shipping centers and attracting more sources of goods. Therefore, in the process of improving the soft power of the international shipping center, it is necessary to integrate the existing

resources, realize the sharing of information resources, and gradually form an international shipping information center matching the international shipping center.

4.2 Energy

4.2.1 Introduction

The natural world contains extremely rich and diverse energy resources, which are the basis for human survival and the driving force for social and economic operations. The constant change of the energy structure is an inevitable law of the development of human history. Mineral energy such as coal, oil and natural gas, and nuclear energy resources such as uranium are non-renewable primary energy sources, solar energy, geothermal energy, hydro energy, wind energy, bioenergy, ocean tide energy, etc. are renewable primary energy sources; Electric energy, hydrogen energy, etc. belong to secondary energy generated by primary energy. With the development of the world economy and science and technology, traditional energy sources have gradually transitioned to new energy structures. The history of human development and utilization of energy is the history of human civilization and progress. And it is also a continuous replacement of energy.

With the aggravation of marine environmental pollution, emission reduction and pollution prevention, as well as reducing the damage to coral reefs caused by ship

mooring, are increasing. There are more stringent regulations and restrictions on the emission of harmful gases such as ships. Green environmental protection and clean fuel have become the demand of the industry. IMO aims to reduce carbon dioxide emissions by 50% by 2050. In the face of the increasingly serious situation of ecological environmental pollution, in order to optimize the energy consumption structure, improve the atmospheric environment and realize the sustainable development of economic development strategy, people tend to clean and efficient ecological high-quality energy and fuel.

4.2.2 Energy Development and Ship Power

At first, ancient humans knew to tie tree trunks, bamboo poles, reeds and so on into rafts, or to use animal skins to make rafts, floating on the water. After the invention of steam engines in the 18th century, many people tried to use them on ships. Steam engine is a reciprocating power machine that converts steam energy into mechanical work. It needs a boiler that boils water to produce high-pressure steam, which can use wood, coal or oil as fuel. The experiment of using steam engine as propulsion power on ships began in 1776. By 1807, Fulton of the United States had made the first practical open-wheel propulsion steam engine ship, Clermon, through continuous improvement. Since then, steam engines have been used as propulsion power on ships for more than a hundred years. It was not until the advent of internal

combustion engines that the status of steam engines declined. Diesel engines are widely used because of their high thermal efficiency and low fuel consumption. After the advent of the diesel engine ship, it developed rapidly and gradually replaced the steam engine ship. Diesel engine power plant is still the main power plant on modern ships.

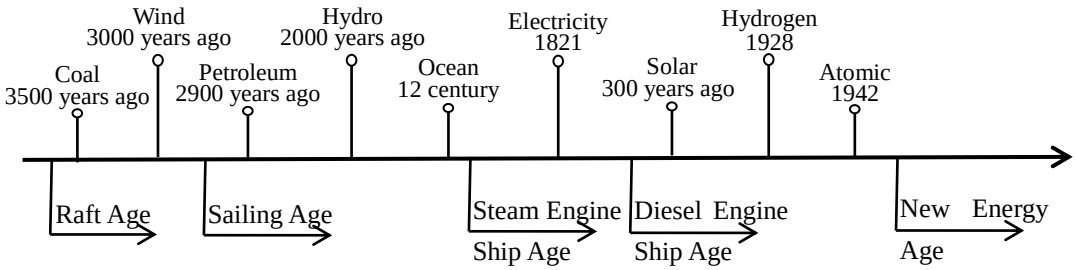

Figure 2 Developments of Energy and Ships

Liquefied natural gas (LNG) is an environmentally friendly marine fuel with methane as its main component. Relevant operation tests show that compared with heavy oil, LNG can reduce nitrogen dioxide emissions by about 80%, carbon dioxide emissions by about 25%, and sulfur dioxide and particulate matter emissions by zero. Compared with diesel fuel, SO2 emissions are zero, NOX emissions are reduced by 85%, and - 90% and CO2 emissions are reduced by 15%-20%. European and American countries are the pioneers in the development of LNG power ships. Since Norway began operating the first LNG power ship "Glutra" in 2000, more and more

LNG power ships have been put into operation and construction. Due to the lag of infrastructure construction and immature business model, the development of LNG power ship is not smooth. And more advanced technologies are needed to support its operation.

4.2.3 Some Measures

In order to build a green port, all regions have begun to promote clean and efficient port equipment. The port promotes the use of clean energy such as shore power by nearby ships, and promotes the transformation and elimination of cleanliness of port machinery whose discharge does not meet the standards. As a ship fuel, LNG releases less harmful substances than diesel, which means the improvement of air quality. So every country has invested a lot of money and talents in the research of LNG ships. For example, in line with the trend of global emission reduction, Singapore, as an important fuel loading port in the world, plans to provide LNG as fuel to ships by 2020, and plans to become the largest LNG marine fuel filling port in the world. Maritime and Port Authority of Singapore (MPA) has also set aside $8.4 million as a Maritime Innovation and Technology Fund to support the construction of new LNG supply vessels.

The International Chamber of Shipping (ICS) issued its annual report for 2019,

which elaborates on the most pressing issues facing the shipping industry. The report shows that the main concern is the Global Sulphur Limit, which will be implemented on January 1, 2020. Sulfur limitation decrees will greatly reduce sulfur emissions from the shipping industry and significantly improve environmental benefits, especially the health of coastal populations. At present, there are two ways to reduce sulfide emissions, using low-sulfur fuels or clean energy, and waste gas treatment systems (desulfurization towers). Desulfurization tower is a system designed to remove sulphide from main and auxiliary engine exhaust gas by water cleaning. The desulfurization tower sprays alkaline water into the exhaust port of the ship to remove SOx from the engine and exhaust gas of the ship. In the seawater system, the natural alkalinity of seawater can largely offset the sulfate produced in the desulfurization process. In the desulfurization process, the pH value of washing water is largely neutralized by the natural alkalinity of seawater. This ensures that the pH value of the discharged water conforms to the rules of the International Maritime Organization (IMO). The ocean is the earth's natural sulfur reservoir and plays a key role in sulfur cycle. There are three main types in the market, open-loop, closed-loop and hybrid. Ship-owners usually choose desulfurization towers according to the capital situation and the maneuverability of the ship type.

IMO has agreed to further discuss greenhouse gas emissions through a three-step

approach and to develop a road map to develop an integrated IMO greenhouse gas strategy by 2023. In April 2018, MEPC 72 adopted the Initial Strategy (IS) which aiming at decarbonize the ship as soon as possible. IS generally wants to reduce the carbon intensity of ships through the implementation of the further stage of the new ship energy efficiency design index (EEDI). In addition, the review of energy efficiency design requirements of ships should be strengthened, and the percentage of improvement for each type of ship at each stage should be determined as appropriate. Compared with 2008, by 2030, carbon dioxide emissions per transport job will be reduced by an average of 40%, aiming to reach 70% by 2050.

Ships are one of the worst fuel consumables in the world, mainly because the high resistance between the hull and the water slows down the ship's speed. They burn about 250 million tons a year and emit about 1 billion tons of carbon dioxide into the air. In a recent study, scientists from Bonn University and colleagues from St. Augustine and Rostock found that ships can save up to 20% of their fuel and thus reduce carbon dioxide emissions as a result of reduced resistance.

Table 3 Measures for Challenges

	Measures
Efficient	Paperless Office
	Real-time Monitoring and Storage of Analytical Data Using Big Data
	Data Sharing by Using Block Chain
Sustainable	Use clean energy, eg. LNG, nuclear energy
	Desulfurization Technology
	Reducing Ship Resistance and Fuel Consumption

Data Source: Self-summary

5. Conclusion

At the Global Climate Action Summit held in San Francisco last September, the World Port Climate Action Plan (WPCAP) was launched at seven of the world's largest ports, including the European ports of Rotterdam, Antwerp, Barcelona and Hamburg. The goal of WPCAP is to take concrete actions to accelerate the reduction of carbon dioxide emissions. These include low-carbon marine fuels, decarburization of cargo handling facilities, power-to-ship solutions, the use of digital tools to improve supply chain efficiency, and the promotion of common and ambitious emission reduction policies in larger geographic areas.

So far, these seven shipping centers have begun to pay attention to the following

actions, and increase the efficiency of scientific and technological innovation, in order to achieve the goal at an early date.

First, we need to use digital tools to improve the efficiency of the supply chain. Secondly, we will accelerate the development of renewable power-2-ship suspension solutions and other zero-emission solutions. In addition, it is also important to accelerate the development of commercially viable and sustainable low-carbon fuels for marine transport and electrified ship propulsion systems for infrastructure. Efforts should also be accelerated to completely remove carbon from cargo handling facilities at our ports.

Innovation in science and technology can improve the utilization of resources, realize the maximum value of fuel, and reduce the emission of harmful gases. The discovery and utilization of new energy is the most important key in today's world shipping industry, and accelerating the technological development of new energy is also the first priority.

Table 4 Challenges and Measure

	Challenges	Measures
Efficient	Paper Bill are Easily Lost or Counterfeit	Paperless Office
	Too Much Historical Data to Seek	Real-time Monitoring and Storage of Analytical Data Using Big Data
	Delayed Transmission of Data in Each Link or Department Affects the Working Process	Data Sharing by Using Block Chain
Sustainable	Traditional Energy has a Negative Impact on the Environment	Use clean energy, eg. LNG, Nuclear Energy
	Existing Ships Emit Excessive Harmful Gases from Their Energy Sources	Desulfurization Technology
		Reducing Carbon Dioxide Emissions

Data Source: Self-summary

By promoting the development of Shanghai International Shipping Center in the direction of green and wisdom, Shanghai International Shipping Center is accelerating the pace of transformation and upgrading. At present, the use of shore power in Shanghai Port can reduce the pollutant emissions by up to 95% each time ships dock. In addition, Shanghai has also achieved remarkable results in the control of pollutant emissions from ships. On April 1, 2016, Shanghai Port took the lead in implementing the first phase of the control work of the ship emission control zone. After the implementation of the control measures, the city's sulfur dioxide concentration decreased by 15% year on year.

Shanghai Port should speed up the promotion and application of shore power facilities, promote the application of LNG power inland ships, improve the utilization rate of clean energy for non-road mobile machinery in the port area, and fully implement the standard receiving and disposal system of pollutants from ships in the port. In addition, efforts should be made to build large data platforms for cross-border trade management and integrated service information platforms for container transport along the Yangtze River, comprehensively promote online acceptance of port business, and promote the electronic delivery of container equipment and bill of lading.

In order to enhance Shanghai's core competitiveness, it should strive to build an international shipping center with global shipping resource allocation capabilities. Shanghai Port should try its best to build a high level of innovation in shipping science and technology, and realize the transformation and development of shipping industry through the application of new technologies such as Internet, big data and intellectualization. Promote the coordination of hub port construction and urban development to achieve energy cleanliness, energy saving, pollutant control and intensive use of land resources.

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