

Research on the Construction of Smart Port based on the Double Circulation Pattern

-- Take Port of Ningbo-Zhoushan as an Example

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Abstract

Under the dual circulation pattern, in order to achieve domestic circulation and international and domestic circulation, it is necessary to play the role of connecting port trade. As a window of export-oriented economy, ports provide fundamental support for national economic construction and foreign trade. With the deepening of economic globalization, the spatial layout and industrial structure of modern ports have undergone changes. China's ports are large in scale and volume, but they also face problems such as low intelligence level, insufficient support from big data, lack of digital technologies such as 5G and Metaverse, and do not give full play to the advantages of large ports. Taking Port of Ningbo-Zhoushan as an example, there is still a gap between it and the world-class strong port.

Keywords

Double Circulation; Port of Ningbo-Zhoushan; Digital Level; Smart Port; 5G Technology.

1. Introduction

The current liberalization of the epidemic is undoubtedly a huge positive news for port foreign trade, with a stable start and a positive trend. Port of Ningbo-Zhoushan, as a large port with the largest cargo throughput in the world, currently has the problem of increasing empty containers. "Adhere to the first-class standard, build and manage the port well, strive to build a world-class strong port, and make greater contributions to national development." For six years from 2017 to 2022, Ningbo Zhoushan Port Terminal has achieved an annual container throughput of more than 10 million TEUs for six consecutive years, making it the second largest single container terminal in the world.

At present, Port of Ningbo-Zhoushan has the advantages of complete infrastructure, excellent geographical conditions, rich resources and large scale. Port of Ningbo-Zhoushan has a complete operating structure and a wide variety of goods. It is an important container ocean trunk port and an import reserve and distribution center of important Strategic material in China. It undertakes one third of the container traffic volume of International flight in the Yangtze River Economic Belt.

However, these achievements are not enough to benchmark the world-class strong port, so the Party Committee of Port of Ningbo-Zhoushan Group will continue to follow the spirit of the Secretary's important speech during his visit to Zhejiang, closely focus on the work goal of promoting high-quality development of enterprises with high-quality party building, overcome difficulties, create excellence and differences, seize every moment to be the "hard core", strive to create a new benchmark of world-class strong port, take a clear political stance, and give full play to the leadership and creativity of party building. And while achieving the goal of becoming a world-class strong port, we will also achieve intelligent construction of the port.

In today's world, building a Smart port has become the mainstream direction, which is an important way to improve China's port service level, port management mode and improve the international competitiveness of ports. During the construction of Smart port, emerging technologies such as 5G, artificial intelligence, Big data analysis, and the currently hot Metaverse and ChatGPT concepts can play an important role and play a key guiding role in the further upgrading of Smart port in the future. Focusing on the key points and shortcomings in the process of port construction, this paper proposes solutions, discusses the construction and development of emerging technologies and Smart port, and hopes to provide some useful directions for the future construction of Smart port.

2. Analysis of the Current Situation and Problems of Ports

2.1. Low Level of Integration and Low Overall Score

The comprehensive scores of the top 10 cities in the comprehensive ranking of international shipping centers in 2022 are listed in Table 1.

Table 1. Top 10 Cities in the Comprehensive Ranking of International Shipping Centers in 2022

Serial Number	City (Port)	Country/Region	Comprehensive score
1	Singapore	Singapore	94.88
2	London	Britain	83.04
3	Shanghai	China	82.79
4	Hong Kong	China	79.15
5	Dubai	UAE	75.74
6	Rotterdam	Netherlands	73.85
7	Hamburg	Germany	73.07
8	New York New Jersey	United States	72.58
9	Athens Piraeus	Greece	68.67
10	Ningbo Zhoushan	China	66.12

2.1.1. The Institutional Mechanisms are Relatively Traditional

Table 2. Comparison between Port of Shanghai and Port of Ningbo-Zhoushan in 2020

Category	Port of Shanghai	Port of Ningbo-Zhoushan
International shipping companies	59 companies	18 companies
International Ship Management Enterprise	110 companies	7 companies
Classification Society	There are a total of 22 foreign classification societies in China approved by the Chinese maritime authorities, including 14 foreign-funded classification societies headquartered in Shanghai	11 companies
Maritime arbitration cases	214 pieces	Almost none
Shipping financing loan	Over 100 billion yuan	Over 18 billion yuan
Shipping brokerage enterprises	27 companies	0
Shipping consulting enterprise	Shanghai Shipping Exchange, Shanghai International Shipping Research Center, and Shanghai Transportation Port and Shipping Development Research Center	Ningbo Airlines Exchange
Shipping insurance companies	59 Property insurance companies operate direct insurance services in Shanghai	1 East China Sea Shipping Insurance Company

At present, the integration of Port of Ningbo-Zhoushan is far from being realized, and the port integration has not yet been in place. From the current situation of port operation, the integration of Port of Ningbo-Zhoushan is still a loose and extensive model, and there is no effective internal integration of various resources of the port. Moreover, the two ports belong to different competent departments, so their management and operation do not need to be coordinated uniformly, resulting in relatively weak integration efforts and inability to optimize the allocation of port resources. See Table 2 for the comparison between Port of Shanghai and Port of Ningbo-Zhoushan in 2020.

2.1.2. Overall Lagging Development of Shipping Services

Compared with Port of Shanghai, the overall development level of shipping services of Port of Ningbo-Zhoushan is relatively backward, and there is also a contradiction between supply and demand of cargo transportation. Up to now, the shipping services of Port of Ningbo-Zhoushan are mainly concentrated on cargo handling and transportation, lacking perfect services related to port production such as tugboat berthing assistance, wharf leasing, Shipping agency and logistics. The number of shipping financing loans, shipping brokerage enterprises, shipping consulting enterprises and shipping insurance enterprises is far behind Port of Shanghai, and some urgently high demand service functions need to be improved, such as shipping finance, insurance, design consulting Maritime arbitration and other businesses in Port of Ningbo-Zhoushan are still in the initial stage, unable to meet customer needs, and have less coupling and narrow application scope.

2.1.3. Integrated Interconnectivity with Low Efficiency

In terms of port customs clearance, the services are cumbersome and cumbersome, and there is a situation where shippers need to travel from different places to declare customs, greatly reducing efficiency. In addition, the transit goods imported and exported from Port of Ningbo-Zhoushan have the problem of low efficiency of customs clearance services. The cumbersome procedures, repetitive operations and insufficient supervision are the problems that Port of Ningbo-Zhoushan is facing, which is also a great opportunity to strengthen and expand the port economy.

2.2. Low Level of Digitalization in Equipment and Operations

The comparison and comparison of various ports in 2022 are shown in Table 3.

Table 3. Comparison of Ports in 2022

Port	Country	Characteristic
Tuas Large Port	Singapore	The port has fully realized the automation of docks, docks, and storage yards, and adopted fully automated AGVs for implementation
Shanghai Yangshan Phase IV	China	Use remote control of quayside bridge and yard bridge to realize automatic management and control of the port, and also use Automated guided vehicle to greatly improve the automation of the terminal
Amsterdam	Netherlands	Improved asset management and monitoring of its flow, and adopted unique professional technology applications in waste management
Hamburg	Germany	Using real-time monitoring and navigation, and utilizing professional technology to obtain shore power from renewable energy sources, as well as using mobile GPS sensors to locate and manage intelligent fleets
Barcelona	Spain	The use of a storm warning system to timely monitor sudden adverse weather conditions and the use of intelligent systems to quantify the movement trajectory of goods
Los Angeles	United States	By collecting real-time data from the port ecological environment, analyzing Big data, and then searching and integrating, the efficiency of the supply chain is improved and the error rate is greatly reduced

2.2.1. The Terminal Management System is Outdated

So far, the core technology of container terminal management systems in the world is mainly mastered in developed countries in Europe and America. Although Port of Ningbo-Zhoushan has gradually approached the world's leading position in the field of automation and intelligent port development in recent years, there is still a certain distance between the container terminal management system and developed countries. Firstly, there is the problem of information silos between systems. Due to the disunity of equipment standards adopted by each module, some subsystems can not realize information sharing, which makes it impossible for the terminal to realize full digitalization. Secondly, there is a problem of insufficient performance in the existing system. Finally, there is a problem of high maintenance costs in the existing system. Therefore, with the development opportunity of Smart port, Port of Ningbo-Zhoushan needs to seize the opportunity to innovate the wharf and management system to break the original world monopoly layout.

2.2.2. Backward Level of Port Collection and Distribution

Compared with Port of Singapore, a world-class port, Port of Ningbo-Zhoushan has a big gap in port operation, which is still operated manually. As for the benchmark Port of Singapore, it had completed the construction of a semi-automatic wharf centered on automated loading and unloading of storage yards as early as 1997. The central control center can coordinate the overall coordination, achieve human-machine separation, remote monitoring, and automatic operation, which not only reduces manual labor intensity but also greatly improves the efficiency of port operation. In recent years, Port of Singapore has continued to promote the upgrading of port infrastructure, combined with Big data, the Internet of Things, intelligent control, intelligent computing and other technical means, strengthened the automation and digital control of terminal plane transportation operations, yard operations, road entrance and exit, and actively explored the scenario based application of emerging technologies such as data analysis, digital twins, AI, etc. While laying out the 5G communication network and smart grid in the port area, we also rely on the Next Generation Port Modeling and Simulation Center (C4NGP) to analyze port operation data, in order to obtain the optimal plan for improving port productivity. The use of Big data and artificial intelligence by Port of Ningbo-Zhoushan has not been specifically implemented in all aspects of port operation, which has not effectively combined the two. Therefore, Port of Ningbo-Zhoushan needs to continue to explore and move forward in high-tech layout and seizing the commanding heights.

2.2.3. The Application Level of Intelligent Devices is Not High

The Automated guided vehicle (AGV)'s own navigation characteristics lead it to be unable to meet the future development of intelligent ports. Port of Ningbo-Zhoushan still uses AGV at present, and there are shortcomings in the real-time, informatization and interconnection of intelligent containers. Now the concept of intelligent guided vehicle (IGV) is proposed. IGV uses the "satellite+sensor" mode for navigation, which has the characteristics of low cost, high precision and easy transformation, It is bound to become the mainstream tool of Smart port transportation in the future. Port of Ningbo-Zhoushan has not yet replaced AGV with IGV, which greatly reduces the efficiency of its cargo transportation. In addition to IGV, the current concept of container intelligence has been proposed. Port of Ningbo-Zhoushan is still in the exploration stage of container intelligence, which is not widely used in actual transportation. IGV and smart container are necessary professional equipment for building Smart port, and they need reasonable and correct application to build a world-class Smart port.

2.3. Low Level of Application of Emerging Technologies

2.3.1. Effectively Promote the Application of 5G, Metaverse, Chatgpt and Other Concepts in Combination with Reality

From the perspective of Port of Ningbo-Zhoushan itself, the current "smart" construction is still limited to the exploration and breakthrough of single business and single terminal, and the concepts of 5G, Metaverse, ChatGPT, etc. cannot be widely applied. In terms of extension scenarios, due to the lack of deeper collaboration and integration with the construction of related scenarios such as "Smart City" and "Smart Customs", effective smart linkage cannot be formed, resulting in insufficient spillover effects of port "wisdom", which greatly reduces the utilization efficiency of current emerging technologies such as 5G, Metaverse and ChatGPT. In terms of the construction of customs clearance, as the current Smart port construction is still in the state of "fighting on their own" of ports, cities, enterprises, regulators and other participants, the "smart chain" has not achieved closed loop, and the information has not achieved interconnection, leading to insufficient "smart power", and the application of 5G, Metaverse, ChatGPT and other concepts has lagged behind.

2.3.2. Insufficient Comprehensive and Efficient Application of Artificial Intelligence Technology

Artificial intelligence includes computer vision, machine learning, and intelligent decision-making. At present, Port of Ningbo-Zhoushan has deficiencies in the mastery of artificial intelligence technology, and there are hidden dangers in the safety production control end. On the application side, there is a lack of scheduling for production control systems and intelligent development of modules.

2.3.3. Lack of Big Data Analysis

Because of the increasing size of ships and port throughput, the amount of data generated by ports in the operation process is also growing rapidly. As an important node in the logistics chain, the data of ports' management operations, after being processed and analyzed by Big data, can guide their business in turn, and the port's scheduling, management and business contacts can also benefit. However, the application of Big data technology in Port of Ningbo-Zhoushan mainly focuses on some data collection and index calculation after the completion of the ship, and the functions of pre operation data collection, operation prediction, scheme optimization, intelligent decision-making, etc. are not perfect. At this stage, the Big data analysis system has achieved automation. Port of Ningbo-Zhoushan is relatively backward in collecting massive data of the whole process of container terminal operations and building an intelligent decision-making Big data knowledge base. There is a technical difficulty in breaking through the wisdom of port machinery and management.

3. Construction Measures of Smart Port

3.1. Promote Digital Integration of Port of Ningbo-Zhoushan

With Port of Ningbo-Zhoushan as the core hub, through digital and intelligent means, we will actively build four major channel systems, namely, north-south coastal (mainly water), north-west coastal (mainly river sea combined transport), west coastal (mainly sea river combined transport), and southwest coastal (mainly sea rail, sea road combined transport), to further promote the concentration and radiation of bulk cargo and container domestic foreign trade transport to Port of Ningbo-Zhoushan.

3.1.1. Innovative Institutional Mechanisms and Digital Empowerment

(1) Innovate the digital management system. Firstly, it is necessary to clarify the responsibilities of various departments in port development, clarify their relationships, utilize current artificial intelligence technology, unify control through management centers, use

artificial intelligence to manage port operations, and coordinate and orderly carry out various tasks according to system settings.

(2) Innovate regional coordination and cooperation mechanisms. In accordance with the requirements of the integrated development of Port of Ningbo-Zhoushan, from the strategic perspective of the whole city and even the whole Yangtze Delta, coordinate the planning of port coordination and cooperation in all administrative regions, actively participate in the construction of the port and shipping logistics system, clear up the obstacles to the coordinated development of the port, and finally build a grand blueprint for multi position division and coordinated development in the top-level design.

(3) Innovate the digital clearance mechanism of port customs. Utilizing 5G technology and Beidou navigation and positioning system, we strictly control the coastline, configure a government led and market coordinated model, accelerate the process of information exchange, mutual recognition of supervision, and mutual assistance in law enforcement among regulatory authorities, coordinate the relationship between the government and the market, and strengthen the concept of the same standards in Hong Kong.

3.1.2. Clarify Functional Positioning and Provide Precise Digital Services

In the process of developing ports, the government plays a leading role and plays the role of a navigator. However, currently, there are still problems such as inaccurate service positioning, insufficient efforts, and insufficient motivation. The government should follow the model of "government planning, enterprise operation, and on-demand construction", develop and firmly grasp key technologies and services, in order to greatly enhance competitiveness.

Big data makes the current service systematic, standardized and digitized. Port of Ningbo-Zhoushan can build a data platform to timely obtain specific transportation information around the port, closely link the port with the surrounding traffic routes, build the Internet of Things, cover the whole port area, and promote the customs clearance cooperation of the Yangtze River Delta Economic Belt.

Moreover, in actual operation, the port needs to expand its hinterland and improve its collection and distribution system. From the internal channel level of the port, strengthen the collection and distribution capacity of highways, railways, and waterways to support the hinterland economy. At the hinterland channel level, make up for the shortcomings of mainland transportation capacity, optimize container transportation, focus on transporting bulk goods, transferring raw materials, and building container trunk lines, focus on intermodal transportation between sea and railways, and cultivate the market.

3.1.3. Realize the Integrated Development of Port Industry City

Establish the concept of "port city interdependence and coordinated development", implement the policy of "freer than Free economic zone", and promote the integrated development of port industry city. Build a complete "ship, industry, and city" logistics information platform, connect with the national transportation and logistics information platform, connect with the government, ports, and related companies, improve communication efficiency, reduce work time, and greatly improve operational efficiency.

(1) Realize coordinated development with Port of Shanghai. The two ports are not far apart in terms of geographical location, and there is not much difference in information technology level. The planning strategy is highly consistent, and reasonable positioning is sought to effectively achieve the staggered development of the two ports, complementary progress, and achieve strong cooperation to jointly build a world-class digital port.

(2) Build a comprehensive port industrial system. From the perspective of the functional positioning of Port of Ningbo-Zhoushan, it is necessary to build a perfect port industrial system. This can save the transportation cost of raw materials, and vigorously promote the

development of the digital industry near the port, mainly in the manufacturing, service, and emerging industries.

(3) Expand the scale of the logistics industry. Take port logistics as the entry point for the integration of port industry city development, integrate logistics and express delivery markets, and form a logistics market system with complete services. At the same time, we will strengthen the introduction and training of talents, and improve the level of practitioners.

(3) Develop the shipping service industry. Focusing on the development of bulk commodity storage and container transportation, we will optimize and integrate the functional layout of the port area, and develop a fourth generation new port with reasonable layout, complete functions, and coordinated port city coordination.

3.2. Promoting Port Intelligence

3.2.1. Promote the Construction of Digital Terminals

The development of the new generation of Smart port shows the trend of more intelligent port operation, more collaborative port logistics supply chain, more convenient port trade, more scene based port data services, more open port business innovation, and more harmonious port ecosystem. The construction of the new generation Smart port of Ningbo Zhoushan Port is to comply with these development trends, from "catcher" to "leader".

First, promote the New Infrastructure construction of Smart port terminals. Make full use of 5G, cloud computing, the Internet of Things, Beidou navigation and other new generation of autonomous and controllable advanced technologies to accelerate the automation construction of Port of Ningbo-Zhoushan container terminal and bulk cargo terminal. The key point is to carry out the pilot project of Smart port construction of Meishan Port Area Phase II Project. According to the idea of "process intelligence + equipment automation", we will strengthen exploration from the aspects of remote control of large equipment in container terminals, 5G technology application, large-scale application of unmanned trucks, integration of internal and external management of intelligent tally system, intelligent dispatching system, etc.

The second is to improve the Terminal Management System (TOS), enabling the terminal to achieve intelligence, informatization, and modernization. TOS uses graphical technology to display real-time information on existing ports, such as container loading and unloading conditions, horizontal transportation processes, etc. The system can also help port managers manage and allocate existing resources reasonably, accelerate container loading and unloading efficiency, shorten container transit time at ports, improve yard space utilization, and reduce container terminal operating costs. Applying TOS to port terminals, focusing on key technologies such as port machinery, automated container terminal operating systems, remote operation and control technologies, and utilizing TOS to carry out key core technology research and development, develop a batch of port intelligent equipment and products with independent intellectual property rights, accelerate technology maturity and transfer transformation, and promote the combination of TOS and multi-sensor integration technology to innovate autonomous vehicles Drones and intelligent robots have new working modes in logistics loading, unloading, handling, delivery, sorting, transportation, and express delivery.

The third is to improve the construction of large-scale customs clearance for digital dock entrances. On the one hand, we need to deepen the "three mutual" customs clearance reform of information exchange, regulatory mutual recognition, and law enforcement mutual assistance among port management departments, innovate and promote specific customs clearance models such as "early declaration", "two-step declaration", and "ship side direct delivery". At the same time, we need to continue to accelerate the automation process of customs clearance equipment, increase the efforts of "machine replacement", compress customs clearance time, accelerate port inspection and release, and continue to reduce the detention time and costs of goods at the port. On the other hand, it is necessary to streamline administration and delegate

power to lower levels in port administration, actively promote online approval of port related projects, enhance the intermediary service capacity of port related approval, and achieve the goals of "Clipper card" and "running once is the bottom line, not running once is the normal, and running many times is the exception" for port and shipping enterprises.

3.2.2. Accelerate the Improvement of Digital Level of Port Collection and Distribution

With Port of Ningbo-Zhoushan as the core hub, through digital and intelligent means, we will actively build four major channel systems, namely, north-south coastal (mainly water), north-west coastal (mainly river sea combined transport), west coastal (mainly sea river combined transport), and southwest coastal (mainly sea rail, sea road combined transport), to further promote the concentration and radiation of bulk cargo and container domestic foreign trade transport to Port of Ningbo-Zhoushan.

One is to promote the digital development of multimodal transportation. We will coordinate the coordinated development of the "four ports" of seaports, airports, land ports, and information ports, and increase efforts to promote the transformation from scattered to centralized transportation, public to rail transportation, and public to water transportation. Focus on building a national sea rail intermodal transport demonstration port, deepen the Port of Ningbo-Zhoushan Zhejiang Jiangxi Hunan (Chongqing Sichuan) container sea rail highway multimodal transport demonstration project, and rely on the Ningbo Jinzhou Railway to carry out the double high container transport in the first place [2] and strive to achieve container sea rail intermodal transport volume of more than 2 million TEU. A number of landmark projects such as Hangzhou Shaoxing Ningbo Smart Expressway have been completed with high standards, promoting the wide application of technologies such as Vehicle-to-everything, driverless driving and vacuum pipelines, and accelerating the construction of high-speed, ubiquitous, smart and safe access facilities network.

The second is to improve the digital level of supporting facilities. Improve the foundation of port supporting facilities in multiple aspects, carry out digital reforms, optimize port logistics sites such as parking lots, container yards, logistics parks, freight yards, distribution management centers, etc., build a batch of smart logistics parks such as Beilun Huashi Lingang, and construct new core container loading and unloading supporting yards and transportation service bases. Use digital models to promote the reduction and intensive development of external storage yards and parking lots at the port, Ultimately, the operational efficiency of the container yard outside the port has been improved by more than 30%.

The third is to implement digital supervision of collection and distribution safety. Accelerate the construction of a collaborative system for port dangerous goods safety supervision, promote the application of AI intelligent analysis, Beidou satellite, and geographic information system, conduct cloud based intelligent analysis and judgment on people, vehicles, ships, ports, and other entities related to port dangerous goods, and achieve the standardization, standardization, and visualization of safety supervision data resources. Research and promote the application of "port security codes", provide security "portraits" of companies, facilities, and equipment, implement full process "code scanning" traceability for goods with risks, and implement "bright codes" for people, vehicles, and ships.

3.2.3. Correct and Efficient Application of Intelligent Guidance Vehicles, Intelligent Containers, and Other Intelligent Devices

Smart containers are used to detect unexpected container openings, confirm the expected opening time through programming, and check whether the opening time is consistent with the scheduled inspection time. If not, GPRS/3G can send an alarm, identify the cargo information, and timely transmit the container cargo and signing information to the traffic Safety management system (TSS) to realize the electronization of signing information, and then transport through the intelligent guided vehicle, The entire process only requires operations

on the digital end, greatly reducing labor costs and greatly improving the overall digital level of the port.

3.3. Promoting the Digitization of Port Construction

3.3.1. Accelerate the Construction and Application of 5g, Metaverse, Chatgpt and Other New Infrastructures and Concepts

At present, with the upgrading of communication and computing, VR/AR equipment, artificial intelligence and other fields, the form of immersive interaction is upgraded, and the independent virtual platform is gradually improved. The virtual world and the real world are interactive and integrated. The concepts of Metaverse and ChatGPT are quite popular. Smart 5G, Metaverse, and ChatGPT are new generation technologies that can be used by smart ports to form a platform based management system, featuring high-speed, low latency, and Dalian connection, It is a network infrastructure to realize human-computer and object interconnection. Through the construction and application of 5G, Metaverse, ChatGPT and other new infrastructures and concepts, it provides a more convenient application experience to meet the application needs of sensing and data collection. It can also apply 5G, Metaverse, ChatGPT and other new infrastructures and concepts to automatic handling equipment and auxiliary handling equipment to achieve accurate material identification, coordinated scheduling of mobile equipment clusters Remote real-time monitoring and other technologies. Moreover, based on the application of 5G, Metaverse and ChatGPT, research and application on intelligent aspects such as remote control, intelligent identification and positioning technology of large port machines will be carried out to jointly promote the informatization, automation and intelligence of Port of Ningbo-Zhoushan, create a "green, environmental friendly and efficient" global 5G Smart port business model, and promote the development of "data+", "intelligent+" port formats and business models. With the help of 5G, Metaverse, ChatGPT and other technological innovation data product supply, we will increase the proportion of value-added services, develop the concept of Big data port governance, obtain and insight into new business models, and can also conduct data interaction, connect people, ships, cargo, etc. with the virtual world, achieve full connection at the port, and combat the most urgent pain point of digital service scenario.

3.3.2. Utilizing Artificial Intelligence to Achieve Safe Production and Intelligent Scheduling of Ports

In terms of safety production, we will fully utilize computer vision and speech recognition technology to promote the integration and application of public and enterprise data, reshape business processes, innovate business scenarios, and promote the accelerated and leapfrog development of the port and shipping service industry. On the basis of achieving safe production, strive to build the digital port and waterway monitoring service platform into a typical application of multi cross collaboration in the field of digital economy reform throughout the province, in order to leverage and attract more international high-end shipping finance, multinational trade logistics enterprises, and professional logistics supply chain service providers to settle in Ningbo; In terms of intelligent scheduling, scenarios such as artificial intelligence planning for shore bridge work, berth allocation, single ship intelligent stowage, and intelligent storage yards are utilized. The experience data and simulation system of existing stowage personnel are utilized, along with machine learning and self training, to achieve efficient port scheduling. Relying on informatization, we implement refined management of planning and control, intelligently dispatch port logistics, greatly improve the level of informatization, and strive to achieve a double harvest of efficiency and efficiency.

3.3.3. Skillfully Use Big Data for Analysis

In the era of "Internet plus", port operation is more commercialized, management and business model become more transparent, and the new competitive advantage lies in the spillover effect of port business innovation, which is achieved through information difference. Promote ports to use Big data analysis to integrate port data, government data, customs data and other data, transform from a simple logistics transportation node to a full logistics supply chain platform and an international trade platform, strengthen the collaboration and linkage between upstream and downstream parties in the logistics supply chain, promote the organic integration of ports with trade, finance, industry, and innovate and expand port trade, port finance, data services and other business fields, Accelerate the construction of a comprehensive digital port and shipping monitoring service platform to promote the development of the port and shipping service industry. And use Big data to form the basic framework of digital port and shipping services: first, build a port and shipping service data center to gather multi subject data such as "cargo", "ship", "box" and "car", and then try to solve the basic problems of Port of Ningbo-Zhoushan such as "what goods are, where they come from, where they go, and how to go" through the convergence, mining and analysis of Big data; Third, use Big data to build a platform for government regulation evaluation and analysis and a platform for market applications and services. Through data analysis, achieve closed-loop monitoring of key elements such as "goods", "ships", "boxes" and "cars", and improve the level of digital supervision; Furthermore, we provide value-added services such as logistics related data status query services and industry analysis reports to meet the production and operation needs of the supply chain; Create a port and shipping service ecosystem covered by Big data.

4. Conclusion

Under the general pattern of "double circulation", Port of Ningbo-Zhoushan should always keep in mind the "hard core" mandate, grasp the opportunity of regional comprehensive economic partnership, strengthen the contact between domestic and foreign countries and regions, promote the development of foreign trade business based on the national development strategy, respond to the strategic layout of a unified domestic market, and strive to become a domestic north-south trade hub port and a world-class digital port. Play an important role in building a safe "dual circulation" cargo connection system both domestically and internationally. While building a Smart port through integration, intelligence and digitalization, we should also build a green port. Empower the digitalization of traditional industries with New Infrastructure, optimize the business environment with digital economy, assist in operation, build an advanced, intelligent, green and low-carbon international port, and strengthen the vanguard of the dual cycle of domestic and foreign trade.

Port of Ningbo-Zhoushan stands at the forefront of the development of the times, stands on the high platform of scientific and technological development, and focuses on the trend of future development. It embraces all rivers, has a broad view of the world, and stands at the forefront of the tide. It is just like the name card of Ningbo - "the ancient and modern books, and the port connects the world". It is innovative development, smart transformation, and building a world-class strong port.

References

- [1] Yuan Yuxiang, Sui Zhenying. Application Status and Development Trend of Emerging Technologies in Smart port [J]. China Water Transport, 2022 (03): 10-15.
- [2] Fan Shasha, Xu Ronghua. Progress, Problems and Countermeasures of Port of Ningbo-Zhoushan Integration [J]. Ningbo Economy: Sanjiang Forum, 2017 (10): 4-8.

- [3] Liu Changman, Zhang Chuanjie, Chen Weibo, et al. Development Trends of Key Technologies for Domestic Coastal Automated Container Terminals [J]. *China Ports*, 2021 (01): 17-23.
- [4] Wu Jiangtao. Research on Financial Services for Small and Micro Enterprises of Commercial Banks [D]. Jiangxi University of Finance and Economics, 2012.
- [5] Li Tan, Wang Li, Wang Yu. Research on the Efficiency of Port Logistics in Liaoning Province and Its Synergistic Development with the Hinterland Economy [J]. *Economic Geography*, 2012,32 (09): 108-113.
- [6] Zhou Bing. Research on Internal Control Process Design of Chinese Enterprises [D]. Southwestern University of Finance and Economics, 2014.
- [7] He Xiaoshan. Experience of Port of Ningbo-Zhoushan integration under supply side reform [J]. *Transportation Enterprise Management*, 2018,33 (03): 1-4.
- [8] Fan Shasha, Xu Ronghua. Progress, Problems and Countermeasures of Port of Ningbo-Zhoushan Integration [J]. *Ningbo Economy (Sanjiang Forum)*, 2017 (10): 16-18+6.
- [9] Zhu Jie, Lu Qian, Zhang Baolai. Application of Artificial Intelligence in Tax Services [J]. *Tax Research*, 2018 (05): 94-103.
- [10] Luo Bencheng. Looking at the Development Trend of Global Smart port from Port of Singapore [J]. *China Ports*, 2020 (11): 5-9.