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# **WORLD MARITIME UNIVERSITY**

Shanghai, China



## **Analysis Of The Influence Of Beibu Gulf Port Development On Regional economy**

By

**ZHANG HANYUE**

**China**

A dissertation submitted to the World Maritime University in partial  
Fulfillment of the requirements for the award of the degree of

**MASTER OF SCIENCE**

**(INTERNATIONAL TRANSPORT AND LOGISTICS)**

2021

## **Declaration**

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

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

**Signature: Zhang Hanyue**

**Date: 2021.6.24**

**Supervised by**

**Professor Chen Yang**

**Shanghai Maritime University**



## **Acknowledgement**

Thanks to everyone I met in WMU and SMU.

And best regards to my parents and relatives.

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## **List of Abbreviations**

<b>ASEAN</b>	<b>Association of Southeast Asian Nations</b>
<b>RGDP</b>	<b>Regional Gross Domestic Product</b>
<b>LQ</b>	<b>Location Quotient</b>
<b>NBS</b>	<b>National Bureau of Statistic</b>

## **Abstract**

**Title of Research Paper: Analysis of the influence of Beibu Gulf Port Development on Regional economy**

**Degree: MSc**

As an important channel for connecting regional logistics, capital flow, and information flow, the port changes from a single transport transfer station to a modern logistics service center which benefit from the scale effect, knowledge spillovers, and brand effects, etc. Port logistics industry clusters have been gradually formed, which has created a new growth point for the regional economy. At the same time, port logistics industry clusters can promote technological innovation within the cluster, drive the development of related industries, and attract labor force to agglomerate, which leads to regional economic growth; On the other hand, regional economic growth expands trade scale, promotes improvement of infrastructure, and provides essential factor resources and policies for the development of port logistics industry clusters.

This article first discusses the theory related to industrial clusters and regional economic growth, and sorts out the literature on industrial clusters, the interaction between port logistics industrial cluster and regional economy; secondly, it begins with basic conditions of port and port logistics needs. Analyze the development status of port logistics industry in the Beibu Gulf Port, and then measure the level of the port logistics industry cluster in the Beibu Gulf by using the location quotient. Finally, some effective policy suggestions are put forward for the port city development of Beibu Gulf which is actively build a smart port. Smart port is a new concept of modern port development and evolution. Under the current situation, Beibu Gulf Port, as an important strategic resource of Guangxi, is becoming more and more prominent in its core position. The construction of Smart Port can better play its driving role in regional economy and provide strong support for promoting the development of Beibu Gulf Economic Zone.

**Keywords: Guangxi Beibu Gulf Economic Zone; Industry Cluster; Port City Interaction; Smart Port; The association of south-east Asian nations**

## **Chapter 1 Introduction**

### *1.1 Research Background and Significance*

With the development of globalization and world economic integration, port cities located in the coastal area have become international or regional centers. This center is the center of politics, economy, trade, transportation, finance, culture, and tourism. Its convenient transportation conditions, well-equipped port facilities, and the agglomeration of people, logistics, and information flow make it an engine power for the economic development of countries and regions. After more than 30 years of practice in reform and opening up, the port's role in promoting urban economic development has been generally recognized. "To open up, build a port first" It is the summary of people's influence on the development of the region and the city by the port.

The Beibu Gulf is located between China and Vietnam, to the north are the ports of China's Guangxi coast, to the east are China's Guangdong Leizhou Peninsula and Hainan Province, and to the west is the northeast of Vietnam. The Beibu Gulf port group and city group discussed in this article refer to the three port cities of Beihai, Qinzhou, and Fangchenggang along the coast of Guangxi, China. The Beibu Gulf port group is located at the junction of the three major regions of eastern, central, and western China. It is the only coastal and border area in western China. The strategic position is indispensable in the cooperation between China and the Pan-Beibu Gulf, the Pan-Pearl River Delta, ASEAN and other domestic and international regional cooperation. Among them, Fangcheng Port is one of the most important coastal ports supported by the state for development. Beihai Port and Qinzhou Port are also listed as important regional ports in the country. Therefore, reorganizing and optimizing the interactive relationship between the Beibu Gulf Port and the city to promote the economic development of the Beibu Gulf Port in Guangxi is of great significance to

the development of Guangxi and even the entire Southwest Economic Circle.

In our country's port city planning, people often ignore the influence of the city where the port is located, and urban development plans also treat ports as separate external activities. In the process of interactive development between ports and cities, there will often be a phenomenon that the existing one is relatively advanced in development, which not only restricts the development speed of the two, but also affects the coordinated development of the entire port city. How to solve the problem of incoordination between the Beibu Bay port and the city is the key to enhancing the comprehensive competitiveness of the port city.

### *1.2 Research Method*

From the perspective of theory, there are a lot of qualitative studies on the interaction between ports and cities in the existing literature. The spatial relationship between ports and cities is only limited to the development and layout of ports, and the research on the economic development of ports and the enhancement of urban competitiveness is relatively weak. In the empirical research, although some scholars have conducted a series of studies on the economic development relationship between ports and their cities and hinterlands, most of them compared with the single port that take the interaction between port groups, port systems and city groups as the research object. This essay selects the port group of Beibu Gulf and the corresponding city group, using the method of combining quantitative analysis and qualitative analysis which carries on the empirical analysis on the relationship between the port group development of Beibu Gulf and the economic development of port city. Besides, this article also carries on the quantitative analysis on the coordinated development of the three ports.

In the research process, this article mainly uses the three methods; Literature research method: Thanks to a large amount of information, I learned about the role of ports in regional economic development. In addition, a large amount of data was collected to analyze the impact of Guangxi Beibu Gulf Port on the regional economic impact; Qualitative analysis: By analyzing the state of development of the port and the regional economy, the internal relationship between port development and urban economic development is obtained; Quantitative Analysis: The linear regression model is used to discuss the impact of the port on the regional economy and analyze the specific impact mechanism of Guangxi Beibu Gulf Port on the regional economy.

### *1.3 Research Content*

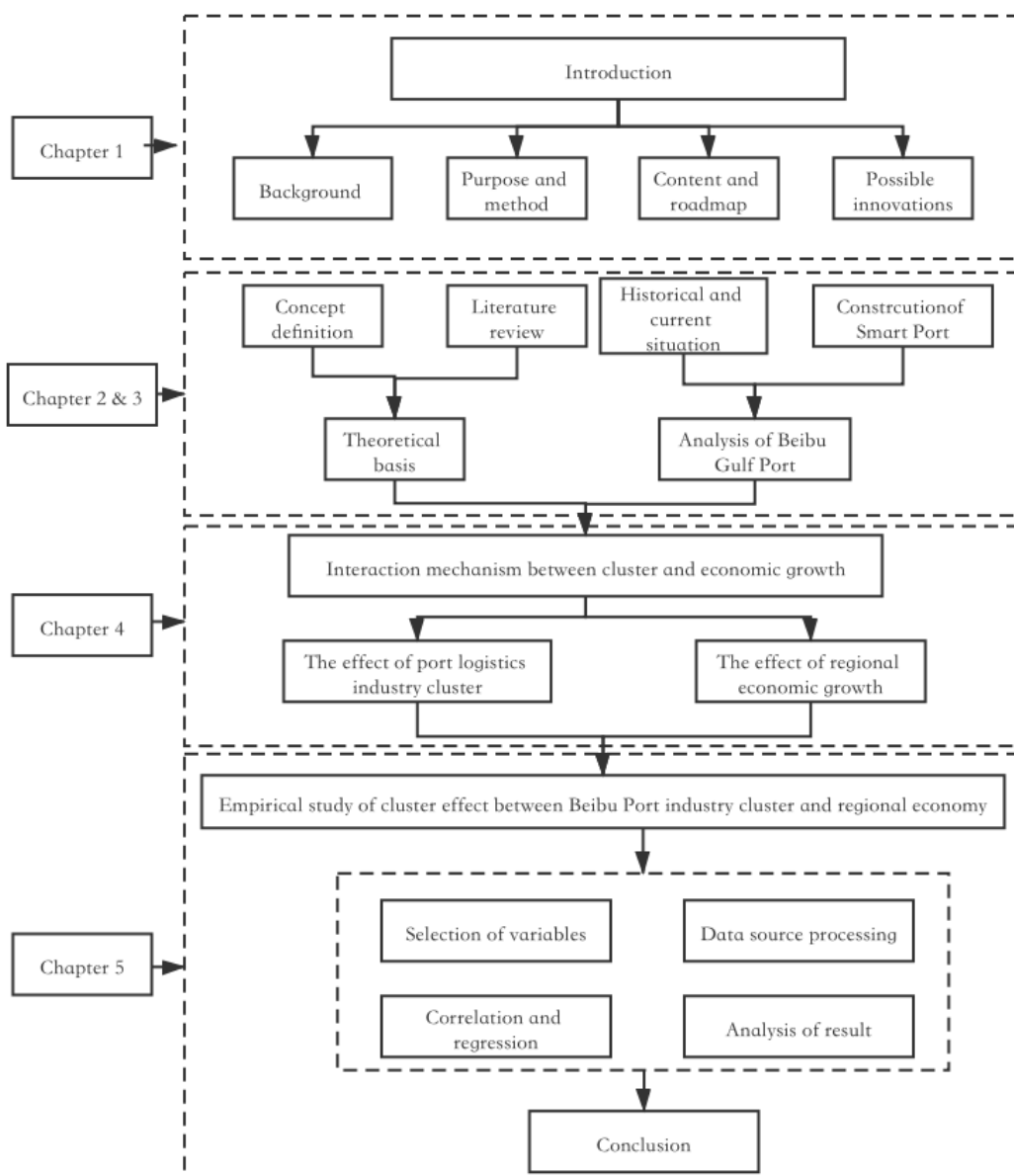
Chapter one consist of introduction, research background, research significance, research purpose and method, research content and technical route and possible innovation. Chapter two illustrate theoretical basis and literature review. This chapter first explain the theory of industrial cluster and the theory of regional economic growth, and then sorts out the port logistics industry cluster and the development of the interaction between the regional economy. Firstly, the paper analyzes the current research trends of the relationship between port and the city from both domestic and foreign levels. Furthermore, the theoretical basis of the interaction between port and city is analyzed from two aspects: the main function of port to city development and city's function to port. Finally, the paper analyzes the theory of port city interaction from the aspects of port city area theory. Also, chapter two explain the definition of city group, industrial cluster and port logistics industry cluster .

Chapter three shows Guangxi Beibu Gulf port logistics industry development status and cluster measurement. This chapter is mainly divided into two parts: the first is to analyze the development status of the port logistics industry in the Guangxi Beibu Gulf from two aspects: the basic conditions of ports and the current demand for port logistics; The second is to use location entropy to measure the level of port logistics cluster in the major urban agglomerations.

Chapter four introduce the interactive mechanism of port logistics industry cluster and regional economic growth. This chapter starts with the mechanism of port logistics industry cluster on regional economy and the mechanism of regional economy on port logistics industry cluster, and systematically constructs the interaction mechanism relationship between them.

Chapter five tells the empirical test of the interactive relationship between Guangxi Beibu Gulf port logistics industry cluster and regional economic growth which include econometric model construction, variable selection and data description. This is one of the core contents of this paper. Firstly, SPSS is used to calculate the correlation coefficient of Beibu Gulf Port City, and then regression analysis is conducted on GDP, port throughput, foreign trade volume and fixed asset investment of Beibu Port City in Qinzhou, Beihai and Fangchenggang Province. Finally, new measurement methods such as co-integration theory are used. Empirical analysis and discussion are made on the relationship between port group development and port city economic development in Beibu Gulf. Chapter 6 is conclusion and proposals. The empirical research of this paper is summarized, and the corresponding countermeasures and suggestions are put forward.

1.4 Structure of Research





## **Chapter 2 Theoretical Knowledge**

### *2.1 The relevant theory of port and regional economy*

The port, which is a transportation hub, has certain water and land transport equipment and conditions, and it can provide entry and exit port service and docking service for ships. The port economy is also an open economy. At the same time, it is based on the port city and supported by its related port industries. On account of the integrated transport system is the main body of the city, the regional economy is further promoted to contribute to regional prosperity. When it comes to regional economy, it refers to the comprehensive product of internal factors and external conditions that affect economic development in a certain region. The regional economy covers not only a geographical concept, but also an even more important economic phenomenon. The material basis of the regional economy depends on a certain area. As far as the level of economic phenomena is concerned, the regional economy reflects the objective laws of economic development in different regions.

#### *2.1.1 Definition of City Group*

The concept of "city group" originated from (1957), and theoretical circles have different understandings of "Megalopolis", the principle of urban planning

"(2011) translated" Megalopolis "into" Metropolis Zone ", which is defined as a

huge urban region with many metropolitan areas connected together and having close interaction in various aspects such as economy, society and culture. Later, scholars at home and abroad put forward relevant concepts. Foreign studies mainly include: Mega Regions (T.G.McGee,1989), Metropolitan Extended Regions (N.Gingsburg,1991), Mega Cities (P.Hall, 1999), Mega Regions (ARPA, 2004).

It mainly includes: urban economic zone (Gu, 1999), urban cluster (Zhang, 2000), and urban alliance (Wang, 2008). Industrial clusters have a strong role in driving the economy. The most important connotation of urban agglomeration is the close industrial connection between cities, and the formation of closely connected industrial clusters and industrial clusters. Relying on the radiation effect of industrial cluster, the cooperative development strategy of urban agglomeration can be formed.

### *2.1.2 Definition of Industrial Clusters*

In the eighteenth century, Adam Smith talked about the relationship between the division of labor and the scope of the market in *The Wealth of Nations*. The division of labor is divided into three categories: intra-enterprise, inter-enterprise and social divisions of labor. The division of labor within an enterprise is essentially an industrial cluster, which is the embryonic research of industrial cluster by foreign scholars. With the development of industrial clusters, its advantages are gradually found. Different disciplines and academic schools also understand the concept of industrial cluster from different point of view. Theories related to industrial cluster mainly include scale economy theory, agricultural location theory, industrial location theory and so on. Michael Porter (1998) was the first person to systematically put

forward the concept of industrial cluster. Following his ideas, this essay defines industrial cluster as a stable, competitive and interrelated collection of a large number of specialized and interrelated small and medium-sized enterprises and institutions gathered in a certain region.

A similar concept to industrial cluster is industrial agglomeration. Industrial agglomeration refers to the highly intensive gathering of different enterprises, organizations and institutions in the same industry in a specific region, which is directly manifested as the high concentration of a certain industry in the region. Generally speaking, industrial agglomeration emphasizes the agglomeration of enterprises in the same industry, and focuses on the dynamic process of the formation of this phenomenon. Industrial cluster focuses on the cooperation between enterprises in different industries, and focuses on the static description of this phenomenon (Gu Yi, 2014).

### *2.1.3 Definition of Port Logistics Industry Cluster*

Professor Haezendonck from the University of Antwerp in Belgium is the first scholar who put forward the concept of port industrial cluster internationally. She defined port industrial cluster as: a series of mutually independent enterprises engaged in port related services, gathering in the same port area, and applying similar competitive strategies, in order to obtain a joint competitive advantage over the external cluster. Zhou Changlin (2006), a Chinese scholar, pointed out that the logistics industry cluster based on the port refers to the industrial organization form and economic and social phenomenon formed by the logistics enterprises and related units with the third party logistics enterprises as the core and division of labor and cooperation in business, which gather in the area near the port and rely on the

port.

Generally speaking, the port logistics industry cluster mainly has the following characteristics. First, the port logistics industry relies on the port geographically. Due to its regional characteristics, the port logistics industry mainly carries out business activities around the port. Second, the main body of the cluster is composed of specialized enterprises and institutions. Port logistics activities include multiple business activity, such as traditional loading and unloading, and storage activities, including freight forwarders, shipping, customs clearance and other activities, these activities as a result of its professional often require specialized company or organization to undertake. At the same time, the connection between each activity makes the port logistics activities exist in cooperation. Third, the emergence and development of the port logistics industry cluster has certain social and economic conditions. As a link connecting the port hinterland with other regions, the development of port logistics can not be separated from the strong support of hinterland economy.

## *2.2 Theoretical Knowledge*

### *2.2.1 Industrial Cluster Theory*

Industrial clusters reduce the cost of enterprise information communication and the cost of logistics. It forms scale effect and external effect, and then enhance regional competitiveness. This will play an important role in raising the level of economic development. In recent years, with the emergence of a large number of industrial clusters in the global scope, the academic circle has further deepened the research on this issue. Industrial cluster theory mainly includes scale economy theory, agricultural location theory, industrial

location theory, core-edge theory, center-periphery theory and competition theory. From the origin, formation, development and other aspects of industrial clusters are discussed in detail.

### *2.2.2 Marshall's Theory of Economies of Scale*

The representative scholar of industrial cluster theory in neoclassical economics is Alfred Marshall (1890). By deeply studying the regional convergence of manufacturing enterprises, he called the agglomeration area "industrial district", and put forward the concept of "internal scale economy" and "external scale economy". The internal scale economy is related to various factors within the enterprise, such as resources, organizational level and management efficiency. The external scale economy is related to the external factors of the enterprise, such as the distance between the enterprise and the raw materials, the market location, the size of the market capacity, the degree of communication, transportation convenience, the level of development of related industries, etc. Marshall believes that the cause of industrial cluster is the pursuit of external economies of scale, and discusses it from three aspects. One is the abundance of labor resources. Due to the agglomeration of related enterprises, the industrial area can attract the agglomeration of ordinary workers or workers with special skills to form a shared labor market, which can guarantee sufficient labor supply for manufacturers. For workers, it can reduce the possibility of unemployment due to economic uncertainty or other reasons. The second is a complete market for intermediate goods. The larger the scale of enterprise cluster, the more likely it is to attract the relevant upstream and downstream enterprises to gather, which facilitates the input of intermediate goods. This reduces the production cost of the cluster enterprises and improves the production

efficiency of the enterprises. The third is knowledge spillover effect. Due to the close geographical distance of enterprises within the scope of cluster, personnel turnover is faster and knowledge spread speed is faster. Thus, it is conducive to the extensive use of advanced science and technology.

### *2.2.3 Agricultural Location Theory and Industrial Location Theory*

Johan Heinrich von Thunnen (1826), a German agricultural economist, is a representative figure of agricultural location theory. He used the analysis method of abstract deduction to analyze the spatial configuration of agricultural production mode starting from a geographically isolated and hypothetical city. It also explains the land rent, location and resource allocation. It also points out that there are different agricultural management methods under different spatial allocation, and the difference of agricultural income leads to the differential land rent.

In Industrial Location Theory, German economist Alfred Weber (1909) mainly analyzed the location choice of enterprises from the perspective of cost saving brought by industrial agglomeration. Weber clearly put forward the concept of "location factor". One of the basic assumptions of the industrial location theory (Weber, 1909) is that location is the important influencing factors of competition between manufacturers and enterprises. Location is also a source of power to promote the development of industrial cluster.

This theory emphasizes the transportation cost, labor cost, industrial location is important factors to consider when enterprises and manufacturers selecting a site. Besides, the ideal and the best industrial location should be the minimum point in the production and transportation costs. Driven by

specialization and division of labor, the cluster phenomenon among enterprises is one of the core contents of the industrial location theory. He also divided "location factors" into "regional factors" that affect the distribution of industries in various regions and "agglomeration factors" that concentrate industries in specific regions. It also points out that the agglomeration of enterprises can reduce the search cost of labor. It can also promote the improvement of infrastructure to achieve scale effect and thus bring cost savings.

In addition, Alfred Weber also divided the industrial agglomeration into two stages. The first stage is the primary stage which the simple expansion of the company's own scale leads to industrial concentration. The second stage belongs to the advanced stage. The existence of large enterprises will promote the local centralization which will also attract more similar enterprises to enter, and then produce more significant scale advantages.

#### *2.2.4 Development Cycle of Port Logistics Industry*

Affected by many factors, the the port logistics industry agglomeration has shown different stages of development over time, as shown in Figure 1.

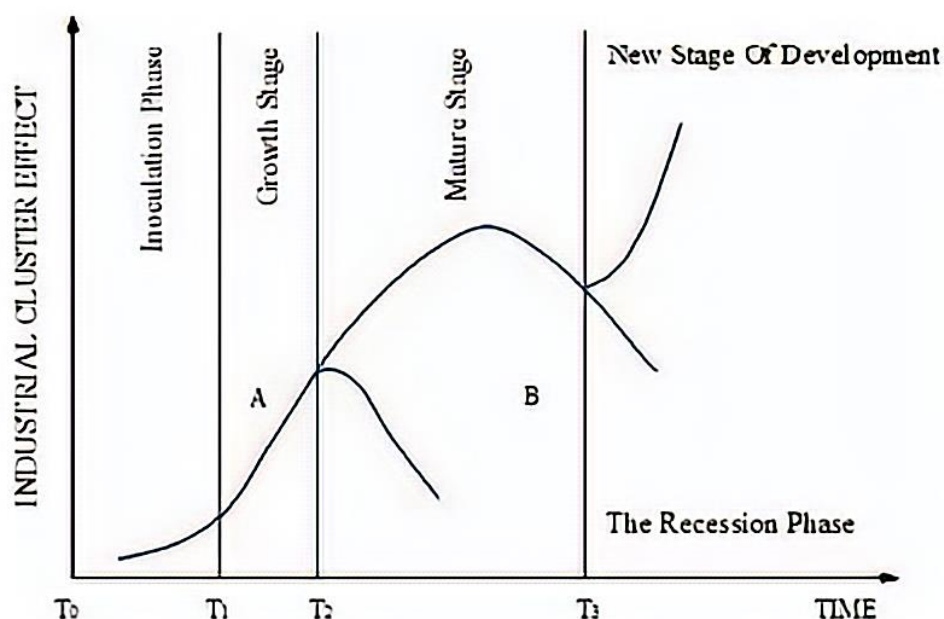


Figure 1. Life cycle of the industry cluster

The life cycle of the port logistics industry cluster shows a trend of increasing-moderate-decreasing. The development of port logistics is divided into gestation ( $T_0$ - $T_1$ ), growth period ( $T_1$ - $T_2$ ), maturity period ( $T_2$ - $T_3$ ) and recession period ( $T_3$ ). At each stage, the development of port logistics presents different characteristics. In the gestation period, logistics companies gradually gather in ports. With the improvement of the level of business specialization and production efficiency, the port logistics industry has developed from a decentralized and internally specialized model to a simple market agglomeration. In the growth stage, driven by the advantages of port resources and government preferential policies, the concentration of regional talents and technologies has been realized. The formation of regional brand effect provides good investment conditions for the port. After the point A, the number of clustered enterprises has increased, and the industrial clusters have developed rapidly. In the mature period, the port logistics clusters are at



a relatively high level, and the regional economy has also shown a good direction of development. The further development of the port logistics industry cluster requires innovative energy to maintain growth, otherwise it will continue to decline after point B. In the recession phase, due to the shortage of land resources, the high labor cost restricts the development of logistics enterprises, making the cluster business restrained. In the different development cycles of the port logistics industry cluster, the economic development of the port area presents different development trends.

### *2.3 Literature review*

In terms of qualitative study on the relationship between port and city, the research in China started relatively late, but after decades of development, some research achievements have been formed. From the earliest notice that the interaction between port cities should be more strictly investigated (Wu Chuanjun & Gao Xiaozhen, 1989) to a more systematic elaboration of the formation, development and related types of ports (Luo Zhengqi, 1989). Zheng Hongyi pointed out for the first time that the relationship between port and city was the core issue in the study of port cities in "Exploration of Port Cities", and expressed his views on the planning and layout of port cities in 1991.

Xu Jiqin write in his essay "Theoretical and Empirical Discussion on the Growth of Port City" which he believes that the driving effect of ports on regional economy is firstly manifested in the port infrastructure construction promoting the growth of port city, and then promoting the regional economic development through the central driving role of port city. The essay " Research on the Interactive Relationship between Ningbo Port and City"

pointed out that in the development process of port cities, ports played an important role in the expansion of urban economy also contributed to the further development of ports (Chang Dongming,2008). The port plays an important role in the generation and development of the city and its economy, and the expansion of the city economy also provides good support and guarantee for the further development of the port, which is a kind of benign interaction.

In terms of quantitative research on economic interaction between ports and cities, Chen Hang quantified the relationship between ports and cities through RCI index, and studied the behavior pattern and interaction mechanism of port city system based on the system dynamics method. Chen Zaiqi et al. made a systematic study on the interactive relationship between Guangzhou port and Guangzhou urban economic development by means of correlation analysis and regression analysis and other quantitative analysis methods. Lin Jianhua and Chen Chun constructed a detailed index system of urban economy and port economy and made specific analysis of the corresponding index system in 2010. By comparing the influences of port cargo throughput and container throughput on urban economy, they obtained the effects of various elements of Xiamen Port on urban economic development. From the perspective of mathematical modeling, he looks for the economic indicators of ports and port cities, so as to reflect their interdependent relationship (Gao Hongli,2010).

### **Chapter 3 Case Background of Beibu Gulf Port**

#### *3.1 Historical Development*

Firstly, in terms of Beihai Port, with its superior natural conditions, Beihai Port

was the sailing start point of the "Sea Silk Road" from China to Southeast Asia, West Asia and Europe as early as the Qin and Han Dynasties. In 1876, Beihai became a foreign treaty port. However, the development of Beihai port has been in a backward state due to the long-term dependence on barge operation for loading and unloading cargo. After the founding of New China, under the leadership of the Communist Party of China, Beihai Port has achieved rapid development. Approved by the State Council in April 1984 as one of China's coastal open cities, port city construction has been accelerating.

Secondly, in the field of Qinzhou Port, as early as 1924, Qinzhou Port was listed by Dr. Sun Yat-sen as the second largest port in the south of China. In 1992, the first phase of the Qinzhou Port Project began construction of two 10,000-ton bulk general berths, Qinzhou officially entered the port development period. In 2008, the 100,000-ton channel was completed and put into use, and the State Council approved the establishment of Qinzhou Bonded Port Zone. At present, Qinzhou Port has built and put into operation a general cargo, bulk cargo, oil and gas, roll-roll, container functions and other public and industrial berths.

Last but not least, Fangchenggang was first built in the 1960s as a preparation port for the War to Aid Vietnam and Resist America. In 2001, the throughput of Fangcheng Port exceeded 10 million tons for the first time. It took 10 years for the cargo throughput of Fangcheng Port to 61.68 million tons in 2011. In 2012, the cargo throughput reached 100.5842 million tons. Fangchenggang actively implements the idea of interactive development between port and industry. The city has made great efforts to support the

development of port industry. In addition to the existing non-ferrous metals, iron and steel, grain, oil, food and energy, equipment manufacturing and chemical logistics, three billion yuan of port-related industries have been developed. The newly introduced nuclear power project, nickel-copper project and steel base have also started construction one after another.

### *3.2 Current Situation*

Among the coastal port cities in the Beibu Gulf, Fangchenggang has the most perfect port function and the earliest development. As a port expanded to meet the needs of the support of the Vietnam War in the century, Fangcheng Port not only has a good harbor and perfect land distribution connection, but also has the characteristics of a large port and a small city like many strategic ports which its throughput is not proportional to the local population and local needs. Besides, the goods transported at the port are not closely related to the local area. Beihai is a coastal city with beautiful beaches. After the real estate shock boom of the late century, Beihai realized the risks of relying on tourism alone, and have an idea to develop in material production and trade through the port and port industry. Objectively speaking, the port conditions of Fangchenggang port are good, and Qinzhou has a huge supply of land and labor poor. Eventually, the government have the idea of building a much larger Beibu Gulf Economic Zone. In the middle of 2006, Guangxi Beibu Gulf Economic Development Plan 2006-2020 was approved and officially upgraded to a national strategy. According to the plan, the Beibu Gulf Economic Zone is positioned as the western maritime corridor for the western development and the key area for cooperation with ASEAN. Beibu Gulf ports and urban agglomeration experienced in a golden period of rapid development.

In terms of policies, the Guangxi Zhuangzu Autonomous Region government has submitted a number of functional policy authorization requirements to the central government, including the establishment of a bonded port area in Qinzhou, the establishment of a comprehensive China-ASEAN border bonded zone, the establishment of a bonded logistics center in Nanning and Fangchenggang. They need to enjoy export tax rebate policy, expanding the bonded logistics function of Beihai Export Processing Zone.

In terms of system, in addition to the establishment of the Beibu Gulf Economic Zone, the three port administrations will also be merged and established. In terms of infrastructure, there are not only supporting high-quality roads, but also planning and constructing kilometers of canals to turn Nanning into a provincial capital with direct water access to the sea. In the logistics service, government subsidize the routes between headquarters Bay Port and Hong Kong routes.

From what has been discussed above, it is clear that the three ports of Qinzhou, Beihai and Fangchen port have begun to get rid of the single transport or transfer function, and initially form a certain scale of port industry, and drive the development of related industries. The tertiary industries, such as maritime shipping agency, finance, insurance and so on, which are related to transshipment at the port, have become an indispensable part of the port economy.

The development patterns of Beibu Gulf port city group mainly gives full play to the advantages of Fangcheng Port in deep water and the convenience of

Qinzhou Bonded Port Zone to promote the development of port logistics and seashore industry. The ultimate goal is to build Qinzhou and Fangchenggang as a logistics base and manufacturing base. Beihai Group focuses on the development of electronic information, biopharmaceutical, Marine development and other high-tech industries and export processing industry. At the same time, it expand the bonded logistics function of export processing zones and protect the good ecological environment. What we also need to know is becoming a coastal cities with beautiful and comfortable living environment also means a lot to a country. Tieshan Port makes full use of the advantages of the deep-water shoreline and the location close to the Pearl River Delta Economic Circle, and strives to build Tieshan Port into a deep-water channel.

### *3.2.1 Improve an intelligent Control System for Port Group*

At present, China's ports are facing the trend of port resources integration. For example, the integration of Zhoushan Port in Ningbo, Zhejiang Province and the establishment of the Zhejiang Port Commission. However, the integration of regional port resources still has some problems in concept and collaborative development. Relying on the unique geographical advantages of Beibu Gulf, Fangcheng Port, Qinzhou Port and Beihai Port effectively integrate the logistics resources of regional port groups. The three ports have realized the unity of strategy, planning, construction and development, which can be regarded as the first regional port resource integration in China. Nowadays, the construction of the Beibu Gulf Smart Port make full use of digital, intelligent and other innovative technologies to build an intelligent control and decision-making analysis platform. These measures will promote

the integration of port group management, production and operation in the Beibu Gulf. Through the implementation of intelligent dispatch and multimodal transport, the operation efficiency of port group is improved.

Beibu Gulf Smart Port will build an efficient scheduling platform and information system through the construction of intelligent control application system of port group. This will strongly promote the group's overall collaborative operation. In addition, the Beibu Gulf Smart Port will strengthen intelligent control by means of information platform construction and business process reengineering. Therefore, regional port resources integration and the ability of coordinated management and control are in a relatively leading position, and can be used as the experience of regional port group resources integration for reference by other ports in China.

### *3.2.2 Work with ACEAN to Advance all-round Cooperation*

In recent years, the competitiveness of Chinese enterprises in the international market is getting stronger and stronger. "Going out" has gradually become an important development trend and direction for Chinese enterprises. In the face of the new world situation and development environment, Chinese President Xi Jinping has put forward the initiative of building the Silk Road Economic Belt and the 21st Century Maritime Silk Road, stressing that countries along the routes should build a win-win "community of interests". The president also proposed the concept of a "community with a shared future" for common development and prosperity. Being global and international has gradually become a brand new trend of port enterprises.

The construction of the Beibu Gulf smart port should seize the good opportunity of favorable policies and actively undertake the construction of the national-level Mazuan-Guandan Industrial Park project. When realizing the relative holding of Kuantan Port in Malaysia (accounting for 40% of the shares), we took the step to cooperate with domestic enterprises and jointly invested in the construction of a steel plant in Malaysia-China Kuantan Industrial Park. Based on the construction of regional port group network collaborative system, Beibu Gulf Smart Port explores an unprecedented new business form and new mode. The main point is resource integration , business model convergence and information exchange. It also need continuous and close project cooperation with Malaysia, Brunei, Indonesia and other ASEAN countries. At the same time, regard ASEAN as the core, we will build a strategic port hub along the "One Belt And One Road" in the further. Through the ASEAN oriented and connected "One Belt And One Road" assets scheduling and logistics transportation organization, the Beibu gulf smart port actively into the global economic integration pattern.

### *3.2.3 Set Standard for Port Logistics Management*

The construction of the Beibu Gulf Smart Port will take Guangxi as the strategic basic point and build an international communication network hub and system. This system faces ASEAN, cover the scope pf southwest and southern regions. The whole system takes an active part in the construction of the information port between China and ASEAN, relying on the National Public Information Platform for Transport and Logistics and the China-ASEAN Information Port. This approach is called "Internet + Port". This concept can gather the port, shipping and logistics transportation information of ASEAN



countries into the national public information platform of transportation and the information port between China and ASEAN. Thus, the transportation and logistics information interconnection and sharing among China, Japan, Korea and ASEAN has been realized. In addition, the construction of Beibu Gulf Smart Port will also rely on its own advanced experience accumulated in the process of port integration to improve the business system of the supply chain. What should be done is to deeply explore and study the standards of business process and management system, regional port group information communication standards, customer service application interface standards, external system interface standards and other relevant standards.

The construction of the Beibu Gulf Smart Port will make full use of the policy advantages of "One Belt And One Road" to optimize the business process of supply chain, and formulate the standards of key elements of the business process of supply chain. Then the relevant standards will be extended to other domestic ports, port groups and other ASEAN ports such as Kuantan Port of Malaysia and Brunei Mora Port, so as to truly realize China's technical export to ASEAN and even "One Belt And One Road" countries along the belt.

#### **Chapter 4 Interaction Mechanism between Cluster and Economic Growth**

Port is an important hub of waterway transportation, which attracts the aggregation of related industries with its unique location advantage. And gradually formed the port logistics industry cluster. The port logistics industry cluster plays a significant role in promoting the infrastructure construction, technological innovation, industrial development and consumption upgrade in city where the port is located.

At the same time, regional economic development also provides the port logistics industry cluster with the support of labor, capital, technology and other elements. These elements create positive function for the optimization and upgrading of the port logistics industry cluster. The relationship between port logistics industry cluster and regional economic growth is more complex. It has the characteristics of nonlinearity, complexity and openness. This section mainly organize the relationship and mechanism between the two parties, which lays the theoretical foundation for the demonstration in the following paper.

#### *4.1 Analysis of the Impact of Port Logistics Industry Cluster on Regional Economy*

With the development of port logistics and shipping industry, port functions have changed from a single transport function to a diversified function including manufacturing, packaging, freight forwarding, warehousing, logistics services and so on. In recent years, modern port has gradually become the best combination point of people, logistics, cash flow and information flow. With the emergence and upgrading of the port logistics industry cluster, the port infrastructure is gradually improved. Regional innovation strength is also increasing, and continues to attract the aggregation of related industries. At the same time, the operation cost of enterprises in the cluster is reduced, and the regional industrial structure is optimized to a certain extent. In addition, labor is attracted to this cluster, benefiting from the large number of enterprises. Thus it will enhance regional vitality. So the mechanism diagram of port logistics industry cluster on regional economic growth is drawn, as shown in below (Figure 2)

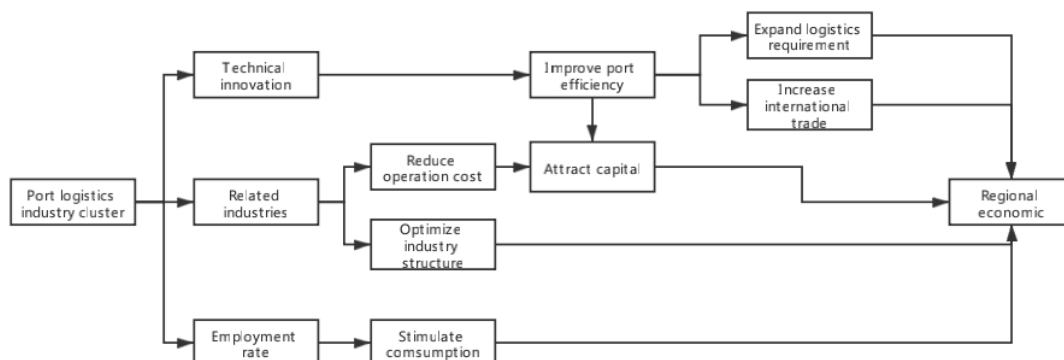


Figure 2. Mechanism of Port Logistics Industry Clusters on Regional Economy

#### 4.1.1 Promote Technical Innovation

Port logistics industry cluster can promote the establishment of innovation network and enhance the regional innovation strength. With the expansion of cluster scale and improvement of cluster level, the attraction of port logistics industrial cluster to universities, research institutes, financial institutions, intermediaries and other organizations is further enhanced. This promotes the establishment of the innovation network, which is mainly based on production, study and research, and supplemented by other auxiliary institutions. Under the function of innovation network, the diffusion of technology and information is accelerating. At the same time, the flow of talents can also realize the spread of knowledge so that enterprises can quickly master the research trends of other enterprises and scientific research institutions, and then they can learn from it. They can even be modified to produce a more optimized technology, resulting in significant savings in research and development and transaction costs. For enterprises with strong innovation power, in order to maintain their leading position in science and technology, they will continue to invest in innovation. And they will also maintain cooperation with relevant scientific research institutions in order to acquire new technologies and new

knowledge; For enterprises with weak innovation strength, benefiting from technology spillover, they can also search for and understand relevant core technologies. The overall innovation strength in the cluster will be further improved. At the same time, the enterprises in the port logistics industry cluster belong to the related departments of the port logistics industry due to their close geographical location. In order to occupy the market, these enterprises must open up fierce competition. And innovation is an important link to improve the core competitiveness of enterprises. On the one hand, market competition increases entrepreneurs' sense of innovation. Entrepreneurs strive to look for management innovation, system innovation and organization innovation to stimulate the vitality of enterprises which can also provide corporate efficiency; On the other hand, in order to keep the market position and share, enterprises need to pay attention to competitors. Companies will also follow the development trend of the industry and actively study frontier science and technology in order to prevent falling behind the market.

Due to the acceleration of the innovation process of the port logistics industry cluster, the level of science and technology of enterprises in the cluster is constantly enhanced. All of these can improve the efficiency of enterprises' operations, optimize the quality of products and services, and thus expand the direct economic impact. At the same time, for the enterprises in the port logistics industry cluster that are responsible for warehousing, transportation, packaging, handling, information support and other functions, the improvement of their technical strength can realize the better operation of the port. These functional enterprises can thus reduce logistics costs, such as warehousing, transportation, demurrage and other costs, and then accelerate

the speed of goods clearance and transshipment. All of this can realize the port logistics facilitation and promote the port operation efficiency and the rise of comprehensive competitiveness. In addition, it can also attract more and more elements in the region to flow through the port and expand the transportation demand of the port in the region. By making full use of port resources and improving port throughput can realize regional economic growth. With the advancement of economic globalization and regional integration, ports play an increasingly important role in domestic and foreign trade, especially in international trade. With the improvement of port transportation efficiency, international transportation will be more convenient. Port import and export trade will continue to grow, and then it will create the development of external economy.

#### *4.1.2 Drive the Development of Related Industries*

Port logistics industry cluster can attract related industries through agglomeration effect and brand effect. Port logistics industry cluster has convenient water and surface transportation conditions and broad hinterland market, which can effectively integrate regional resources and attract related industries to cluster. These industries mainly include basic industries such as warehousing, transportation, loading and unloading and distribution, derivative industries such as processing, packaging, post and telecommunications, insurance and banking, and modern service industries such as hotels, catering and tourism. With the entry of related industries, resources are increasingly concentrated in ports and surrounding areas. In this way, the industrial chain within the port logistics industry cluster can be connected and the production efficiency within the cluster can be improved. Because of the strong correlation among the enterprises in the cluster, the

localization network is constructed through specialized division of labor and cooperation, and the advantages of the enterprises in the cluster are used. In this way, the group advertising effect can be brought into play, the brand appeal can be expanded, and through the collaborative sharing and complementarity of market resources, the "regional brand" can be finally formed to attract the inflow of capital and the entry of related enterprises.

With the entry and development of related industries, the scale of port logistics industry cluster is further expanded. This will help achieve economies of scale and lower costs for businesses. Industrial clusters can improve the level of specialization of enterprises. In order to achieve better and better development, enterprises in clusters must pay attention to their own core business. At the same time, in the process of cluster development, their own core business will continue to deepen, and then improve the overall operation efficiency of the cluster. At the same time, the port logistics industry cluster is more economical in terms of transportation, inventory and information searching. The port has the advantage of natural sea transportation. With the increasing completion of the collection and distribution system, the combined railway and water transport has been gradually realized. It is more convenient and efficient to connect within and between clusters. Benefiting from the convenience of logistics and the gathering of a large number of associated enterprises, there are a large number of suppliers to provide the required raw materials and production services for enterprises in the cluster, which can also reduce the inventory cost and raw material cost of enterprises. Moreover, with the construction of the innovation network in the cluster, related enterprises can share the innovative technology in time. Enterprises make the connection closer between each other, but also more convenient to find

trading objects, reduce the cost of information search. In addition, the emergence of port logistics industry clusters can also reduce the default costs of enterprises because of the close geographical location and stable trading relationship which can limit the out-of-line behaviors to some extent. It will also reduce the risk of signing and performing contracts between enterprises. As the level of port logistics industry cluster is gradually improving, the transaction cost of enterprises is greatly saved. At the same time, the port logistics benefits from the improvement of basic facilities and the improvement of port operation efficiency and other factors. Due to the profit-driven capital, it tends to choose cluster areas for investment.

The development of related industries will also drive the optimization and upgrading of regional industrial structure. Regional industrial structure refers to the proportion of various industries in the regional economy. According to its evolution principle, it is mainly transferred from the primary industry to the second and tertiary industries; Transfer from labor-intensive industries to technology-intensive and capital-intensive industries. On the one hand, with the help of the specialized division of labor and cooperation within the cluster, through the continuous adjustment of the internal enterprises, it will ensure the regional organizational structure reasonable; On the other hand, due to the existence of a large number of similar enterprises, the vitality of the region is enhanced, which can make the industrial life cycle longer. Port logistics industry cluster mainly includes secondary industries such as industry and manufacturing, tertiary industries such as warehousing, transportation and finance, and also involves administrative departments such as customs, inspection and quarantine, and taxation. Therefore, the industrial structure can be greatly optimized and adjusted.

#### *4.1.3 Driving Employment Rate and Attract Labor Concentration*

Port logistics industry clusters attract the inflow of talents and improve the quality of regional labor force. With the continuous development of the port logistics industry cluster, the number of enterprises increases, and the demand for labor force gradually expands. When job opportunities are increasing, it will attract a large number of workers to gather here. In the long run, the scale and level of the port logistics industry cluster are increasing day by day, and the production and service provision of enterprises in the cluster will become more diversified. With the gradual expansion of enterprise scale, the demand for management personnel and high technical personnel increases, thus attracting the entry of talents from outside the cluster. For enterprises in the cluster, the cost of labor search can be reduced, the available and needed labor can be found quickly and accurately, and the operation efficiency of enterprises can be improved. For the workers themselves, they will have greater development space and more career opportunities; For port logistics industry cluster, the flow of labor force will promote the flow of knowledge and technology, thus promoting regional innovation. Talent pool can also further attract the entry of related industries, thus expanding the scale of the cluster.

The inflow of labor force can bring positive economic effect to economy and drive regional consumption. The inflow of talents can bring the advanced management concept and technology to the enterprise, so as to enhance the strength of the enterprise and create greater economic value. At the same time, the agglomeration of population will inevitably lead to the demand for catering, transportation, housing, communications, finance, education,



medical care and other industries. This can drive the development of basic industries and force of regional consumption demand, then finally stimulate economic development.

#### 4.2 Analysis of the Impact of Regional Growth on Port Logistics Industry Cluster

Port logistics industry cluster is the derivative of economic development to a certain stage, its development needs to be based on the continuous growth of regional economy. The more flourish domestic and foreign trade, the greater the demand for port logistics. At the same time, due to the strengthening of economic strength, the construction of relevant public facilities will also be increased. In addition, regional economic development can also attract labor, capital, technology and other factors, so as to drive the growth of port logistics industry cluster. The economic policies of the government in the region where the port is located also have a profound impact on the development of the port logistics industry. For example, the government offer some preferential treatment such as the establishment of the bonded port and free trade zone. All in all, it attracts related industries and expands the size of industrial clusters. The action mechanism of regional economic growth on port logistics industry cluster is shown in Figure 3 below.

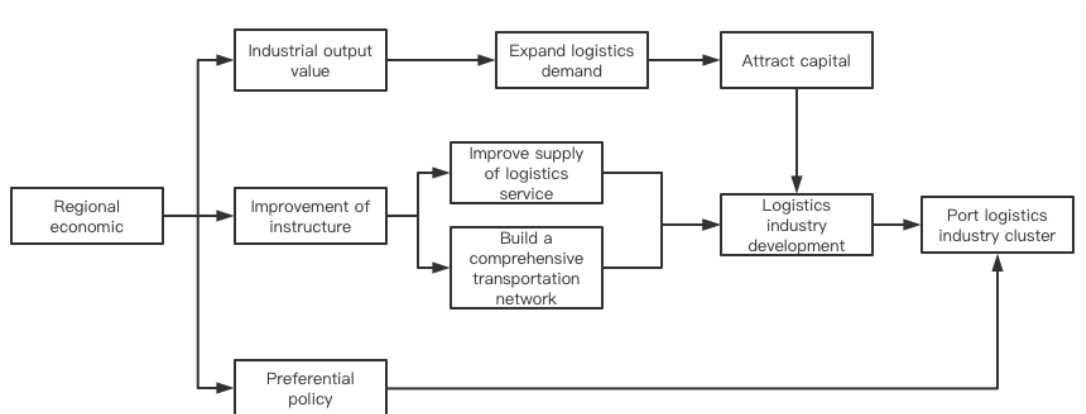


Figure 3. Mechanism of Regional Economy on Port Logistics Industry Cluster

#### *4.2.1 Drive the Development of Trade and Expand the Demand for Port Logistics*

Port logistics is a collection of various raw materials, transportation and service resources. The main function of it is to provide services for economic development. In essence, the demand for port logistics mainly comes from the demand for goods transportation generated in the process of regional economic development, including two parts: internal trade and foreign trade. The stronger the regional economic strength, the more frequent the trade will be with the economies outside the region. On the one hand, the demand for port logistics expands correspondingly, it will intensify the pressure on the port logistics industry and stimulate the investment in related industries. On the other hand, it can also directly promote the expansion of port logistics scale and improve the development of cluster.

From the perspective of economic development level, port cities with high economic development level have very flourished market transactions and large commodity circulation scale within and outside the region. The transportation, transshipment, import and export of many sources of goods are mainly completed through ports, that is why port logistics plays an important role in the transportation of goods. When the demand of port logistics exceed the original port logistics capacity, the pressure of port logistics will be intensified. That is to say, when the market is in a state of short supply, capital which is driven by profit will invest in the port logistics industry. As a result, the number of port logistics related enterprises in the region increases, economies of scale are further strengthened, and the level and quality of cluster is also improved.

In terms of the industrial structure of the economy, with the acceleration of industrialization and modernization, the proportion of the secondary and tertiary industries will rise rapidly. The development speed of port logistics is directly proportional to the development level of the secondary and tertiary industries, so the adjustment of industrial structure will increase the demand for port logistics. At the same time, the changing trend of industrial structure in the region also has an important impact on the structure of logistics cluster. Furthermore, it will make the logistics service function tend to be multi-functional, so that the port logistics industry cluster can adapt to the regional economic structure. Therefore, regional economic growth will drive the development of related industries within the region, and ultimately improve the overall level of port logistics industry cluster.

#### *4.2.2 Build a Comprehensive Transportation System*

The rapid development of regional economy can promote the gradual improvement of urban infrastructure, including port infrastructure and urban traffic facilities. The demand for port logistics is constantly expanding, which puts forward new demands and challenges to port throughput and transportation efficiency. In addition, economic growth also improves the financial capacity of the region, which can offer some favorable treatment and resources to the construction of infrastructure such as waterways, docks and berths. Port transport supply capacity can be improved, and thus enhance logistics efficiency and service level. With the increase of port cargo volume, more enterprises related to port logistics will be attracted to gather, and the number and more and more business types of upstream and downstream enterprises in the cluster will appear. At the same time, due to

the expansion of the business volume of some original enterprises in the cluster, the scale of enterprises, economic benefits, technological level and so on will also be highly improved, thus promoting the improvement of the level of the cluster.

At present, in order to realize integrated logistics and build multimodal transport system, it is necessary to provide the activity space for the port and the channel connecting the inland transport. For example, port and airport, port and railway station, port and road network, etc. Because the port is a special and important node in the transportation. Only through strong and perfect integrated transport network, can meet the rapid transfer of goods demand, while ensuring the fast connection of land and sea transport network in space and material. When the port logistics can meet the requirement of convenience, the port transport mode will be more attractive, and further bigger the port service scope. The enhancement of the port's ability to guarantee the supply of goods is conducive to the formation of economies of scale. Therefore, regional economic growth provides a strong engine for the development of port logistics and make clusters get better.

#### *4.2.3 Promote the Government to Improve Relevant Laws and Regulations*

The rapid growth of economy provides a good policy environment for the development of port logistics industry cluster. In order to adapt to the new situation and create new economic growth points, many regions have vigorously implemented the strategy of "revitalizing the city with the port" because the port logistics industry has a strong external effect and diffusion effect. This will gradually improve the relevant laws and regulations. From the government's perspective to support the development of port logistics industry.

The relevant policies and regulations do not directly affect the development of port logistics industry in fact, but it affect the allocation of production factors through adjustment. The main policies consist of support for port technology, investment in port industry, preferential policies for port core areas and free port policies. First, these policies can emphasize the importance of industrial clusters. Many enterprises related to the port logistics industry will consider settling in the port logistics industry cluster area, in order to enjoy the preferential conditions of tax, investment and financing brought by the policy. Secondly, the related policy can promote the world-wide resources to the port area, so as to meet the demand of the port logistics industry cluster for technology, investment, labor, supporting services and so on. At the same time, the open flow of capital, logistics and information is very necessary to port logistics. Thirdly, the policy of free port and free trade can provide a free environment for the port logistics industry. Customers are more likely to transit goods here. In the other word, the related policy create customer stickiness. Therefore, regional economic growth can promote the prosperity of manufacturing, warehousing, transportation and so on. To sum up, regional economic growth has guided the growth of industrial clusters.

## **Chapter 5 Quantitative Analysis of Beibu Gulf Port and Regional Economic Development**

### *5.1 The Selection of Indicator Variables*

Firstly, the sum of foreign trade is selected as the indicator variable representing the urban economic development, and the port throughput is selected as the indicator variable representing the port development. Considering that port infrastructure is also an important part of social fixed assets, the investment amount of fixed assets in the three cities of Qinzhou,

Beihai and Fangchenggang was selected as the control variable. Among the above variables, the foreign trade volume reflects the foreign trade relations of the port groups in the Beibu Gulf, and it is also an important indicator of the export-oriented development of regional economy. GDP is regarded as the best indicator to measure the economic status of a country or a region. Port throughput reflection is the operating condition of a port, and it is the important reference index to calculate port income. The investment of fixed assets reflects the situation of the investment of fixed assets in the three cities.

Table 1. 2010-2019 List of port and economic situation in Beibu Gulf Port

year	throughput	foreign trade	investment in fixed assets	urban GDP
2010	18575	177.06	785.07	8552.44
2011	23335	233.31	1016.45	10299.94
2012	26873	294.74	1263.22	11303.55

2013	29276	328.47	1190.67	12448.36
2014	31025	405.53	1384.21	13587.82
2015	31421	512.62	1622.78	14797.8
2016	32041	478.97	1823.78	16116.55
2017	34449	572.1	2049.11	17790.68
2018	37866	623.38	2152.23	19627.81
2019	37916	682.02	2378.58	21237.14

(Source: Guangxi Bureau of Statistics)

### 5.2 Correlation analysis

The process of measuring the degree of correlation between two things and expressing it with appropriate statistical indicators is called correlation analysis. Since the variables studied in this paper are all normal continuous variables and the relationship between them is linear, the correlation between binary isometric variables can be determined by the Pearson correlation coefficient.

The calculation formula of the simple correlation number is as follows:

$$r = \frac{\sum_{i=1}^n (x_i - \bar{x})(y_i - \bar{y})}{\sqrt{\sum_{i=1}^n (x_i - \bar{x})^2 \sum_{i=1}^n (y_i - \bar{y})^2}}$$

The value range of the correlation coefficient is 0-1. The more the absolute value of the correlation number is close to 1, indicating that the stronger the correlation is. At the same time, the more the correlation number is close to 0, the weaker the correlation degree. In general, the correlation strength of the variable is judged by the following four norms: the correlation coefficient is 0.8-1.0, it is strong correlation; The correlation coefficient is 0.6-0.8 strong

correlation, and the correlation coefficient is 0.4-0.6 moderate correlation. A correlation coefficient of 0.2-0.4 indicates a weak correlation. The correlation number of 0.0-0.2 is very weak correlation or no correlation. Using statistical analysis software, we can get the following table 2.

Table 2. The result of correlation coefficient

category	throughput			foreign trade volume		investment in fixed asset
	investment in fixed asset	urban GDP	foreign trade	urban GDP	investment in fixed asset	urban GDP
R	0.949	0.961	0.963	0.986	0.983	0.992

As can be seen from the above table, there is a high correlation between the throughput, foreign trade, investment in fixed assets and each other of Beibu Gulf ports. In terms of priority, relative to the port throughput, the correlation of variables is foreign trade, three cities' GDP and fixed asset investment in order.

### 5.3 Regression analysis

Correlation analysis can only show that there is a strong correlation between the hypothetical variables, but it lacks a constant quantity denotation. For this reason, we can obtain the fitting degree and the correlation equation of the variables by using the one-element linear regression method. In order to



reduce the mutual interference among the variables, we set up a one-dimensional linear regression equation for the above three variables and the cargo throughput at the port:

$$y = \beta_0 + \beta_1 x + \varepsilon$$

where Y represents the cargo throughput at the port, X represents the turnover of foreign trade, fixed capital and investment, and urban GDP.  $\beta_0$  is the constant term,  $\beta_1$  is the regression coefficient,  $\varepsilon$  is the random disturbance term. The test of this equation is conducted by goodness of fit, and the number of determinants is:

$$R^2 = \frac{(\sum x_i y_i)^2}{\sum x_i^2 \sum y_i^2}$$

The closer R is to the apparent regression line, the better the fitting degree is. Using Eviews statistical analysis software, we can get the mathematical relationship parameters between port throughput and the other three variables. The obtained port throughput, turnover of foreign trade, investment in fixed asset and GDP of Beihai, Qinzhou and Fangchenggang are respectively:

(1)  $y = 15403 + 34.462 x$

$R^2 = 0.927, F = 100.995, D.W. = 1.363$

(2)  $y = 12990.737 + 11.035 x$

$R^2 = 0.91, F = 73.171, D.W. = 1.035$

(3)  $y = 9537.793 + 1.423 x$

$R^2 = 0.915, F = 97.725, D.W. = 0.756$

The above regression model not only gives the mathematical relationship between port throughput and the other three variables, but also confirms that

in the correlation relationship between port throughput and the other three variables, urban GDP and throughput are in the first position of correlation. The correlation between fixed capital, production and investment, and foreign trade volume is in the second and third positions respectively, that is, the above variables show a hierarchical correlation with port intake and export volume. In recent ten years, especially since the Beibu Gulf Economic Zone has been promoted as the national development plan, the economy of Beibu Gulf has developed rapidly, and the economic growth of port cities in Beibu Gulf has become the main reason for the increase of port throughput. The huge investment of the regional government in the infrastructure construction of the Beibu Gulf port group is an important reason to promote the increase of port throughput. It can be seen that investment, infrastructure construction and urban economic development are the necessary conditions for the growth of Beibu Gulf ports. The effect of volume on foreign trade is much greater than that of foreign trade on volume; If the government need to see the harmonious development of the relationship between the port city of Beibu Gulf, they may have to select the appropriate port industry while the city's economy is growing continuously.

#### *5.4 Econometric analysis of Beibu Gulf Port and Regional Economy*

##### *5.4.1 Economic Significance Test*

The port throughput is positively correlated with the city's regional GDP. The port economy can promote the upward development of the regional economy. The above shows that the model can be tested by economic significance.

#### *5.4.2 Goodness of Fit Test*

It can be seen from the model that the determinable coefficient  $R^2$  are 0.927, 0.91 and 0.915 respectively, indicating that the model fits the data well. But the established model has three explanatory variable, it is possible to have the problem with multiple collinearity. As regard to the significance test of regression equation,  $\text{Prob}>F=0.0000$ , it can be indicated that the regression equation is significant. In regard to significance test of regression parameters, the value of  $p>|t|$  is 0.000, it is obviously that the P value is less than 5% of the significant level, so the null hypothesis can be rejected, and the probability of rejecting the null hypothesis is zero, indicating that the throughput of Guangxi Beibu Gulf Port has an obvious impact on the regional GDP of Guangxi.

#### *5.5 Quantitative Evaluation Measures*

The development levels of ports in China's provinces are not consistent because it is influenced by relevant policies, geographical location conditions, hinterland economic conditions and other factors. In order to objectively measure the level of port logistics industrial clusters in the Beibu Gulf port, this paper also uses location quotient to measure.

At present, there are many measurement indexes on industrial agglomeration level in the academic circle. Each measurement method has its own aspect of emphasis and applicable scope. Besides, the data requirements are also different. In the process of measuring the level of port logistics industry cluster, it is difficult to obtain the indicators such as the number and scale of port enterprises. At the same time, it is considered that the location quotient index is suitable for measuring the degree of industrial cluster of an industry in a

certain region. Also, it has the characteristics of simple calculation and strong representativeness. In order to analyze the situation of port logistics industry cluster in more detail and to consider the availability of data, this paper mainly uses location quotient to calculate the level of port logistics industry cluster in each region of the Beibu Gulf port

#### *5.5.1. Location Quotient*

Location quotient (LQ) is an important index to measure the degree of industrial concentration proposed by P. Hagett. It is mainly used to reflect the spatial distribution of elements in a certain region, and can also be used to measure the regional specialization degree of an industry. There is a complex relationship between the port logistics industry cluster and the regional economy (Peng et al., 2018). To measure it, the location quotient and per capita GDP are referred to as the evaluation criteria. The location quotient is an indicator for measuring the specialization level of industrial agglomeration. The greater the location quotient, the higher the specialization level. Location quotient also known as Location Entropy. It is calculated by the following formula.

$$LQ = \frac{(e_0/E_0)}{(e_1/E_1)}$$

Where  $e_0$  represents the throughput of port logistics;  $E_0$  represents the throughput of nationwide port logistics;  $e_1$  represents the marine industry yield of the port areas;  $E_1$  represents the total yield of the marine industry in the port areas nationwide. The regional economic development is evaluated quantitatively based on the National Bureau of Statistics (NBS) data and per capita GDP.

### 5.5.2 Instance Data Statistics

Guangxi Beibu Gulf Port has contributed to a good industrial cluster effect of the ports to drive the development of regional economies, for example, the typical Beihai Port. In 2019, the throughput of Port reached 508 million tons. Guided with the policies such as the Economic Development Plan of Guangxi Beibu Gulf, we have seen the rapid development of regional marine economy in Guangxi Province.

According to the statistics, the location quotients of the Beibu Gulf Port Logistics Industry Cluster from 2007 to 2014 are shown in Table 3.

Table 3. The location quotient of Beibu Gulf Port from 2012 to 2019

Year	2012	2013	2014	2015	2016	2017	2018	2019
LQ	1.425	1.485	1.691	1.783	1.829	1.875	1.882	1.906

Based on the information published by the NBS, the distribution of per capita RGDP in Guangxi is shown in Table 4.

Table 4. The RGDP distribution of Beibu Gulf Port from 2012 to 2019

Year	2012	2013	2014	2015	2016	2017	2018	2019
RGDP	2.424	2.648	2.869	3.100	3.346	3.659	4.001	4.296

(Source: Guangxi Bureau of Statistics)

### 5.5.3 Analysis Summary

The port logistics industry cluster has created a brand effect for the port areas and enhanced the talents and investment attractiveness in the local. It is clear

from the positive analysis of the Guangxi Beibu Gulf Port that the higher the degree of logistics industry cluster, the greater its contribution to the regional economy in port areas; The corresponding regional economic development will render a good environment for developing the port logistics industry with the advanced port infrastructure construction.

Up till now, the port logistics industry cluster is still in the growth phase in China. Only when the competitive advantage is improved greatly to facilitate the development of industrial clusters can the regional transoceanic economy get more flourishing.

## **Chapter 6 Conclusions and Suggestions**

### *6.1 Conclusion*

With the development of global trade, the importance of logistics to regional economic development continues to increase. In recent years, scholars have been discussing the relationship between logistics and regional economic development. As an important part of modern logistics, the port is an important carrier for a region to open to the outside world. On a global scale, most economically developed cities are port cities or have direct access to ports. Guangxi Beibu Port is an important port in the country and has played a prominent role in the economic development of Guangxi. In order to further understand the relationship between port economy and regional economic

development, this article mainly analyzes the impact of Beibu Gulf Port on regional economic development. It aims to provide useful suggestions for the coordinated development of Beibu Gulf Port and the regional economy.

Research findings are as follows:

1) The development of Guangxi Beibu Port has changed the regional industrial structure, and industries such as logistics, manufacturing, and foreign trade have become Guangxi's important industries. The expansion and construction of the port area has injected new vitality into the regional economy, provided employment opportunities to a certain extent, and eased employment pressure.

2) The development of Beibu Gulf Port has promoted the formation and development of the regional port industry, formed a port industry cluster and industrial base, and used the advantages of the port to reduce unit costs for enterprises and achieve better economic benefits.

3) The development of Beibu Gulf Port has promoted the construction of the regional transportation network. In order to better connect port transportation services and promote the development of inland waterway navigation, the pattern of inland waterway navigation is gradually improved.

4) Use regression model to carry out quantitative analysis, and obtain the contribution of Beibu Gulf Port development to Guangxi's economic development. In terms of the three major industries, Beibu Gulf Port has a particularly significant impact on the secondary and tertiary industries.

Finally, in order to better realize the development goals of Beibu Gulf Port, and at the same time realize the coordinated development of the port and the regional economy, this article puts forward some useful suggestions. In view of the difficulties encountered at present, the service industry economy is

relatively lagging, export-oriented labor-intensive manufacturing is difficult to transform, strategic emerging industries are not developed enough, ecological improvement and industrial development are mutually restricted, and corresponding countermeasures are proposed which is speed up structural optimization and promote upgrading; strengthen the level of technology, encourage research and development; strengthen enterprise management; strengthen the construction of ecological civilization, and alleviate the contradiction between industrial development and the ecological environment.

### *6.2 Limitations of the Research*

Due to factors such as research time, research perspective, personal ability, etc., this research still has certain deficiencies. The biggest disadvantage is that only port throughput, turnover of international trade and regional GDP are considered in the quantitative analysis. Four types of data are used in this article. Port throughput reflects the development level of a port, and GDP reflects the economic development level of a city. In fact, this has great limitations. There are many factors that affect the level of economic development of a region. It is not comprehensive enough to use the GDP value of this region alone. In addition, there is no unified concept of regional economy. Therefore, in order to facilitate calculation and data acquisition, the data of Guangxi directly in the hinterland is used as the model data, and the indirect hinterland is not quantitatively analyzed, which is not comprehensive enough.



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