

Analysis on Construction of Regional Maritime Centre and Economic Development Based on Symbiosis Theory

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Abstract: In this paper, the performance of the three elements of symbiosis in the regional maritime center and the economic development has been analyzed. At the same time, the coupling relationship between the maritime center and the economic development has been also quantitatively studied through taking the maritime center in Qinzhou as the example. The results show that although there is an apparent symbiosis tendency between the regional maritime center and the economic development, the symbiotic relationship is in the moderate position and the symbiotic mode is still fragile. The results are consistent with the development of reality. Meanwhile, in view of the demands of integrated symbiotic development, the advice that it is necessary to optimize the symbiotic units from the base and optimize the symbiotic environment from the content has been provided in this paper.

Keywords: Economic development, regional maritime centre, symbiosis theory.

1. INTRODUCTION

The symbiotic theory initially belonged to the field of biology field and some scholars have applied it into the fields of sociology, economics and management. The application of symbiosis theory mainly include the application in industrial organization, such as Lambert (2002) and Desrochers (2004), etc; the research on symbiotic relationship of enterprises, such as Lingdan (2006) and Wangfei (2013) [1]; the industrial agglomeration and symbiosis, such as Long Yunguang (2009) and Li Tianfang (2013) [2]; the application of symbiosis theory has been widely applied. In the field of port industries, Zhang Guangxin (2011) [3] has used the symbiotic mode to study the development of port-centered industries and hinterland industries and he thought that the isolated development of industries could be improved through the symbiosis mode. Sunming (2013) [4] further analyzed the four symbiotic theoretical modes of maritime services. Gao Lina (2011) [5] applied the symbiotic theory in the research of ports groups in Shandong Peninsula and the five port groups have been quantitative studied. The researches of scholars have shown that the symbiotic theory can be applied in solving the development problems of port industry and surrounding economic development. Therefore, Qinzhou has been taken as the example in this paper to analyze the symbiotic relationship between the construction of regional maritime center and the economic development.

The maritime center has the strong logistic distribution capabilities. The efficiency is mainly reflected in the radiation aspect of regional economy. It is not only the regional distribution center, but also the starting point as well as the end point of hinterland commodity circulation. The maritime

centers around the world have gradually developed into the leaders of regional economy (Zhang Li, 2008) [6], which directly affects the economic trend. The relationship of the maritime center and the hinterland economy has naturally become the symbiosis mode with common development and prosperity. In Bohai Sea region, Yangtze River Delta and Pearl River Delta, there all exists the interaction pattern that the economy promotes the circulation and the circulation can also promote the economy. The interdependence of port center and regional economy in Qinzhou has been gradually strengthened in recent years. The development of port industry has strongly promoted the economic progress of Qinzhou. The implementation of some policy measures such as the operation of bonded port areas, the settlement of various enterprises and the construction of the coastal railway as well as the highways and some projects such as the settlement of CSSC, the import of vehicles and the wine trading base are focusing on how to expand the port industry. With the continuous demands of maritime, the symbiotic relationship between them will be further strengthened under the mutual impetus.

2. SYMBIOTIC CATEGORIES OF THE CONSTRUCTION OF REGIONAL MARITIME CENTER AND THE ECONOMIC DEVELOPMENT

The symbiotic unit refers to the basic energy and the exchange unit of symbiosis or symbiotic relationship, which is the basic material of symbiotic system. The symbiotic units of the regional maritime center and the economic symbiosis are the enterprises that carry out the commodity trades through ports and the departments that can provide the services, including the foreign trade companies, the maritime service companies, the port freight forwarders, the port logistics companies, the customs and the port authorities, etc. The image parameters of symbiosis are the external characteris-

tics of symbiotic units, such as the business size, the image and the service projects, etc. The quality parameters of symbiotic units refer to the products of enterprises, the main business and the partnership of enterprises, etc. The symbiotic unit is a symbiotic micro-molecule. The combination of several symbiotic units has laid the basis for symbiosis. The image parameter and the quality parameter measure the levels of symbiotic units. In the symbiosis of maritime center and regional economy, the symbiotic units can rapidly grow after getting the stronger energy supplement and the faster energy exchange rate. Then, a strong symbiotic development prospects can be formed. As the symbiotic units, the port enterprises, the enterprises in Bonded Port and the regional enterprises have significant deficiencies. The image parameter is insufficient, such as the small scale, the missing corporate images and the simple profit model. At the same time, the industry chain of introduced enterprises is not fully extended and the collaboration with local enterprises is immature. The driven development trend of symbiosis is difficult to be formed. Therefore, in the symbiotic process of regional maritime center and economic development, the fragile symbiotic units, the unstable symbiotic foundation and the poor symbiotic stability lead to the poor symbiotic effect.

According to the symbiotic theory, there are four symbiotic modes between symbiotic units, namely the parasitism, the commensalism, the asymmetric mutualism and the symmetric mutualism. As the parasitism is a one-way profit form, it does not exist in a market economy. The commensalism is a single winning form in which a party earns profits and another party does not change. Therefore, this form can not last long., the most common symbiotic modes are the symmetrical and asymmetrical mutualisms. The industries and the enterprises that play dominant roles in industrial chain can obtain more benefits. The symbiotic system of them presents the asymmetric mutualism. The symbiotic form in completely market conditions is called the symmetrical mutualism.

The regional maritime center and the regional economic development have the interdependent and mutually reinforcing relationship in the symbiotic process. In the earlier stage, the economic development can promote the construction of maritime center. In the later stage, the construction of the service industry of maritime center can stimulate the economic growth. The asymmetric mutual symbiotic relationship is shown. The benefits brought by symbiotic system have different performance in maritime center and economic development. According to the evolution of symbiotic systems, it is required to conduct the energy exchange between the regional maritime center and the regional economy based on labor division and cooperation so as to reach a more stable and efficient level. Then, the highest integrated form can be eventually formed. The regional enterprise has become a part of whole symbiotic ecology. The contact between them has also broken the single-chain structure and it shows reticular distribution. The market is fully developed and competitive. The benefits can be evenly distributed in symbiotic units. The symmetrical mutualism symbiotic relationship has been formed in the symbiotic units and the regional economy as well as the maritime development has also entered into the upward period of circulation interaction.

3. SYMBIOTIC DEMONSTRATION OF THE CONSTRUCTION OF REGIONAL MARITIME CENTER AND ECONOMIC DEVELOPMENT

The concept of coupling comes from physics, which has been widely applied in social and economic development researches. It refers that two or more social phenomenon is integrated into a whole to bring the maximum benefits. The subsystems are closely related through a link and the orderly development can be achieved in the process of dynamic adjustment. Scholars have also tried to establish the relationship between symbiosis and coupling to explain the economic issues, such as the symbiotic coupling of eco-industry chain (Qi Zhenhong *et al.* 2010) [7], (Li Ying, 2013) [8]. Gao Lina (2014) has analyzed the development of port groups through the combination of symbiotic theory and coupling theory. The integrated symbiosis has the similar development model with the coupling development. The target is to reduce the internal costs and improve the efficiency through strengthening the contact of subsystems or symbiotic units so as to form the overall operation of foreign exchange. Therefore, the coordinated development between two or more units can be handled. In this paper, the coupling model has been employed to study the symbiotic issues of the construction of regional maritime center and the economic development.

μ is set as the order parameter of maritime center and μ_{ij} represents the contribution value of each index, namely the j^{th} variable parameter of the i^{th} index, $i=1, 2, \dots, n$; $j=1, 2, \dots, m$. ω is the order parameter of regional economy and ω_{ij} represents the contribution values of each evaluation index in economic development, namely the j^{th} variable parameter of the i^{th} index, $i=1, 2, \dots, n$; $j=1, 2, \dots, m$. The upper limit α_{ij} and η_{ij} of order parameter and the lower limit β_{ij} and ζ_{ij} of order parameter are respectively selected according to the yearly value of North Sea and Fangcheng Port. x_{ij} and y_{ji} respectively represent the j^{th} variable parameter of the i^{th} index in order parameters. The acquisition process of the subsystem evaluation model of the two industries is:

The contribution value of each evaluation index of maritime center is: $\mu_{ij}=(x_{ij}-\beta_{ij})/(\alpha_i-\beta_{ij})$, in which $i=1, 2, \dots, n$; $j=1, 2, \dots, m$. The contribution value of each evaluation index of economic level is: $\omega_{ij}=(y_{ji}-\zeta_{ij})/(\alpha_j-\eta_{ij})$, in which, $i=1, 2, \dots, n$; $j=1, 2, \dots, m$. The value of μ_{ij} and ω_{ij} ranges from 0-1. If the value is closer to 1, the contribution of x_{ij} and y_{ji} on subsystems will be greater.

The contribution model of operational indicators of each subsystem of maritime center is: $\mu_i=\sum_{j=1}^m \lambda_{ij} \mu_{ij}$, $i=1, 2, \dots, n$, $\sum_{j=1}^m \lambda_{ij}=1$. The contribution model of the economic development indexes is: $\omega_i=\sum_{j=1}^n \delta_{ij} \omega_{ij}$, $i=1, 2, \dots, n$, $\sum_{j=1}^n \delta_{ij}=1$.

C is set as the coupling correlation degree of maritime center and economic development level: when the two systems are interacted, the coupling correlation degree is: $C=\{(\mu \cdot \omega) / [(\mu + \omega) (\mu + \omega)]\} / 2$ and the value of C is $0 \leq C < 1$. The meaning is: when $C=0$, there is no coupling relationship between maritime center and economic development level and the construction of maritime center is in its infancy; when $0 < C \leq 0.3$, it is indicated that they are in the low coupling relationship and the maritime center is in the growth stage; when $0.3 < C \leq 0.7$, it is shown that they are in the mod-

Table 1. Decision table of coupling coordination degree.

Coupling Coordination Degree	Types of Industrial Development	Coupling Coordination Degree	Types of Industrial Development
0.00-0.009	Extreme Recession	0.50-0.59	Excessive Development
0.10-0.19	Severe Recession	0.60-0.69	Primary Development
0.20-0.29	Moderate Recession	0.70-0.79	Moderate Development
0.30-0.39	Mild Recession	0.80-0.89	Good Development
0.40-0.49	Brink of Recession	0.90-1.00	Excellent Development

Table 2. Basic data of regional economic development and maritime center.

	λ_1	Δ_{ij}	Qinzhou X _{ij}	North Sea (Order Parameter)	Fangcheng Port (Order Parameter)
	Regional Economic Development	Overall Economic Status 0.4	GDP(Billion yuan)0.5	691.32	630.09
Per capita GDP(yuan)0.2			22147	40372	50302
Proportion of the Third Industry 0.3			0.34	0.316	0.336
Economic status of Associated Industries 0.6		Total Amount of Transportation Storage and Post(Billion yuan)0.2	0.53	0.43	1.13
		Total Sales of Social consumer Goods(Billion yuan)0.1	237.56	146.51	71.3
		Freight Volume(ten thousand tons)0.3	21456	4386	1360
		Freight Turnover(billion ton km)0.2	197.33	58.2213	401.16
Total Amount of Import and Ex- port(million dollars)0.2	376656	207820	489826		
	λ_2	Δ_{ij}	Qinzhou Y _{ij}	North Sea (Order Parameter)	Fangcheng ?Port (Order Parameter)
	Basic Conditions of port 0.7	Number of berths 0.3	14	9	31
Quay Length(m)0.2		11206	6040	13945	
Container Routes(bar)0.3		11	3	14	
Water Depth(m)0.2		12.5	9.5	13.5	
Export of ports 0.3	Cargo Handling Capacity(ten thousand tons)0.6	5622	1757	10058	
	Container Throughput(TEU)0.4	47.4	127.09	27.02	

erate coupling relationship and the maritime center is in the early stage of development; when $0.7 < C \leq 1$, it is indicated that they are in the high degree of coupling relationship and the maritime center is in the late stage of development.

Although the coupling degree has explained the association of maritime center and economic development, the development of them can not be shown. The phenomenon that the development levels of them are low and the coupling degree is high may be appeared. Therefore, it is required to further analyze the relationship between them through the coupling coordination degree.

The model is $D = (C * T)^{1/2}$, in which C is the coupling-related systems. $T = a * \mu + b * \omega$, $a + b = 1$, in which a and b re-

spectively represent the contribution coefficients of maritime center and regional economy Table 1.

The index selection should be able to make effective response to the regional economic development and the maritime economy status and evaluate the maritime center as well as the current input and output. In order to reflect the characteristics of establishing maritime center in Qinzhou, the data of North Sea and Fangcheng Port has been consolidated and considered as the order parameter to compare with the data of Qinzhou. The coupling evaluation system has been established through selecting four dimensions which include 14 indicators. And the index system of the symbiotic development relations of regional economy and maritime center has been formed Table 2.

Table 3. Contribution value of regional economic dimensions μ_{ij} .

GD P	Per Cap-ita GDP	Proportion of the Third Industry	Total Amount of Transportation Storage and Post	Total Sales of Social consumer Goods	Freight Volume	Freight Turnover	Total Amount of Import and Export
0.5	0	0.3	0.0286	0.1	0.3	0.0812	0.1198

Table 4. Contribution value of regional maritime center dimensions ω_{ij} .

Number of berths	Quay Length	Container Routes	Water Depth	Cargo Handling Capacity	Container Throughput
0.0681	0.1308	0.2181	0.15	0.2796	0.0816

The determination of the dimension weight and the index weight of index system employs the form of expert scoring. The score form and the data are from “Statistical Yearbook of Guangxi in 2013” and the statistical bulletin of Qinzhou, North Sea and Fangcheng Port in 2012 Tables 3 and 4.

Assuming that $\mu_i = \sum \lambda_{ij} * \mu_{ij}$, $\mu_1 = 0.8$, $\mu_2 = 0.6269$ can be obtained. Similarly, $\omega_1 = 0.567$, $\omega_2 = 0.3612$, the comprehensive contribution value is $\mu = \sum \lambda_i * \mu_i$, which is substituted to calculate $\mu = 0.69614$. Then, the comprehensive value of the regional maritime center is: $\omega = 0.50526$. The final coupling correlation degree is expressed as $C = \{(\mu * \omega) / [(\mu + \omega)]\}^{1/2} = 0.37668$.

Coupling coordination degree: Through the further analysis of model and the coupling development relationship $D = (C * T)^{1/2}$, it is required to choose $a = 0.65, b = 0.35, T = 0.65 * 0.69614 + 0.35 * 0.50526 = 0.6293$. Then, the coupling development degree is obtained: $D = (C * T)^{1/2} = 0.4869$.

$C = 0.37668$, when $0.3 < C \leq 0.7$, the development of maritime center and regional economy is in the moderate coupling relation. The regional maritime center is in the initial stage of development. The results of model are consistent with the development status.

In reality, the construction of the regional maritime center is proposed in recent years and demonstrated. The infrastructure and the facilities of regional maritime center are not perfect. The regional maritime center is still in the construction stage. After the integration of Beibu Gulf Port, the division of ports has been further clarified to avoid the vicious competition and form the status with functional complementation and coordinated development. However, the promoting role of ports in hinterland economy is limited. The function of ports in Qinzhou is single, which takes loading and unloading of ore, oil and others as the prominent business. They only serve for the land and sea transit and cargo transport. The port industry is weak and the goods are frequently imported and exported. The hinterland economic development is disjointed with the port economy and the symbiotic interface is not formed. The symbiotic degree, the correlation degree and the support degree are weak. The construction degree of industry chain is low. The whole maritime industry and the regional markets are in the low value part of circulation chain.

$D = 0.4869$, $0.40 < D < 0.49$, it is indicated that although they have the moderate coupling relation from the perspective of coupling coordination degree, this relation is not

strong. The development of regional maritime center and economy is at the brink of recession. The changes in any part can cause the regress of bilateral symbiotic relationship. From the aspect of practical development, the interaction relation of regional maritime center and regional economy is established in recent years and the current dependency is still relatively weak. Two parts should work together to promote the development. Therefore, the continuous integration, correlation and symbiotic development of them are the main trends to prevent the isolation and achieve win-win results.

CONCLUSION

From the empirical analysis, it is found that there exists a strong coupling relationship between the regional economy and the maritime center. The trend of mutual integration and symbiotic development is obvious. However, due to the low coupling coordination degree, the relation between them is still on the verge of recession and the symbiotic relationship is very fragile. The changes of any part can affect the symbiotic development. The model analysis is consistent with the actual development. In recent years, the economic growth in Qinzhou is at the forefront place in Guangxi and the construction of maritime center is also in its infancy. The implementation of some supporting policies and the construction of facilities such as China-Malaysia industrial park and Qinzhou technical industrial park have changed Qinzhou Port from “transportation center” to “logistics center + service center”. In 2013, the container throughputs in Qinzhou Port are 601,000 TEUs, which makes Qinzhou Port become the biggest domestic container transport port in Beibu Gulf. In July, 2013, the “Development Plans of Regional and International Maritime Center in Qinzhou” has further cleared the target steps of building the regional and international maritime center in Qinzhou. According to the concept of “front dispatch station” [9], Qinzhou Port has moved for the target of front dispatch station of comprehensive transportation and logistics with the construction of highway and coastal railway, which further strengthens the leading role of regional economy. In future, it is required to further promote the construction of maritime center, strengthen the correlation of maritime center and regional economy and continuously promote the symbiotic integration. From the perspective of symbiosis theory, the following problems should be stressed:

Firstly, it is required to optimize the symbiotic units from basis. In the aspect of construction of maritime center, in

recent years, the types of goods and the amount of goods in Qinzhou Port are continuously increased. The cargo transport is changed from the general bulk to the large amount of dry bulk and the specialization of containers [10]. However, the comprehensive ability of port is poor, the professional level is low, the dock and the equipment capacity have not yet reached the requirements of building a logistics center and the construction of container wharf is lagging behind. Therefore, it is required to accelerate the construction of regional maritime center, take the "Development Plans of Regional and International Maritime Center in Qinzhou" as the lead, strengthen the infrastructure construction and introduce the internationally renowned maritime enterprises so as to promote the rapid growth of maritime center. In the aspect of regional economic growth, the economy in Qinzhou has maintained the double-digit growth in five years. The increase is 2.18 percent higher than the one in Guangxi, which ranks the third place in Guangxi. According to the analysis of growth, consumption, investment and exports are the "three carriages" to stimulate the economic growth, but the steps of the "three carriages" in Qinzhou are uncoordinated and synchronized. Relying on the investment has been the main reason to achieve the economic growth in Qinzhou. In 2012, the sum of the consumption and the exports is less than 1/2 of fixed assets investment. With the gradual improvement of national macroeconomic policies, the national investment will be compressed. The method of solely relying on the investment to maintain the economic growth is not a permanent solution. Therefore, the changes of economic growth methods are also the demands to optimize the symbiotic units and reach the integrated symbiosis.

Secondly, it is necessary to optimize the symbiotic environment from content. First, it is required to strengthen the contact of maritime center and economic development and guide as well as nurture the foreign trade enterprises. At the same time, it is necessary to develop the outward paths through taking Qinzhou Bonded Port and China-Malaysia industrial park as the platforms. Meanwhile, it is also demanded to increase the investment and extend the industrial chain based on the existing petrochemical industry, oil industry and metallurgy industry so as to build the core coastal industrial base of Guangxi. Second, it is required to continuously improve the transportation network and establish the regional logistics information platform as well as the logistics network system that integrates the functions of procurement, transportation, storage, processing and distribution. Third, it is needed to innovate the policy environment. The thoughts of "new strategic pivot" proposed by Premier Li Keqiang and "Pillar" thought of Peng Qinghua should be fully understood. At the same time, it is necessary to establish the regulations on the basis of industrial parks and bonded economic development so that relationship between the regional economy and the maritime industry can be further strengthened and coordinated and the development of symbiotic environment can be promoted.

In this paper, through analyzing the symbiotic status of regional maritime center and economic development and evaluating the symbiotic degree by employing coupling model, it is found that there exists a moderate coupling relation between them and the symbiotic correlation is initially realized. However, the coupling correlation degree is low, the symbiotic relationship is very fragile, the maritime center is in the initial stage of construction and the port industry is in its infancy. In recent years, the regional economy has rapidly grown, which is not entirely due to the port industry. Therefore, it is required to doubly promote the symbiotic units and essentially optimize the symbiotic units. At the same time, it is necessary to optimize the symbiotic environment in the aspects of regional infrastructure construction, network platform and full utilization and development of policies so that the integrated symbiosis of the construction of regional maritime center and economic development can be ultimately achieved.

CONFLICT OF INTEREST

The author confirms that this article content has no conflict of interest.

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