Theory and method of land and sea overall planning of provincial coastal zone industrial space based on the perspective of multi-scale coordination —— Take Fujian Province as an example

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Abstract: Under the strategic guidance of ecological civilization and building a maritime power, "blue economy" has become a new engine driving Chinas economic growth. The optimization of industrial spatial layout of coastal zones is crucial to handling the relationship between high-quality development of Marine cities and high-level protection. Multi-scale overall perspective and key grasp is the key to improve the comprehensive benefits of coastal zone industrial spatial planning. Starting from the land and sea coordination goal of territorial space planning and the practical problems of provincial coastal zone industrial development, the multi-scale cross-border coordination theoretical framework of "external environment- -internal pattern- -resource elements" is constructed, and the cross-border coordination path of "region-provincial-bay area" is put forward. Based on the theoretical method, it is suggested that Fujian province should cultivate the "land-sea double-fan" global ocean center city cluster between Fujian and Taiwan at the regional level, build a spatial pattern of large density, large density and low influence at the provincial level, and build diversified bay units with land-sea coordination and industry-city integration at the bay level. The research can provide theoretical and practical reference for the high-quality development of provincial coastal zone industry and the comprehensive management of land and sea.

Key words: coastal zone; land and sea coordination; industry; multi-scale; provincial level

The optimization of the spatial layout of the Marine economy, the construction of a modern Marine industrial system and the effective protection of Marine ecological resources are the important support and key contents for the construction of a Marine power and an ecological civilization[1-2]. As early as the 12th Five-Year Plan period, China proposed to build three Marine economic circles in the south, east and north to strengthen the agglomeration and development of Marine industries. With the strategic deployment of "accelerating the development of Marine economy and building a Marine power" put forward in the report of the 19th National Congress of the CPC, Shandong, Zhejiang, Fujian, Guangdong and other major provinces of Marine economy responded positively to accelerate the development of coastal industries and accelerate the construction of a strong Marine province.

The coastal zone with rapid urbanization is both a high-density economic agglomeration zone and also a typical ecological fragile zone. It is urgent to explore the scientific layout method of the coastal zone industrial space to balance the relationship between high-quality development and high-level protection. In July 2023, At the meeting of the National Conference on Ecological and Environmental Protection, General Secretary Xi Jinping emphasized the "implementation of an ecological and environmental governance system featuring land and sea coordination and regional linkage", further clarifying the core guidelines for cross-border coordination of development and protection in coastal areas. However, the current coastal zone spatial planning pays more attention to ecological environment protection and safety bottom-line control, and underconsiders the realistic needs of high-quality industrial development and high-efficiency use of space[3–5]; Pay more attention to the industrial development demands of

municipal and county administrative units, and the research on the cross-regional coordinated development of coastal zone industries is insufficient[6-7]. The provincial coastal zone has the scale conditions of regional economic units, coordination of city and county administrative units and identification of bay natural units. Provincial coastal zone industrial layout planning is the spatial implementation of the development and deployment of the national Marine economy, and also the direct basis for the transmission to the industrial spatial planning of coastal zones at the city and county levels. Therefore, it is an important level for the scientific planning and coordinated development of cross-border coastal zone industrial space.

Facing the practical problems and high-quality development goals of cross-boundary coordination of coastal zone industrial space, the "Bay Area" is proposed as the basic unit of the overall planning of land and sea of provincial coastal zone industry, breaks the inertia logic of the division of city and county administrative units, fully integrates the advantageous industries of the whole province, and actively integrates into the global ocean center city cluster. Based on this, the paper will explore the provincial coastal zone industrial development strategy of "regional-provincial-bay" and cross-border coordination, correctly handle the relationship between high-level protection and high-quality development, and then improve the social, economic and ecological benefits of coastal zone space.

1. Study of the origin and concept analysis

1.1 Relevant concepts of coastal land and sea coordination

Coastal zone refers to the special geographical area under the influence of sea and land interaction. As a dynamic developing social ecological system, its geographical spatial scope radiates to the land and sea based on the coastline[8]Is a gradual transition and uncertain range[9]. The current demarcation methods of coastal zone spatial scope mainly include administrative boundary method, natural geographical labeling method, spatial distance method, environmental unit method and comprehensive demarcation method[9]. Due to the provincial coastal zone to explore regional economy as a whole, ecological protection as a whole and administrative management as a whole of industrial spatial planning theory and method, therefore, how to combine the goal of multi-scale coordination, comprehensive use of the above methods of different scale unit, scope of scientific definition is still the difficulty of the current coastal zone industrial spatial planning.

Land and sea coordination is to establish a comprehensive coordinated relationship and development model of resource utilization, economic development, environmental protection and ecological security in the two natural systems of land and ocean. Land and sea coordination is the basic principle of the territorial spatial planning of coastal areas. It is based on the correlation between the integrity of the coastal zone ecosystem and the development and utilization activities, coordinating the land and sea functional zoning, and considering the development orientation, spatial layout and institutional arrangement between land, sea and air[10–13], Its overall content includes ecological environment, resource elements, social economy, safety, disaster prevention and governance rights and interests and other fields. It requires cross-departmental, cross-regional and cross-system cooperation and coordination to promote the efficient utilization and scientific protection of land and sea resources. However, in objective practice, due to the lack of understanding of cross-system interactions such as land-sea relations, man-and-land relations and regional spatial relations, the spatial scope, content points and

technical methods of land-sea coordination are still not clear.

1.2 Research significance of land and sea coordination of coastal zone industrial space

Less than 20% of Chinas coastal area in the land area carries 50% of the countrys big cities, 60% of the population and 70% of the GDP. As a typical fragile area with highly concentrated population and economy, the industrial space of the coastal zone is faced with the following three characteristics and problems: First, the coastal zone area is the key area for the green transformation of Chinas industrial economy. Its industrial proportion is nearly 5 percentage points higher than the national average level, the output value of petrochemical industry accounts for about 75% of the national average, and the steel production capacity accounts for about 78% of the national average, which is in the critical stage of the transformation of old and new industrial drivers. Secondly, the coastal zone is under great environmental protection pressure. The vast number of land-borne pollutants in coastal areas reaches more than 10 million tons per year. About 15% of the sections of the sea rivers are inferior to V water quality, about 10% of the bay waters are seriously eutrophication, and about 42% of the coastal zones have environmental overload. Moreover, due to the human behavior in the context of rapid urbanization, such as land reclamation and shoreline cutting, the natural coastline of the national coastal zone has been less than 40%, and the curvature of the coastline has been greatly reduced. Finally, the coastal zone has an extremely important ecological status. The coastal zone gathers almost all important ecosystem types of mountains, rivers, forests, farmland, lakes and grass, which should not only carry the resource supply demand of economic and social development "from the top of the mountain to the ocean", but also absorb the human activitiesIn order to prevent and resist all kinds of ecological disasters and environmental risks from the ocean and land areas, it is a strategic place for the relationship between scientific and coordinated development and protection. Therefore, the development of industrial economy in coastal zone and its spatial layout is urgent to coordinate land and sea ecological security, environmental security and spatial benefits, so as to support the high level protection and high quality development of coastal zone space

1.3 Necessity of multi-scale coordination of provincial coastal zone industrial space

As an important research level and key component of the territorial space planning system, the scientific planning of the provincial coastal zone industrial space is the key support for the sustainable development of the national coastal areas, and also an important guide for the coastal cities and counties to implement the requirements of land and sea coordination. At present, the land and sea coordination of provincial coastal zone industrial space faces the following three problems:

Regional economic linkage is insufficient, and it is urgent to accelerate the integration into the Marine central city cluster. The development of industrial space development in Chinas coastal zone is gradually moving from the agglomeration stage of Shanghai, Tianjin, Hong Kong, Shenzhen and other big cities to the network connection stage of Marine center city cluster. Under the influence of inclined allocation of resource elements and regional siphon effect, on the one hand, the absorption effect of Marine central cities on resource elements is far greater than the diffusion effect. The flow of people, logistics, capital flow and information in coastal provinces further gather to a few core cities along the coastal expressway traffic channel. On the other hand, due to the lack of support of major infrastructure in connecting the central and western regions and the poor construction conditions of portals connecting international ocean cities, the

value of core cities in coastal provinces such as Hainan, Fujian, Liaoning is not demonstrated in terms of location function and land and sea hub portals[14], Gradually being marginalized by the regional Marine center city cluster.

The proportion of sea-related industries in the province is not high, and the homogeneous competition of coastal economy in cities and counties is greater than the coordination. From the perspective of the whole province, the industrial economy around the bay is significant. However, due to the historical neglect of the value of Marine resources, a large number of non-Marine industrial parks occupy high-quality coastal space, which affects the economic benefits of the coastal zone space. According to statistics, there are only 11 Marine industrial parks in Fujian province, within 5km of the coastline, accounting for 39.29%. In addition, the provincial cities and counties coastal leading industries lack of overall planning. Taking Fujian Province as an example, the two core bay areas of Xiamen Bay and Fuzhou Minjiang Estuary have long existed the competitive relationship between regional energy level, functional sequence and resource elements, and the regional cooperative agglomeration degree and characteristic function differences of leading industries in the coastal zones of other cities and counties in the province are also obviously insufficient.

There are significant problems between land and sea functions in the Bay Area, and the coordination between high-level protection and high-quality development is insufficient. The bay is often the spatial unit where the sea boundary of adjacent coastal cities and counties is located, and it is also the natural geographical unit of the land and sea social ecological composite system. Its ecological protection and environmental governance need the cross-boundary coordination between the land and sea functions in the layout and ecological environment protection of adjacent cities and counties. Under the past mode of land-sea separation, the high intensity urban development and industrial development around the Bay bring great pressure to the ecological environment of the Bay Area. Meanwhile, under the planning perspective of traditional administrative boundary, the functional conflict between the coastal industrial development of Binhai city and county and its adjacent cities is significant. For example, the iron and steel metallurgy and other heavy industries in Luoyuan County, the north bank of Luoyuan Bay, Fujian Province, conflict with the fishery and aquaculture sea area in Lianjiang County, the south bank. The Bay Area is facing great pressure on production and ecological security, and it is urgent to achieve the industrial development goal of land and sea coordination through cross-border coordination.

In conclusion, due to the coastal area sea relationship, land and sea relations and regional relations, a single scale of industrial space research is difficult to further analyze the regional economic unit, the gulf natural unit and administrative unit multifaceted problems and their relationship, need to cross geographical areas, across administrative boundaries, across ecological system, explore the theoretical method of land and sea as a whole.

1.4 Difficulties and challenges of land and sea overall planning

Based on the practical problems of the spatial layout of land and sea industries in provincial coastal zones, it is necessary to systematically explore the theories and methods of land and sea overall planning with multi-scale coordination, so as to realize the utility of industrial spatial planning in coastal zones with the integration of land and sea, human and sea harmony, regional coordination and cross-system gain. Before that, the following three difficulties and challenges need to be clarified:

First, the spatial scope of multi-scale land and sea overall planning delineation. There is no unified standard for the demarcation of the spatial scope of the coastal zone. How to define the overall scope of land and sea at different scales by combining the ecosystem, economic connection and governance units is a major difficulty in the current industrial spatial planning of the coastal zone.

Second, the formulation of a target framework for multi-scale coordinated land and sea planning. The provincial coastal zone industrial spatial planning is an important spatial planning level for implementing the strategic deployment of the national maritime power, cultivating the global Marine center city cluster, and coordinating the development of the regional Marine industry. At the macro level, it is necessary to accelerate the integration into the global Marine center city network; at the meso level, it is necessary to build a high-quality coastal industrial system; at the micro level, it is necessary to use Marine resources efficiently to balance the protection and development. How to respond to the national development strategy and match the development goals of provincial and city and counties is an important challenge facing the industrial space development of coastal zone.

Third, the exploration of the system gain planning path of cross-border coordination. Facing the present situation of the development of coastal space and multi-scale target framework, traditional land and administrative unit dominated planning control mode is not applicable, so to explore across the sea ecosystem, across cities and counties in administrative boundaries, across the spatial development path of traditional geographical area, to improve the comprehensive benefit of coastal zone industry space layout.

2. Construction of multi-scale cross-boundary coordination theoretical model of provincial coastal zone industrial space

In provincial coastal zone industrial space as a whole high level of protection and high quality development target traction, combined with industrial space multi-scale sea as a whole the key problem and the main challenge, in the original economic geography "boundary effect" theory framework, on the basis of building "area-provincial-bay" multi-scale crossover as a whole theoretical framework, to explore the provincial coastal zone industry overall planning path method to build the theoretical framework.

2.1 Introduction of the theoretical framework of boundary effects

As an interdisciplinary research framework, boundary effect theory aims to analyze the interaction of different boundaries and their influence on economic, cultural and social development, including the boundaries or junctions of geographical, cultural, economic, ecological and other dimensions[15-16]. In the dimension of industrial development in the coastal zone, the relevant research focuses on the impact of economic and geographical boundary, administrative boundary and natural boundary on production efficiency and regional competitiveness.

First, the economic and geographical boundaries shape the regional economic spatial pattern through their influence on human activities and resource allocation. The "central-edge model" proposed by economists Alfred Weber and Friedrich Laurenz explores the economic differences and inequalities between central and marginal areas caused by boundaries[17-18]And further points out that the cross-boundary flow of industrial resource elements in a certain stage can bring the multiplier effect of the overall development of the region.

Secondly, the administrative boundary affects the regional industrial economic pattern and regional ecological space integrity through the division of territory and the difference of control rules. For example, it is almost difficult to identify the administrative boundaries of the city from the night light photos in Europe, but it clearly shows that in the centers of London, Paris, Amsterdam and Milan, the development footprint of industrial economic space is still significantly constrained by the traditional administrative boundaries. On the other hand, the adjacent administrative units often affect the ecological spatial continuity and the integrity of the ecological species habitats because of the spatial resource utilization patterns and their institutional differences[19]. Therefore, the cross-administrative boundary coordination based on the integrated development of industrial economy and the integrity of the ecosystem is the key path to realize the sustainable ecological development and the efficient utilization of resources[20]。

Finally, the natural boundary is the main boundary that restricts the integrated development of land, sea and air space and resource elements in coastal cities. Land-sea interaction is an intrinsic mechanism for the complexity of social ecosystems in the coastal zone. However, the traditional governance model with the natural boundary of coastlines as the boundary ignores the cross-distribution, migration patterns, ecological functions and their effects on biodiversity of different species in this transitional area, and also ignores the discharge of land pollutants into the sea with bays and estuaries as the typical worst-hit areas[21-22]. Therefore, the land and sea separation of the coastal zone space area will seriously affect the safety and stability of the coastal zone ecosystem[23]。

To sum up, the traditional economic geographical boundary, administrative boundary and ecosystem boundary significantly affect the free flow of industrial resource elements and the coordinated protection of ecological elements in the coastal zone. The transboundary coordination of breaking the boundary effect is the key to the high-level protection of coastal zone space and the high-quality development of industry.

2.2 Analysis of the theoretical framework and mechanism of cross-border coordination

Cross-border as a whole theoretical framework from the external environment of complex system, internal pattern and resources from three aspects of the theory of boundary effect extension, its goal is through the external environment open interconnection, internal function pattern optimization and resource flow control, realize the complex system in the multi-scale level orderly integration and system gain. The theory of spatial crossover coordination of coastal zone industry includes the identification of important boundaries and the analysis of the action mechanism of key elements, including three aspects. See Figure 1.

External environment refers to the industrial development environment of the coastal zone composed of resources and markets. The demand for rational allocation of regional resources and the demand for rapid response of domestic and foreign market changes will promote the overall planning of industrial space to break through a single economic and geographical unit to realize the open interconnection of external environment. Internal pattern refers to the distribution pattern of Marine industrial space within the province, which is the concentrated embodiment of industrial agglomeration degree and coordination degree. The development of Marine industry in the province needs to solve the homogeneous competition caused by the isolation of administrative units, and has the need to optimize the pattern of promoting industrial division of labor and agglomeration. Resource elements refer to the land and sea resource elements in the Bay Area. Under the traditional land and sea separation mode, the disharmony of

land and sea functions hinders the flow of land and sea resources. By breaking through the cross-border coordination of land and sea interface, the free flow and efficient control of land and sea elements are realized.

Under the multi-scale perspective of external environment, internal pattern and resource elements of complex systems, the theoretical logic of land and sea overall planning of coastal industrial space is revealed, and the cross-border coordination path of "region, province and bay boundary" is explored through the cross-border coordination of economic geographical boundary, administrative boundary and natural boundary is explored. See Figure 2.

3. On the cross-border coordination path guidance of "regional-provincial-Bay Area" coordination

Based on the theoretical model of cross-border coordination, the spatial scope and basic unit of multi-scale land and sea coordination of coastal zone industrial space are defined, the development target framework is formulated, and the gain path of cross-border integration system is explored.

3.1 Multi-scale cross-border coordination unit and clear scope

At the regional level, break the provincial land and sea administrative boundary, and study the global ocean center city cluster where it is located. Under the background of blue economy, the Marine central city cluster is not only an important carrier for coastal provinces to participate in global competition and cooperation, but also an important node to open up the land and sea economic corridor and the basic unit to integrate into the global Marine economic network pattern. Therefore, taking the Marine central city cluster as the regional overall planning scope can support the national blue economy development network facing the world.

At the provincial level, the land research scope covers all county-level administrative regions along the coast, and the sea areas are the corresponding administrative sea areas and islands. City and county units are not only the basic units of the Marine administrative boundary, but also an important control unit for the implementation of territorial space planning. The spatial scope of the coastal zone composed of the administrative boundary of coastal city and county is the region with the most significant interaction between land and sea, the most concentrated development of Marine industry and the most urgent demand for ecological protection. Therefore, as the core scope of the provincial coastal zone land and sea coordination, it is typical and fundamental.

At the bay area level, the main scope of the land side is the administrative boundary of coastal towns and streets, and the sea is the dominant functional area of the sea. As a complete social ecosystem, the Bay Area has the spatial characteristics of crossing land and sea interfaces, crossing ecosystem and crossing administrative boundaries, and is a scientific land and sea coordination unit. At present, Dubai, San Francisco, New York and other regions all take the Bay Area as an important unit to formulate spatial development plans. The spatial units in the Bay Area should determine the scope by comprehensive demarcation method: based on the mechanism of land-sea cross-system influence, evaluate the influence scope of land and sea elements, and combine the social and economic factors and spatial planning and management foundation to establish the land and sea overall spatial scope based on the bay ecosystem unit[24-25]。

3.2 Exploration of the objectives and paths of multi-scale cross-border coordination

Regional interconnection: open up land and sea channels to realize two-way interconnection. The specific path is to break through the boundary of economic and geographical units, take the initiative to build a regional land-sea connectivity hub to the inland linkage, and expand overseas to actively integrate into the global ocean city economic network. With the transformation and upgrading of coastal industries and the reform of the global division of labor system, relying on the cluster of the ocean central city, the development of coastal China and the development of the high-quality development of the cross-regional linkage of the industrial chain, relying on the international shipping center and cross-border industrial cooperation system to promote the continuous upgrading of the modern coastal Marine industries and enhance the global competitiveness of the region.

Provincial division of labor: break the flat competition and strengthen the leading function of the Bay Area. The specific path is to break through the administrative boundary of cities and counties, and guide the classified agglomeration and efficient and intensive development of provincial Marine industries with the leading functional bay area as the basic unit. On the one hand, the leading functional units of the Bay area with full coverage are sorted out within the province to form the functional system and cooperative network of the Bay area within the province. Individual cities and counties no longer act independently, but integrate into different leading functions to participate in the provincial industrial division of labor and cooperation system, and improve the effect of industrial scale economy. On the other hand, following the principle of "central agglomeration" and minimum influence surface, guide polluting heavy industries to gather in a few bays, reduce the diffusion range of heavy industry in the sea, and improve the comprehensive benefits of ecological space in the province.

Bay Area agglomeration: resolve the boundary isolation and improve the comprehensive social and ecological benefits. The specific path is to break through the natural boundary of the coastline and the administrative boundary involved in the bay, and to dredge the land-sea ecological interaction and the circulation network of production factors in the Bay Area. Deeply analyze the relationship between Hong Kong industry and city in the Bay Area, focus on the development orientation of the Bay Area with different leading functions and energy levels, coordinate production, life and ecological functions across the administrative boundaries of neighboring cities and counties, and guide the integration of industry and city or the moderate separated development of industry and city. Secondly, the compatibility of land and sea functions should be scientifically evaluated, the contradiction between land and sea functions should be resolved across the coastline natural boundary, and the security bottom line of the space development of coastal zone industrial space should be strictly observed.

4 Empirical interpretation: the land and sea coordination strategy of multi-scale coordination of industrial space in the coastal zone of Fujian Province

Through the connotation analysis of the multi-scale crossover coordination theory of "external environment- -internal pattern- -resource elements", the multi-scale provincial coastal zone industrial spatial crossover coordination path of "regional interconnection- -provincial division of labor- -Bay area agglomeration" is put forward, and the theoretical and method logical framework is set up. The cases of coastal zone in Fujian province with representativeness of Marine industry development and typical regional economic pattern are selected. In terms of Marine industry, the Marine economy of Fujian province is growing rapidly, with the growth of

Marine GDP about 1.5 times of the national average, and the Marine GDP ranks the third in China. In the dimension of regional development, although Fujian province is the first gateway to Taiwan Province, it is located in the periphery of the Marine economic circle in the central Yangtze River Delta and the Guangdong-Hong Kong-Macao Marine economic circle in the south, facing the risk of further marginalization. At the provincial level, as a typical "double-heart" economic spatial pattern, the industrial competition and cooperation relationship of its provincial Marine city system needs to be optimized. At the Bay Area level, the 3752km coastline of Fujian province has a long twists and turns, which is a typical multi-bay Marine province. According to the 14 major bay areas of the provincial Marine function zoning, the 11 natural and social bay units of the coastal cities and counties are seamlessly delimited according to the administrative boundaries and geographical characteristics[24-25]. Therefore, the coastal zone of Fujian Province is selected as the research object, and based on the theoretical framework and path guidance of cross-border coordination, the provincial coastal zone industrial space land-sea coordination strategy of "regional-provincial-bay area" is explored. See Figure 3.

4.1 Regional level: Inside and outside, cultivate "land and sea double fan" global ocean center city cluster between Fujian and Taiwan

Cross-Straits integration to build a maritime gateway for foreign exchanges. Seizing the opportunity of building a demonstration zone for integrated development across the Taiwan Straits, Fuzhou and Xiamen will connect with Taipei and Kaohsiung to foster a state-level Marine center city cluster. First of all, with Fuzhou Port and Xiamen Port as the starting platforms to connect with North America, Southeast Asia and other regions, Fuxia will be built into an international trade center with strong resource allocation ability and an international logistics hub that seamlessly connects "sea Silk" and "Land Silk". Secondly, learn from the Randstad region of the Netherlands, through the industrial division of labor and cooperation in Amsterdam, Rotterdam, The Hague and Utrecht, and participate in the international competition [26,27] with the "urban network system". To Xiamen spring gold①And fuma②In order to further strengthen the linkage relationship with the leading industries of Taiwan Province, on this basis, reserve the cooperation space for connecting ports and routes and other infrastructure and upstream and downstream industrial chains, strengthen the construction of modern Marine industrial system, and cultivate the strategic fulcrum of maritime power and the integration of the two sides. See Figure 4.

Hhinterland support, open up the strategic channel of land and sea coordinated development. Learn from the northeast of the United States, improve the transportation network, establish talent flow and innovation cooperation mechanism, and promote the coordinated development of coastal cities such as New York and Philadelphia and inland cities[28]. We will improve the inter-provincial comprehensive transportation system of Fuzhou and Xiamen facing the central and western regions, actively connect with the central and western urban agglomerations, and further connect central Asia, Europe and other regions to form land economic arteries, and strengthen the industrial and resource elements between Marine cities and hinterland cities. See Figure 4.

4.2 Provincial level: gradient difference, build a spatial pattern of coastal industry with large density, large density and low influence

Multi-bay coordination, the establishment of gradient difference bay area industrial system. According to the resource endowment and upper planning of each bay area, the leading

functions and industrial positioning development of three types of bay units, such as "Leading Bay Area, Supporting Bay Area and basic Bay Area", are guided. For example, Xiamen Bay has formed an industrial system featuring port logistics and international shipping services, strengthening the "head" leadership. Minjiang Estuary, Quanzhou Bay and Meizhou Bay have formed a multi-productive and integrated industrial system featuring modern fishery, shipbuilding and Marine engineering equipment manufacturing and ecological tourism, consolidating the "waist" support. The seven basic bay areas, including Xinghua Bay, Dongshan Bay and Luoyuan Bay, will build diversified coastal and specialized industrial bay areas around the advantageous Marine industries of cities and counties to strengthen the competitiveness of leading industries.

Bottom line control, to build a low impact degree of the coastal industrial pattern. According to the bottom line safety analysis of land and sea coordination, the industrial prohibited zones, restricted zones and optimized zones in specific functional zones are divided, and the key areas of ecological bottom line control in the Bay Area are defined. First of all, considering the restrictive factors of industrial development such as environmental function zoning, Marine ecological red line, Marine ecological function zoning and ecological security pattern, and combining with the conflict analysis of land and sea industries, the key industrial types under control: polluting industry and Marine fishery are determined. Secondly, the prohibited, restricted and optimized areas for polluting industries and Marine fishery development should be scientifically divided to guide the moderate agglomeration of polluting industries, and form a spatial pattern of coastal industry and Marine fishery with "large density and large density". Finally, based on the land and sea function control logic of the bottom-line adaptation, the industrial spatial layout strategy with low environmental impact degree and high elastic development potential is explored.

4.3 Bay Area level: Classified guidance to build a diversified bay unit with land and sea coordination and integration of industry and city

Classified guidance, scientific optimization of the spatial pattern of the Bay Area coordinated by Hong Kong industry and city. First, cultivate a regional-led bay area with "integration of industry and city". Drawing from Singapores Coastal Bay Area, we will innovate the development model of Marine economy under the guidance of the comprehensive functions of a global Marine center city, and promote the development of Marine services such as Marine finance, law, shipping and tourism. Second, we will expand the comprehensive support bay area of "promoting production with the city". Relying on the good comprehensive supporting facilities and scientific research and cultural foundation of high-level cities, we will optimize the Marine high-tech industry, maritime technology innovation services and high-end Marine equipment manufacturing industries, and cultivate a Marine industrial system with strong competitiveness. Third, to build a basic industrial bay area that "promotes the city by production". Follow the ecological bottom line control logic, promote the agglomeration of specialized functions, improve the production efficiency of the basic industrial bay area, reduce the regional impact of polluting industries, and improve the comprehensive social-ecological benefits of the complex ecosystem of the bay.

Cross-border linkage, around the bay to build a high-quality Marine industrial cluster. Drawing on the concept of ecosystem services in Norways coastal zone planning, organically combining land and Marine resources, comprehensively considering the development needs of diversified industries such as Marine fishery, tourism and energy, and coordinating multiple

departments to formulate unified coastal zone development planning and management policies[29-30]To build a Bay Area industrial cluster with complementary advantages such as Marine fishery + comprehensive services, Marine fishery + biomedicine, petrochemical industry + new materials, iron and steel metallurgy + Marine industry, Marine pasture + and offshore wind power (Figure 5). Based on the relationship between industrial connection and industry and city, the Marine industrial clusters, such as moderately separated, highly connected and deeply embedded, are divided to scientifically guide the high-quality development of industries in the Bay Area.

5 Conclusion

Collaborative governance based on the overall perspective and key elements is an important path to achieve high-quality development and high-level protection in coastal areas, and an important support for promoting the construction of maritime power and ecological civilization. This paper builds the "external environment-internal pattern-resource elements" cross-border as a whole theory and "regional-provincial-bay area" collaborative cross-border plan as a whole path, is to promote coastal industrial space multi-scale coordination of the "feasibility solution", the practice path still need to combine the international situation and macro policy changes and optimization. The current competition pattern of the world Marine economy has long jumped out of the level of single city and even urban agglomeration, and a multi-scale competition system with the Greater Bay Area as the regional coordination unit and the global Marine center city as the core is taking shape. In the process of how to improve the Chinas share in the global Marine economic system, how to through high quality development and high level protection improve the comprehensive benefit of coastal space, participate in global competition and cooperation, is the reform of the important issues of coastal industrial spatial planning, need to continuously explore in the theory and practice level.

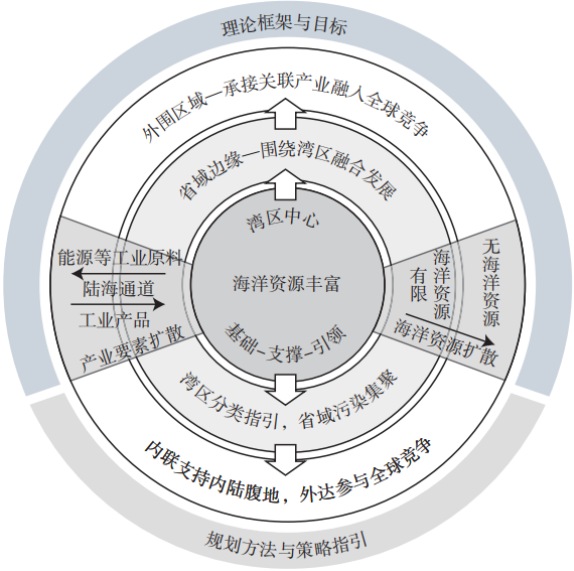
explanatory note

① Xiaquanjin refers to Xiamen City, Quanzhou City of Fujian Province and Kinmen City of Taiwan Province.

② Fuma refers to Fuzhou City of Fujian Province and Matsu Township, Taiwan Province.

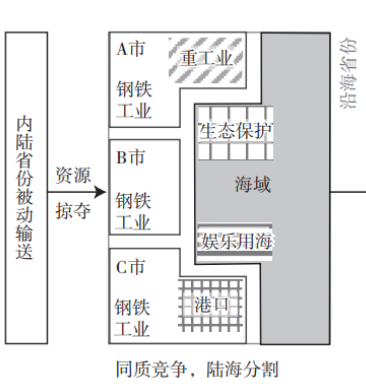
(A) The traditional "center-to-edge" theoretical model

(B) Theoretical model of "external environment- -internal pattern- -resource elements"

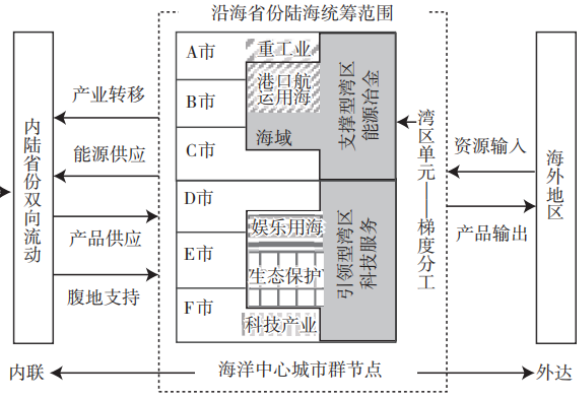


(C) Cross-border coordination model of "region-provincial-Bay Area"

Figure 1 Multi-scale interaction model of Marine economic elements



(A) The development pattern of coastal zone under the traditional mode



(B) Industrial development pattern of the coastal zone under the cross-border coordination mode

Figure 2 Cross-border coordination mode with the Bay Area as the unit

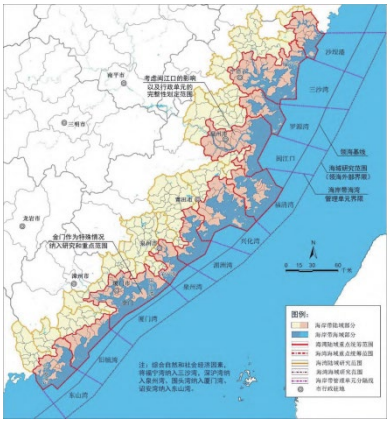


Figure 3 Division of coastal zones and bay areas in Fujian Province

Source: Wen Chao-xiang, et al[24]

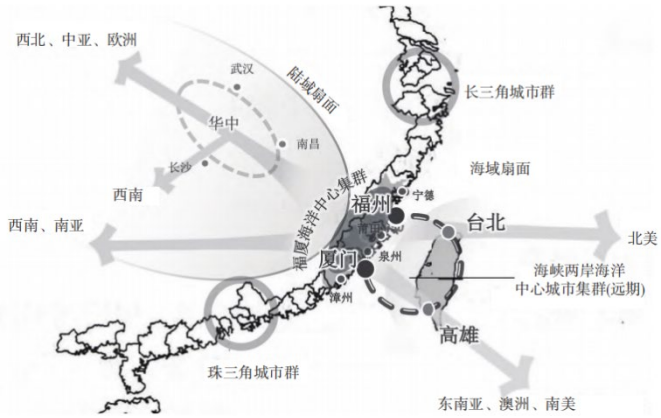
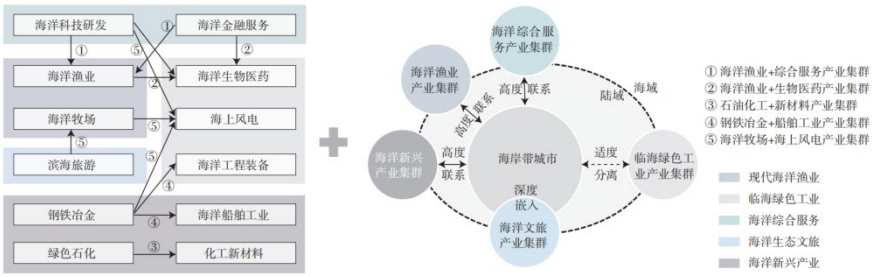


Figure 4 Schematic diagram of the "land and sea double-fan" cross-regional coordinated spatial pattern between Fujian and Taiwan

Source: Policy Suggestions "Cultivating * * Ocean Center City Cluster to build the strategic fulcrum of China * * * *" Wen Chaoxiang, Zhu Jiasong, Lin Xiaoru, etc., adopted by the Xiamen Municipal Committee of the Communist Party of China



(A) Linkage of Marine industrial clusters in coastal zone cities; (B) Coordination between industry and city in coastal cities

Figure 5 The collaborative path of industrial cluster linkage and industry-city relationship with the Bay Area as a unit

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