**Research on the training of Marine talents in Lianyungang based on CDIO mode**

**Abstract:** The ocean is a strategic place for high-quality development. As marine economic activities are technology-intensive and basic-intensive industrial fields, a large number of leading talents with innovative capabilities, cross-border integration, and international vision are required. The development and construction of the Marine industry needs a large number of leading talents with innovation ability, cross-border integration and international vision. Therefore, how to cultivate a talent team with excellent quality and reasonable structure is an urgent problem to be solved. As one of the first coastal open cities in China, Lianyungang needs to do a good job in the construction of Marine talents and show its due responsibility as a port city. Starting from the current situation of Marine talent construction in Lianyungang, this paper puts forward the research ideas and countermeasures for the construction of Marine talent team from the perspective of CDIO model.

**Keyword:** Marine talent; Marine power; CDIO model; talent team

I. Introduction

It is clearly stated in the report of the 20th National Congress of the Communist Party of China that "develop the Marine economy, protect the Marine ecological environment, and accelerate the construction of a Marine power". Marine talents are an important supporting force for the construction of a Marine power, and the main driving force for the sustainable development of the Marine industry. Lianyungang is located in the central coastal area of China, facing the Yellow Sea in the east. It is one of the first coastal open cities in China. Lianyungang has a sea area of 7516 square kilometers and a coastline of 195.88 kilometers. It has a complete range of coastal types, including Lian Island, Qinshan Island, Ping Island and other 20 islands, among which Lian Island is the largest bedrock island in Jiangsu Province, and Haizhou Bay fishing ground, one of the eight major fishing grounds in China, gathers a variety of Marine resources such as "harbor, fishery, scenery, island, Tu, energy" and the only comprehensive Marine university in Jiangsu Province.​ We will strive to strengthen the maritime map, strengthen coordination between land and sea, accelerate the cultivation and expansion of modern Marine fisheries, gather momentum and energy to promote high-quality development of the Marine economy, and show greater responsibility in building a strong maritime province and maritime power. To comprehensively promote the new practice of Chinese-style modernization of Lianyungang to open up a new track and inject blue momentum [19,20]. Marine undertakings are science and technology intensive and talent intensive undertakings, and Marine talents are the first resource for developing Marine undertakings and shaping urban Marine competitiveness. In recent years, the Marine economy of Lianyungang has a strong momentum of development. The gross Marine product has increased from 68.28 billion yuan in 2015 to 104.28 billion yuan in 2022, with an average annual growth rate of 6%, accounting for 28% of the city's GDP, and the Marine economy has developed rapidly. However, there is a great difference between the construction of Lianyungang's Marine talent team and the needs of Marine economic development. How to cultivate a Marine talent team with a larger scale, better quality and more reasonable structure, better build a Marine talent cluster area, boost the construction of a leading modern Marine city and build a strong Marine city is an important content of the current talent work of Lianyungang.

CDIO mode is an engineering education mode, inherits and develops the concept of engineering education reform in Europe and the United States for more than 20 years, and systematically puts forward operable standards for ability training, comprehensive implementation and inspection and evaluation. "Learning by doing" is advocated, including conceive, design, implement and operate. CDIO theory has the characteristics of systematization, focusing on the cultivation of comprehensive quality and close connection with industry. This provides a good framework and concept, through the study of the whole process from task development to operation, so that learners can take the initiative to study and practice, and organically combine various courses. Although this concept was first put forward by engineering education, with its continuous development and improvement, it has also been widely used in various personnel training construction. Based on this, we integrate the CDIO concept with the goal of talent training in the Marine industry, take the problem as the orientation, think of the strategy of Lianyungang's Marine talent training, design the talent training plan that can be realized, and optimize the current Marine talent training system of Lianyungang.

2. The main practices of Lianyungang marine talent training

2.1Strengthen policy support for the cultivation of marine talents

​ In recent years, all coastal cities and regions have actively responded to the call of strengthening the province and city by sea, and constantly improved the treatment of all kinds of Marine talents. In 2023, Jiangsu Provincial Government issued the Marine industry action plan to mention: "Deepen the construction of Lianyungang Marine Economic Development Demonstration Zone, build a modern Marine city with mountain and sea characteristics, and build a gathering place of Marine talents". All levels and departments of Lianyungang fully implement the decisions and arrangements of the central and provincial Party committees, put the construction of a strong Marine city in a more important position, deepen the understanding, intensify the work, highlight the focus, and make greater efforts to promote the high-quality development of Marine economy. The Lianyungang Government issued various policies to attract and cultivate Marine talents, improve the evaluation system of Marine talents, improve the treatment of Marine talents, and retain Marine talents. In 2023, Lianyungang Municipal Government issued the Three-year Action Plan for Marine Science and Technology Innovation of Lianyungang City (2023-2025), proposing to carry out the action of gathering Marine innovation talents, accelerate the gathering of high-end innovation talents, and improve the level of marine-related colleges and universities. We will improve the introduction and training mechanism of cutting-edge talents in Marine science and technology, strengthen cooperation with domestic and international key scientific research institutions, train a number of discipline leaders with academic innovation ability, and establish a high-level Marine scientific research team. Lianyungang "14th Five-Year Plan" talent development Plan points out that we should focus on the development to the sea and build a Marine talent team. Focusing on emerging industries such as Marine technology, we will strengthen project funding and supporting incentives, and introduce and train a group of high-level innovation and entrepreneurship talents and teams with international leading standards. Talents in key Marine industries will be included in the introduction plan of high-level and urgently needed talents of Lianyungang City, and employers will be encouraged to introduce high-end Marine talents through flexible ways such as consultant guidance and project cooperation. Attach importance to Marine science and technology education, build a multi-level Marine talent training system, encourage universities to speed up the establishment of emerging Marine industry majors, fully support the construction of Jiangsu Ocean University into a doctoral degree granting unit, support the construction of Marine related majors and coastal campus.

2.2Strengthen the carrier support for the cultivation of marine talents

In recent years, Lianyungang City has made great efforts in Marine resources, adhering to the "external introduction and internal training" two-way efforts, focusing on the introduction of high-end talents, high-energy platforms, high-value projects; We will accelerate inward tapping of potential and integration of resources to provide scientific and technological support for the development of the Marine industry. Layout of professional incubation carriers for sea-related industries; It undertook the first through train for science and technology financial services in northern Jiangsu, carried out activities such as "Expert Travel to serve 100 Enterprises", introduced 72 vice presidents of science and technology in universities related to the sea, cultivated 33 high-tech enterprises related to the sea, and accelerated the "climbing up the scale" of enterprises related to the sea. Actively integrated into the construction layout of Jiangsu coastal science and technology innovation corridor, it has 35 marine-related innovation platforms, and 6 innovation platforms have been included in the construction list of 20 key Marine science and technology innovation platforms in Jiangsu Marine Industry Development Action Plan, ranking first in the province. Set up a special service class to promote the construction progress of gas turbine scientific device, which is the only one of the two national major scientific and technological infrastructure in north Jiangsu and the only one in the province. Kangyuan Pharmaceutical was successfully approved as a national key laboratory and joined the Jiangsu Laboratory Alliance, introducing academician Tian Jinzhou to co-build academician workstation. We will promote the transfer and transformation centers of achievements in the construction of Jilin University, Ocean University of China, Shanghai Ocean University and other universities. It has signed cooperation agreements with the China-Israel Exchange Center and the Guangdong CIS International Science and Technology Cooperation Alliance, reached cooperation intentions with the University of Haifa in Israel, promoted the construction of the Belt and Road Technology transfer Center, and accelerated the transformation of sea-related achievements at home and abroad. The coastal campus of Jiangsu Ocean University has been approved for construction, and the Marine discipline has become a provincial dominant discipline.

2.3Strengthen cooperation and exchanges in the cultivation of marine talents

Lianyungang City has made extensive efforts to cultivate Marine talents, hired 5 academicians as consultants for Marine economic development of Lianyungang city, and gathered 35 scientific research forces to establish the only ocean-related industry-university-research cooperation alliance in Jiangsu Province. We will make every effort to build a platform for the transformation of high-level achievements, laying a good foundation for the training and development of Marine talents. We introduced two academician teams, set up a joint research and development laboratory for Marine corrosion protection engineering technology, accelerated the construction of a blue carbon laboratory and a Marine high-end equipment manufacturing platform, and issued an open fund. To build major platforms led by Taihu Laboratory Lianyungang Center and Jiangsu Province Marine Resources Development Technology Innovation Center, gather high-level Marine science and technology innovation elements at home and abroad, cultivate a number of dynamic Marine science and technology innovation subjects, and establish Jiangsu Province marine-related industry-university-Research Cooperation Alliance, "Future Marine Industry Venture Capital Alliance" and new material Industry-university-research cooperation Alliance. A total of 412 enterprises have been promoted to establish 580 school-enterprise alliances with 14 universities and institutes related to the sea. Establish a Marine talent training base, carry out joint training and order-type training of Marine talents, promote the construction of Marine talent innovation platform, strengthen cooperation with well-known domestic marine-related universities, research institutes and leading Marine enterprises, establish a marine-related industry-university-research cooperation alliance, and build a provincial Marine resource development technology innovation center.

3.The main problems in the cultivation of marine talents in Lianyungang

3.1The education system for marine talents needs to be strengthened

Lianyungang has relatively few Marine education resources. The construction of a modern Marine city requires sufficient Marine professionals and reserves of talents, and it is necessary to strengthen the training of Marine high-tech professionals. The knowledge system of Marine science and technology is huge and complex. To develop Marine economy, it is necessary to cultivate multi-level and multi-field comprehensive talents. Although Lianyungang has been actively promoting the sustainable development of Marine science, it has invested relatively little in Marine education resources. The level of Marine scientific research platform is not high, the overall level is still relatively backward, and scientific and technological personnel resources are scarce. There are only two institutions specializing in Marine teaching, including Jiangsu Ocean University, and five research and experimental development institutions. The scientific and technological resources related to the sea are not only far behind those of Qingdao, Xiamen and other coastal cities, but also weaker than those of Nantong in the province, which cannot meet the needs of Marine talents for the construction of modern Marine strong cities. Modern Marine science and technology involves many disciplines, and it is necessary to cultivate students' ability to study and solve problems across disciplines. There are a large number of relevant majors in the school, but fewer majors in high-tech and other aspects, which cannot meet the demand for talents in the emerging Marine industry. The city does not pay enough attention to the basic Marine education, little work has been carried out on the education of professional Marine knowledge and characteristic Marine knowledge, lack of general education, and not much publicity of Marine science popularization, resulting in the lack of deep Marine awareness and Marine territorial awareness of residents.

3.2The training mechanism for marine talents needs to be improved

From the perspective of system and mechanism, Lianyungang lacks a unified plan for the construction and training of talents, the function of the relevant functional departments of the government to coordinate all kinds of Marine talents has not been given full play, and the linkage mechanism among organizational departments, industrial departments and human resources departments has not been formed. The construction of various types of Marine talent markets can not meet the needs of economic and social development for Marine talents. The introduction mechanism of Marine talents in Lianyungang is limited and not fixed, and it cannot absorb more high-level Marine talents and advanced Marine technologies from advanced Marine cities. Problems such as low treatment of Marine talents and poor scientific research environment affect the quantity and quality of the introduction of young Marine talents. The implementation of the training mechanism for Marine talents is not in place, and the investment of some Marine departments in human resources is symbolic, and the development focuses on short-term skills training without long-term vision. There is a lack of continuity and systematization of learning and training, and a lack of fixed mechanisms for continuing education and re-learning. Although various departments and industries have recognized the importance of talents, the perspective status of talents has not been paid enough attention, and there is still a big gap in the capital investment in the training of Marine talents and the material incentive for Marine talents. Therefore, the construction of Marine talents in Lianyungang needs to make further efforts in the introduction, training, flow, incentive and other aspects of Marine talents, and improve the mechanism.

3.3The strategy of cultivating marine talents needs to be optimized

First of all, there is no social atmosphere that attaches importance to the cultivation of Marine talents, although various departments and industries have recognized the importance of talents and adopted a series of talent introduction measures, talent training and management systems. However, the actual status of talents has not been paid enough attention. Some of them change careers and invest in enterprises and commerce due to low treatment and low income. Therefore, Marine talents would rather obtain a richer income than invest in the further study and improvement of science and technology and knowledge. Secondly, the fund guarantee for the training of Marine talents is insufficient. Compared with other coastal cities, there is still a big gap between Lianyungang's investment in the training of Marine talents and its material incentive to Marine talents. Finally, the awareness of Marine culture is not strong. The importance of the ocean and the significance of cultivating Marine talents are undoubtedly reflected and valued under the influence of Marine culture. The Marine culture of the Chinese nation has a long history, but the awareness of Marine culture is not much left in the minds of the masses. The publicity of Marine culture in all walks of life is not enough, and the effect of Marine culture construction is not obvious, which indirectly affects the training of Marine talents.

4.Based on the idea of Lianyungang marine talent training under the CDIO model

4.1Conception stage - overall layout of talent training strategic mechanism

In the conception stage of Marine talents training, it is necessary to optimize the overall design of Marine cultural industry talents training based on the problems existing in Marine talents training: From a macro point of view, we should formulate a scientific strategic plan for the development of Marine talents, establish the strategic principle of giving priority to the development of talents, make a macro, strategic and forward-looking comprehensive plan for the scale, structure, layout, policies and measures of the development of Marine talents, and lead the healthy and coordinated development of the construction of Marine scientific and technological talents. We will incorporate the construction of Marine talents into the overall planning of talent construction of governments at all levels, and make overall plans for the construction of talent teams in various marine-related industries. From the micro point of view, it is necessary to formulate a set of practical standards for strengthening the implementation of Marine talents, and put forward some targeted suggestions for various types of Marine talents, increase the introduction of Marine talents, promote the development of Marine human resources information base, and integrate Marine talents. And adopt key introduction, welfare policy incentive and other ways to implement the purpose of talent training.

4.2Design stage - innovate the training mechanism of marine talents

In the design stage, it is necessary to focus on the development needs of the region and implement the innovative introduction strategy of Marine high-quality talents: firstly, it is necessary to adopt targeted means of introducing high-level and high-quality talents to tap cutting-edge talents in the Marine industry. Secondly, it is necessary to strengthen the overall strategy of Marine industry development by relying on universities, enterprises and research institutes related to the sea, and on this basis, further expand the foreign exchange of high-quality talents and realize the sharing of development achievements, that is, strengthen the digital management of Marine human resources in various regions and information sharing in various regions. To carry out active exchanges and cooperation with universities and enterprises in the surrounding coastal areas, improve the training level of Marine talents in the region, and improve the one-sided introduction of Marine cultural talents. In addition, we should do a good job in evaluation and incentive work, formulate different use schemes for different types of Marine talents, and establish a use mechanism that can promote the rapid growth of Marine talents, so as to maximize the role of Marine talents and make them grow up quickly and become high-level talents who can take charge independently. Establish a fair and just talent incentive mechanism, abolish the life-long system, introduce competition, and set up a special fund to encourage the contribution and innovation of Marine talents, and mobilize the enthusiasm of Marine talents. Finally, it is necessary to give full play to the role of the national talent market, use various preferential policies to reasonably guide the orderly flow of Marine talents, give full play to the intermediary role of the market, and guide Marine talents to the most needed places.

4.3Realization stage: increase investment in education and scientific research, and improve the multidisciplinary interdisciplinary mixed training model

In the design stage, it is necessary to increase investment in Marine knowledge education and scientific research, vigorously promote the construction of Marine science laboratories and Marine research infrastructure, increase capital investment and set up special funds, create a good scientific research and entrepreneurship environment, strengthen the construction of libraries and networks, provide scientific research materials and scientific research guidance personnel, and provide a superior scientific research environment for Marine talents. In addition, we should strengthen active exchanges with advanced Marine cities, learn advanced technologies, master high-tech, and provide scientific research support for the training of Marine talents. The development and progress of the Marine cause not only needs talents of various professional Marine disciplines, but also needs interdisciplinary talents who not only understand professional Marine knowledge, have professional Marine professional skills, but also understand politics, economy, law and operation and management. To some extent, the complexity of the Marine business determines that its requirements for interdisciplinary Marine talents are more stringent than those of other industries. At the same time, with the continuous emergence of the emerging Marine industry and the continuous development of the service industry, the number of innovative talents in the Marine industry is becoming higher and higher. Moreover, the characteristics of Marine talents are also developing towards universality and diversity. The emerging Marine industry not only needs talents in Marine disciplines such as Marine biology, but also needs inter-disciplinary talents with high ataccomplishes in politics, economy, law and management. It can be seen from this that Marine education belongs to a compound and interdisciplinary applied discipline. Therefore, it is necessary to carry out innovative changes in the teaching implementation mode of Marine culture courses by rationally allocating educational resources, constantly optimizing the structure of higher education, and guiding colleges and universities to give full play to their advantages in setting and adjusting Marine professional disciplines. At the same time, it is necessary to strengthen the training of multi-disciplinary integrated talents for Marine talents, and scientifically arrange the multi-disciplinary integrated curriculum.

4.4Operation stage - to build a new carrier for the development of marine talents, and promote the in-depth integration of production, education and research

In the operation stage, further integration of industry, university and research should be promoted to give full play to the optimal role of the three parties. First, we will build a number of scientific and technological innovation teams and scientist studios led by world-class scientists. We will establish a Marine personnel training system guided by social needs, with marine-related enterprises as the main body and Marine research institutes and universities as the support, and gradually form a new model of integrated development of industries, universities and research institutes. Secondly, we should give full play to the city's existing advantages in Marine talents, rely on national major projects and scientific research platforms, focus on the implementation of national Marine strategy and the needs of far-reaching Marine development, and attract world-class Marine strategic scientists and all kinds of Marine talents centering on key industrial chains such as Marine equipment. At the same time, Marine institutions actively promote in-depth cooperation with universities and scientific research institutions, encourage education, enterprises, scientific research institutions and other relevant units to form a new cooperation mechanism, adopt the way of education synchronization, school-enterprise synchronization, public institutions cooperate with relevant universities to jointly carry out scientific research projects, use the research resources and advantages of the university, and improve their own scientific research level. We will strengthen the development of talent carriers such as Marine innovation practice bases, Marine talent training bases and post-doctoral research stations, and support the establishment of marine-related industry-university-research cooperation alliances with well-known domestic marine-related universities, research institutes and leading Marine enterprises. Finally, institutions provide internship opportunities to outstanding college students, providing students with a practical platform for Marine conservation research. Promote further cooperation between Marine colleges and Marine enterprises, build a scientific and technological innovation platform and practical production base integrating industry, university and research, and provide a booth for the training of Marine talents.

5.Conclusion

With the rapid development of Marine economy and the implementation of the strategy of maritime power, the demand for Marine talents is increasing. How to cultivate a talent team with good quality, good structure and high efficiency has been an urgent problem to be solved at present. Based on the current situation of the training of Marine talents in Lianyungang, this paper discusses the direction and thinking of the future construction of Marine talents in Lianyungang based on the CDIO model. First of all, the government should make overall plans for the strategic mechanism of talent training from the macro perspective, and formulate a set of implementiable standards from the micro perspective. Secondly, we should innovate the management mechanism of Marine talents, innovate in the introduction, training, selection, evaluation and incentive of Marine talents, and find the most suitable mechanism for the development of modern Marine talents. At the same time, we should increase investment in Marine education and research, and improve the interdisciplinary and mixed training mode. Finally, a new carrier of talent development should be built, and an industry-university-research model relying on platform carriers and taking enterprises as the main body should be developed to cultivate a high-quality and professional Marine talent team, so as to make greater contributions to the development of Marine economy, protection of Marine ecology and promotion of sustainable development.

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