

How to Promote the High-quality Marine Economic Development by Marine Technological Innovation

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Abstract: How marine technological innovation promotes high-quality development of marine economy is an important topic today. In this paper, based on the connotations of marine technological innovation and high-quality marine economic development, the role of marine technological innovation in driving high-quality marine economic development is explored, such as laying down the resource base for high-quality marine economic development, promoting the transformation of high-quality development mode of marine economy, optimizing the structure of marine economic structure and developing the scale of marine economy, with the expectation of providing a reference for high-quality marine economic development.

1. Connection of marine technological innovation

Marine science and technology are subordinate to the science and technology system and therefore are also applicable to the concept of scientific and technological innovation. Scholars have different opinions on marine innovation. By integrating their research results, it can be defined as practical activities, which are specifically implemented in the arrangement and combination of systems. In this way, it can play a role for individuals and achieve efficient and synergistic effects, so that knowledge can be updated, technology and craft can be improved, and skills can be changed, thus creating higher economic and social values, and ecological values. Marine technological innovation contains many contents, which can be summarized as follows:

First, integration, collaboration and innovation of science and technology. In the past, they were separated, but with the development of evolution, they began to permeate, connect, integrate and act closely with each other to form an organic whole. Synergies will occur when technology and science cannot be completely separated and can be used in marine development as indispensable tools. Since the development of marine innovation, science and technology have gradually integrated with each other, so it is necessary to treat them as a whole from a new perspective by breaking the limitations brought by emphasizing one aspect in the past and breaking through their respective fields, to eliminate the past shortcomings, solve the existing problems, enrich the knowledge, promote the development of science, and lay a foundation for future disciplinary progress.

Second, the relationship between marine technological innovation and economic and social factors. Marine technology innovation driven by social development has broken through past limitations and started to combine with various factors, which in turn has a close relationship with economic society. As the development of the times drives technological progress, marine activities have become the target of attention in many countries. As a result, policies and regulations are issued at any time, scientific management systems emerge, innovative subjects change internally, past operation modes have been abandoned and correlations among various elements have been formed. Change is not only limited to itself, but to the whole economy and society. As a whole, it breaks through the original limitations, overcomes the past shortcomings and forms a new situation. The link between economic society and innovation is the relationship between various factors. Innovative design needs to be studied from the overall perspective in each part in order to broaden the horizon and correctly understand the innovation of marine science and technology.

Third, significant benefits-the purpose and an important symbol of innovation. The achievements

brought by marine innovation can only be reflected through the realization of value, and will be reflected in the market when they are transformed, so that the innovation effect will be judged by value. Although some achievements cannot be directly reflected in the market, they can also be determined by social judgment and other forms to determine whether more value has been created, which are mostly reflected in social and ecological benefits.

2. Connotation of high-quality marine economic development

2.1 Concept of marine economy

Nowadays, marine development activities are becoming more and more active, so marine economy has become the focus of all countries, and also spawned the gradual development of research. The deepening of research makes people's understanding of marine economy more and more perfect and different from that in the previous times. More and more scholars at home and abroad have devoted themselves to this study from different perspectives, covering different areas, adopting different methods, to put forward the concept of marine economy. Although there are different opinions, they have some commonalities, including:

First, the definition of marine economy in foreign countries. The study of marine economy started earlier abroad, but mostly from the perspective of land economy, with neither clear definition nor special description. The continuous development of marine activities in various countries has led to more and more in-depth research. More and more foreign scholars are committed to this from various perspectives to explore its connotation, and the scope of marine economy is becoming wider and wider. Some of them put forward the concept of marine economy. For example, the U.S. Marine Policy Committee believes that marine economy is an economic activity, developed around the ocean for production inputs depending on its attributes or uses its geological advantages to carry out activities, both on the sea or on the seabed. Charles studied the marine economy and thought it is a kind of economic activity, in which marine resources are invested. Judith studied the marine economy and agreed that it is as an economic activity for the provision of products and services, partly of which is derived from the ocean and its resources, and therefore is determined by the latter ^[1].

Second, domestic scholars' understanding on the connotation of marine economy. Although domestic scholars started late in marine economic research, with the development of marine activities, they also gradually paid attention to and increasingly deepened the related research by constantly absorbing the ideas of foreign scholars, drawing on their methods, introducing their theories, and on this basis putting forward their own views which thus have diversified characteristics. Domestic scholars mainly understand that marine economy is: (1) the sum of development and utilization of marine industry and related activities; (2) the general name of all kinds of activities in the process of human development and utilization of marine resources, from production to operation to management; (3) the general name of all kinds of economic activities with the ocean as the place of activity and the ocean resources as the object of development ^[2]; (4) the ocean-centered economy, whose development activities revolve around the ocean and its space, such as production and processing of marine resources, development and utilization, protection and service. With the development of society, people are looking to the ocean to obtain more benefits and meet their own needs. At this time, the ocean and its resources can become the object of labor, so as to obtain material wealth after a series of economic activities. All these processes are incorporated into the ocean economy, which is essentially the material achievement of ocean development ^[3]; (5) the general term for all kinds of economic activities centered on the ocean, with the place of activity as marine space and the object of utilization as marine resources. With the continuous increase of human needs and marine activities, marine economy has developed accordingly. The utilization of marine space has become an inevitable trend and the development of marine resources has attracted wide attention. People take them as the object of labor to carry out production activities and obtain material products. Marine economy revolves around the ocean, which is the key to distinguish it from the land economy, so the content of marine economy can be

defined. The marine economy is related to the ocean, so it can be classified as follows: 1) In a narrow sense, marine economy refers to the economy of simply using the ocean, including only the water body itself, resources and space. 2) The broad sense marine economy includes the narrow sense marine economy, including the upper and lower interface industries and general equipment manufacturing industries, and other marine related economic activities. 3) Generalized marine economy covers a broader scope, not only the marine economy mentioned above, but also the land industry and inland river economy related to it, that is, island economy and coastal economy ^[4].(6) The sum of the economies that have a specific dependence on the ocean, covering a wide range, from the venue to the object of sale, from resource support to location selection, from the object of service to the raw materials of primary products ^[5].

Based on summarizing the research results of scholars, marine economy is defined as various industries and related economic activities related to marine development. People develop and utilize the ocean for the ultimate purpose of obtaining economic benefits, making full use of ocean space, effectively developing marine resources and launching various activities around the ocean, all of which belong to the marine economy ^[6].

Based on this, the concept of marine economy is defined and analyzed in depth. It is found that all activities are closely related to marine environment and resources. They are not merely an extension of land economy, but an economic activity centering on the ocean and have their independence.

2.2 The concept of high-quality marine economic development

Throughout the marine economic growth, its changes mainly focus on the following aspects: one is to increase the input of resource elements to drive the growth of output scale on the premise of unchanged marine technical conditions; the other is to strengthen the innovation of marine technical management, make effective use of marine resources and improve the efficiency of element allocation, which will increase output and improve product quality. Such a situation is not preconditioned by increasing the input of marine resources. Even if the increase is limited, it will ultimately lead to the growth of marine economy, which is distinct from the first growth mode, while the second is the quality of economic growth.

The high-quality marine economic growth can be explained from different perspectives. In a narrow sense, it is considered to be the effective utilization of marine resources by marine economy by taking scientific methods, making full use of marine science and technology, effectively allocating resources, improving utilization efficiency, abandoning the original extensive management methods, and gradually transforming to intensive and economical management to greatly improve the utilization of various factors. Achieving high-quality marine economic growth can be reflected in the output by making full use of advanced science and technology, improving management level, strengthening technological innovation and promoting quality and dynamic change, which will result in great changes in output and significant improvement in quality, and inevitably bring great benefits to the economy. In a broad sense, the understanding of high-quality development of marine economy is not limited to the above-mentioned aspects, and various factors need to be considered at the same time, such as social and cultural influences, politics and ecology, which are the results of multiple factors. New changes have taken place in the new era, and high-quality marine economic development is imperative, which can be reflected in many aspects, such as the innovation of industries, the development of the coastal areas that are obvious to all, the complementarity and coordination between the marine economy and other fields. Similarly, marine environmental resources cannot be ignored, and sustainable development is the main theme of the future; at the same time, the openness and sharing of development achievements should be emphasized.

3. The role of marine technological innovation in driving high-quality marine economic development

Economic development cannot be separated from scientific and technological innovation, but

also is related to many factors, such as capital accumulation and labor investment, of which the key is scientific and technological innovation ^[7]. Throughout the development history of western developed countries, economic development is inseparable from science and technology, and with the evolution of the times, its contribution rate has become higher and higher, from only 20% at the beginning of the last century to 80% currently ^[8]. Marine scientific and technological innovation cannot be separated from expanding new resources and ensuring the resources, environment and ecological basis for the high-quality marine economic development, promoting the recycling of resources and improving the efficiency of resource utilization. Only on this basis can it truly play a leading role in developing new industries, optimizing industrial structure, developing the marine economy and expanding the overall scale.

3.1 Strengthening the resource base of high quality marine economic development

As a natural resource, marine resources can exist in the ocean in many forms, which can be either material, energy or space, but they can be exploited and utilized by human beings for greater benefits ^[9]. Marine resources can be further classified with different attributes of biology, minerals, energy and space. Economic development cannot do without natural resources, as can marine resources, which are the basic material basis for the high-quality marine economic development. The main body of marine economy relies on the development and utilization of marine resources. The vast majority of the earth is the ocean, which is more than 70% in terms of area alone, while the ocean has a completely different world, and the sea space provides a huge material wealth for human beings. The living organisms move from the sea to the land. The sea provides them with living conditions and makes them develop continuously. The abundant marine resources become the resource conditions that human society depends on for survival. The extremely abundant resources owned by the ocean, if exploited and utilized, will certainly contribute to the development of human economy and change the whole society at the same time. Human beings have been engaged in marine activities for a long time. The early development of marine resources was limited to fishing and transportation. However, with the continuous expansion of social development in this field, the scale has been further increased and the efficiency has been greatly improved, which is closely related to technological innovation and technological progress.

The role of marine technological innovation is not limited to this, for example, technological advances can improve resource utilization and also contribute to the high-quality development of the marine economy. Although the exploitation and utilization of abundant resources in the ocean is conducive to the development of human society, their "scarcity" should be recognized because resources are not inexhaustible. People should have a deep understanding of resources to update the concept of development, recycle, and truly achieve total quantity control, which is inseparable from scientific and technological innovation. To develop resources, people must have a full understanding of them by making a correct evaluation of the total amount known through exploration and investigation, so as to determine the scale of development, control it in time and make it more coordinated. At this stage, resources are not fully utilized. Recycling is the development direction in the future so that more products can be acquired on the basis of equal investment and thus greater economic value can be gained. Technological innovation is the basis for this and can be achieved only with the support of science and technology.

3.2 Promoting the transformation of high-quality development mode of marine economy

The mode of economic growth refers to its method and pattern, with the purpose of achieving economic growth, by means of changing the production factors. In the past, China was underdeveloped in economy, obviously insufficient in many aspects, unsatisfactory in the development of science and technology, which had an impact on economic growth. The original growth mode is relatively backward, with epitaxial growth as the main part ^[10], so is the development of marine industry. Throughout the development history of China's marine industry, fisheries and transportation industry were the main industries in the early stage, and the benefits were obtained through extensive operation, mainly in the aspect of scale expansion. Although the benefits could be thus brought by expanding investment, thus the scale increased substantially in the

short term, it also brought many disadvantages. Continuous expansion of business scale will inevitably lead to the reduction of resources and the destruction of ecological environment, which is tantamount to killing the goose that lays the golden egg. Obviously, the expansion of the scale intensifies the competition, resulting in both losses, which is inevitably not conducive to the future development of the industry. Extensive growth mode, which has driven industrial development to a certain extent, has become an obstacle and will inevitably bring about negative impact if not abandoned. Today, the world pays more attention to sustainable development, which is also the main direction in the future. Extensive growth has not adapted to the changes of the times, and connotative growth has become the mainstream. Attention is no longer paid to the unlimited expansion for the development of resources, but more on the efficiency of resource allocation, mining the potential on the existing scale, protecting the ecological environment, recycling, improving comprehensive benefits and achieving sustainable development. Under the above background, product types will be increased, production efficiency will also be greatly improved, and greater benefits will be obtained under the premise of unchanged input, industrial structure will be adjusted to make it more rational, all of which need the support of scientific and technological innovation. The change of growth mode is very important to the marine economy, and only the development of science and technology can bring about a new situation in which innovation plays an irreplaceable role.

Today, economic growth is no longer dependent on scale expansion, but on the improvement of product quality. The role of upgrading is evident, and there is no economic growth without technological advances. In order to gain benefits in the market, enterprises need to effectively develop and rationally utilize marine resources, improve their types and quantities, continuously innovate in technology and improve their competitiveness by realizing their own development, thus increasing economic benefits. In recent decades, the conspicuous development of China has witnessed the great achievements of marine economy, which was lagged behind with many problems in product processing in the early stage when low price is the stepping-stone for entering into the international market, which is not conducive to its own development. After fully recognizing the importance of products, practitioners began to introduce technology, purchase equipment and adjust product structure to continuously improve product quality and make it more competitive. According to the statistical results in 2010, China has become the largest exporter of seawater products^[11].

3.3 Optimizing industrial structure of marine economy

Industrial structure adjustment is very important to economic development and has been tested by history, but technological innovation and progress are the basis of industrial adjustment. After a long period of development of human society, the progress of agricultural technology has brought a major change. In the past, people lived on fishing and hunting, stayed in the original state with insufficient food, which were all changed by the development of agricultural technology. Later, an agricultural society gradually formed and the first industrial structure adjustment was realized. The sign of the second industrial structure adjustment is the establishment of modern industrial system. Agricultural society has undergone a long period and changed greatly in the 18th century when the use of steam engines makes everything different and industrial society follows. By the middle of the last century, more and more new technologies were applied in practice. Electronic computers were invented, which greatly changed people's lives, and also made the development of the tertiary industry. The service industry gradually became the mainstream, and the third industrial structure adjustment appeared. These are the major changes of human society, showing a new look. Thus it is clear that every evolution of industrial structure is closely related to technological innovation and technological progress.

The impact of scientific and technological innovation is ubiquitous, which is the main driving force for industrial structure change driving economic development. The same is true for the marine economy, so will the industrial field. Marine economic industry is essentially a production and service sector closely related to marine resources, including development, utilization and

protection ^[12]. Marine industries can also be classified according to industry attributes or by reference to the time of formation. Development of marine economic industry is closely related to structural optimization, and innovation and progress of science and technology are its important foundation.

The development and application of high and new technologies have brought many changes to marine industry and also affected traditional industrial sectors whose overall structure has been greatly improved and internal structure has been optimized, presenting a new look. Most of these industries in China have gradually developed after the founding of the People's Republic of China, and the introduction of high and new technologies has made them a modern production sector. With the stability and economic development of the country, ocean science and technology have been progressing since the 1960s. After decades of continuous development, it has entered a new stage at the beginning of this century. Mainstream innovation and unstoppable development have pushed the utilization of marine resources to a new stage. More resources being found also promoted the formation of some new economic and industrial sectors. In addition to the original fishery and transportation industry, the rise of marine aquaculture, the vigorous development of tourism, as well as the comprehensive utilization of marine oil and gas and marine biomedicine, have shown a momentum of development in full swing.

The department that rises with the development of science and technology is called the emerging marine industry. In the new century, the society shows an increasing speed of innovation, an unstoppable trend of progress, a new level of human utilization of marine resources which is still developing, followed by major breakthroughs and emerging industries. In this context, not only has the utilization of marine mineral resources reached a new stage, but also the energy utilization rate has been gradually increased and environmental protection has begun to be put on the agenda. In the future, the marine industry will take on a new look.

Overall, the marine industry is divided into three major industries, occupying different proportion in different periods, which is also an important symbol of industrial structure optimization. The development of marine industry has undergone a series of periods from the primary stage to a higher level, and the industrial structure is in the process of constant adjustment and always presents a highly polarized development trend according to the overall situation. The marine industry is constantly adjusted and gradually optimized based on and driven by the development of science and technology. At the initial stage of development, the level of science and technology is poor, with traditional industries as the focus of development, so fishing and transportation industry has become the main development direction of all countries, in addition to salt industry and other ancillary industries. Fishery used to be the leading factor in this stage and also an important part of the industrial structure. At this time, the proportion is in the order of "primary industry, tertiary industry and secondary industry". However, with the development of science and technology, the demand of society is constantly increasing and related industries are further developed, which promotes the tertiary industry to become the mainstream and gradually take advantage in the process of overtaking. Then, the industrial structure is adjusted and the proportion changes to the order of "tertiary industry, primary industry and secondary industry". But the adjustment is always dynamic. The development of science and technology has promoted the emergence of some emerging industries, including biomedicine, oil and gas exploration, high-end ships and marine equipment, which begin to occupy an important position in the national economy, exceeding other industries into the advanced stage of development, and have their proportion gradually increased. The original order is broken again, and the industrial structure is optimized at the same time, forming the proportion of "secondary industry, tertiary industry and primary industry".

3.4 Developing the scale of the marine economy

In recent years, many countries begin to attach importance to the high-quality development of marine economy, especially in coastal countries. They continue to increase investment, adjust policies and measures to develop marine science and technology, and strive to take a leading

position, unchanged since the 1980s. As a result, international marine science has taken on a new phase with many achievements coming out and development in various fields, from oceanic plate to El Nino, from submarine hydrothermal solution to Southern Oscillation, from marine exploration to extremities, from natural gas hydrate to biodiversity. Looking at the conspicuous progress made in the development of marine science and technology in the past decades, it is found that the introduction of innovation lays the foundation for future development and promotes the sustainable development of the oceans. In the future, a broader space will be presented with the establishment of a sound system. Countries need more than that, because strategic needs exist. While research and development are of great importance, it is also indispensable to protect marine rights and interests and maintain marine defense safety, which has led to the multi-angle and multi-faceted evolution of science and technology development. Countries have increased their investment according to their own needs and made many achievements in the high-tech field. The investment in R&D has never stopped and becomes more and more intense. At the same time, comprehensive integration has become the mainstream and international cooperation is very common. Due to the complex marine environment, different regions present different characteristics, stereoscopic resource distribution brings more requirements, and countries may face difficulties in their individual development. If cooperation can be strengthened and innovation introduced, each with its own strengths and comprehensive development, it will be beneficial to the progress of marine science and technology, promote marine development, provide effective means and tools for the future and meet the actual needs of all countries.

Marine technological innovation has been predominating, and many achievements have been highlighted to provide powerful tools for marine development. Therefore, the latter shows a trend of increasing depth and breadth. Throughout the marine development of human beings, development has shown different characteristics, which can be summarized as seven types, the first one of which is space utilization. With the development of technology, great breakthroughs have been made in shipping industry, and communication has also broken the original limitations and developed to a higher level, followed by the utilization of mineral resources and energy. Ocean, with abundant mineral resources, cannot be fully developed due to technical level in the past, but now the development of science and technology provides opportunities for it. In the era of energy shortage, the utilization of marine energy will bring new opportunities. Thirdly, the development of biological resources. For a long time, the development of biological resources has been confined to the primary stage only, but at present, it is progressing to a higher level gradually with the development of technology. Fourthly, development of marine tourism. The use of the ocean can be more than just the resources themselves. The related tourism and entertainment industry will also bring higher benefits, and they can gradually develop with the ocean as the center. Fifthly, marine waste disposal. People cannot exploit the ocean unrestrictedly and the problems brought by it must be solved, which is the inevitable requirement of sustainable development. Sixthly, military use of the ocean. At the national level, the development of the oceans is not limited to obtaining economic benefits, but also to strengthen coastal defense and make full use of the oceans for progress. Seventhly, marine investigation and research. As an inevitable prerequisite for making full use of the ocean, the investigation and research of the ocean has brought about the development of marine science and technology and promoted the marine economy. With the progress in recent decades, various countries have changed and the scale has been expanding, showing new characteristics. Judging from the situation of various countries, the contribution of marine economic output value has also increased substantially, many of which are more than 5%, and are still developing at a rapid speed, with great potential. Innovation and progress of marine science and technology is the prerequisite of everything. In this way, high-quality development of marine economy can be promoted and continuously improved, especially in developed countries.

4. Conclusions

Based on the connotations of marine technological innovation and high-quality marine economic development, the role of marine technological innovation in driving high-quality marine economic

development is explored, such as laying down the resource base for high-quality marine economic development, promoting the transformation of high-quality development mode of marine economy, optimizing the structure of marine economic structure and developing the scale of marine economy, with the expectation of providing a reference for high-quality marine economic development.

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