

Research on the Development Path of Green Marine Economy in the Era of Ecological Civilization

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Abstract: This article explores the development path of the green marine economy in the era of ecological civilization. It highlights the importance of developing a green marine economy and how it has become a global consensus. The article suggests that China should take proactive measures to optimize its marine industrial structure, promote marine scientific and technological innovation, strengthen marine resource protection and environmental governance, and enhance the competitiveness of the marine economy. The ultimate objective is to achieve sustainable development of the ocean, expand the blue economic space, and accomplish the goal of green marine economic development.

Keywords: Ecological civilization; Marine economy; Sustainable development

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1. Introduction

Developing a green marine economy in the era of ecological civilization has become the focus of global attention. Firstly, the ocean plays an important role in the Earth's ecosystem. It is the largest body of water on the earth and has rich biological and energy resources. It also bears the important mission of regulating the global climate and ecological balance. Due to human misconduct and environmental pollution, the marine ecosystem has suffered serious damage, and the marine ecosystem has also suffered huge threats^[1,2]. Secondly, as human beings' dependence on marine resources continues to increase, the development of the marine economy has also become a focus of global attention; the marine economy includes marine fisheries, marine transportation, marine petrochemicals, marine tourism, and other fields. The development of these fields is of great significance to global economic and social development^[3-6]. Due to over-exploitation and pollution, the marine ecological environment has been severely damaged, and the development of the marine economy has also been greatly affected. Finally, the construction of ecological civilization has become the focus of global attention. The construction of ecological civilization refers to a development model that pays attention to environmental protection and sustainable development in economic development. This development model emphasizes the harmonious coexistence of man and nature and pays attention to the sustainable use of resources and the protection of ecosystems^[7]. In the context of ecological civilization construction, developing a green marine economy has become the focus of global attention.

2. The relationship between ecological civilization and green marine economy

2.1. Ecological protection and sustainable development

The construction of ecological civilization is closely connected with developing the green marine economy. The concept of sustainable development is the core of the construction of ecological civilization, and the sustainable use of marine resources is an important part of sustainable development^[8]. Therefore, ecological protection and sustainable development are the cornerstones of a green marine economy.

2.2. Sustainable utilization of marine resources

Marine resources are limited and must be managed and utilized in scientific ways. A green marine economy emphasizes the sustainable use of marine resources. It achieves long-term utilization and sustainable development through rational development, effective protection, and ecological restoration.

2.3. Development of blue economy

Blue economy refers to economic activities based on marine resources, supported by science and technology, and aiming at sustainable development. The green marine economy is an important part of the blue economy. Developing a green marine economy can promote economic development and industrial upgrading in coastal areas, improve the utilization efficiency of marine resources, and protect the ecological environment^[9].

2.4. Ecotourism and recreational fisheries

Ecotourism and recreational fishing are important components of the green ocean economy. By developing ecotourism and recreational fisheries, the protection and restoration of marine ecology can be promoted. Public awareness of marine ecology and protection awareness can also be improved. Additionally, it can promote the development of related industries and improve the economic benefits of coastal areas.

2.5. Marine pollution prevention and environmental restoration

Marine pollution and environmental damage are important issues for developing the green marine economy. By strengthening marine pollution prevention and environmental restoration, the marine ecological environment can be protected, and the utilization efficiency of marine resources can be improved^[10]. Moreover, it can promote ecological restoration and environmental improvement in coastal areas and improve residents' quality of life.

2.6. Green technology and innovation

Green technology and innovation are important supports for developing a green ocean economy. The effective utilization of marine resources and the protection of the ecological environment can be promoted by promoting and applying advanced green technologies. In addition, it can promote the upgrading and development of the marine industry and improve the competitiveness and sustainability of the marine economy.

2.7. Policies, regulations, and international cooperation

Policies, regulations, and international cooperation are important guarantees for developing a green ocean economy. By formulating and improving relevant policies and regulations, the management and protection of marine resources can be strengthened, and the development of a green marine economy can be promoted. Furthermore, international cooperation can be strengthened to respond to global marine ecological and environmental issues jointly.

2.8. Social participation and public awareness

Social participation and public awareness are important driving forces for developing a green ocean economy. By strengthening publicity and education, the public's understanding and awareness of marine ecological environment protection will be improved^[11]. Additionally, all sectors of society can be encouraged to actively participate in developing the green ocean economy, forming a good situation in which the government, enterprises, and society can jointly participate.

2.9. Green Ocean economic benefit model

The Green Ocean economic benefit model includes $Total\ benefits = Direct\ economic\ benefits + Ecological\ benefits + Social\ benefits$.

Among them, direct economic benefits refers to the direct economic benefits obtained through the development and utilization of marine resources, such as the output value and profits of industries such as fishery, shipping, ocean engineering, coastal tourism, etc., which can be expressed by **Formula (1)**:

$$Direct\ economic\ benefits = \sum (Industry\ yields) \quad (1)$$

Ecological benefits refer to the benefits brought by protecting and restoring the marine ecological environment, such as reducing pollution, restoring ecological balance, improving biodiversity, etc. It can be expressed by **Formula (2)**:

$$Ecological\ benefits = (Ecosystem\ services\ recover) - (Environmental\ Costs) \quad (2)$$

Social benefits refer to the social benefits of developing a green ocean economy, such as increasing employment opportunities, promoting community development, and improving people's living standards. It can be expressed by **Formula (3)**:

$$Social\ benefits = (Social\ wellbeing\ improvements) - (Social\ costs) \quad (3)$$

Through the above formula, the development benefits of the green ocean economy can be comprehensively assessed, and the weights can be adjusted and optimized for different industries and development goals. In the process of implementing a green marine economy, attention should be paid to the balanced development of economic benefits, ecological benefits, and social benefits to ensure the goal of sustainable development.

3. International green marine economic development experience and enlightenment

3.1. Policy guidance

Policy guidance is an important means to promote the development of the green marine economy. By formulating relevant policies and regulations, the United States has stipulated requirements for marine resource development and environmental protection, providing legal protection for developing a green marine economy. Moreover, the government provides financial and technical support to encourage enterprises to conduct green production and research and development. Implementing these policies provides a strong guarantee for the rapid development of the green marine economy.

3.2. Technological innovation

Scientific and technological innovation is a key factor in promoting the development of the green marine economy. Australia has made significant progress in marine science and technology, such as marine energy and biotechnology. The innovation and application of these technologies not only improve the utilization efficiency of marine resources but also reduce the degree of damage to the environment. By strengthening scientific and technological innovation, the sustainable development of the green marine economy can be promoted.

3.3. Environmental awareness

Environmental awareness is an important foundation for promoting the development of green marine economy. Portugal has formed a good atmosphere for public participation in developing a green marine economy. Governments, enterprises, and all sectors of society attach great importance to environmental protection and actively take measures to reduce pollution and waste. This increased environmental awareness has provided strong social support for developing a green marine economy.

3.4. Regional cooperation

Regional cooperation is an important way to promote the development of the green marine economy. Thailand and China have established a cross-regional cooperation mechanism to jointly promote the development of a green marine economy. By strengthening international cooperation, resources and technologies can be shared, overall competitiveness improved, and the rapid development of the green ocean economy promoted.

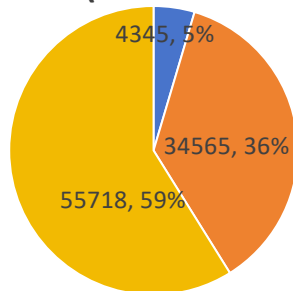
3.5. Industrial upgrading

Industrial upgrading is one of the important means to promote the development of the green marine economy. Japan is actively developing emerging industries based on traditional marine industries, such as marine tourism, marine biomedicine, etc. Developing these emerging industries improves economic benefits and supports the sustainable development of a green marine economy. Upgrading traditional industries to improve resource utilization efficiency and environmental protection levels is also an important way to promote the development of a green marine economy.

3.6. Blue economy

Blue economy refers to economic activities based on marine resources. China has achieved remarkable results in developing a blue economy. Through scientific planning and management, rational development and utilization of marine resources and promotion of the development of the blue economy can improve economic and ecological benefits and provide strong support for the development of green marine economy. Preliminary calculations of the overall operation of China's marine economy show that the national marine industry's GDP in 2022 was 9,462.8 billion Chinese Yuan (CNY), an increase of 1.9% over the previous year, accounting for 7.8% of the GDP, the same proportion as last year. Among them, the added value of the primary marine industry was 434.5 billion CNY, the added value of the secondary industry was 3,456.5 billion CNY, and the added value of the tertiary industry was 5,571.8 billion CNY, accounting for 4.6%, 36.5% and 58.9% of the gross production value of the marine industry respectively.

Output value (billion Chinese Yuan)



■ The added value of the first industry ■ The added value of the secondary industry ■ The added value of the third industry

Figure 1. Overall operation of China's marine economy in 2022

3.7. Talent training

Talent cultivation is one of the important guarantees for promoting the development of the green marine economy. France attaches great importance to talent training and introduction, providing sufficient human resources for developing the green marine economy. By strengthening education and training, the quality and ability of talents are improved and intellectual support is provided for developing the green marine economy.

3.8. International experience

International experience is one of the important references for promoting the development of a green ocean economy. The Republic of Korea has formed mature experiences and models for developing a green marine economy. China can learn from and draw on these experiences and combine them with its actual situation to promote the development of China's green marine economy. In addition, it is imperative to actively participate in international cooperation and exchanges, share global resources and technologies, and improve the competitiveness and influence of China in the global green ocean economy.

4. Research on the development path of China's green marine economy

4.1. Optimizing the marine industry structure

Adjusting the marine industry structure is important for developing the green marine economy. To achieve the goal of green marine economic development, China must optimize the marine industry structure and promote the development of traditional marine industries in the direction of high-end, intelligent, and sustainable ^[12-15]. Specifically, the following measures can be taken,

- (1) Promote the upgrading and transforming of traditional marine industries, increase scientific and technological investment, and improve their technical and environmental protection levels. For example, fishermen are encouraged to adopt advanced fishing technologies and equipment to improve fishing efficiency and resource utilization efficiency; clean energy and energy-saving technologies are promoted to reduce carbon emissions from the marine transportation industry.
- (2) Cultivate emerging marine industries. Actively cultivate emerging marine industries, such as marine biomedicine, marine new energy, etc., to increase the added value and competitiveness of the marine economy. For example, marine biological resources can be used to develop marine drugs and biological products with independent intellectual property rights; marine energy resources can be used to develop new energy industries such as marine wind power and marine tidal energy.
- (3) Improve the marine service industry. Accelerate the development of marine logistics, marine tourism, and other service industries, and increase the proportion and level of marine service industries. For example, marine logistics efficiency can be improved and logistics costs can be reduced by building marine logistics centers and port logistics parks; rich marine resources and beautiful seaside scenery can be utilized to develop the marine tourism industry and create a distinctive marine tourism brand.

4.2. Promoting marine scientific and technological innovation

Marine technological innovation is an important driving force in promoting the development of green marine economy. To achieve the goal of green marine economic development, China must strengthen marine scientific and technological innovation, improve independent innovation capabilities, promote advanced technology, and promote the transformation and upgrading of the marine economy. Specifically, the following measures can be taken,

- (1) Strengthen the construction of marine science and technology innovation systems. Increase investment

and support for marine scientific and technological innovation and improve independent innovation capabilities. Strengthen cooperation among universities, scientific research institutions, and enterprises to promote the transformation and application of scientific and technological achievements.

- (2) Promote advanced marine engineering technology. Actively promote advanced technologies in marine engineering, marine resource development, and marine environmental protection, and improve marine economic development's scientific and technological content. For example, new energy technologies such as ocean wind power and ocean tidal energy can be promoted to improve the utilization efficiency of ocean energy.
- (3) Strengthen the application of marine information technology. Use information technology to promote the digital and intelligent development of the marine economy. For example, technologies such as big data and artificial intelligence can be used to improve the accuracy of ocean observations and predictions and provide a scientific basis for the development of the ocean economy.
- (4) Cultivate innovative talents in marine science and technology. Increase the training and introduction of innovative talents in marine science and technology, and improve the quality and ability of talents. For example, high-level talents can be attracted to participate in marine science and technology innovation activities by setting up special funds and providing preferential policies.

4.3. Strengthening the protection of marine resources

Efforts will be made to bolster the management of marine resources by improving existing systems, enhancing monitoring and investigation techniques, and gaining a comprehensive understanding of resource distribution and utilization. Priority will be given to the strict protection of marine resources, particularly through intensified management of critical areas such as marine fisheries and ecology, ensuring their sustainable utilization. Additionally, initiatives will focus on enhancing resource utilization efficiency by actively promoting resource-saving production methods and augmenting the added value of marine resources.

4.4. Deepening marine environmental governance

The monitoring of the marine environment will be fortified, with a focus on establishing and refining monitoring networks. Measures will be implemented to intensify monitoring and control of pollutant emissions and environmental quality, with an emphasis on promoting pollution prevention and control through increased investment and effort. Supervision of pollution sources will be strengthened, alongside endeavors to bolster environmental risk prevention through enhanced risk assessment and preemptive measures, thereby bolstering the capacity to respond to environmental emergencies.

4.5. Strengthening marine ecological restoration

Initiatives will be undertaken to conduct ecological restoration projects aimed at rejuvenating damaged marine ecosystems and restoring ecological balance. Research into ecological protection and restoration technologies will be intensified, with increased investment and support to enhance the scientific and technological efficacy of restoration projects. Furthermore, efforts will be made to promote the concept of ecological protection through heightened publicity and education, fostering greater public awareness and participation in ecological conservation.

4.6. Promoting sustainable development of the ocean

Guidance will be strengthened to facilitate the formulation of scientifically grounded marine economic development plans, delineating clear development objectives and key tasks. Emphasis will be placed on

promoting green development through increased investment and support, advocating for environmentally friendly production methods and lifestyles. Enhanced international cooperation will be pursued, with active participation in global marine economic cooperation to leverage shared resources and technologies, thereby enhancing China's competitiveness and influence in the global maritime economy.

4.7. Expanding blue economic space

Efforts will focus on the development and utilization of deep-sea resources, with increased investment and support to expand the blue economic space. Initiatives will be directed towards promoting a marine circular economy model, enhancing resource utilization efficiency and value. Strengthened regional cooperation in the marine economy, alongside collaboration with neighboring countries and regions, will be prioritized to jointly advance the development of the blue economy.

4.8. Enhancing the competitiveness of the marine economy

Measures will be taken to enhance product quality through increased investment and support for research and development, aiming to improve competitiveness. Emphasis will also be placed on brand building, cultivating, and promoting well-known brands to enhance brand awareness and reputation. Additionally, efforts will be made to expand market channels, both domestically and internationally, to increase market share and product influence.

5. Conclusion

Developing a green ocean economy is a long-term and complex process that requires the joint efforts and support of the entire society. From an international perspective, developed countries such as the European Union and the United States have achieved remarkable results in marine resource development and marine ecological protection, forming a green marine economic development model driven by technological innovation. Domestically, with the deepening of ecological civilization construction, as progress is made, theoretical and practical research on the green marine economy is becoming increasingly abundant, mainly focusing on marine ecological compensation mechanisms, blue economic development, and other fields. In the future, attention will be directed toward studying the development trends in this field, aiming to offer more theoretical support and practical guidance for promoting the sustainable development of China's green marine economy. Simultaneously, it is hoped that through the research presented in this article, increased attention can be drawn to the development of a green ocean economy, fostering joint efforts toward promoting the sustainable development of the global ocean economy.

Disclosure statement

The author declares no conflict of interest.

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