

# Research on the Upgrading of the Marine Industry Structure in Fujian Province under Environmental Regulation

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**Abstract:** The marine industry is a vital strategic sector for national economic development, holding immense potential and opportunities. This paper aims to explore the issues concerning the upgrading of the marine industry in Fujian Province under environmental regulation, and to discuss methods for enhancing the competitiveness and sustainable development of the marine industry. Taking the intensity of environmental regulation as the core explanatory variable, the level of marine technological innovation as the explanatory variable, and the index of marine industry structural adjustment as the dependent variable, a panel threshold regression model is established to examine the effect of the level of marine technological innovation in Fujian Province, thereby providing theoretical and practical guidance for the upgrading of the marine industry. This research also plays a positive role in promoting the development of the marine industry for relevant departments and enterprises, further enhancing the competitiveness and sustainable development capability of China's marine economy.

**Keywords:** Environmental Regulation; Marine Economy; Industrial Structure Upgrading; Technological Innovation; Fujian Province

## 1. Introduction

In the wake of rapid global economic development, the maritime economy has emerged as a pivotal driver of economic growth. As the world's second-largest economy, China has a steadily increasing contribution to the maritime economy. With abundant maritime resources, Fujian Province possesses a distinct advantage in developing the maritime economy. Setting forth the

overarching goal of becoming a "Maritime Power Province" by 2025, Fujian Province is vigorously sparking innovation in maritime science and technology, optimizing and fortifying advantageous industries, fostering the growth of emerging sectors, and accelerating the construction of significant maritime industry projects.

Research on the impact of environmental regulations on the transformation of the maritime economy's industrial structure has garnered widespread attention. Theoretical propositions elucidate the influence of environmental regulations on industrial structure and their transmission mechanisms<sup>[1]</sup>. Under conditions of economic openness, enterprises may engage in interregional transfer of polluting industries based on disparities in environmental standards or regulatory stringency to circumvent or reduce compliance costs<sup>[2]</sup>. Moderately stringent and appropriate environmental regulations incentivize enterprise technological innovation, stimulating improvements in resource utilization efficiency to alleviate or offset the compliance costs imposed by environmental regulations. Through the innovation compensation effect, achieving Pareto improvements, industries are coerced to transform and upgrade their structures in a process akin to "survival of the fittest"<sup>[3]</sup>. Sun Yuyang et al. (2019) examined the nonlinear (U-shaped) relationship between environmental regulatory intensity and industrial structure, positing that only after surpassing a threshold can environmental regulations foster the upgrading of regional industrial structures<sup>[4]</sup>.

Potential Marginal Contribution of this Paper: Empirically testing the impact of environmental regulations on the transformation and upgrading of maritime industry structure in Fujian Province, this study offered a more comprehensive

investigation. By incorporating the level of maritime technological innovation into the theoretical analytical framework and utilizing panel regression models to assess the effects of maritime technological innovation in Fujian Province, this research introduces a novel academic perspective.

## 2. Development Status of the Maritime Industry in Fujian Province

Fujian's primary industry is predominantly represented by fisheries, with a focus on marine capture that encompasses coastal fisheries, deep-sea fisheries, and fishery services. In recent years, Fujian Province has actively promoted the modernization of its fisheries, increasing support for technological innovation in this sector to enhance production efficiency and sustainability. The secondary maritime sector in Fujian is primarily involved in marine engineering, marine equipment manufacturing, and marine energy.

The province boasts a multitude of marine engineering projects, such as port construction and island development, which are pivotal for the advancement of Fujian's maritime economy. Furthermore, Fujian has made notable strides in marine equipment manufacturing and the development and utilization of marine energy, thus providing substantial support for the extension of the maritime industrial chain. The tertiary industry in Fujian encompasses marine tourism, marine cultural and creative industries, and marine scientific services. With abundant coastal resources and a unique maritime cultural heritage, marine tourism has emerged as one of the key drivers of economic growth in Fujian Province. Additionally, the province is actively fostering the marine cultural and creative sector, utilizing cultural products and artistic expressions to explore and perpetuate the essence of its maritime culture. Moreover, Fujian has made significant progress in the field of marine scientific services, offering technological support and technical services essential for bolstering the marine economy.

### 2.1 Division of the Maritime Industry Structure in Fujian Province

In 2006, China issued the *Classification of Maritime and Related Industries* (GB/T 20794-2006). In 2014, the National Marine Information Center reclassified industries in

accordance with the standard (20153536-T-418). As displayed in **Table 1.**, the maritime economy encompasses 28 subcategories within two major categories: maritime industries and related maritime industries. The maritime industry engages in production and service activities related to the development, utilization, and preservation of the oceans. It includes primary maritime industries such as marine fisheries, marine oil and gas, marine mining, marine salt industry, marine transportation, coastal tourism, and other core maritime industries, alongside marine scientific research, education, management services. Based on the tripartite industry classification, the first maritime industry pertains to marine fisheries, marine aquatic products, and related sectors within the primary industry. The second maritime industry comprises marine aquatic product processing, marine power, and related sectors within the secondary industry. The third maritime industry encompasses marine transportation, coastal tourism, and related sectors within the tertiary industry.

### 2.2 Overall Scale of the Marine Industry in Fujian Province

From 2008 to 2019, the total marine GDP of Fujian Province demonstrated a steady upward trend. There was a slight decline in 2020 and 2021; however, overall, the marine GDP from 2008 to 2021 exhibited consistent growth. The trends in the growth of the marine primary, secondary, and tertiary industries were particularly pronounced. While the primary marine industry showed a steady growth trajectory, its growth rate was relatively slow. The secondary marine industry consistently experienced growth between 2008 and 2019, although there was a significant drop in 2020, followed by a rapid increase in 2021. The tertiary marine industry, on the other hand, displayed rapid growth from 2008 to 2019, experienced a sharp decline in 2020, but continued to grow in 2021, maintaining a GDP that consistently surpassed that of the primary and secondary industries (see **Table 2.**).

The primary and secondary marine industries in Fujian Province are the dominant factors driving the development of the marine economy. The tertiary industry holds the largest share in the marine GDP. Consequently, the contributions of the primary and secondary

industries to the marine economy appear inadequate, resulting in insufficient impetus for the development of the tertiary sector,

which in turn leads to a sluggish growth rate in marine GDP and overall marine development.

**Table 1. Classification of Maritime Industries**

Industry	Subdivision of Industry Structure	Three-tier Industry Classification
01 Marine Fisheries	Core Maritime Industry	Primary Industry
02 Marine Aquatic Product Processing Industry	Core Maritime Industry	Secondary Industry
03 Marine Oil and Gas Industry	Core Maritime Industry	Secondary Industry
04 Marine Mining Industry	Core Maritime Industry	Secondary Industry
05 Marine Salt Industry	Core Maritime Industry	Secondary Industry
06 Marine Shipbuilding Industry	Core Maritime Industry	Secondary Industry
07 Marine Engineering Equipment Manufacturing Industry	Core Maritime Industry	Secondary Industry
08 Marine Chemical Industry	Core Maritime Industry	Secondary Industry
09 Marine Pharmaceutical and Bioproduct Industry	Core Maritime Industry	Secondary Industry
10 Marine Engineering Construction Industry	Core Maritime Industry	Secondary Industry
11 Marine Renewable Energy Utilization Industry	Core Maritime Industry	Secondary Industry
12 Seawater Utilization Industry	Core Maritime Industry	Secondary Industry
13 Marine Transportation Industry	Core Maritime Industry	Tertiary Industry
14 Marine Tourism Industry	Core Maritime Industry	Tertiary Industry
15 Marine Scientific Research	Marine Scientific Research, Education, and Management Services	Tertiary Industry
16 Marine Education	Marine Scientific Research, Education, and Management Services	Tertiary Industry
17 Marine Management	Marine Scientific Research, Education, and Management Services	Tertiary Industry
18 Marine Technical Services	Marine Scientific Research, Education, and Management Services	Tertiary Industry
19 Marine Information Services	Marine Scientific Research, Education, and Management Services	Tertiary Industry
20 Marine Ecology Protection and Environmental Monitoring and Governance	Marine Scientific Research, Education, and Management Services	Tertiary Industry
21 Marine Geological Exploration	Marine Scientific Research, Education, and Management Services	Tertiary Industry
22 Marine Social Organizations, Foundations, and International Organizations	Marine Scientific Research, Education, and Management Services	Tertiary Industry
23 Intertidal Agricultural and Forestry	Marine-related Industry	Primary Industry
24 Marine-related Equipment Manufacturing	Marine-related Industry	Secondary Industry
25 Marine Product Reprocessing	Marine-related Industry	Secondary Industry
26 Marine Material Manufacturing	Marine-related Industry	Secondary Industry
27 Wholesale and Retail of Marine Products	Marine-related Industry	Tertiary Industry
28 Marine-related Services	Marine-related Industry	Tertiary Industry

### 2.3 Structure of the Marine Industry in Fujian Province

In accordance with the *Classification of Marine and Related Industries* (GB/T 20794-2021), the marine economy classification for 2020 and 2021 has been revised from its previous structure, comprising marine industries (encompassing primary marine industries, marine research education, and management services), to a new

framework consisting of marine industries, marine research education, marine public management services, upstream marine-related industries, and downstream marine-related industries. For the sake of data consistency, this study combined marine research education and marine public management services under the category of marine research education management services, while also merging upstream and downstream marine-related industries into a single category called

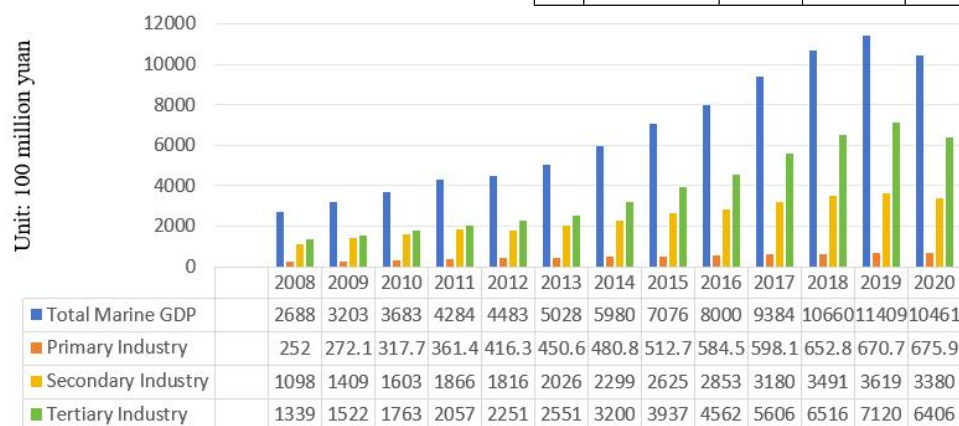
marine-related industries.

As depicted in **Figure 1.**, the structural composition of Fujian's marine production from 2008 to 2021 exhibits a "321" structure. The primary industry increased significantly from 25.2 billion yuan in 2008 to 67.59 billion yuan in 2020, representing a year-on-year growth of 168%. The secondary industry expanded from 109.78 billion yuan to 337.96 billion yuan over the same timeframe, reflecting a growth rate of 208%. In contrast, the tertiary industry experienced substantial growth, rising from 133.85 billion yuan to 640.58 billion yuan, which corresponds to an impressive growth of 379%. In 2020, the contributions of Fujian's three major marine industries to the total marine GDP were as follows: 6.46% from the primary industry, 32.31% from the secondary industry, and 61.23% from the tertiary industry. Notably, the contributions from both the primary and secondary marine industries have been on a gradual decline, while the tertiary marine industry has shown a consistent increase in its contribution. Compared to the national contributions of China's three major marine industries, which stand at 4.6% for the primary

industry, 36.5% for the secondary industry, and 58.9% for the tertiary industry, Fujian demonstrates a relatively higher contribution from the primary and tertiary sectors. This trend is primarily a result of Fujian's advantageous coastline, which fosters the cultivation of high-quality and diverse marine products, alongside the development of premium coastal tourism resources.

**Table 2. Total Marine GDP of Fujian Province from 2008 to 2021**

Year	Total Marine GDP (100 million yuan)	Primary Industry (100 million yuan)	Secondary Industry (100 million yuan)	Tertiary Industry (100 million yuan)	Proportion of Marine GDP in Regional GDP (%)
2008	2688.2	252.0	1097.7	1338.5	24.8
2009	3202.9	272.1	1408.9	1521.9	26.2
2010	3682.9	317.7	1602.5	1762.7	25.0
2011	4284.0	361.4	1866.0	2056.6	24.4
2012	4482.8	416.3	1815.9	2250.7	22.8
2013	5028.0	450.6	2026.2	2551.2	23.1
2014	5980.2	480.8	2299.3	3200.2	24.9
2015	7075.6	512.7	2625.4	3937.4	27.2
2016	7999.7	584.5	2853.1	4562.1	27.8
2017	9384.0	598.1	3179.9	5606.0	29.2
2018	10659.9	652.8	3490.8	6516.3	29.8
2019	11409.3	670.7	3618.7	7119.9	26.9
2020	10461.3	675.9	3379.6	6405.8	23.8
2021	10841.5	796.6	3822.2	6222.8	21.9



**Figure 1. Structure of the Marine Industry in Fujian Province from 2008 to 2021**

### 3. The Impact Mechanism of Environmental Regulation Intensity on Marine Industry Structure

#### 3.1 Direct Influence of Environmental Regulation on Marine Industry Structure

##### 3.1.1 Promoting upgrading of marine industries

Environmental regulations often result in increased costs for heavily polluting marine industries, compelling enterprises to undergo technological upgrades and adopt cleaner,

more efficient production methods<sup>[5]</sup>. Through instruments such as discharge permits, environmental inspections, and impact assessments, these regulations restrict waste water, gas, and solid waste emissions, thus prompting marine-related enterprises to renew their technological equipment and enhance their pollution control capabilities, ultimately optimizing their production processes. Marine enterprises are encouraged to innovate green technologies, as environmental regulations incentivize the adoption of eco-friendly and energy-efficient technologies and equipment.

For instance, green ship technology, which includes energy-saving designs, the use of clean energy, and pollution treatment equipment, can substantially mitigate marine pollution.

Such regulations force high-pollution and high-risk marine industries to reform or shut down operations. For example, illegal waste dumping and overfishing practices face stringent penalties, thus fostering a transition from traditional exploitation to sustainable operational management. Additionally, environmental regulations promote the development of emerging eco-friendly industries, such as the manufacturing of environmental protection equipment and environmental consulting services.

#### 3.1.2 Optimizing marine industry structure

Environmental regulations can facilitate the adjustment and upgrading of the marine industry structure. They operate as a set of institutional arrangements designed to impose environmental standards, issue discharge permits, and levy environmental taxes, thereby constraining pollutant emissions and encouraging enterprises to adopt environmentally friendly measures. These regulations can guide the marine industry towards a greener, low-carbon, and intelligent direction, effectively reducing marine environmental pollution. Stringent environmental policies and standards can curb the expansion of high-pollution, high-energy-consuming industries and penalize polluting entities while rewarding environmentally responsible businesses. This approach promotes the development of green, low-carbon, and circular economies, resulting in a transformation of the marine industry from polluting sectors to cleaner industries. This transformation not only decreases resource consumption and environmental pollution but also enhances product quality and market competitiveness.

Furthermore, environmental regulations can optimize the internal structure of marine industries. By implementing differentiated environmental policies and standards, regulations can guide enterprises to shift towards fields characterized by higher technological content and added value, thus improving the internal structure and resource allocation within the marine sector. These regulations also encourage coordinated

development between the marine industry and other sectors. The growth of marine industries necessitates collaboration and synergy with other industries, and environmental regulations can facilitate cooperation for mutual benefits, achieving dual objectives of economic and environmental sustainability.

### 3.2 Indirect Influence of Environmental Regulation on the Marine Industry Structure

#### 3.2.1 Social implications

The implementation of environmental regulations may exert indirect effects on the production and operations of marine-related enterprises, consequently influencing employment opportunities. On one hand, environmental regulatory policies can incentivize enterprises to engage in technological innovation and industrial upgrading, thereby enhancing production efficiency, profitability, and expanding job prospects. On the other hand, these policies may lead to the decline and transformation of certain traditional industries, resulting in the potential disappearance or relocation of some positions, thereby exerting pressure on employment opportunities<sup>[6]</sup>.

The enforcement of environmental regulations can also impact income distribution among different societal groups. On one hand, environmental regulatory policies may escalate production costs for enterprises, diminishing profit margins and potentially reducing labor compensation, leading to a decline in income for specific groups. Conversely, these policies can stimulate the development and advancement of green industries, elevating profitability levels and technological sophistication in related sectors, consequently increasing the demand for highly skilled labor and augmenting the income levels of specific groups.

#### 3.2.2 Technological influence

Environmental regulations play a pivotal role in stimulating marine technological innovation. By enhancing the demand for environmentally friendly technologies within the marine industry, environmental regulations drive enterprises to pursue technological upgrades and structural adjustments. The enforcement of environmental regulatory policies exerts pressure on marine-related enterprises, compelling them to engage in technological

innovation and research and development to reduce production costs, enhance efficiency, and meet environmental sustainability requirements. The implementation of environmental regulations can foster increased investment in scientific research and development by enterprises, encouraging the exploration and application of environmentally friendly technologies. This, in turn, propels technological advancements and innovation within the marine sector, thereby advancing the progress of marine industry technological innovation.

#### **4. Impact of Environmental Regulation on the Marine Industry Structure in Fujian Province**

##### **4.1 Data Description and Indicator Construction**

This study aims to explore the influence of environmental regulation on the upgrading of the marine industry structure in Fujian Province, utilizing data sourced from the China Ocean Statistical Yearbook and the China Statistical Yearbook for the period from 2009 to 2022.

The intensity of environmental regulation is defined as the degree to which the government prioritizes environmental issues and the rigor of the regulatory measures implemented. This intensity reflects the government's commitment to environmental protection and serves as a vital indicator for assessing the level of environmental conservation both nationally and regionally. To empirically investigate the effect of environmental regulation on the transformation of the marine economic industry structure within Fujian Province, this research analyzed statistical data from 2008 to 2021. In the model construction, the marine industry structural adjustment index was utilized as the dependent variable, while other relevant indicators acted as independent variables. To address issues of heteroscedasticity, all indicators underwent logarithmic transformation.

##### **4.1.1 Dependent variable**

**Marine Industry Structural Adjustment Index (ST):** This study adopted the ratio of the tertiary marine industry to the second marine industry as a measure of structural adjustments in the marine sector, drawing on the methodology outlined by Liu Ming (2017) [6].

A positive and significant regression coefficient for environmental regulation with respect to this ratio would indicate a beneficial effect on the adjustment of the marine industry structure in Fujian Province. Conversely, a negative regression coefficient would suggest an adverse impact of environmental regulation on this adjustment.

##### **4.1.2 Core explanatory variable**

**Intensity of Environmental Regulation (ER):** A unified standard for measuring the intensity of environmental regulation has yet to be established. Scholars from both Chinese and international spheres primarily assess environmental regulation from the following perspectives: formal and informal environmental regulations [7]; examining the strength of environmental regulation policies; measuring pollution control investments as a proportion of total enterprise costs or output; using a single metric to gauge intensity of environmental regulation, such as pollution control investment amounts, total emission fees collected, and even compliance rates for specific pollutants or the simultaneous compliance rate; and comparing the total investment in industrial pollution control to industrial value-added. Due to data availability and completeness, this study adopted the fifth method, utilizing the ratio of annual industrial pollution control investment to industrial value-added in Fujian Province as a measure of environmental regulation intensity (see **Table 3.**).

##### **4.1.3 Explanatory variable**

**Level of Marine Technological Innovation (KJ):** Marine technological innovation serves as a crucial catalyst in the emergence of novel industries, such as marine biomedicine and marine renewable energy, through the development and application of advanced technologies and equipment[8]. The contribution of these burgeoning industries to the marine economy has steadily increased, thus injecting fresh momentum into the sustainable development of the sector. Through research and technological upgrades, marine technological innovation has elevated the technical standards of traditional industries, such as fisheries and transportation. The implementation of new technologies and equipment has enhanced the production efficiency and quality levels of these sectors, thereby bolstering their competitiveness.

Adopting the methodology of Yang Lin and Wen Xin, this study employed the number of

marine patent grants as a measure of the level of marine technological innovation<sup>[9]</sup>.

**Table 3. Intensity of Environmental Regulation in Fujian Province from 2008 to 2021**

Year	Industrial Pollution Control Investment (100 million yuan)	Industrial Added Value (100 million yuan)	Intensity of Environmental Regulation
2008	15.57628	4755.45	0.003275459
2009	12.86918	5106.38	0.002520216
2010	15.32955	6397.71	0.0023961
2011	14.25992	7675.09	0.001857948
2012	23.76346	8541.94	0.002781975
2013	38.39635	9455.32	0.00406082
2014	42.4	10426.71	0.004066479
2015	44.7	10820.22	0.004131154
2016	22.6	11698.36	0.001931895
2017	14.73943	12674.89	0.001162884
2018	16.42	14781	0.001110886
2019	12.76453	16170.45	0.000789374
2020	17.5766	15745.55	0.00111629
2021	12.04011	17787.5977	0.000676882

#### 4.2 Model Construction

This study employed time series analysis from 2008 to 2021 to analyze the impact of environmental regulation on the marine industry structure in Fujian Province. The marine industry structural adjustment index was treated as the dependent variable, with the intensity of environmental regulation as the core explanatory variable and the level of marine technological innovation as an explanatory variable. The study empirically investigated the influence of environmental regulation on the marine industry structure in Fujian Province. The model is specified as follows:

$$ST = \alpha + \beta ER + cKJ + \varepsilon \quad (1)$$

Where,  $ST$  represents the marine industry structural adjustment index,  $ER$  denotes the

intensity of environmental regulation,  $KJ$  signifies the level of marine technological innovation,  $\alpha$  is a constant term,  $\beta$  and  $c$  are the regression coefficients of  $ER$  and  $KJ$  for  $ST$  respectively, and  $\varepsilon$  represents the random disturbance term. **Table 4.** presents the descriptive statistics for each variable.

#### 4.3 Result Analysis

From **Table 5.**, it is evident that the results of the model testing indicate that all variables pass the significance test at the 10% level. This suggests that both the intensity of environmental regulation and the level of marine technological innovation significantly impact the adjustment of the marine industry structure in Fujian Province.

**Table 4. Descriptive Statistics of Variables**

	N	Minimum	Maximum	Mean	Standard Deviation
Marine Industry Structural Adjustment Index	14	1.0802	1.9675	1.472247	0.3168241
Intensity of Environmental Regulation	14	0.0007	0.0041	0.002277	0.0012454
Level pf Marine Technological Innovation	14	1.0000	127.0000	37.000000	33.7456550

**Table 5. Test Results**

Model		Non-standardized Coefficient		Standardized Coefficient
		B	Standard Error	
1	(Constant)	-0.662	0.465	
	ER	-0.120	0.086	-0.343
	KJ	0.090	0.043	0.512

The coefficient  $\beta$  is -0.120, and it has passed the significance test, indicating that the

intensity of environmental regulation from 2008 to 2021 has a suppressive effect on the

marine industry structure in Fujian Province. This aligns with Yang Lin's assertion that, in the short term (as this study spans 14 years, a relatively brief period), environmental regulation tends to hinder the upgrading of the marine industry structure. However, in the long term, the innovation compensatory effect generated by environmental regulation may offset the short-term suppression, thereby promoting the upgrading of the marine industry structure.

The coefficient for marine technological innovation is 0.090, indicating that it exerts a positive effect on the upgrading of the marine industry structure in Fujian Province. Marine technological innovation enhances the sustainable development capacity of the marine industry by strengthening ecological environmental protection and facilitating resource recycling, thereby promoting structural upgrades in the marine sector and achieving a win-win scenario for both economic and ecological benefits. The impact of marine technological innovation on the marine industry structure is multifaceted; it fosters emerging industries, elevates the technological levels of traditional industries, optimizes industrial structures, increases economic added value, and enhances sustainable development capabilities, thus driving the continuous advancement of the marine economy<sup>[10]</sup>.

## 5. Policy Recommendations

### 5.1 Enhancing Business Environment

For enterprises primarily engaged in emerging marine industries and recognized as high-tech businesses, it is imperative to fully implement tax policies such as enhanced deductions for research and development expenses, preferential income tax rates for high-tech enterprises, exemptions on imported equipment, and other tax incentives. This approach maximizes the incentive for enterprises to increase research and development investment while elevating the overall societal spending on research and development. Tailored tax policies based on the characteristics and developmental needs of the marine industry should be developed to lighten the tax burden on businesses and enhance their competitiveness. Encouraging financial institutions to provide more

convenient and flexible financial services to marine enterprises, meeting their financing needs and reducing their financing costs, is essential. Enhancing the information technology infrastructure within the marine industry is essential for improving the level of informationization and management efficiency of enterprises, as well as for reducing operational costs. Industry associations and intermediary organizations play a crucial role in this sector by providing enterprises with more specialized and efficient services and support.

### 5.2 Increasing Financial Support for Marine High-Tech Industries

First, it is essential to seek national-level support for regional demonstrations of marine economic innovation and secure provincial funding specifically for marine high-tech industries. This can be facilitated through the establishment of special funds dedicated to advancing Fujian's marine high-tech sector, aimed at facilitating the transformation and upgrading of marine industries, supporting project R&D, technological innovation, and talent development. Priority should be given to industries such as marine biopharmaceuticals, high-end marine equipment, and biotechnology, focusing on overcoming critical technological challenges in key industrial sectors and expediting the transformation of outcomes in Fujian's marine high-tech industries.

Second, there is a need to actively leverage financial resources to establish venture capital funds that will attract additional investment into Fujian's marine high-tech sector. By investing in promising marine high-tech enterprises and projects, these funds can help facilitate rapid growth while providing financial backing and management expertise to mitigate developmental risks. Initiatives such as modern blue industry venture capital funds and "technology loans" should be employed to support the growth of innovative technology enterprises and enhance the core competitiveness of the industry.

Third, it is crucial to increase fiscal investment in research and development for marine high technologies, thereby providing support for research institutions and enterprises engaged in cutting-edge technological exploration and innovation. Enhanced research efforts should



aim to break through core technological barriers within Fujian's marine high-tech industries, boosting their innovative capabilities and competitive strengths. Establishing specialized talent training centers for marine high-tech industries will strengthen the cultivation and attraction of related talents. Additionally, incentives such as scholarships and research funding can be introduced to draw talented individuals into the arena of marine high-tech research and innovation.

### **5.3 Cultivating an "Ecological Marine Industry"**

By leveraging technological innovation, the progression toward the transformation and enhancement of the blue industry is facilitated, culminating in the establishment of a distinct and competitive Strait Blue Industry Belt exhibiting regional characteristics. This initiative aims to expedite the swift development of the marine economy and the establishment of a maritime powerhouse. Emphasis is placed on embracing the concept of "Ecology+", actively exploring pathways to realize ecological advantages. By integrating the regional features and marine resource endowments of Fujian Province, the concerted advancement of marine ecology and industry is pursued. The promotion and nurturing of unique marine industries such as king abalone, grouper, and eel are advocated, with a vision to construct modern ecological aquaculture zones that further fortify and enhance distinctive industrial sectors.

A restructuring of the marine fisheries industry is proposed to foster a high-end, intelligent, and environmentally friendly marine fishery. Increased support is recommended for marine ranching, deep-sea aquaculture, and deep-sea fishing, with the aim of expanding marine fisheries operations into deeper and offshore waters. The promotion of ecological aquaculture models is advocated to mitigate pollution in the cultivation process and elevate the quality of cultured products. Concurrently, a reinforcement of monitoring and regulation practices for aquaculture environments is deemed necessary to ensure stability and sustainability. The encouragement of technological innovation and research and development efforts within the marine fisheries sector is crucial to propel advancements in fishing equipment,

aquaculture techniques, and fishing technologies. Enterprises are encouraged to bolster their focus on technological innovation and research and development to enhance fishing production efficiency and product quality. The convergence of marine fisheries with tourism, culture, education, and other sectors is envisioned to foster the creation of a marine ecological industry cluster in Fujian Province, thereby expanding the industrial and value chains of the marine economy. Furthermore, there is a call to extract the sustainable and profound cultural influences inherent in marine food culture, with a strategic focus on the deep transformation of the value of marine ecological products. Long-term planning for the development of eco-gastronomic landmarks is recommended, along with a scientific approach to the coordination of primary, secondary, and tertiary industries in support of marine ecological development.

### **5.4 Establishing a Sound Marine Environmental Monitoring System**

The strategic placement of monitoring stations in key maritime zones and sensitive sea areas is essential, ensuring coverage across various depths and distances from the coastline. These monitoring stations should be equipped with cutting-edge monitoring devices and technologies capable of real-time and precise assessment of parameters such as marine water quality, marine biology, and seabed conditions. Leveraging the research strengths of various departments focusing on marine affairs and environmental protection in Fujian Province, along with the academic expertise of institutions like Fuzhou University and Xiamen University, as well as marine research organizations in Fujian, endeavors in marine resource surveys, marine environmental conservation, and marine biological studies are conducted. Additionally, Fujian Province encourages enterprises to intensify their investments in marine scientific and technological innovation to drive the transformation and application of marine technological achievements, consequently enhancing the level of marine monitoring technology and establishing a comprehensive land-sea integrated environmental monitoring system that capitalizes on complementary advantages. Enhancements in the research and

application of marine environmental monitoring technologies, encompassing remote sensing, sonar technology, underwater robotics, among others, are emphasized. These technologies offer more nuanced marine environmental data, aiding in the timely warning and swift response to pollution incidents.

### 5.5 Driving Digital Transformation in the Marine Industry

A dedicated focus is directed towards enhancing the digital brand construction of Digital Fujian. Defining the brand positioning of Digital Fujian, emphasizing its distinctiveness and strengths, aligning with the characteristics and developmental needs of the marine industry in Fujian Province, and articulating the brand image and promotional slogan of Digital Fujian to enhance brand awareness and reputation are prioritized. Strengthening the publicity of Digital Fujian through various channels such as media coverage, advertising campaigns, and social media outreach is emphasized. Leveraging tools like the Internet and big data to precisely target desired audiences, augmenting the effectiveness and impact of brand promotion, and improving the quality management of Digital Fujian products and services to elevate their quality standards are essential strategies outlined for comprehensive advancement.

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