Technological Innovation and Regional Development Patterns of China’s Marine Economy (2000–2023)

Yuheng Zhao, Boxiao Zhang, Zihan Gao, Jiangwen Liu, Yicheng Fu
Presenter: Yicheng Fu
School Of Peace And Development, Renmin University Of China
E-mail:fuyicheng@ruc.edu.cn

From 2000 to 2023, China’s marine economy maintained rapid growth, exerting a driving effect on the national economy. This study proposes to measure the development of the marine economy from the perspective of patent data and finds that invention patents in the marine industry have maintained steady growth. Since 2016, the growth of patents in the core layer of the marine economy, classified by statistical standards, has accelerated significantly.

This study extracts keywords based on the descriptions of marine industries specified in China’s GB/T 20794-2021 statistical standard, constructs regular expressions, and matches them with the patent data published by the State Intellectual Property Office of China to obtain patent-related data of the marine industry. By 2023, the cumulative number of patent applications in China’s marine industry had reached 50,332.

GB/T 20794-2021 also defines the concepts of the core layer, supporting layer, and peripheral layer of the marine economy. The core layer consists of major marine industries, the supporting layer includes marine scientific research, education, and public administration, and the peripheral layer covers marine upstream and downstream industries. This study finds that since 2016, the number of patent applications and grants in the core layer of the marine economy has increased significantly, reflecting the fact of innovation-driven growth of the marine economy.

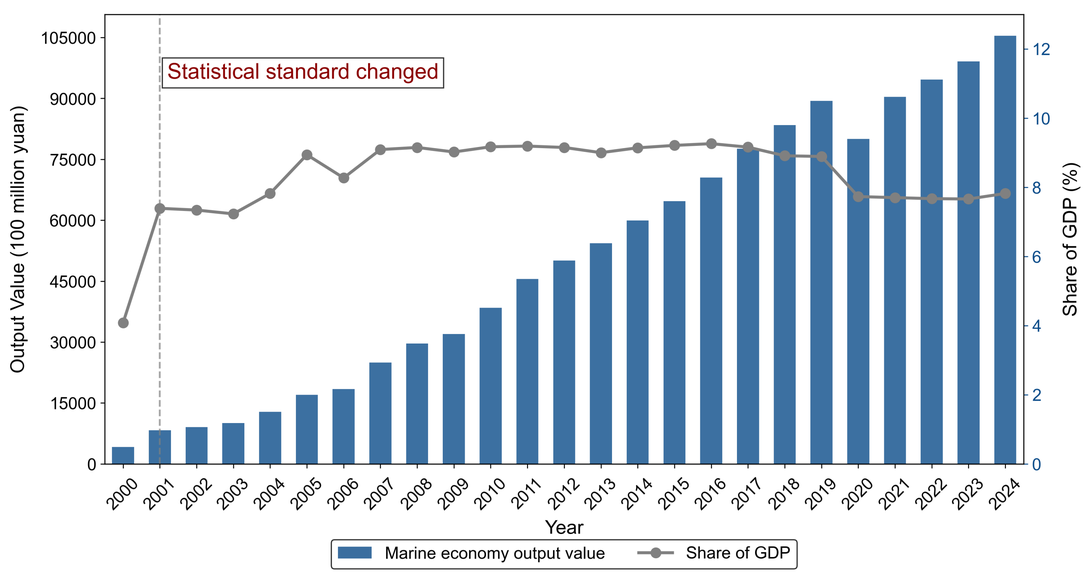
Since 2016, diversified policies covering planning guidance, financial support, and technological R&D have been introduced at the central and local levels, and these policies show a strong positive correlation with the growth of patents in key coastal cities. Although the average contribution rate of the marine economy to GDP is close to 9%, its share of patent applications and grants is only about 3%, indicating that there is still considerable room for improvement in technology transfer and innovation output.

This study suggests that multilateral cooperation in the Western Pacific region should be strengthened to share deep-sea development and utilization technologies and promote the coordinated development of the regional marine economy.

Keywords for marine economy-related patent matching based on China's GB/T 20794-2021 (national statistical standard) – 758 total, with selected ones translated into English for reference.

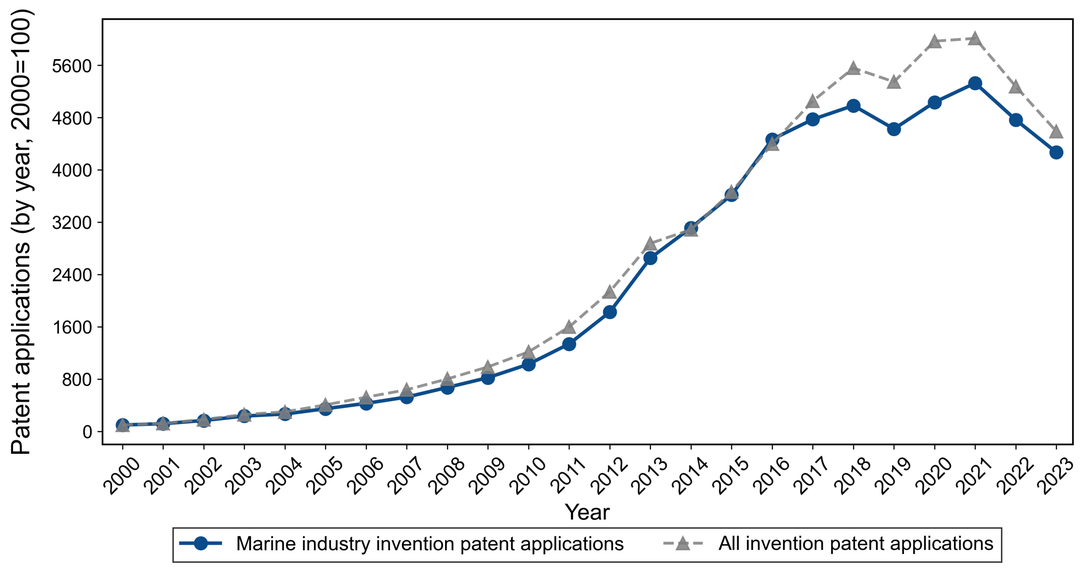
Types	Marine Basic Elements	Marine Facilities & Equipment	Marine Industrial Activities	Marine Technology Applications	Marine Spatial Regions	Marine Ecological Environment	Marine Policy & Management
Keywords	Seas, Seawater, Ocean Waves, Tides, Ocean Tides, Sea Salt, Sea Fish, Seaweed, Seagrass, Corals, Coconut Shells, Spirulina, Coral Reefs, Fish Liver Oil, Fish Collagen	Steering Gear, Ports, Lighthouses, Buoys, Floating Rafts, Navigation Marks, Cages, Cofferdams, Hydrophones, Submersibles, Navigation Mark Equipment, Marine Stations	Reclamation, Aquaculture, Salt Production, Shipping, Diving, Shipbuilding, Salinization, Fish Oil, Fishing Ports, Fish Reefs, Fisheries, Ocean-Going, Reclamation&Filling,	Marine Energy, Tidal Energy, Wave Energy, Tidal Current Energy, Salinity Gradient Energy, Temperature Difference Energy, Ocean&Information, Ocean&Engineering	Nearshore, Coastlines, Waterways, Islands, Coastal Areas, High Seas, Seashores, Bays, Cross-Sea, Wharves, Coastal Areas, Coastal Zones, (Sea|Ocean)&Nearshore	Seaweed, Seagrass, Corals, Coral Reefs, Spirulina, (Sea|Ocean)&Organisms, (Sea|Ocean)&Microorganisms, (Sea|Ocean)&Aquatic	Coastal Defense, Sea-Related, Marine Economy, (Sea|Ocean)&Economy, (Sea|Ocean)&Operation, (Sea|Ocean)&Public Welfare

Trends in China's Marine Economy (2000-2024)



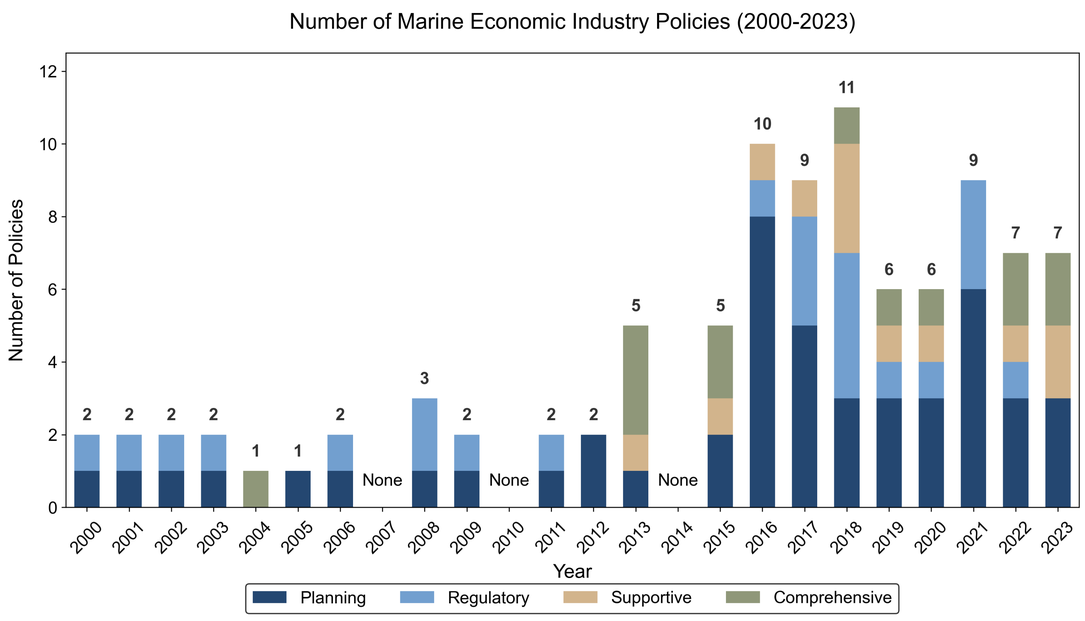
China's marine economy has developed continuously since 2000, growing at a relatively fast pace and accounting for a significant proportion of GDP.

Comparison of China's Marine Patents and Total Patents



Technological innovation in China's marine economy field shows a steady upward trend. As of 2023, the cumulative number of patent applications in China's marine industry has reached 50,332

Number of Marine Economic Industry Policies (2000-2023)

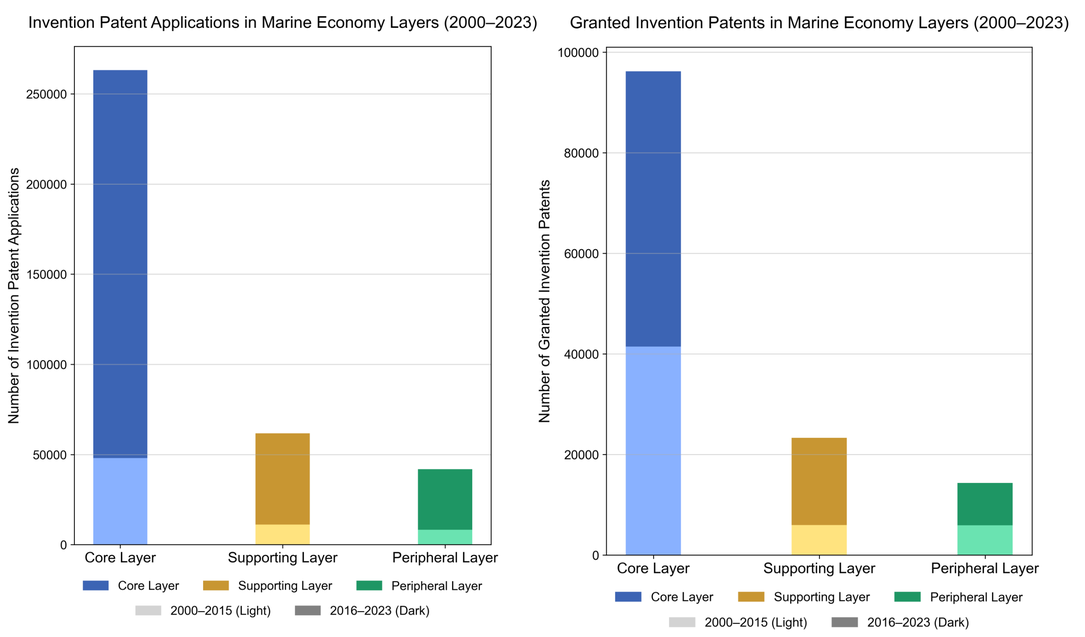


Since 2016, central and local governments have significantly increased policy support for the marine economy, with policies improving in both quantity and quality.

In quantity, annual policies rose from 1-3 in earlier years to 10 in 2016, peaking at 12 in 2018. In quality, policies expanded from single regulatory types to a diversified toolkit covering planning, funding, and technological research.

They focused on key areas like efficient marine resource development, eco-protection innovation, and high-end equipment manufacturing, driving the marine industry toward high-tech, high-value-added upgrading.

Invention Patent Applications in Marine Economy Layers (2000–2023) / Granted Invention Patents in Marine Economy Layers (2000–2023)



China’s marine economy industries are categorized into core, supporting, and peripheral layers per GB/T 20794-2021. Comparing invention patent applications and grants across these layers from 2000 to 2023 (with 2016 as the cutoff), the core layer has consistently dominated, with significantly more patents than the other two layers.

Post-2016, patent activities in all layers accelerated sharply compared to 2000-2016, especially in the core layer. This reflects that over the past decade, China’s marine economy-related industries—marked by patent levels—have achieved technology-driven rapid growth.

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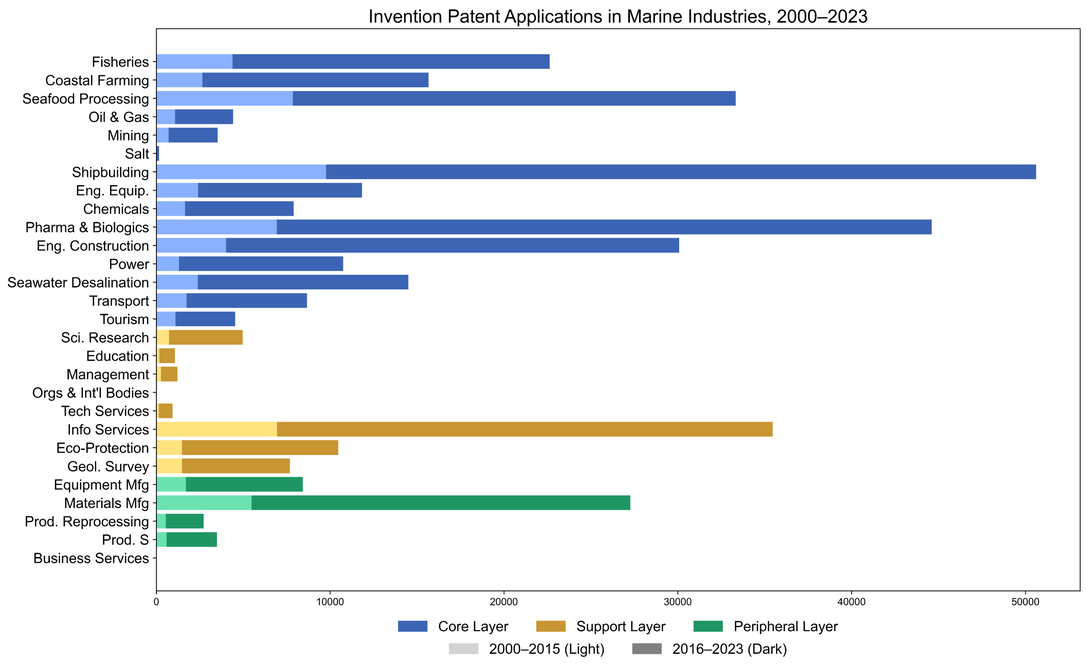

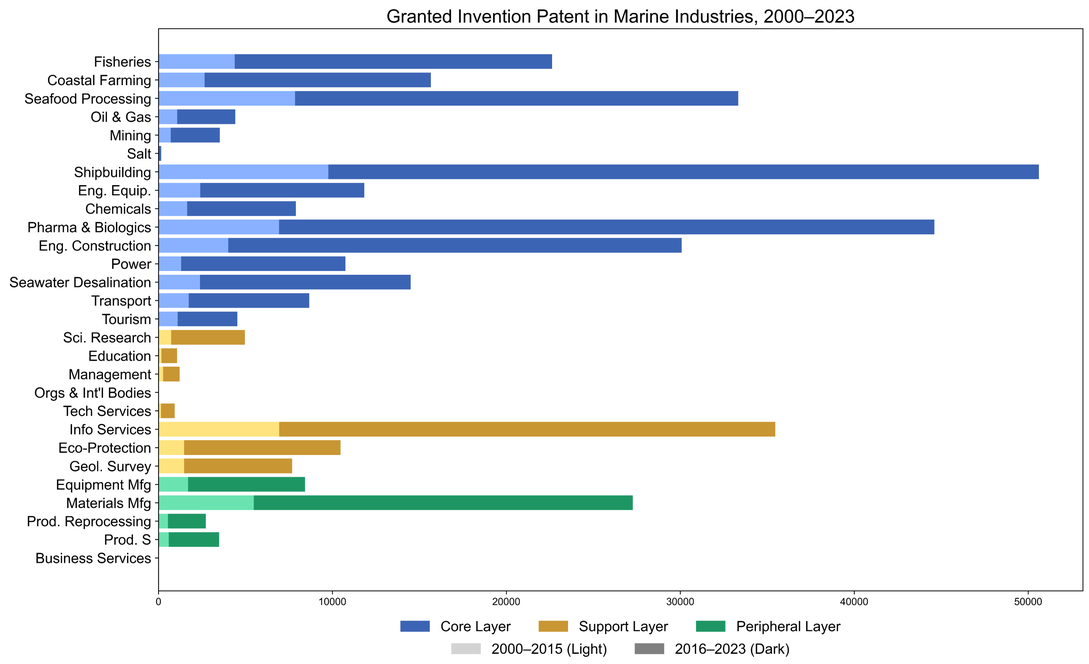

The aforementioned marine economic circles are further refined into the industries corresponding to each circle. It can be observed that industries with hi gh content of technological elements, such as the marine shipbuilding industry, marine engineering equipment manufacturing industry, and marine inform ation services, have seen relatively significant growth in patent applications and grants since 2016. The industry-specific differences in such growth trend s reflect the characteristic that the endowment of technological elements has been continuously improving in the process of marine economic developm ent.

Difference-in-Difference model based on the policy support time node (2012)

Benchmark Model: $Y_{i,t} = \alpha + \beta\,(Treat_i \times Post_t) + \gamma X_{i,t} + \mu_i + \lambda_t + \varepsilon_{i,t}$

	(1)	(2)	(3)	(4)
	Full Samples, Year 2012			
	total_apply	total_apply	total_granted	total_granted
Treat*Post	838.547***	616.974**	311.755***	269.9241**
	(190.927)	(256.122)	(44.958)	(117.135)
Constant	-131.271	271.455	-9.463	102.566
	(96.885)	(207.650)	(256.122)	(82.679)
Control Variables	No	Yes	No	Yes
City Fixed Effects	Yes	Yes	Yes	Yes
Year Fixed Effects	Yes	Yes	Yes	Yes
Observations	2064	2064	2064	2064
R^2	0.682	0.724	0.645	0.662
Mean	276.48	276.48	98.87	98.87