

Research on the network map of literature information distribution in China's marine economic development demonstration zone

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Abstract

Purpose – China has established 14 marine economic development demonstration zones in 2018, which has become an important step in exploring the high-quality development of the marine economy. The paper statistically analyzes the documents related to the field of marine economy and special economic zones (SEZs) and strives to find out the hot spots, intersections and related development contexts of the two in the research direction, so as to provide some ideas for later research.

Design/methodology/approach – By taking the bibliographic information data of “Marine Economy” and “Special Economic Zone” in the Web of Science database as a sample, the paper applies the Citespace bibliometric tool to analyze the evolution of disciplinary distribution, research country, author collaboration and research hotspot trends in the two fields.

Findings – It can be found from the paper results that the current research on marine economy and SEZs involves the intersection of many disciplines. China and the United States are the leaders in this field. However, there is more extensive cooperation between authors from different countries, but the cooperation depth needs to be strengthened. At the same time, compared with the terrestrial economy, the trend of its research hotspots is lagging to a certain extent. Moreover, there is still no systematic and professional research paradigm on marine economy.

Research limitations/implications – At present, there are a few research studies on marine economic development demonstration areas or marine SEZs, and related bibliographical references are incomplete, which leads to insufficient samples, and bibliometric methods cannot fully reveal the general research rules and development trends in this field.

Originality/value – The research on the marine economic development demonstration area is still in its infancy. The paper jointly analyzes the literature in the two fields of marine economy and SEZs, aims to find the intersection and related research hotspots of the two, and provides references for the future research of marine development demonstration areas, which is of certain practical significance.

Keywords Marine economy, Special economic zone, Marine economic demonstration zone, Bibliometrics

Paper type Research paper

1. Introduction

In 2018, in the context of increasing downward pressure on global economic growth and countries seeking new economic growth points, China has promulgated an important policy on establishing demonstration zones for marine economic development, and has decided to set up 14 such zones in coastal areas. The marine economy is a pillar of China's national economy, an important element in “opening up,” a vital guarantee for national economic security, and a strategic space for future development (Jiang *et al.*, 2014). With economic and



trade policy reform, China's marine economy has grown rapidly and kept pace with gross domestic product (GDP), especially from 2001 to 2020 [1]. As the world's second largest economy, China's marine economy is also a critical part of its economy (in 2019, China's marine GDP accounted for 9% of its GDP [2]), and China attaches great significance to the healthy development of its marine economy. Marine economy has become a vital driving force for the economic development of coastal areas, which can provide new vitality for China's sustainable development in the future and has become a foundation to promote high-quality economic development (Liu *et al.*, 2017).

The marine economic development demonstration area is a regional marine functional platform responsible for marine economic system and mechanism innovation, agglomeration of marine industries, integrated development of terrestrial and marine economy, and protection of marine rights and interests. It is also an important measure for achieving high-quality development in the marine economy. The effects of industrial agglomeration and scale can be brought into full play by constructing carriers and platforms for the agglomeration and development of marine industries to promote sustainable and healthy development of the marine economy (Xu, 2012). The marine economic development demonstration area is conducive to the transformation and upgrading of the marine industry, promotes the organic integration of the innovation chain, industrial chain, capital chain and policy chain in the marine sector, and promotes the effective integration and efficient use of various resources, which can promote the sustainable development of the regional marine economy and society, and promote the high-quality development of the marine economy (Fu and Qiu, 2020). However, current research on marine economic development demonstration areas is mainly focused on the long-term planning, industrial layout, functional area setting and demonstration area policies of a specific demonstration zone. Few studies have examined the development, construction and evaluation of marine economic development demonstration areas (Zhao *et al.*, 2020). Research has shown that the theoretical construction and method innovation of marine economic development are lagging behind research on terrestrial economic development (Pascoe, 2006). Marine economic development is expected to become one of the driving forces behind China's future economic development. The marine economic demonstration area initiative is an important attempt by China to develop its marine economy with vigor. To some extent, issues and ideas about the development of the marine economy can refer to the research paradigm of the terrestrial economy. The development and evaluation of marine economic demonstration zones also correspond to special economic zones (SEZs), similar to those on land (Hannesson, 2002). To sum up, we collected literature on marine economy and SEZs, and conducted statistical analysis on the collected literature, aiming to clarify the development sequence of marine economy and SEZ research. Theoretically speaking, the bibliographic measurement and combination of the research status, development trend, and hot issues of the marine economy and SEZs can provide a reference for the academic community to study a series of issues in the marine economic development demonstration area in the future, which will be of practical significance.

2. Current status of marine economy and special economic zone development

2.1 Research status of marine economic development

Strictly speaking, the marine economy still belongs to the economic category. To a certain extent, this follows the research paradigm of traditional economics. However, the research on traditional economics is mostly based on terrestrial economy, marine and land, as economic carriers, which bring different models to the process of economic development. Therefore, the research paradigm of terrestrial economics is helpful for studying the development of the marine economy, but the deviation caused by the difference between the two cannot be

avoided in the research results. At present, most scholars' research on the marine economy still relies on the research methods for the terrestrial economy. For example, [Tao et al. \(2020\)](#) used the terrestrial economy research model to discuss the marine economy from the perspective of factor input and production. In order to study the energy structure and consumption of China's marine economic development demonstration zones, they took energy consumption as a dependent variable and introduced it into the economic analysis model. By defining the energy consumption factor of the production function, they focused on analyzing the influence mechanism of energy consumption on the development of SEZs. [Luo et al. \(2020\)](#) studied the development of China's marine economy, constructed the development model of China's marine economy system from different dimensions, and analyzed the development model of marine economy from the perspective of industry. [Carvalho and de Moraes \(2021\)](#) also used the input–output model to quantify the development and coordination relationship between Brazil's marine and terrestrial economies.

Regarding economic development processes, the measurement of economic efficiency has always been a hot topic in academic research, and scholars have introduced the measurement of terrestrial economic efficiency in the development of the marine economy. In a study exploring the relationship between the resilience and efficiency of the marine economy, [Zhu and Li \(2021\)](#) studied marine economy from another perspective. He used variable method and super-efficiency model based on relaxation to measure the elasticity and efficiency of marine economic development in coastal areas of China, their evolution trend, and the response of local government to marine economic development and policy making mode. It is believed that it is necessary to build a coordinated development system for the terrestrial-marine economy led by marine economic benefits, build a diversified industrial system and enhance economic resilience to achieve high-quality development of the marine economy.

[Wen et al. \(2020\)](#) took the Guangdong–Hong Kong–Macao Greater Bay Area as a research object to establish input–output indicators to measure marine economic efficiency using data envelopment analysis (DEA) and referring to terrestrial economy models. This approach provided a reference value for improving the efficiency of the marine economy and realizing the high-quality development of the marine economy. [Di and Dong \(2017\)](#) provided a different way of thinking about the development of the marine economy. He believed that the coordination of land-based and marine-based economies is needed to achieve marine economic development. His paper uses symbiosis theory to explore the land-marine economic symbiosis mechanism and the logical symbiosis function to construct a land-marine economic symbiosis evolution model. The results show that the coordinated development of terrestrial and marine economies can effectively improve the quality and efficiency of production factors and enhance the coordinated development of terrestrial and marine economies.

Environmental protection cannot be ignored during economic development. Since the Industrial Revolution, the development of the terrestrial economy has had irreversible effects on the ecological environment, and humankind has paid a huge price for this. Given the consequences of land economic development, research on marine environmental protection is becoming a topic of growing concern in academic circles as the marine economy becomes increasingly important. Research on the marine ecological environment encounters the same problems as research in the marine economic field. Most research methods used in the marine ecological environment are based on terrestrial ecology, and a specific and professional marine ecological environment research paradigm has not yet been developed.

Current research on the marine ecological environment is similar to that on terrestrial environmental protection, and the relationship between economy and environment is still the most important research object. To explore the relationship between China's marine economy and the marine environment, [Wang et al. \(2021\)](#) studied the relationship between the marine economy and the marine environment, and explored the development relationship between

the marine economy and the environment in China by modeling and analyzing the marine ecosystem. The results show that the degree of coordination of the marine ecological economy in China's coastal provinces and cities is gradually increasing. The coordination between the ecological environment and the economy has increased, but China's marine environmental problems cannot be underestimated. [Chen et al. \(2017\)](#) analyzed the decoupling relationship between "quantity" and "speed" between China's marine pollution and economic growth from 2002 to 2013 and found that the state of marine pollution and economic decoupling changed rapidly, and marine pollution deteriorated quite frequently. At present, the development of China's marine economy is still at the cost of environmental pollution, while the development of marine economy also brings great pressure to the marine environment. [Sun et al. \(2022\)](#) proposed a framework for evaluating marine ecological carrying capacity from multiple angles using the Technique for Order of Preference by Similarity to Ideal Solution (TOPSIS) method based on analytic hierarchy process entropy. In the past two years, the marine ecological carrying capacity has dropped sharply due to the rapid development of the marine economy, raising concern for marine ecological protection. To develop marine economy, it is necessary to abandon the extensive economic development mode and not use the environment and resources for development. To establish a sound and healthy marine economic development mode is the basis for maintaining long-term and stable economic development, which is closely related to the policies of local governments. [Ye and Quan \(2021\)](#) analyzed the influence of government preferences and environmental regulations on the green development of the marine economy. Environmental regulations can significantly promote the green development of the marine economy, but there is a degree of lag. Simultaneously, environmental policies and regulations formulated by governments in different regions play different roles in the environment-friendliness of the marine economy. Therefore, the authors of this paper believe that the government should improve the marine environmental supervision system and formulate differentiated marine economic green development policies.

Green development has become a critical element in current marine economic development; however, China's marine ecological and environmental protection prospects are still not good. The main reason is that the current development model of China's marine economy is still resource-oriented, and marine resources occupy a dominant position in the development of the marine economy. In addition, substantial amounts of the marine mineral, biological, energy, space and climate resources are consumed ([Sun et al., 2018](#)). Researchers have made significant efforts in this regard. Some scholars are concerned about the basic contradiction between marine economic demand and marine resource supply. They have addressed this by starting from the economic sustainability of marine resources, constructing a relationship model between marine resources and economic development and the sustainable development evaluation model of the marine economy, and balancing the demand relationship between the marine economy and resources ([Chávez et al., 2021](#); [Wu et al., 2020](#)).

Massive investment in marine resources has become the main driving force for marine economic growth, and it is also the primary source of pressure on the marine environment. [Ren et al. \(2018a, b\)](#) evaluated the contribution rate of the total factor productivity of the marine economy in the coastal areas of China by considering the coastal areas of China as research objects. The results show that the main factor driving marine economic growth is the input of resource elements, and China continues to adopt an extensive marine economic growth model. At the same time, the environmental problems in coastal areas are becoming more and more prominent. As China's coastal economic development still belongs to the extensive mode, a series of energy and environmental problems are increasingly serious. Therefore, resolving the contradiction between marine economic development and the environment has become an important issue requiring urgent attention ([Ren, 2021](#)).

At present, most scholars believe that innovation and technological progress are still effective ways to resolve the contradictions between the economy and the environment. In

order to study the impact of technological development on the marine economy and the environment, Ren *et al.* (2018a, b) measured the efficiency of green economy under the development situation of China's marine economy. They incorporated unexpected outputs into the total factor productivity model, such as energy consumption and CO₂ emissions, to evaluate the development quality of China's marine economy. It is believed that technological progress is mainly responsible for the increase in green efficiency in China's marine economy, while the increase in technical efficiency has little impact and may even have an adverse effect. Kang *et al.* (2020) examined the green development of the marine economy from the perspective of technological innovation, measured biased technological progress in the marine field using the DEA-Malmquist model, and analyzed different influencing factors. It was found that the factor productivity of the marine economy shows an increasing trend, mainly due to the positive impact of technological progress. Moreover, technological progress in the marine field is gradually favoring energy conservation and emissions reduction. Mo and Lou (2019) used the theory of marine development to construct a comprehensive evaluation index system for the marine economy based on the DEA model, and proposed the MEA (marine development energy analysis and comprehensive evaluation DEA model). It has also been found that technological progress is effective in realizing the healthy, green development of China's marine industry.

Research on marine economic development started late. Generally speaking, the relevant research on the marine economy still adopts the research paradigm of a land-based economy, so it takes time to verify whether the conclusions reached are entirely in line with the development of the marine economy. The research methods adopted by the researchers also cover many fields, such as marine economics, environmental economics, resource management, geography, mathematical models, geographic information systems and systems analysis. Researchers are still in the cross-research stage, and there are no prominent phase characteristics or systematic research theories and methods.

2.2 Current development status of special economic zones

The primary purpose of establishing SEZs is to enable a region to adapt to globalization and benefit from it. Moreover, it is an urgently required measure to improve the local economic living standards and protect local industry from the accelerated loss and destruction caused by globalization (Shi, 2007). With the success of Shenzhen and the Four Asian Tigers in the SEZ policy, many countries such as Vietnam, Brazil, India, Iran, Jordan, Pakistan, the Philippines, Poland, North Korea, Russia, Ukraine, the United Arab Emirates, Colombia, South Korea, Peru and Kazakhstan have begun to establish SEZs (Ye and Shi, 2007). Based on the number of SEZs that will be established or have been established, the World Bank estimates that there will be more than 3,000 projects related to SEZs developed in nearly 127 countries around the world in the future (World Bank, 2011). Scholars from various countries have provided different perspectives on how special economic-zone policies affect regional development. Thakur (2021) conducted a comprehensive analysis of India's SEZ policy. He believes that the main goal of a SEZ is to promote exports in a barrier-free environment, create job opportunities, and promote regional and national economic growth. His paper also encourages entrepreneurs to expand their businesses near small towns through SEZs, thereby achieving overall regional and national growth.

Alkon (2018) used empirical methods to verify the success of India's SEZ policy. He used the study of China's SEZs as an example and drew on a large number of economic and social development variables to discuss the effects of establishing SEZs in India. The conclusion was that a SEZ policy could effectively promote the development of the local economy. In addition, Alkon considered the differences in the impacts of SEZ policies in India and China, and the conclusions are helpful in understanding the successful models of SEZs around the world.

Ambroziak and Hartwell (2018) used counterfactual assessment methods to study the impact of Poland's establishment of SEZs on local and regional development. The conclusion was that the establishment of SEZs positively impacts the development of backward areas in Poland. However, this effect was weak and negative in relatively affluent areas. Ciżkowicz *et al.* (2017) verified the success of a SEZ policy in Poland from another perspective. He analyzed the employment and investment data of Poland's county-level regions at the enterprise level and found that SEZs positively affect employment in the county concerned and neighboring counties. The impact on investment is relatively weak; however, there is still a detectable effect.

Li and Wang (2021) arrived at a similar conclusion in his research on Laos's SEZ policy. By studying the implementation of the SEZ policy in Laos, and using information entropy, DEA model and correlation analysis model, this paper analyzes the implementation effect of the SEZ policy, including the utilization efficiency of land and resources and the change of economic structure, achieving industrialization and promoting economic globalization in Laos. Kleibert (2018) also analyzed the urbanization trajectory of Manila with the development of SEZs in the Philippines as an example, showing how the Philippines integrates global capital flows with the help of SEZ policies and drives local economic development.

Many scholars have argued that SEZs have promoted regional development. Establishing SEZs in relatively backward areas to achieve regional development is also a topic that draws attention in academic circles. Newman and Page (2017) analyzed the effects of industrial agglomeration in low-income countries and proposed that spatial industrial policies can be designed in relatively backward areas to promote the development of clusters. They considered the feasibility of establishing SEZs in Africa, as well as the policy measures adopted to promote the development of SEZs, and provided evidence of the zones' success. SEZ policies can promote economic development, and this has been widely recognized by academics. However, some scholars hold different opinions. Crane *et al.* (2018) believes that there are major regional differences within China and that the establishment and success of SEZs have led to the prosperity of China's coastal areas, creating greater economic gaps between regions. The gap between the eastern coastal areas and the central and western regions will increase with time. Therefore, it is necessary to continue expanding the influence of SEZs and even establish new SEZs in different regions to stimulate investment and narrow the economic gap.

Gogishvili and Harris-Brandts (2020) also examined the establishment of SEZs in Georgia and analyzed the adverse effects. It is believed that the establishment of SEZs poses a major threat to the democratic process related to urban planning at the local and national levels and could deepen the gap between the rich and poor. Scholars have not yet accepted this argument, nor has it become mainstream in academia. Therefore, the establishment of SEZs remains the first choice for many countries to achieve economic development. China's establishment of a maritime economic development demonstration zone in 2018 is an innovative attempt based on the SEZ policy in the maritime sector, which benefits from the successful experience of China's construction of terrestrial SEZs. China is still at the forefront in developing its marine economy by establishing marine economic development demonstration areas (Li *et al.*, 2017). However, as with marine economic research, there are few relevant studies on marine SEZs. Whether the research on marine SEZs can learn from or even apply the research paradigm of terrestrial SEZs still needs verification.

3. Data sources and research tools

3.1 Data sources

In this study, the core collection database of Web of Science was selected as the retrieval database, and there were two types of literature retrieval. The first type of retrieval was

“Ocean Economy” or “Marine Economy,” with a time span from January 2010 to November 2021, and a total of 355 items of related bibliographic information was collected. The second type of retrieval theme was “Special Economic Zones” or “Free Economic Zones,” with a time span from January 2010 to November 2021, and 238 items of related bibliographic information were collected.

3.2 Research tools

The primary research tool in this study was the CiteSpace visual analysis software. It focuses on the potential knowledge contained in the scientific analysis. It is a citation visualization analysis software that has gradually developed against a background of scientific metrics and data visualization. This software can visually present the structure, regularity and distribution of scientific knowledge (Chen, 2014). Because the visual Atlas generated by CiteSpace is intuitive and convenient and can clearly reflect research cooperation, hotspots and frontiers in the research field, it has been accepted and used by scholars from many disciplines. In this study, CiteSpace 5.8 was selected as the research and analysis tool to conduct econometric analysis in two fields: marine economy and SEZs.

4. Analysis of research results

4.1 Distribution of disciplines in related fields

Analysis of co-occurrence disciplines can help illuminate the interdisciplinary situation in related fields, and researchers can master the internal relations among disciplines through the established discipline association network (Chen, 2016). Based on the separate discipline analysis of the marine economy and SEZs using bibliographic data, the network node of CiteSpace selects the category. To improve the analysis efficiency, the literature threshold was set to the top 10 articles [3] cited most in each year. Then, the subject distribution network Atlas of the marine economy and SEZs was obtained (Figures 1 and 2), in which the Atlas only identified the subject names with the top 10 publication frequencies.

There are 42 nodes (n) in the disciplinary map logo in Figure 1, indicating that 42 disciplines are involved in marine economic research. Moreover, there are 132 links in the map, indicating that the disciplines involved in marine economic research are also densely

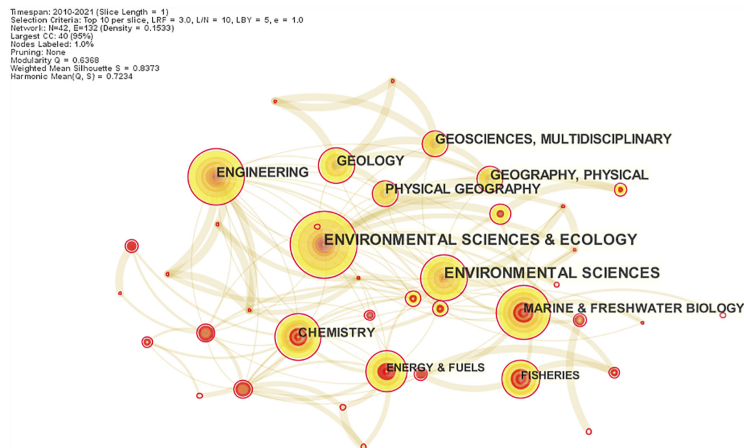


Figure 1.
Network graph of
discipline distribution
in marine economic
study field

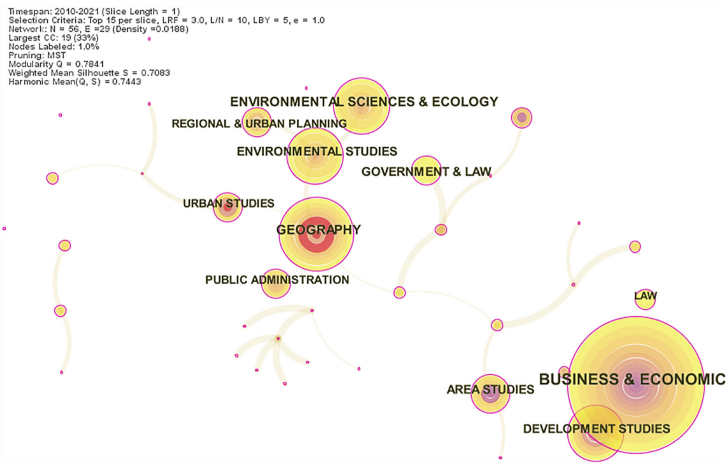


Figure 2. Discipline distribution network map of research on SEZs

crossed. The thicker the connection lines between different disciplines, the deeper their connections with each other. See Table 1 for the distribution of disciplines in the top 10 publications in the Atlas.

Figure 2 shows the disciplinary mapping distribution of the SEZ, which involves 24 disciplines with 24 nodes. It also includes 78 links, which shows that the links between disciplines are relatively dense. However, because the links of the nodes in the Atlas are shallow, there is no deeper intersection of the fields involved. See Table 2 for the distribution information of the top 10 disciplines on the map of the SEZs.

A comparison of the above graphs shows that the research on “Marine Economy” involves a wide range of research fields, and most of the literature is concentrated in environmental science, ecological science and geographical science. The number of published papers in these disciplines exceeded 50, followed by biology, physics, natural geography, energy and fuel, and other disciplines. Nevertheless, the research literature on “special economic zones” is relatively concentrated and mainly distributed in business and economic disciplines. There are also related studies in regional economic development, urban research, public management and urban planning, but the number is small, and the literature distribution in these disciplines is relatively uniform. Moreover, the research fields of marine economy and SEZs also partially overlap because both involve environmental science and ecology. In

Serial number	Frequency	Centrality	Research field
1	91	0.52	Environmental Sciences and Ecology
2	80	0.23	Environmental Sciences
3	78	0.11	Geology
4	52	0.34	Engineering
5	51	0.06	Geosciences, Multidisciplinary
6	43	0	Physical Geography
7	30	0	Geography, Physical
8	25	0.35	Marine and Freshwater Biology
9	20	0.17	Chemistry
10	9	0.10	Energy and Fuels

Table 1. Ranking of the disciplines in marine economic research

addition, economic development is a field where the research directions of the two fields show considerable overlap.

In the study of the marine economy, the environment, ecology and geography are topics that cannot be avoided. There are 249 documents related to these three subjects, accounting for 70% of the data collected in this field. Therefore, the environment and ecological geography play a crucial role in the study of the marine economy. Notably, physical geography and energy have also made contributions to the field of “Marine Economy.” The “Special Economic Zones” research mainly focuses on commerce and economy, with 95 core papers accounting for approximately 37% of the sample data. The remaining papers are related to urban planning and governance, regional economic development and other related studies.

In the network graph of discipline distribution in the research field, the centrality of each discipline reflects a close relationship with other disciplines. For example, from the above chart, the central lines of environmental science and commercial economy are 0.52 and 0.39, respectively, indicating that these two disciplines play the core role and act as the bridge in the research of “Marine Economy” and “Special Economic Zone,” respectively.

4.2 National cooperation network

This section combines and analyzes the bibliographic data related to the marine economy and SEZs. In addition, countries and institutions conducting research in related fields will be visualized, which will help master the distribution of countries involved in the research in both fields.

There are 593 pieces of merged data, which are visualized by CiteSpace to generate the national cooperation network map of “Marine Economy” and “Special Economic Zone.” As shown in Figure 3, there are 49 nodes with 179 relationships among them, showing that 49 countries are involved in related research. The area of each node represents the number of publications in the literature. The larger the area, the greater the number of publications in the field. The connection line represents cooperation between countries. The thickness of the connection line represents the size or degree of cooperation (Li *et al.*, 2017). The thicker the connection line, the more frequent the cooperation among countries.

Table 3 is a ranking of five countries with a high frequency of publications in the fields of “Marine Economy” and “Special Economic Zones.” Overall, China and the United States firmly occupy the top two positions in these two fields, exceeding those of other countries. What is more, Chinese scholars have contributed more than half of the research results in the fields of “Marine Economy” and “Special Economic Zones.” The three to five countries with the most publications on the marine economy are traditional marine powers, and the top three to five in SEZs are France, Germany and Japan.

Series number	Frequency	Centrality	Research field
1	95	0.39	Business and Economics
2	37	0.15	Geography
3	35	0.24	Environmental Sciences and Ecology
4	30	0.03	Development Studies
5	30	0.07	Environmental Studies
6	29	0.06	Government and Law
7	27	0.06	Area Studies
8	19	0	Urban Studies
9	18	0.01	Public Administration
10	17	0.01	Regional and Urban Planning

Table 2.
Ranking of the
disciplines in SEZ
research areas

TimeSpan: 2010-2021 (Slice Length = 1)
 Selection Criteria: Top 10 per slice, LRF = 3.0, LIN = 10, LBV=5, e=1.0
 Network: 1041, Ed=18 (Density = 0.1439)
 Largest CC: 35 (89%)
 Nodes Labeled: 1.0%



Figure 3. National (regional) cooperation network

	Marine economy Number of published papers	Centrality	Country	Special economic zones Number of published papers	Centrality	Country
1	282	0.55	Peoples R China	196	0.41	Peoples R China
2	76	0.18	USA	53	0.12	USA
3	29	0.29	England	14	0.10	France
4	22	0.12	Australia	10	0.08	Germany
5	15	0.04	Denmark	7	0	Japan

Table 3. Ranking of the number of articles issued by each country (region)

Figure 4 shows a timeline view of intercountry cooperation. The United States and Australia were pioneers in research on the ocean. Domestic scholars have been researching the marine economy since 2012, and the research results show a blowout trend, with cooperation among countries being very close.

TimeSpan: 2010-2021 (Slice Length=1)
 Selection Criteria: Top 10 per slice, LRF = 3.0, LIN = 10, LBV = 5, e = 1.0
 Network: 1041, Ed=18 (Density=0.1439)
 Largest CC: 35 (89%)
 Nodes Labeled: 1.0%

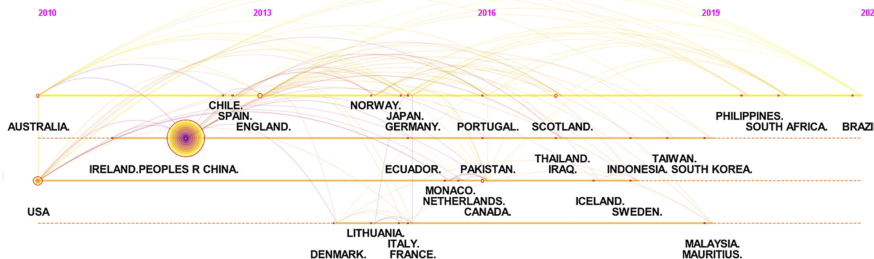


Figure 4. National cooperation network timeline

4.3 Author cooperative network

The author cooperative network affords a valuable opportunity to study the relationship between citations and citations in the author’s research results. Figure 5 shows an author cooperative network for “Marine Economy” and “Special Economic Zones.” The graph has 583 nodes, and the content of the author Wang Y is cited the most, with centrality in the cooperative network of 0.28. A node with a centrality exceeding 0.1 occupies a core position in the knowledge graph (Kudratilloev and Akhmedov, 2021). Wang *et al.* also reported a centrality of over 0.1. It was found after checking that the work of the two authors has indeed promoted research on the marine economy. Table 4 shows the number of articles published by these authors in related fields. In addition to the two scholars mentioned above, international institutions such as the Organisation for Economic Co-operation and Development (OECD) and World Bank have published research in the fields under examination. There are many literature citations among authors. However, the links between the various core modules show relatively little collaborative research. This demonstrates that there is still a lack of deep communication between authors, which is not conducive to the progress of disciplines in the related fields.

4.4 Analysis of research hotspots

Research hotspots refer to the perspectives or themes focused on by a group of studies with strong relevance over a certain time. Keywords are a tight summary and refinement of an

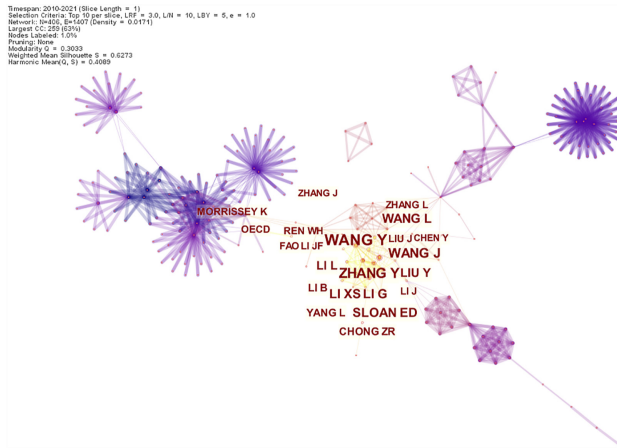


Figure 5. Author cooperation network

Frequency	Burst	degree	Centrality	Author
133		55	0.28	Wang Y
55	15.32	30	0.16	Wang J
46	4.63	25	0.05	World bank
46	12.59	23	0.06	Farole T
32	8.8	39	0.05	Levien M
31		15	0.09	OECD
29	6.43	29	0.11	Morrissey K
22		9	0	Ren WH
20		14	0.05	UNCTAD
18	6.52	15	0.01	Aggarwal A

Table 4. Author’s post top 10

article's research topics and content. Related research hotspots can be found and accessed through a visual analysis of keywords (see Figure 6).

From the word frequency co-occurrence chart, it is not difficult to find that the primary keywords for the research on "Marine Economy" and "Special Economic Zone" are the following: SEZ, marine economy, growth, impact, sustainable development, China, policy, ocean economy and maritime industry. These keywords reflect the research hot spots in these two fields, where growth refers to economic growth, and impact refers to the impact of policies related to marine and SEZs (see Table 5).

We also show the evolution of research hotspots using CiteSpace's hot keyword time zone distribution network map (Figure 7). The time zone map shows that "Marine Economy" has always been a hot topic, focusing on the areas of policy, trade and investment around 2010,

Timespan: 2010-2021 (Slice Length = 1)
 Selection Criteria: Top 10 per slice, LRF = 3.0, L/N = 10, LBY = 5, e = 1.0
 Network: 81547, Ed:1388 (Density = 0.0231)
 Largest CC: 270 (77%)
 Nodes Labeled: 1.0%
 Pruning: None

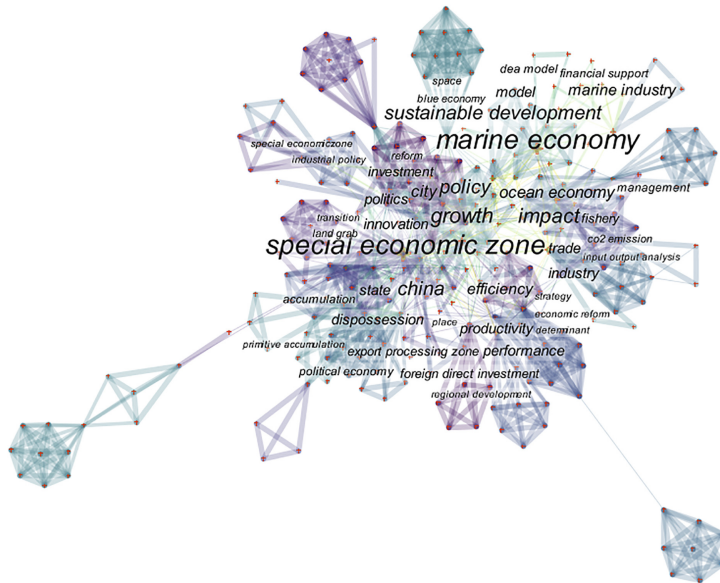
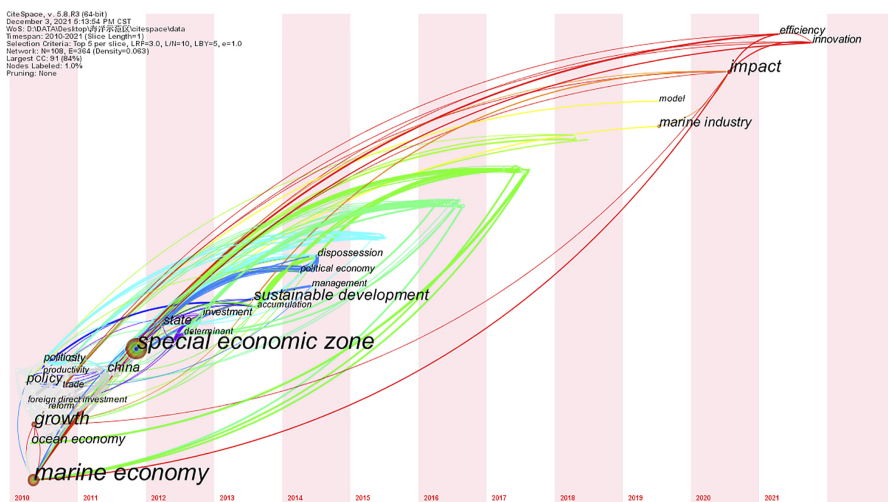


Figure 6. Keyword co-occurrence network Atlas

Frequency	Burst	Degree	Centrality	Keywords
109		48	0.77	Special economic zone
108	26.64	16	0.21	Marine economy
35	6.52	20	0.21	Growth
27		7	0.03	Impact
18		5	0.02	Sustainable development
13	4.23	16	0.07	China
13	3.46	20	0.25	Policy
12		7	0.07	Ocean economy
12	4.55	2	0	Marine industry

Table 5. Keywords frequency top 9

Figure 7.
Keyword time
zone view



while the research on “Marine Special Economic Zones” has shown an explosive growth since 2012. According to the data, the State Council of China issued a policy for establishing marine economic demonstration zones and successively approved the establishment of marine economic demonstration zones in Shandong Province, Zhejiang Province, Guangdong Province, Fujian Province and Tianjin in January 2011. Since then, scholars have conducted extensive research on this topic. The main research content is also focused on hot topics such as the economy, environment and sustainable development of demonstration zones. Consequently, the marine industry has gradually become a popular research topic. By 2021, the primary research subjects in this field were marine economic efficiency and innovation (see Table 6).

4.5 Literature co-citation analysis

Co-citation analysis refers to one cited document simultaneously citing two or more articles as references. In bibliometrics, cited articles constitute the research frontier, and cited articles constitute the knowledge base. The CiteSpace tool was used to draw a map of the literature citation network and cluster it. As shown in Figure 8, the clustering module value (Q value) and contour coefficient (S value) were the indices used to evaluate the drawing effect of the map (Kaufman and Rousseeuw, 2009). When $Q > 0.5$ and $S > 0.7$, the drawing effect of the Atlas was remarkable. The Atlas was $Q = 0.93$, $S = 0.97$, and the clustering result was excellent. There are nine clustering categories in the Atlas cited in the literature. This paper briefly introduces the top six with the largest clustering scale (see Figure 9).

Table 6.
Literature clustering
results

Id	Size	Silhouette	Mean(year)	Cluster label
#0	60	0.942	2008	Development studies
#1	50	0.983	2006	Anthropology
#2	46	0.961	2009	Urban studies
#3	44	0.921	2008	Business; management
#5	39	0.949	2014	Environmental studies; geography
#8	37	0.956	2008	Area studies; international relations; political science

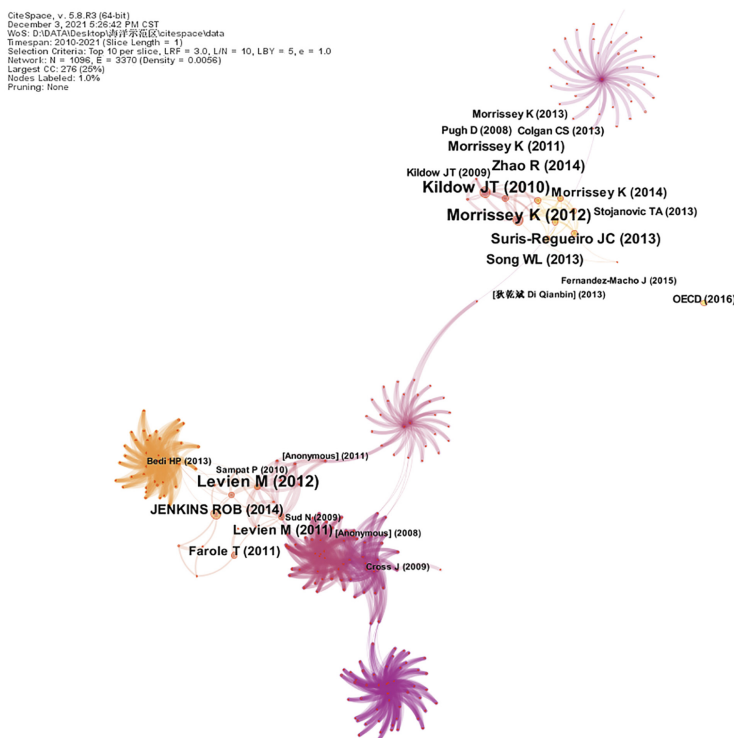


Figure 8.
Literature co-citation network

#0 Development studies. The number of members in this cluster is 60, which means that 60 papers are classified in this category, and the profile coefficient is as high as 0.942, which shows that the clustering effect is excellent. The main research content in this category is the sustainable development of SEZs and marine economies.

#1 Anthropology. This cluster has 50 members, mainly involving anthropological studies. Anthropology is a discipline that comprehensively studies human beings from the perspectives of culture, society, biology, history and language. The development of the marine economy and the establishment of SEZs are closely related to human activities. Therefore, this type of literature has mainly studied the influence of marine economic development on human activities from different perspectives.

#2 Urban studies. The 46 documents in this category primarily focus on regional economic development, management and evaluation. Among these, the establishment of SEZs has the greatest impact on urban development. In addition to analyzing urban development from the perspective of SEZs, this study also includes an analysis of the impact on regional economies of developing a marine economy in some coastal cities.

#3 Business management. The number of members in this category is 44. This kind of literature mainly involves two aspects. The first is ocean management, which includes research into marine economic development, marine assets accounting, marine resources and safety protection, and other related fields. The second aspect is the management research content of SEZs, including the development mode, development path and energy utilization.

CiteSpace, v. 5.8.R3 (64-bit)
December 3, 2021 5:46:34 PM CST
Web: D:\DATA\Desktop\58\FF\引证[CiteSpace\data
Timespan: 2010-2021 (Slice Length=1)
Selection Criteria: Top 10 per slice, LRF=3.0, L/N=10, LB=5, e=1.0
Network: N=1096, E=3270 (Density=0.0056)
Largest CC: 276 (25%)
Nodes Labeled: 1.0%
Pruning: None
Modularity Q=0.9324
Weighted Mean Silhouette S=0.9795
Harmonic Mean(Q, S)=0.9554

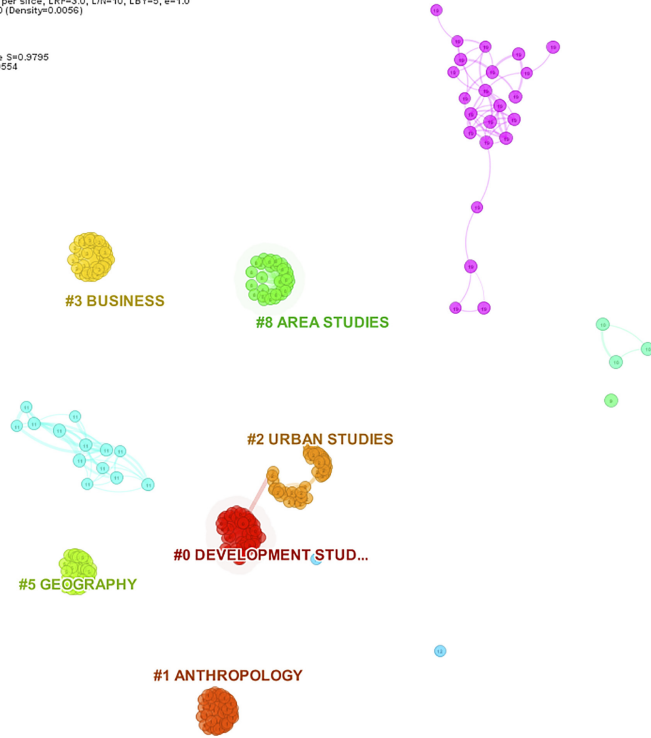


Figure 9.
Literature co-citation
clustering

#5 Environmental studies: Geography. Five clusters were related to the environment and geography and included 39 members. This category mainly focuses on research on marine environmental resources, marine environmental protection and marine geography. In addition, it includes the impact of the establishment of SEZs on the regional environment.

#8 Area studies, international relations and political science. This category is mainly a collection of studies on SEZs. It mainly focuses on the policy, development, trade, inter-regional relations and other aspects of the establishment of SEZs.

5. Conclusions and suggestions

In general, regarding the marine economy and SEZs, there is an overall upward trend year by year in the core research groups, and China's research achievements are in the lead in terms of quantity. However, coverage of the basic theory of building and influencing is weaker compared to the United States. Therefore, China needs to promote international academic exchanges and cooperation and strengthen the theoretical research in this field. From the analysis of the author's cooperative network and national cooperative network, there are also considerable regional barriers to the research on the marine economy and special zones at present, and the cooperation between the state and author is mostly limited to the research level, without forming deeper practical applications and exchanges. In addition, the distribution of the research results of the marine economy is relatively scattered, many

journals are being used, but the number of core journals is small. Therefore, stable, professional journal groups have not been formed. Furthermore, joint research on the marine economy and the SEZs involves many cross subjects. The lack of a methodology for marine professionals and, simultaneously, a lack of support are apparent. The study of marine economic zones is relatively scarce; therefore, there is an urgent need for sorting, induction and summary for the two fields. Moreover, to achieve a deeper understanding, it is necessary to explore new marine economy research methods, improve the research system, and obtain scientific, objective and comprehensive research results to provide strong support for constructing marine economy demonstration zones in China.

Using bibliometrics and knowledge graphs, this study analyzed the relevant literature on the marine economy and SEZs at different levels. Due to the limitations of the literature metrology software and the shortage of sample material, we could not perform the analysis for all the years. The related literature data and the non-core database providing literature citation information are limited; moreover, the sample size is not big enough, and the analysis object is not rich. However, our study demonstrates that researchers need to devote more time and energy to research in this field.

After looking at countries around the world against the background of developing marine economy demonstration areas, it becomes clear that the theoretical basis of marine economic development in our country must keep up with the actual development. In addition, there is a need for China to improve the construction level of the marine economy demonstration area, actively improve the relevant research into power and influence in a new round of marine economy development, improve competitiveness and contribute to the development of the world's marine economy.

Notes

1. Data source: China Marine Economic Development Report 2020
2. Data source: China Marine Economic Development Report 2019
3. The information contained in the top 10 most cited documents each year can contain most of the information of the citation network. Unless otherwise specified, the selection of documents below will be set according to this.

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