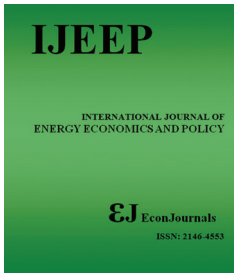

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How Does the Blue Economy Align with Sustainability? A Bibliometric Analysis of Trends and Themes

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ABSTRACT

Sustainability of the blue economy is attracting growing interest among academics as an economic strategy that leverages sustainable marine resources. This study aims to investigate the evolution of publication trends and map keywords that help identify the main themes in this field. A bibliometric analysis was conducted of 382 scientific articles indexed by Scopus from 2003 to 2024. Data were processed using R software, Microsoft Excel, and VOSviewer. The findings indicate an annual growth of 23.49% %in this area of study, with a publication peak in 2024. The United States ranks as the most productive country, whereas the University of British Columbia and Stanford University have emerged as the most researched institutions. Marine policies have been identified as the most relevant and documented resource. The analysis uncovered four primary themes in the study of blue economy sustainability: Environmental sustainability, sustainable oceans, water management and policy, and marine conservation. This study serves as a foundation for further exploration to enhance the understanding of the future sustainability of the blue economy.

Keywords: Blue Economy, Sustainability, Bibliometric Analysis, Ocean Resources, Environmental Sustainability
JEL Classifications: Q2, Q56, Q57, O3, R5

1. INTRODUCTION

The ocean plays an important role in providing resources for human survival, economic development, food security, and regulation of global ecosystems (Falkenberg et al., 2020; Kulkarni, 2023; Vrancken, 2021). In addition, marine biodiversity immensely contributes to the economic value of marine ecosystems, which highlights its role in the global economy as it provides many benefits in various sectors, such as livelihoods, fisheries, tourism, energy, minerals, and biotechnology, which contribute significantly to the global economy (Hastuti et al., 2023; Pendleton et al., 2020; Vrancken, 2021). However, these resources face threats of pollution, overfishing, and climate change (Elentably et al., 2022). Degradation of the marine environment affects biodiversity and poses a risk to human health, as polluted water can contaminate seafood and disrupt ecosystems (Saha and Saha, 2024). The sustainable management of marine resources is essential for long-term ecosystem health and well-being (Kulkarni, 2023; Petterson et al., 2021). Therefore, the sustainable management and conservation of marine resources are essential for maintaining human health and the integrity of marine ecosystems (Ardito, 2021; Touwe, 2020).

The sustainability approach has evolved significantly since its inception, becoming a widely recognized goal for human society in the 21st century (Hajian and Kashani, 2021). This approach emphasizes the importance of maintaining a balance between the use of natural resources and the need to preserve them for the current and future generations. (Jhariya et al., 2021) One of them is the management of marine resources that face pressure from climate change and human activity (Hodgson et al., 2022). It aims to meet the needs of the present without compromising the ability of future generations to meet their needs (Elsawy and Youssef, 2023). The concept has been described as a “magic concept” due to its broad appeal, positive normative charge, the possibility of overcoming current conflicts, and global marketability (Tøllefsen,

2021). Incorporating sustainability dimensions into maritime policy at all levels is critical to supporting sustainable growth (Nõmmela and Kõrbe Kaare, 2022). Despite its widespread use, reaching a consensus on the definition of sustainability remains a challenge (Tøllefsen, 2021).

The concept of a blue economy has emerged as a new approach to sustainably manage marine resources while promoting economic growth and social justice (Choudhary et al., 2021; Cisneros-Montemayor et al., 2022). The blue economy offers opportunities to realize the sustainable, resilient, and inclusive management of marine resources (Amon et al., 2022). Implementing a blue economy strategy is important for maritime countries because it can improve the economy while maintaining the marine ecosystem (Alifa and Zahidi, 2024). The capacity to build a sustainable blue economy depends on the availability of resources and social, governance, and infrastructure conditions (Cisneros-Montemayor et al., 2021). To achieve equitable and sustainable outcomes, challenges in governance, such as institutional and policy coordination in collaborative planning, must be addressed for effective implementation (Benzaken et al., 2022; Cisneros-Montemayor et al., 2021). Overall, the blue economy has a significant potential to achieve sustainable development goals and drive economic growth.

A blue economy is essential to achieving sustainable development goals (SDGS) by balancing economic growth with the protection of marine ecosystems (Lee et al., 2020). The blue economy not only contributes to the 14th Sustainable Development Goals (SDGs) on marine ecosystems (life below water) but also plays a role in overcoming poverty alleviation (SDGs 1), food security (SDGs 2), and economic growth (SDGs 8) through the management of aquatic resources, thereby contributing to various sustainable development goals (SDGs) (Alharthi and Hanif, 2020; Kovačić et al., 2021). Additionally, the blue economy promotes innovative approaches that align with biodiversity conservation and pollution reduction, which are essential for sustainable development. (Pace et al., 2023) As countries increasingly realize the potential of their marine resources, the blue economy serves as a strategic tool for modernization and geopolitical positioning, especially for coastal countries such as China (Fabinyi et al., 2021; Midlen, 2024). However, coastal countries, such as Africa, face challenges in implementing blue economy strategies because of their limited financial and technological capacity (Akpomera, 2020). Thus, a cohesive strategy that integrates these elements is essential for realizing sustainable development goals (SDGs) in a sustainable blue economy.

Recent research on blue economy sustainability highlights its important role in conserving natural resources and achieving development goals (Ovchynnykova et al., 2024). Forward-looking techniques have been used to identify future challenges and opportunities, uncovering key trends, such as digitalization, blue biotechnology, and ecosystem services (Pace et al., 2023). These studies emphasize the need for integrated ocean management tools, circular systems, and a collaborative research infrastructure to support a sustainable blue economy (Pace et al., 2023). Renewable energy is recognized as being important for reducing the carbon footprint of the maritime industry, with emerging research focusing on climate change, aquaculture, and marine spatial planning (Pires Manso et al., 2023). These findings underscore the need for a revised economic strategy that prioritizes environmental sustainability in order to ensure long-term economic resilience.

To support sustainability in the field of the blue economy, a critical analysis of previous studies is needed to provide an overview of future research potential that is useful for researchers to explore the understanding of the sustainability of the blue economy more deeply. Conducting a bibliometric analysis is an appropriate method to achieve this goal (İri and Ünal, 2024). Bibliometric analysis is also helpful for measuring the extent to which the sustainability of the blue economy contributes to marine conservation and economic well-being. Recent bibliometric studies have revealed various research themes in this field, such as the blue economy and coastal tourism (Kabil et al., 2021), sustainable development of the blue economy (Liang et al., 2022), blue economy and aquaculture (Silvestri et al., 2024), blue economy, and the total environment (Lee et al., 2021). However, no single study has revealed the sustainability of the blue economy through bibliometric analysis. Therefore, the results of this study are important. This study can identify relevant research on the sustainable development agenda in the marine sector. This will be useful for stakeholders, including policymakers, academics, and industry players, to develop effective strategies to address challenges in the field of a sustainable blue economy.

2. MATERIALS AND METHODS

This research uses a quantitative method with a bibliometric analysis approach to conduct literature reviews and understand the research landscape in the field of sustainable blue economy (Apriantoro et al., 2023; Apriantoro et al., 2023). Bibliometric analysis uses mathematical and statistical tools with computers to measure the relevance and impact of publications in a research field (Apriantoro and Maulana, 2025). Bibliometrics can be applied to a variety of disciplines, including economics, to map scientific information and improve research visibility (De Sousa et al., 2024a; Ninkov et al., 2022). This method of analysis can be used to assess scientific literature and identify trends, influential works, and research gaps by utilizing publication metadata (Alam et al., 2023; Lazarides et al., 2023). This method has the advantages of cost-effectiveness and the ability to analyze large datasets without full-text access (Hemmingsen et al., 2023). Thus, bibliometrics are a valuable and relevant tool for conducting comprehensive literature reviews in the field of sustainable blue economy.

The tools used in this study were R Software, Microsoft Excel, and VOSview. R Software was utilized to examine documents and citations, and VOSviewer was applied to analyze the co-occurrence network of keywords related to the blue economy sustainability topic (Apriantoro et al., 2024).

The research data were extracted from the Scopus database and exported in a CSV file format on October 10, 2024. The Scopus database was selected as the primary data source because it is the most extensive and high-quality bibliometric resource widely

recognized for its reliability in supporting quantitative scientific research.

This study investigated several stages. The first stage is to conduct a literature review on related topics to confirm the relevance of the research using bibliometric analysis. This stage is also helpful in choosing appropriate keywords to represent the scope of the research topic (Subhi Apriantoro et al., 2023).

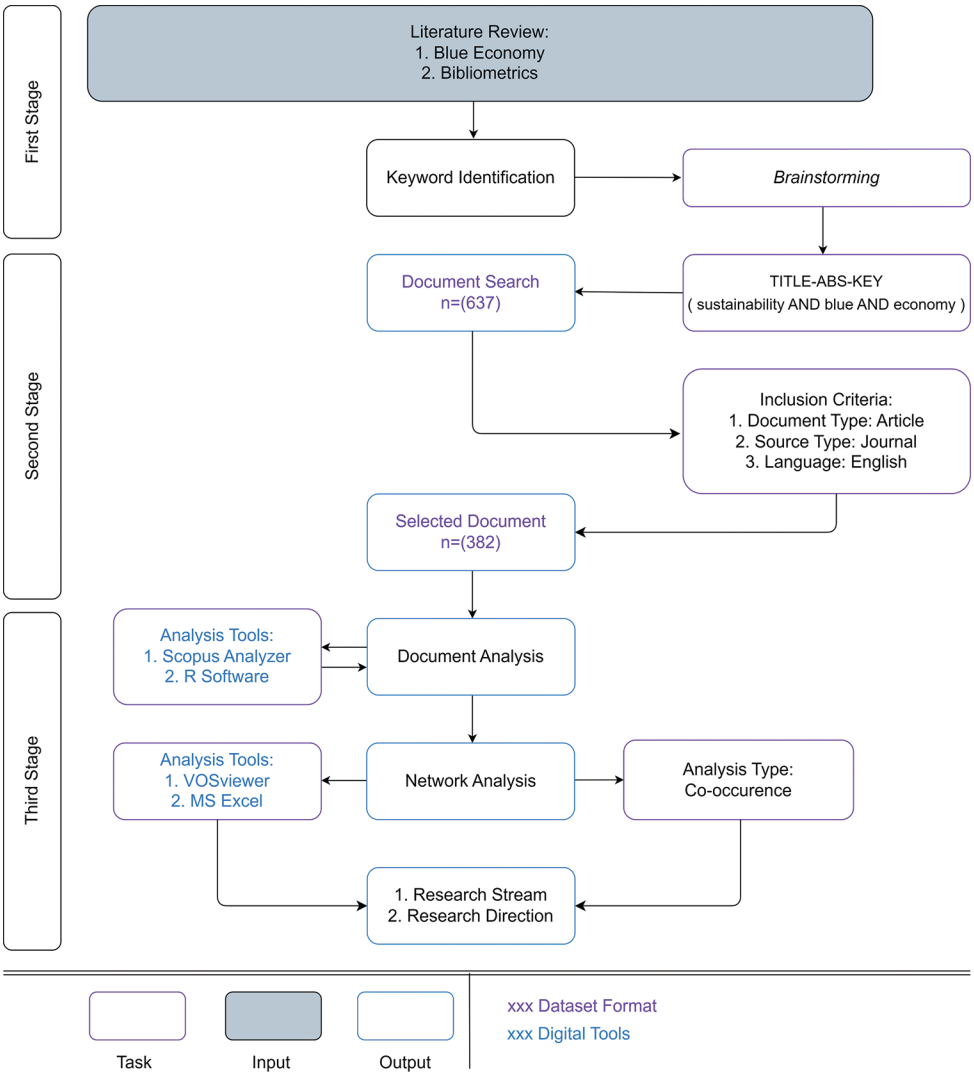
The second stage is to search for documents from the Scopus database using the search document feature with predetermined keywords, namely the sustainability blue economy. Using the search query TITLE-ABS-KEY (sustainability AND blue AND economy), 637 results were obtained in the overall document. This shows that the number of documents is appropriate for analysis using a bibliometric approach, as (Rogers et al., 2020) suggested by a minimum of 200 documents in the bibliometric analysis. Filtering was also carried out using the Boolean operator TITLE-ABS-KEY (sustainability AND blue AND economy) AND (LIMIT-TO [DOCTYPE, "ar"]) AND (LIMIT-TO [SRCTYPE, "J"]) AND (LIMIT-TO [LANGUAGE, "English"]) to limit the documents that appear only in the form of English articles sourced from journals so that the final result of the resulting documents is 382 documents.

The third stage is the document-analysis process. Data exported from the Scopus database were then analyzed based on documents with Biblioshiny opened using R software. Citation analysis was also performed to identify the most impactful authors and sources. Microsoft Excel processes the analysis data through diagrams and tables to make them easy to understand. Meanwhile, VOSviewer was used to analyze the co-occurrence or frequency of keywords related to fatwa topics. The types of analyses used were network, overlay, and density analyses. This analysis makes it possible to identify the themes, trends, and potential for future research (Puspita and Tanjung, 2024; Riani and Fatoni, 2022; Sukmana et al., 2024) as summarized in Figure 1.

3. RESULTS AND DISCUSSION

Table 1 contains the data on the information processed in Biblioshiny. The data were analyzed on October 11, 2024, and the results are displayed in the table. From the data, 382 articles were

Figure 1: Research stages diagram



published between 2003 and 2024. The document was written by 1683 authors, including 55 single authors and 37.96% international authorship collaboration, with 24595 references and an average citation of 16.34.

3.1. Annual Trends

Figure 2 illustrates the growth in document publication productivity from the 1st year of publication until now. The diagram shows that the first article was published in 2003 with only one document. This shows that blue economy sustainability is classified as a new topic because it has been around for approximately two decades since the first research was published. No significant increase was observed after the first publication. Even a few years later, there were no publications until 2013, when growth began to occur gradually. A drastic increase occurred in 2020, and the number of documents doubled from the previous year. By 2022, the number of publications stagnated, but the growth in the number of publications continues to increase. In 2024, this will be the peak of the highest number of publications, with a total of 84 documents, even though it has not been even one year. This illustrates the increasing demand for this topic.

Table 1: Data information summary

Description	Results
Main information about data	
Timespan	2003:2024
Sources (Journals, Books, etc.)	205
Documents	382
Annual growth rate %	23.49
Document average age	2.66
Average citations per doc	16.34
References	24,595
Document contents	
Keywords plus (ID)	2440
Author's keywords (DE)	1407
Authors	
Authors	1683
Authors of single-authored docs	55
Authors collaboration	
Single-authored docs	59
Co-authors per Doc	4.87
International co-authorships %	37.96
Document types	
Article	382

3.2. Mapping the Leading Countries

The ten most active countries in this publication are shown in Figure 3. The United States is the most productive country in blue economy sustainability research, with 72 publications. The United Kingdom followed with 66 publications. China ranked third with a total of 42 documents. Australia and Canada had 39 and 33 documents, respectively. France occupied the last position, with a total of 21 documents. This diagram shows that countries with strong economies, such as the United States, the United Kingdom, and China, have a high research interest in exploring the development of the sustainable blue economy. This indicates that these countries have a strategic need to manage their marine resources sustainably. On the other hand, countries from Europe, such as Spain, Italy, Germany, and France, dominated this study.

3.3. Profiles of Top Research Institutions

Figure 4 shows the top ten institutions that produced the most documents related to the sustainability of the blue economy. The University of British Columbia and Stanford University are the most productive institutions, with 12 publications each. Further, it is Lancaster University, with a total of 10 documents. The University of Tasmania, the Commonwealth Scientific and Industrial Research Organisation, and the Institute for Marine and Antarctic Studies are in the following positions, contributing nine documents each. This was followed by the Memorial University of Newfoundland and the University of Queensland, which had eight documents. The last was Simon Fraser University and the University of California, Santa Barbara, with seven documents. In general, these institutions are dominated by those in Australia and Canada.

3.4. Contributions Authors

The top ten most prolific authors are shown in Figure 5. The figure shows that the most active researcher is Andrés Cisneros-Montemayor, with some works written in six documents. Subsequently, several authors had the same number of documents, namely Edward Hugh Allison, Nathan J. Bennett, Elizabeth Ann Fulton, Le Thanh Ha, Benjamin S. Halpern, and Christina C Hicks, each with five documents. The authors who occupy the last three positions each have four documents, namely Karen Evans, Celine Germond-Duret, and Gesche Krause among the ten authors; the number of documents they have is not much different.

Figure 2: Annual trends

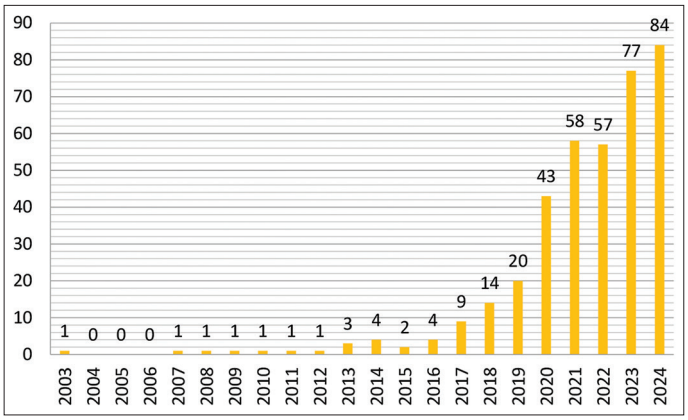


Figure 3: Mapping the leading countries

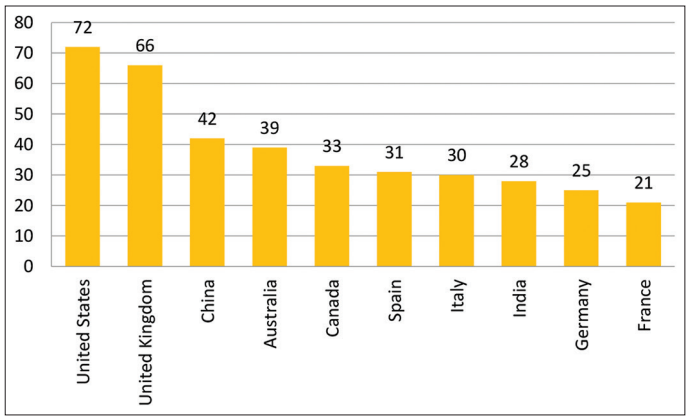


Figure 4: Profiles of top research institutions

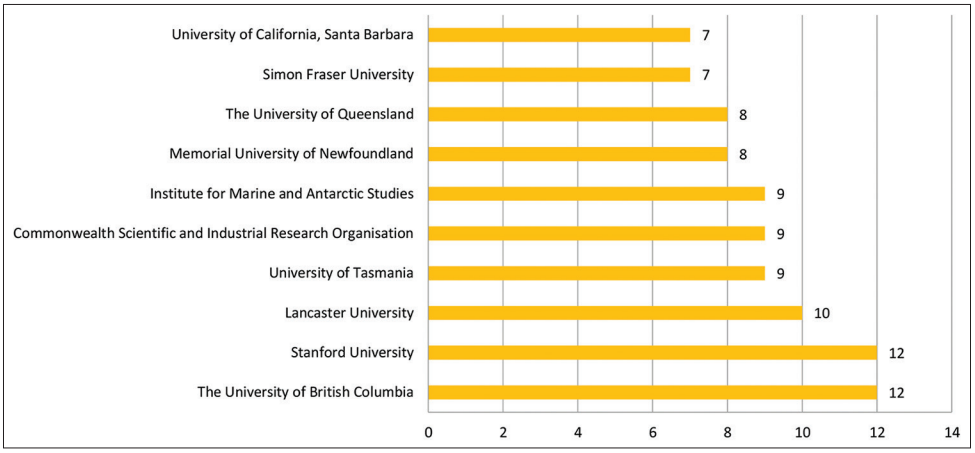


Figure 5: Contributions authors

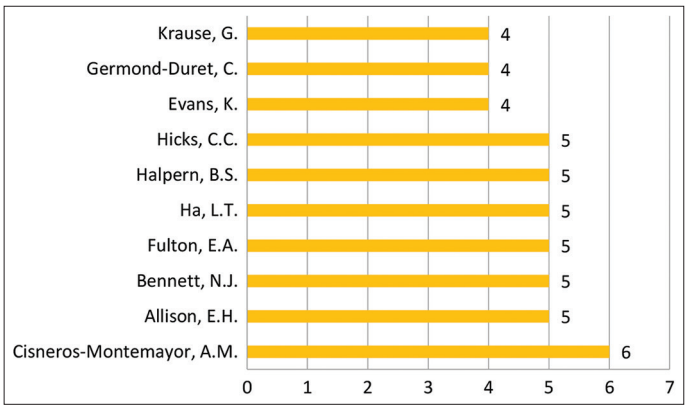
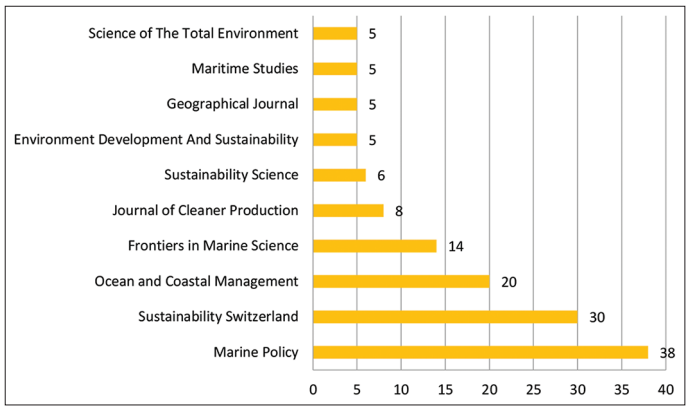


Figure 6: Prominent publication sources



3.5. Prominent Publication Sources

Figure 6 shows the ranking of the top ten sources or journals with the highest productivity. Marine Policy achieved first place with some published articles, with as many as 38 documents. Second is Sustainability Switzerland, which publishes 30 documents. The third place is occupied by Ocean and Coastal Management, with 20 documents. Meanwhile, in the sixth to tenth ranks, Environment Development and Sustainability, Geographical Journal, Maritime Studies, and Science of the Total Environment have the same number of documents, five each.

3.6. Collaborations Authors

Figure 7 shows the document analysis results using R software, displaying a chart of the top ten countries with corresponding authors' countries consisting of Single Country Publication (SCP) and Multiple Country Publication (MCP). China ranked at the top, with SCP dominating with 20 documents. The United Kingdom occupies the second position and is dominated by the MCP. Australia follows it with a superior SCP, but has the same number of MCPS as the USA and Spain, with 11 documents. The country with the highest MCPS is the United Kingdom, which has 15 documents, while China remains superior regarding SCP. Overall, the countries of the corresponding authors are dominated by those originating from the European continent.

3.7. Most Globally Cited Documents

Table 2 shows the data of the documents with the most citations globally, along with the total citations per year. (Bennett, 2018) The document has the highest total citations of 163, and the number of citations per year is relatively high at 23.29. The large number of citations shows that this document significantly influences research. Next is the (Clapp et al., 2018) with a total of 133 citations and 19.00 total citations per year. This was followed by (Smith-Godfrey, 2016) 131 and a total citation per year of 14.56. In the last position, there is a document by (Bennett et al., 2018) that again shows that Bennett Nj has two documents written in the same year with many citations. This illustrates that Bennett Nj has made a significant contribution to this field of research. The document with the highest total citations per year was (Li et al., 2021) 25.75. This shows that the document (Li et al., 2021) Can obtain a large number of citations in a short time, although not as many as other documents, indicating the relevance of the document's topic. In general, the total number of citations and the total citations per year are not always directly proportional. Likewise, the year of publication does not affect the total citations because some articles have a relatively high total citation count even though the year of publication is newer.

3.8. Most Locally Cited Documents

Table 3 shows the top ten documents with the highest local achievement in blue economy sustainability. The document with the most local citations (Smith-Godfrey, 2016) It has a local citation 16 and a global citadel 131, with a total LC/GC ratio of 12.21%. In the following position, (Bennett, 2018) local citations,

Figure 7: Collaborations authors

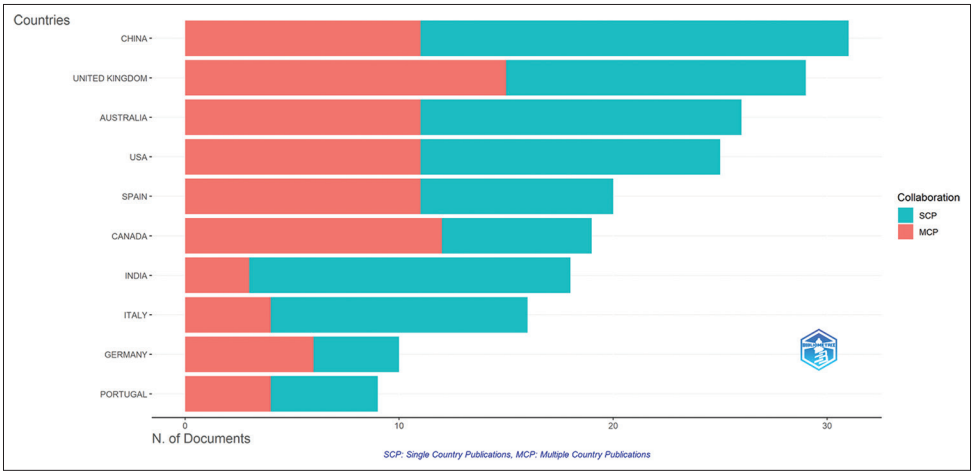


Table 2: Most globally cited documents

Paper	Total citations	TC per year
Bennett, 2018, Mar Policy-A	163	23.29
Clapp et al. 2018, J Peasant Stud	133	19.00
Smith-Godfrey 2016, Marit Aff	131	14.56
Bennett 2019, Coast Manage	113	18.83
Li et al., 2021, Iscience	103	25.75
Phelan et al., 2020, J Sustainable Tour	99	19.80
Islam and Shamsuddoha, 2018, Environ Sci Policy	90	12.86
Nash et al. 2020, One Earth	85	17.00
Pauly 2018, Mar Policy	82	11.71
Bennett et al., 2018, Mar Policy-B	82	11.71

Table 3: Most locally cited documents

Document	Local citations	Global citations	LC/GC ratio (%)
Smith-Godfrey, 2016, Marit Aff	16	131	12.21
Bennett, 2018, Mar Policy-A	14	163	8.59
Nash et al., 2020, One Earth	6	85	7.06
Schutter and Hicks, 2019, J Polit Ecol	6	49	12.24
McKinley et al., 2019, Environ Dev Sustainability	6	48	12.50
Niner et al., 2022, Environ Sci Policy	5	20	25.00
Sarker et al., 2018, Ocean Coast Management	5	77	6.49
Bond, 2019, J Polit Ecol	5	34	14.71
Caswell et al., 2020, Fish Fish	4	37	10.81
Phelan et al., 2020, J Sustainable Tour	4	99	4.04

global citations, and LC/GC ratios were 14, 163, and 8.59%, respectively. Di peringkat ketiga terdapat dokumen (Nash et al., 2020) yang mempunyai 6 citasi local, 85 citasi global, dan 7.06% rasio LC/GC. (Bennett, 2018) The document has the most global citations, which shows that the document ranks the most at the global level, but also occupies the top position at the local level. The document (Niner et al., 2022) Had the highest LC/GC ratio of 25.00%. This shows the extent to which a document is receiving attention and is more relevant locally in this area. In general, the number of local citations, global citations, and LC/GC ratios did not affect each other.

3.9. Authors' Local Research Impact

Table 4 shows the ranking of the top ten most influential authors based on calculating the H index, G index, M index, total citations, number of publications, and year of publication start. The H index measures a writer's productivity through the number of publications and citations received. The G index shows that the author has some of the most cited articles, at least as many as the number of G index. The M index shows the growth of a writer's influence from year to year. Based on the data provided, the author with the most influence was Nathan J. Bennett, who wrote five documents in 2018 with a 5 H index, 5 G index, 0.714 M index, and 409 total citations. This was followed by Andrés Cisneros-Montemayor, who has six documents with a 5 H index, 6 G index, 1 M index, and 85 total citations. Furthermore, Yuan Li has an H and G index of 5, with a 1 M index and 141 citations. The last position, namely, U. Rashid Sumaila, who wrote four articles starting in 2018, has 4 H and G indexes, 0.571 M, and 216 total citations. It can be seen that Andrés Cisneros-Montemayor is the most superior in the G index and the M index. The number of documents indicates that he has many documents with citations, and the growth of his influence is relatively fast in a short time.

3.10. Publication Sources' Local Research Impact

Table 5 displays the most influential journals measured through the H index, G index, M index, total citations, number of publications, and year of publication. The journal with the most influence is Marine Policy, which has published 38 documents starting in 2013 with an 18 H index, 30 G index, 1.5 M index, and 933 total citations. These data show that marine policy has significantly influenced this study. Second, Sustainability (Switzerland) issued 29 documents with H, G, M, and 12, 18, 2, and 369 citations. The third place is Ocean and Coastal Management, which has 20 documents with a 10 H index, 17 G index, 1.429 M index, and 309 total citations. In the last ranking, One Earth only has four documents with a 3 H index, 4 G index, 0.6 M index, and 106 total citations. The Geographical Journal has the fastest productivity since its publication began in 2023 because it has the highest M index of 2.5.

3.11. Visualising Keyword Networks

Figure 8 results from processing the Scopus dataset in the VOSviewer software to map keywords related to the sustainability blue economy. This analysis is often called keyword network analysis because each keyword that appears forms a network with the others, indicating a relationship in the research. This analysis uses co-occurrence as the type of analysis, with the whole counting method, to analyse all keywords as the unit of analysis. Furthermore, the minimum number of keyword occurrences set is seven, so out of the 3397 keywords found, 128 keywords meet the threshold to be analysed. In addition, keyword verification is also carried out to remove less relevant keywords, such as article keywords, and eliminate some duplicate keywords that refer to the same thing to reduce the accuracy of analysis, such as animals, blue economies, ecosystems, ecosystem services, fisheries, humans, investments, and sustainable development goals. The minimum number of cluster sizes used in this analysis is 10, so the network forms 4 clusters with red, green, blue, and yellow colours. Cluster 1 is depicted in red with 38 items dominated by the keywords climate change, aquaculture, and circular economy. Cluster 2 has 28 items

Table 4: Authors' local research impact

Author	H index	G index	M index	TC	NP	PY start
Bennett Nj	5	5	0.714	409	5	2018
Cisneros-Montemayor Am	5	6	1	85	6	2020
Li Y	5	5	1	141	5	2020
Allison Eh	4	5	0.667	179	5	2019
Germond-Duret C	4	4	0.667	88	4	2019
Halpern Bs	4	5	0.8	219	5	2020
Hicks Cc	4	5	0.667	223	5	2019
Krause G	4	4	0.8	71	4	2020
Okafor-Yarwood I	4	4	0.8	171	4	2020
Sumaila Ur	4	4	0.571	216	4	2018

Table 5: Publication sources' local research impact

Source	H index	G index	M index	TC	NP	PY start
Marine Policy	18	30	1.5	933	38	2013
Sustainability (Switzerland)	12	18	2	369	29	2019
Ocean and Coastal Management	10	17	1.429	309	20	2018
Frontiers in marine science	9	14	1.5	290	14	2019
Journal of cleaner production	6	8	1	251	8	2019
Geographical Journal	5	5	2.5	43	5	2023
Sustainability Science	5	6	1	117	6	2020
Journal of Political Ecology	4	4	0.667	164	4	2019
Environment, Development and Sustainability	3	5	0.5	124	5	2019
One Earth	3	4	0.6	106	4	2020

Figure 8: Visualising keyword networks

depicted in green, dominated by the keywords sustainability, blue economy, and environmental economics. Cluster 3 is displayed in blue, with 14 items with dominating keywords: Sustainable development, economics, and economic and social effects. Cluster 4 has 12 items in yellow, dominated by economic growth, marine environment, and economic development.

3.12. Visualising the Evolution of Key Topics

Figure 9 shows the results of visualising the keyword network analysis in overlay mode. This mode classifies keywords by year to analyse the evolution of blue economy sustainability research trends from year to year. In this image, the colour of the nodes increasingly inclined towards dark blue indicates that the topic of the study is getting older. In contrast, the colour of the nodes that are increasingly inclined towards yellow indicates that the topic is more recent in this study. It can be seen that the dark blue colour shows that research on these keywords was published on average around 2021 and even below, such as resource management, decision making, Australia, policy making, and Africa. Meanwhile, the keywords in yellow indicate the latest topics in the research, which are around 2023, such as equity, marine pollution, seaweed, sustainable blue economy, and Europe. Overall, the keywords in the image are still relatively new because they only range from 2020 to 2023; therefore, research on sustainability in the blue economy is a new topic, as it is the latest research trend that interests researchers.

3.13. Density Analysis and Pattern Mapping

Figure 10 is a visualisation image of keyword network analysis in the density mode used to identify keyword density based on its use in sustainability and blue economy. The bright yellow keywords indicate that they are often used and researched topics, such as

Figure 9: Visualising the evolution of key topics

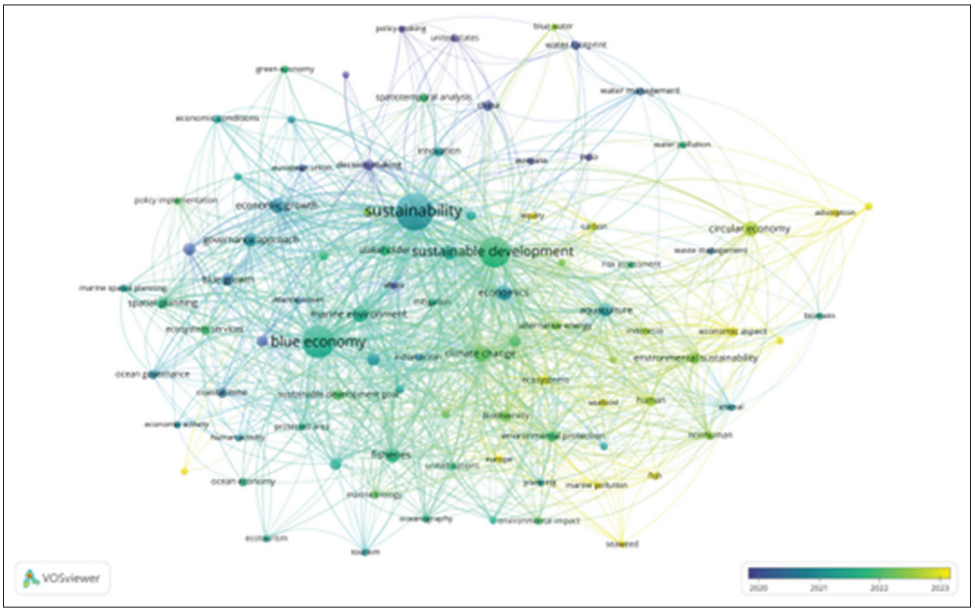
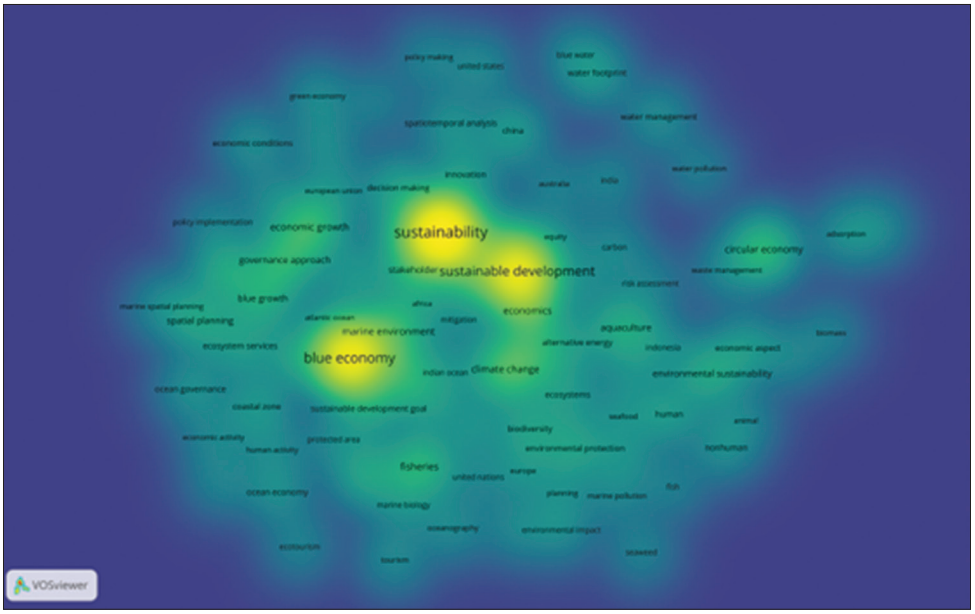


Figure 10: Density analysis and pattern mapping



sustainability, blue economy, and sustainable development. Faded yellow keywords indicate that these are less researched topics, such as animal, Atlantic Ocean, biomass, ecosystem, and marine pollution. Most of the keywords that appear are still lacking in research, so research in this area is still relevant and needs to be explored more deeply by researchers in the future.

3.14. Clustering of Major Themes

Table 6 lists keywords based on each cluster, the number of occurrences, and total link strength. Each cluster is then grouped into a theme representing all the keywords in the cluster. Cluster 1 is grouped into the theme of environmental sustainability. Several studies on this theme have highlighted the issue of environmental damage, so various efforts have been made to find solutions for environmental sustainability in natural resource management. Several studies have revealed several concepts to manage the environment so that it is maintained, such as recycling. (Mostafa et al., 2022) Renewable energy (Majumder et al., 2024), circular economy (Sauvé et al., 2021) and waste management (Garcia-Garcia et al., 2024). Konsep ini tidak hanya mendukung terhadap pengelolaan lingkungan, namun juga menciptakan keseimbangan dalam bidang ekonomi dan pelestarian lingkungan dalam jangka panjang. Pada intinya, berbagai topik yang ada dalam tema ini bertujuan untuk mengurangi kerusakan lingkungan dalam mengelola sumber daya yang berkelanjutan.

The theme of sustainable ocean represents Cluster 2. This theme is dominated by the keywords blue economy and sustainability, which are the topics of this study. This theme focuses on sustainability aspects in the marine sector, one of which is the blue economy, which discusses the sustainable use of marine resources in economic development. The blue economy is the right solution for the long-term management of marine resources in an environmentally friendly manner to take advantage of the tremendous economic potential of the sea. For example, ecotourism is environmentally friendly tourism that utilizes the potential of marine natural beauty to support the local economy. (Phelan et al., 2020) The fisheries sector can also be optimized for its use while maintaining its marine ecosystem, and (de la Puente and de la Lama, 2019) all forms of sustainable use of marine resources must be regulated through policies that involve the participation of various stakeholders, ranging from local communities, governments, and the private sector (Hoerterer et al., 2020).

Cluster 3 presents themes of water management and policy. This theme illustrates the importance of water management to sustainability. (Bona et al., 2024) One way to develop good planning is through policy-making and appropriate decision-making (Jain and Mukherjee, 2022). Effective water management can prevent water pollution and maintain the quality of blue water. In addition, water footprint measurements can help monitor water consumption during economic activities. (Sauvé et al., 2021) All of this aims to ensure the sustainable availability of clean water.

Cluster 4 was described under the theme of marine conservation. This theme highlights the conservation and management aspects of the sea and coastal zones. Conservation management maintains

Table 6: Clustering of major themes

Cluster	Keyword	Occurrences	Total link strength	Theme
1	Climate change	38	294	Environmental sustainability
	Environmental sustainability	21	162	
	Circular economy	33	129	
	Renewable energy	8	70	
	Waste management	8	56	
	Recycling	8	58	
	Marine ecosystem	11	89	
	Mitigation	7	62	
	Environmental protection	17	144	
	Environmental policy	9	91	
2	Blue economy	146	700	Sustainable ocean
	Coastal zone	14	104	
	Marine policy	21	130	
	Fisheries	29	219	
	Governance approach	27	186	
	Ocean economy	11	51	
	Resource management	7	31	
	Sustainability	196	922	
	Ecotourism	8	34	
	Marine spatial planning	10	80	
3	Water management	8	56	Water management and policy
	Water pollution	7	47	
	Water footprint	13	46	
	Blue water	8	32	
	Economic and social effects	20	197	
	Economics	33	257	
	Policy making	8	43	
	Decision making	17	116	
	Spatiotemporal analysis	12	63	
	Planning	7	75	
4	Coastal zone management	13	99	Marine conservation
	Conservation management	9	63	
	Marine biology	9	92	
	Marine environment	32	218	
	Protected area	8	72	
	Indian ocean	9	70	
	Economic development	24	182	
	Economic growth	32	180	
	Green economy	10	47	
	Strategic approach	10	72	

marine ecosystems and biodiversity in protected areas. (Casimiro et al., 2022) Research on the marine environment and marine biology will also help study the dynamics of marine conservation in deep marine ecosystems to protect the sustainability of marine resources and ecosystem balance, especially in the Indian Ocean region (Elentably et al., 2022; Kadagi et al., 2022).

4. CONCLUSION

This comprehensive bibliometric analysis of 382 publications (2003-2024) demonstrates that the blue economy's alignment with sustainability manifests through four dominant research themes: Environmental sustainability, sustainable oceans, water management policy, and marine conservation. The field has experienced remarkable annual growth of 23.49%, peaking in 2024, with the United States, the University of British Columbia, and Stanford University emerging as the most productive contributors. While influential sources like Marine Policy and prominent authors such as Andrés Cisneros-Montemayor and Nathan J. Bennett (as measured by H-index, G-index, and M-index) have shaped the discourse, keyword analysis reveals both established foci (sustainability, blue economy, sustainable development) and critical gaps (marine pollution, equity, Atlantic Ocean ecosystems). Notably, China leads in corresponding authorship, though predominantly through single-country publications. The research landscape clearly shows the blue economy's theoretical alignment with sustainability principles, yet practical implementation challenges remain, particularly regarding ecosystem-specific studies, pollution mitigation, and equitable resource distribution. These findings not only map the current intellectual terrain but also highlight the need for more balanced, interdisciplinary research to fully realize the sustainable blue economy's potential, bridging the gap between policy frameworks and on-the-ground environmental and social outcomes.

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