

Environmental Impacts of Blue Economy Initiatives: A Bibliometric Review

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ABSTRACT

Studies on the blue economy are no longer just a national issue, but have become a major global concern. This study aims to affirm global commitment to blue economy initiatives that align with the economic sector, marine ecosystems, and community welfare within the Sustainable Development Goals (SDGs) framework. Using a bibliometric approach, this study maps research development, identifies trends and key topics, and evaluates gaps based on the Scopus database from 2016 to 2025. The results indicate an increase in publications over the past 5 years, particularly in the areas of sustainable fisheries, marine conservation, and renewable marine energy. Although the economic contributions of the blue economy are increasingly recognized, damage to marine ecosystems from unsustainable practices remains a challenge. Therefore, balancing economic growth with environmental conservation is necessary. The originality of this study lies in its emphasis on less-explored topics, such as blue carbon and socio-economic integration, which can inform future research efforts.

Keywords: Blue Economy, Environmental Impacts, Bibliometrics, Sustainability, Marine Management

JEL Classifications: Q01, Q22, Q24, Q56, O13

1. INTRODUCTION

The Paris agreement, reinforced in the Glasgow Climate Pact (Hachaichi, 2023), affirms the global commitment to protecting the Earth's climate. One way to achieve this goal is through the principle of the blue economy (Campero et al., 2023), which is an integral part of the Sustainable Development Goals (SDGs) (Novaglio et al., 2022). The blue economy is not only relevant in countries with extensive coastal areas, such as Colombia and Indonesia, but also in European countries that have adopted inclusive and sustainable development policies in the marine sector (Lyons et al., 2023).

Since 2015, research on the environmental impact of blue economy initiatives has grown rapidly, as they have gained recognition in the context of sustainable development. This research encompasses marine resource management, the impacts of climate change, and the challenges faced by marine ecosystems due to human

activities. Since the early 2000s, the blue economy has attracted the attention of international organizations and governments, driving interdisciplinary research on the interactions between the economy and ecosystem (McKinley et al., 2024). Sustainability policies have become a key focus in enhancing the effectiveness of these initiatives, with stakeholder collaboration increasingly emphasized to achieve optimal sustainability (Sayedwa and Queiros, 2022).

Marine resources have great potential to drive economic growth, create jobs, and improve community welfare (Alsaleh et al., 2023). However, marine resources must be used wisely to ensure environmental sustainability. Therefore, the blue economy, with its focus on harmonizing the economic sector, the marine ecosystem, and community welfare, offers a sustainable approach (Hossain, 2021). At the 2012 US Senate hearing, the concept of a "blue economy" gained traction as a commitment to strengthening maritime affairs.

As in China, which has developed research on the blue economy after countries in Europe, North America, and other parts of Asia, prioritizing economic reform through a maritime power strategy (Fu et al., 2023). This strategy includes the development of a maritime economic resilience network, with the benefit of promoting sustainable global blue economic growth (Akhtar et al., 2025). Maritime economic resilience is now a significant focus of research. Along with this research, experts have pointed out that maritime economic resilience can be enhanced through various factors, such as continuous evaluation (Lu et al., 2020), the adaptability of the maritime economy to external pressures, and effective recovery processes.

Although the blue economy has been the focus of significant research, a gap remains in the literature regarding the environmental impact of blue economy initiatives. Bibliometric analysis was chosen for this study because of its ability to systematically map research developments, identify trends, and reveal relationships between researchers, institutions, and research topics. This method also allows for quantitative analysis of existing literature, thereby providing a comprehensive overview of the direction of the blue economy research (Aanesen et al., 2023).

The blue economy has emerged as one of the concepts of the Sustainable Development Goals (SDGs), which can be used by communities to align economic development with environmental sustainability in coastal and marine areas (Silva et al., 2024). The blue economy also strives to ensure the security of the marine ecosystem during economic development in coastal areas. Experts also emphasize that the application of sustainable principles in economic activities is crucial for aligning economic growth with ecological conservation efforts (Ding and Tabeta, 2024). With the blue economy, international trade can operate smoothly because all seas and oceans play a role in supporting sustainable living and providing easy access to global markets. Therefore, the blue economy is a potential approach to achieving sustainability in coastal and marine areas.

2. METHODOLOGY

This bibliometric analysis relied on the Scopus database as its primary data source (Apriantoro et al., 2025; El Ashfahany et al., 2025). The data collection took place in January 2025, employing a systematic Boolean search within the title, abstract, and keywords to ensure the relevance of the topics (Alhamdania and Apriantoro, 2023). The specific search phrase used was: (“blue economy” OR “blue growth”) AND (“environmental impact” OR “marine sustainability” OR “coastal development”). To keep the analysis on track, only articles from peer-reviewed journals published between 2016 and 2025, written in English, and addressing the environmental or socio-economic factors of blue economy projects, were included. In contrast, non-academic materials, such as editorials, notes, and news articles, as well as those unrelated to the blue economy, were excluded. Duplicate records identified through matching DOIs, titles, and authors were discarded using automatic detection combined with manual review.

A set of data cleaning steps was implemented to guarantee precision and uniformity before creating bibliometric maps. Names

of authors were standardized to combine spelling differences that relate to the same person, while institutional affiliations were adjusted to reflect their most commonly accepted formats. Entries with incomplete or incorrect metadata were either corrected or removed as necessary. Furthermore, keyword standardisation was conducted to bring together terms with equivalent meanings, for example, various expressions of “climate change,” which enhanced the dependability of co-occurrence and clustering outcomes (Apriantoro et al., 2024).

Even with the structured method used, it is important to recognize a number of limitations. Using Scopus as the sole database might have overlooked important research found in various academic sources. Additionally, the search method is influenced by the keywords used, meaning that some new or local phrases tied to the blue economy might not have been thoroughly included. This research also focuses on measurable factors, such as the number of publications, citations, and co-occurrence networks; consequently, it does not assess the procedural soundness or significant points of the studies reviewed, which could limit interpretive richness (Apriantoro et al., 2023).

To evaluate the strength of the findings, the search terms were broadened to encompass the general phrase “marine economy,” which was then subjected to multiple rounds of mapping and thematic analysis. The overall pattern remained largely unchanged, consistently highlighting three key thematic groups: The environmental impacts associated with blue economy activities, issues related to climate mitigation, and the management of water resources. While slight differences were noted in the prominence of certain keywords and the density of the clusters, the primary thematic structure remained unchanged. This uniformity suggests that the core results are not significantly influenced by the details of the original query, thereby reinforcing the credibility of the bibliometric results of the study.

3. DOCUMENT ANALYSIS

Research on the blue economy has expanded significantly in recent decades, driven by growing global awareness of the need to sustainably manage ocean resources. To understand the scope, evolution, and scholarly impact of this field, a bibliometric analysis was conducted on a dataset of scientific publications spanning from 1978 to 2025. Table 1 presents key indicators that capture the volume, collaboration patterns, intellectual foundations, and academic influence of blue economy research over this 47-year period.

Table 1 shows that there are 574 documents covering a period of 47 years. These consist of 2643 authors, 49 individual authors, with 35.71% international co-authors, 34765 references, and an average of 32.84 citations/document. These numbers demonstrate the significant growth of the literature on the blue economy over time and the increasing number of researchers working on this topic. The high number of international authors suggests that the blue economy and its environmental impacts are viewed as global issues that require collaboration across borders. This is important because the health of the oceans and the future of industries that

Table 1: Main information about data

Description	Results
Timespan	1978:2025
Sources (Journals, Books, etc)	299
Documents	574
Annual Growth Rate %	7.18
Document Average Age	5.62
Average citations per doc	32.84
References	34765
Keywords Plus (ID)	5166
Author's Keywords (DE)	2130
Authors	2643
Authors of single-authored docs	49
Single-authored docs	50
Co-Authors per Doc	5.02
International co-authorships %	35.71
Article	574

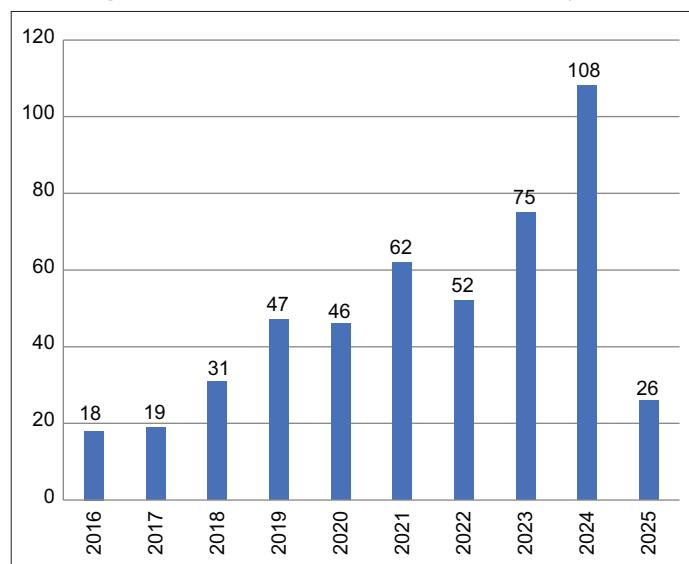
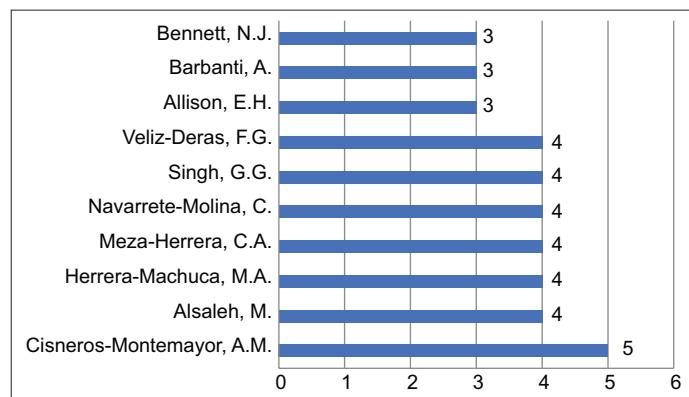
depend on the sea can't be solved by just one country alone. Moreover, the large number of references indicates that research in this area draws on knowledge from multiple fields, including economics, marine biology, environmental science, and policy studies. The average number of citations also indicates that these studies have been widely read and discussed, demonstrating a significant impact on conversations about sustainability. The fact that 49 of the papers were written by a single person alone means that individual researchers continue to make important contributions with their own unique ideas.

3.1. Document by Year

Figure 1 shows the publication trend related to the blue economy and environmental impact over the past decade. Publications increased from 2016 to 2019, followed by a decline in 2020 to 46 documents. The number of publications increased again in 2021 to 62 documents, but declined to 52 documents in 2022. This publication trend then reversed with a significant surge in 2023-2024, peaking in 2024 with 108 documents. However, in 2025, the number of publications dropped sharply to 26 documents. This dynamic pattern illustrates the close connection between research in the blue economy and global policies and economic conditions. The drop in 2020 occurred due to the pandemic, which led many institutions to prioritise health and economic recovery over research. The rise in 2021 and again in 2023-2024 stems from the UN's Ocean Science Decade, which has led to increased funding and collaboration for studies related to the ocean. The highest point in 2024 indicates a growing global interest in sustainable fishing, ocean protection, and the use of renewable energy from the sea. The sudden decline in 2025 may be due to a delay in updating the database or a temporary slowdown inherent in the research process. All this demonstrates that blue economy research undergoes significant changes in response to global events, the availability of funding for research, and collaborative efforts, highlighting its ongoing evolution and adaptability.

3.2. Document by Author

Figure 2 shows a list of the 10 authors with the highest number of publications on this topic. The author with the highest number of publications is Cisneros Montemayor, A. M., who has published 5 documents. Next are six other authors, each with four publications, including Alsaleh, M., Herrera Machuca, M. A., Meza Herrera, C.

Figure 1: Publications trends based on the last 10 years**Figure 2: Publications trends based on the 10 most prolific authors**

A., Navarrete Molina, C., Singh, G. G., and Veliz Deras, F. G., who are in second place. The diversity of these authors reflects that strong global collaboration can play a role in enhancing understanding and efforts to address environmental challenges through blue economy initiatives. The fact that Cisneros Montemayor, A. M., is a prominent figure indicates that he has consistently contributed to the growth of theoretical and practical research on sustainable fisheries and the management of marine resources. Additionally, the involvement of authors from diverse parts of the world and various fields demonstrates that the blue economy is being examined from multiple angles, including economics, environmental policies, and social sciences. This mix of knowledge helps make the discussions more complete, covering not just the environment but also the economy and the well-being of communities. Additionally, the fact that several authors have written four papers each shows that a group of key researchers is forming and playing a big role in shaping ideas and guiding future work. These authorship patterns demonstrate the importance of scholars continuing to collaborate and establish connections across different countries.

3.3. Document by Affiliation

Figure 3 shows that the Chinese Academy of Sciences ranks first in terms of the number of publications, with a total of 13 documents,

reflecting China's important role in scientific research related to marine ecosystems and sustainability. Meanwhile, the affiliation with the lowest number of publications is Plymouth Marine Laboratory, which has published 6 documents. This indicates that top institutions, particularly those with strong government and financial backing, are typically the primary creators of knowledge in the blue economy. The Chinese Academy of Sciences is a key player because it has a vast network of researchers and numerous resources, helping shape global discussions about maintaining ocean health.

On the other hand, although Plymouth Marine Laboratory publishes less, its work remains important because it often focuses on practical research and collaborates with other groups in Europe. Overall, the amount of knowledge created and shared about the blue economy largely depends on the strength of the institution, its collaboration with others worldwide, and the type of research it chooses to conduct.

3.4. Document by Country

Figure 4 shows that the United States is the region with the highest number of publications on this topic, reaching 119 documents. In second place is China with 94 publications, focusing on marine resource management and renewable energy. The country with the fewest journal publications on the blue economy topic is the Netherlands, with a total of 22 documents. Meanwhile, several European countries have also made significant contributions to policy-based research and marine ecosystem management, including the United Kingdom, with 75 publications, Italy, with 60 publications, and Spain, with 48 publications. These results indicate that studies on the blue economy are dispersed globally. In North America and Asia, there's a significant focus on new technologies and the responsible use of resources. In Europe,

the primary focus is on how governments manage resources and establish regulations to protect the environment.

The US and China are producing a significant amount of research because they have invested heavily in equipment and facilities for studying the oceans. However, the work from Europe shows that collaboration and having strong policies are still crucial for addressing environmental problems worldwide.

3.5. Document by Source

Figure 5 illustrates the distribution of articles on the blue economy across various academic journals, highlighting the primary sources that influence scholarly discussions. "Science of the Total Environment" and "Sustainability Switzerland"

Figure 4: Publication trends by country

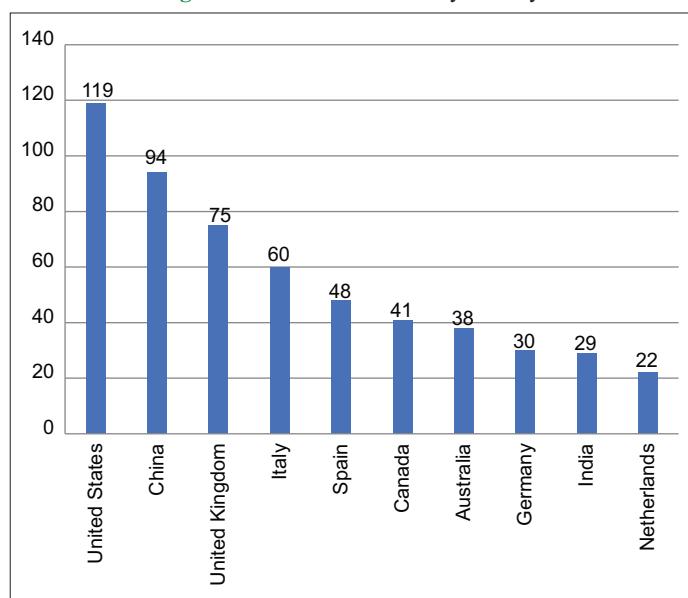


Figure 3: Publication trends based on affiliation with the highest number of publications

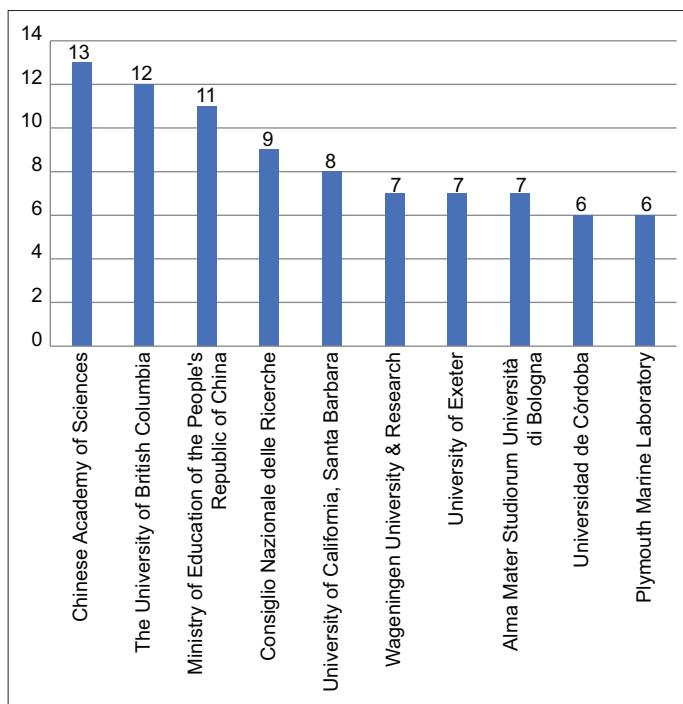
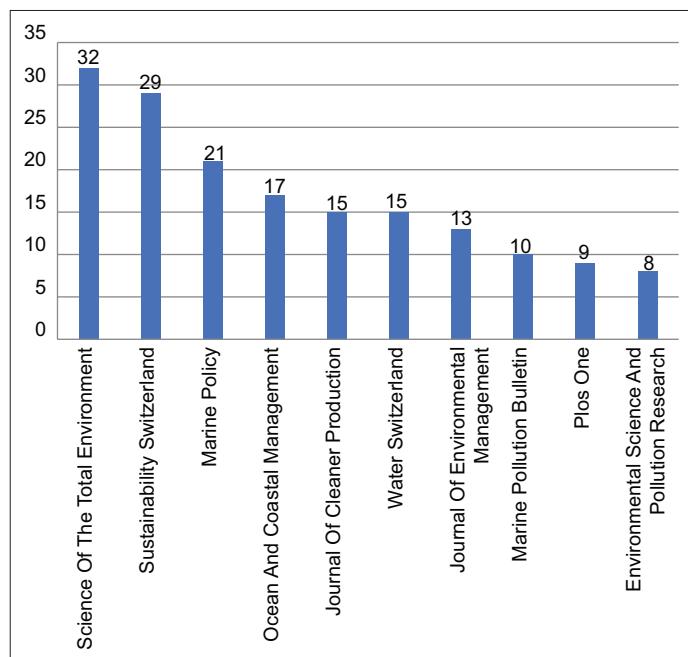


Figure 5: Publication trends based on number of searches



stand out as the top journals, with 32 and 29 articles published, respectively. Their significance suggests that the environmental effects of blue economy efforts are largely examined through a mix of perspectives that include environmental management, sustainability policies, and the use of marine resources. On the other hand, *"Environmental Science and Pollution Research"* with only eight articles, makes a smaller but still important contribution, mainly addressing pollution management and specific local studies.

The significant presence of *Science of the Total Environment* implies that researchers are focused on broad and integrated studies related to sustainability in ocean contexts. In contrast, *Sustainability Switzerland* focuses on discussions centred around concepts and policies that align with the Sustainable Development Goals (SDGs). Overall, these trends in publication indicate a growing academic interest in linking the health of marine ecosystems to socio-economic development. The emphasis on research in high-quality journals also reflects the growing importance and global significance of blue economy studies as crucial for fostering sustainable environmental governance.

4. DOCUMENTS ANALYSIS 2

4.1. Corresponding Author's Countries

Figure 6 shows that there are three countries with the most publications on this topic: China, the United States (USA), and Italy, which all exhibit the most characteristics of single-country publications. China ranks first with a total of 57 authors from single-country publications, indicating that most of the research comes from domestic collaborations, and 27 authors are involved in multiple-country publications. The United States is in second place with 44 authors in single-country publications (SCP) and 12 in multi-country publications (MCP), showing a pattern similar to China. Meanwhile, Italy is in third place, with a more balanced composition, comprising 24 SCP and 11 MCP, reflecting its active involvement in research both nationally and internationally. From a continental perspective, Asia, through China and India, and North America, represented by the USA and Canada, emphasize national publications. Conversely, European countries (Italy, the United Kingdom, Spain, and Germany) show greater dominance in international collaboration, as evidenced by the high proportion of MCPs, particularly in the United Kingdom and Germany. This pattern shows how different areas' main goals and the way money is given affect how research projects work together.

Table 2 shows that the paper by Pendleton et al. (2012) in *PLOS ONE* ranks first, with the highest total number of citations, at 1151. In second place, the paper by Ishaq et al. (2022) received 845 citations, while third place was occupied by Hoekstra et al. (2012) with 733 citations. When looking at the average citations per year, Ishaq H's paper recorded the highest number at 211.25 citations per year, followed by Pendleton L with 82.21, and Oni et al. (2022, *Energy Convers Manage*) with a total of 78.00 citations per year. This data suggests that a high total number of citations does not always directly correlate with the number of annual citations. This is evidenced by Oni Ao, who has a relatively low total citation count of 312 but records a high annual citation count of 78.00.

Additionally, the year of publication does not always determine the total number of citations, as demonstrated by Pendleton L, who remains the most cited despite being published over a decade ago (2012). These results demonstrate that outdated research from the past remains relevant in discussions about the blue economy and the importance of maintaining a healthy environment.

Table 3 shows that there are four papers, each of which received three local citations: Novaglio et al. (2022), *Rev Fish Biol Fish*; Depellegrin et al. (2019), *Sci Total Environ*; Ferreira et al. (2007), *Aquaculture*; and Ene et al. (2013), *J Clean Prod*. Although the number of local citations is the same, this does not necessarily reflect the low global impact of these papers. For example, Laforteza et al. (2018) in *Environ Res* has only two local citations but has accumulated 283 global citations. Similarly, Navarrete-Molina et al. (2019) reports that Animal, despite having only two local citations and 13 global citations, records a relatively high local-to-global citation ratio (LC/GC) of 15.38%. Similarly, the paper by Novaglio C, which only received three local citations, has been cited 44 times globally, indicating a consistently significant

Figure 6: Corresponding author's countries

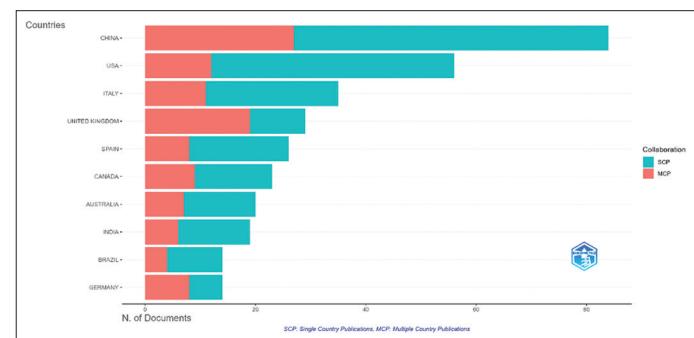


Table 2: Most global cited document

Paper	Total citations	TC per year
(Pendleton et al., 2012)	1151	82.21
(Ishaq et al., 2022)	845	211.25
(Hoekstra et al., 2012)	733	52.36
(Ma et al., 2016)	648	64.80
(Hertwich et al., 2015)	567	51.55
(Nyssen et al., 2004)	460	20.91
(Chan et al., 2018)	415	51.88
(Liu et al., 2013)	352	27.08
(Oni et al., 2022)	312	78.00
(Laforteza et al., 2018)	283	35.38

Table 3: Most local cited documents

Document	Local citations	Global citations	LC/GC ratio (%)
(Novaglio et al., 2022)	3	44	6.82
(Depellegrin et al., 2019)	3	55	5.45
(Ferreira et al., 2007)	3	210	1.43
(Ene et al., 2013)	3	131	2.29
(Mio et al., 2024)	2	37	5.41
(Sarwar, 2022)	2	78	2.56
(Navarrete-Molina et al., 2019)	2	13	15.38
(Capacci et al., 2015)	2	66	3.03
(Laforteza et al., 2018)	2	283	0.71
(Zanuttigh et al., 2015)	2	49	4.08

influence in the international sphere. These differences indicate that local citations demonstrate the relevance of a study in a specific area, while global citation numbers reflect its broader impact in the academic world. Therefore, both measures help in understanding the impact of blue economy research.

4.2. Network Analysis (Network)

Figure 7 shows the results of co-occurrence visualization of research related to the blue economy and environmental impact, with a minimum keyword occurrence limit (cluster size) of 20. The analysis results produced three main clusters distinguished by colour. Cluster 1 (red) comprises 45 items, with dominant keywords such as “article,” “environmental protection,” “sustainable development,” and “economics,” indicating a focus on sustainability and economics. Cluster 2 (green) comprises 32 items, with dominant keywords such as “environmental impact,” “sustainability,” “economic analysis,” and “greenhouse gas,” which highlight aspects of environmental impact and economic analysis related to emissions. Meanwhile, cluster 3 (blue) contains 26 items, with dominant keywords such as “water management,” “water supply,” “water footprint,” and “efficiency,” indicating a focus on water resource management and efficiency in its use. The presence of these three clusters shows that research on the blue economy isn’t focused on just one area, but covers many different topics. The first group highlights how sustainable development goals are connected to economic growth, demonstrating that researchers often consider both ecological and economic factors. The second group exhibits growing concern about greenhouse gas emissions and their connection to ocean activities, aligning with global discussions on climate change. The third group

emphasises the importance of effective water management and efficient water use, which is particularly crucial in areas where freshwater is scarce. Taken together, these groups demonstrate that blue economy research spans multiple fields and addresses both local and global environmental issues.

Figure 8 presents an analysis of keywords based on the overlay display. From this visualization, it can be seen that keywords such as blue economy, marine environment, blue economics, climate change, and economic growth were most frequently used in 2021. Meanwhile, keywords such as environmental impact, economics, and water supply have been popular for some time, with a high frequency of use since 2018. This indicates that research on the blue economy is continually evolving in response to global priorities and the development of policies. In 2021, the terms “blue economy” and “climate change” gained increased prominence due to the global focus following the Paris Agreement and the early years of the UN Decade of Ocean Science. At the same time, words like “environmental impact” and “economics” have been used regularly since 2018, showing ongoing interest in how environmental issues affect economic growth. The visual representation also illustrates how new terms gain popularity as new problems emerge, such as the adoption of renewable energy and efforts to protect the oceans. These changes mean that blue economy research adapts to both new scientific ideas and changes in society and politics, making it relevant for future discussions about sustainability.

Figure 9 shows that the highest density of keywords that have been extensively researched are “article” and “environmental impact.”

Figure 7: Network visualization

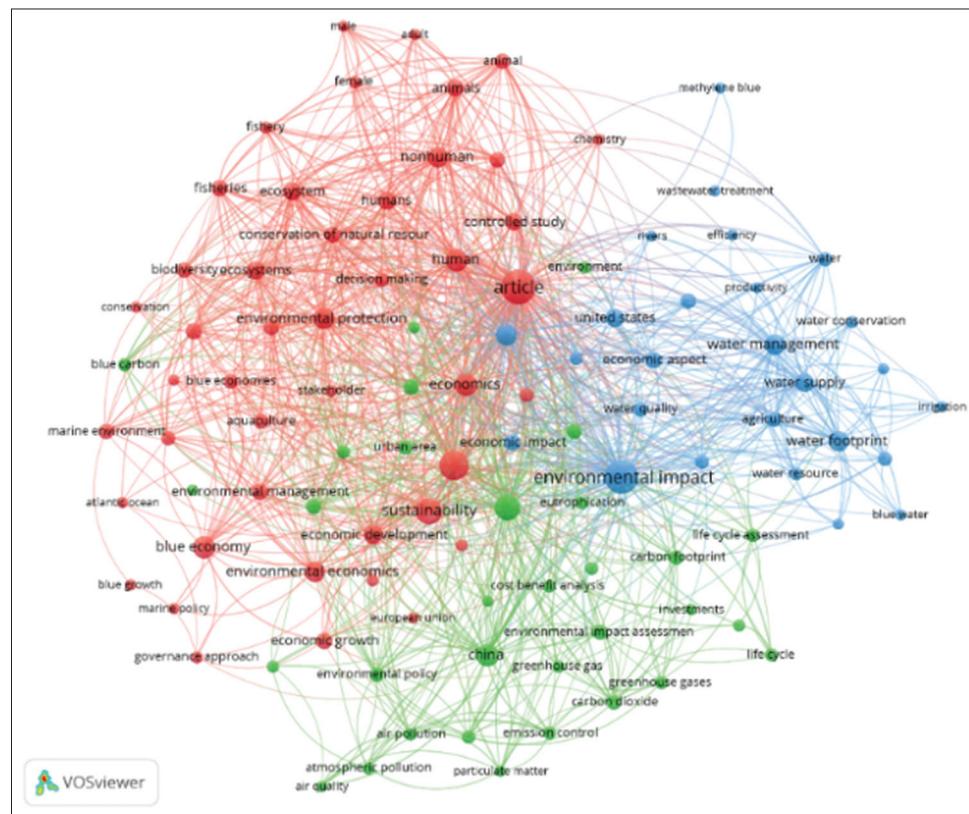


Figure 8: Overlay visualization

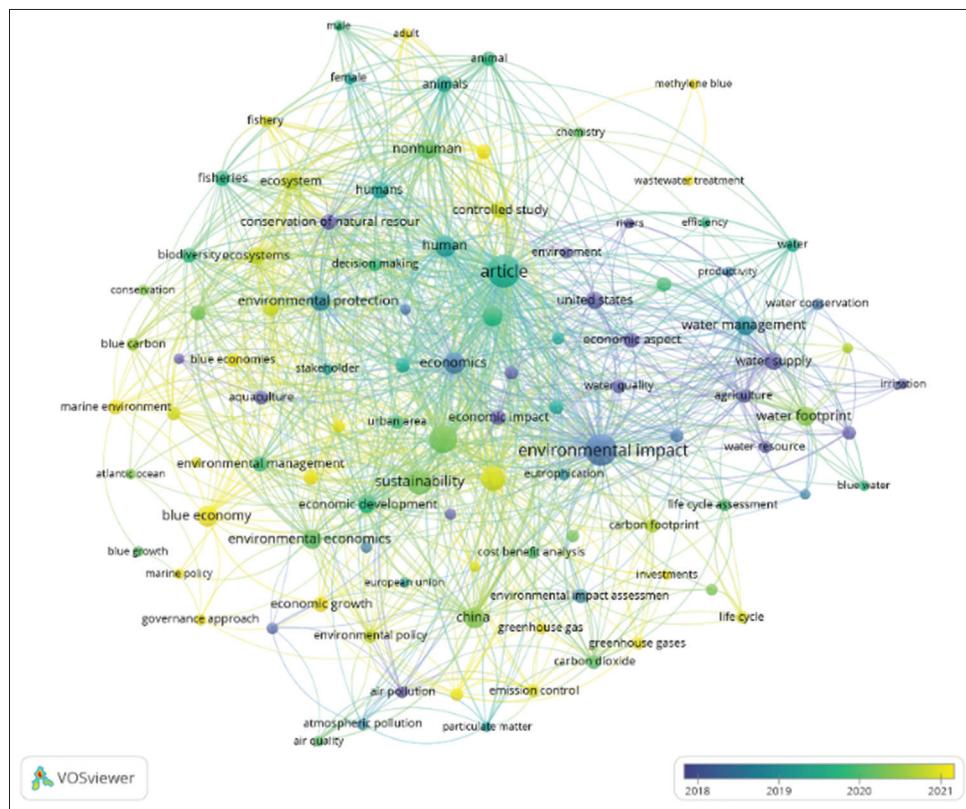
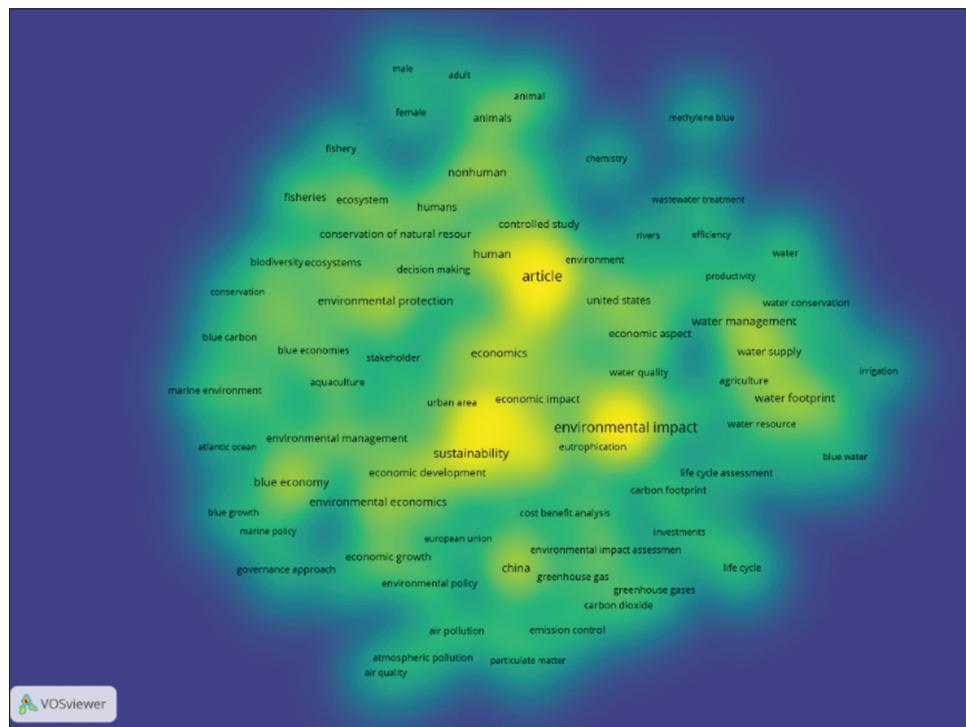


Figure 9: Density visualization



Meanwhile, keywords that are rarely researched with low density are “conservation of natural resources” and “blue carbon.” This pattern suggests that research on the blue economy has primarily focused on general environmental issues and their broad impacts, rather than addressing more specific topics such as natural resource

conservation and blue carbon, which are still in their early stages. The word “environmental impact” appears frequently, highlighting the widespread concern about the adverse effects of not utilising the ocean in a sustainable manner, such as overfishing and pollution. At the same time, the word “article” is used frequently,

indicating that researchers are investing considerable effort in writing about case studies, policies, and real-world findings. On the other hand, the word “blue carbon” isn’t used as much, even though it plays an important role in fighting climate change by storing carbon in places like mangroves and seagrass beds. This suggests that insufficient research has been conducted on this topic, particularly in terms of the number of studies published. Similarly, “conservation of natural resources” hasn’t been studied as much, maybe because it’s hard to balance conservation with economic growth. These results suggest that future research could focus more on these specific areas to enhance the current understanding of environmental impact.

5. CONCLUSION

This study demonstrates the significant growth in research on the blue economy and its environmental impacts in recent years. By looking at 574 documents from 1978 up to 2025, it’s clear that topics like marine resources, sustainability, and environmental challenges are now very important in development studies. The research demonstrates that the blue economy fosters a balance between ecological balance, economic opportunities, and the well-being of communities. This illustrates how it’s a field that combines various areas of study. Examining the evolution of research publication over time reveals fluctuations, particularly due to significant events such as the COVID-19 pandemic and initiatives like the UN Ocean Science Decade. There was a significant increase in 2024, with a greater focus on sustainable fishing, ocean protection, and the use of clean energy. The research team comprises both individual scientists and international groups. Some important names in the field include *Cisneros Montemayor*, *A. M.* Universities such as the Chinese Academy of Sciences, and countries like the U.S., China, and Italy are leading the way in shaping the direction of this research. There are also differences between regions. North America and Asia are more focused on technology and resource management, while Europe focuses on policies and collaboration across countries. Important journals, such as *Science of the Total Environment* and *Sustainability* Switzerland, help shape the discussion in the field.

Older, important papers by authors like Pendleton et al.’s, published in 2012, and Novaglio et al.’s, published in 2022, remain very influential today. Studies using network and mapping techniques found three main areas of research: (1) The blue economy and its environmental impact, (2) reducing the effects of climate change, and (3) managing water resources with social and economic consequences. Although more attention is being paid to sustainability and environmental issues, there are still areas that receive little study, such as blue carbon and the protection of natural resources. These could be great areas for future research. Overall, research on the blue economy is evolving and encompasses various areas, including policy, environmental conservation, economics, and social aspects. Future studies should work more collaboratively across different fields, explore topics that are not yet well understood, and develop policies that foster the growth of the ocean economy while also protecting the environment and supporting local communities. The blue economy provides a real way to help achieve the Sustainable Development

Goals, ensuring that using the ocean’s resources helps both the environment and people’s well-being at the same time.

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