Article

Bibliometric Analysis of Environmental, Social, and Governance Management Research from 2002 to 2021

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Abstract: Extreme weather events caused by climate change have increased people's focus on sustainability. Environmental, social, and governance management (ESGM) has become crucial for corporate operations and development; ESGM has attracted the attention of the academic communities, and the number of related studies has continued to increase. However, this topic is multidisciplinary and diverse; therefore, this study used the Web of Science Core Collection Database to conduct a bibliometric analysis of ESGM-related articles published from 2002 to 2021. Bibliometrix (R language), VOSviewer, and CiteSpace were used to identify and analyze research trends related to the number of studies, research fields, authors, national institutions, and keywords. The importance of management and governance was identified through keyword analysis; important keywords identified were financial performance, adaptive governance, property rights, sustainable development goals, and corporate governance.

Keywords: ESG; management; financial performance; adaptive governance; property rights; sustainable development goals; corporate governance

1. Introduction

According to the 2004 "Who Cares Wins" report from the United Nations, environmental, social, and governance (ESG) factors should be used as benchmarks for evaluating enterprises. After the signing of the Paris Agreement by 195 governments in 2015, increasing emphasis has been placed on investment in greenhouse gas reduction efforts and renewable energy [1,2]. With the impact of extreme weather events and climate change, investors' focus on ESG issues has increased. The increased attention on ESG issues from governments and investors pressured corporations to take action, making ESG management (ESGM) crucial to a firm's operational development. An analysis of these problems found that they are related to people closely. How to achieve sustainability through human activities is an important topic for future academic discussions.

ESGM involves the planning, implementation, assessment, and control of ESG in economic, legal, and ethical aspects; these actions can be taken by institutions, organizations, and individuals, and they can provide valuable information for operators and investors to aid decision-making [3–5]. In addition, with increases in the global population [3], extreme climate change affects the resources and value of forests and agricultural land [6]. How to overcome and adapt to the impact of extreme climate change and how to take into account the economic, environmental, and social aspects of sustainable development have become the most important issues for enterprises. From the perspective of the extended

responsibility of producers, the environmental problems arising from the production behavior of enterprises are their responsibilities [7]. The spread of the SARS-CoV-2 virus, which is suspected to have been caused by human contact with wild animals at the Wuhan Seafood Wholesale Market in China, has made consumers and investors pay more attention to corporate social responsibility (CSR) and sustainability [8]. Affected by the epidemic, employees have been working from home, asking for leave, and passing away, which have tested the company's resilience, affecting ESG-focused investment strategies [9]. As a result, effective ESGM has become a challenge for businesses, and many follow the Sustainable Development Goals (SDGs) described in the United Nations Framework Convention on Climate Change (UNFCCC) [10]. SDGs 7, 9, 12, and 17 are related to sustainable business management.

- SDG 7 (affordable clean energy): ensuring sustainable energy for everyone and industrially innovating to ensure sustainable development.
- SDG 9 (industry, innovation, and infrastructure): Actively carry out industrial innovation in the face of sustainable development.
- SDG 12 (sustainable consumption and production patterns): promoting cradle-to-cradle designs and encouraging companies to produce green, low-carbon products.
- SDG 17 (partnerships for the achievement of SDGs): encouraging and facilitating the contribution of the public and public–private social partnerships.

Research developments and trends in a field can be identified through a review of the relevant literature. Analyzing ESG literature, one can find that bibliometric studies have been widely used to analyze changes in various areas of research, such as trends in ESGM in the finance industry [11], the achievement of socially and environmentally viable economic growth through sustainable smart city ecosystems [12], and the practice and transfer perspective of enterprises' and organizations' adaptability and long-term adaptation to climate change [13]. Many related topics use bibliometric research to identify future trends [14–17]. However, no one has performed a bibliometric analysis of ESGM.

To elucidate research progress and trends related to ESGM, this study conducted a bibliometric analysis. The search period analyzed was from 2002 to 2021. Global research trends were identified to summarize technological advances and current research trends related to ESGM from a bibliometric perspective. This study conducted an in-depth analysis of ESGM to identify the main trends that still need to be strengthened in Sustainable Management Systems for Sustainable Organizations. Finally, related prospects and challenges were explored to support future research and decision-making in the field of ESGM technology. Provide important references for academic research and ESGM implementation in practice.

2. Materials and Methods

2.1. Materials

This bibliometric investigation was conducted using ISI—Web of Science (WoS) core data from the Science Citation Index Expanded (SCIE), Science Citation Index (SCI), and Social Sciences Citation Index (SSCI) for Clarivate Analytics [18–20]. This is because, compared with other journals, WoS is a core journal in various fields and an important academic achievement, and the bibliographic data can be dated back to 1898 with academic representation. In the WoS built-in search field, search for topic terms such as environmental, social, governance, and management in fields within a record. The fields are 1. Title, 2. Abstract, 3. Author Keywords, and 4. Keywords Plus; the documents were categorized as either original research or review articles. For the 2002–2021 period, 3599 relevant articles were retrieved, and their data were analyzed using bibliometrix (K-Synth Srl, Naples, Italy), VOSviewer (Leiden University, Leiden City, The Netherlands), and CiteSpace (Chaomei Chen, Philadelphia, PA, USA) [21,22].

2.2. Methods

Bibliometrics provides insight into all key components of the macro-research scientific dimension and can be aggregated and analyzed at the national level or by the academic structure of individual disciplines, disaggregating academic productivity by country, institution, journal, and researcher. Understand the influence and cooperation of various countries, research institutions, journals, and researchers in specific fields of knowledge and present the status and trends of academic development in various fields more broadly.

In this article, keywords were used to research the data in the database. Keywords are the core of a scientific paper. The analysis of keywords can give us an idea of the topic of the paper since the keywords given in the paper must have some kind of relevance. This association can be expressed by the frequency: the more frequently the words appear in the same document, the closer the relationship between the two topics. Co-occurrence analysis explores the frequency of nouns or phrases in literature to identify relationships between topics in the discipline that the literature represents. By calculating the frequency of occurrence of two subject words in the same document, a co-word network of the association can be formed. A research hotspot is a concentrated phenomenon in a technical field over a period of time that is manifested by the emergence of many literatures on a technical issue. The analysis of research hotspots helps to clarify the development process and correctly understand the research trend.

In the section on limitations of research methods, the data in the WoS database were focused firstly. Some early articles are missing documents or the author's name when they are registered, which may affect the analysis results. In addition, the database is not included in real time, and there is a time difference between the articles and the latest research by scholars. Therefore, the information from the database does not fully represent the latest research. Besides, there are also limitations in keywords, although keywords can represent the subject of the article, the content can't be represented by only a few words or sentences. Moreover, when some scholars select keywords, it may not be accurate enough to reflect the content of the article. In this article, Bibliometrix (R) was used to analyze the relationships between three fields (journals, keywords, and research institutions) and authors according to time series. The data set was input into VOSviewer to analyze data related to authors, sources, and keywords (e.g., keyword co-occurrence). For example, if the same words were used in two documents, keyword co-occurrence was indicated. The larger the number of co-occurring keywords was, the higher the similarity between two documents in terms of topic [23–25]. Finally, the visual time series revealed using CiteSpace was used to discuss important research trends [26–28] and determine the most cited document and the most prominent problem within that document. The goal was to understand the importance of ESGM in various research areas (Figure 1). In addition, some references were investigated in detail to determine the importance of the corresponding documents to the literature and provide valuable information for future ESGM research.
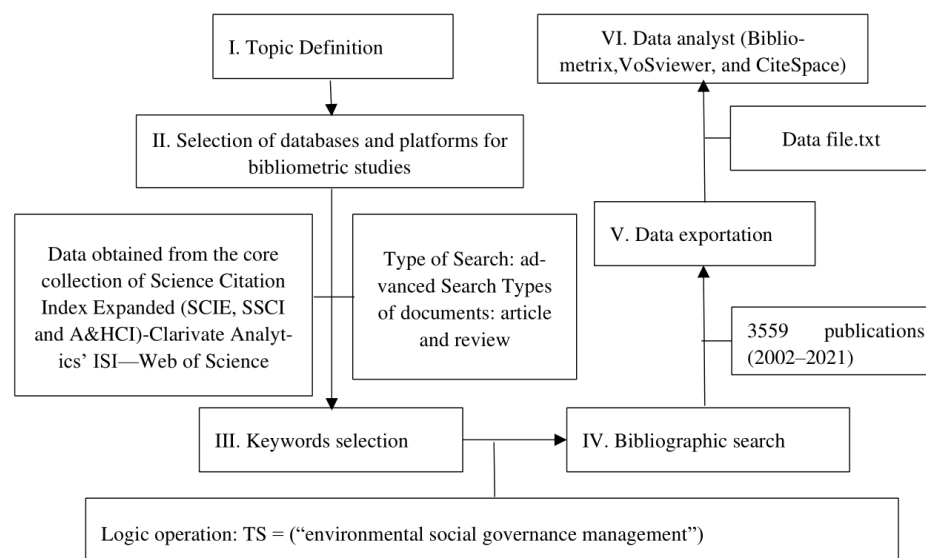
Figure 1. Flowsheet of the six steps making up the bibliometric analysis.

3. Results and Discussion

3.1. Changes in ESGM Research According to a Bibliometric Analysis

Through bibliometric analysis, the researchers determined that the number of publications in the field of ESGM has increased in the last 20 years. Although the number of related publications increased between 2005 and 2014, the total number of published documents per year was fewer than 200 (Figure 2). However, in the 7 years after the signing of the Paris Agreement (from 2015 to 2021), the number of related documents increased significantly every year, reaching 579 by 2021. From 2002 to 2021, the total number of articles published was 3559. In addition, the number of published articles related to ESGM has increased, indicating that climate change has encouraged researchers of sustainable management to highlight the importance of environmental issues. The goals of sustainable development, net-zero carbon emissions, and increased investment have brought ESGM to the forefront in enterprises [29]. The 2002–2021 period saw a 45-fold increase in the number of ESGM-related papers published.
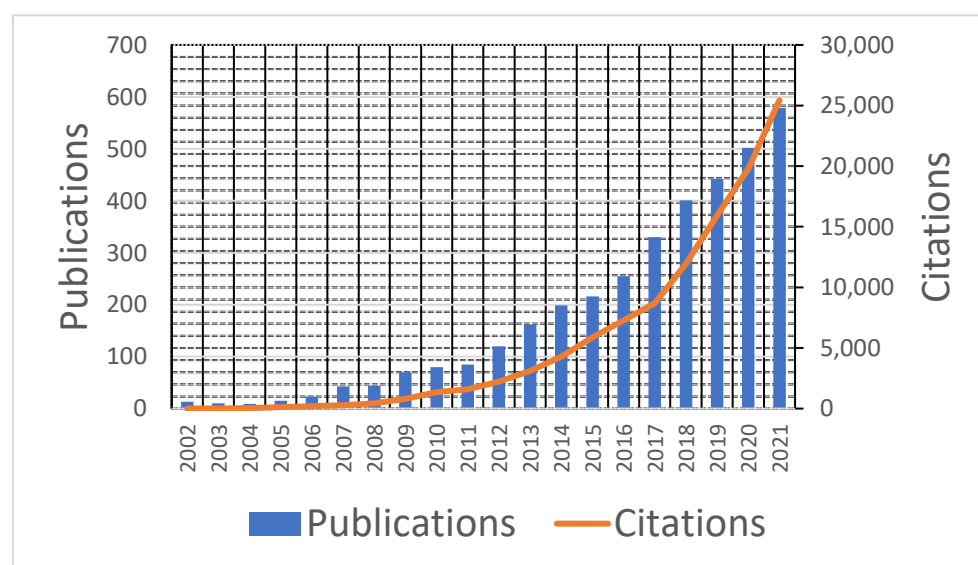

Figure 2. Number of publications and average citations (2002–2021).

The bibliometric analysis results related to each research area are presented in Table 1. The subject category was based on research areas in the WoS Core Collection. The ranking results reveal the importance of environmental sciences and ecology (60.96%), business and economics (20.20%), science and technology (and other related topics; 16.89%), public administration (8.17%), and geography (7.45%) in ESGM research. One document could cover multiple fields, resulting in an overall number of documents exceeding 3599. The percentage of disciplines and journals would be over 100%. An evaluation of discipline and journal groupings revealed that popular ESGM research topics were sustainable development and environmental governance; related research focused on adaptive management, natural resource management, environmental management, and resilience management.

Table 1. The top 10 disciplines, journals, affiliations, and countries of publication associated with ESGM research.

Ranking	Disciplines	Number of Articles	% (of 3599)
1	Environmental sciences and ecology	2194	60.96
2	Business and economics	727	20.20
3	Science, technology, and other topics	608	16.89
4	Public administration	294	8.17
5	Geography	268	7.45
6	Engineering	246	6.84
7	Water resources	234	6.50
8	Development studies	176	4.89
9	Social sciences and other topics	150	4.17
10	Biodiversity and conservation	113	3.14
Ranking	Journal	Number of articles	% (of 3599)
1	Sustainability	247	60.96
2	Ecology and Society	173	20.20
3	Journal of Cleaner Production	129	16.89
4	Environmental Science & Policy	93	8.17
5	Marine Policy	90	7.45
6	Journal of Environmental Management	83	6.84
7	Business Strategy and the Environment	73	6.50
8	Journal of Business Ethics	69	4.89
9	Land Use Policy	67	4.17
10	Corporate Social Responsibility and Environmental Management	58	3.14
Ranking	Affiliations (Country)	Number of articles	% (of 3599)
1	Stockholm University (Sweden)	97	2.70
2	University of Queensland (Australia)	72	2.00
3	University of British Columbia (Canada)	66	1.83
4	James Cook University (Australia)	63	1.75
5	Wageningen University (The Netherlands)	63	1.75
6	University of Waterloo (Canada)	56	1.56
7	Australian National University (Australia)	52	1.44
8	Arizona State University (United States)	50	1.39
9	University of Tasmania (Australia)	50	1.39
10	University of Melbourne (Australia)	41	1.14

Table 1. *Cont.*

Ranking	Countries	Number of articles	% (of 3599)
1	United States	913	25.37
2	England	521	14.48
3	Australia	479	13.31
4	Canada	397	11.03
5	The People's Republic of China	299	8.31
6	Spain	265	7.36
7	Germany	264	7.34
8	The Netherlands	254	7.06
9	Sweden	243	6.75
10	Italy	174	4.83

3.2. Keyword Research

Co-word analysis of keywords in different research fields can be used to identify research hotspots [28–30]. Figure 3a presents the results of a cluster analysis of the 50 most common keywords used by authors in the literature over the past 20 years. In this type of map, colors represent different clusters, and clusters are based on relationships.

Through a VOSviewer analysis, 5199 relevant keywords were identified from selected studies published from 2002 to 2021. Overall, the keywords that appeared with the highest frequency in the selected articles were management (1299 times), governance (1215 times), conservation (367 times), framework (363 times), sustainability (322 times), climate change (301 times), policy (296 times), performance (292 times), CSR (230 times), and ecosystem services (221 times). These findings indicate a growing interest in ESGM. On the basis of the keyword analysis conducted, the following observations and recommendations were made: (1) Enterprises or organizations must discuss operating performance when formulating management policies for sustainable development. (2) In corporate governance, managers must focus on the links between information disclosure, the transparency of internal business activities, and the external environment. In addition, discussions of climate change, climate policy, and ecology-related issues revealed the impact of environmental issues on enterprises and the impact of enterprises on society.
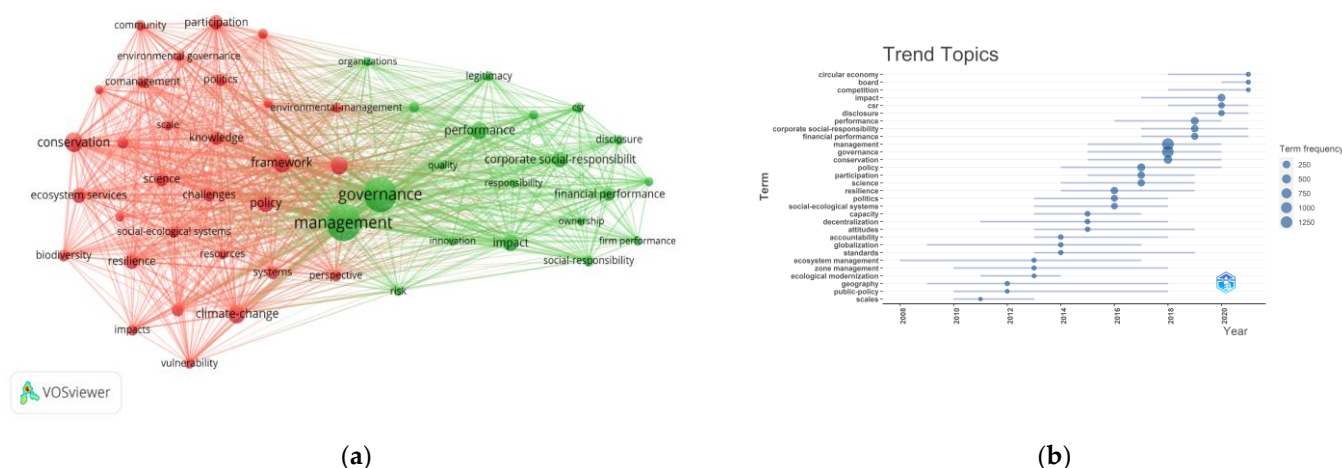

(**a**)　　　　　　　　　　　　　　　　　　　　　　　　(**b**)

Figure 3. (**a**) Clustering of the 50 most frequently used keywords over 20 years and (**b**) The trend topics over the last 20 years.

A bibliographic coupling of the 50 most common keywords was conducted, and the main two clusters are represented by red and green. The red cluster relates to the environment, ecology, and ESGM policies such as conservation, frameworks, co-management, and participation; the main themes were climate change, water, and biodiversity. The green clusters were mainly related to the strategic aspects of business operations, such as impact,

performance, CSR, and legitimacy discussion. Among the aforementioned themes, CSR, financial performance, and social responsibility were the main ones. Table 2 shows the main keyword clusters obtained using VOSviewer.

Table 2. Main keyword clusters obtained using VOSviewer.

Cluster (Items)	Keywords in a VOSviewer Network
Red (30)	Conservation, framework, sustainability, climate change, policy, ecosystem services, resilience, participation, science, knowledge, challenges, systems, adaptation, politics, lessons, co-management, biodiversity, impacts, social-ecological systems, community, environmental management, vulnerability, institutions, resources, scale, water, environmental governance, decision-making, perceptions, and natural resource management.
Green (20)	Management, governance, performance, impact, financial performance, corporate social responsibility, social responsibility, CSR, information, disclosure, legitimacy, determinants, risk, firm performance, organizations, quality, innovation, ownership, responsibility, and environmental performance.

"Keyword plus" refers to all the reference titles of the article reviewed by the WoS editing team, which selected the relevant keywords not listed by the author or the journal of publication. Figure 3b is a trend topic chart revealing the relevance and development of keyword plus in a particular research field. The chart is composed of an intuitive situation and lists the top three trends related to major research topics each year. Ecosystem management was the main focus from 2008 to 2018. Management, governance, and conservation were the most widely discussed topics in 2018. In 2021, the main topics were financial performance, disclosure, CSR, competition, management boards, and the circular economy. Discussions of the management board theme started in 2020 because a company's board of directors affects management and decision-making related to CSR, ESG, and financial performance [30]. The COVID-19 outbreak in November 2019 sparked the most heated discussions on impact, csr, and disclosure in 2020. In 2021, due to the intensification of the greenhouse effect and the impact of climate change (e.g. extreme climates, Arctic ice melting, high temperatures, floods, etc.), humans started to discuss the circular economy again, trying to reduce the use of earth's resources to reduce greenhouse gas emissions. In addition, in the face of great changes in the external environment, people's discussion of impact has also turned to disclosure and CSR. In other words, the internal resilience and adaptive disclosure of sustainable management systems have become the main topics in the study of sustainable organizations, and these topics are already related to corporate competition and belong to the board of directors. This is also the hottest topic of discussion in 2021: circular economy, boards, and competition.

3.3. Most Cited Documents

The most cited document is an important metric because it highlights the most impactful and intensively researched topics. Table 3 presents the 10 most cited articles related to ESGM from 2002 to 2021. These articles were submitted to journals in SCIE and SCI; most of the articles (about 70%) that appeared in the rankings focused on environmental science, society, and ecology.

The top four studies explored resilience and the adaptive management of social ecosystems. According to Folke, who discussed the origin and development of resilience, it is a branch of ecology that inspires social and environmental scientists to challenge the stable and balanced views held by those in dominant positions (first place, 3604 citations) [31]. Two useful tools for building resilience in social ecosystems are structured scenarios and proactive adaptive management. These tools must be flexible and open-ended; they must also integrate institutions into multilevel governance systems to achieve learning and improve adaptability (second place, 1476 citations) [32]. Adger noted that with the extreme weather risks caused by climate change, the adaptability of society depends on its capacity to engage in collective action and accumulate social capital (third place, 1283 citations) [33]. Nelson, Adger, and Brown noted that resilience is systems-oriented; resilience enables a network of autonomous actions and social capital to be harnessed, and the capacity to

adapt is a core feature of social ecosystems (fourth place, 1113 citations) [34]. With the growing severity of climate change, resilience management and adaptive management are essential to the promotion of ESGM, as are systematic and dynamic perspectives [35].

The articles ranked fifth and seventh explored the co-management of ESG-related challenges; one of these studies demonstrated the development of an adaptive co-management system using Sweden and Canada as examples. It explored how local communities organize through social networks, manage ecosystems, learn collaboratively, and increase their resilience to change. Their social networks connect institutions and organizations of various sizes and facilitate the flow of information (fifth place, 1077 citations).

Lemos and Agrawal reviewed a document on environmental governance and noted that mixed environmental governance, which involves the combined management efforts of public institutions and private partners, represents a strong commitment to change and the alleviation of environmental damage (seventh place, 917th citations) [36]. Successful ESGM requires co-management efforts and a move away from localism; the ecological environment must be the main focus.

The articles ranked sixth, eighth, and ninth have the same research topic: participation in ESGM activities. The document ranked sixth (1042 citations) and described how CSR increases accessibility to financing and investment. Stakeholder engagement and transparency are crucial for corporate capital management [37]. The authors of the document ranked eighth (865 citations) proposed a systematic framework for identifying barriers to adaptation to climate change; the framework involves planning adaptation processes and focuses on potentially challenging and barriers, helping participants identify obstacles and providing a systematic assessment of key issues supporting climate change adaptation at all levels [38]. The authors of the document, which ranked ninth (with 858 citations) reviewed the literature on citizen engagement and community participation, and they proposed using a new approach to guide policymakers in selecting a decision-making process tailored to the needs of the community [39]. Participation is central to improving ESGM.

In the document ranked tenth (841 citations), the researchers indicated that ecological and environmental problems caused by human activity have severely affected the environment. These problems on Earth could affect other planets because the risk of crossing thresholds will trigger nonlinear, planetary-scale systems within Earth-scale systems and cause sudden, major changes in the environment. Humanity faces three major problems: climate change, rapid biodiversity loss, and changes in the global carbon cycle [40]. These problems are the main motivation for promoting ESGM.

Table 3. The top 10 most cited articles in ESGM research over the last 20 years.

Ranking	Title	Journal	Year	Citations
1	Resilience: The emergence of a perspective for social—ecological systems analyses	Global Environmental Change: Human and Policy Dimensions	2006	3604
2	Resilience and sustainable development: Building adaptive capacity in a world of transformations	Ambio	2002	1470
3	Social capital, collective action, and adaptation to climate change	Economic Geography	2003	1281
4	Adaptation to environmental change: contributions of a resilience framework	Annual Review of Environment and Resources	2007	1113
5	Adaptive co-management for building resilience in social-ecological systems	Environmental Management	2004	1076
6	Corporate Social Responsibility and Access to Finance	Strategic Management Journal	2014	1036
7	Environmental governance	Annual Review of Environment and Resources	2006	916
8	A framework to diagnose barriers to climate change adaptation	Proceedings of the National Academy of Sciences of the United States of America	2010	865
9	Citizen participation in decision making: Is it worth the effort?	Public Administration Review	2004	856
10	Planetary Boundaries: Exploring the Safe Operating Space for Humanity	Ecology and Society	2009	818

3.4. Network of Most Productive Authors

Figure 4a illustrates the author network; the number of citations per author was used to determine the size of the network circle; a larger size indicates higher importance. The lines between researchers represent the number of coauthor links, and the distance between two authors was determined by the strength of their relationship. In the visualization of data on 40 authors, six clusters were noted: (1) red, 11 authors; (2) green, 9 authors; (3) blue, 7 authors; (4) yellow, 6 authors; (5) purple, 4 authors; and (6) light blue, 3 authors. The most cited authors in each cluster were Folke (3998 citations), Bodin (2095 citations), Brown (1782 citations), Armitage (1640 citations), Plummer (1367 citations), and Bennett (1171 citations). In the following paragraphs, with consideration of the relevance indications on the WoS database, the most relevant documents in three more clusters are discussed. In addition, the most frequently referenced keyword cluster was introduced.

The red cluster (Figure 4a) represents research on co-management, adaptive management, collaborative management, social learning, and collective action. The most relevant document in this cluster was on research steps for exploring co-management [41]. Some of the main factors related to adaptive co-management are deliberation, vision, social capital accumulation, trust, and governance systems; capacity is increased through networks and partnerships, as well as a social learning cycle of action–reflection–action [42]. Those involved in co-management must reinforce knowledge learning amid uncertainty and environmental change, and they must learn how to adapt to new environments [43]. The promotion of collaborative approaches improves social and institutional learning; related outcomes are adaptive management, collaborative learning networks, and knowledge coproduction [44]. This study highlights a new strategy related to ESGM. Under certain operating conditions, this strategy can be applied in businesses, communities, and national and international institutions.

The green cluster (Figure 4a) relates to research on social networks, conservation-related social science, environmental social science, conservation science, social–ecological systems, and complex multilevel systems. Social networks bring different stakeholders together to discuss issues related to natural resources; however, in different social networks, structural differences remain in relationship density, cohesion, subgroup interconnectivity, and network concentration [45]. Interdisciplinary research on collaborative networks has revealed that such networks have a substantial effect on individuals' ability to solve various environmental problems [46]. Social network analysis (SNA) is a new framework for understanding the family livelihood combination [47,48]. Increased attention has been devoted to ensuring that governance institutions align with and adapt to ecosystems and cross-scale structures [49]. The blue cluster (Figure 4a) represents studies on resilience, adaptive capacity, transformation, community empowerment, decentralization, and devolution. Resilience is the capacity to buffer change, learn, and develop as a framework for understanding how to sustain and enhance adaptive capacity in a complex world of rapid transformations. Two useful tools for building resilience in social-ecological systems are structured scenarios and active adaptive management [31]. ESGM involves using resilience to change, learn, and develop [32]. The social impact of cross-border interactions depends on the resilience of the societies involved [40]. The protection of water resources improves the resilience of social ecosystems; these systems protect human well-being by avoiding major regime shifts and ensuring stable environmental conditions [50].

The red cluster represents research on implementation aspects related to co-management, adaptation management, and negotiation management. The blue cluster represents research on resilience. The green cluster relates to research on social networks and social ecosystems. Evidently, in the ESGM field, authors are using multidisciplinary research and applying new technologies to study energy.
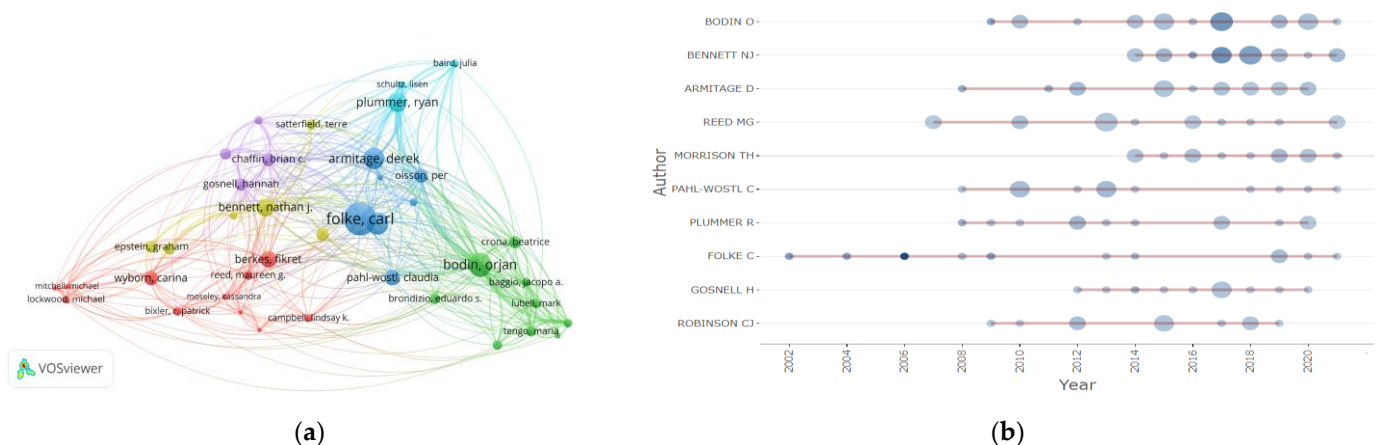
(**a**)　　　　　　　　　　　　　　　　　　　　　(**b**)

Figure 4. Author-based bibliometric analysis. (**a**) A network of the 40 most productive authors, and (**b**) The top 15 authors' research output over the past 20 years.

Figure 4b presents the output of the top 15 authors over tha past 20 years; the circle reveals the number of articles. The larger the circle, the greater the number of articles. Color represents the total number of citations per year; the darker the color is, the larger the number of citations is. Bodin (Stockholm University, Sweden) was the most productive author from 2009 to 2021, with large numbers of citations in 2015, 2017, and 2020 and the most papers published (19; 2095 citations). The most productive author in 2018 was Bennett (University of British Columbia, Canada; 14 articles). Armitage had the most publications in 2015. Reed (University of Saskatchewan, Canada) published the most studies in 2013. Folke (Stockholm University, Sweden) published seven studies from 2002 to 2021 but was the most cited author (3998 citations), demonstrating the value of their studies.

3.5. Bibliometric Research Related to Journals, Institutions, and Countries

Figure 5a presents the 80 most common journals for literature on ESGM. The journal network was established on the basis of bibliographic coupling, and the relevance of projects was determined by the number of references shared by them. On the basis of the number of documents published on ESGM per publication, the one ranked first is Sustainability, the second is Ecology and Society, and the third is the Journal of Cleaner Production. In terms of number of citations, Global Environmental Change–Human and Policy Dimensions ranked first, and Ecology and Society ranked second. Figure 5a presents clusters of journals; the largest cluster is the red one (22 journals), which features the most important journal: Sustainability. In addition, smaller clusters, namely the green (21 journals), blue (21 journals), yellow (15 journals), and purple (1 journal) clusters, are present. The most crucial research connections in each cluster can be determined on the basis of the scope of relevant journals.

Figure 5b. The three-field plot analysis was conducted using R. It reveals the relationship among three domains, namely, journal, keyword, and an author's research institution. Sustainability was the most prominent journal and had the strongest relationship with the following keywords: management, governance, climate change, and conservation. The research institutions that had the most articles published were Stockholm University (ranked first), the University of British Columbia (ranked second), and the University of Queensland (ranked third; Table 1).

(**a**)

(**b**)

Figure 5. (**a**) The 30 most expressive journals of publications related to ESGM, (**b**) The 30 most expressive research institutions of publications related to ESGM.

Figure 6 presents the 50 most productive countries in terms of ESGM research. The most productive countries were the United States (913 articles), England (521 articles), Australia (479 articles), Canada (397 articles), and China (299 articles; Table 1). The distribution of the first three clusters is as follows: Cluster 1 (13 countries and 1170 articles, cited 43,801 times): Germany, The Netherlands, Scotland, Finland, Norway, Denmark, Portugal, Austria, Belgium, Poland, Greece, Romania, and Ireland (red clusters); Cluster 2 (11 countries and 1610 articles, cited 51,060 times; green cluster): England, the People's Republic of China, Spain, Italy, Brazil, India, South Korea, Malaysia, Taiwan, Wales, and Vietnam; Cluster 3 (10 countries and 2260 articles, cited 106,052 times); the United States, Australia, Canada, Sweden, Mexico, Japan, Chile, Thailand, Argentina, and Kenya (blue cluster) (see Table 4). The graph accounts for the number of coauthored studies to determine the relevance of each country.
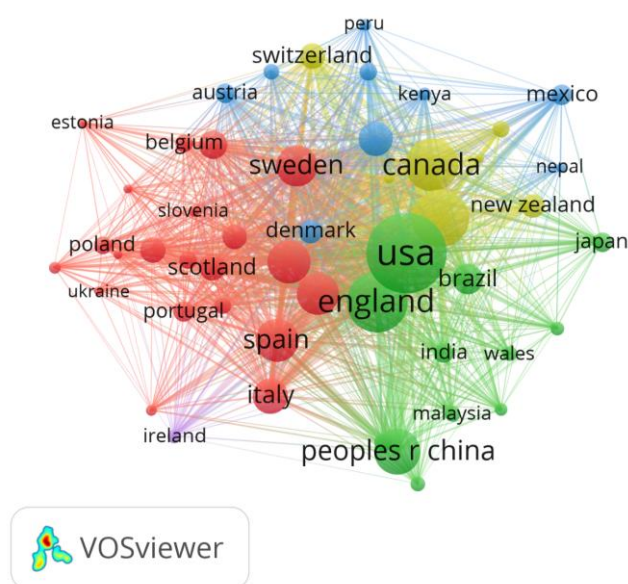

Figure 6. The 50 most expressive countries in ESGM research over the last 20 years.

Table 4. Relationships among countries, articles, and citations in the cluster.

Cluster	Countries	Articles	Cited (Frequency of Times)
1	Germany, The Netherlands, Scotland, Finland, Norway, Denmark, Portugal, Austria, Belgium, Poland, Greece, Romania, Ireland	1170	43,801
2	England, Peoples Republic China, Spain, Italy, Brazil, India, South Korea, Malaysia, Taiwan, Wales, Vietnam	1610	51,060
3	USA, Australia, Canada, Sweden, Mexico, Japan, Chile, Thailand, Argentina, Kenya	2260	106,052

3.6. ESGM Research Trends

Through a timeline visualization in CiteSpace depicting clusters horizontally (Figure 7) and an analysis of the cluster labels of each cluster and the studies ranked in these clusters, the present study revealed that the ESGM research trend hotspots are mainly focused on the following five topics: #0 financial performance, #1 adaptive governance, #2 property rights, #3 SDGs, and #4 corporate governance.

The largest cluster, namely financial performance (cluster #0), is associated with the rapid growth in socially responsible investment over the past decade and global industrial operations, reflecting the growing awareness of social, environmental, ethical, and corporate governance among investors. The correlation between ESGM and financial performance has become a key consideration for investors [51]. The adoption of CSR proposals leads to increased revenue and excellent financial performance; such proposals can increase enterprise value [52]. Credit rating agencies give higher ratings to companies with better CSR and financial performance [53]. Wang and Sarkis searched Bloomberg's database on CSR governance and related outcomes, and they extracted financial performance data from the COMPUSTAT database by using an observation sample of the top 500 green companies in the United States from 2009 to 2013. CSR outcomes mediate the relationship between CSR governance and financial performance [53]. Most related studies have concluded that ESG is positively correlated with financial performance, but others have concluded that no significant relationship exists between ESG and financial performance [54].

In the United States, federal regulation and taxation are the only viable means of encouraging companies to invest in efforts to mitigate climate change [55]. Through ESGM, the production performance of the agriculture and animal husbandry industries can be improved; these industries account for 14.5% of New Zealand's greenhouse gas emissions because cows emit methane and nitrous oxide through flatulence. Studies have demonstrated that if the health of dairy cows can be improved, their methane emissions can be reduced. This can reduce the carbon footprint of milk production and increase the profitability of the dairy industry. This synergy depends on improved livestock management productivity and feeding methods [56]. In addition, in a study on the relationship between greenhouse gas emissions and the financial performance of Australian companies, an analysis of data pertaining to 69 Australian-listed companies revealed a positive correlation between greenhouse gas emissions and corporate financial performance [57]. Studies have demonstrated that Australian public firms' (its dominant industry is mining) commitments to voluntarily reduce greenhouse gas emissions are in direct conflict with corporate values and financial performance goals. Although a positive correlation exists between greenhouse gas emissions and the financial performance of the aforementioned companies (mining), carbon emissions can also be reduced through effective planning and the improvement of production models; increased production capacity will ensure satisfactory financial performance and reduce greenhouse gas emissions [58–61].

Adaptive governance (cluster #1) is a form of corporate governance that involves responding to environmental changes. In the face of environmental uncertainty, scholars are increasingly calling for the adoption of a coordinated resource management system [62]. Climate change and demographic changes have forced people to rethink how governments manage environmental resources, and the concept of adaptive governance has become key

for resource management in the face of the complexity and uncertainty associated with rapid environmental change [63–65].

Environmental projects have identified how and under which conditions collaboration in environmentally sustainable projects is considered effective for adaptive governance in social-ecological systems. Diversity in visions and approaches is valued, and resources that stimulate creativity in social arrangements and environmental practices enable collaboration in environmental projects, increasing the effectiveness of adaptive governance solutions [66]. The agricultural industry requires greater resilience to deal with economic, environmental, social, and institutional challenges and persevere through appropriate adaptive governance [67]. Edwards et al. focused on the value and application of role-playing games to solve complex problems. These games involved environmental, social, cultural, and economic challenges, and the authors investigated the extent to which they could inform adaptive governance solutions [68]. Hurlbert and Gupta developed institutional and analytical models for adaptive governance that enable a redesign of assessment tools through interdisciplinary interactions between agriculture workers and policymakers; these authors reviewed climate change scenarios and identified the key dimensions of adaptive governance [69]. Adaptive governance, as a response to problems caused by extreme weather events, requires the accumulation of ESGM experience and practice [70,71].

From a legal perspective, property rights can be used to explore the relationship between resources and humans; certain environmental resources are considered to have established environmental rights and are not affected by the system [72]. The protection of these rights is the responsibility of governments entrusted by the people. The protection of these environmental rights can involve enterprises; for example, sustainable ocean governance and investment can help protect coral reefs and fishery resources [73]. However, a new framework corresponding to environmental issues is required, and it should ensure robust environmental property rights, expand the use of economic incentives and market-based regulatory strategies, and redefine social norms pertaining to the environment [74]. Furthermore, financial instruments can be used to achieve policy objectives related to the promotion of environmental issues [75]. Langemeyer et al. proposed three changes to the property system of natural resources, they focused on the right to use, control, and have authority, and they proposed a framework for distinguishing eight types of property rights [76]. Intellectual property rights influence sustainable development, and although patents provide a strong economic incentive for innovation, they limit the further commercialization of patented materials or technologies, thereby hindering global progress [77–79].

SDGs (cluster #3) can be divided into environmental, social, and economic goals; these goals affect each other, and sustainable progress at the economic level cannot be achieved without progress at the environmental and social levels. To achieve SDGs, on the basis of risk assessments, managers within a firm propose plan adjustments, formulate new plans, and implement these plans to obtain the approval of the firm's board of directors [80]. Exploring transformative innovation policies related to SDGs is a priority in ESGD [81]. The importance of land increases as efforts are made to achieve SDGs related to food, health, water, and climate. Multifunctional planning within soil and water system boundaries is required to avoid further land degradation and promote land restoration [82]. The pursuit of SDGs is interdisciplinary, and a firm's financial and nonfinancial reporting mechanisms reveal links between SDGs and the field of accounting [83]. SDGs are global goals for innovation; companies are expected to play a key role through sustainable practices. Companies can participate in sustainable practices if the boards of directors make sustainability a key goal. These practices may include the participation of institutions, organizations, and individuals in co-management and sharing [84]. Global supply chains play a key role in the environmental, social, and economic functioning identified in the SDGs [85], and these chains create ESGM value.

The relationship between corporate governance (CG; cluster #4) and corporate environmental innovation is more significant in industries with lower carbon emission costs and

less dependence on energy inputs [86]. The emphasis on environmental risk management by boards of directors, independent directors, and board chairs is positively correlated with CG performance [87]. The link between the sustainability commitments of small and medium-sized enterprises and access to financing is relevant to this study [88]. Artificial intelligence has achieved substantial innovation and affected company operations and management; it has a strong role in promoting improvements in CG [89]. Carbon emissions have been identified as a major contributor to global warming, and the challenges posed by climate change-induced extreme weather events must be highlighted [90]. For a board of directors, gender diversity, independence, and the establishment of a sustainable environment committee play crucial roles in reducing carbon emissions [91]. In the face of climate change and increased carbon emissions, corporate governance has a key strategic role in environmental protection.

In the past 20 years, the major changes experienced by businesses were the dot-com bubble, financial crises, extreme weather events, and the COVID-19 pandemic. In the face of such crises, the maintenance of financial performance is particularly vital. How to persevere during crises is a crucial topic for enterprises. During such crises, the discussion of relevant laws is necessary, and SDGs should be formulated. These actions can indicate that companies actively deal with challenges and formulate strategies related to CG.
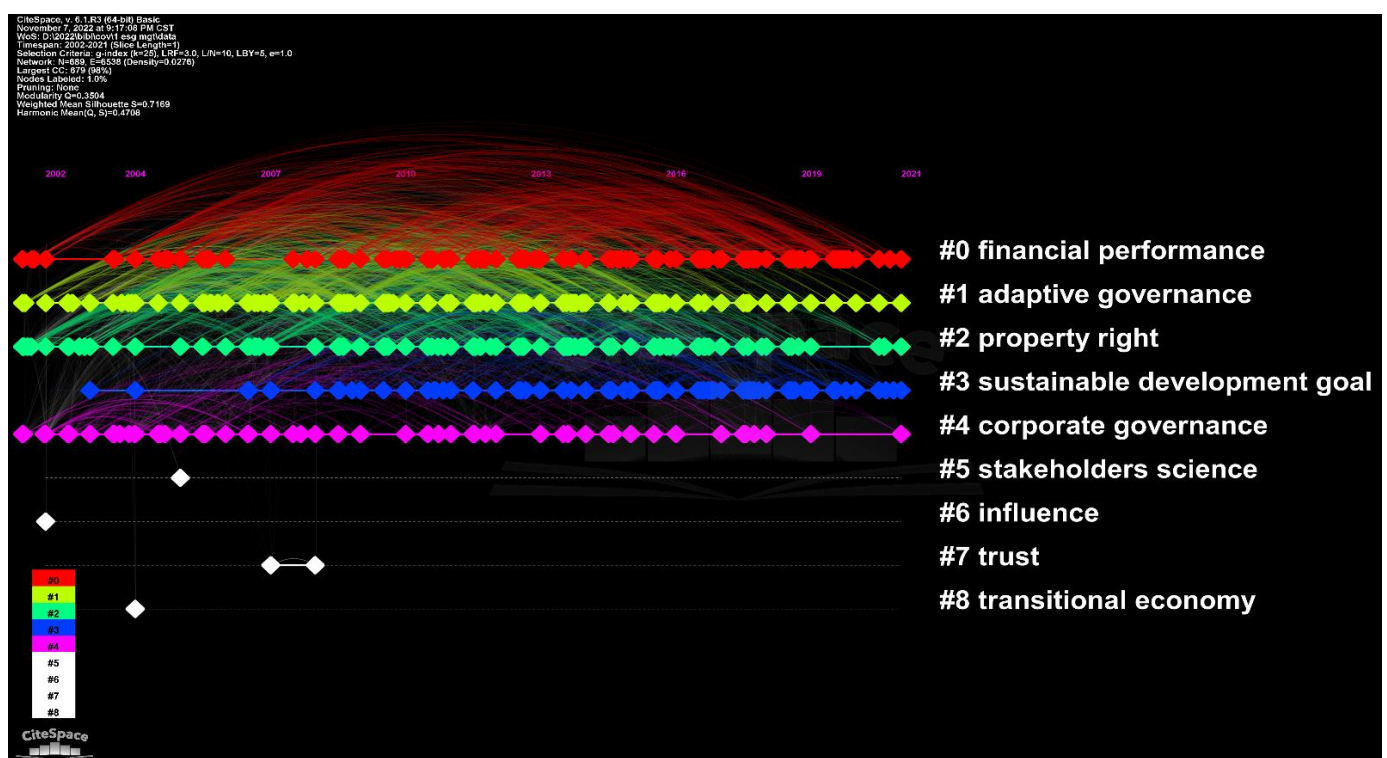

Figure 7. Trend paths in the studies of ESGM research.

4. Conclusions

This bibliometric study explored developments and trends in the 20 years of ESGM research; it conducted a scientific analysis of how ESGM has been used for protecting the environment, improving business performance, and rebuilding value. According to Bibliometrix, the number of studies from 2017 to 2021 accounted for almost 63% of all ESGM studies in these 20 years, and the number of such studies will continue to increase. Environmental sciences and ecology (60.96%) and business and economics (20.20%) were the focus of 81% of these studies. Among the keywords analyzed by VOSviewer, management (1299 times) and governance (1215) were the most used, indicating that resilience and co-management are related to governance and decision-making. In the author cluster,

ESGM authors were demonstrated to be active in various fields, and numerous studies have focused on new technologies. The region with the largest number of clusters is Europe, indicating that Europe is the region that attaches the most importance to ESGM worldwide; Australia is home to 5 of the top 10 research institutions, indicating that Australia attaches great importance to ESGM research.

Business organizations are facing more and more shocks from all directions, so academia has turned the discussion of shocks to resilience and adaptation. After the impact of climate change and COVID-19, organizations must improve the social adaptability and contingency attitude of employees. Through the discovery of issues and being led by the board of directors to make joint commitments, active participation, joint management, collaborative learning, and cohesion of the team via social network contacts, the team will collectively cooperate and assist the government in epidemic prevention and disaster management. Also, organizations must think about the investment in sustainable human resource management (S-HRM) in order to face future normality or complex climate or environmental issues, but the establishment and research of related systems still need to be researched by academia.

Finally, the key ESGM research trends identified through a CiteSpace analysis are global performance, adaptive governance, property rights, SDGs, and corporate governance. Global research, surveys, analyses of ESGM practices, carbon emission reductions, and resource applications were key research focuses. In short, research on ESGM is multidisciplinary, suggesting that the development of multiple research areas is critical to the maturation of ESGM research. Finally, in addition to the involvement of institutions, organizations, and individuals, co-management and the combined efforts of public and private institutions can strengthen ESGM and result in a sustainable, green, and innovative business ecosystem. The development trend of ESGM is mainly based on financial performance, but investors and consumers are paying more and more attention to the relationship between CSR and financial performance. Therefore, organizations can no longer focus on investors' profits, but on the interests of the whole society, and safety is the main business direction. In addition, in the face of the complexity and uncertainty of the rapid changes in the external environment of the organization, the topic of organizational adaptation must start from the governance level and integrate resources to implement. The property rights system promotes innovative environmental protection actions and is also an important bridge for organizations to invest in assisting the government. Taking COVID-19 as an example, travelers must cooperate with epidemic prevention in collective quarantine sites. However, due to the large number of passengers, the collective quarantine sites cannot accommodate so many people, resulting in a decline in quality and affecting travelers' impressions of the country. The government has established specialized quarantine hotels to accommodate transit travelers, and have set up quarantine taxis to replace ambulance deliveries. In this case, the government expanded the property rights of hotels and taxis to use them for epidemic prevention and delegated part of the operating power to the organization. Through short-term professional training, in addition to solving the government's problems, it also brings benefits to the organization, successfully balancing social responsibility and organizational performance. In addition, for the organization, the commitment of employees is particularly important, especially in the case of the young employees. For this reason, the innovative system of becoming a manager through stock options and shareholding can promote employees' recognition and participation so that the organization can operate more smoothly.

The acronym for ESG first appeared in the "WHO CARES WINS" report published by the United Nations. In the report, it is proposed that enterprises should incorporate "environment", "social responsibility" and "corporate governance" into the evaluation benchmarks of enterprise operations. These have become important factors for enterprises to dedicate to management, decision-making, and investment. This research is limited to the discussion in the field of "ESG management" which is more limited than the field of "sustainable management". The analysis data is taken from the WoS core database and

is limited to data in a more academic way, lacking real-time information in the industry. Due to the limitations of research data, which affect the wider discussion of SDGs, it can focus more on the presentation of corporate's ESGM issues. Through the collection of forward-looking information in academia, more accurate trend analysis can be carried out, providing a more worthy reference for academic research and development and industrial development towards sustainability, creating ESG-sustainable organizations, and creating greater value.

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