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Research in ESG and Sustainability: Bibliometric Mapping of the Domain

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Abstract:

The integration of Environmental, Social, and Governance (ESG) into sustainability has become a popular topic in research and business, yet collaborative research on this topic remains relatively new and understudied. To gain a deeper understanding of the ESG landscape in business research and its impact on sustainability, this article aims to analyze the current literature, present the current state of knowledge, key trends, and future prospects for this topic, and provide an in-depth synthesis of all published research papers. This will provide valuable insights for researchers, the business community, and regulatory bodies, and open up alternative research paths for aspiring researchers. Using the Scopus database for the period (2014-2025), we found that 1,888 final articles were published in English. After analyzing bibliometric performance indicators, such as the annual trend in the number of articles produced, countries, journals, authors, and research institutions, we arrived at the following set of results: a steady and noticeable increase in the number of published articles, especially since 2020, i.e., after the COVID-19 crisis. China is a leader in this field, and Sustainability Switzerland is the journal with the highest number of research contributions. Regarding research institutions, Sapienza Università di Roma from Italy is the best contributor. Regarding authors, Buallay Amina Mohammed from Bahrain is the most published author. After mapping, using the co-occurrence network of key keywords, four main clusters related to this topic were identified: CSR and Sustainability, Risk Management, Financial Performance, and Sustainable Development, Environmental, and Innovation. This review concludes by presenting a roadmap that includes emerging research paths that can be explored in depth in future studies to promote better and more comprehensive integration to achieve sustainability and maximize corporate value.

Keywords: ESG - Sustainability - Bibliometric Analysis - Scopus – VOSviewer.

1. INTRODUCTION :

Corporations are increasingly focused on their environmental effect, social responsibilities, and strong governance frameworks that can enhance or solidify their reputation in relation to public opinion, policymakers, and society as a whole. This is due to citizens adopting environmentally friendly consumer practices, preferring products and services that are considered sustainable and socially responsible. These trends are gradually harmonizing, which has prompted regulators and policymakers to focus on the environmental, social, and corporate governance sector to ensure effective mediation, transparency, and certainty [1], [2], [3]. Environmental sustainability, social engagement, and good governance have recently gained increased attention from consumers and investors during the COVID-19 crisis [4]. leading to the emergence of what is known as "Environmental, Social, and Governance (ESG) finance." ESG criteria now influence the actions and decisions of companies, investors, and consumers alike [5]. Sustainability is no longer a luxury commodity, but an absolute necessity [4].In addition, Sustainability is at the core of corporate social responsibility and its associated concepts, as efforts and initiatives implemented in this context are focused on the survival and well-being of all stakeholders involved. Corporate social responsibility has become closely linked to the concepts of sustainability and sustainable development [6], [7]. Environmental, social, and governance aspects have become extremely important and are now an integral part of major business organizations [8] [9] . Also, Corporate Social Responsibility (CSR) is typically linked to the obligation of corporations to foster sustainable economic development at a macro level, whereas corporate sustainability focuses predominantly on the longevity of the corporation itself, which is essential for fulfilling societal expectations of being a "responsible corporate citizen" [10] [11].

Furthermore, ESG encompasses a broad spectrum of concerns pertaining to the environment (e.g., climate change, carbon emissions, energy), social responsibility (e.g., product safety, employee welfare, human rights), and governance (e.g., corruption, board independence, shareholder protection) [12], [13]. Adhering to sustainability principles seeks to apply ESG standards for sustainable development, incorporate circular economy and energy efficiency measures, and ensure accountability to shareholders through transparent sustainability reporting [14]. A paradigm for analysis and application that satisfies stakeholder requirements is founded on the Triple Bottom Line (TBL) framework—Economic (Profitability), Social (Social Responsibility), and Environmental (Ecology) [15][16]. The significance of the ESG paradigm for banking and the economy is escalating swiftly. Both progressive and conventional investors have been monitoring the surge in ESG enthusiasm and are now propelling the demand for a deeper comprehension of ESG performance [10]. This significant interest stems from the fact that a large body of literature has found that companies that better respond to environmental, social, and corporate governance requirements perform better than companies that are not responsible [17], [18]. Similarly, ESG is intrinsically linked to the UN's 17 Sustainable Development Goals (SDGs), since it pertains to methods that foster sustainable development to create value within organizations [19], [20].

Although there is a wealth of literature on the relationship between ESG and sustainability, there is a significant body of research that has not approached this topic from a bibliometric perspective. Therefore, This study offers an overview of the quantity and quality of existing research, identifies dominant trends and methodologies in the literature, and reveals gaps or inadequately covered areas of research. In this regard, Bibliometric analysis offers significant insights into multiple facets of scientific literature, facilitating the identification of the historical progression of publications, pivotal research references, principal subject areas, the evolution of a scientific discipline, and the emergence of burgeoning keywords within the literature. Moreover, it might aid in pinpointing essential components of a research agenda for subsequent inquiries. Through the examination of publishing trends and citation networks, researchers can enhance their comprehension of the knowledge creation process and its influence on the scientific landscape. Bibliometric techniques are especially valuable in decision-making processes concerning research and development strategies and the selection of competent project leaders, utilizing evidence-

based quantitative data from the scientific community [21][22], [23] [24]. Our study covers 1,888 articles that addressed our research topic over a 10-year period (2015-2024), which were extracted from the Scopus database. To conduct the bibliographic analysis, we used the VOSviewer software, version 1.6.20. To achieve this, we can pose the following various research questions:

RQ1: What has been the historical evolution of publications on ESG and Sustainability?

RQ2: Which countries contribute the most to the topic of ESG and Sustainability?

RQ3: What are the main investigative references in ESG and Sustainability?

RQ4: Which institutions are most involved in ESG and Sustainability?

RQ5: Who are the most prominent and involved authors on the topics of ESG and Sustainability?

RQ6: What are the main thematic clusters in the literature on ESG and Sustainability?

RQ7: What are the main elements of the research agenda for future research on ESG and Sustainability?

2. Materials and Methods:

To gain a comprehensive overview of our research area, we turned to the Scopus database. We chose Scopus because it contains a wide variety of peer-reviewed articles, particularly in the social sciences [25], [26], [27] [28]. On January 4, 2025, we included the two keywords "Esg" and "Sustainability" along with logical operators, which connect words to expand or narrow search results, such as "And." Articles were screened by Title, Abstract and Keywords, as follows:

TITLE-ABS
KEY (esg AND sustainability) AND PUBYEAR > 2014 AND PUBYEAR < 2025 AND (LIMI T-TO (SUBJAREA , "BUSI") OR LIMIT-TO (SUBJAREA , "ECON") OR LIMIT-TO (SUBJAREA , "SOCI")) AND (LIMIT-TO (DOCTYPE , "ar")) AND (LIMIT-TO (PUBSTAGE , "final")) AND (LIMIT-TO (SRCTYPE , "j")) AND (LIMIT-TO (LANGUAGE , "English"))

In the first search, we obtained 4427 documents, including articles, papers, Book chapters, Reviews, Books, and Conference reviews for the period 2006-2026. After entering the year filter, for the period from 2015 to 2024, we were left with 3499 documents. Then, we moved on to identifying the Subject areas we would like to focus on, which are specific to economics. We chose 3 areas, which are: Business, Management and Accounting, Economics, Econometrics and Finance, and Social Sciences, to obtain 2751 documents. Then, from the Document Type box, we selected only articles, and we obtained 2037 articles. Then, we entered the Final Publications filter, from which we selected the finally published articles, so we had a sample consisting of 1948 articles. Then, we added the Source Type filter, to select only journals, so we had 1941 articles. Finally, we selected articles published in English only, so we had 1888 final articles ready for bibliometric analysis.

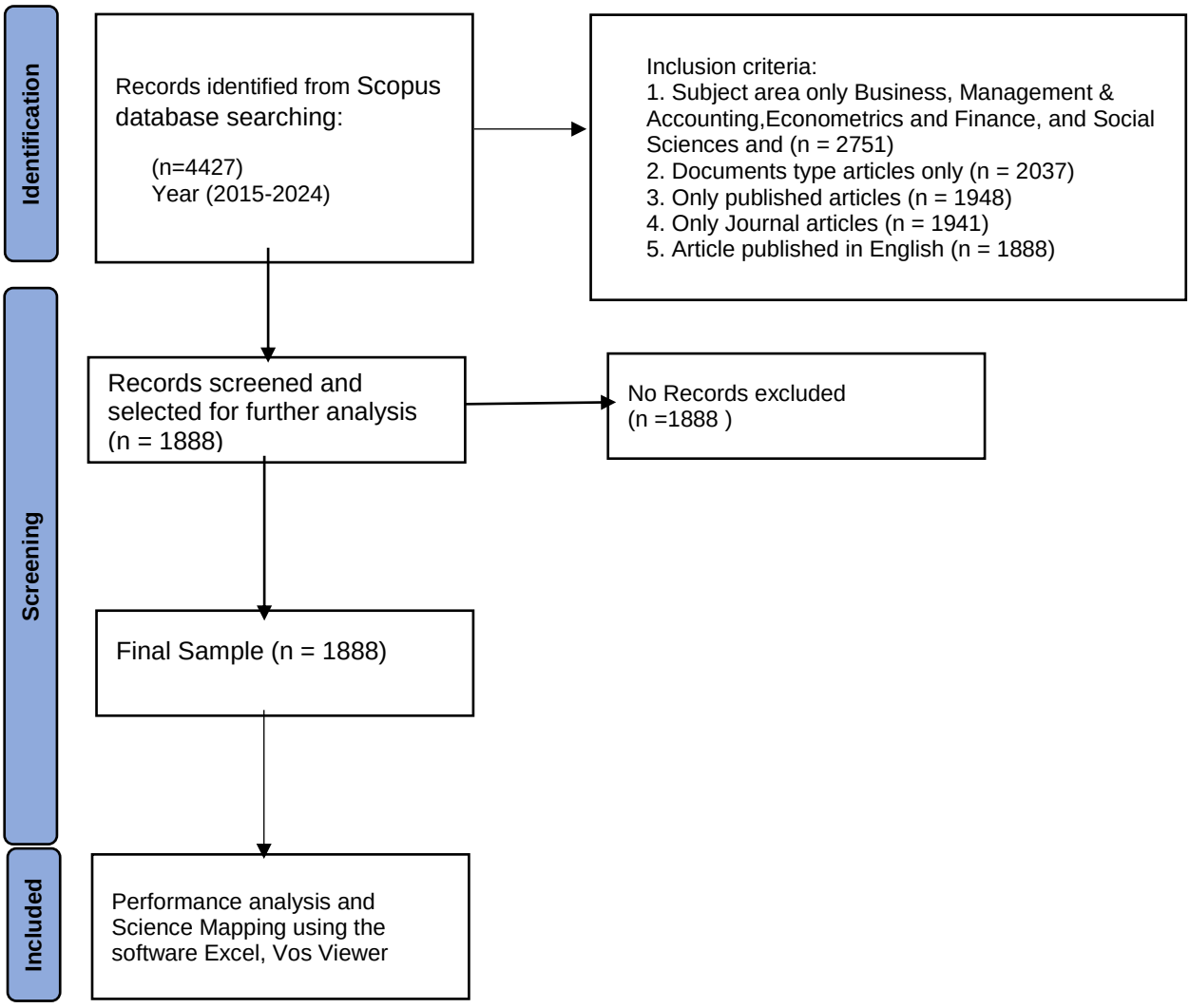
This was executed to furnish an evolutionary overview of the subject. Furthermore, data were obtained from the Scopus database, and article metadata, including title, author, journal, year of publication, keywords, abstracts, citations, academic affiliation, and research funding, were documented based on the information taken from Scopus. Two databases were established: one in Excel format for performance bibliometric analysis and another in CSV format for science mapping analysis utilising VOSviewer version 1.6.20.

Subsequent to the collection and amalgamation of pertinent publications, the following phase involved data analysis utilising bibliometric analysis software, namely VOSviewer. VOSviewer is a widely utilised instrument for the visualisation and analysis of bibliometric networks. It enables researchers to do co-citation analysis, co-authorship analysis,and keyword co-occurrence analysis to ascertain the most influential publications, authors, and keywords in the domain of ESG and sustainability [29][30], [31].

This research study employs a systematic methodology and incorporates a bibliometric analysis of the evolution of academic works pertaining to ESG and sustainability, revealing significant trends and patterns in this field [32]. This comprehensive analysis offers significant insights into the changing ESG and sustainability landscape, along with the principal reasons driving its evolution [33], [34], [35], [36]. This analysis helped us identify the relationships and connections between different keywords and country, providing a deeper understanding of the research on ESG and sustainability.

Figure 1 is a flow chart of this study designed based on the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) statement was created [37].

Figure 1. Prisma framework



Source: Authors compiled from Scopus Database.

3. Results and Analysis

Performance analysis evaluates the efficacy of various scientific entities using a variety of bibliometric indicators derived from publication and citation data, so providing an overarching perspective on the field. This analysis seeks to assess the publication and citation performances of academics, institutions, countries, and journals. Performance analysis entails the evaluation of scientific output based on quality and quantity metrics pertaining to the elements (author, publication, country, institution/university) within the downloaded dataset relevant to the investigated domain. Furthermore, this analysis includes a citation assessment to evaluate the efficacy of the outputs within the pertinent field [38].

3.1 Performance Analysis

3.1.1 Analysis of Publications

Reference Publication Year Spectroscopy (RPYS) is a bibliometric technique utilised to examine the historical origins and evolution of research domains. This method delineates the distribution of publication years for cited references. This research aids in identifying the years that garnered the most attention in a particular field and how this interest has evolved over time, indicating when literature has concentrated in distinct periods [39], [40].

Figure 2. illustrates the annual growth in the number of published articles. Over the past 10 years, 1888 articles were published on the topic of ESG and Sustainability, totaling 188.8 million articles. These articles can be divided into two periods. The first period (2015-2019) witnessed little production on this topic, with the total number of articles not exceeding 120. The second period (2020-2024) witnessed a significant increase in the number of articles, accounting for the majority of the articles (93.64%). Production continued to grow significantly, doubling from year to year, reaching its highest peak in 2024, reaching 827 articles. This remarkable growth can be attributed to the increased interest in this topic during and after the COVID-19 crisis, which highlighted the urgent need for companies to address environmental, social, and governance aspects in order to achieve sustainability. Moreover, the majority of the publications emphasised that corporations, investors, and consumers have clearly redirected their focus towards corporate sustainability issues. The increased interest in this topic is also due to the emergence of a new regulatory regime, the Corporate Sustainability Reporting Directive, in 2021 [8] [41].

The preliminary results indicate that research on ESG and sustainability reporting has experienced a significant annual increase during the examined years, transitioning from a period of "paucity" (2015–2019) to a period of "growth" (2020–2024), which is ongoing. Consequently, it is anticipated to persist in an experimental growth phase for the foreseeable future.

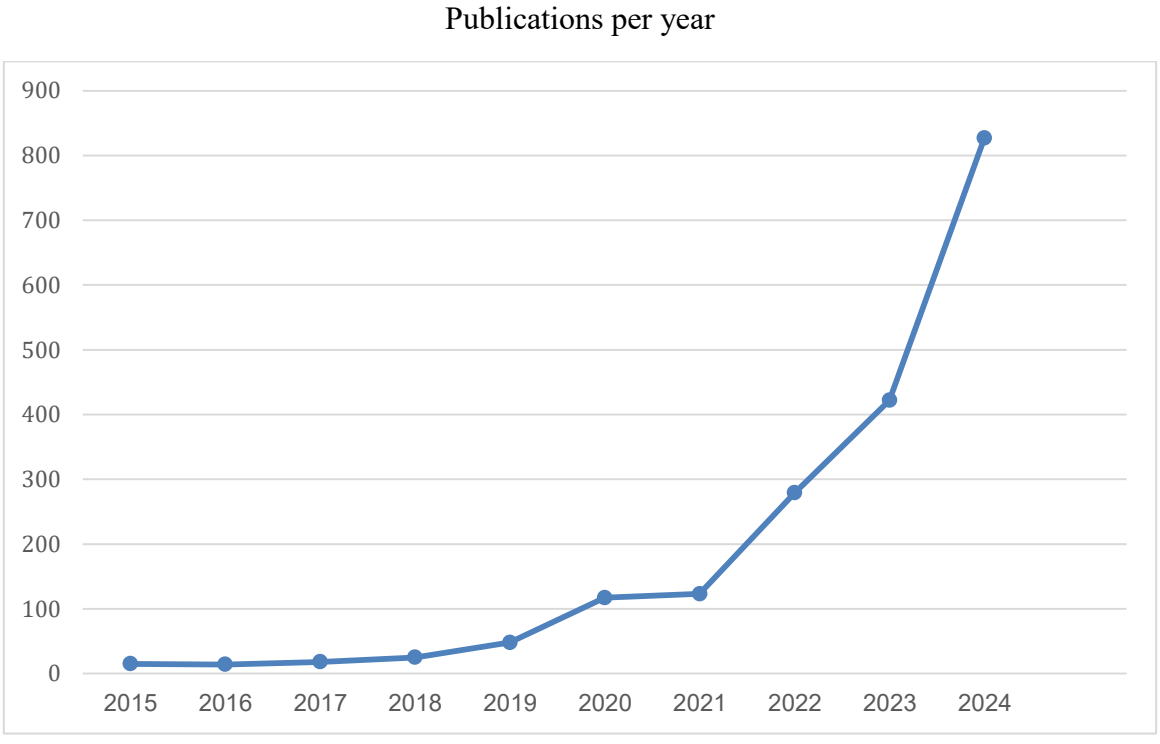


Figure 2. The number of publications on ESG and Sustainability per year.

3.1.2 Analysis of Country

The following table (01) shows the contributions of different countries to global publishing, in terms of the number of articles published per country, accompanied by the total number of citations. This analysis only considered the top 10 countries in terms of productivity on the topic of ESG and Sustainability. These ten countries combined contributed 74.95% of the articles. According to this data, China led the

number of research contributions on this topic, with 240 articles and a total of 5182 citations. China's lead in the number of research publications is due to its challenge to reach the goal of peaking carbon dioxide emissions before 2030 and achieving carbon neutrality before 2060 [42]. Italy followed with 216 articles and a total of 7638 citations, followed by the United States with 203 articles and 8300 citations. In terms of the total number of citations, articles from the United States ranked first with 8300 citations, followed by Italy and the United Kingdom with 7638 and 6928 citations, respectively. As for the highest citation rate, calculated by dividing the total number of citations by the number of articles, Germany recorded the highest number of citations per article (48.67), despite ranking eighth in terms of the number of final articles. Publications from EU member nations, including Germany, Italy, and Spain, garnered substantial citation counts, reflecting the exceptional quality of the outputs of research. In addition, we find that developing and emerging countries are increasingly paying attention to research in the field of ESG and sustainability, with three countries among the top ten countries in research contributions: India, Malaysia, and South Korea, ranked fifth, seventh, and tenth, respectively, with a total of 307 articles. It is also worth noting that 116 countries contributed 1888 articles, of which six countries exceeded the 100-article publishing threshold, as shown in Table (1). Overall, the top ten countries with the largest number of publications span four continents, including several developed and developing countries, demonstrating that ESG and sustainability research is receiving global attention.

Table 01 : Publications per country

Country	Number of Articles	TC	C/A
China	240	5182	21.59
Italy	216	7638	35.36
United States	203	8300	40.89
United Kingdom	162	6928	42.77
India	133	2891	21.74
Spain	110	4405	40.05
Malaysia	96	1764	18.38
Germany	91	4429	48.67
Australia	86	3860	44.88
South Korea	78	1260	16.15

Notes : The table reports the results for productivity and influence of each country. Abbreviations : TC = Total Citations ; C/A = Citations per Articles. Source : Prepared by authors based on Excel.

3.1.3 Analysis of Journal

Table 2 below shows the top 10 journals in terms of their research contributions on the topic of ESG and Sustainability, along with the total number of citations for each journal's articles, their publisher, and their Cite Score and SJR. The journals also identify the most cited articles in each journal, along with the number of citations for each article. Regarding the number of journals contributing to this topic, we found 160 journals. Sustainability Switzerland, published by MDPI, tops the ranking with 321 articles,

representing 17% of the total value of articles published during the period 2015-2024, and 90.93% of the total articles published by the remaining nine journals. It is followed by Corporate Social Responsibility and Environmental Management, published by John Wiley & Sons. It came in second place with 71 research contributions and a total of 3063 citations. Business Strategy and the Environment, which is affiliated with the same publisher as the previous journal (John Wiley & Sons), came in second with 5755 citations and a total of 70 articles. The latter has the highest average number of citations per article (23.7), as well as the highest average for both Cite Score and SJR, reflecting the quality of its research articles. This is reflected in the article [43] that received 721 citations. This high number of citations for this article exceeds the combined citations of two journals that were among the top 10 fields in terms of research contributions. Meanwhile, the number of articles in journals ranked from 4th to 10th ranged between 21 and 44, including 3 journals published by Elsevier. In conclusion to this analysis, it can be said that these ten journals contributed 36.28% of the total number of published articles, and all of them have high rates in terms of Cite Score, as well as SJR.

Table 02 : Top 10 contributing journals

Journal	**Number of Articles**	**TC**	**Publisher**	**CS**	**SJR**	**HCA**	**TCA**
Sustainability Switzerland	321	8104	MDPI	7.7	0.688	[44]	455
Corporate Social Responsibility and Environmental Management	71	3063	John Wiley & Sons	14.7	2.294	[45]	346
Business Strategy and the Environment	70	5755	John Wiley & Sons	23.7	3.609	[43]	721
Journal of Cleaner Production	44	2632	Elsevier	20.7	2.174	[46]	593
Finance Research Letters	39	1030	Elsevier	10.7	1.711	[47]	105
Journal of Sustainable Finance and Investment	31	1312	Taylor & Francis	14.4	1.146	[48]	166
Journal of Risk and Financial Management	31	426	MDPI	5.0	0.480	[49]	141
International Review of Financial Analysis	24	895	Elsevier	11.1	2.288	[50]	446
Resources Policy	22	456	Elsevier	17.0	2.381	[51]	54
Sustainability Accounting Management and Policy Journal	21	1524	Emarald	22	1.449	[52]	323

Notes : The table reports the results for productivity and influence of each journal. Abbreviations : TC = Total Citations ; CS = Cite Score : HCA = Highest Citation Artcile: TCA = Total Citation Artcile. Source : Prepared by authors based on Excel.

3.1.4 Analysis of Institution

The aggregate quantity of research articles disseminated by a nation or institution signifies its scholarly emphasis and general prowess. This analysis offers numerous research advantages, as it can assist researchers in substantiating future proposals for international research and may facilitate the establishment of collaborations among students, instructors, research groups, and even universities [53], [54].

Table 3 presents the top 10 research institutions in terms of their research contributions to articles on ESG and sustainability. A total of 160 research institutions contributed to the publication of 1,888 articles throughout the study period. Sapienza Università di Roma (Italy) led the ranking with 23 articles, totaling 1,051 citations. Universiti Teknologi MARA (Malaysia) followed with 17 articles, totaling 280 citations. The Hong Kong Polytechnic University (Hong Kong), Brunel University London (United Kingdom), and Ahlia University (Bahrain) tied for third place, with 15 articles each, totaling 334, 1012, and 929 citations, respectively. Institutions ranked between 6th and 10th contributed 14 articles each. It's worth noting that the lowest research contribution was 5 articles per institution (out of 51 research institutions that contributed 5 articles each).

Regarding the geographical affiliations of these research institutions, we find that 3 institutions from Italy contributed, which is expected given Italy's second-place ranking in research production, as shown in Table 1. We also find 3 research institutions from Arab countries among the top 10 research institutions. However, a noteworthy point is the absence of research institutions affiliated with the United States of America, despite its third-place ranking in scientific production (see Table 1).

Table 03 : Top 10 contributing Institutions

Institution	Number of Articles	TC	Country
Sapienza Università di Roma	23	1051	Italy
Universiti Teknologi MARA	17	280	Malaysia
The Hong Kong Polytechnic University	15	334	Hong Kong
Brunel University London	15	1012	United Kingdom
Ahlia University	15	929	Bahrain
Capital University of EcoNomics and Business	14	855	China
Università degli studi di Bari Aldo Moro	14	756	Italy
Alma Mater Studiorum Università di Bologna	14	634	Italy
King Faisal University	14	203	Saudi Arabia
University of Sfax	14	478	Tunisia

Notes : The table reports the results for productivity and influence of each institutions. Abbreviations : TC = Total Citations.

3.1.5 Analysis of Author

The study sample included 160 authors from around the world who published 1888 articles on ESG and sustainability. Of these, 21 authors published five or more articles. The top 10 authors, as shown in Table 4, are Buallay, Amina Mohammed, from Bahrain, who published 12 articles. She is the only author to have surpassed 10 published articles. Rezaee, Zabihollah, from the United States, followed with nine articles. Victor Barros, from Portugal, came in third with eight articles. For the authors ranked fourth to tenth, the number of publications ranges from seven to five publications, respectively. Regarding the total number of citations, We find that Rezaee, Zabihollah has the highest number of citations, with his nine articles garnering 949 citations. He is followed by Escrig-Olmedo, Elena from Spain, with 754 citations. The latter has the best average per article cited, which is calculated by dividing the total number of citations by the number of articles. Regarding the h-index, Hussainey, Khaled from the United Kingdom has the highest average, having contributed seven articles with a total of 628 citations. Rezaee, Zabihollah follows with an average of 33 citations. The latter ranked between first and second place in terms of the

total number of articles he published, the total number of citations, the average citation per article, and the h-index, Which reflects the quality of his research. In addition, the top 10 authors in terms of research contributions hail from countries across the five continents, with Europe accounting for 60% of these authors' affiliations. This may be attributed to researchers from this continent's interest in the topic of ESG, who see it as closely linked to sustainability.

Table 04 : Top 10 contributing authors

Author	Number of Articles	TC	C/A	h-index	Country
Buallay, Amina Mohammed	12	753	62.75	25	Bahrain
Rezaee, Zabihollah	09	949	105.44	33	United States
Barros, Victor	08	298	37.25	13	Portugal
Hussainey, Khaled	07	628	89.71	54	United Kingdom
Makarenko, Inna O	07	38	05.43	13	Ukraine
Bax, Karoline	06	104	17.33	08	Germany
Escrig-Olmedo, Elena	06	754	125.67	12	Spain
Zumente, Ilze	06	277	46.17	05	Latvia
Al Amosh, Hamzeh	05	200	40	19	South Africa
Bodhanwala, Ruzbeh J	05	229	45.8	05	India

Notes : The table reports the results for productivity and influence of each authors. Abbreviations: TC = Total Citations ; C/A = Citations per Articles. Source : Prepared by authors based on Excel.

3.2 Science mapping

Network analysis facilitates statistical evaluation of the generated maps to indicate various metrics of the overall network or the relationships and intersections among the identified clusters [55] [56]. Application context Visualisation techniques are employed to depict a scientific map and the outcomes of various analyses [57] [58].

3.2.1 Index Keyword occurence

Conceptual structure analysis is utilised to comprehend the study landscape known as the “research front” and to pinpoint the most significant and contemporary subjects. This study elucidates the conceptual framework of writings pertaining to a certain issue, uncovering its principal themes, subthemes, and interrelations. Factor analysis, a subset of conceptual structure analysis, investigates the interrelationships and configurations among multiple variables in a dataset, condensing these variables into fewer, significant groups or factors [59], [60], [61]. This approach is valuable for identifying different research trends as well as the general structure of a field of study by using keywords through frequency counting [24].

To achieve this ultimate goal in this type of analysis, we entered all records extracted from the Scopus database into VOSviewer. We then included keywords that had a minimum of 20 occurrences, 46 of which exceeded the threshold. This was a total of 1,887 keywords. We then excluded four keywords related to countries, regions, and states: United States, European Union, Europe, and China. This allowed us to conduct a comprehensive analysis, rather than analyzing a specific region or country. This left us with 42 common keywords divided into four main

groups and topics, with 2,418 occurrences, 715 links, and a total correlation strength of 4,430. These keywords are detailed in Table 5 below.

Table 05 : Descriptive summary of each keywords

Keywords	Number of Occurrences	Total Links	Total Link Strength	Keywords	Number of Occurrences	Total Links	Total Link Strength
Cluster 1				Policy Making	22	33	91
Banking	25	29	88	Risk Assessment	45	36	169
Business	30	33	110	Sustainable Development	203	41	619
corporate social responsibility	138	40	454	Sustainable Development Goal	47	36	151
Covid-19	29	32	104	**Cluster 3**			
Financial Market	23	32	99	Carbon Emission	24	30	78
Governance Approach	200	41	756	Climate Change	36	32	118
Investment	87	39	317	Decision Making	49	37	185
Management Practice	30	33	97	Environmental Impact	33	35	128
Performance Assessment	76	40	305	Firm Size	42	37	155
Stakeholder	85	40	320	Green Economy	23	35	99
Stock Market	34	30	131	Manufacturing	21	31	94
Strategic	29	29	116	Market	20	27	80

Approach				Conditions			
Sustainability	443	41	1424	Spatiotemporal Analysis	24	31	78
Cluster 2				Supply Chain Management	22	31	86
Economic Growth	22	32	97	**Cluster 4**			
Environmental Economic	70	40	329	Business Development	21	26	79
Environmental Management	36	36	141	Corporate Strategy	57	38	227
ESG	25	26	91	Emprical Analysis	29	32	122
Finance	53	39	221	Industrial Performance	62	38	263
Finance System	40	39	179	Innovation	47	33	186
investments	27	29	119	Panel Data	26	29	112
Performance	25	28	109	Regression Analysis	38	34	132

Note**.** Source: Prepared by the authors.

The density of the elements also influences the visual depiction of keywords as shown by the numerical value associated with the color. A greater concentration of colors signifies a substantial increase in the search group, whereas a dispersed hue denotes a term with a lesser frequency. This indicates that the search parameters remain constrained and necessitate additional investigation for a potential future study [62], [63]. As shown in Figure 3, the red and green clusters indicate areas of significant academic focus, while the blue and yellow clusters indicate areas of lesser interest but which are beginning to develop as important adjacent fields.

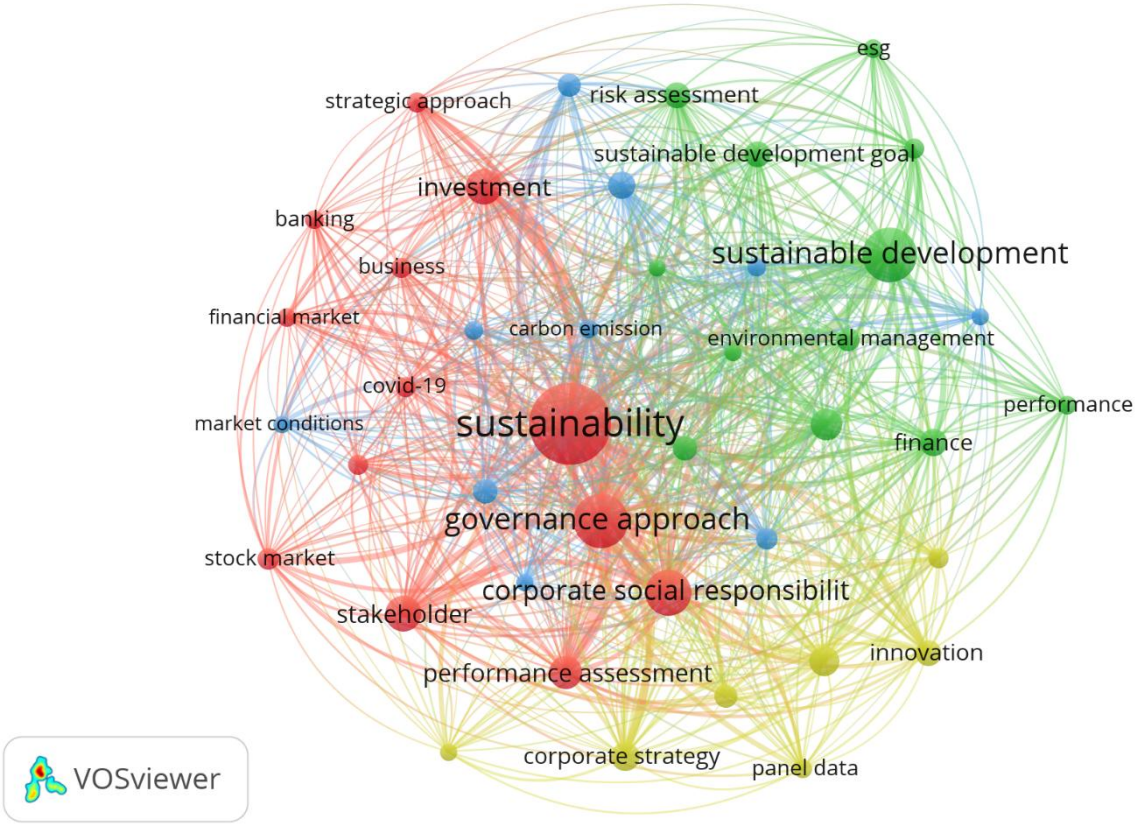


Figure 3. Co-occurrence network of Index keywords.

Cluster 01 : CSR and Sustainability

This cluster consists of 13 common index keywords (Banking, Business, corporate social responsibility, Covid-19, Financial Market, Governance Approach, Investment, Management Practice, Performance Assessment, Stakeholder, Stock Market, Strategic Approach and Sustainability), and this cluster is in red. Its keywords have the highest interconnectedness, cohesion, and most common appearance among them. The most common and frequently appearing index keywords in this cluster are: “corporate social responsibility”, “governance approach”, and “sustainability”. This cluster is related to: CSR and Sustainability.

Interest groups, or stakeholders, have become more assertive and play an increasingly important role, influencing corporate decisions and exerting significant pressure through their demands. Companies have shifted from prioritizing shareholder profits alone to considering societal perceptions of corporate social responsibility and the sustainability of their businesses. Therefore, they must assess the needs and well-being of stakeholders and integrate them into their objectives. The new goal of corporations is no longer economic profit, but rather value creation in a globalized context. Strengthening the two-way communication between organizations and society has become a new challenge for companies. Companies must recognize and acknowledge social movements and issues, and integrate them into their corporate culture [64], [65], [66]. In the United States, the U.S. Securities and Exchange Commission's Investor Advisory Committee has called for companies registered with the SEC to disclose information related to environmental, social, and governance (ESG) concerns that significantly influence investor investment and voting decisions [67], [68], [69]. The European Union's Non-Financial Reporting Directive (NFRD 2014/95/EU) requires large companies and organizations with more than 500 employees to disclose "non-financial and diversity-related information" in their management reports. The NFRD adopts a dual-importance approach, requiring companies to disclose the impact of sustainability issues on their operations and the impacts of their activities on society and the environment [70] [71]. In addition to shareholder value, financial sustainability is critical, especially for risk-averse investors, as it

mitigates refinancing and bankruptcy risks and enhances returns in a constrained and costly capital market [64], [65], [66]. Therefore, to demonstrate improved performance and differentiate themselves to stakeholders, top sustainability performers demonstrate greater adherence to the Sustainable Development Goals (SDGs) [72], [73]. Strong ESG performance will provide a competitive advantage for companies and investors, reflecting a healthy society. Given the sustainable importance of this topic, several international bodies, such as the World Bank and the International Monetary Fund, are devoting significant resources to researching sustainable banking methodologies. These approaches are particularly used in the areas of sustainable finance, corporate governance, and bank management. This has been demonstrated by banks integrating environmental risks and social inequalities into their decision-making processes [74], [75], [76]. This interest has increased, particularly during the COVID-19 crisis[77], [78], [79]. Therefore, companies and banks must adopt a proactive approach by conducting environmental assessments to identify optimal opportunities to achieve the most effective sustainable strategy [80], [81].

Cluster 02 : Risk Management, financial performance, and Sustainable Development

This cluster is less cohesive than the first cluster, but more coherent and cohesive than the third and fourth clusters. This cluster consists of 12 common index keywords: Economic Growth, Environmental Economic, Environmental, Management, ESG, Finance, Finance System, investments, Performance, Policy Making, Risk Assessment, Sustainable Development, and Sustainable Development Goal. The most common index keywords in this cluster are: “Sustainable Development”, “Environmental Economic”, and “Risk Assessment”. This cluster relates to: Risk Management, Sustainable Development, and the financial performance.

Risk management and sustainability are two important elements that must be continuously monitored. Risk management plays a critical role in corporate strategy, impacting financial performance and sustainability [82], [83], [84]. Risk management frameworks are no longer limited to traditional financial risks; they also include sustainability risks, including climate change, reputational issues, and regulatory compliance, which are becoming increasingly important for companies operating in global markets. Integrating sustainability into risk management enables organizations to assess environmental, social, and governance (ESG) risks and implement data-driven strategies to achieve financial and operational resilience [85], [86], [87]. Commitment to sustainability principles aims to integrate ESG criteria to achieve sustainable development by integrating circular economy and energy efficiency technologies, and ensuring accountability to shareholders through transparent sustainability reporting [88], [89]. The analysis and implementation model that meets stakeholder requirements is based on the "Triple Bottom Line" (TBL) framework: economic (profitability), social (social responsibility), and environmental (environment) [43][90]. Effective enterprise risk management consists of five core components: governance, strategy, performance evaluation, and communication, aligned with the company's objectives to provide a comprehensive approach to risk management [85], [91]. Comprehensive risk management frameworks improve transparency and stakeholder engagement, aligned with the company's performance objectives. A company's risk management system must be effective and focused on stakeholder engagement to achieve performance goals. Recent research indicates that incorporating sustainability elements into enterprise risk management frameworks enhances an organization's resilience and mitigates operational risks, thereby enhancing performance and improving efficiency, creating long-term value [92], [93], [94]. It also impacts economic development and raises its levels to higher levels, which is consistent with the Sustainable Development Goals [95], [96], [97].

Cluster 03 : Environmental

This cluster focuses on the environment, and the three most frequently occurring index keywords are: “Decision Making”, “Climate Change” and “Environmental Impact”. This cluster consists of 10 primary index keywords, which have a strong correlation with each other, but are less correlated than the keywords in the previous two clusters. These 10 keywords are: Carbon Emission, Climate Change,

Decision Making, Environmental Impact, Firm Size, Green Economy, Manufacturing, Market Conditions, Spatiotemporal, Analysis, and Supply Chain Management.

Over the past ten years, companies have been forced to comply more stringently in the environmental field due to stakeholders' awareness of climate change and environmental degradation [98], [99].The implementation and practice of carbon management is important for improving corporate value. Carbon management, such as external carbon assurance, carbon communication, and setting carbon reduction targets, has a positive and significant relationship with enhancing a company's market value [100], [101]. Furthermore, corporate value is negatively impacted by increased carbon risk, as carbon management systems mitigate the negative impact of carbon emissions on corporate value. This is demonstrated by the sequestration of greenhouse gases, including carbon dioxide (CO2), which trap heat in the Earth's atmosphere, causing global climate change [102], [103]. Therefore, companies have increasingly used environmental performance as a variable in research, and they increasingly recognize that performance evaluation goes beyond generating profits to include corporate responsibility towards the environment. The results obtained from most studies and research demonstrate a positive and significant relationship between environmental disclosure (ED) and financial performance (FP) [104], [105]. This means that strong environmental disclosure improves financial performance, while weak disclosure weakens it. This is based on the premise that the presence of ED and levels of environmental tracking motivate managers to enhance financial planning by reducing agency costs. This leads to environmental disclosure improving corporate performance. In contrast, as the legitimacy strategy assumes, knowledge disclosure represents a resource and also improves performance [106], [107], [108]. Accordingly, all decisions and the consequences of a company's actions, which affect some or all stakeholders, must be documented and included in activity reports. Corporate social responsibility is an effective tool for strengthening the relationship between environmental disclosure and financial planning for ESG companies, and for building a positive image for them [109] [110]. In conclusion, the researchers suggest that the green economy, characterized by the principles of "environmentally friendly," "low-carbon," and "intensive development," should be included as a strategy to combat global warming and then achieve sustainability [111], [112], [113].

Cluster 04 : Innovation

The analysis results shown in Figure 3 indicate that innovation ranked fourth and last among the clusters identified as the most important topics linking ESG and sustainability. The latter consisted of 7 main index keywords: Business Development, Corporate Strategy, Empirical Analysis, Industrial Performance, Innovation, Panel Data and Regression Analysis. The following three main index keywords emerged: “Industrial Performance”, “Corporate Strategy”, “Innovation”.

Corporate value can be derived from two categories of resources: tangible resources, including capital and assets, and intangible resources, including reputation, intellectual capital, and intellectual property (IP), represented by innovation [114], [115]. Innovation is the tool most companies use to initiate sustainable change, which includes earnings management, corporate social responsibility, accountability, and transparency by adopting innovations that take into account the three dimensions of sustainability[114], [115]. Innovation is also measured by research and development expenditures or technological outputs, such as patents or patent applications [116], [117]. Therefore, innovation is critical to increasing value and expanding the effectiveness of social responsibility by enhancing a company's reputation and capital. The reputation generated by innovation is a tangible and powerful asset in increasing corporate value. Whether green or conventional innovation, both positively impact corporate value [118], [119]. Numerous studies demonstrate that ESG innovation significantly impacts financial results and helps proactively attract environmentally related opportunities [120], [121]. Innovation also positively impacts corporate value when combined with ESG performance, as corporate environmental, social, and governance initiatives have direct positive effects on innovative performance [120], [121], [122]. Thus, increasing corporate value is linked to enhanced social performance. Innovation is classified into two categories:

significant environmental innovation, which enhances corporate value, and traditional innovation, which negatively impacts corporate value by increasing carbon emissions and, consequently, impacts ESG performance [123], [124]. In addition, innovation acts as a catalyst in strengthening the link between ESG performance and business value, thus facilitating the adoption of highly efficient technologies and achieving sustainability. Although investments in eco-innovation and eco-design may negatively impact financial performance in the short term, the return on these investments may exceed the relative cost of the initial investment in the long term [125][126]. Ultimately, it can be emphasized that innovation enhances the importance of ESG performance in increasing business value, particularly in the context of rapid environmental transformations and unforeseen disasters such as COVID-19 [127][128]. Innovation also has the potential to be a valuable tool for sustainable industrial development through investment in research and development and patent development. In this regard, the focus has been on companies operating in the industrial sector, as they are among the main contributors to environmental pollution due to pollutant emissions from production activities [129][130]. Therefore, green innovation is a useful tool for promoting the sustainable success of industry while preserving its environmental benefits [131], [132].

4. Conclusions

In conclusion, this study analyzed the evolution of ESG research and its relationship to sustainability, with the aim of developing a new and comprehensive framework of the key factors influencing ESG performance and its link to sustainability across countries and regions. The results obtained through bibliometric analysis, based on the Scopus database over the past 10 years (2015-2024), revealed significant developments in this topic, particularly after the COVID-19 crisis. This has necessitated the urgent need for companies and banks to adopt ESG rules and allocate a financial envelope for them, which will positively impact their financial performance in the long term (RQ1). Quantitative indicators by country also showed that China and Italy enjoy broad productivity; Quality indicators (article citations) indicated that the United Kingdom and Germany were highly productive (RQ2). Regarding the most productive journals on the topic, the results showed that Sustainability Switzerland, published by MDPI, emerged as the most productive journal with 371 articles out of 1888 produced. However, in terms of CiteScore, Business Strategy and the Environment, published by John Wiley & Sons, emerged as the most productive journal with the highest value (23.7) (RQ3). An analysis of the most contributing institutions showed that Sapienza Università di Roma from Italy topped the rankings, with two (02) institutions from the same country (Italy) among the top 10 contributing institutions (RQ4). The authors' analysis also revealed that researcher Buallay Amina Mohammed from Bahrain was the most contributing researcher, while articles by researcher Escrig-Olmedo Elena from Spain emerged as the best articles in terms of quality (RQ5). This review paper also outlines the intellectual framework and potential emerging themes in the field of ESG impact on sustainability. We analyzed clusters to create a conceptual map of existing knowledge on the topic. Through a common Index keyword analysis, we identified distinct thematic clusters, each representing a set of interconnected terms and ideas in the field of environmental, social, and governance (ESG) and their impact on sustainability. Current scholarly output on the topic is organized into four distinct thematic clusters: CSR and Sustainability as the primary theme; Risk Management, Financial Performance, and Sustainable Development as the secondary theme; Environmental as the third theme; and Innovation as the fourth theme (RQ6).

Regarding the research agenda—the direction of future research based on the main themes derived from the research area—there is a pressing need to expand existing knowledge on concepts such as Governance Approach, Corporate Strategy, Green Economy, Climate Change, and Carbon Emission. In addition, future studies should delve deeper into the topic. Green finance is another distinct academic field that has received significant attention and is closely linked to ESG performance due to its rating and reporting systems. However, future research could address these topics, as each case may present unique characteristics and dynamics that may influence the relationship between variables. Future studies could also integrate literature from related fields such as financial and environmental disclosure (RQ7).

This review possesses both theoretical and practical consequences. Initially, it provides significant insights into the comprehensive effects of this bibliometric analysis on ESG research and its impact on Sustainability. Secondly, it asserts that bibliometric analysis is an effective instrument for understanding the expanding corpus of literature within a certain research domain. We established the protocol for this review, which encompasses performance analysis, and thematic mapping. This explicit methodological framework offers a reproducible blueprint for forthcoming bibliometric research across several fields, enhancing methodological progress. Third, researchers may utilize our study findings to identify appropriate journals for their forthcoming work, acknowledge the most prominent and impactful writers in this domain, consult their publications, and get insights from them. Furthermore, it is crucial to identify the nations and institutions that significantly contribute to the formation of academic partnerships and derive advantages from writers' scholarly experiences. This will advance the research domain and facilitate the interchange of knowledge and innovation. Moreover, it is essential to emphasize significant areas of interest and unexamined subjects, in addition to investigating prospective research approaches within this domain. This review's findings offer crucial evidence about the importance of revealing ESG efforts in augmenting the sustainability and the possible positive influence on investor reactions. This, consequently, aids investors in making more informed investment decisions and enhances their confidence in the organization. This assessment underscores the significance of cultural variation among nations in formulating goals and strategies to fulfill societal aspirations and work objectives, as well as in developing consistent worldwide standards. Fourth, This review paper underscores the significance of publishing ESG information, which is crucial for augmenting the value, reputation, and performance of companies while promoting sustainable development. This study underscores the significance of the research domain and provides a framework for future inquiries to facilitate the ongoing evolution and progress of ESG research.

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Data availability

No data was used for the research described in this paper.

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