

*Original Research*

## **A Bibliometric and Visual Analysis in the Field of Environment, Social and Governance (ESG) Between 2004 and 2021**

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### **Abstract**

Environment, Social and Governance (ESG) has attracted increasing research interest in sustainable management and decision-making in recent years. To further understand the research status and trend, the purpose of this study is to adopt bibliometric and visual methods to analyze the knowledge structure and the evolution path in the research field of ESG. Based on 1735 papers on ESG in the Web of Science Collection database from 2004 to 2021, this study uses CiteSpace and VOSviewer to present a bibliometric overview of publications, citation structure, authors, universities, countries/regions, journals, and keywords that work on this Topic. Results indicate that scholars increasingly regard ESG as an integrated sustainability analysis framework and pay more attention to the connection among its dimensions. According to the growth trend, ESG may remain a hot research topic for the next few years. The USA is the most productive country, followed by England and China. Journals on ESG research with higher effective factors have higher co-citation frequency and publications. And Sustainable development, corporate governance, corporate social responsibility, ESG, and ESG ratings as the research hotspots are presented. Additionally, this study provides an overview of the ESG research trends for future researchers. This may aid researchers in understanding current patterns and future study paths, allowing future authors to perform their studies more successfully.

**Keywords:** ESG, Bibliometric, Visual Analysis, Research Trends, Citespace, VOSviewer.

### **Introduction**

Sustainable development is the general program leading the development of human society. Enterprises are the backbone of sustainable development. However, the behavior of enterprises pursuing profit maximization and reducing environmental and social benefits is increasingly

apparent (Blank, Sgambati & Truelson, 2016). Governments have called enterprises to pay attention to the impact of the overall economy, society and environment while pursuing the maximization of interests, thus providing a good market environment for the sustainable development of society. After nearly 20 years of development, Environment, Social, and Governance (ESG) has gradually become the analytical framework for evaluating the sustainable development of enterprises. The ESG concept has attracted more academic and practical attention in this context.

There is no clear academic definition of ESG. In the 1990s, as the public was concerned about environmental deterioration, investors began considering environmental factors in their investments. In 2001 and 2002, financial fraud scandals broke out in Enron and World Com, which significantly damaged the interests of investors and made investors pay more attention to corporate governance (Williams, 2008). 'Who Cares Wins', written by the United Nations Global Compact, integrated the dimensions of Environmental, Social, and Governance and put forward the ESG concept for the first time in 2004 (The Global Compact, 2004). In 2006, the Principles for Responsible Investment (PRI) required that ESG factors should not only be included in investment decisions but also promote the ESG development of invested entities. Since then, ESG has gradually spread to the world. Global Sustainable Investment Alliance (GSIA) said ESG-related factors have increasingly influenced investors. These factors are not included in traditional corporate financial statements but can affect future returns. The United States and Europe have promulgated ESG-related regulations and policies in recent decades. It puts forward higher standards and requirements for the ESG system to be included in investment decision-making.

Gao, Meng, Gu, Liu & Farrukh (2021) have studied the ESG field using 690 articles from the Scopus database and made profound progress. Aiming to find new pieces of evidence and complement the research conducted by Gao et al. (2021), we further use new data to explore the internal relationship between ESG research among publications, citation structure, authors, universities, countries, journals, author keywords and research trends with bibliometric and visual analysis. Different from the research of Gao et al. (2021), we use 1735 articles from the Web of Science Collection database and employ CiteSpace and VOSviewer to understand the research status and trends in the ESG field. Furthermore, we also get different findings which are more helpful information for future researchers and policymakers. Moreover, ESG has reached a certain level of development which can be seen from the fact that there are 438 articles in 2020 only. It's necessary to identify new potential research trends.

### **Literature Review**

The existing literature mainly studied the relationship between ESG and economic consequences. ESG performance will affect the risks faced by enterprises (Starks, 2009). ESG has an impact on the system risk of enterprises, and this impact is more significant in enterprises with higher product differentiation. The better ESG performance, the lower the company risk (Albuquerque, Koskinen & Zhang, 2017). Enterprises with higher ESG performance are more flexible, and enterprises with higher ESG levels perform better in the 2008 financial crisis, which shows that ESG performance can improve the anti-risk ability of enterprises (Lins, Servaes & Tamayo, 2017). Some papers prove that higher ESG performance has wider investors and will face lower lawsuit risks, eventually leading to lower capital costs (Hong & Kacperczyk, 2009). The impact of ESG performance on the credit rating of corporate bonds

depends on the country where the enterprise is located and the importance it attaches to ESG (Stellner, Klein & Zwergel, 2015). Companies with poor performance in the environment generally have lower credit ratings and lower yields (Seltzer, Starks & Zhu, 2022). ESG can reduce the specific legal risks of the company and have a higher market valuation (Hong & Liskovich, 2015). In addition, some studies have found that ESG rating increases the specific risks of enterprises. When enterprises improve their ESG rating, they lose flexibility, decreasing stakeholder benefits (Becchetti, Ciciretti & Hasan, 2015). According to the different influences of ESG components, the capital cost of enterprises with a poor environment is higher (Chava, 2014). Green enterprises have lower capital costs (Pástor, Stambaugh & Taylor, 2021). The capital cost of green stocks depends on the wealth of unsuspecting investors (Pedersen, Fitzgibbons & Pomorski, 2021). The capital cost of green projects has not decreased (Flammer, 2021).

The influence of ESG on company performance or value is widely researched. According to different measures of performance or value, existing research conclusions mainly include the positive and negative relationship between ESG and company performance or value. The choice of rating agencies impacts portfolio performance constrained by ESG (Aich, Thakur, Nanda, Tripathy & Kim 2021). Overall, the positive correlation between ESG and company performance or value is the mainstream. The country's characteristics impact the ESG, and the legal origin can predict the ESG performance of enterprises better than the political system, social preference and financial performance of enterprises (Liang & Renneboog, 2017). When the CEO of a company is married, it will increase the diversity of the company and the score of employees, thus improving the ESG score of the company (Hegde & Mishra, 2019).

Regarding the influence of ESG on non-financial factors, it not only becomes the evaluation index of financial investment and enterprise management but also displays enterprise innovation, green governance, risk prevention and control. ESG also promotes the performance of green innovation, which plays an intermediary role (Xu, Liu & Shang, 2021). Previous literature is increasing regarding ESG as a sustainability analysis framework and paying more attention to the connection among its dimensions.

As mentioned previously, the Topic of ESG has been studied in the context of bibliometric analysis by Gao et al. (2021). Like other academic studies, the bibliometric analysis could get different results for the data from a different database. Using different retrieval strategies could get more related searches. Furthermore, more potential links could be found through different threshold settings in keyword co-occurrence. Considering these factors, we use 1735 articles from the Web of Science Collection database and employ CiteSpace and VOSviewer to take a bibliometric and visual analysis of the ESG topic and to meet the gaps in the current article's analysis.

### **Objectives and Contributions of this study**

The main objective of this study is to investigate the performance and structure of the ESG literature and aid researchers in understanding current patterns and future study paths. In this regard, we pursue the following objectives: use more new data to reflect the characteristics of the literature; employ Citespace and VOSviewer to present a bibliometric overview in the ESG field; set the different thresholds to identify and describe the hotspots of the subject; find out the transfer of research directions and look for future research opportunities; meet the gaps in the current article's analysis.

Four contributions have been made to this study. First, we describe the evolution process of ESG research and propose an analysis of the highly cited publications, citation structure, authors, journals, universities, and countries. Second, we highlight the understanding of highly cited publications and research hotspots issues in the ESG field, such as sustainable development, corporate governance, corporate social responsibility, ESG and ESG ratings. Thirdly, the relevant papers are analyzed to trace the transfer of research directions and look for future research opportunities. Fourthly, we present a visual analysis that provides a more functional and valuable study for future studies on ESG research.

### **Materials and Methods**

Bibliometric methods offer a convenient and nonreactive tool for studying collaboration in research. Pritchard (1969) defines bibliometric analysis as applying mathematical and communication methods to books and other media communication. A comprehensive statistical review of a specific topic can help researchers to better understand the basic knowledge and the knowledge structure within a subject field (Zhu, Tong & Song, 2021). A bibliometric study mainly analyzes the information on the keywords, references, journals and even productivity of authors, countries and institutions. Through bibliometric analysis, researchers can summarize the current situation and development trends of research fields or specific diseases and provide directions and ideas for future research (Lu et al., 2019). In the literature, many bibliometric studies have been analyzed in finance, management and economics (Avilés-Ochoa, Flores-Sosa & Merigó, 2021). CiteSpace and VOSviewer are the commonly used bibliometric visualization tools for data analysis and visualization (Van Eck & Waltman, 2010). Our study uses CiteSpace 5.6.R4 and VOSviewer 1.6.11 as visual and analytic research tools. Besides, we used EXCEL to make tables and conducted a detailed comparative analysis.

The publications were obtained from the Web of Science Collection database. Web of Science is recommended as the preferred database website for citation spatial analysis and contains citation information sources. ESG refers to how corporations and investors unite environmental, social and governance concerns into their business structure (Gillan, Koch & Starks, 2021). As noted, this study regards environmental, social, and governance. Considering this factor, the retrieval strategy can be defined as Topic = (ESG) or ("Environment" and "Social" and "Governance") AND included all languages. The span time was set from 2004 to 2021. 2004 is the starting point because "ESG" first appeared in 2004, while the search took place in June 2022. The criteria for retaining documents are as follows: (1) Based on Web of Science categories, relevant literature in non-economic and non-management fields were excluded, and the categories of Business, Business Finance, Economics and Management remained, (2) the analysis considered research articles. A total of 7174 publications were obtained. After excluding 4788 non-economic and management categories, we retained 2386 publications. The strategy for retaining documents is shown in Figure 1. Finally, 1735 articles were downloaded in the format of "Plain text" and "Full Record and Cited References" and then exported into software for further analysis.

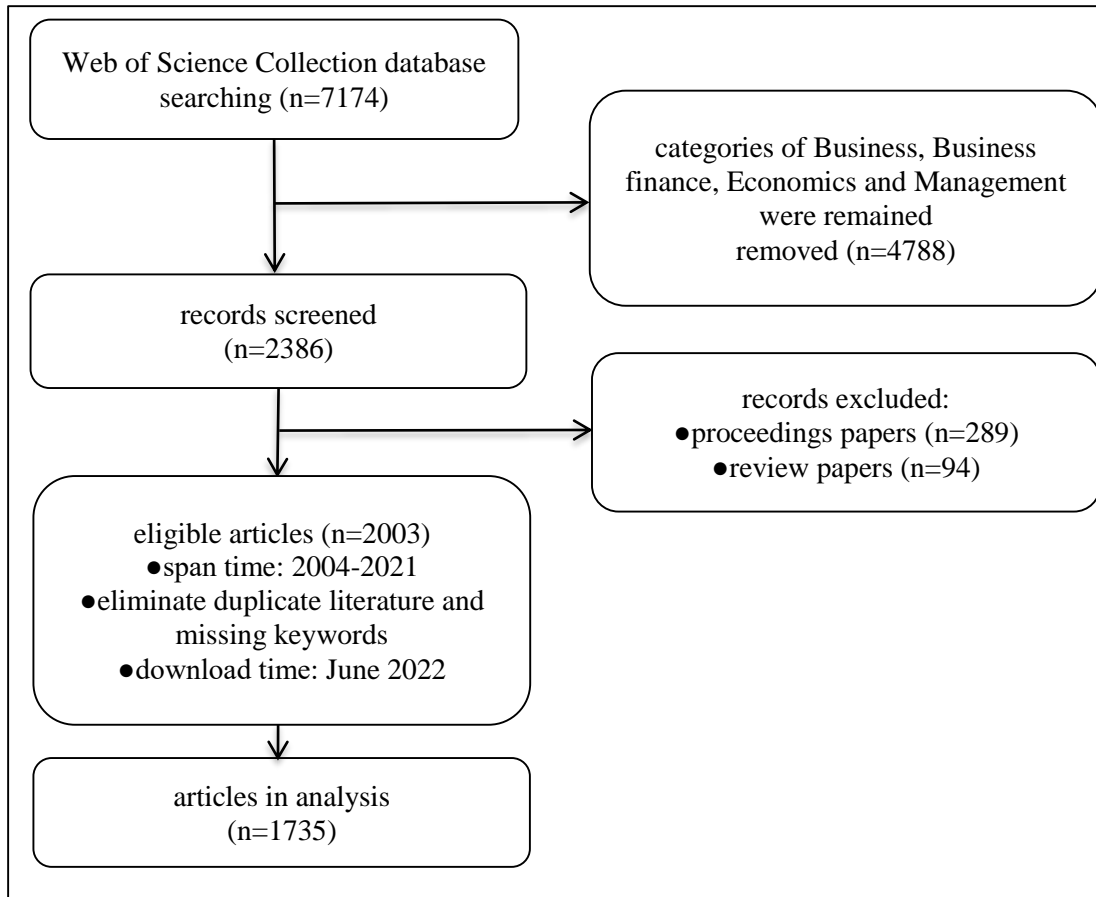


Figure 1: The diagram of including and excluding articles

We used a thesaurus file for the pre-processing phase to manage and clean the raw data obtained to combine related terms. At this stage, some similar terminologies used interchangeably by scholars in the ESG conception were merged to avoid duplication. Mainly include: replacing "environment social government" and "environment social and government" with ESG; replacing "Corporate social responsibility", "Corporate social and responsibility" and "socially responsible" with CSR; replacing "Socially responsible investment" with SRI; replacing "Ethics and compliance management" with ECM; replace "modern portfolio theory" with MPT; replace "Corporate social responsibility disclosure" with CSRD.

## Results

### Analysis of publications

During 2004-2021, a large number of papers on ESG appeared. Figure 2 shows the number of publications published every year, and it can be seen that this number has dramatically increased, especially in the last four years. Moreover, the publication of the model fitting curve shows exponential growth based on the annual article output ( $y = 0.2867x^3 - 5.4977x^2 + 32.883x - 37.637$ , and the degree of fitting:  $R^2 = 0.9934$ ). Based on the cumulative number of publications, we estimate 570 articles will be published in 2022.

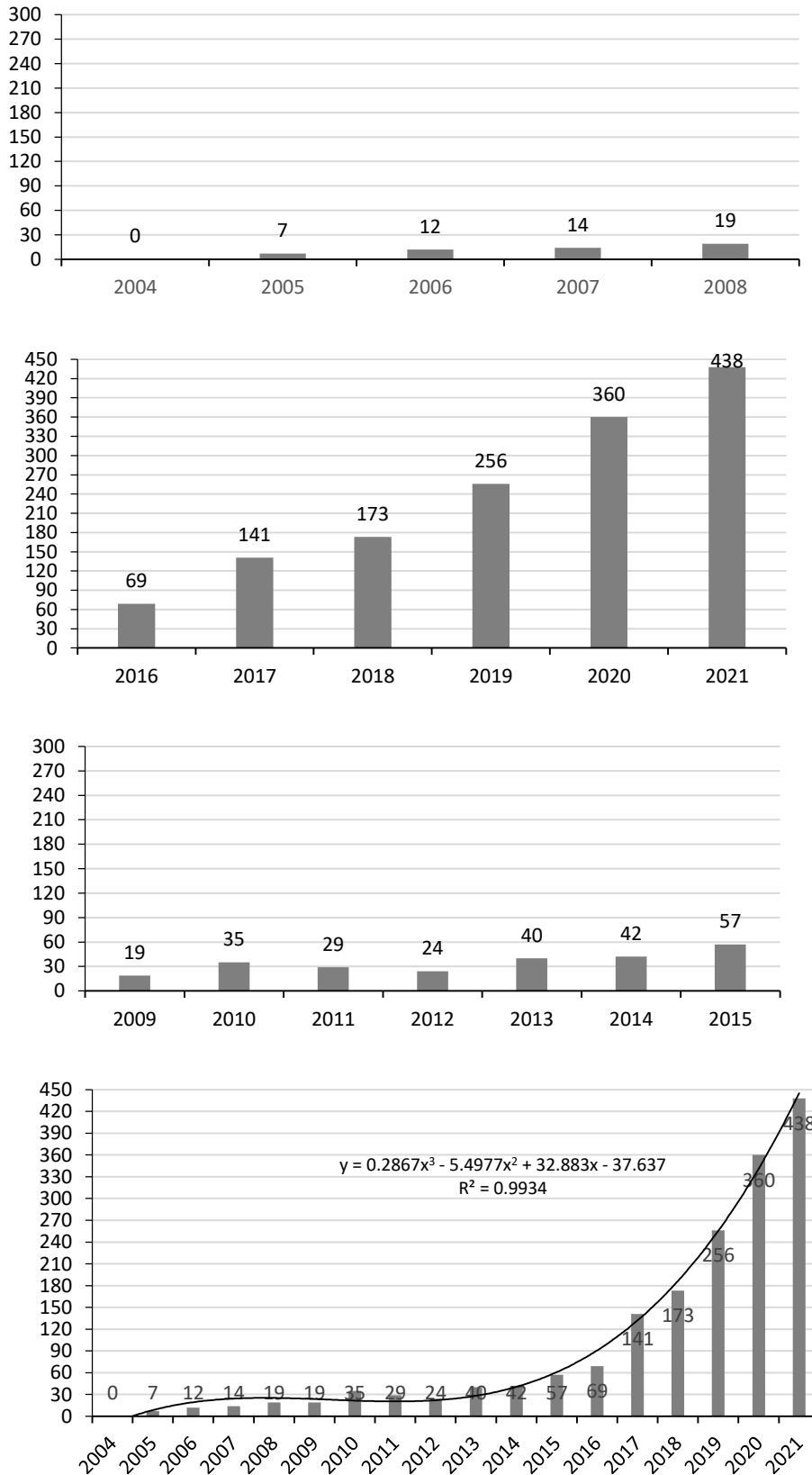


Figure 2: ESG papers published annually (2004-2021)

### Analysis of citation structure

An analysis of citation structure can identify the key authors and articles contributing to ESG research. Table 1 lists the twenty highly cited papers from 2004 to 2021. The most cited paper is written by Carney, who identifies that family-controlled firms' competitive advantage arises from their system of corporate governance, which gives advantages in a scarce environment and facilitates the creation and utilization of social capital. The second most cited paper belongs to Sheng, Zhou & Li (2011), who focus on an emerging country China to distinguish social ties to change institutional and market environments. Marquis and Qian is another influential work on Corporate Social Responsibility (CSR) reporting in China.

Table 1

The top 20 most co-cited references regarding ESG from 2004 to 2021

R	TC	Title	Author/s	Year	C/Y
1	808	Corporate governance and competitive advantage in family-controlled firms	Carney, M	2005	50.50
2	695	The Effects of Business and Political Ties on Firm Performance: Evidence from China	Sheng, SB; Zhou, KZ; Li, JJ	2011	69.50
3	609	Corporate Social Responsibility Reporting in China: Symbol or Substance?	Marquis, C; Qian, CL	2014	87.00
4	432	Corporate Social Responsibility in Western Europe: An Institutional Mirror or Substitute?	Jackson, G; Apostolakou, A	2010	39.27
5	414	Green Governance: Boards of Directors' Composition and Environmental Corporate Social Responsibility	Post, C; Rahman, N; Rubow, E	2011	41.40
6	389	The Causal Effect of Corporate Governance on Corporate Social Responsibility	Jo, H; Harjoto, MA	2012	43.22
7	369	The Effect of Board Characteristics on Firm Environmental Performance	de Villiers, C; Naiker, V; van Staden, CJ	2011	36.90
8	341	Business Model Innovation for Sustainability: Towards a Unified Perspective for Creation of Sustainable Business Models	Evans, S; Vladimirova, D; Holgado, M; Van Fossen, K; Yang, MY; Silva, EA; Barlow, CY	2017	85.25
9	318	Determinants of the Adoption of Sustainability Assurance Statements: An International Investigation	Kolk, A; Perego, P	2010	28.91
10	301	The Role of the Board in the Dissemination of Integrated Corporate Social Reporting	Frias-Aceituno, JV; Rodriguez-Ariza, L; Garcia-Sanchez, IM	2013	37.63
11	287	The social responsibility of international business: From ethics and the environment to CSR and sustainable development	Kolk, A	2016	57.40

R	TC	Title	Author/s	Year	C/Y
12	278	The performance consequences of ambidexterity in strategic alliance formations: Empirical investigation and computational theorizing	Lin, Z; Yang, HB; Demirkan, I	2007	19.86
13	265	Do institutional investors drive corporate social responsibility? International evidence	Dyck, A; Lins, KV; Roth, L; Wagner, HF	2019	132.50
14	256	Is Corporate Responsibility Converging? A Comparison of Corporate Responsibility Reporting in the USA, UK, Australia, and Germany	Chen, S; Bouvain, P	2009	21.33
15	247	Towards a renaissance in international business research? Big questions, grand challenges, and the future of IB scholarship	Buckley, PJ; Doh, JP; Benischke, MH	2017	61.75
16	245	Stakeholder Engagement and Corporate Social Responsibility Reporting: the Ownership Structure Effect	Prado-Lorenzo, JM; Gallego-Alvarez, I; Garcia-Sanchez, IM	2009	20.42
17	240	ESG performance and firm value: The moderating role of disclosure	Fatemi, A; Glaum, M; Kaiser, S	2018	52.33
18	225	Social Accountability: What Does the Evidence Really Say?	Fox, JA	2015	37.50
19	225	The Influence of Governance Structure and Strategic Corporate Social Responsibility Toward Sustainability Reporting Quality	Amran, A; Lee, SP; Devi, SS	2014	32.14
20	223	Public policies on corporate social responsibility: The role of governments in Europe	Albareda, L; Lozano, JM; Ysa, T	2007	15.93

Abbreviations: R = Rank; C/Y = Citations per year; TC = Total citations

In addition, the citation structure was classified and counted, and the information was presented from 2004 to 2021 Aich, S., Thakur, A., Nanda, D., Tripathy, S. & Kim as shown in Table 2. Remarkably, the publications published from 2016 to 2019 were the most cited. Only 4.96% of the papers have more than one hundred citations, and 45.71% have more than ten citations. At the same time, 85.99% of the papers regarding ESG have been cited at least once. In addition, there are highly cited papers almost every year, and 2016 has the most cited papers with more than one hundred citations.

Table 2  
References citation structure from 2004 to 2021

Year	TP	TC	≥200	≥100	≥50	≥20	≥10	≥5	≥1
2004	0	0	0	0	0	1	0	0	0
2005	7	1174	1	2	4	5	6	7	7
2006	12	572	1	2	4	8	10	10	12

Year	TP	TC	≥200	≥100	≥50	≥20	≥10	≥5	≥1
2007	14	1078	3	4	5	9	11	12	14
2008	19	1092	1	3	9	12	14	16	18
2009	19	1192	2	4	7	10	15	15	18
2010	35	2545	2	8	15	27	31	32	35
2011	29	2421	3	5	9	19	22	23	29
2012	24	1700	1	5	12	17	23	23	24
2013	40	1944	1	6	10	25	37	38	40
2014	42	2655	3	9	16	24	29	34	41
2015	57	2620	1	6	19	40	49	53	57
2016	69	3256	1	11	25	44	56	64	69
2017	141	4459	2	8	27	65	91	109	141
2018	173	3709	0	7	17	49	104	141	170
2019	256	3637	1	3	11	50	116	157	207
2020	360	2911	0	2	4	45	121	198	298
2021	438	1980	0	1	5	23	58	154	312
%			1.33%	4.96%	11.47%	27.26%	45.71%	62.59%	85.99%

Abbreviations: TP and TC = Total papers and citations; ≥200, ≥100, ≥50, ≥20, ≥10, ≥5, ≥1 = number of papers with equal or more than 200, 100, 50, 20, 10, 5 and 1 citations.

### Analysis of authors

Table 3 shows the authors who contributed the most to ESG research in Business, Management and economics. Isabel-Maria from the University of Salamanca is the most productive author with ten publications, and she has been cited in three hundred and one papers. In second place is Amina Buallay, with eight publications. Buallay (2019) believes that ESG has a significant positive impact on corporate performance. Professor Collins Ntim mainly studies accountability, ethics, sustainability, etc.; his research was cited at 61.43 per paper. The list shows some authors are high C/P as Ans kolk, Paolo Perego, Rodriguez-Ariza and Giovanna Michelin, with each publication cited more than 97 times on average. Other authors also have made outstanding contributions. It has appeared that some researchers with high h-index such as Isabel-Maria (h=65), Ans kolk (h=74), Khaled Hussainey (h=50), Chan (h=51), Scholtens (h=50) and Shunsuke Managi (h=63). They are all active authors in the ESG field. Furthermore, in recent years, more researchers have been focusing on ESG.

Table 3

Ranking of top 25 most published authors regarding ESG from 2004 to 2021

R	Author name	University	TP	TC	C/P	H	≥ 200	≥ 100	≥ 50	≥ 20
1	Garcia-Sanchez, Isabel-Maria	Univ Salamanca	10	301	30.10	65	0	1	1	6
2	Buallay, Amina	Brunel Univ	8	130	16.25	18	0	0	0	4
3	Ntim, Collins G.	Univ Southampton	7	430	61.43	44	0	3	3	5
4	Martinez-Ferrero, Jennifer	Univ Salamanca	7	263	37.57	37	0	0	1	5
5	Kolk, Ans	Univ Amsterdam	6	858	143.00	74	2	3	5	5
6	Gallego-Alvarez, Isabel	Univ Salamanca	6	358	59.67	38	1	1	2	3
7	Eccles, Robert G.	Harvard Univ	6	170	28.33	-	0	1	1	2

R	Author name	University	TP	TC	C/P	H	≥ 200	≥ 100	≥ 50	≥ 20
8	Uyar, Ali	La Rochelle Business Sch	6	112	18.67	35	0	0	0	2
9	Lombardi, Rosa	Univ Roma La Sapienza	6	66	11.00	23	0	0	0	2
10	Perego, Paolo	Erasmus Univ	5	487	97.40	19	1	2	2	3
11	Serafeim, George	Harvard Univ	5	337	67.40	44	0	2	2	4
12	Li, Shaomin	Old Dominion Univ	5	300	60.00	41	0	2	2	3
13	Crifo, Patricia	Univ Paris West	5	160	32.00	21	0	0	0	5
14	Hussainey, Khaled	Univ Portsmouth	5	116	23.20	50	0	0	0	2
15	Chan, Kam C.	Western Kentucky Univ	5	97	19.40	51	0	0	1	2
16	Hamdan, Allam	Ahlia Univ	5	81	16.20	27	0	0	0	2
17	Rodriguez-Ariza, Lazaro	Univ Granada	4	539	134.75	35	2	2	2	3
18	Michelon, Giovanna	Univ Padua	4	407	101.75	31	0	2	3	4
19	Scholtens, Bert	Univ Groningen	4	258	64.50	50	0	2	2	3
20	Galbreath, Jeremy	Curtin Univ	4	256	64.00	36	0	0	2	4
21	Jesus Munoz-Torres, Maria	Jaume I Univ	4	206	51.50	28	0	0	2	4
22	Rezaee, Zabihollah	Univ Memphis	4	202	50.50	46	0	1	2	3
23	Managi, Shunsuke	Univ Michigan	4	169	42.25	63	0	1	1	2
24	Capelle-Blancard, Gunther	Univ Paris 1 Pantheon Sorbonne	4	118	29.50	24	0	0	0	3
25	Kilic, Merve	Samsun Univ	4	84	21.00	24	0	0	0	2

Abbreviations are available in Tables 1 and 2 except: C/P=Cites per paper; H = h-index

### Analysis of universities and countries

Table 4 lists the top 20 universities where the most influential productions have been published. As shown, Salamanca University was ranked first, with 22 publications, followed by City university Hong Kong, with 17 publications and the total citations; the University of Erasmus, Hong Kong Polytech University, Oxford University, and Macquarie University, with 15 publications. Six universities in the list are from England, accounting for 30%. It also appeared that some universities with high C/P, such as City University Hong Kong, Erasmus University, Concordia University and Amsterdam University.

Table 4

Ranking of top 20 universities regarding ESG from 2004 to 2021

R	University	Country	TP	TC	C/P	≥200	≥100	≥50	≥20
1	Univ Salamanca	Spain	22	1084	49.27	2	3	5	13
2	City Univ Hong Kong	China	17	2019	118.76	3	4	5	10
3	Erasmus Univ	Netherlands	15	1027	68.47	2	4	5	7
4	Hong Kong Polytech Univ	China	15	578	38.53	1	1	4	9
5	Univ Oxford	England	15	456	30.40	0	2	2	4
6	Macquarie Univ	Australia	15	394	26.27	1	1	1	4
7	Univ Birmingham	England	14	567	40.50	0	2	4	7
8	Univ Portsmouth	England	14	414	29.57	0	1	1	5
9	York Univ	Canada	13	513	39.46	0	2	2	6

R	University	Country	TP	TC	C/P	≥200	≥100	≥50	≥20
10	Ahlia Univ	Bahrain	13	194	14.92	0	0	0	4
11	Univ Cambridge	England	12	467	38.92	1	1	1	4
12	Univ Manchester	England	12	270	22.50	0	0	1	6
13	Univ Valencia	Spain	12	261	21.75	0	1	1	3
14	NYU	USA	12	229	19.08	0	0	2	3
15	Univ Sfax	Tunisia	12	96	8.00	0	0	0	1
16	Concordia Univ	Canada	11	1231	111.91	1	3	4	7
17	Univ Amsterdam	Netherlands	11	1036	94.18	2	3	7	8
18	Univ Zurich	Switzerland	11	305	27.73	0	0	3	5
19	Sapienza Univ Rome	Italy	11	300	27.27	0	1	2	3
20	Massey Univ	New Zealand	11	118	10.73	0	0	1	2

Abbreviations are available in Tables 1, 2 and 3

Table 5 shows the top 20 countries with the most productive and influential publications on topics of ESG. The USA is the most active country publishing 438 papers, followed by England and China, publishing 254 and 173 papers, respectively. Considering the number of total cites, the most influential countries are the USA, England, China, Australia, Spain, and Canada, with more than 3500 citations. Regarding C/P, Spain, Canada, Netherlands and Scotland they exceeded 30 times. Overall, 22.03% of the publications are from the United States, 12.81% are from England, and 8.72% are from China, specifically Hong Kong, China.

Table 5

Ranking of top 20 most productive countries regarding ESG from 2004 to 2021

R	Country	TP	TC	C/P	≥200	≥100	≥50	≥20
1	USA	438	12512	28.57	10	31	63	126
2	England	254	6738	26.53	3	18	35	77
3	China	173	4603	26.61	4	9	21	46
4	Australia	140	3566	25.47	1	9	21	45
5	France	134	2693	20.10	0	3	13	45
6	Spain	117	3683	31.48	4	9	18	49
7	Italy	114	2731	23.96	1	7	15	40
8	Canada	110	3716	33.78	2	8	16	45
9	Germany	88	2636	29.95	0	10	17	28
10	Netherlands	63	2648	42.03	3	10	16	26
11	India	58	521	8.98	0	0	1	8
12	Malaysia	43	666	15.49	1	2	2	7
13	Brazil	39	565	14.49	1	1	3	6
14	South Africa	35	632	18.06	0	1	4	8
15	Sweden	33	723	21.91	0	1	5	11
16	South Korea	32	758	23.69	0	2	5	9
17	Switzerland	32	727	22.72	0	2	5	9
18	U Arab Emirates	27	420	15.56	0	2	2	5
19	Tunisia	27	291	10.78	0	0	0	4
20	Scotland	26	907	34.88	0	3	8	13

Abbreviations are available in Tables 1, 2 and 3

Bibliographic coupling is a measure to show how other countries use similar references in their publications and focus on a similar point (Gu, Meng & Farrukh, 2021). In the results of the bibliographic coupling of countries, each circle represents a country/region, and each color represents a cluster. The results in figure 3 are based on the minimum 5 as a threshold value. There are a total of five clusters in the results. It can be seen that countries of the same color may be mainly concerned or face the same problems. For example, in the purple cluster, the publications from the USA, China, Australia, South Korea and New Zealand cited each other and were concerned about similar issues.

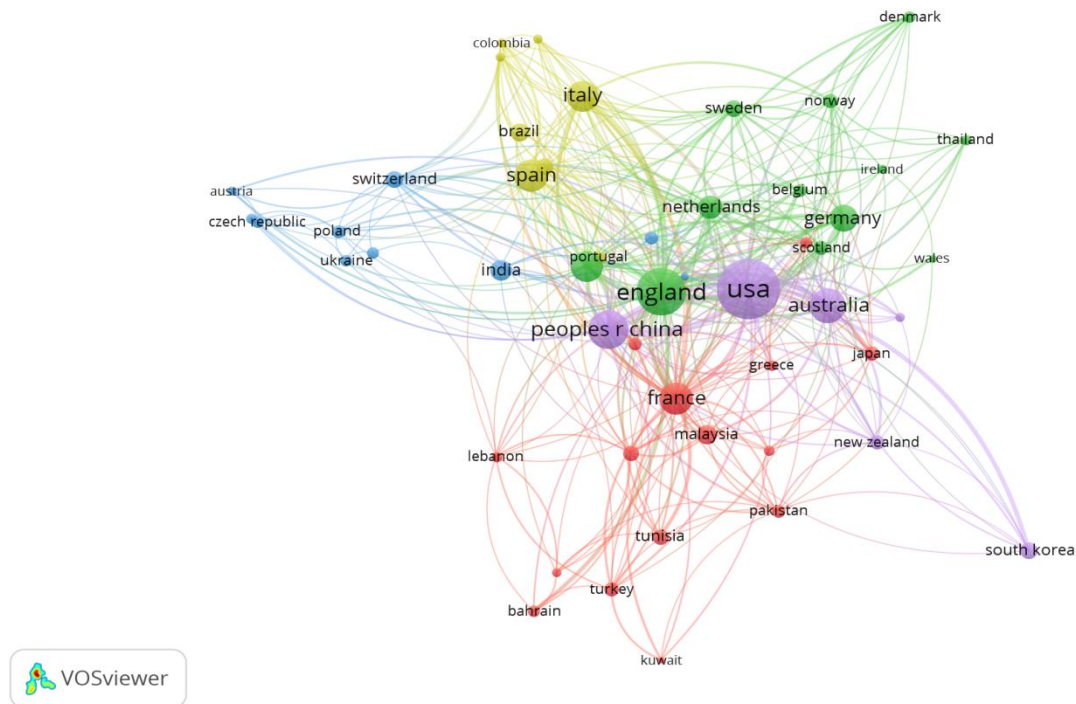


Figure 3: Bibliographic coupling of countries/regions

Furthermore, based on the number of clusters, it can be inferred that different countries face differences in environmental, social and governance (ESG) issues. There are also extensive collaborations between countries/Regions (Figure 4). We can also observe that universities in the United States are the relative focus, connecting with most institutions.

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 Timespan: 2005-2021 (Slice Length=1)  
 Selection Criteria: p-modes (k=25), LRF=3.0, L/N=10, LBY=5, e=1.0  
 Network: N=531, E=1746 (Density=0.0124)  
 Largest CC: 488 (91%)  
 Nodes Labeled: 1.0%  
 Pruning: None

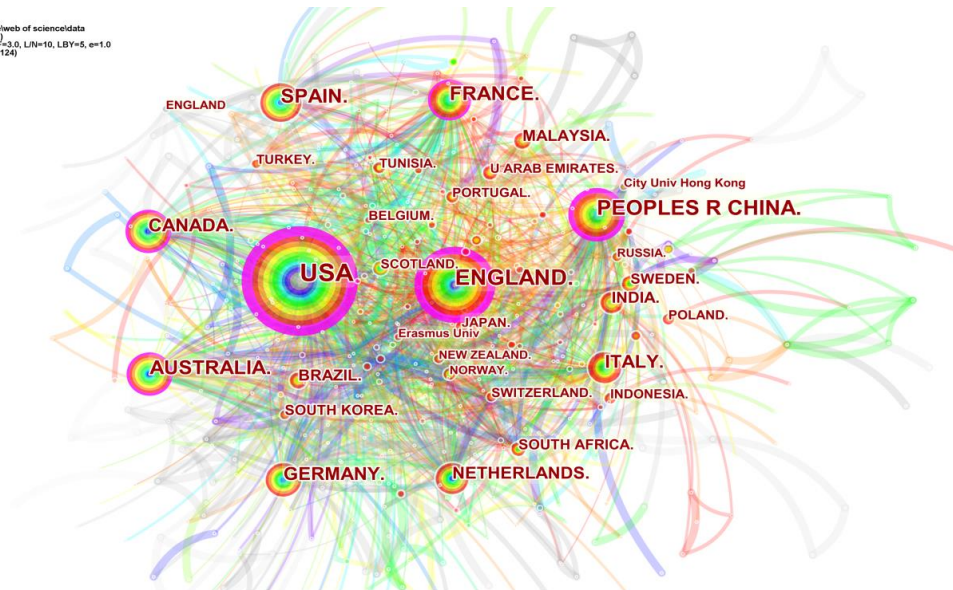


Figure 4: Knowledge map of countries/regions and universities' cooperation network

**Analysis of Journals**

The number of ESG publications in the top 20 cited journals is shown in Table 6. The top journal with the most significant number of papers is the Journal of Business Ethics, a key node in the network with a total of 93. It is followed by Corporate Social Responsibility and Environmental Management (91) and Business Strategy and The Environment (88). The ratio of the top 20 cited journals to the total number of papers was 35.33%. Comparing the frequency of citations, the Journal of Business Ethics (5185), Business Strategy and the Environment (4174), and Corporate Social Responsibility and Environmental Management (3606) have a higher frequency. This shows the leading position of these three journals in the field of ESG. Corporate Governance-an International Review (895) and Business & Society (697) also have a high frequency. The citations of the top 20 journals accounted for 50.14% of the total citations. Notably, the Journal of Business Ethics also has the highest number of citations per paper, reaching 55.75. Among the journals mentioned above, Business Strategy and the Environment has the highest impact factor of 10.8, followed by Corporate Social Responsibility and Environmental Management (8.46) and Journal of Business Ethics (6.33).

Table 6

The top 20 most productive journals regarding ESG from 2004 to 2021

R	Journal	TP	TC	C/P
1	Journal of Business Ethics	93	5185	55.75
2	Corporate Social Responsibility and Environmental Management	91	3606	39.63
3	Business Strategy and The Environment	88	4174	47.43
4	Journal of Sustainable Finance & Investment	53	333	6.28
5	Journal of Portfolio Management	33	156	4.73
6	Corporate Governance-an International Review	29	895	30.86
7	Sustainability Accounting Management and Policy Journal	23	393	17.09
8	Corporate Governance-the International Journal of Business in Society	23	227	9.87
9	Ecological Economics	19	584	30.74
10	Social Responsibility Journal	19	233	12.26

R	Journal	TP	TC	C/P
11	Finance Research Letters	16	224	14.00
12	Journal of Applied Corporate Finance	16	91	5.69
13	Energy Policy	15	273	18.20
14	Business & Society	14	697	49.79
15	Management Decision	14	320	22.86
16	Journal of Risk and Financial Management	14	111	7.93
17	Journal of Investing	14	39	2.79
18	World Development	13	537	41.31
19	Journal of Corporate Finance	13	425	32.69
20	Journal of Business Research	13	309	23.77

Abbreviations are available in Tables 1, 2 and 3

### Analysis of keywords

The keywords analysis is a method to analyze the relationship between research topics by counting the co-occurrence of keywords, which helps discover research hotspots and research structure (Fabregat-Aibar, Barberà-Mariné, Terceño & Pié, 2019). Our study selects author keywords as statistical objects for keyword analysis. Among all 4405 author keywords, we set the author keywords that appear at least 14 times for analysis, and 54 author keywords meet the threshold. The co-occurrence network of the significant author keywords cluster is shown in Figure 5, and the top 20 author keyword occurrences are given in Table 7.

Table 7

Top 20 author keywords occurrences from 2004 to 2021

R	Keyword	Cluster	Occurrence	Total Link Strength
1	CSR	3	324	406
2	ESG	4	204	274
3	corporate governance	2	180	261
4	sustainability	3	118	166
5	sustainable development	1	74	130
6	SRI	4	68	89
7	environmental	1	65	127
8	institutional theory	5	50	57
9	financial performance	2	48	81
10	ESG investing	3	40	30
11	disclosure	1	37	66
12	sustainability reporting	1	37	65
13	stakeholder theory	5	36	65
14	China	2	36	33
15	integrated reporting	1	34	52
16	ESG performance	1	33	40
17	stakeholder engagement	1	31	65
18	firm value	1	28	42
19	ESG disclosure	1	27	49
20	covid-19	4	27	40

Abbreviations are available in Tables 1 and 2 except Occurrence=frequency of keyword occurrence; Total Link Strength = total co-occurrence times of keywords with other keywords.

According to the significant author keywords, the main topics can be divided into five aspects: sustainable development (red cluster), corporate governance (green cluster), corporate social responsibility (blue cluster), ESG (yellow cluster), and ESG ratings (purple cluster).

*Cluster 1:* The theme proposed in this cluster (red cluster) mainly focuses on sustainable development, including ESG reporting, integrated reporting, sustainability reporting, ESG disclosure, ESG performance, ESG score, firm value and value relevance. ESG is an analytical framework for corporate sustainability. Given the trend of sustainable development, which is also the philosophy of ESG, the research on the relationship among the three dimensions of ESG has attracted much attention to meet sustainability. Corporate governance researchers pay more attention to firms' social and environmental performance (Walls, Berrone & Phan, 2012). In this regard, the former includes corporate sustainability, environmental sustainability, sustainable finance, and sustainable reporting. In addition, ESG choices mainly emphasized ESG reporting, ESG disclosure and voluntary disclosure. ESG disclosure gets in touch with the diversity of the board. In most research patterns, internal governance factors are usually considered a key variable, which aims to reveal the complex internal process and psychological mechanism of ESG.

*Cluster 2:* The theme proposed in this cluster (green cluster) mainly focuses on corporate governance, including the board of directors, executive compensation, gender diversity, environmental disclosure, social capital, financial performance, firm performance, innovation and China. Corporate governance is the core and strategic cornerstone of ESG. By strengthening corporate governance, firms can fundamentally promote the continuous improvement of environmental and social benefits and achieve stable and long-term performance. Enterprises implant ESG concepts into their strategies, clarify the board of directors' responsibilities at the board level and establish a matching governance management structure and mechanisms systems.

*Cluster 3:* The theme proposed in this cluster (blue cluster) mainly focuses on corporate social responsibility (CSR), including ESG investing, sustainability, accountability, institutional investors, portfolio construction, strategy, risk management and emerging market. The European Union put forward the concept of CSR in 2001. ESG originated from CSR, which is both related and different. Both emphasize that we should focus on the interests of shareholders and other stakeholders at the same time. However, CSR is a concept put forward from the perspective of enterprises, and its meaning is broader and challenging to measure. ESG is a concept put forward from investors' perspective, so it is also called ESG Investment. Compared with the broad connotation of CSR, ESG mainly measures the fulfilment of corporate social responsibility from three aspects: environmental, social and governance. If investors evaluate the company's ESG performance and make investment decisions based on it, it will undoubtedly impact its ESG practice.

*Cluster 4:* The theme proposed in this cluster (yellow cluster) mainly focuses on ESG, including Social Responsible Investment (ISR), sustainable investing, institutional ownership, green bond, COVID-19, climate change and business ethics. In the context of the COVID-19 and climate change, demand for ISR is growing despite a weak global economy. Investing in companies that integrate environment, society and governance and serve stakeholders, not just short-term shareholders, is also more valuable. ESG system includes information disclosure, performance rating and investment practice, which complement each other. When the enterprise has made ESG disclosure, the agencies can evaluate the firms' ESG more accurately, and

investors can use ESG performance to guide practice more confidently. To expand the supply and scale of ESG investment, improving the information disclosure and evaluation system and promoting the system construction of rules, supervision, and self-discipline of ESG investment is necessary. Portfolio theory will be widely used in ESG investment. The critical role of portfolio construction in this domain is a hot research theme and will be so in the future.

Cluster 5: The theme proposed in this cluster (purple cluster) mainly focuses on ESG ratings, including stakeholder theory, legitimacy theory, institutional theory, agency theory, earning management, corporate financial performance, and corporate social performance. ESG disclosure includes environmental, social responsibility and corporate governance (Environment, Social and Governance, ESG) information. ESG ratings refer to the evaluation of ESG disclosure by rating agencies. ESG ratings are also controversial. Even in countries where ESG is relatively mature, the results of different rating agencies are very different. As ESG ratings provide company-level information, studies on the influencing factors and economic consequences of ESG ratings are becoming more and more abundant.

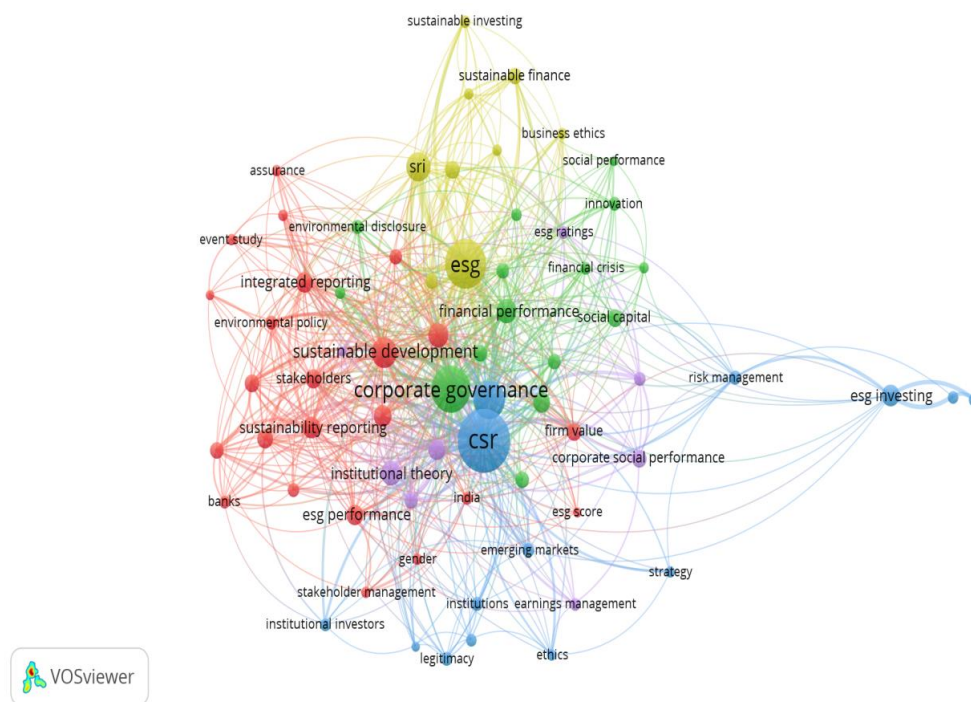


Figure 5: Co-occurrence network of major author keywords

## Discussion

The purpose of analyzing the temporal characteristics is to reflect the origin and development process of the research topic. In our study, 1735 articles related to ESG were analyzed by a bibliometric method from 2004 to 2021. according to the growing trend, similar to Gao et al.'s study (Gao et al., 2021). We divided the research period into three stages. The first stage is the initial stage from 2004 to 2008. Before the ESG concept was established, Corporate Social Responsibility (CSR) was a more well-known concept. Due to the severe challenges of climate and the environment, the environmental protection movement is also rising. As a result of ESG, the report Who Cares Wins, written by the United Nations Global Compact in 2004, first proposed the ESG concept. After that, the number of publications waved

from 2004 to 2008, with 0 papers in 2004, which increased to 19 papers in 2008. The research mainly focused on corporate social responsibility, responsible investment, and public trust, which focused on a particular dimension of ESG. The second stage is the steady growth from 2009 to 2015. After the Global Influential Investment Network launch in 2009, some influential research institutions and scholars appeared. Their research mainly focused on the influence of domestic market characteristics, country attributes, gender, and CEO characteristics on ESG. The number of articles grew steadily, and more than 240 were published during this period. The third stage is the rapid growth from 2016 to 2021. During this period, the total number of publications was reached 1437, far higher than the other stages. These results show that the concept of ESG is getting more and more attention and may remain a hot research topic for the next few years.

According to the list of top-cited publications, we found that research content ranges from the factors of ESG (political ties, board characteristics, business model innovation, institutional investors, public policies) to utilizing ESG for the sustainable development of enterprises. Besides, in the research on ESG's economic consequences, the article "ESG performance and firm value: The moderating role of disclosure" has laid a good foundation. Like Gao et al.'s study (Gao et al., 2021), many papers focus on a single country or region, such as China, the USA, the UK, Australia, Germany and Europe. The citation structure result suggests that scholars increasingly regard 'environment, society, and governance as an integrated sustainability analysis framework and pay more attention to the connection among different dimensions (E/S/G). Besides, masses of papers are increasingly focusing on the influence of ESG on a firm's risk, performance, financial behaviour, report, and value.

Based on the analysis of universities and countries/regions, most universities are from developed countries/regions. Few ESG research universities exist in emerging market countries or regions such as mainland China, India, and Brazil. The reason may be that ESG research in emerging market countries started later. This also highlights the natural driving characteristics of ESG research in emerging countries or regions. Furthermore, as is common among the top productive countries/regions, international collaboration is important for ESG development. In a citation network, we found that the number of outputs is associated with the number of research institutions, the development level of countries/regions, and the people who focus on ESG issues.

Furthermore, according to the analysis of author keywords, CSR, ESG, corporate governance and sustainability were frequent keywords. Based on the hotspot analysis and the bursts shown in Table 8, some keywords that need further study are found, such as risk management, institutional investors, sustainability reporting, corporate finance, etc. On this basis, we propose four possible research trends about ESG for future researchers.

The first type of research is the impact of ESG performance on risk management. In recent years, the global economy has been affected by COVID-19, and enterprise operations' systematic and non-systematic risks have increased. Good ESG performance can help enterprises establish a good corporate image and improve their reputation, thus affecting enterprise risk management. Therefore, the impact of ESG performance on risk management is a hot research topic. The risks that ESG may affect include stock price collapse, company default, social trust, climate, and supply chain risks. ESG research on risk management can help enterprises reduce risks and promote the smooth operation of enterprises.

The second kind of research is the interaction between ESG and institutional investors. On the one hand, ESG performance, as the consideration factor of institutional investors, will affect the investment choice of institutional investors and then affect their shareholding preference; On the other hand, the shareholding preference of institutional investors will promote the improvement of enterprise ESG behaviour and obtain higher ESG rating. Most of the existing literature studies the impact of ESG and institutional investors unilaterally. The research on the interaction between ESG and institutional investors can enrich the existing literature research results to a certain extent.

The third is the ESG rating construction and investment strategies application. Many international rating agencies have explored and formed ESG rating systems. Investment institutions have formulated several investment strategies, including screening, integration, shareholder proposition, sustainable investment, influence investment and theme investment, combined with the ESG ratings. The future ESG ratings will be widely used in the investment field. ESG performance may well affect the company's capital structure to some extent. Meanwhile, more exploration will be made on the influence of ESG ratings on emerging capital markets. Additionally, ESG rating standards will converge internationally and play an important role in formulating sustainable financial reporting in the future.

The fourth type of research is the impact of ESG on corporate financial behaviour. As a kind of non-financial information disclosure, ESG information will directly impact the enterprise's accounting, audit, and sustainable development reports. In addition, this kind of information disclosure has dramatically improved the transparency of enterprises, reduced the degree of information asymmetry between enterprises and investors, management and shareholders' meetings, and reduced agency costs, which has a far-reaching impact on enterprise innovation activities, foreign direct investment, and other behaviours. In future research, we can further study the impact of ESG on various financial behaviours of enterprises. Furthermore, we can improve enterprises' understanding of ESG systems; on the other hand, we can enrich the literature on the impact of ESG.

*Table 8*  
*Top 20 Keywords with the Strongest Citation Bursts*

Keywords	Year	Strength	Begin	End	2005 - 2021
business	2004	5.38	2005	2016	
guanxi	2004	2.89	2005	2016	
corporate governance	2004	4.91	2010	2015	
shareholder activism	2004	2.87	2010	2016	
board of director	2004	3.34	2011	2018	
collaboration	2004	2.97	2013	2016	

Keywords	Year	Strength	Begin	End	2005 - 2021
policy	2004	2.42	2013	2015	
sustainability reporting	2004	2.78	2014	2017	
strategy	2004	3.46	2015	2018	
stakeholder engagement	2004	3.74	2016	2018	
SRI	2004	2.62	2016	2019	
integrated reporting	2004	2.49	2016	2017	
value creation	2004	2.88	2017	2018	
voluntary disclosure	2004	2.84	2017	2018	
board diversity	2004	3.84	2018	2019	
responsibility disclosure	2004	2.89	2018	2019	
institutional investor	2004	2.55	2018	2020	
ESG rating	2004	2.47	2018	2021	
risk management	2004	2.97	2019	2021	
price	2004	2.74	2019	2021	

Abbreviations: Begin is when the keyword starts to mutate, End is the end time, the middle time difference is the duration of the keyword mutation, and Strength represents the mutation strength.

### Conclusions

The objective of this study was to present the development of ESG and discuss the research related to ESG. Our study proposes a bibliometric and visual analysis of ESG research. Note that the information was retrieved from the Web of Science Collection database. However, data from other databases or collected at different times may have different findings. Bibliographic coupling, keyword co-occurrence and co-citations can analyze clustering and future trends. More relaxed threshold settings can be set in future work to identify potential connections between subtopics.

According to the growth trend, ESG may remain a hot research topic for the next few years. Citation structure suggests that scholars increasingly regard "environmental, social, and governance" (ESG) as an integrated sustainability analysis framework and pay more attention

to the connection among different dimensions. The publications published from 2016 to 2019 were the most cited. Isabel-Maria from the University of Salamanca is the most productive author with ten publications, and she has been cited in three hundred and one papers. In recent years, more researchers have been focusing on ESG. Salamanca University was the most influential institution regarding ESG. The USA is the most active country. Universities from the USA were the relative focus, connecting with most institutions. The top journal with the largest number of papers was the *Journal of Business Ethics*, a key node in the network. The co-words analysis indicates that sustainable development, corporate governance, corporate social responsibility, ESG, ESG ratings are the research hotspots. We also propose four possible research trends about ESG for future researchers in the discussion section.

### Limitations

As with other academic studies, our study also has some limitations. First, the analyzed data in our study was downloaded from the Web of Science Collection database. Therefore, data from other databases or collected at different times may have different results and conclusions. In addition, our study is limited to Business, Business Finance, Economics and Management. As a result, the analyses may not fully cover all available papers and may lead to an incomplete list of articles related to the ESG field. Besides that, we used Topic (covering titles, abstracts, or keywords) as a search range, which may lead to other findings. These limitations can be addressed in future research by extending the coverage of databases and types of documents and using similar terms. Also, future work could generate networks of bibliography coupling and keyword co-occurrence with looser threshold settings to identify more potential links between identified sub-themes. Thus, more promising fields of study could be explored by associating relevant subtopics or from different grouping solutions of the literature.

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