

Visual Analysis of CSR Based on Knowledge Graph - Data from WoS 2018-2022

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Abstract: The study of CSR has been receiving a lot of attention and is a hot issue in academic research and has developed relatively prosperous and numerous research area. However, analyzing these research results after 2018 using knowledge mapping is relatively rare. This study examines the development and trends in the field of CSR research using a sample of 9445 articles from the WoS platform and bibliometric methods in terms of the change in the number of literature, authors, High-frequency cited, and keywords. The results show the accelerated development of CSR research in terms of number and breadth. The research hotspots and trends in this field are proenvironmental behavior, financial constraints, co-creation, and COVID-19 pandemic, with COVID-19 pandemic likely to be a top research priority.

1. Introduction

With the development of the economy and society, Corporate social responsibility (CSR) practices are gradually becoming an irreversible global trend. Research on CSR is also experiencing an unprecedented boom in recent years. As of 2022, there are 20,410 CSR-related publications on the Web of Science, of which 9445 belong to 2018. This indicates that the business community, researchers, and scholars have had a strong interest in this field recently[1].

In The Social Responsibility of Businessmen in 1953, Howard R. Bowen proposed that "businessmen have to formulate policies, make decisions, or take specific actions by the goals and values desired by society[2].Carroll(1979)first classified CSR as economic, legal, ethical, and philanthropic responsibility, arguing that businesses give financial or other support to events or activities primarily in the hope that the society will be rewarded and that, ultimately, the business will be rewarded[3]. Some studies have argued that corporate efforts are seen as acts of enthusiasm and friendliness and not just companies that want to get something in return[4]. From this, it can be seen that consumers are eager to see responsible behavior from companies, and they want companies to demonstrate fair, honest, and transparent approaches to all stakeholders[5]. It has also

been found that the CSR concept will evolve over time and vary by country and cultural context[6]. The outbreak of the new crown epidemic at the end of 2019 has brought about a contradictory conflict between society's expectations of higher responsible corporate behavior and the financial constraints and the enormous survival pressures prevalent in companies themselves at a time when the study of CSR hotspots and overall trends has specific research significance.

The visualization approach refers to using visual and intuitive representations to display complex resource content after converting raw data into visual elements to deepen the user's understanding. The Citespace software system is a Java-based platform for measuring and analyzing scientific literature data information developed in 2004 by Dr. Chao-Mei Chen, a Chinese scholar in the School of Information Science and Technology at Drexel University visualization software[7]. Some scholars applied Citespace to analyze China's development stages and key drivers of CSR theoretical research. The article concluded that CSR in China is experiencing a shift in practice from exogenous to endogenous, crude to refined, and compliance to strategic and theoretical research will also show development trends such as issue-based, interdisciplinary, and cross-cultural[8]. Some scholars have also used cite space to study the social responsibility of special enterprise types and special topics. Yang et al combine the advantages of the traditional bibliometric tools with the strengths of the latest bibliometric software CiteSpace to achieve a comprehensive knowledge review of ER and build a knowledge graph model[9]. Zhao et al seek to analyze and visualize the evolution and research trends in the field of CSR leadership by using bibliometric methods. From a sample of 1432 peer-reviewed articles, they map the landscape of CSR leadership research and identify key developments and patterns from 1994-2020[10].

In recent years, based on the concept of sustainable development, increasingly companies have been asked to assume social and environmental responsibility. Meseguer-Sanchez et al have successively studied this topic[11].

In summary, it can be seen that there are a considerable number of articles applying Citespace to CSR research. But the overall CSR trend studies based on CSR are mostly focused on the period before 2020, and there are few CSR studies after 2020, especially during the epidemic. Accordingly, this study uses the CSR-related literature published on the Web of Science from 2018 to 2022 as a sample and quantitatively uses CiteSpace software to examine and visualize it through knowledge mapping. We conduct a bibliometric analysis of the current research status and research frontiers in this field while deeply analyzing CSR research focuses and hotspots, and explore the research trends of CSR, with a view to the research results making valuable contributions to the construction and application of CSR concepts by scholars and the business community. Help capture the hot topics related to it and, simultaneously, facilitate the development of new strategies for enterprises to fulfill relevant social responsibilities.

2. Research Methodology

2.1. Data Sources

The data used in this study were obtained from the Web of Science search platform of the Institute for Scientific Information (ISI), and subject searches were conducted in both SCI-E and SSCI databases of the platform using CSR as a search term, with the time frame set from July 2018 to 2022. We limited the data to scientific papers and excluded book reviews, conferences, editorials, and books, which were not the focus of this study. Other articles appearing in commercial journals and meetings were also removed because they were less likely to acknowledge scientific contributions. After selecting the raw data, 9458 records were collected (collected on July 15, 2022). After further de-duplication using the analysis software, 13 papers that were ineligible and duplicates were removed to obtain 9445 good records, which were the base data for our study.

2.2. Research Methods

Citespace software is used to make statistical analysis on the number of articles, published, authors, institutions, keywords, etc.

3. Analysis of Primary Data

3.1. Analysis of the Number of Articles Published

The number of publications reflects, to some extent, the active research of scholars on a topic and demonstrates the hotspots of study in a particular field. To analyze the trends in this academic field, Figure 1 summarizes and shows the number of publications in the field of CSR from 2018 to 2022. Based on the data collected, it is observed that the number of articles in this field shows a significant increase from 2018 to 2020. However, the upward trend slows down from 2020 to 2022 but still shows an upward trend (the data for 2022 are available as of July, and the movement cannot be predicted at this time). This trend also indicates that this topic will continue to receive academic attention in the current and future years. 1375 articles in 2022, a significant decrease from the previous year, is why this study's data collection date of July 15, 2022.

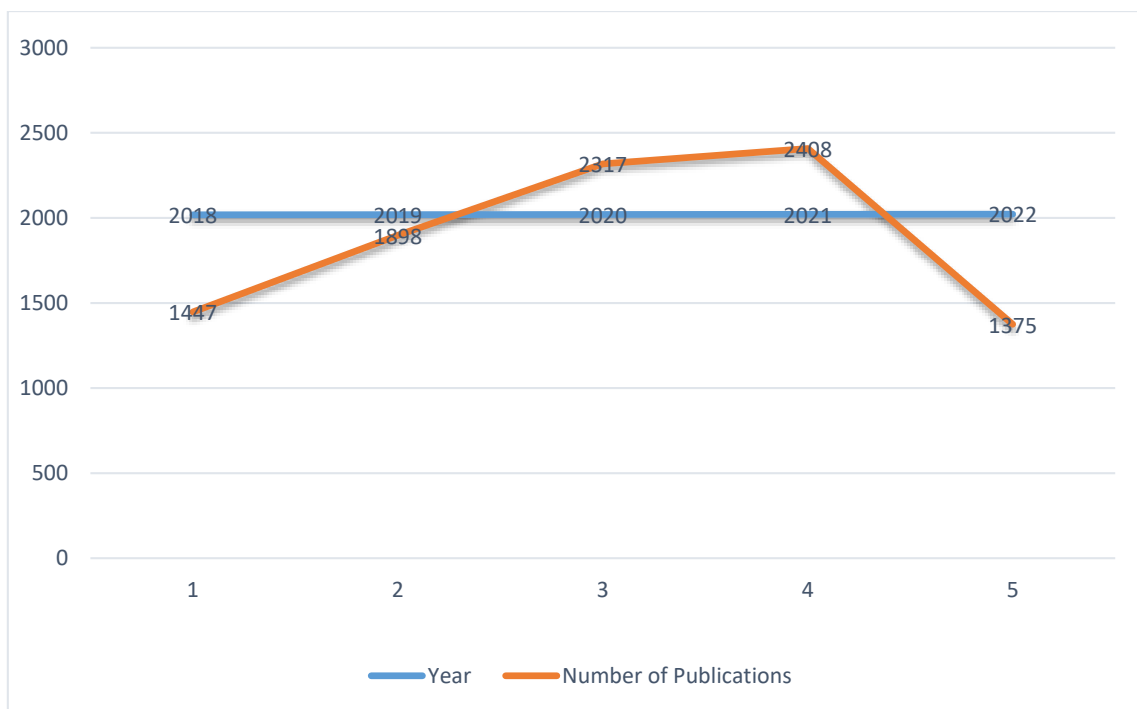


Figure 1: 2018-2022 Number of Publications over Years (CSR).

3.2. Analysis of Author

An author's literature in a field represents the depth of their research, and visual analysis of the authors allows for identifying authoritative scholars in that research area. In the literature analysis, authors who have published more than 30 papers on the same topic in five years are considered high-producing authors in this study. In the research sample selected for this study, there are 24 high-producing authors, among which the most prolific is LEE S with 87 publications, followed by ZHANG Y with 71 publications, who belong to the leaders in this field. The authors with more than 30 publications are counted, as shown in Table 1.

Table 1: High output of authors' articles (CSR).

Quantity of documents issued	Degree	Centrality	Author
87	4	0.04	LEE S
71	3	0.02	ZHANG Y
63	3	0.06	KIM S
61	3	0.1	WANG Y
59	3	0.06	LIU Y
58	1	0	KIM J
51	3	0.02	LI Y
46	2	0.02	LEE J
44	5	0.12	CHEN Y
40	2	0.01	WANG J
40	3	0.03	WANG X
38	3	0.11	LI X
37	1	0	WANG C
37	6	0.05	KIM H
37	7	0.08	GARCIA-SANCHEZ I
36	3	0.03	ZHANG J
34	3	0.02	CHEN H
34	3	0.02	LI J
34	4	0.06	ZHANG Z
34	4	0.02	ZHANG L
32	1	0	WANG L
31	3	0.05	CHEN C
31	6	0.09	CHEN S
31	2	0.04	LEE C

Figure 2 further reveals the past five years of collaboration among authors in the CSR research field. It can be found that the number of authors producing articles shows a positive correlation with the frequency of association, i.e., high-producing authors tend to collaborate.

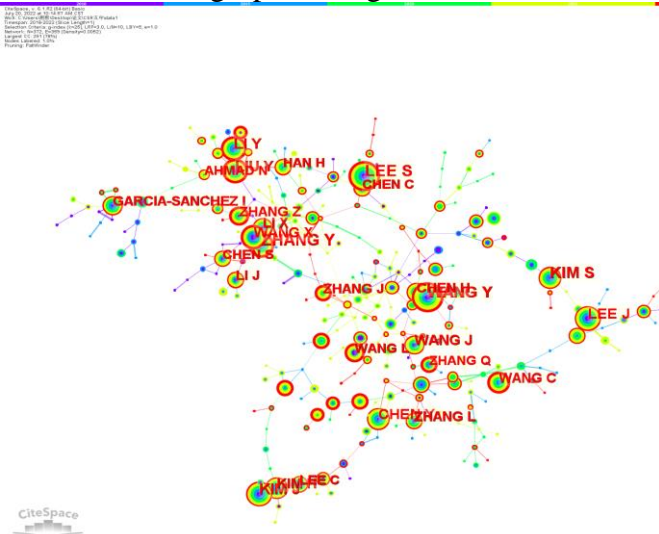


Figure 2: 2018-2022 Cooperation of the author (CSR).

3.3. Analysis of High-Frequency Cited Articles

The citations reflect that the literature has a particular academic reference value in the field of CSR research and is an essential indicator of the level of authors and the journal's quality. Therefore, the literature with a high citation rate is organized in Table 2.

Table 2: High-frequency cited articles (CSR) (frequency > 200).

Citation Counts	Degree	Centrality	Author/journal,DOI	Year	Title
343	0	0	He H, 2020, J BUS RES, 116, 7, DOI 10.1016/j.jbusres.2020.05.030I343	2020	The impact of Covid-19 pandemic on corporate social responsibility and marketing philosophy
301	1	0	Chen YC, 2018, J ACCOUNT ECON, 65, 22, DOI 10.1016/j.jacceco.2017.11.009 301	2018	The effect of mandatory CSR disclosure on firm profitability and social externalities: Evidence from China
301	14	0.03	Jamali D, 2018, INT J MANAG REV, 20, 30, DOI 10.1111/ijmr.12112 301	2018	Corporate Social Responsibility in Developing Countries as an Emerging Field of Study
279	1	0	Dyck A, 2019, J FINANC ECON, 131, 22, DOI 10.1016/j.jfineco.2018.08.013 279	2019	Do institutional investors drive corporate social responsibility? International evidence
266	2	0.03	Hussain N, 2018, J BUS ETHICS, 149, 22, DOI 10.1007/s10551-016-3099-5 266	2018	Corporate Governance and Sustainability Performance: Analysis of Triple Bottom Line Performance
262	1	0	Albuquerque Rui, 2019, MANAGE SCI, 65, 19, DOI 10.1287/mnsc.2018.3043 262	2019	Corporate Social Responsibility and Firm Risk: Theory and Empirical Evidence
246	4	0.01	Bebbington Jan, 2018, ACCOUNT AUDIT ACCOUN, 31, 23, DOI 10.1108/AAAJ-05-2017-2929 246	2018	Achieving the United Nations Sustainable Development Goals: An enabling role for accounting research
243	1	0	Awasthi A, 2018, INT J PROD ECON, 195, 12, DOI 10.1016/j.ijpe.2017.10.013 243	2018	Multi-tier sustainable global supplier selection using a fuzzy AHP-VIKOR based approach
238	1	0	Kim Y, 2019, INT J HOSP MANAG, 76, 11, DOI 10.1016/j.ijhm.2018.04.007 238	2019	The effect of green human resource management on hotel employees' eco-friendly behavior and environmental performance
211	2	0	Elakremi A, 2018, J MANAGE, 44, 39, DOI 10.1177/0149206315569311 211	2018	How Do Employees Perceive Corporate Responsibility? Development and Validation of a Multidimensional Corporate Stakeholder Responsibility Scale

The highly cited literature can be divided into the following three categories: one is CSR practice research, which focuses on the correlation between CSR and related factors. The most cited one is the effect of mandatory CSR disclosure on firm profitability and social externalities: The second category is studied, corporate social responsibility and sustainability. The more frequently cited are Corporate Social Responsibility in Developing Countries as an Emerging Field of Study (Jamali,

2018); the third category relates to the impact of the new factors of the new crown epidemic on CSR, The impact of the Covid-19 pandemic on corporate social responsibility and marketing philosophy (He, 2020); it is the most cited article in five years, showing that the context of the new crown epidemic is strongly influencing the direction of CSR research development.

4. Analysis of Hot Topics

4.1. Keyword Co-Occurrence and Cluster Analysis

In this study, using CiteSpace software, we found a total of 928 keywords and 780 links in the keyword co-occurrence map, with a network density of 0.0162, indicating that these keywords are variously and more closely related. The larger the font and the more lines, the more frequent the keywords appear, and the high-frequency terms in Figure 3 mainly include "corporate social responsibility," "performance," "sustainability," and "financial performance."

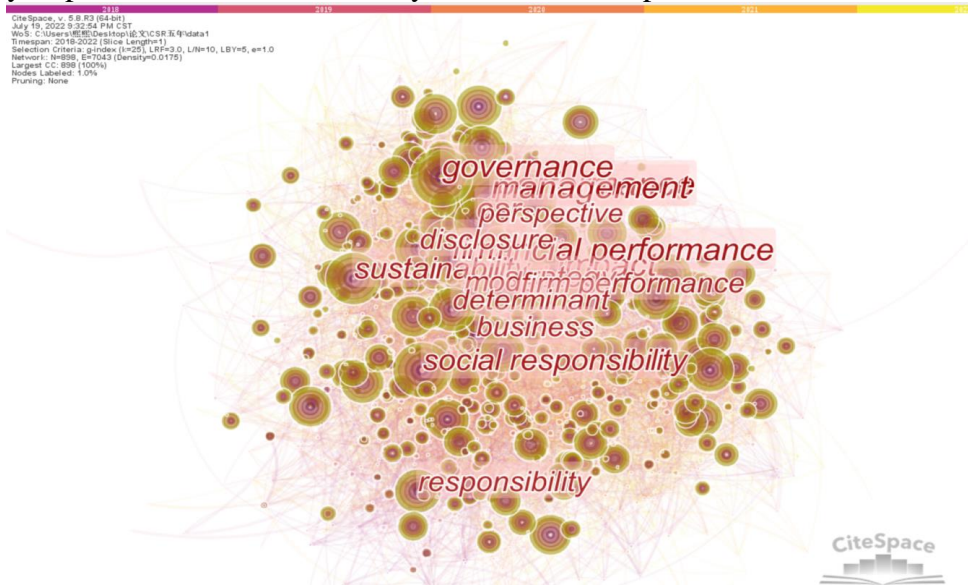


Figure 3: Co-occurrence analysis of keywords(CSR), Nodes=898, Links=7043.

Table 3: Top 10 keywords according to frequency and centrality (CSR)

Keyword	Fre	Keyword	Centrality
Performance	1835	Environmental protection	0.03
Impact	1714	Impact	0.02
Financial performance	1130	Firm performance	0.02
Sustainability	751	Collaboration	0.02
Firm	748	Outcm	0.02
Strategy	672	Entrepreneurial orientation	0.02
Disclosure	609	Trade off	0.02
Model	591	International business	0.02
Firm performance	586	Integrated reporting	0.02
Determinant	575	Mediation	0.02

To provide a more accurate overview of the areas and topics covered by current CSR research, this study removes the terms "CSR" and "corporate" and "management" before conducting a detailed count of high-frequency keywords. Table 3 shows that the top-ranked keyword is "performance" with a frequency of 1,835, followed by "impact" with a frequency of 1,714. In

addition, "financial performance" in the third place, "firm performance" in the tenth place, and "performance," "The third-ranked term 'financial performance,' the tenth-ranked term 'firm performance' and 'performance' should be grouped. This shows that academics are placing more emphasis on performance, often combining CSR with various performance aspects and analyzing whether and how they have an impact.

The top 10 for both cases are presented in Table 3. Table 3 shows significant differences in the ranking based on frequency and centrality, where the keywords "environmental protection", "impact", and "firm performance" lead to centrality. The keywords "environmental protection", "impact", and "firm performance" lead in terms of centrality, showing the significant influence these words can have. The fact that "impact" and "performance" lead in both rankings indicates that times such as "performance", "corporate performance", "financial performance". "financial performance" and "impact factors" are of greater interest in CSR research than other issues.

Based on the keyword co-occurrence analysis, we used CiteSpace to further interpret the information of clusters using the LLR clustering algorithm. This resulted in Figure 4, which shows the eight main Clusters found. Table 4 gives further details of these clusters, and it should be noted that after sorting, we removed a set of duplicate clustering information, resulting in seven categories. Silhouette is between 0.5 and 1 and is often used as a measure of the internal homogeneity of clusters, or how similar a silhouette is between 0 and 1 and is usually used to measure the internal uniformity of a set, or how similar an object is to other clusters compared to its own. The higher the value, the more valid the groups formed and the better the things match within their collections. Group 0 focuses on the stakeholders' interests, and the study revolves around female directors, corporate governance, corporate governance mechanism, board gender diversity, and corporate tax avoidance. Group 1 focuses on sustainable development, where research includes sustainable supply chain, circular economy; green innovation; sustainable performance; dynamic capabilities. Group 2 is devoted to global production-related studies, including global production networks, global supply chain, social licenses; multinational enterprises; extractive industries. Group 3 focuses on Customer mentality. Group 4 focuses on organizational mentality and behavior. Group 5 focuses on decision making and information. Group 6 focuses on ethical values. These seven categories are the main areas of CSR research in the last five years. They are also the current hotspots of research, where the combination of stakeholders, especially female directors, sustainable development, and CSR, turns out to be increasingly.



Figure 4: Cluster analysis of keywords

Table 4: The details of keywords in clusters (CSR)

Clustert ID	Size	Silhouette	LLR	Main Theme
0	195	0.537	female director; corporate governance ; corporate governance mechanism ; board gender diversity; corporate tax avoidance	Stakeholder
1	184	0.555	sustainable supply chain ; circular economy; green innovation; sustainable performance; dynamic capabilities	Sustainable development
2	173	0.557	global production network; global supply chain; social license; multinational enterprises; extractive industries	Global production
3	140	0.655	customer loyalty; cause-related marketing; purchase intention ; behavioral intention; consumer responses	Customer mentality
4	90	0.751	organizational citizenship behavior ; organizational identification; organizational commitment ; job satisfaction; organizational support	Organizational mentality and behavior
5	23	0.954	closed-loop supply chain ; considering corporate social responsibility; pricing decision; consumer-friendly firm ; information value	Decision making and information
6	11	0.871	market-based asset; ethical tension ; neoliberal paradoxe ; researching social justice value; excuses charter school	Research based on ethical values

To further examine the temporal pattern of how keyword clustering evolves, we converted the text into a timeline view, as shown in Figure 5. For example, cluster #0, or the cluster related to stakeholders, starts in 2018 and continues until 2022. In this cluster, frequently used keywords include "women director", "corporate governance", "COVID-19", "financial". Only clusters #0 and #4 are still significantly active in 2022; they are female direct (Stakeholder) and organizational citizenship behavior (Organizational mentality and behavior). Otherwise, cluster #7 market-based assets (which we categorized as #6 Research based on ethical value) does not continue in 2020, indicating that this area of research is no longer a priority.

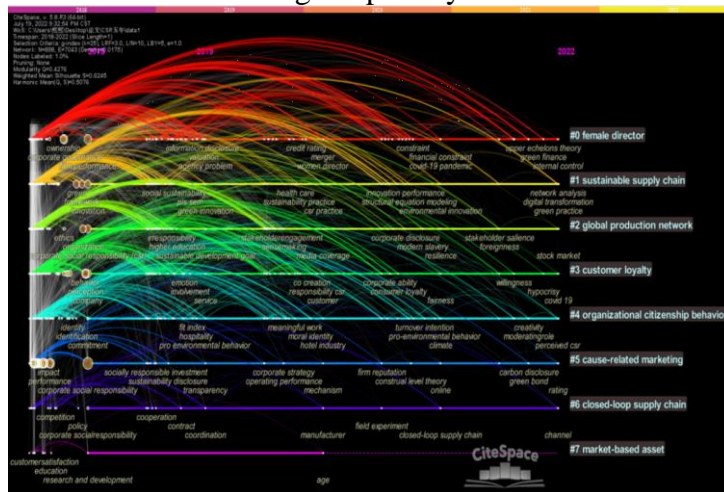


Figure 5: Timeline view of popular keywords in different clusters (CSR).

4.2. Citation Burst of Keywords

Top 35 Keywords with the Strongest Citation Bursts

Keywords	Year	Strength	Begin	End	2018 - 2022
perspective	2018	22.39	2018	2018	
research agenda	2018	12.51	2018	2018	
environmental management	2018	7.83	2018	2018	
reverse logistics	2018	7.3	2018	2018	
fair trade	2018	6.36	2018	2019	
united states	2018	6	2018	2018	
conduct	2018	5.92	2018	2018	
multinational enterprise	2018	5.77	2018	2018	
conservation	2018	5.72	2018	2019	
metaanalysis	2018	5.24	2018	2018	
private regulation	2018	5.09	2018	2019	
environmental policy	2018	4.93	2018	2018	
society	2018	4.8	2018	2019	
association	2018	4.47	2018	2018	
south africa	2018	4.45	2018	2019	
global governance	2018	4.45	2018	2019	
country	2018	4.21	2018	2018	
competitiveadvantage	2018	4.18	2018	2018	
partial least square	2018	4.18	2018	2018	
geography	2018	4.9	2019	2019	
resistance	2018	4.48	2019	2020	
religion	2018	4.41	2019	2019	
failure	2018	4.41	2019	2019	
product market competition	2018	4.76	2020	2022	
pro-environmental behavior	2018	6.97	2021	2022	
financial constraint	2018	6.49	2021	2022	
co creation	2018	6.29	2021	2022	
covid-19 pandemic	2018	6.2	2021	2022	
environmental innovation	2018	5.9	2021	2022	
climate	2018	4.72	2021	2022	
technological innovation	2018	4.18	2021	2022	
renewable energy	2018	4.13	2021	2022	
esg disclosure	2018	4.13	2021	2022	
corporate social responsibility disclosure	2018	4.13	2021	2022	
resilience	2018	4.13	2021	2022	

Figure 6: Citation burst of keywords over time (CSR).

Visualizing keyword emergence using CiteSpace makes it possible to identify sudden occurrences or large numbers of citations of specific keywords. Keyword burst mapping can visually reveal past research targets and current hotspots and developments in the field based on burst keywords at various times. As shown in Figure 6, the burgeoning keywords in many CSR research have changed over time. In this study, we selected the top 35 keywords in prominence intensity. We found that the most keywords were highlighted in 2018, with 13 keywords; the keywords that were highlighted in 2019 were 5; in 2022 there is only one emergent keyword that produce market competition; in 2021 there are 11, with top-ranking proenvironmental behavior, financial constraints, co-creation, and COVID-19 pandemic. 2018 has the most emergent keywords because our study started in 2018, so keywords carried over from previous years will reflect the emergent in 2018, but not necessarily in 2018. We also found that no keywords that emerged in 2018 and 2019 were able to continue into 2021, while most of the keywords that continued into 2022 exploded in 2021. This suggests that research in this area has changed considerably around 2021, with the current focus on proenvironmental behavior, financial constraints, co-creation, and the COVID-19 pandemic. While environmental and the study of finance have long been the focus

of CSR research, in 2021, COVID-19 pandemic-related CSR research also emerged as a new area. Still, the intensity of its prominence was not particularly prominent. 2022 saw less data, so no new emergent keywords were identified.

5. Conclusion

Firstly, the volume of literature related to CSR shows a significant growth trend and is growing at a faster rate, indicating the continued academic attention to research on this topic. The impact of the Covid-19 pandemic on corporate social responsibility and marketing philosophy (H, 2020) is the most cited article in the past five years, which shows that the context of the new crown epidemic strongly influences the direction of CSR research.

Secondly, this study analyses several authors who are highly prolific in the field of CSR and have a high level of collaboration between highly prolific authors. In the sample selected for this study, there are 24 prolific authors, the most prolific being LEE S with 87 publications, followed by ZHANG Y with 71 publications, who are among the leaders in this field.

Thirdly, the analysis of hot topics shows that the research on CSR in the past five years has been focused on seven categories: Category 1 focuses on stakeholder interests; Category 2 on sustainable development; Category 3 on global production; Category 4 on customer mentality; Category 5 on organizational mentality and behavior; Category 6 on decision making and information; and Category 7 on research based on ethical values. Category 5 focuses on corporate mentality and behavior; Category 6 on decision making and communication; and Category 7 on research based on moral values. These seven categories are the main areas of CSR research in the past five years. They are also the current hotspots of research, among which the combination of stakeholders, especially female directors, sustainable development, and CSR research, has been increasing.

Fourthly, evolutionary trends found that future CSR research will continue to focus on stakeholder-related research and customer mentality research, including "women director," "corporate governance," "COVID-19", "financial", "female direct (Stakeholder) and organizational citizenship behavior (Organizational mentality and behavior). Female direct (Stakeholder) and organizational citizenship behavior (Organizational mentality and behavior). The research will focus on proenvironmental behavior, financial constraints, co-creation, and the COVID-19 pandemic. The number of citations in the literature suggests that the COVID-19 pandemic should be a top priority.

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