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Science Mapping: A Bibliometric Analysis of Sustainability Among SMEs

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Abstract

Sustainable development has become an inescapable strategy for small and medium-sized enterprises (SMEs) in recent years. However, despite the enormous support from governments, stakeholders, and other related agencies towards sustainability policies, many SMEs are unaware of their sustainability and environmental footprint obligations. Thus, based on bibliometric and distance-based visualisation of similarities (VOS) analysis, the purpose of this paper is to outline a broad-spectrum perspective of the structure of research in sustainability among SMEs. The paper uses the data from Scopus online database as of October 2022. Based on “key-terms” search results, 1421 valid documents were obtained for further analysis using VOS viewer software and Harzing’s Publish or Perish for citation metrics and analysis. The finding shows that Journal of Cleaner Production and Sustainability (Switzerland) is the field’s most relevant journal. The People’s Republic of China ranked as the most contributor country in productivity with 193 (13.58%) published documents. Among many authors, concerning the frequency of citations, Chen’s (2008) article emerges as the most cited article with 681 cites and an average of 48.64 citations per year. This paper contributes to SMEs sustainability research by providing a global perspective on the concept’s investigation using bibliometric data and graphical networks.

Keywords: Sustainability; SMEs; Bibliometric analysis; Scopus database.

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Introduction

In recent years, there has been an increasing interest in Small and medium-sized enterprises (SMEs) involvement in sustainable development as it has become an inevitable strategy. Onwunta and Casper (2020) showed that SMEs have a passive attitude toward sustainable development and turn a blind eye to assessing their effect on the environment. Add to that, despite the enormous support from governments, stakeholders, and other related agencies towards sustainability policies, so many SMEs are still oblivious to their responsibilities in terms of sustainable performance and environmental footprint (Cariola *et al.*, 2020).

Furthermore, the recent research showed that SMEs, as a group, have a significant harmful effect on the environment by producing large amounts of waste materials (Jabbour *et al.*, 2020). Nonetheless, despite their potential to exert significant environmental pressures, SMEs’ ability and

willingness to manage the impact on the environment of their businesses has been identified as a significant source of concern (Quartey & Oguntoye, 2020). Several of the primary reasons for these concerns are limitations of the resource (primarily costs, time, and expertise), a lack of incentives, a poor understanding of how sustainable business relates to the SME, a lack of clarity on the beneficial effects of corporate sustainability, as well as the notion that their environmental impacts, if any, are negligible (Amankwah-Amoah & Syllias, 2020; Das, Rangarajan & Dutta, 2020).

According to Etemad (2020), SMEs are moving slowly, and some are refusing to respond to the call for sustainability due to uncertainty. Therefore, as highlighted by Gonzales-Gemio *et al.* (2020), SMEs have limited information on the appropriate action or procedures to be taken, and as a matter of fact, many keep quiet when it comes to the sustainability mission. It has been stated that SMEs face challenges such as a lack of knowledge, innovations, quality system and internal motivation and orientation that prevent them from adopting sustainable practices (Ali *et al.*, 2020, Kassab *et al.*, 2022). This means that although the aforementioned could be seen as “legitimate” grounds for resistance to sustainability from the perspective of SMEs, the realities of sustainable development render them meaningless. In light of the fact that the unchecked use of our planet’s natural resources endangers the ability of future generations to provide for their own needs, we must find ways to reduce our consumption (Brundtland, 1987; Keskin *et al.*, 2013; Cervelló-Royo *et al.*, 2020).

With the ever-increasing body of research has been done on SME sustainability, which offers a valuable focus for concerted scholarly research. Accordingly, examining the nature and dynamics of published articles is a common technique among scholars who work in the fields of bibliometrics and bibliography. As able to track the evolution of the observed topic of interest, journal publication activity, or scientific discipline (Kassab *et al.*, 2022). The purpose of a bibliometric analysis is to determine trends in a particular field of study by assessing the quality and quantity of relevant published materials. Bibliometric analysis, in other words, can reveal the academic strength of an institution and the potential of citation/co-citation models, thus encouraging the investigation and clarification of the main work contents and progress of a certain discipline, by conducting in-depth research on the characteristics of published literature. Modern bibliometric methods don’t just rely on crude numerical and statistical calculations; they also factor in the influence of major researchers and publications and highlight the role that a field’s knowledge institutions and current advancements play in shaping the trend of research.

Moreover, bibliographic databases like Scopus have advanced analytic tools to fully empower scholars to exploit the potential of accessible bibliographical data. Thus, according to Zakaria *et al.* (2021) the most common bibliometric analysis indicators are publication classification, citations, authorship, publication impact, and country. Nonetheless, the bibliometric methodology is often divided into two forms of analysis: performance analysis and science mapping (Ahmi *et al.*, 2020), evaluated using the number of citations or citations per year, total h-index or g-index, cite score, as well as other various matrices. The first deals with the productivity of individuals, institutions, and nations and the second deals with the prevalent themes in a scientific field. Notably, the ability to analyse publications’ development, trend, or productivity by evaluating the quantity of publications in a specific research area.

In light of the above discussion, the subject of “*sustainable performance*” or “*sustainability*” is a serious matter that necessitates immediate attention. As a result, not just governments or citizens, but also corporations, academics, and policymakers, must work together to solve this issue. Therefore, this paper sought to science mapping of SMEs sustainability. In order to empirically document the field’s volume, intellectual structure, and directions for knowledge advancement, authors turned to bibliometric techniques.

The use of bibliometrics, text mining, and data visualisation. the following research questions are addressed by the authors:

- Q1. What is the growth state of publications over the years?*
- Q2. What are the most productive publication source titles?*
- Q3. Which are the most prolific countries in publication productivity?*
- Q4. What are the most highly cited and influential articles?*
- Q5. Who are the most cited and influential authors?*
- Q6. What are the most frequently appearing keywords?*
- Q7. What are the potential future research directions of SMEs sustainability?*

This article will provide an overview of the development of research on Sustainability among SMEs and present the current state of the art in this field, as well as to highlight trends from previous research and map them to the global evolution of the subject. The remainder of this paper is organised as follows: First, presents the theoretical background concerning the sustainability of SMEs. Then, describe the research method used in this article. Next, the analysis and results section present the information collected from the Scopus database documents. After that, research discussion, implication, limitations, and future research direction. And finally, the conclusion section addresses the study's overall findings.

Literature Review

Due to emerging concerns about sustainable practices in commercial settings, the role of SMEs in the arena of sustainability remains underexposed (Jabbour *et al.*, 2020). According to recent research, most SMEs consider sustainable and environmental issues to be non-critical aspects of their businesses, nor do they contribute to competitive business advantage (Arsawan *et al.*, 2020). This is evidenced by the fact that, in general, SMEs believe that their environmental impacts are negligible. Due to their smaller size, SMEs believe they have very little responsibility for overseeing their sustainable performance and environmental footprint.

Furthermore, prior studies have also shown that SMEs are unaware of environmental legislation, and the complex nature of the legislation might further befuddle and prevent businesses from fully understanding the implications of being unsustainable (Ngu *et al.*, 2020). As mentioned earlier, the majority of SMEs believe that their environmental impact is relatively low; as a consequence, they are unaware of the extent to which environmental issues and legislation actually impact them.

Moreover, although some studies show that an increasing number of SMEs are trying to engage in at least some environmental initiatives, many still believe that they have no significant effect on the environment (Dey *et al.*, 2018). The reluctance to take into account the environmental agenda is also driven by the fact that participating in environmental initiatives is expensive. For instance, monitoring and recording the environmental sustainability of Asian manufacturing SMEs is critical, and in light of recent evidence, monitoring of the region's two largest countries (China and India) is exceptionally crucial. One study looks at how manufacturing SMEs in India's leather goods industry are contributing to pollution in their communities by discharging tanner wastewater (Ndubisi *et al.*, 2021). The textile bleaching sector has a similarly dismal track record when it comes to environmental performance (Ndubisi, 2008). There is a parallel in China, where the manufacturing sector, which includes many small and medium-sized enterprises (SMEs), is considered a "red category" (very polluting) business due to the exceptionally high levels of smoke and dust particle emissions it produces (Ndubisi, 2008). The mining industry is another area of worry, as the Chinese government has shut down around 20,000 minor mines, coke, and steel mills due to their detrimental effects on the environment (Jabbour *et al.*, 2020). While the service sector contributes to the country's sustainability strategy, it has been identified that manufacturing SMEs are majorly responsible for environmental issues (Ghadimi *et al.*, 2020). For example, researchers argue that the serious influence of manufacturing SMEs on the environment is approximately 60–70% of total pollution,

which is considerably higher than the larger industries (Chang & Cheng, 2019). As a consequence, laws such as the Cleaner Production Law, the Law on the Prevention of Radioactive Pollution, and the Environmental Impact Assessment Law have been enacted by some Asian governments to help limit this phenomenon.

Indeed, provided the changes in social, legislative, and ecological landscapes, SMEs are striving to manage rising social demands to concentrate on environmental and social issues (Ndubisi *et al.*, 2021). Aside from government intervention, the influence of society is another motivator for businesses to take socially and environmentally responsible actions to achieve the considerable niche of sustainability. The potential benefits of sustainability are reflected not just in tangible financial results as well as other economic indicators but also in many managerial ways. Sustainable development advances enterprise reputation (Baah *et al.*, 2021), ensures the lawfulness of managerial decisions (Almagtome *et al.*, 2020), encourages labour relations, attracts resources, and relieves stakeholder pressure on the enterprise (Baah *et al.*, 2021), and acts as a competitive strategy for enterprises. Nevertheless, numerous SMEs are not aware of this potential benefits. as well, several SME owners/managers even claimed to be completely unaware of their business's environmental impact (NetRegs, 2016; Dey *et al.*, 2018). As a matter of fact, they are somewhat unaware of how environmental legislation may actually impact their enterprises (NetRegs, 2016). Consequently, SMEs have been characterised as being unconvinced of sustainable initiatives, and where they have appeared to recognise its significance, but their actions have not matched this awareness (Journeault, Perron & Vallières, 2021). Consequently, they are described in existing literature as laggards whenever it comes to environmental responsibility, making it more difficult and complex to engage in corporate sustainability initiatives (Quartey & Oguntoye, 2020; Das *et al.*, 2020).

In a nutshell, despite their small size, these small businesses may contribute a major portion of global pollution. With this realisation, SMEs must begin to recognise their roles in promoting sustainability initiatives. As previously stated, SMEs generally have little knowledge of sustainable issues and a poor understanding of concepts. From the above-mentioned, such a lack of comprehension and awareness of how sustainability initiatives may eventually impact SMEs survival, it is deemed timely that this current research is undertaken to draw the roadmap for SMEs sustainability. Besides, with the limited exploration of sustainable initiatives among SMEs, sufficient study attention is indeed necessary to support SMEs adoption of the sustainability concept. In line with these assertions, using empirical documentation of the intellectual structure, volume, and knowledge-development tendencies, this study seeks to discover common points and future interdisciplinary research between sustainability and SMEs. Therefore, this study sought to science mapping of SMEs sustainability using the integration of bibliometric, text-mining, and visualisation analyses.

Research Methodology

The research sample was selected using data from Scopus, a database of scholarly articles. The exported data comprised complete bibliographic records, such as citation and bibliographical data, details about funding, the abstract, keywords, etc. The primary criteria for bibliographic unit research corresponded to scientific papers published between 1988 to 2022 and were limited to business, social and economic subjects' area. The competitive nature of the Scopus bibliographic platform compared to other specialised databases was the major research subject of several scientific papers (Harzing & Alakangas, 2016), and more comprehensive time coverage of recorded units was emphasised as its most significant advantage (Mongeon & Paul-Hus, 2016). Scopus is a database that combines a large collection of abstracts and citations from scholarly works in many different fields with additional data and links to that material. The following keywords have been used to search relevant articles which is relevant to the topic, namely "sustainable development" or "environmental management" and "SME*" or "small firm*" or "small business*" or "small and medium enterprise" were used to search for research articles. This study concentrated on the titles of the articles since they indicate the related topic that is derived from the research subject and the study's purpose. Furthermore, Kassab *et al.* (2022) explained in their study that the title of an article

is the first thing a reader sees; therefore, it is essential to grab their attention with relevant information. Fig. 1 shows the search strategy. In this study, errata documents were excluded to avoid double counting and retracted documents that might create false-positive results. Based on the query, the results of the given criterion amounted to 1421 scientific papers, of which bibliographic data was retrieved on 10 October 2022. Next, the data were analysed using “Microsoft Excel” to calculate the frequencies of the published materials and to design the relevant chart and graph; “VOSviewer” software to construct and to visualise the bibliometric networks; and “Harzing’s Publish and Perish” software to calculate the citations metrics and some of the other frequencies. Those tools benefit by investigating the keywords co-occurrence and references co-citation, authors, and sources.

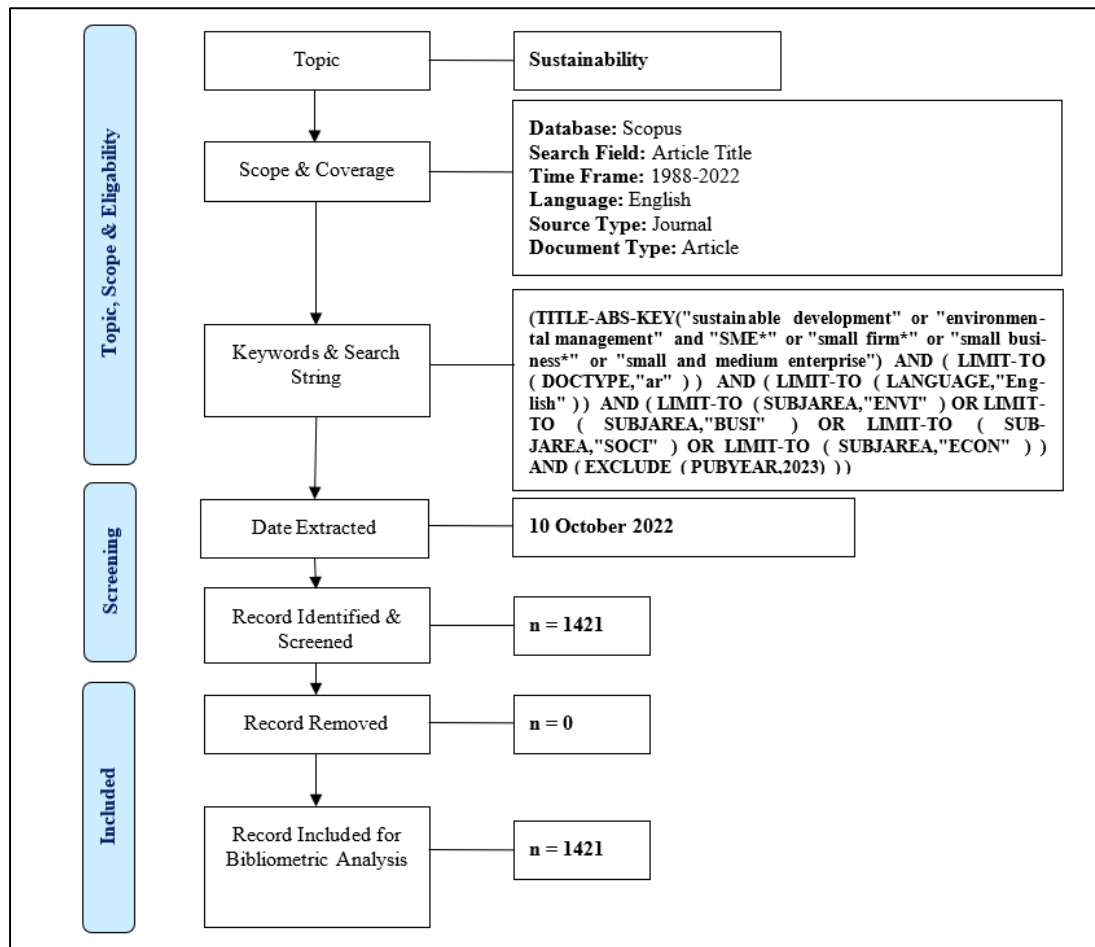


Fig. 1: Flow Diagram of the Search Strategy

Furthermore, considering the benefits of a literature review (Mallinguh & Zeman, 2020), the second phase of the result and findings aims to identify and review the highly top 15 cited articles in the field of sustainability among SMEs. This method allowed the researcher to develop a systematic overview, reveal gaps and highlight the insights and trends as well as shed light on future research direction in the field of SMEs sustainability. Following the guidelines developed by Demir *et al.* (2017), in an effort to narrow the scope of the literature study, we looked specifically at studies that focused on sustainability drivers in the context of business and management. The results of this stage are presented in the second phase of the result and findings.

Results and Analysis

The analysis is divided into two phases; phase one is “research trends”, which include documents’ growth of publication, productive publication titles, and country collaboration and productivity of extracted scholarly works. While phase two is “research quality”, which includes citation analysis, authorship and keyword analysis. Most of the findings are reported as frequency, percentage and visualisation. Furthermore, the top 15 cited articles in SMEs sustainability were presented and discussed in detail, driven by citation analysis and citation metrics.

Research Trends

The study analyses the research trends by evaluating the growth of publications by years, productive publication titles, country collaboration, as well as evaluation of the quality of published articles.

Growth of Publication

The first publication covered in the Scopus database, which fulfils inclusion criteria by containing key terms in the article title, dates back to May 1988. Called “*Evolutionary or fragmented environmental policy making? Coal, power, and agriculture in the Hunter Valley, Australia*,” this paper has been published in the journal “*Environmental Management*,” written by Diana G. Day (1988). Fig. 2 provides an overview of recent advancements and trends in the study of the factors that influence the sustainability of small and medium-sized enterprises. As a result, the results provide an evaluation of 1421 articles found in Scopus database. Even though sustainability conversations have been happening since the 1980s, the recent decade has seen a rise in focus on SMEs and sustainability. As 178 Articles were published in 2022, 194 were published in 2021, 170 were published in 2020, 140 were published in 2019, and 92 were published in 2018. The total number of observed publications clearly shows that the interest in SMEs sustainability topic is attracting considerable research attention in recent years.

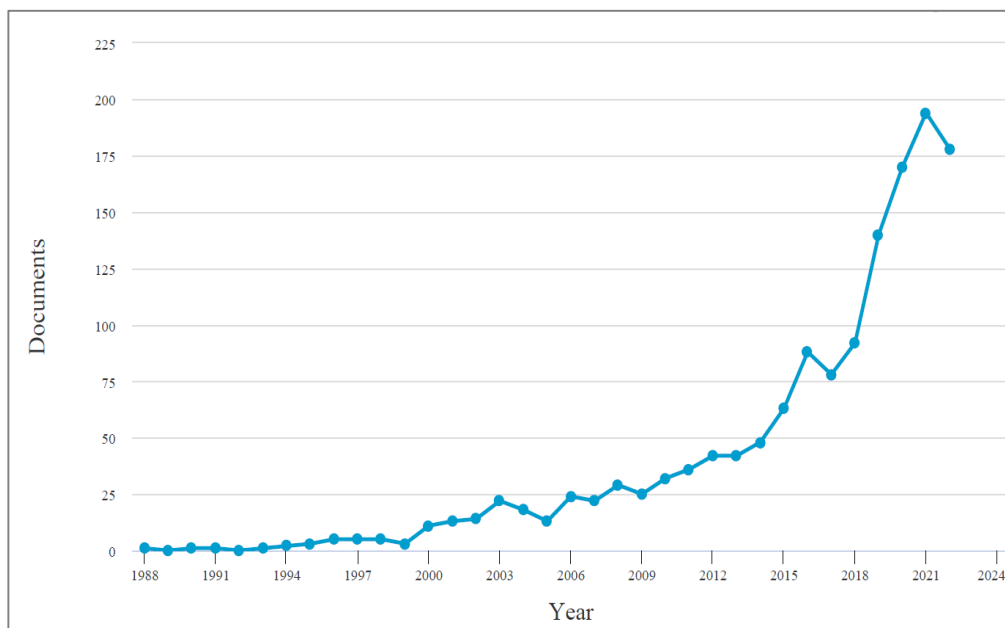


Fig. 2: Number of Papers in 1988-2022

Source: Scopus Analytics.

Productive Publication Titles

Furthermore, among the most widely read academic journals, the Journal of Cleaner Production (13.09%), Sustainability (12.32%), Business Strategy and the Environment (4.08%), and Corporate Social Responsibility and Environmental Management (2.04%) are the most prolific periodicals in

terms of article output as shown in Table 1. In the meantime, fewer articles were published in other publications. Additionally, the Scopus categories of Engineering, Environmental Sciences, Green & Sustainable Science & Technology have some of the world's best publications in their respective fields (e.g., *Journal of Cleaner Production*; *Sustainability*; *Resources Conservation and Recycling*; *Environmental Science and Pollution*).

Table 1: Most Active Source Title

Source titles	Record count	%
Journal of Cleaner Production	186	13.09
Sustainability Switzerland	175	12.32
Business Strategy and the Environment	58	4.08
Corporate Social Responsibility and Environmental Management	29	2.04
Production Planning and Control	17	1.20
International Journal of Production Economics	15	1.06
Science of the Total Environment	15	1.06
Journal of Environmental Management	12	0.84
Resources Conservation and Recycling	12	0.84
Technological Forecasting and Social Change	11	0.77

Source: Scopus Analytics

A map of journal co-citation analysis was then computed and displayed (Fig. 3). Each journal's co-citations are represented on the co-citation map as a bubble or node. The journals are clustered together in close proximity because of the high rate at which they are cited by one another (Maier *et al.*, 2020). This suggests a chain of overlaps in the subject matter of various articles. The map also includes a series of lines, each of which represents a co-citation link between two publications in different journals. Each node is assigned a colour that represents the frequency with which articles from the same journal are cited by one another. This suggests that there is some degree of content similarity between publications of the same colour (Liu *et al.*, 2020). In our sample of 28658 sources, 275 met the threshold of 30 sources citations. The analysis showed 216 items within six clusters of co-cited journals, as shown in Fig. 3.

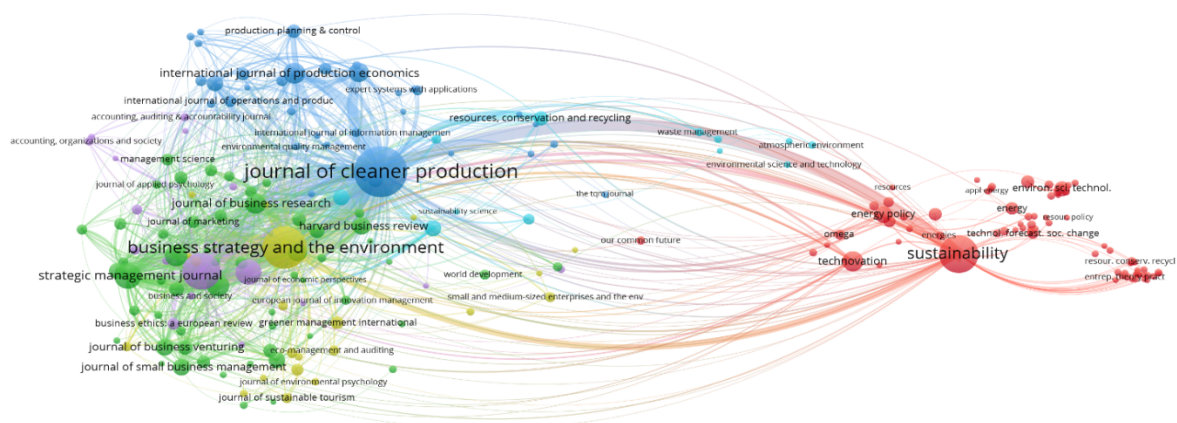


Fig. 3: Co-citations of Cited Sources

Source: Created by the Author Based on the VOSviewer Analysis.

With 75 items, the red cluster is the largest in the network. In this cluster, Sustainability (1121 citations) is the primary publication, *Technovation* (319 citations), *Energy Policy* (219 citations), and *Resources Policy* (198 citations). Journals from the fields of environmental studies, operations research and management, engineering, and business make up the red cluster. Next, the violet cluster has 56 items, and its top picks are the periodicals listed as follow: *Journal of Business Ethics* (1061 citations) and *Business Strategy and the Environment* (1419 citations). Journals in business, management, and environmental studies are all represented in this cluster. Then, the blue cluster, which consists of 35 items and is represented by a journal: *Journal of Cleaner Production* (2028 citations), *International Journal of Business Economics* (338 citations), and *International Journal of Production Research* (283 citations). Journals covering the fields of engineering, environmental studies, and green and sustainable technology make up the blue cluster. After that, the green cluster consists of 21 items, with the following periodicals serving as cluster leaders: *Strategic Management Journal* (532 citations), *Academy of Management Journal* (382 citations), *Academy of Management Review* (377 citations), and *Journal of Business Venturing* (233 citations). The cluster includes journals from the categories of business and management. Last not least, 17 items that make up the yellow cluster are led by the following publications: *Business Strategy and the Environment* (1419 citations), *Corporate Social Responsibility and Environmental Management Journal* (498 citations), and *European Journal of Innovation Management* (311 citations). Journals in business, management, and environmental studies are all represented in the yellow cluster. And lastly, the light blue cluster includes 12 items and is headed by the *Journal of Environmental Economics and Management* (681 citations), *Ecological Economics* (213 citations), *Journal of Management* (209 citations), and *Journal of Operation Management* (212 citations). The light blue cluster is composed of journals of the management category.

Country Collaboration and Productivity

According to an examination of the works indexed in Scopus, the vast majority (1,421) were written by researchers in developed countries (United Kingdom, United States, Italy, Spain, Australia, etc.) (see Table 2).

Table 2: Top 10 Countries Contributed to the Publications

Country	Record count	%
China	193	13.58
United Kingdom	185	13.02
United States	111	7.81
Italy	103	7.25
Spain	84	5.91
Australia	78	5.49
India	75	5.28
Malaysia	58	4.08
Canada	57	4.01
Germany	54	3.80

Source: Scopus Analytics.

Nevertheless, the overlay visualisations which used to show developments over time that there are many studies from China, India, and Malaysia have contributed significantly, as shown in Fig. 4. The government's policy directions, proper regulation, and societal awareness all play a role in the rise of research in this area. In the meantime, the greatest obstacle in the context of developing countries appears to be a lack of defined standards for sustainable development for various parties. The dearth of literature exploring the sustainability of small and medium-sized enterprises from the vantage point of emerging countries was therefore recognised by other academics (Kassab *et al.*, 2022).

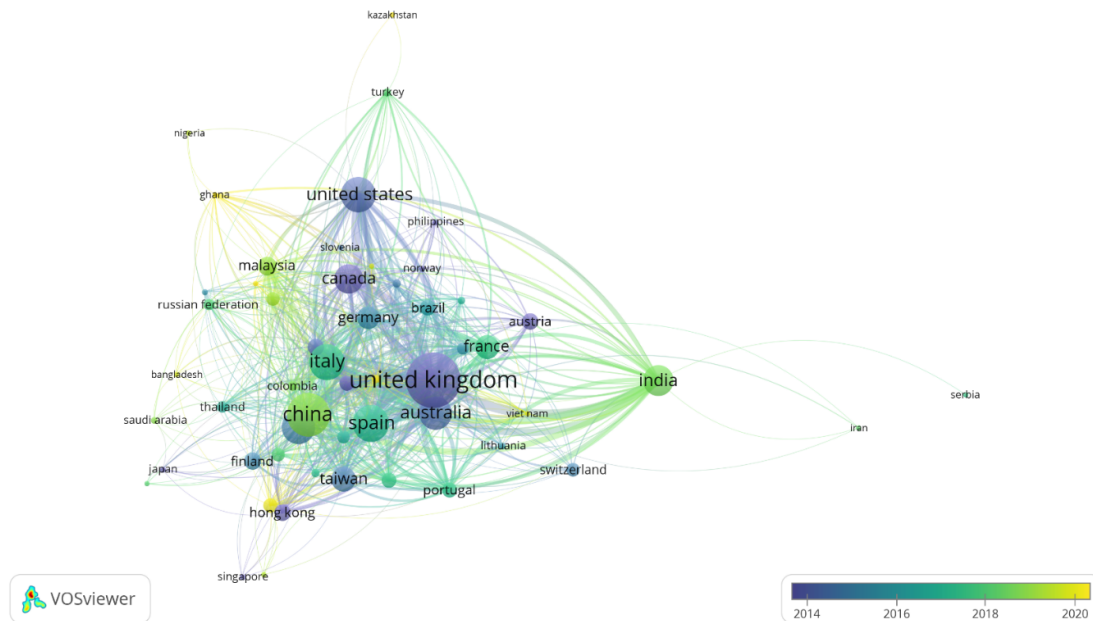


Fig. 4: Overlay Visualisation of Countries Contributed to the Publications*

Source: Created by the Author Based on the VOSviewer Analysis.

*Note: Minimum number of documents of an author = 1; Minimum number of citations of an author = 5

Research Quality

Assessment of an article's "quality" or "impact" based on the frequency with which it is cited by other authors. A publication's or an author's influence can be gauged by tracking how often they are referenced in subsequent publications, a process known as "citation analysis."

Citation Analysis

As of 10 October 2022, the retrieved documents' citation metrics are summarised in Table 3, which displays the total citations for all papers retrieved together with the average citations per year. According to the data, 1421 retrieved articles have been cited 39226 times over 34 years (1988-2022), with an annual citation rate of 1153.71.

Table 3: Citations Metrics

Metrics	Data
Publication years	1988-2022
Citation years	34
Papers	1421
Citations	39226
Citations/year	1153.71
Citations/paper	27.6
Citations/author	17056.02
Papers/author	589.94
h-index	97
g-index	145

Source: Publish or Perish Software.

Moreover, we used citation analysis to identify the most influential papers within our data set. According to the analysis's guiding premise, a paper's impact grows proportionally with the number of times it is cited by other scholars in the same subject. The 15 most-cited papers are listed in Table 4 below.

Table 4: Top 15 Highly Cited Articles

No.	Authors	Title	Year	Cites	Cites per Year	Source
1	Chen, Y. S.	The driver of green innovation and green image - Green core competence	2008	681	48.64	Journal of Business Ethics
2	Aragón-Correa, J. A., Hurtado-Torres, N., Sharma, S., & García-Morales, V. J.	Environmental strategy and performance in small firms: A resource-based perspective	2008	673	48.07	Journal of Environmental Management
3	Lee, S. Y., & Klassen, R. D.	Drivers and enablers that foster environmental management capabilities in small- and medium-sized suppliers in supply chains	2008	436	31.14	Production and Operations Management
4	Bos-Brouwers, H. E. J.	Corporate sustainability and innovation in SMEs: Evidence of themes and activities in practice	2010	427	35.58	Business Strategy and the Environment
5	Gadenne, D. L., Kennedy, J., & McKeiver, C.	An empirical study of environmental awareness and practices in SMEs	2009	416	32	Journal of Business Ethics
6	Singh, S. K., Del Giudice, M., Chierici, R., & Graziano, D.	Green innovation and environmental performance: The role of green transformational leadership and green human resource management	2020	376	188	Technological Forecasting and Social Change
7	Yam, R. C., Guan, J. C., Pun, K. F., & Tang, E. P.	An audit of technological innovation capabilities in Chinese firms: Some empirical findings in Beijing, China	2004	336	18.67	Research Policy
8	Van Hemel, C., & Cramer, J.	Barriers and stimuli for ecodesign in SMEs	2002	323	16.15	Journal of Cleaner Production
9	Caniato, F., Caridi, M., Crippa, L., & Moretto, A.	Environmental sustainability in fashion supply chains: An exploratory case-based research	2012	316	31.6	International Journal of Production Economics
10	Chen, Y. S.	The positive effect of green intellectual capital on competitive advantages of firms	2008	314	22.43	Journal of Business Ethics
11	Gupta, H., & Barua, M. K.	Supplier selection among SMEs on the basis of their green innovation ability using BWM and fuzzy TOPSIS	2017	307	61.4	Journal of Cleaner Production
12	Del Brio, J. A., & Junquera, B.	A review of the literature on environmental innovation management in SMEs: Implications for public policies	2003	289	15.21	Technovation
13	Simpson, M., Taylor, N., & Barker, K.	Environmental responsibility in SMEs: Does it deliver competitive advantage?	2004	269	14.94	Business Strategy and the Environment
14	Moore, S. B., & Manring, S. L.	Strategy development in small and medium sized enterprises for sustainability and increased value creation	2009	268	20.62	Journal of Cleaner Production
15	Revell, A., Stokes, D., & Chen, H.	Small businesses and the environment: Turning over a new leaf?	2010	246	20.5	Business Strategy and the Environment

First, one can see that the article entitled “*The driver of green innovation and green image - Green core competence*” by Chen (2008) produced the most influential document with the highest number of citations (681 citations or an average of 48.64 citations per year). The findings demonstrate that a company’s green core competencies positively correlated with its green innovation performance and green image. As a consequence, firms benefited from focusing on developing their green core competence, which helped them to increase their green innovation and green image or, as it is simply called, green reputation.

Next, the article entitled “*Environmental strategy and performance in small firms: A resource-based perspective*” by Aragón-Correa *et al.* (2008) produced the second most influential document with the number of citations (673 citations or an average of 48.07 citations per year). From reactive regulatory compliance to proactive pollution prevention and environmental leadership, the study found that SMEs in the automotive repair sector in Southern Spain use a wide range of environmental strategies. It is hypothesised that the distinctive strategic features of SMEs, such as shorter lines of communication and closer interaction, the presence of an owner’s vision, flexibility in managing external relationships, and an entrepreneurial orientation, underpin these strategies,

which are linked to three organisational capabilities: shared vision, stakeholder management, and strategic proactivity. The research showed that the most proactive businesses had the best financial results.

Then, the article entitled “*Drivers and enablers that foster environmental management capabilities in small- and medium-sized suppliers in supply chains*” by Lee and Klassen (2008) produced the third most influential document with the number of citations (436 citations or an average of 31.14 citations per year). The study revealed factors that initiated and improved environmental capabilities in SMEs over time. With the help of a number of distinct mechanisms, green supply chain management promoted and sustained the growth of suppliers’ environmental capabilities. Subsequently, synergistic connections manifested in mutually beneficial customer-vendor interactions, resource accumulation, and skill building. These results, when combined with those of studies focusing on larger suppliers, form the basis for an integrative framework that can guide efforts by suppliers, buyers, and government agencies to improve environmental performance.

After that, Then, the article entitled “*Corporate sustainability and innovation in SMEs: Evidence of themes and activities in practice*” by Bos-Brouwers (2010) produced the fourth most influential document with a number of citations (427 citations or an average of 35.58 citations per year). This research shows that many sustainable innovations aim to improve technological processes (eco-efficiency) and cut production costs. These developments are examples of incremental innovation. Integrating sustainability into a company’s orientation and innovation processes results in value creation, such as the introduction of novel products to the market (radical innovations) and productive partnerships with various stakeholders. Simply put, the results show that if more people knew about the innovative traits of SMEs and how to assess sustainable innovation activities, SMEs’ sustainability performance would improve.

And finally, Then, the article entitled “*An empirical study of environmental awareness and practices in SMEs*” by Gadenne *et al.* (2009) produced the fifth most influential document with the number of citations (416 citations or an average of 32 citations per year). With increasing awareness of environmental issues, there has been a rising demand for environmental-friendly business practices. This article explores the link between stakeholder influence and environmental consciousness, and how the latter motivates the former to take steps within businesses to lessen their negative effects on the environment. What this study shows is that when laws are put in place to protect the environment, businesses become more environmentally conscious and open to implementing new green practises.

Authorship Analysis

By analysing the relationships between the most frequently cited authors, we can see where the most significant research communities are concentrated. Only 197 of the 85,229 authors had at least 50 citations from other works. In addition, five distinct groups of academics were found, as shown in Fig. 5.

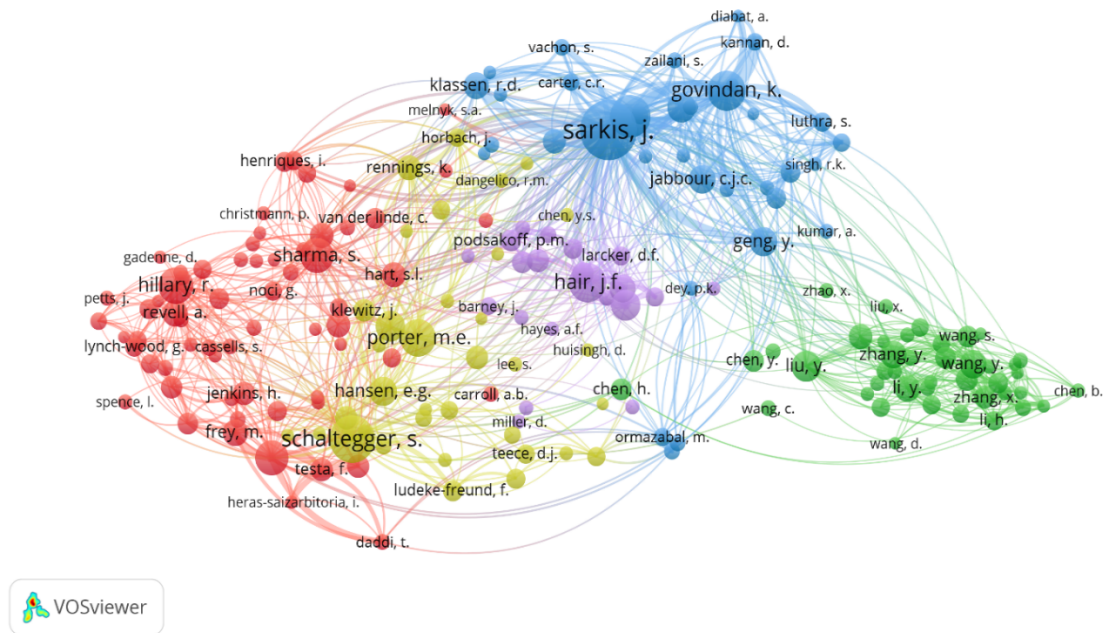


Fig. 5: Co-citations of cited authors
Source: Created by the author based on the VOSviewer analysis.

The cluster in red includes 64 items and is led by Hillary, R. (218 citations and 4833 total link strength), Sharma, S. (206 citations and 6171 total link strength), and Hart, S. L. (131 citations and 4007 total link strength). The cluster in green includes 42 items and is led by Zhang, Y. (149 citations and 3543 total link strength), Wang, Y. (151 citations and 3918 total link strength) and Liu, Y. (173 citations and 4581 total link strength). The blue cluster includes 35 items and is led by Sarkis, J. (441 citations and 14547 total link strength), Govindan, K. (250 citations and 8613 total link strength) and Jabbour, C. J. E. (152 citations and 4937 total link strength). The cluster in yellow colour includes 35 items and is led by Porter, M. E. (231 citations and 4785 total link strength). In addition, this cluster comprises Schaltegger, S. (321 citations and 7551 total link strength) and Hansen, E. G. (161 citations and 4667 total link strength). Finally, the violet cluster includes 21 items and is led by Hair, J. F. (240 citations and 6949 total link strength), and Sarstedt, M. (171 citations and 5026 total link strength).

Keyword Analysis

Researchers use keyword analysis to try and uncover all of the relevant publications that contain a specific term. Major study areas concerning small and medium-sized enterprises and sustainability were determined by analysing the scholars' chosen keywords from the abstracts of the articles. Specifically, the larger the node in the network, the bigger the importance of the keyword. In addition, the strength of the connections between nodes can be understood by their distance from one another in the network. As can be seen in Fig. 6, keyword groups are highlighted in various hues after being discovered by the VOSviewer software.

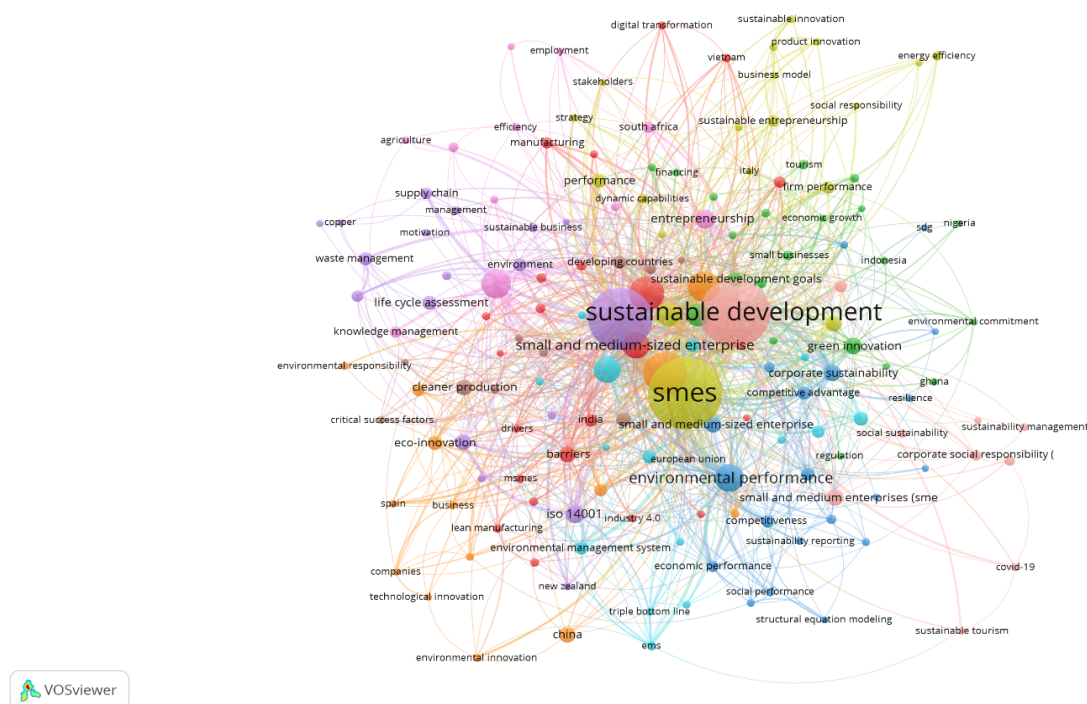


Fig. 6: Co-occurrence of author keywords in the publications.
Source: Created by the author based on the VOSviewer analysis.

Of the total of 4068 keywords, 163 had at least five occurrences each. Ten distinct groups emerged from the data. The five main clusters serve as a summary of the most common topics discussed in the scientific literature. The largest set, consisting of 23 items, can be found in the red cluster that is being driven by the phrase “*sustainable development*.” The keyword “*SMEs*” serves as the umbrella term for the green cluster, which contains a total of 21 individual items. The keyword “*environmental performance*” serves as the overarching for the 20 items that make up the blue cluster. The keyword “*innovation*” consists of 19 items that comprise the orange cluster. Lastly, “*Sustainability*” consisting of 18 items that make up the violet cluster.

Discussion

The study's primary goal was to objectively document the intellectual structure, volume, and knowledge-development paths of sustainability and SMEs in order to find shared ground and future interdisciplinary research. We conducted a bibliometric analysis, looking at 1421 articles from periodicals included in Scopus, to achieve our aims. A growing number of researchers are turning to bibliometric analysis as a means of showing how research is shifting over time. In this section, we summarise the findings and address the research questions.

The first research question addressed in this study is about the state of publication growth over time. The first findings show that the number of articles on the issue of SMEs' sustainability has recently increased dramatically. Even while the concepts are not new (we found articles dating back to 1988), the volume of published papers increased significantly in the recent ten years, from 2011 to 2021, when compared to preceding eras. This conclusion is obviously not based on solid ground; it is simply an initial assessment of the size of the literature on SMEs and sustainability; the total number of observed publications clearly shows that the interest in the topic of SMEs sustainability has attracted significant research attention in recent years. This progress can be attributed to a variety of factors, one of which is the globalisation of the economy, which has driven SMEs to discover new means of surviving and prospering; in this regard, sustainability is a solution.

Above and beyond that, society is becoming more aware of environmental issues, and so the concept of sustainability is becoming more prevalent.

Having this initial conclusion in hand, we go to the second research question, which is to identify the most prolific publishing source titles. To answer this question, we conducted a bibliometric examination of the literature. In this scenario, we needed to create a sample database of articles from SMEs sustainability research. 1421 articles comprised our sample database. We discovered, using bibliometric research, that the journals with the largest number of published papers are, in order, the Journal of Cleaner Production. The Journal of Sustainability is the second most-published journal. Following that, the third journal, Business Strategy and the Environment, and the fourth journal, Corporate Social Responsibility and Environmental Management, feature a large number of publications on the theme of SMEs sustainability.

Having this second conclusion, we approach the third research question, in order to determine the most prolific countries in publishing production. The research of the Scopus database publications found that the majority of the publications were produced by experts from industrialised countries (United Kingdom, United States, Italy, Spain, Australia, etc.). Nonetheless, the overlay visualisations used to highlight changes over time that there are a large number of articles from China, India, and Malaysia are quite noteworthy. Government policy orientations, suitable legislation, and societal awareness all contribute to increasing research in this area. Meanwhile, in the case of developing countries, a lack of clear standards for sustainable development for various participants appears to be the key impediment. Based on these findings, academics interested in the sustainability of SMEs in underdeveloped countries may be able to discover relevant publishing venues.

With this third conclusion in hand, we go to the fourth research question, which is to identify the most highly cited and influential articles. As part of our research, we conducted a citation analysis to identify the most influential papers in our data set. According to the analysis's guiding premise, a paper's impact grows proportionally with the number of times it is cited by other scholars in the same subject. Since then, we have shifted our attention to the research field's intellectual structure, or the most frequently cited publications and authors. Science mapping's capacity to pinpoint the most influential publications in the scientific literature is a key strength. By examining their impact on the field of study, we can learn about the theoretical underpinnings of the field and its point of origin. Our co-citation analysis revealed that the article entitled "*The driver of green innovation and green image - Green core competence*" by Chen (2008) produced the most influential document with the highest number of citations (681 citations or an average of 48.64 citations per year). Next, the article entitled "*Environmental strategy and performance in small firms: A resource-based perspective*" by Aragón-Correa *et al.* (2008) produced the second most influential document with the number of citations (673 citations or an average of 48.07 citations per year). Then, the article entitled "*Drivers and enablers that foster environmental management capabilities in small- and medium-sized suppliers in supply chains*" by Lee and Klassen (2008) produced the third most influential document with the number of citations (436 citations or an average of 31.14 citations per year). After that, Then, the article entitled "*Corporate sustainability and innovation in SMEs: Evidence of themes and activities in practice*" by Bos-Brouwers (2010) produced the fourth most influential document with a number of citations (427 citations or an average of 35.58 citations per year). And finally, Then, the article entitled "*An empirical study of environmental awareness and practices in SMEs*" by Gadenne *et al.* (2009) produced the fifth most influential document with the number of citations (416 citations or an average of 32 citations per year).

With this fourth finding in hand, we go on to the fifth research question, in order to identify the most cited and influential Authors. An author co-citation map was created for the most significant authors in the subject, identifying five main clusters. Some key writers from the largest clusters include (Hillary, R; Sharma, S; and Hart, S. L), who have also collaborated and created the link between the SMEs sustainability field of research. They also include articles that are among the top 15 most cited. Other notable researchers in the field include (Zhang, Y; Wang, Y; Liu, Y;

Sarkis, J; Govindan, K; Jabbour, C. J. E; Porter, M. E; Schaltegger, S; Hansen, E. G; Hair, J. F; Sarstedt, M).

With this fifth conclusion in hand, we go to the sixth research question, which is to determine the most often occurring terms. This section of the study addressed the most researched themes in the investigated field, and for that we conducted a keyword co-occurrence analysis and developed a keyword co-occurrence map, identifying ten unique clusters. To get a better picture of the developing study subjects, we opted to remove the five most commonly used terms from the map: sustainable development, SMEs, environmental performance, innovation, and sustainability. In general, if we consider recent international environmental regulations, global concern about the use of natural resources, or the increasingly competitive business environment, we can get a clear picture of how, in order to be competitive, organisations, particularly SMEs, must implement sustainability requirements in addition to quality, innovation, and environmental protection.

Limitations and Future Direction

There are several limitations that must be taken into account when interpreting the research findings. Science mapping's systematic, quantitative method of assessing the organisation of a knowledge base also presents a challenge. Science mapping does not replace review procedures that assess substantive findings taken from research publications because it focuses on "Meta-data" connected with documents making up a body of knowledge. For this reason, it is important to stress that the present study merely lays the groundwork for future research syntheses that will investigate the results of studies on SMEs' sustainability. The formation of the sample database also has some restrictions. This paper employed specific search queries/keywords (e.g., sustainable development, environmental management, SME, small firm, small business, small and medium enterprise) to identify the preliminary list of scholarly works published and indexed by Scopus. The strategy relied on the idea that documents' titles, authors'-assigned keywords, and abstracts would reveal whether or not the writers had taken a "sustainability perspective" in their investigation of the topic at hand. Nonetheless, this method was prevalent in previous bibliometrics-related studies (Ahmi *et al.*, 2020; Kassab *et al.*, 2022). Although Scopus is one of the largest online databases indexing all scholarly papers, it still does not contain all sources available completely. As a result, some exclusions are to be expected from this paper. Moreover, no search query can fully contain all of the scholarly papers in this area. Even if we read every single article in over 2000 publications and narrowed the sample down to 1421, we might still miss something important. Therefore, it is always reasonable to anticipate both false positive and false negative results. Furthermore, this analysis included data from 1988 through October of 2022, and fresh studies are published virtually daily.

Furthermore, Scopus' definition was used to estimate the ranking of authors in this study. Some authors may also enroll multiple names in Scopus or have their names spelt differently. Thus, it resulted in the inaccuracy of the productivity of their authorship and affiliation details. Not all publications on the long-term sustainability of small and medium-sized enterprises would have made the cut had the authors not included the terms we used to define inclusion in their titles. Furthermore, the citation count used to evaluate research impact may not be an accurate reflection of the quality of individual studies. However, despite these limitations, this work presents a unique look at SMEs sustainability studies by presenting a more comprehensive, systematic, and objective evaluation. Previous qualitative review studies have mainly relied on subjective judgement, whereas a few quantitative review studies have merely described statistical data.

Finally, it is important to note that, despite the quantitative precision of bibliometric analysis, interpreting co-citation maps is not always a cut-and-dried process. In addition, it can be difficult to determine what threshold to use for co-citation analysis. In light of this, Zupic and Cater (2015) noted that the researcher needs a preexisting familiarity with the literature in order to "make sense" of the results of co-citation studies. We can draw the conclusion that a new field is rapidly emerging at the intersection of small and medium-sized enterprise and sustainability; we can single out a few dedicated researchers; and we have the means, in the form of scholarly journals, to disseminate the information widely enough that the entire society can benefit.

Conclusion

In conclusion, this study utilised bibliometric analysis to objectively document the intellectual structure, volume, and knowledge-development paths of sustainability and small and medium-sized enterprises (SMEs) in order to find shared ground and future interdisciplinary research directions. The findings showed a significant increase in the volume of published papers on SMEs sustainability, with the Journal of Cleaner Production being the most prolific publishing source title. The majority of publications were produced by experts from industrialised countries, but a growing number of articles from developing countries were also observed. The study identified the most influential papers, with the article by Chen (2008) being the most cited and influential document. Lastly, the most significant authors in the subject were identified through author co-citation mapping. These findings can serve as a basis for future research in the field of sustainability and SMEs.

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