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A Comprehensive Dataset for Bibliometric Analysis of Sustainable Entrepreneurship with Augmented Bibliometric Approach

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Abstract

Objective: The issue of Sustainable Entrepreneurship (SE) has attracted significant attention in recent years, aligning with the concerted global efforts to carry out the SDGs for 2030. Hence, this study aimed to analyze state of the art in SE research to navigate the result of international publication trends regarding SE for 20 years.
Design/Methods/Approach: This study uses bibliometric analysis to explore the evolution of streams of 338 papers from the Scopus database spanning from 2003 to 2022, including identifying the evolution of publications, contributions of authors, countries, and core journals to a field. In addition, we use the Augmented Bibliometric Approach by mapping and visualizing trend analysis of bibliographic coupling, co-citation, and co-author relationships of datasets, using VOSviewer 1.6.19.
Findings: The result showed a consistent upward trajectory in publications from 2015 onwards. Furthermore, our study showed influential authors, papers, countries, and journals within this domain.
Originality/Value: This study contributes to elucidating the evolution of SE, serving as a valuable resource for future studies, aiding in the formulation of theoretical frameworks, and facilitating advancements in this area.
Practical/Policy implication: Given the results, managers should apply various techniques to minimize the negative impact of their business continuity, a strategic approach towards the triple bottom line. Practitioners and policymakers should be able to interpret innovations in sustainability assessment systems further to enable them to formulate policies, strategies, and guidelines to promote the sustainable development agenda (SDGs).

Keywords: Augmented bibliometric approach, Bibliometric analysis, Sustainable entrepreneurship, Scopus database

JEL Classification: M13, M14, C88

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1. Introduction

Traditionally, financial values have motivated entrepreneurial activities (Schumpeter, 2003), but due to the increasing awareness of global issues, the focus has shifted towards incorporating environmental and social goals into business operations. Currently, entrepreneurs are actively integrating pro-socio-environmental beliefs toward their business practices (Cohen & Winn, 2007; Muñoz et al., 2018; Dean & McMullen, 2007; Gast et al., 2017) and making attempts to diminish their company's negative impact on the ecological (Choi & Gray, 2008). The context of Sustainable Entrepreneurship (SE) is often associated with the phenomenon of entrepreneurship and sustainability (Shepherd & Patzelt, 2011a), as well as making a subfield increasingly important (Gast et al., 2017; Muñoz et al., 2018). SE is a tool for achieving a more sustainable future (Cohen & Winn, 2007; Pacheco et al., 2010) and solving complicated environmental and social problems by implementing creative solutions (Schaltegger et al., 2018). Even though generating profits continues to be a crucial aspect of SE, further features referring to the Triple Bottom Theory, such as providing advantages for the planet (Hanohov & Baldacchino, 2018), creating jobs, and enhancing communities' lives are also key objectives of SE (Sarango-Lalangui et al., 2018).

Social and environmental issues are widely raised in SE studies and are interesting to discuss. First, SE focuses on issues linked to the environment or ecology (Dean & McMullen, 2007; Boons & Lüdeke-Freund, 2013), encouraging the usage of terms such as eco-entrepreneurship (Rodgers, 2010), referring to entrepreneurs that running their businesses adopt an ecological perspective in (Schaltegger, 2002) or a green perspective (Gast et al., 2017). Furthermore, SE also focuses on social issues (Schaltegger & Wagner, 2011) and how individuals produce innovative solutions in reacting to their community issues (Neck et al., 2009). The literature on SE has additionally linked to sustainable growth and the triple bottom line (Terán-Yépez et al., 2020).

A broad and comprehensive view of SE requires engaging in potentially beneficial sustainable behaviors (Belz & Binder, 2017; Parrish, 2010) and changing them into sustainable products and services to generate added value (Soto-Acosta et al., 2016; Sung & Park, 2018). This kind of research providing a macroscopic overview of the main factors of SE in the form of conceptualization of the proposed construct will capture the unique organizational characteristics of sustainable enterprises. Thus, it will facilitate the research into capability building, innovation, and competitive advantage in sustainable enterprises. It supports both researchers and entrepreneurs in shaping up and refining future research activities and investments in line with the policy of SE.

The subject of how firms might serve as an inspiration for more sustainable growth has taken on critical value (Figge et al., 2002; Kuckertz & Wagner, 2010a; Schaltegger & Wagner, 2011; Shepherd & Patzelt, 2011a; Szopik-Depczyńska et al., 2017). Therefore, there is increased concern about the critical function of successful actions of sustainable practices (Edgeman, 2013; Shepherd & Patzelt, 2011a). Indeed, sustainability-related entrepreneurship still encounters complex choices in identifying fundamental factors and how these factors correlate with each other. Publications of such analyses have been applied to several disciplines and sub-fields of research to examine the trends of SE. The interesting bibliometric study in this field of entrepreneurship has also been utilized for a variety of ranges, including social entrepreneurship (Rey-Martí et al., 2016), sports entrepreneurship (Huertas González-Serrano et al., 2020), international entrepreneurship (Baier-Fuentes et al., 2019), entrepreneurial university (Forliano et al., 2021). Our study presents an analysis of bibliometrics to gain a perception of the subject and identify the principal authors, countries, and journals dedicated to investigating the SE topic. In order to provide more comprehensive knowledge, we utilize visualizing techniques, such as bibliographic coupling, co-authoring, and co-citation. Furthermore, we also present the citation structure over time as an aid in comprehending the historical progression regarding citation impact and publication volume.

Development trends toward SE focus on considering how SE relates to sustainable development. In this sense, researchers have focused on innovation issues, sustainable innovation, and sustainable business models. There are several under-studied areas, and this analysis tries to capture the theories for conducting SE-related studies. The main contribution to socio-economic development is that our research employs an innovative approach to scrutinizing the SEs' literature so that researchers can use it in their theoretical frameworks and research for future studies. Research on this subject is still dispersed despite increased production rates, hence supporting the need for further systematization. In addition, the study provides practitioners and policymakers with a helpful starting point for creating SE and taking into their managerial and organizational implications.

This document is structured as follows, first, presenting the context highlighting previous studies in the SE field. The methods employed encompass the citation structure analysis of the most influential publications, journals, countries, and authors within its domain. Bibliographic data are subjected to graphical analysis using the VOSviewer software, thereby augmenting the insights obtained from the study. Before concluding, this study deliberates on the primary trends and patterns derived from the analysis, offering valuable insights into the subject matter. Additionally, it presents an agenda for future research, emphasizing avenues for further exploration and investigation.

2. Literature Review and Hypotheses Development

Sustainable Entrepreneurship Review

Business trends have shifted toward social responsibility and sustainable practices (Amini & Bienstock, 2014; Kraus et al., 2018). This trend includes addressing crucial social and environmental concerns by adopting sustainability (Hapenciuc et al., 2015; Rogers et al., 2013). Broadly, the goal of SE is to emphasize the entrepreneurs' role in developing non-economic benefits for communities (Shepherd & Patzelt, 2011a) as well as to ensure comprehensive corporate social responsibility through harmonizing environmental resilience, social justice, and economic health over entrepreneurial nature (Schaltegger & Wagner, 2011; Kuckertz & Wagner, 2010). The utilization of environmental, social, and economic activities for sustainable aspects is a reaction to globalization experienced by the market and the increasing stakeholder demand for corporate social commitment and transparency(Hapenciuc et al., 2015; Wątróbski et al., 2018).

Globalization, markets, and business dispersion emphasize the cross-border combination, sectoral incorporation, and companies' stabilization in cross-border markets, which are the main activities for creating business strategies and policies (Amini & Bienstock, 2014; Jankowski et al., 2019). These practices will be pursued in the sustainable business context to maintain the balance in economic, environmental, and social business activities (Choongo et al., 2016). Sustainability-oriented enterprises aim to maintain harmony between economic, social, and environmental dimensions (Crals & Vereeck, 2005; Schaltegger & Wagner, 2011). Therefore, SE can be defined as applying an entrepreneurial approach to meet environmental and societal goals (Kuckertz & Wagner, 2010; Crals & Vereeck, 2005; Schaltegger & Wagner, 2011).

Over the last decade, a growing statistic of literature studies have been published to conceptualize SE through the evolution of the discipline and provide offer ideas for forthcoming studies (Muñoz & Cohen, 2018; Dean & McMullen, 2007; Sarango-Lalangui et al., 2018; Thompson & Eijkemans, 2018; Gast et al., 2017; Shepherd & Patzelt, 2011). Initial literature reviews mainly concentrated on defining SE, distinguishing the area from groups of entrepreneurship, such as environmental entrepreneurship and social entrepreneurship (Thompson & Eijkemans, 2018), as well as following its 'components' (the triple-bottom-line) and relationships (Pacheco et al., 2010). SE is broadly recognized as a unique field that addresses how entrepreneurship can make a meaningful contribution to a more sustainable society. As the field of SE continues to evolve, studies have increasingly focused on its evolution, outlining the key topics and roadway for future analyses (Ramírez et al., 2019; Terán-Yépez et al., 2020; Sarango-Lalangui et al., 2018).

3. Method

3.1 Bibliometric Analysis

The bibliometric analysis enables a quantitative study of the studied literature (Merigó & Yang, 2017). Bibliometrics can analyze different literature to determine the conceptual structure and theme evolution (Alonso et al., 2009). It can also be an indicator to assess the production and productivity of the most popular publications, carrying the total amount of papers, citations, average citations per year, and the impact factor of the publication journal that be considered in the bibliometric study (Alonso et al., 2009). In addition, the h index designed by Hirsh in 2005 can be an indicator in accounting for the impact and quantity of publications (Alonso et al., 2009).

The analysis is increasingly developing approaches and techniques, such as bibliographic coupling, co-authorship analysis, co-occurrence of keywords, and co-citation (van Eck & Waltman, 2010). It uses a methodological innovation regarding traditional literature reviews (De Bakker et al., 2005). The combination of various bibliometrics methodologies enhances broader insights concerning the study field. Co-citation and bibliographic coupling analyses (Chang et al., 2015) can be employed to explain the intellectual structure of a branch of knowledge (Boyack & Klavans, 2010; Chang et al., 2015). Co-citation analysis is a technique for quantifying the interactions and connections among papers and figuring out different levels of citations (Chang et al., 2015). Furthermore, it measures the interactions between the two publications using citations (ibid). The bibliographic coupling analysis implies that two papers are confirmed when different documents are cited. It measures the interactions between the two papers by "coupling strength," given the citation to the other papers shared (Martyn, 1964). The bibliographic coupling analysis has also proven to be an excellent technique for identifying potential subjects (Zhao & Strotmann, 2008). Co-authorship refers to the inclusion of multiple authors in a paper, facilitating the identification of scientific collaborations (Merigó & Yang, 2017). The co-occurrence of keywords is when identifying keywords more frequently used in the same document (Merigó & Yang, 2017).

Based on the benefits of incremental bibliometric analysis, this study uses approaches from van Eck & Waltman (2010) and Alonso et al. (2009). Bibliometric analysis is useful for tracking theory and study stream evolution (Zupic & Cater, 2015; Walsh & Renaud, 2017) and identifying primary journal contributions to an area (Albort-Morant & Ribeiro-Soriano, 2016). The methods can be adopted with organized reviews (such as systematic literature reviews and meta-reviews) since they provide a measurable path to explore current and future studies trends and performance (Zupic & Cater, 2015; Jiang et al., 2017).

3.2 Article Selection Process

We specified our domain to perform electronic literature searches of the articles published on SE in Scopus-indexed quality journals because Scopus provides access to more indexed journals. It was also a robust database that allowed several sorting, refining, and ranking options (Terán-Yépez et al., 2020). Given the need to restrict references to the most relevant, we use the "sustainable entrepreneurship" keyword. We found that "sustainable entrepreneurship" is the highest keyword searched in this research field. High-frequency keywords are usually identified as important research themes for bibliometric analysis (Chen & Xiao, 2016). In some academic databases, high-frequency keywords are utilized to analyze research hotspots and develop domain trends (Su et al., 2014). We retrieved documents spanning from 2003 to 2022 and presented 739 documents. Then, we sorted the documents based on the article as type document, and 521 documents were found. Articles written by experts and reviewed by several other experts before publication were chosen to ensure the article's quality. The article language chosen in this research was not limited, although 98% of the result was in English. For relevance to a specific field, the search was refined by limiting it to three specific subject areas, including (1) Business, Management, and Accounting, (2) Economics, Econometrics, and Financials, and (3) Research articles (Muñoz et al., 2018). As a result, 338 documents were found, and a bibliometric analysis was performed based on these papers. Selection can be reviewed based on inclusion and exclusion criteria (Table 1). The subsequent step was to map citation patterns, keywords, and paper linkages in the database using the VOS Viewer (Jiang et al., 2017; Walsh & Renaud, 2017; Zupic & Cater, 2015).

Table 1. Inclusion and Exclusion Criteria

Inclusion Criteria
Articles listed indexed in the Scopus database
Publication year: 2003 until 2022
Document type: peer-reviewed articles
Articles published in the subject area: Business, Managemet and Accounting; Economics, Econometrics and Finance.
Exclusion criteria
Article not referring to "Sustainable Entrepreneurship"
Publication before 2003 and after 2022
Book chapter, conference paper, review, book, editorial, erratum, note

4. Result and Discussion

Table 2 shows the record of study articles and journals covered in this review. We have found that the Journal of Cleaner Production (n=47) covers the main part of the study, then Business Strategy and the Environment (n=26), International Journal of Entrepreneurial Behavior and Research (n=16), Journal of Business Venturing (n=11) and the rest of journals with under ten research articles each for contain articles relating to SE.

Table 2. Summary of Research Articles Included in This Review

Journal Name	**No. of Article**
Journal of Cleaner Production	47
Journal of Entrepreneurship in Emerging Economies	2
Social Responsibility Journal	1
RAUSP Management Journal	1
International Journal of Management Education	6
Journal of Hospitality, Leisure, Sport and Tourism Education	1
Technology in Society	1
Journal of Business Venturing	11
Business Strategy and the Environment	26
International Small Business Journal: Researching Entrepreneurship	2
International Journal of Entrepreneurship and Innovation	3
Universidad y Sociedad	1
Journal of Innovation and Knowledge	1
Sustainable Technology and Entrepreneurship	1
Organization and Environment	7
International Entrepreneurship and Management Journal	4
Business Strategy and Development	4
Journal of the Knowledge Economy	2
Management Decision	3
International Journal of Entrepreneurial Behaviour and Research	16

Journal Name	No. of Article
Journal of Small Business and Enterprise Development	4
British Food Journal	4
Entrepreneurial Business and Economics Review	3
Journal of Enterprising Communities	3
China Finance Review International	1
South Asian Journal of Business and Management Cases	1
Entrepreneurship Research Journal	2
Administrative Sciences	4
Journal of Business Research	4
European Management Journal	1
Digital Business	1
International Journal of Trade and Global Markets	2
Economic Research-Ekonomska Istrazivanja	3
Journal of Small Business Management	4
Environment, Development and Sustainability	5
Tec Empresarial	1
IEEE Transactions on Engineering Management	2
African Journal of Economic and Management Studies	1
World Journal of Entrepreneurship, Management and Sustainable Development	9
Scientific Annals of Economics and Business	1
Organization, Technology and Management in Construction	1
Emerald Emerging Markets Case Studies	5
BAR - Brazilian Administration Review	1
Journal of Sustainable Tourism	1
Annals of Tourism Research	2
Journal of Business Economics and Management	3
Technological Forecasting and Social Change	3
Management Review Quarterly	1
Journal of Business Strategy	1
Small Business Economics	8
Journal of the International Council for Small Business	4
Serbian Journal of Management	1
Small Enterprise Research	3
International Journal of Emerging Markets	1
Rivista di Studi sulla Sostenibilita	1
Academy of Entrepreneurship Journal	2
International Journal of Entrepreneurship and Small Business	6
Journal of Environmental Management and Tourism	1
Revista Venezolana de Gerencia	1
International Journal of Globalisation and Small Business	1
Industria Textila	1
Journal of Risk and Financial Management	2
Journal of Business Venturing Insights	3
Entrepreneurship: Theory and Practice	4
Journal of Entrepreneurship and Public Policy	1
Entrepreneurship and Sustainability Issues	6
Critical Perspectives on International Business	1
Journal of Business Ethics	5
Journal of Small Business and Entrepreneurship	2
International Journal of Scientific and Technology Research	2
Corporate Social Responsibility and Environmental Management	2
Indian Journal of Economics and Development	1
Cogent Business and Management,	1
Asia Pacific Journal of Tourism Research	1
DLSU Business and Economics Review	1
International Journal of Entrepreneurship	1
Review of Integrative Business and Economics Research	1
Tourism Analysis	1
International Journal of Entrepreneurship and Innovation Management	3

Journal Name	No. of Article
International Journal of Business and Globalisation	1
International Journal of E-Entrepreneurship and Innovation	1
Strategic Change	1
Journal of Developmental Entrepreneurship	1
Innovar	1
Tourism Planning and Development	1
Journal of Entrepreneurship	1
Organization Studies	1
Journal for International Business and Entrepreneurship Development	1
Journal of Entrepreneurship and Innovation in Emerging Economies	2
Polish Journal of Management Studies	1
International Journal of Entrepreneurial Venturing	5
International Journal of Business and Society	1
Espacios	2
International Journal of Sociology and Social Policy	1
Technological and Economic Development of Economy	1
Journal of Innovation and Entrepreneurship	1
Innovation: The European Journal of Social Science Research	1
Frontiers in Energy Research	1
Business and Society	1
Estudios Gerenciales	1
Economics and Sociology	1
Competitiveness Review	2
Gender in Management	1
Journal of Knowledge Management	1
Corporate Governance (Bingley)	2
Global Business and Organizational Excellence	1
Industry and Higher Education	1
Management Research Review	1
Journal of Innovation Management	1
Journal on Chain and Network Science	1
Amfiteatru Economic	1
Mediterranean Journal of Social Sciences	1
Journal of Place Management and Development	1
International Journal of Information Systems in the Service Sector	1
International Journal of Business Research	1
EuroMed Journal of Business	1
Entrepreneurship and Regional Development	1
Management (Croatia)	1
Academy of Management Journal	1
Leisure Studies	1
New England Journal of Entrepreneurship	1
Journal of Technology Management and Innovation	1
Advances in Culture, Tourism and Hospitality Research	1
International Journal of Agricultural Sustainability	2
Journal of Advances in Management Research	1
Progress in Industrial Ecology	1
	338 articles

Network analysis was performed to find the keywords co-citation of journals, bibliometric networks-based co-authorship, co-citation, bibliographic coupling, and keyword co-occurrence analysis using VOSviewer. Table 3 shows the key details of extracted documents by Scopus for bibliometric analysis.

Table 3 Key Details of Extracted Documents by Scopus for Bibliometric Analysis

Description	Results
Timespan	2003-2022
Average years from publication	18.77
Sources	126

Description	Results
Documents	338
Average citations per documents	34.52
Average citations per year per doc	1.92
References	16,940
Document types	
Article – final stage	330
Article – peer review	8
Software used for analysis	VOS Viewer

4.1. Evolution of Publication

Figure 1 displays the evolution of SE publications found on Scopus over time. From 2005 to 2016, the publication of papers on SE experienced relatively slow growth, but there was a significant increase starting from 2017 and continuing into recent years. The notable surge can be associated with various disciplines' growing interest in this topic (Muñoz & Cohen, 2018). We found that 70.10% of the published documents are in the time frame from 2017 to 2022. The biggest influence of this surge was the United Nation's Agenda of Sustainable Development Goals (17 SDGs) for 2030, which world leaders should start to adopt this agenda on January 2016 (United Nations, 2015). In addition, as the publication specializing in sustainability increased (Muñoz et al., 2018; Gast et al., 2017), the significance of sustainability entrepreneurship was highlighted globally (Terán-Yépez et al., 2020). Given the rising amount of study in sustainability, concerns have been given to the changing business trends toward sustainable business practices. Sustainability encompasses social, environmental, and economic dimensions (Kuckertz & Wagner, 2010; Schaltegger & Wagner, 2011), while SE emphasizes the significant entrepreneurs' role in developing non-economic benefits to communities (Rogers et al., 2013; Kuckertz & Wagner, 2010). In addition, SE entrepreneurs present a complete vision of corporate social responsibility through their entrepreneurial conduct by balancing social fairness, economic growth, and environmental stability (Schaltegger & Wagner, 2011; Kuckertz & Wagner, 2010). Therefore, SE can be broadly defined as the utilization of entrepreneurial approaches to meet societal and environmental goals (Kuckertz & Wagner, 2010; Crals & Vereeck, 2005; Schaltegger & Wagner, 2011). The effective execution of sustainable practices through entrepreneurial activities is imperative for fostering a more sustainable economy (Schaltegger & Wagner, 2011; Shepherd & Patzelt, 2011a).

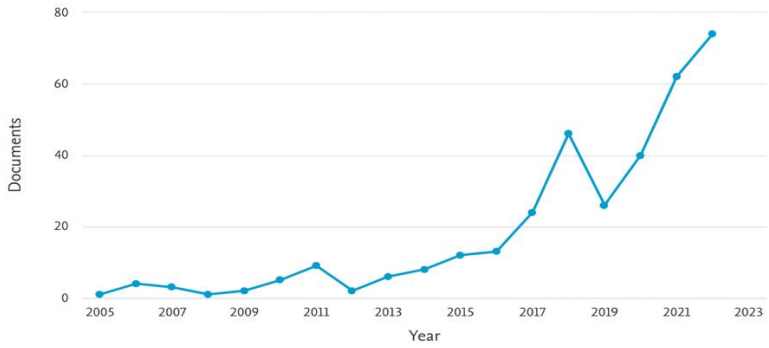

Figure 1. Number of SE Publications Per Year

4.2. Highest Citation

The general citation structure analyses were performed before exploring articles with the highest citation. The analysis included the number of papers concerning the citation threshold (Cancino et al., 2017). In this matter, 26.33% and 12.89% of papers have earned at least 10 and 25 citations, respectively. A total of 8 and 40 documents have received at least 300-902 and 50-99 citations, as shown in Table 4.

Table 4. General Citation Structure

Number of Citation	Total Publication	%
≥500 citations	5	1.48%
≥300 citations	3	0.89%
≥100 citations	20	5.92%
≥50 citations	20	5.92%
≥25 citations	50	14.79%
≥10 citations	89	26.33%

Number of Citation	Total Publication	%
≥1 citation/s	151	44.67%
Total Papers	338	

The important concern for biometrics is uncovering the most popular and influential studies in SE by the number of citations gained. Table 5 shows the top ten cited papers up to 2022, and the most influential study in this list is "Sustainable Entrepreneurship and Sustainability Innovation: Categories and Interactions," with 899 citations. Schaltegger & Wagner's (2011) study proposed a framework to position SE concerning sustainable innovation, providing managers with a reference to introduce and pursue SE. It discovered the circumstances under which SE and sustainability innovation manifested spontaneously. The findings held significant consequences for theoretical understanding and practical applications. In addition, the study elucidated the determinants that prompted certain firms, under specific circumstances, to transition toward sustainability innovation. Further studies were needed concerning innovation, motivation, and the previous SE model to be refined. With 81.7 citations per year, Schaltegger & Wagner's (2011) paper was the most suitable one to represent SE. Other notable authors were Dean & McMullen (2007) and Cohen & Winn (2007), with 823 and 821 citations, respectively. In addition, Table 4 showed a notable trend where the majority of highly cited papers exhibit a logical dependence on the year of publication. These papers tend to experience a delayed impact, with limited or no citations occurring within the first one or two years of publication. Typically, these papers take approximately four to ten years to garner substantial citation recognition.

Table 5 shows that five years after Belz & Binder (2017) published their paper in the Journal of Business Strategy and the Environment, 258 citations totaling 51.6 on an annual scale were received. The high number of citations is consistent with the view that interest in SE is increasing. Their research conducted a qualitative analysis with several case designs to build a theory and contribute to a better understanding of the SE process, which primarily pursues the Triple Bottom Line approach. The SE process proposed by Belz & Binder (2017) includes six phases: 1) recognizing ecological or social problems, 2) recognizing ecological or social opportunities, 3) formulating double-bottom-line solutions, 4) formulating triple-bottom-line solutions, 5) funding and establishing sustainable enterprises, and 6) making or participating sustainable markets.

Tabel 5. The Highest Citation

No.	Citation/Authors	ArticleTitle	Source	Total Citation	Total Citation per Year
1.	(Schaltegger & Wagner, 2011)	Sustainable entrepreneurship and sustainability innovation: Categories and interactions	Business Strategy and the Environment	899	81.7
2.	(Dean & McMullen, 2007)	Toward a theory of sustainable entrepreneurship: Reducing environmental degradation through entrepreneurial action	Journal of Business Venturing	823	54.9
3.	(Cohen & Winn, 2007)	Market imperfections, opportunity and sustainable entrepreneurship	Journal of Business Venturing	821	54.7
4.	(Hockerts & Wüstenhagen, 2010)	Greening Goliaths versus emerging Davids - Theorizing about the role of incumbents and new entrants in sustainable entrepreneurship	Journal of Business Venturing	691	57.6
5.	(Shepherd & Patzelt, 2011b)	The New Field of Sustainable Entrepreneurship: Studying Entrepreneurial Action Linking "What Is to Be Sustained" With "What Is to Be Developed"	Entrepreneurship: Theory and Practice	583	53.0
6.	(Kuckertz & Wagner, 2010b)	The influence of sustainability orientation on entrepreneurial intentions - Investigating the role of business experience	Journal of Business Venturing	416	34.7

No.	Citation/Authors	ArticleTitle	Source	Total Citation	Total Citation per Year
7.	(Schaltegger et al., 2016)	Business Models for Sustainability: A Co-Evolutionary Analysis of Sustainable Entrepreneurship, Innovation, and Transformation	Organization and Environment	356	59.3
8.	(Pacheco et al., 2010)	Escaping the green prison: Entrepreneurship and the creation of opportunities for sustainable development	Journal of Business Venturing	313	26.1
9.	(Belz & Binder, 2017)	Sustainable Entrepreneurship: A Convergent Process Model	Business Strategy and the Environment	258	51.6
10.	(Young & Tilley, 2006)	Can businesses move beyond efficiency? The shift toward effectiveness and equity in the corporate sustainability debate	Business Strategy and the Environment	257	16.1

4.3. Authorship

Table 6 contains 18 authors whose respective institutions and countries published the most on SE. Author Fichter, K excelled with nine publications, while Hörisch, J.; Schaltegger, S.C.; and Muñoz, P each contributed 6 publications. From the 18 most published authors, 12 had ≥1000 citations, and Schaltegger, S.C. received 11,641 citations. Schaltegger, S.C. had the highest h-index of 54, 15 authors had an h-index ≥10, and 2 authors had an h-index of 4 and 2, respectively.148 of Schaltegger's documents were cited by 7,924 with a total of 11,641 citations. The main study interests were in sustainable entrepreneurship, corporate sustainability management reporting, strategic and stakeholder management, operations, and strategic sustainability management, and environmental and sustainability accounting.

Table 6. 18 Authors who Published the Most on SE

No	Author	P	TP	University	Country	TC	HI	TC/ TP	≥ 100	≥ 50	≥ 10	≥1
1.	Fichter, Klaus	9	25	Universität Oldenburg	Germany	810	12	32.4	1	5	9	8
2.	Hörisch, Jacob	6	42	Leuphana Universität Lüneburg	Germany	1,780	22	42.4	6	5	17	13
3.	Schaltegger, Stefan C.	6	148	Leuphana Universität Lüneburg	Germany	11,641	54	78.7	33	23	49	34
4.	Muñoz, Pablo	6	45	Durham University	United Kingdom	1,823	21	40.5	4	8	18	11
5.	Cohen, Boyd	5	27	EADA Business School	Spanyol	3,808	20	141	9	1	12	4
6.	Lans, Thomas	4	44	Hogeschool vanArnhem en Nijmegen	Netherlands	1,752	22	39.8	4	7	18	13
7.	Tiemann, Irina	4	5	Universität Oldenburg	Germany	178	4	35.6	0	2	2	0
8.	Wagner, M	4	123	Universität Augsburg	Germany	7,638	40	62.1	19	13	37	39
9.	Blok, Vincent	3	145	Wageningen University & Research	Netherlands	3,861	32	26.6	8	13	56	54

No	Author	P	TP	University	Country	TC	HI	TC/ TP	≥ 100	≥ 50	≥ 10	≥1
10.	Brettel, Malte	3	166	Rheinisch-Westfälische Technische Hochschule Aachen	Germany	5,202	40	31.3	11	24	52	44
11.	Carayannis, Elias Gorge	3	371	The George Washington University	United States	7,717	42	20.8	17	22	89	103
12.	Fellnhofer,Katharina	3	35	ETH Zürich	Switzerland	664	14	19.0	1	2	15	15
13.	Hakala, Henri	3	21	LUT University	Finland	769	13	36.6	1	4	9	4
14.	Hansen, Erik G	3	40	Johannes Kepler University Linz	Austria	4,033	23	100	10	4	17	8
15.	Kant, M.	3	4	Technische Universität Berlin	Germany	34	2	8.5	0	0	1	2
16.	Kuckertz,Andreas	3	69	Technische Universität Berlin	Germany	2,576	24	37.3	4	10	23	21
17.	LüdekeFreund, Florian.	3	32	ESCP Europe Business School	Germany	4,383	17	137	11	3	6	8
18.	De Lange, Deborah	3	22	Ted Rogers School of Management	Canada	332	10	15.1	0	1	10	4

Note: P = Publication; TP = Total Publication; TC = Total Citation; HI = Hirsch Index

4.3. Country

Table 7 presents the top 10 countries that have at least 14 publications in SE. For the country analysis, this study used the citations count and publications. Regarding region, we found that six out of ten countries belong to the European region, which occupied more than half of our listed countries. The next region on our list was Asia, where India produced the most published paper, and Malaysia had the highest number of citations. We found that the publication in SE was dominated by Germany and the United Kingdom (UK), with 61 and 42 papers, respectively. As the most productive country in SE, Germany has achieved a commendable level of sustainable industrialization, effectively balancing economic growth, employment opportunities, social security, and environmental protection. Based on the German Sustainable Development Strategy 2021, in July 2016, the Federal Government thoroughly progressed its sustainability plan and straightened it with the UN's 17 SDGs. Given the immense political significance of sustainability, the Chancellery is directly responsible for implementing the strategy. Several companies in Germany were also committed to society to run a sustainable business. CSR mainly depends on the core business of each company, while globalization affects economic, social, and environmental conditions. Specifically, globalization influenced Germany's environmental, social, and economic performance. In this country, most DAX-listed companies, institutes, SMEs, and non-governmental organizations were members of the UN Global Compact which was established in 1999 (hi4csr.com, 2016).

Table 7. Countries with the Most Publications

No.	Country	Year										TP	TC	TC/ TP
		03-04	05-06	07-08	09-10	11-12	13-14	15-16	17-18	19-20	21-22			
1.	Germany				1	3	3	6	15	11	22	61	3,820	62.6
2.	UK		2		1	1	1	6	11	2	19	43	1,425	33.1
3.	US			2	2	5	2		6	9	15	41	1,564	38.1
4.	Netherlands			1			3	4	5	4	7	24	812	33.8
5.	Italy								3	6	13	22	239	10.9
6.	Spain								6	7	8	21	401	19.1

7.	India	1			2	6	11	20	98	4.9
8.	France		2	2	4	2	9	19	320	16.8
9.	China	1			2	2	9	14	119	8.5
10.	Malaysia			2	2	4	6	14	177	12.6

Note: TP = Total Publication; TC = Total Citation

4.4. Reputable Journal

Important information is needed when interweaving representations from different sources of papers to develop SE studies in subsequent periods. Table 8 shows the rankings of the top 10 journals indexed by Scopus that published papers on SE topics. We used the number of papers published, Cite Score 2021, Scientific Journal Rankings 2021, Impact Factor 2021, h-index, and Quartile being major metrics to assess the impact of academic literature in SE studies. This index is a straightforward measure of the quantity and visibility of journal publications (Bornmann & Daniel, 2007). It also increases when new studies are published and attract citations. As a result, this index is an accurate proxy of the entire effect of a journal's contribution to a certain topic. Our result showed that publication in SE on a broad spectrum of journals used factors linked to sustainability, entrepreneur, and entrepreneurship. The most dominant journal is the Journal of Cleaner Production, with an impact factor of 11,072 as of 2021. The journal "Business Strategy And The Environment" also boasts an impressive impact factor of 10.801. Journal of Cleaner Production holds a significant 232 h-index, indicating that each of its 232 published papers has received at least 232 citations.

In connection with the journal ranking parameter, such as Scimago Journal & Country Rank or SJR, Scopus makes a clustering of journal quality. Regarding journal quality, Quartile One (Q1) is the top cluster, followed by Q2, Q3, and Q4. This clustering approach can also aid in identifying suitable journals for publishing papers, thereby increasing the likelihood of receiving more citations. Table 8 showed that six of ten journals were in the Q1 category, and the rest were in Q3. Therefore, we can conclude that the top 10 journals that publish the most papers on SE topics strongly impacted and contributed to the SE. This finding also notifies us that SE was a very interesting area for study and has the opportunity to be published in reputable international journals with a good impact factor.

Table 8. Citation Structure of the Top 10 Journals Indexed by Scopus that Publish the Most SE Papers

No.	Journals	TP	CS2021	SJR2021	IF2021	HI	Q
1.	Journal of Cleaner Production	47	15.8	1921	11072	232	Q1
2.	Business Strategy and The Environment	26	11.9	2,241	10,801	115	Q1
3.	International Journal of Entrepreneurial Behavior and Research	16	8.0	1,206	5,995	75	Q1
4.	Journal of Business Venturing	11	14.6	5,829	13.139	196	Q1
5.	Small Business Economics	8	10.7	2,630	7,096	142	Q1
6.	Organization and Environment	7	8.6	1,616	5,299	64	Q1
7.	International Journal of Entrepreneurship And Small Business	6	1.3	0.287	1.147	38	Q3
8.	International Journal of Management Education	6	5.5	0.819	4,564	34	Q1
9.	World Review of Entrepreneurship Management and Sustainable Development	6	1.1	0.233	1010	17	Q3
10.	Emerald Emerging Markets Case Studies	5	0.2	0.225	0.210	7	Q3

Note: TP = Total Publication; CS = Cite Score; SJR= SCImago Journal Rank; IF = Impact Factor; HI = Hirsch Index; Q = Quartile.

As previously mentioned, a notable surge in publications on SE is evident in 2017 when analyzing the temporal evolution of paper publications. In conducting a random comparison, our result in Figure 2 showed remarkable growth of the Journal of Cleaner Production was ahead of others. Our findings implied that the Journal of Cleaner Production was an appropriate publication destination for SE topics. This journal has 29 years of experience publishing papers discussing Cleaner Production practices theoretically and practically. They also cover sustainability and environmental issues across companies, regional governments, educational institutions, and communities.

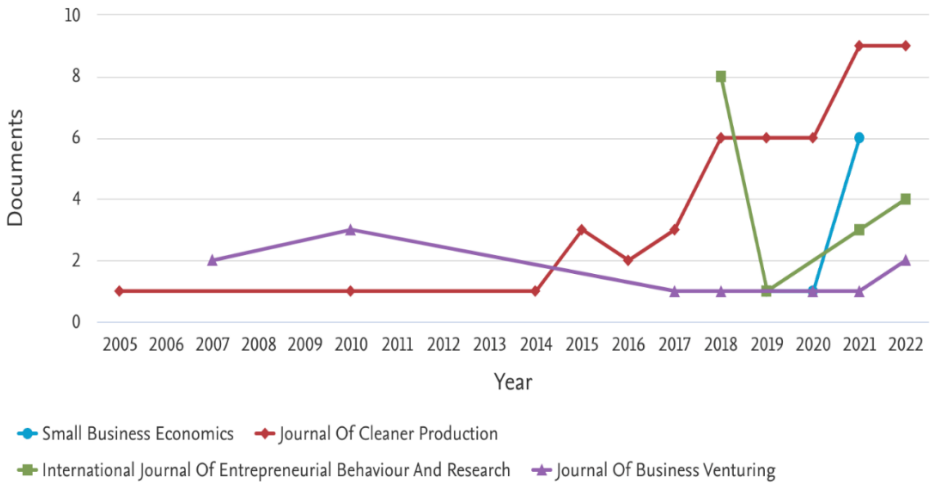

Figure 2. Total Documents by Source

Graphical Analysis with VOSviewer

Graphical mapping, or scientific mapping, has enriched a broader method in bibliometrics analysis. It displays the structure and dynamic elements of scientific studies and may be used to complement the bibliometric performance indicator approach (Walsh & Renaud, 2017). Consequently, to attain a more integrated and comprehensive view of the already displayed results, graphical mappings publishing SE are displayed in this part. As mentioned in the previous section, this investigation applied VOSviewer 1.6.19, which visualized bibliographic materials through the co-citation of journals, bibliometric networks-based co-authorship, co-citation, bibliographic coupling, and keyword co-occurrence analysis.

The co-citation of the most-cited journals is explored first for graphical mapping. Figure 3 shows our results based on a threshold of 60 sources and 100 strongest citation connections (Andrade-Valbuena et al., 2022). Four different colors in Figure 3 showed four distinct clusters of journals represented the most connections or nearness between the sources. Nearness in a cluster reflects the journal's relationship in terms of co-citation. In the first cluster in the lower-left of the green cluster, a strong co-citation relationship exists between a group of journals, including Business Venturing, Academy Management Review, and Academy of Management Journal. The second cluster with the yellow color represented showed that Business Strategy and the Environment, Journal of Business Ethics, and Greener Management International have strong co-citation between journals. The third cluster in blue color showed the strong co-citation between the Journal of Cleaner Production, Research Policy, and Organization & Environment. Finally, the fourth cluster in red color showed a strong relationship between Entrepreneurship Theory and Practice, Small Business Economics, and the Journal of Small Business Management.

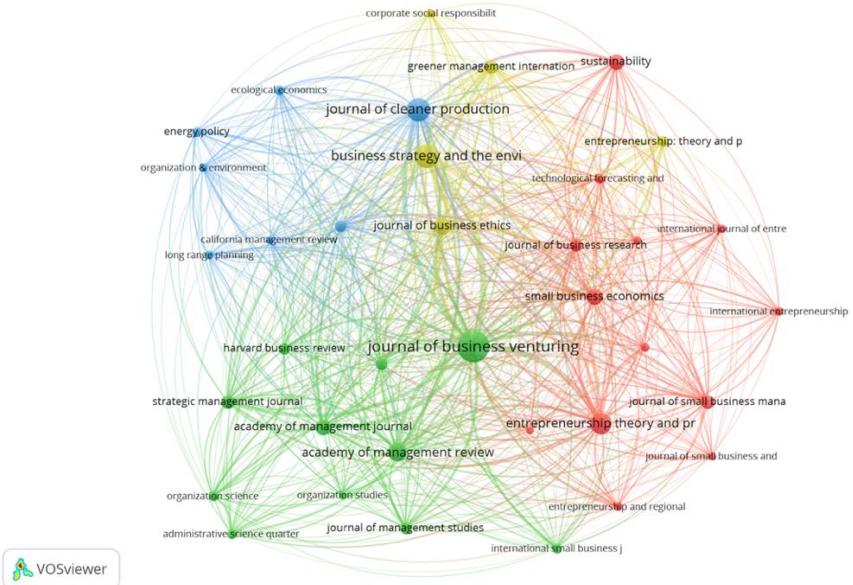

Figure 3. Co-citation of Journal

The use of bibliographic coupling allowed us to identify papers that refer to the same set of cited documents (Boyack & Klavans, 2010). A minimum threshold of two documents was used, and 300 connections were set as the

most representative. Our result in Figure 4 confirmed the findings from Table 6, in which Fichter, K, Hörisch, J. Schaltegger, S.C., and Muñoz, P were the top four authors in SE. In addition, figure 4 also showed the connections between authors, where 9 clusters were identified. The orange-colored area contained a higher concentration of connections. This study showed a stronger connection and closer relationship between Fichter and Schaltegger, indicating that these two authors frequently cited in the same documents.

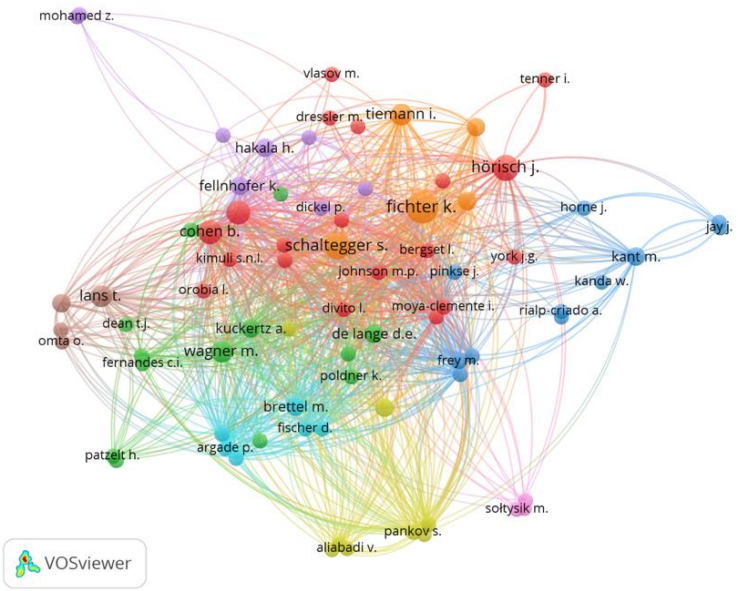

Figure 4. Bibliographic Coupling of Authors

Figure 5 consisted of the bibliographic coupling between countries, and we found that most papers in SE were published in Germany, the United Kingdom, and the United States, consistent with our result in Table 7. Figure 5 also showed co-authorship patterns among countries, displaying the most impactful countries and the depth of collaboration. Consistent with the previous finding, Germany, the United Kingdom, and the United States have robust connections and exhibit significant levels of communication in the field.

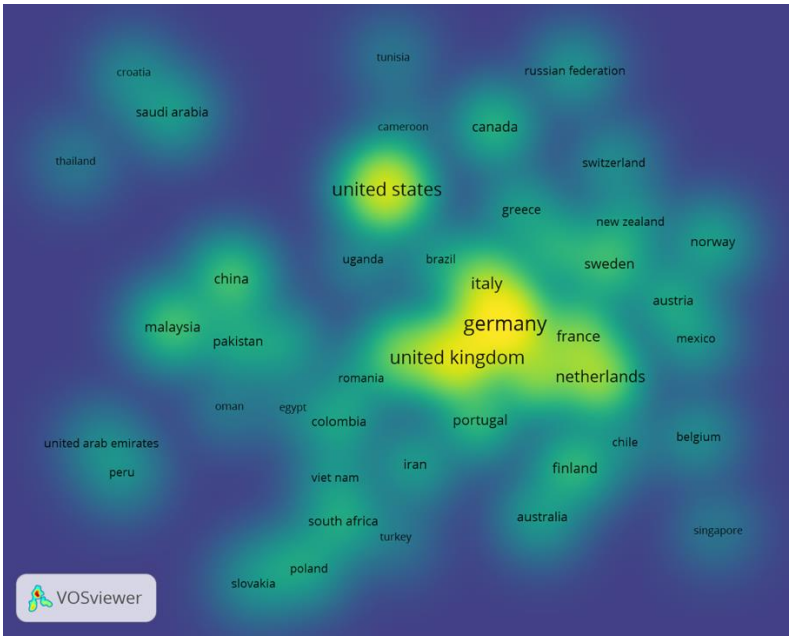

Figure 5. Bibliographic Coupling by Countries

Figure 6 shows our result of co-authorship by country using density visualization, which demonstrated the level of communication and the most influential countries. In line with the previous analysis, Germany was the most influential

country, followed by the United States. Further, we also provide network visualization of co-authorship by country in Figure 7. The largest nodes in the figure indicate the most influential countries in SE. The connection line represents international collaboration, and we set a minimum threshold of five documents and 100 connections during the analysis. The size of circles reflect the number of published articles per country, while the color of each corresponds to the cluster encompassing each of the diverse country groups. Our result in Figure 7 showed two strongest co-authorship lines. First is Germany, which has the strongest collaborative link with Netherlands, Portugal, and France. Following Germany, the second is the United States which presented a strong collaborative link with Saudi Arabia, Croatia, and Egypt.

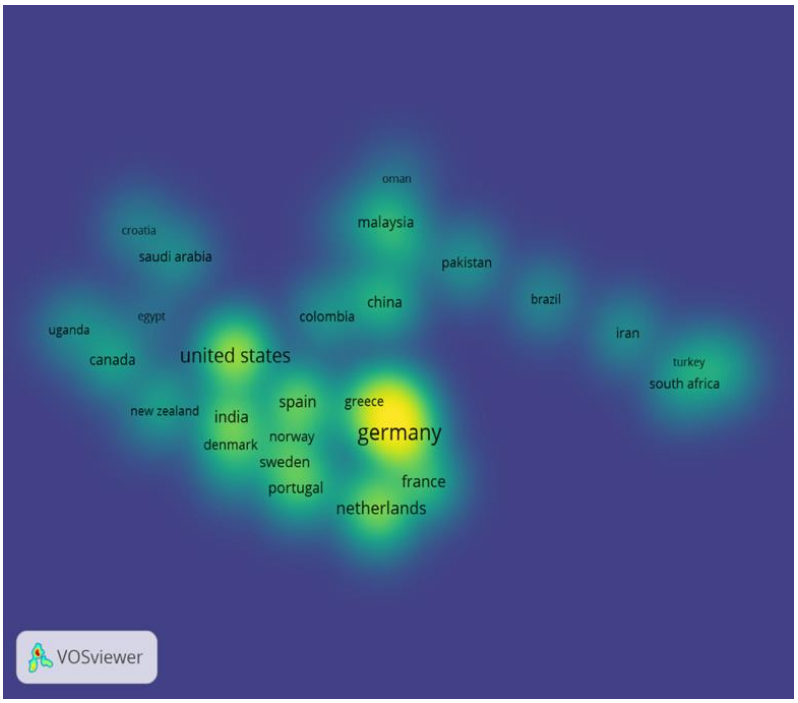

Figure 6. Co-authorship by Country – Density Visualization

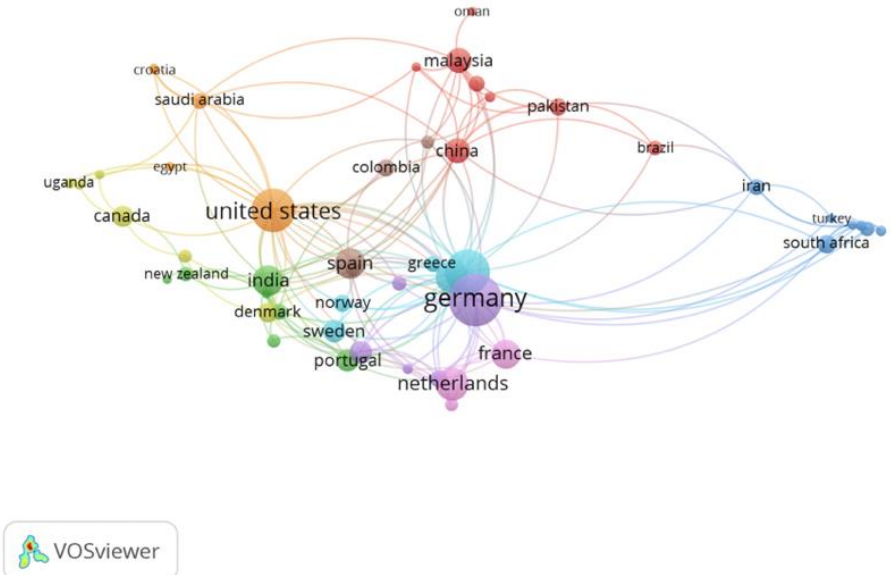

Figure 7. Co-authorship by Country – Network Visualization

Finally, we analyzed the most used keywords in SE, and presented the result in a graphical presentation with a network graph using a threshold of five occurrences. The diameter of the circles in the figure represents the keywords corresponding to the words' relevance in the SE studies. These words' network connections were used as the basis to decide the most closely connected keywords. Based on our result in Figure 8, the main keyword in SE was sustainable entrepreneurship itself, followed by sustainable development, sustainability, and entrepreneurship. In addition, we

provided Table 9, displaying all the most frequent keywords with their respective occurrences and the overall strength of the connections. The main words were sustainable entrepreneurship itself, followed by sustainable development, and sustainability. By analyzing these keywords, we uncovered that the study trend in SE encompasses a broad spectrum of focal points and offers several avenues to explore. We supported Fu & Ho (2012), where study movements can be seen by quantitatively investigating the frequency of keywords to bring a relatively up-to-date picture of the subject.

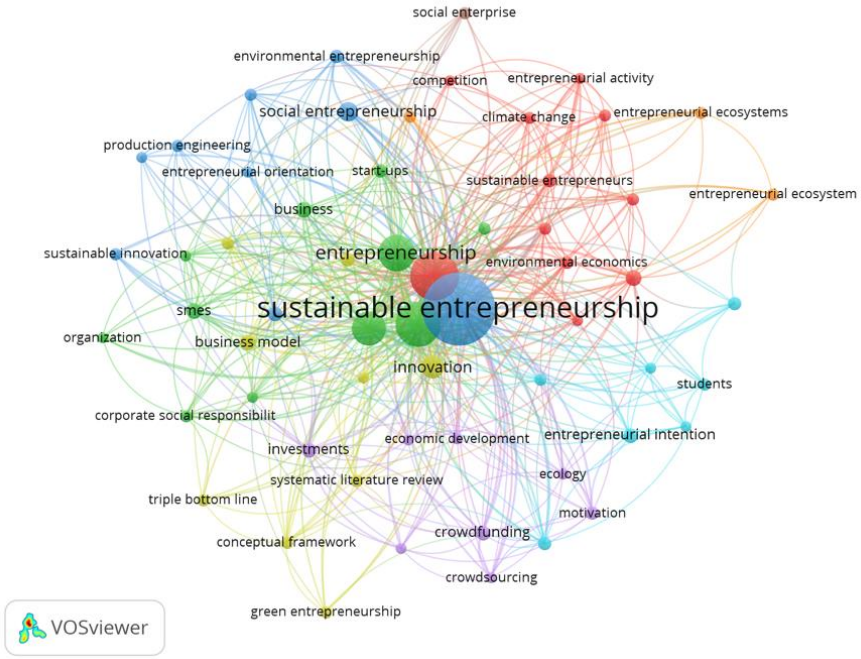

Figure 8. Co-occurrence by Keywords

Table 9. The Most Frequently Used Keywords

No.	Keywords	Occurrencess	Total Link Strength
1.	Sustainable Entrepreneurship	211	454
2.	Sustainable Development	94	311
3.	Sustainability	82	246
4.	Entrepreneurship	54	117
5.	Entrepreneur	49	188
6.	Innovation	23	70
7.	Social Entrepreneurship	16	45
8.	Business	11	40
9	Planning	11	50
10.	Business Model	10	40

5. Conclusion

Over the past decade, studies on SE gained significant attention. They contributed to the methodological level, where an incremental bibliometric approach could better understand the relationship between ideas, authors, and study streams. The utilization of a bibliometric approach proved to be valuable due to the diverse and multidisciplinary nature of SE, which encompassed a diverse range of disciplines within the natural and social sciences. Our reveal that specific pathways have arisen around particular concepts generated in a subset of seminal works in the discipline. The detection of discipline-level trends, patterns, and trajectories informed the development of future SE study agendas.

This study contributes to the field of investigation as it provides the prominent authors and documents on the subject and the leading countries and journals until 2022. The most significant countries in publishing on SE are Germany, the United States, and the United Kingdom. The most relevant Scopus-indexed journals are the Journal of Cleaner Production, Business Strategy, and Environment and the International Journal of Entrepreneurial Behaviour and Research. There is indeed the potential for conducting comparative studies on SE across countries, specifically considering that the primary publications in this field are predominantly from Europe. Given the results, managers must

apply various techniques to minimize their businesses' sustainability impact as a strategic approach towards the triple bottom line. Managers may develop strategies to minimize the sustainability impact in their business like adopting circular economy practices, supress the environmental burden aligned with the business activity, and building any activity that may decrease the business carbon footprint. For example, companies may encourage their employees to use more public transportation to go to work by giving them transportation fees besides their regular wages. This simple example may reduce the carbon footprint of any kind of business.

Practitioners and policymakers should be able to further apply innovations in sustainable systems assessment to enable them to produce policies, strategies, and recommendations to propose SDGs agendas. To assess the sustainable system, United Nations Conference on Trade and Development introduced an innovative approach to achieve SDGs: mission-oriented, pro-poor and inclusive; grass roots; social; and digitally enabled open and collaborative. For example, the Global Village Construction Set of Open Source Ecology is an initiative to create 50 tools with open-source blueprints and instructions that a farm needs to be sustainable and autonomous. By making available blueprints and instructions, the initiative seeks to make tools accessible to everyone, especially those in small communities, in order to help create a sustainable society by helping local actors gain new knowledge, develop their own tools and also help to improve available technologies. The initiative is an inspiration for other makers and entrepreneurs and can also provide lessons for existing research and development institutions. Practitioners and policymakers should be able to validate the drivers for creating sustainable entrepreneurial intentions and enhance entrepreneur adoption of sustainable practices. The strategy approach to triple-bottom-line has been a topic of attention in SE literature by targeting social, environmental, and economic goals. New ideas emerged to discuss further how to build market-changing, sustainability-oriented, and sustainable innovation business models.

Author Contribution

Author 1: conceptualization, writing original draft, data curation, formal analysis, visualisation, methodology. Author 2: review and editing, writing review and editing, supervision, validation
Author 3: writing original draft, validation, supervision.

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Conflict of Interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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