Bibliometric mapping of sustainable entrepreneurship in the 21st century to guide future research

Campo Elías López-Rodríguez[1,*], Andrés Mauricio Acosta López[2], Miguel Ángel Díaz Díaz[3]

[1]The Business Administration programme at Universitaria Agustiniana, Bogotá, Colombia
Orcid: http://orcid.org/0000-0003-4061-2979
[2] Marketing programme at Universitaria Agustiniana, Bogotá, Colombia
Orcid: https://orcid.org/0009-0005-5265-9434
[3] Director of the Marketing programme at Universitaria Agustiniana, Bogotá Colombia
Orcid: https://orcid.org/0000-0002-2488-909X

[*]Corresponding author e-mail: campo.lopez@uniagustiniana.edu.co

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Abstract. In the 21st century, sustainable entrepreneurship has taken on a fundamental role as an innovative strategy to address growing environmental, economic, and social challenges. In this context, the aim of this research was to identify the scientific output focused on sustainable entrepreneurship in the 21st century through a bibliometric analysis. The Scopus database was used to analyse a total of 1,157 documents, applying techniques such as citation network analysis, bibliographic coupling, and the analysis of the conceptual structure of these documents. Among the main results, thematic clusters emerged such as sustainable business strategies and competitive development in SMEs, business models and decision-making with social and environmental impact, higher education and entrepreneurial training for sustainable development, and entrepreneurship and economic analysis for sustainable development in developing countries. The study offers a comprehensive view of the main research lines that connect sustainability, entrepreneurship, education, and economic development within business and social contexts, contributing to a deeper understanding of how scientific knowledge around sustainable entrepreneurship has evolved, while identifying trends, gaps, and opportunities for future research. These results can guide corporate policymakers, sustainability managers, universities, and businesses in designing strategies, educational programmes, and business practices that promote sustainable entrepreneurship.

Keywords: entrepreneurship, sustainability, environment, sustainable entrepreneurship.

1. Introduction

In the twenty-first century, sustainable entrepreneurship has assumed a fundamental role as an innovative strategy for addressing the growing environmental, economic, and social challenges. This business approach seeks to balance economic development with environmental conservation and the promotion of social well-being, aligning with the Sustainable Development Goals (SDGs) established by the United Nations (UN)

(United Nations, 2015). The need for sustainable business models responds to a global context characterized by climate change, resource overexploitation, and social inequalities, which has driven a transformation in consumption patterns and in the way, companies operate in the marketplace (Bocken et al., 2014).

Sustainable entrepreneurship integrates economic, social, and environmental practices, fostering a business model that aims to generate shared value while mitigating negative impacts (Schaltegger et al., 2016). This type of entrepreneurship has gained relevance in vulnerable contexts, as it offers innovative solutions to social and economic problems such as unemployment, social exclusion, and environmental degradation (Kirkwood & Walton, 2010).

Sustainable entrepreneurship is not limited to the creation of businesses that minimize their environmental footprint; it also seeks to generate a positive impact on society and the economy. According to Cohen & Winn (2007), this form of entrepreneurship is characterized by identifying and exploiting market opportunities that solve environmental and social problems while generating economic returns. This holistic approach enables entrepreneurs to address global challenges such as poverty, inequality, and climate change while building viable and scalable business models. Sustainable entrepreneurship encourages innovation in products, services, and processes, which not only reduces operating costs but also enhances market competitiveness (York & Venkataraman, 2010).

Sustainable entrepreneurship also plays a crucial role in the transition toward a circular economy, in which resources are used more efficiently, and waste is minimized. According to Geissdoerfer et al. (2017), the circular economy is a model that promotes the reuse, repair, and recycling of materials, thereby reducing dependence on non-renewable natural resources. Such initiatives not only benefit the environment but also create economic and social opportunities, especially in vulnerable communities where access to resources and employment is limited (Bocken et al., 2014).

Despite the economic, social, and productive relevance of this topic, the academic literature on sustainable entrepreneurship still exhibits significant gaps. Although there are studies that explore its specific dimensions, the absence of an integrated and systematic vision hinders a comprehensive understanding of these phenomena (Muñoz & Cohen, 2018). In this regard, bibliometric analysis emerges as a fundamental tool for examining the evolution of scientific output in this field, allowing

the identification of publication patterns, collaboration networks among researchers, and emerging areas of interest (Zupic & Čater, 2015).

In light of the above, the objective of this article is to conduct a bibliometric analysis of the scientific production related to sustainable entrepreneurship in the twenty-first century. With bibliometric techniques, research trends, academic collaboration networks, and the predominant themes in the existing literature will be examined. This approach will enable the mapping of knowledge development in this field, providing valuable information for academics, policymakers, and entrepreneurs interested in the intersection between sustainability and responsible consumption.

The relevance of this study lies in its ability to offer a comprehensive overview of the current state of research on sustainable entrepreneurship and conscious consumption, identifying emerging trends and knowledge gaps. By consolidating a solid theoretical foundation, this work will contribute to the development of new lines of inquiry that foster more sustainable business models and more responsible consumption strategies (Hall et al., 2010). This exercise will generate recommendations for the design of public policies and business strategies aligned with the transition toward a sustainable economy.

This study will not only enrich the academic corpus on entrepreneurship and sustainability but will also serve as a key source of information for the formulation of business strategies, the design of public policies, and sustainability education. In a world increasingly oriented towards social and environmental responsibility, understanding the evolution of sustainable entrepreneurship and its impact on consumers becomes an imperative for research and business practice.

To address this objective, the study examines the following research questions: How has the scientific output associated with sustainable entrepreneurship evolved? Who are the most prominent authors on this topic? Which studies have had the greatest impact in terms of citations? Which journals have published the largest number of works on sustainable entrepreneurship? Which countries lead scientific production in this area? How is bibliographic coupling manifested in the publications? What is the behavior of citation networks? How is the conceptual structure of publications focused on sustainable entrepreneurship defined? The methodological strategy, results, discussion, and conclusions of the study are presented below.

2. Materials and methods

Document retrieval for the bibliometric analysis was performed using Scopus, a suitable tool for accessing scientific literature across different disciplines and fields of study with a comprehensive perspective (Pranckutė, 2021). The data collection was conducted in March 2025, considering documents published from the year 2000 to the present.

The main reason for beginning the bibliometric study in the year 2000 lies in the establishment of the Millennium Development Goals (MDGs) by the United Nations (UN), which aimed to address global challenges such as poverty, education, and health. It is noteworthy that during the document search, no scientific output containing the term "sustainable entrepreneurship" in the title, abstract, or keywords was found for 2000 or 2001. It was not until 2002 that a publication appeared.

This study encompassed all disciplines and areas of knowledge available in Scopus from 2000 to 2025 to provide a comprehensive approach to bibliometric analysis. No language restrictions were applied, and conference proceedings, book chapters, and full books were included, while reports, errata, short surveys, and editorial notes were excluded. The resulting search syntax was as follows:

TITLE-ABS-KEY ("Sustainable entrepreneurship") AND PUBYEAR > 2001 AND PUBYEAR < 2026 AND (EXCLUDE (DOCTYPE, "tb") OR EXCLUDE (DOCTYPE, "no") OR EXCLUDE (DOCTYPE, "er") OR EXCLUDE (DOCTYPE, "ed")).

To analyse the bibliometric impact of journals, the concepts of the H, G, and M index are clarified. The H-index is an indicator that combines productivity and scientific impact, providing an integrated measure of the quantity and visibility of academic output, in this case that of scientific journals (Hirsch, 2005). The G-index, proposed by Egghe (2006) considers the set of a journal's most highly cited documents, assigning greater weight to the most influential publications; meanwhile, the M-index normalises the H-index according to the journal's life cycle by dividing the H-index value by the number of years elapsed since its first publication (Ndwandwe et al., 2021).

We processed the data in R 4.4.3 (released 28 February 2025) with the open-source package bibliometrix, which specialises in scientometric and bibliometric analyses (Aria & Cuccurullo, 2017). We complemented the analysis with VOSviewer, an open-source application for constructing and visualising bibliometric networks (Van Eck & Waltman, 2010).

3. Results

3.1. Scientific document production

The bibliometric analysis shows that between 2002 and 2025 a total of 1,157 documents were published, distributed across 811 journal articles (70%), 27 books (3%), 180 book chapters (15%), 95 conference papers (8%), and 44 review articles (4%). A total of 2,747 authors participated, of whom 170 (6%) wrote individually and 2,577 (94%) collaborated in co-authorship. International collaboration accounts for 30%, with an average of 2.87 authors per document and an overall collaboration index of 2.48. The annual growth rate of publications is 17.5%, and each document has received an average of 25.5 citations.

Figure 1 reveals a steady increase in scientific production from 2002 to 2024, with a notable surge beginning in 2011. While the early years show only incipient figures, from 2014 onward a sustained rise is evident, growing from 28 documents that year to 238 in 2024—a dynamic that reflects mounting interest and a scientific consolidation of sustainable entrepreneurship. The years 2021, 2022, and 2023 stand out for recording more than 120 publications annually, reinforcing this upward trend. This upward trend is likely to continue through 2025.

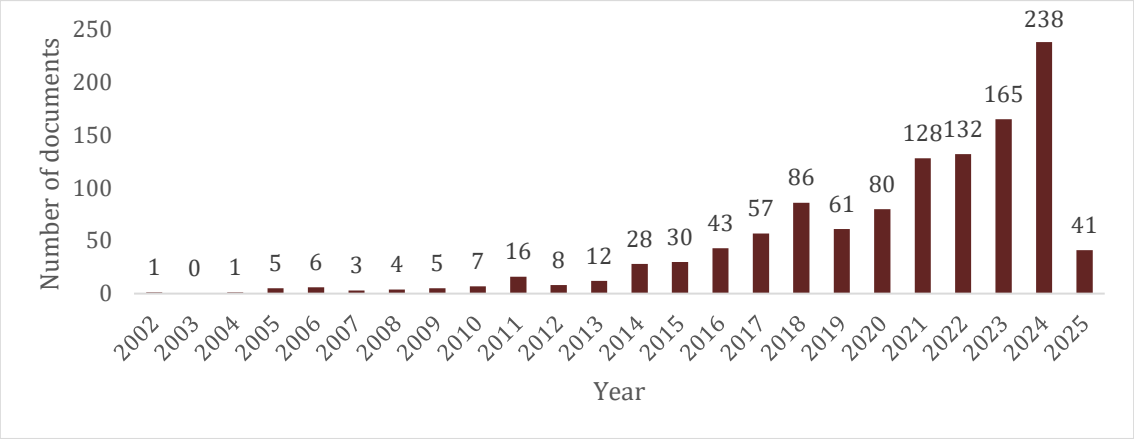

Figure 1. Annual Scientific Output

3.2. Most prolific authors

The scientific output of the authors shows differences both in their total number of publications and in their fractional contribution, as illustrated in Table 1. The most prominent author is Klaus Fichter, a German scholar and professor at the Carl von Ossietzky University of Oldenburg who directs the Borderstep Institute for Innovation

and Sustainability. His research focuses on developing tools and support systems for sustainable entrepreneurship, innovation processes, eco-startups, and methods for measuring sustainability impact (Fichter & Tiemann, 2018; Fichter & Tiemann, 2020; Fichter et al., 2023).

At a comparable level of productivity is Stefan Schaltegger, a Swiss German economist and professor of management with an emphasis on sustainability management at Leuphana University of Lüneburg, where he heads the Centre for Sustainability Management. His research interests lie in integrating sustainability into management, specifically through environmental accounting, sustainability control, and sustainable innovation (Schaltegger & Wagner, 2011; Schaltegger & Tiemann, 2018; Schaltegger et al., 2023).

Third is Gjalt de Jong, a Dutch academic and associate professor at the University of Groningen, Campus Fryslân, where he leads the Department of Sustainable Entrepreneurship in a Circular Economy. His research centers on analyzing how companies can embed sustainable practices into their business models, promoting transitions toward circular and sustainable economies (De Jong, 2023; De Jong, 2019).

Table 1. Most representative authors.

Authors	Articles	Articles fractionalized
Fichter K.	9	3.58
Schaltegger S.	9	3.75
De Jong G.	8	4.12
Hörisch J.	8	5.83
Ratten V.	8	4.83
Wagner M.	8	4.75
Gaurav A.	6	1.58
Gupta B.	6	1.58
Hansen E.	6	2.58
Long T.	6	2.7

3.3. Highest impact studies

Table 2 presents the documents with the highest citation counts. Leading the list is the study by Schaltegger & Wagner (2011), with a total of 1234 citations. This work makes a significant contribution to the field of sustainable entrepreneurship by proposing a classification that systematically connects entrepreneurial activity with sustainability-

oriented innovation. The authors argue that sustainable entrepreneurship pursues not only economic objectives but also drives social and environmental transformations through both incremental and disruptive innovations.

Dean & McMullen (2007) occupy second place with 1073 citations. Their research proposes a theory of sustainable entrepreneurship focused on reducing environmental degradation through entrepreneurial action. They contend that entrepreneurs play a crucial role in creating innovative solutions that seek not only economic gains but also the mitigation of negative environmental impacts.

The third most-cited contribution is that of Cohen & Winn (2007). These authors contend that market failures—such as pollution, asymmetric information, negative externalities, and the undervaluation of natural resources—create key opportunities for sustainable entrepreneurship. Rather than acting as obstacles, such conditions can be leveraged by innovative entrepreneurs to develop solutions that advance economic, social, and environmental well-being. Hence, sustainable entrepreneurship emerges as a strategic response that transforms market limitations into competitive advantages, fostering responsible business models (Halberstadt et al., 2024).

Table 2. Documents with the highest citation counts.

Authors	Title	Total Citations	TC per Year
Schaltegger & Wagner (2011)	Sustainable entrepreneurship and sustainability innovation: categories and interactions	1234	82.27
Dean & McMullen (2007)	Toward a theory of sustainable entrepreneurship: Reducing environmental degradation through entrepreneurial action.	1073	56.47
Cohen & Winn (2007)	Market imperfections, opportunity and sustainable entrepreneurship.	1041	54.79
Klewitz & Hansen (2014)	Sustainability-oriented innovation of SMEs: a systematic review.	957	79.75
Hockerts & Wüstenhagen (2010)	Greening Goliaths versus emerging Davids—Theorizing about the role of incumbents and new entrants in sustainable entrepreneurship.	897	56.06
Kuckertz & Wagner (2010)	The influence of sustainability orientation on entrepreneurial intentions—Investigating the role of business experience.	549	34.31
Schaltegger et al. (2016)	Business models for sustainability: A co-evolutionary analysis of sustainable entrepreneurship, innovation, and transformation.	512	51.20

Pacheco et al. (2010)	Escaping the green prison: Entrepreneurship and the creation of opportunities for sustainable development.	416	26.00
Belz & Binder (2017)	Sustainable entrepreneurship: A convergent process model.	399	44.33
Gast et al. (2017)	Doing business in a green way: A systematic review of the ecological sustainability entrepreneurship literature and future research directions.	376	41.78

3.4. Most influential journals

Regarding the journals with the highest citation levels, Table 3 places the Journal of Cleaner Production in first position, boasting an H-index of 39 and a total of 5252 citations, underscoring its influence on scientific output related to sustainable entrepreneurship. Its publications address the efficiency of production processes and the reduction of environmental impact; from an interdisciplinary perspective, they cover topics such as cleaner production, circular economy, waste management, energy efficiency, sustainable design, life-cycle assessment, and corporate social responsibility. In second place is Sustainability (Switzerland), with an H-index of 24 and 2,848 citations. Although likewise interdisciplinary, this journal's scope embraces environmental pollution, climate change, and natural-resource management, while also including socioeconomic and business-related themes. Third is Business Strategy and the Environment, with an H-index of 19 and 3514 citations. Its bibliographic interests focus on corporate environmental management, eco-innovation, green finance, circular economy, corporate social responsibility, and sustainable governance.

The G-index confirms the leadership of the Journal of Cleaner Production (G = 62) and Sustainability (Switzerland) (G = 47), indicating that their influence is reinforced by a set of highly cited articles. However, the M-index reveals a different pattern: Sustainability (Switzerland) shows the highest value (M = 3.091), suggesting an accelerated growth in its scientific impact over a relatively shorter period compared with more established journals.

The ranking of journals with the greatest number of publications, displayed in Figure 3, features these same three titles; however, under this indicator Sustainability (Switzerland) occupies first place, followed by Journal of Cleaner Production, with Business Strategy and the Environment in third. These journals have published 124, 62, and 39 documents, respectively, on sustainable entrepreneurship. This confirms that the

trio not only leads in publication volume but also exhibits a high citation level, reflecting their academic relevance and the impact of their contributions to the scientific body of knowledge on this topic.

Table 3. H, G, and M indices of the leading journals.

Journal	H index	G index	M index	Total citations
Journal of Cleaner Production	38	62	1.583	5252
Sustainability (Switzerland)	34	47	3.091	2848
Business Strategy and the Environment	19	39	0.950	3514
International Journal of Entrepreneurial Behaviour and Research	14	22	1.750	943
Journal of Business Venturing	11	12	0.579	4574
International Journal of Entrepreneurial Venturing	9	11	1.125	453
International Journal of Management Education	8	12	0.800	278
Entrepreneurship and Sustainability Issues	7	7	0.875	164
International Entrepreneurship and Management Journal	7	10	0.875	139
Journal of Business Research	7	9	1.167	345

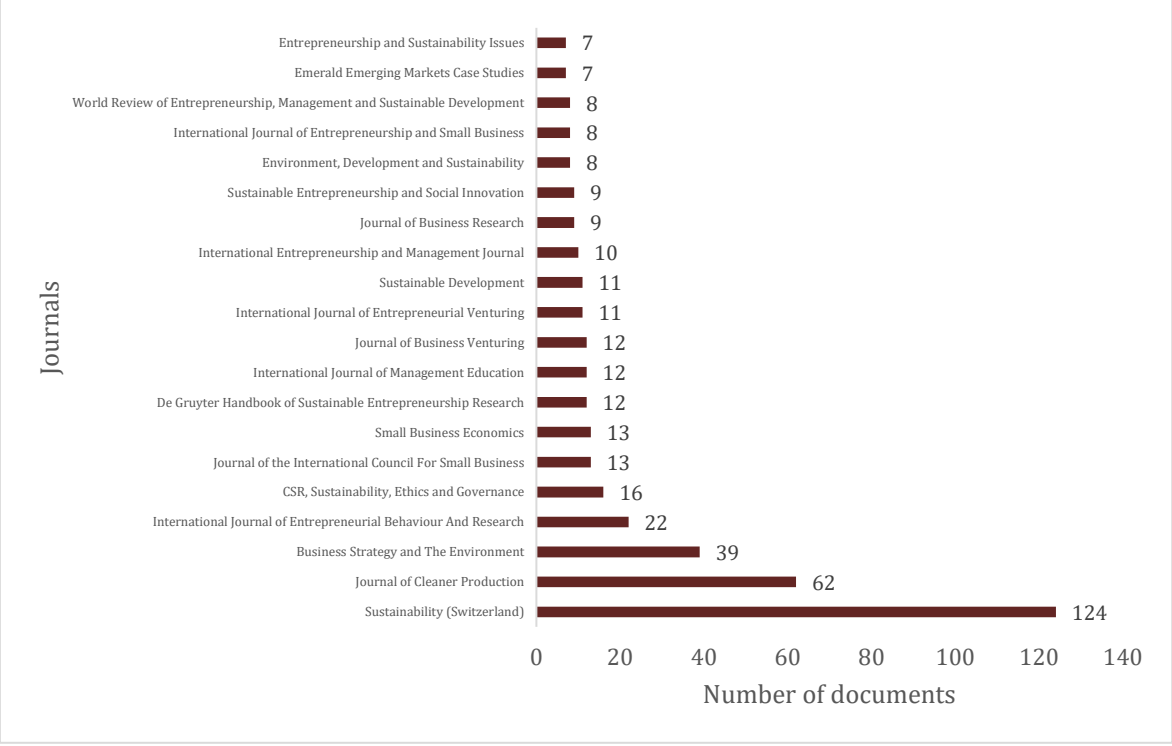

Figure 3. Leading journals by number of published documents

3.5. Countries leading scientific production

Table 4 lists the countries with the greatest number of publications, as well as their levels of international collaboration in scientific output on sustainable entrepreneurship. Germany heads the ranking with 88 documents, of which 67 are domestic publications and 21 are international collaborations, underscoring the country's institutional, academic, and corporate commitment to sustainability through close ties among universities, research centers, and the productive sector (Karahan, 2024; Mueller, 2024). In second place is China, with 73 documents—48 single-country publications and 25 international collaborations. China has enacted robust environmental policies and made significant investments in renewable energy, energy efficiency, and waste management, developments that have spurred scientific production in these areas (Radulescu et al., 2024; Liu et al., 2023).

Closing out the top three is Spain, which has 57 documents, of which 44 are domestic publications and 13 international collaborations. Spain's standing reflects public-policy initiatives that have strengthened factors such as the circular economy, green innovation, and social responsibility, driven by the active involvement of universities, technology centers, and scientific collaboration networks (Alonso-Almeida et al., 2020; Llonch Andreu et al., 2024; González-Relaño & Sánchez-Medina, 2021).

Table 4. Number of published documents and levels of international collaboration by country.

Top	Country	Documents	Single-Country publications	Multiple-Country publications
1	Germany	88	67	21
2	China	73	48	25
3	Spain	57	44	13
4	India	53	48	5
5	Italy	43	25	18
6	United Kingdom	43	26	17
7	USA	43	27	16
8	Netherlands	39	26	13
9	Portugal	30	17	13
10	France	24	14	10

3.6. Bibliographic-coupling structure

This analysis highlights the coupling of documents, countries, and journals with the highest scientific output. Bibliographic coupling of documents is a bibliometric technique that identifies relationships between two scientific papers when both cite one or more references in common (Nandy et al., 2024). Figure 4 displays several scientific communities through which knowledge networks on sustainable entrepreneurship have been consolidated.

The red network features a community formed principally by the documents published by Schaltegger & Wagner (2011), Cohen & Winn (2007), and Schaltegger et al. (2016). The yellow network comprises studies such as Shepherd & Patzelt (2011), Kuckertz & Wagner (2010), and Shepherd & Patzelt (2013). Finally, the green network emerges as a key result of this coupling, highlighting the works of Vuorio (2018), Sadiq et al. (2022), and Hooi et al. (2016).

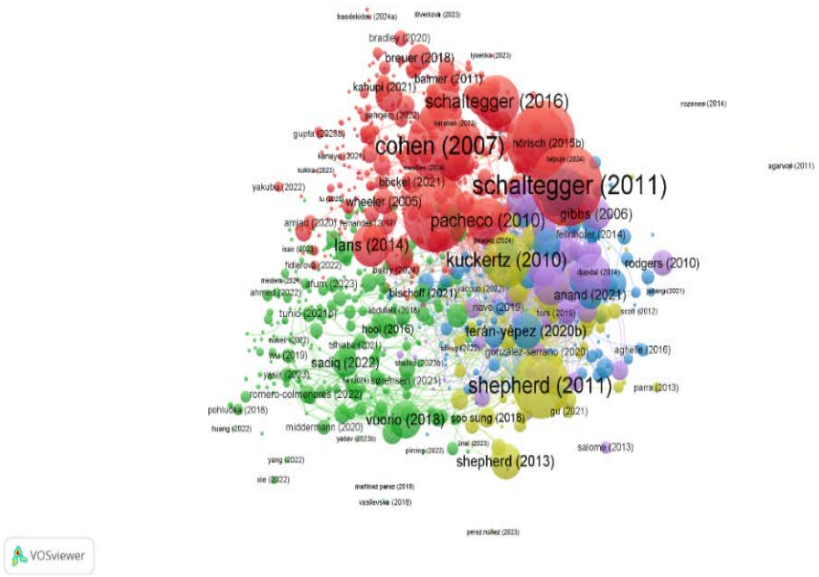

Figure 4. Bibliographic coupling of documents

Figure 5 depicts the bibliographic coupling among countries—a technique that identifies how frequently two or more nations cite the same sources, thereby revealing collaboration networks, academic influences, and geographic research trends worldwide (Mas-Tur et al., 2021). One major collaboration network (green) comprises Germany, the United Kingdom, the Netherlands, Austria, France, and Denmark. A second network

(red) is formed by India, Portugal, China, Romania, Pakistan, and Malaysia. Third, a collaboration network (yellow) is led by the United States, Saudi Arabia, South Korea, and Taiwan.

This evidence shows that such coupling not only exposes the intensity of international academic relationships but also highlights the formation of geographic blocks of collaboration around sustainable entrepreneurship, thereby reflecting shared interests and an emerging interdependence in global scientific production.

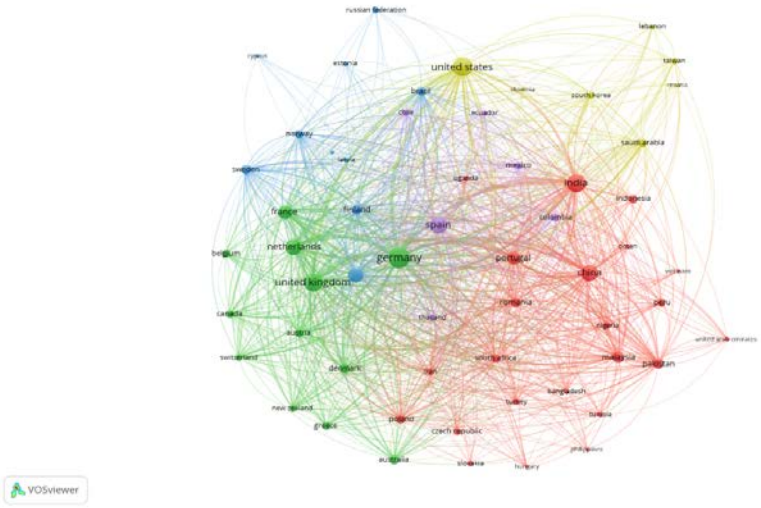

Figure 5. Bibliographic coupling of countries

Bibliographic coupling of journals is a bibliometric technique aimed at identifying the relationships among scientific journals based on the references they share in their published articles, thereby indicating thematic and disciplinary affinity (Nandy et al., 2024). Figure 6 visualizes scientific communities and the intellectual proximity among the principal journals that publish research on sustainable entrepreneurship.

One such community, highlighted in red, is led by the journal Sustainability (Switzerland), which shows intellectual proximity chiefly with the International Journal of Management Education, Entrepreneurship and Sustainability Issues, and the Journal of Entrepreneurship and Innovation.

A second community, shown in blue, is formed by the Journal of Cleaner Production, Business Strategy and the Environment, and the International Journal of Entrepreneurial Behaviour and Research. A third community, depicted in green,

comprises the International Journal of Entrepreneurial Venturing, the Journal of Business Venturing, and Business Strategy and Development.

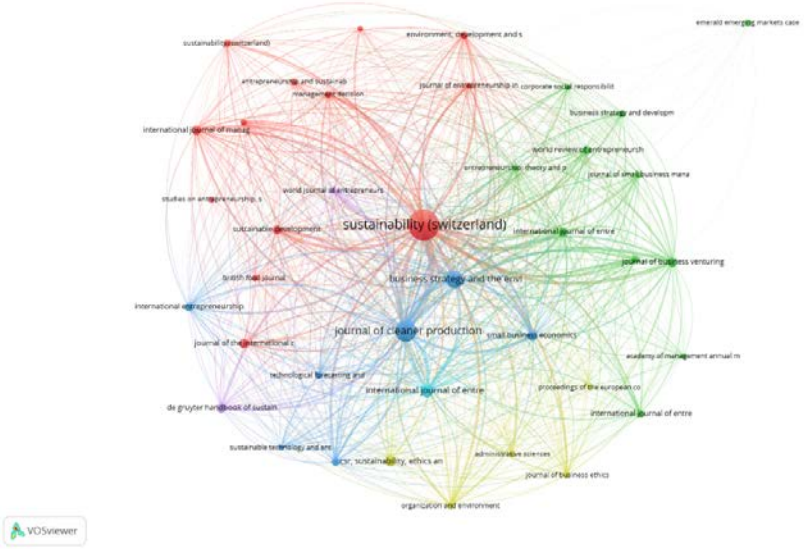

Figure 6. Bibliographic coupling of journals

3.7. Citation network dynamics

Author co-citation analysis, presented in Figure 7, visualizes scientific relationships among researchers according to how frequently authors are cited together in other publications (Phan Tan, 2022). Four author groups emerge in terms of centrality. The blue cluster is headed by Stefan Schaltegger, Rolf Wüstenhagen, and Florian Lüdeke-Freund, whose work centers on corporate sustainability, environmental innovation, and the transition toward sustainable business models.

The green cluster (Cluster 2) is led by Boyd Cohen, Dean Shepherd, and Marcus Wagner; their publications have shaped the treatment of sustainability in the entrepreneurial sphere, underscoring the importance of innovation and the integration of sustainability into business strategy. The red cluster (Cluster 3) consists mainly of Marko Sarstedt, Francisco Liñán, and Alain Fayolle, who have advanced both the theoretical and practical consolidation of entrepreneurship by embedding sustainability into entrepreneurial processes and business education. Finally, the yellow cluster (Cluster 4) groups Klaus Fichter, David Audretsch, and Erik Stam, whose contributions have deepened understanding of the role of entrepreneurial ecosystems in fostering sustainable entrepreneurship by providing tools for financial, environmental, and social management.

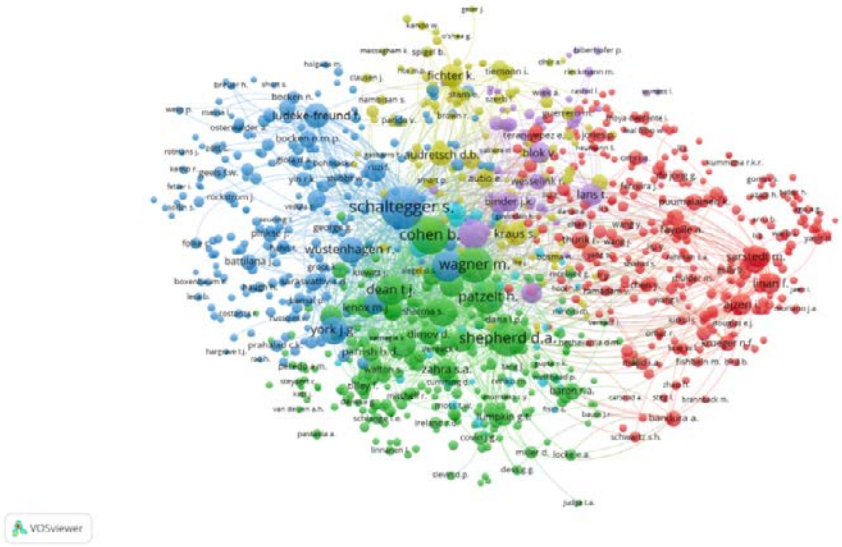

Figure 7. Author co-citation

Journal co-citation analysis was used to identify the intellectual structure of sustainable entrepreneurship by examining relationships among journals that are cited together in scientific publications (Phan Tan, 2022). Figure 8 highlights the central importance of the journal Sustainability (Switzerland)**,** which becomes the pivotal axis in this indicator. Likewise, journals such as Journal of Business Venturing**,** Journal of Small Business Management**,** Journal of Cleaner Production, and Business Strategy and the Environment also stand out. This pattern of journal co-citation reveals the formation of an academic core oriented toward sustainable entrepreneurship, underscoring the main reference sources that confer scientific legitimacy within this field.

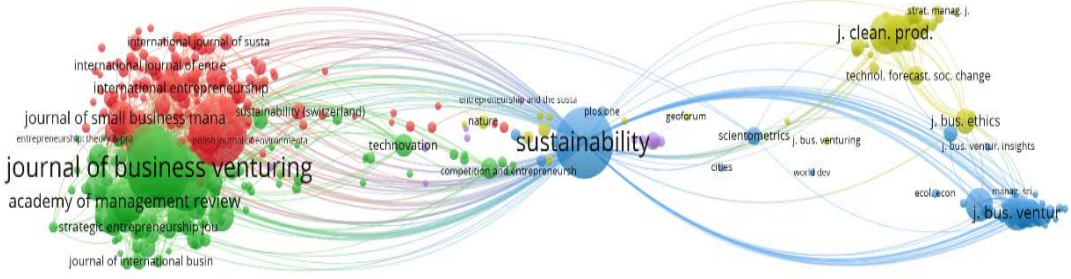

Figure 8. Journal co-citation

3.8. Conceptual structure of the scientific output

The conceptual structure of the scientific output, analyzed through a bibliometric technique, enabled this study to identify the main emerging thematic clusters related to sustainable entrepreneurship by examining the co-occurrence of keywords proposed by authors in their scientific works (Aria & Cuccurullo, 2017). These clusters point to future research lines that link sustainability, entrepreneurship, education, and economic development in business and social contexts, with sustainable entrepreneurship as the focal theme. The main thematic clusters are shown in Figure 9 and are characterised as follows:

Sustainable business strategies and competitive development in SMEs.

This green cluster addresses the relationship between sustainability, entrepreneurship, and business development in small and medium-sized enterprises (SMEs), considering their adaptation to market dynamics and the digitalization of organizational processes. It highlights models explaining how firms can enhance industrial performance and competitiveness by balancing economic growth with sustainable practices that strengthen their market position.

Business models and decision-making with social and environmental impact.

The red thematic cluster integrates business development and sustainable entrepreneurship, with a strong focus on decision-making and strategic planning that links the environment, socioeconomic effects, and the role of societies and institutions in business models. It underscores how sustainable business models and social entrepreneurship drive trade and investment practices aligned with the triple-bottom-line approach, balancing economic performance with social and environmental responsibility.

Higher education and entrepreneurial training for sustainable development (SDGs).

This purple cluster highlights the relationship between higher education and the training of entrepreneurs committed to the 2030 Agenda and the achievement of the Sustainable Development Goals (SDGs). Its themes promote active learning, fostering responsible attitudes and greater awareness of environmental and social issues among students, preparing them to face global challenges and to advance business models aligned with sustainable development.

Entrepreneurship and economic analysis for sustainable development in developing countries.

Finally, the blue thematic cluster explores the role of entrepreneurship in economic development and the transition toward a green economy in developing nations. It examines the links between investment, finance, and the adoption of alternative energies as pillars of sustainability. Its topics analyze how financial and investment decisions in emerging economies can foster a balance between economic growth and environmental preservation.

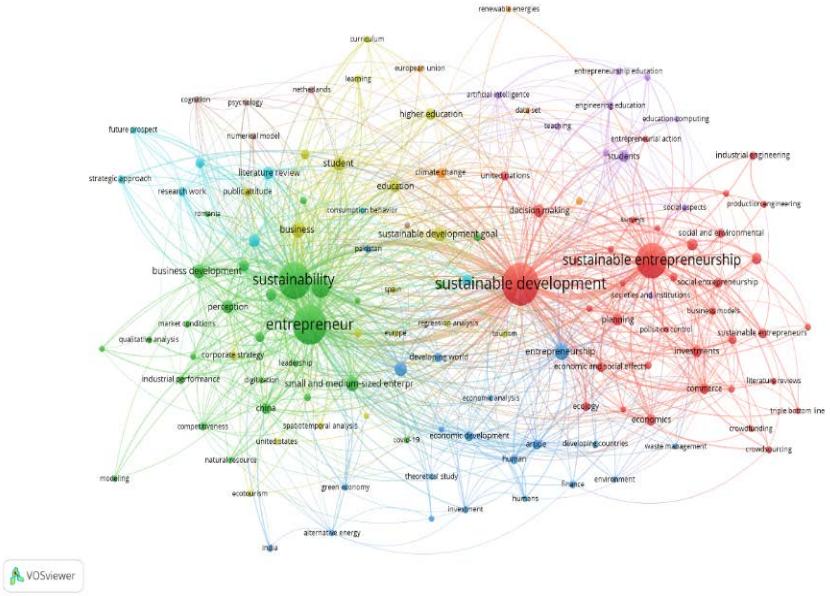

Figure 9. Keyword co-occurrence

4. **Discussion and Conclusions**

The bibliometric results reveal an exponential increase in output on sustainable entrepreneurship between 2002 and 2024 (average annual growth rate 17.5%), a finding consistent with other reviews of green business research (Blanco et al., 2023; Halberstadt et al., 2024). The post-2014 surge coincides with the adoption of the Sustainable Development Goals (SDGs) and the rise of the circular economy in Europe and Asia (United Nations, 2015; Radulescu et al., 2024), confirming that the global policy agenda acts as a driving force for research applied to responsible business models.

The clusters led by Schaltegger, Fichter, and De Jong reaffirm the dominance of the German European school, focused on impact measurement and sustainable business models (Fichter & Tiemann, 2018; Schaltegger et al., 2023). Meanwhile, the cluster linked to Cohen, Shepherd, and Wagner validates the persistence of frameworks that view entrepreneurship as a response to environmental market failures (Cohen & Winn,

2007; Dean & McMullen, 2007). The convergence of these two cores reflects a methodological integration of institutional economics and transformational innovation.

Journal of Cleaner Production tops the citation rankings for the topic, whereas Sustainability (Switzerland) leads in article volume, confirming both the field's interdisciplinarity and the relevance of open-access Q1–Q2 journals (Muñoz & Cohen, 2018). Germany and China dominate in both output and international collaboration, supporting Karahan's (2024) hypothesis on the role of national innovation systems in shaping green knowledge networks.

The co-occurrence analysis identifies four thematic foci: (i) SMEs and sustainable competitiveness, consistent with literature on green practice adoption in smaller firms (Klewitz & Hansen, 2014); (ii) triple-impact business models, aligned with circular-economy and shared-value creation (Geissdoerfer et al., 2017); (iii) higher education and the SDGs, underscoring universities' role in training sustainable entrepreneurs (González-Relaño & Sánchez-Medina, 2021); and (iv) green finance in emerging economies, corroborating links between green finance and start-ups in developing countries (Sadiq et al., 2022). These clusters indicate a shift from foundational questions toward operational issues of scalability and financing.

A gap persists in measuring social impact, as most studies privilege environmental and economic variables (Halberstadt et al., 2024). Moreover, only 9 of the 20 most productive countries belong to the Global South, highlighting the need for evidence from Latin America, Africa, and Southeast Asia (Mas-Tur et al., 2021). The results also reveal only incipient integration of the responsible-consumer perspective, despite its demonstrated relevance to sustainable purchase intention (Carrington et al., 2014). These gaps open avenues for future research based on mixed methods and standardized ESG (Environmental, Social, and Governance) metrics.

Key findings from the analysis indicate that, in terms of disciplinary growth and maturity, scientific production on sustainable entrepreneurship has exhibited a steady increase since 2002, with noticeable peaks following the promulgation of the Sustainable Development Goals (SDGs). The field is both maturing and expanding, bolstered by international collaboration networks.

The study shows that citations concentrate around two main currents: (a) the perspective of opportunities arising from market failures (Dean & McMullen, 2007) and (b) the vision of innovation in sustainable business models (Schaltegger & Wagner, 2011). Their convergence outlines an integrated framework that harmonizes economic

incentives with socio-environmental purposes. Thematic clusters align with today's agenda: sustainable SMEs, triple-impact business models, entrepreneurial education linked to the SDGs, and green finance in emerging economies.

Although studies on sustainable entrepreneurship are primarily concentrated in Global North countries, this study reveals that only 9 of the 20 most productive countries belong to the Global South. This underscores the need to develop contextualized theoretical frameworks tailored to the ecological, social, and economic realities of regions such as Latin America, Africa, and Southeast Asia, avoiding the indiscriminate application of models designed for developed economies. Such an approach can generate more relevant and locally grounded knowledge, fostering sustainable entrepreneurship solutions that effectively address region-specific challenges.

The sustained growth of scientific output and the consolidation of leading authors and journals indicate a rising interest and a robust academic foundation that can guide policies and programs aimed at sustainability. The identified thematic clusters point to strategic areas of application: the development of sustainable business strategies in SMEs can enhance competitiveness and innovation; the integration of business models with social and environmental impact enables more responsible managerial decisions; the training of entrepreneurs committed to the SDGs highlights the need for educational and capacity-building programs in sustainability; and the link between entrepreneurship and economic analysis in developing countries signals opportunities to guide investments and policies that balance economic growth with environmental preservation.

Future research should focus on consolidating robust social-impact metrics, generating evidence from the Global South, and connecting entrepreneurial decision-making with responsible consumption. Policymakers involved in sustainable entrepreneurship need to promote green incubators, hybrid financing instruments, and policies that incorporate comparable ESG metrics. For academia, longitudinal studies evaluating the evolution of impact intent and its translation into tangible results are paramount.

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