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Mapping the Research Landscape of Sustainable Startups: A Bibliometric Perspective

by

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Mapping the Research Landscape of Sustainable Startups: A Bibliometric Perspective

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Abstract

This study provides a comprehensive bibliometric analysis of the academic literature on sustainable startups, mapping the evolution, structure, and thematic orientation of the field in the decade following the introduction of the United Nations Sustainable Development Goals (SDGs). Using a dataset of 984 peer-reviewed journal articles indexed in Scopus between 2015 and 2025, the analysis combines descriptive indicators with network-based techniques, including co-citation, co-authorship, and keyword co-occurrence analyses. The results reveal a sharp and sustained growth in scholarly attention to sustainable startups, accompanied by increasing geographic diversification and interdisciplinary engagement within the social sciences. While publication output is concentrated in a limited number of countries and journals—most notably sustainability-oriented and energy-focused outlets—the intellectual structure of the field is organized around six main thematic clusters, spanning entrepreneurial ecosystems, eco-innovation and circular economy, sustainable business models, digitalization, energy and climate change, and social responsibility. A small number of highly influential authors and research groups play a central bridging role, facilitating knowledge diffusion across otherwise fragmented research streams. Beyond documenting publication trends, this bibliometric mapping clarifies the conceptual boundaries of sustainable startup research and highlights persistent gaps, particularly the limited integration of sustainability-oriented startups into core entrepreneurship theory and the lack of standardized approaches to measuring environmental and social impact. By explicitly acknowledging the trade-offs inherent in bibliometric indicators—especially with respect to journal reputation and non-measurable qualitative dimensions—this study positions bibliometrics as a complementary tool for framing and contextualizing empirical research rather than as a normative evaluation of scientific quality. Overall, the findings depict a rapidly maturing research field in which sustainable startups are increasingly recognized as key agents of systemic transition, linking innovation, entrepreneurship, and sustainability. The study offers a structured and replicable overview that informs future theoretical development and empirical investigation in sustainability-oriented entrepreneurship.

Keywords: Sustainable startups; Sustainable entrepreneurship; Bibliometric analysis; Circular economy; Sustainable business models; Innovation; SDGs

1 Introduction

The role of startups in modern economic and social systems has become increasingly important over the past two decades. As young, innovation-driven companies, startups are in a privileged position to both develop and scale innovative solutions to socially important challenges, which include climate change, sustainable development, and environmental protection. In particular, among SMEs, startups are playing an important role in advancing the SDGs (Bocken, 2015; Horne et al., 2020; Trautwein, 2021). In this sense, startups are crucial economic actors in driving sustainable transition thanks to their unique characteristics and capabilities. A key aspect is their intrinsic capacity for innovation (Sehnem et al., 2022) which can generate new technologies, innovative products, and services that address pressing environmental and social challenges (Trautwein, 2021).

At the same time, the academic debate on sustainability and entrepreneurship has expanded considerably, particularly since the adoption of the United Nations Sustainable Development Goals (SDGs) in 2015. In light of this, sustainability has become a pillar of corporate strategy, with almost all large companies having a vice president-level executive with the word “sustainability” in their title. Most large companies now have explicit public statements on sustainability policy and claim to apply a “triple bottom line” that takes into account the company's financial, environmental, and social performance (Elkington, 1998).

At the heart of this are sustainable startups, i.e., early-stage companies that integrate environmental and social value creation into their business models. Research on circular startups, for example, highlights how these companies rely on hybrid growth strategies and shows that circular startups, similar to other hybrid organizations, are engaged in both commercial activities and impact scaling activities (Han et al., 2023).

To better understand the correlation between sustainability and startups, this study applies a bibliometric approach to systematically analyze academic output on sustainable startups. In this sense, bibliometric analysis has become increasingly popular in the social sciences, as it allows for the quantitative mapping of large bodies of literature and the identification of intellectual structures through the analysis of citations, co-citations, and co-occurrences (Donthu et al., 2021). Compared to traditional narrative or systematic literature reviews, bibliometrics provides greater transparency and replicability, while enabling the visualization of research clusters, collaboration networks, and thematic trends. These characteristics make bibliometrics ideally suitable for interdisciplinary and emerging fields such as sustainability-oriented

entrepreneurship, where the literature embraces different domains (economics, social sciences, environmental studies) as well as is constantly evolving.

The analysis was based on data from Scopus, one of the most comprehensive databases of peer-reviewed literature, covering the period 2015-2025. This time period is particularly relevant as it coincides with the global spread of the SDGs and the intensification of academic interest in sustainable business models. The focus is limited to journal articles in the fields of business, economics, and social sciences, written in English and published in the final stage, in order to ensure both rigor and comparability. In this way, the study seeks to provide a clear overview of the subject.

The purpose of this bibliometric study is not to provide a normative assessment of the “best” journals, authors, or theories in the field of sustainable startups, nor to replace critical scholarly judgment with purely quantitative indicators. Rather, the objective is to offer a structured and replicable mapping of the academic landscape in which the phenomenon of sustainable startups is embedded. In this sense, the bibliometric analysis serves three complementary functions.

First, it provides a systematic overview of the scientific production on sustainable startups. Second, through network-based techniques, it helps reconstruct the intellectual structure of the field.

Third, it provides an analytical framework clarifying which concepts and lines of research are most central to the literature on sustainable startups. Accordingly, bibliometrics is employed here as a complementary tool, aimed at framing and contextualizing the empirical analysis that follows, rather than as a substitute for theoretical interpretation.

Then, it is structured around the following research questions (RQs):

- ◇ **RQ1:** Which are the main publishing trends in the literature on sustainable startups over the last decade?
- ◇ **RQ2:** Which countries, institutions, authors, and journals have been the most proactive and most influential in this area?
- ◇ **RQ3:** Which thematic clusters and schools of thought emerge from the co-occurrence and co-citation analyses?
- ◇ **RQ4:** What research gaps and possible future directions can be identified through this bibliometric mapping?

In this regard, this study seeks to offer several contributions. First, it provides a structured overview of the intellectual landscape of research on sustainable startups, highlighting how the field has evolved in terms of volume, geography, and disciplinary scope. In addition, it identifies

the most influential actors—authors, journals, institutions, and countries—that have contributed most to the debate, thus providing a reference point for scholars approaching the field. Third, it also identifies the conceptual clusters and thematic directions that currently dominate the literature, such as sustainable business models, the circular economy, and eco-innovation. Finally, by highlighting gaps in the research, it provides possible avenues for future research, emphasizing how further studies could help to highlight the correlation between sustainability and startups.

2 Methodology

The bibliometric analysis presented is based on data downloaded from Scopus, one of the largest and most widely used databases of peer-reviewed academic publications. Scopus is generally preferred to Web of Science (WoS) in social and management sciences because of its broad coverage and robust metadata, which make it particularly well suited for large-scale mapping activities (Mongeon & Paul-Hus, 2015). Bibliometric analysis has emerged as a widely recognized methodology for mapping the intellectual structure of scientific fields and identifying research trends. Unlike traditional narrative or systematic reviews, which rely heavily on limited synthesis, bibliometric methods permit quantitative, replicable, and transparent analysis of large bodies of literature (Zupic & Čater, 2015; Donthu et al., 2021). This objectivity makes bibliometrics increasingly popular for consolidating fragmented research domains and assessing the dynamics of scientific knowledge. Through techniques such as co-citation, bibliographic coupling, co-authorship, and keyword co-occurrence analysis, bibliometrics allows for the visualization of knowledge networks and the identification of thematic clusters that structure a given subject area (Donthu et al., 2021).

The use of bibliometric approaches is also beneficial for new and inter-disciplinary fields, like sustainable entrepreneurship and green startups, in which literature can be scattered over several as well as diverse disciplines, journals, as well as theory bases. With the unification of descriptive statistics as well as network analysis, bibliometric approaches offer a macroscopic visualization of publication trends as well as a microscopic comprehension of a research area's intellectual bases as well as patterns of collaborative working relationships (Donthu et al., 2021a, Verma and Gustafsson, 2020).

It also enables the discovery of new trends and knowledge gaps that inform subsequent research directions (Donthu, Kumar, Pandey, & Lim, 2021a; Verma & Gustafsson, 2020). Furthermore, unlike meta-analyses or systematic reviews, bibliometric methods provide larger and more objective perspectives through the use of large-scale bibliographic databases rather than

interpretation (Aguinis, Pierce, Bosco, Dalton, & Dalton, 2011; Snyder, 2019). In addition, improvements to databases such as Scopus and Web of Science, along with visualization software such as VOSviewer and Gephi, have made bibliometric studies more accessible and analytically robust (van Eck & Waltman, 2010; Aria & Cuccurullo, 2017). After all, bibliometric analysis allows for a more in-depth assessment of disciplinary development, giving researchers a strategic framework to see where their contributions fit into an ever-growing knowledge base (Donthu, Kumar, & Pattnaik, 2020b; Wallin, 2005).

2.1 Database selection

The dataset for this bibliometric study was extracted exclusively from Scopus, a choice made deliberately and in line with established methodological practices in bibliometric and science-mapping research within the social sciences. Comparative studies have consistently shown that Scopus provides broader and more balanced coverage of peer-reviewed journals in business, management, economics, and social sciences than Web of Science, particularly for interdisciplinary topics such as sustainability and innovation (Mongeon & Paul-Hus, 2015).

Compared to alternative sources, Scopus offers structured and high-quality metadata, including standardized information on authors, affiliations, citations, keywords, abstracts, and subject categories. These features are essential for conducting network-based analyses such as co-citation, co-authorship, and keyword co-occurrence, which form the backbone of bibliometric mapping and performance analysis (Cobo et al., 2011; Zupic & Čater, 2015). Moreover, Scopus allows data export in structured formats (e.g., CSV, BibTeX, RIS), ensuring full compatibility with established bibliometric software such as VOSviewer and Bibliometrix and thereby enhancing transparency and replicability (Aria & Cuccurullo, 2017; Donthu et al., 2021).

Although Google Scholar provides wider coverage in terms of document volume, its inclusion of non-peer-reviewed materials, inconsistencies in metadata quality, limited transparency of indexing criteria, and vulnerability to duplication significantly reduce its suitability for systematic and replicable bibliometric analyses (Harzing & Alakangas, 2016). For these reasons, Google Scholar is generally considered inappropriate for network-based bibliometric techniques that rely on standardized and reliable bibliographic information.

Finally, methodological guidelines recommend the use of a single high-quality database—rather than merging multiple sources—when the objective is to map intellectual structures and thematic patterns, as database integration often introduces noise, duplication, and distortions in citation networks (Zupic

& Čater, 2015; Donthu et al., 2021). Accordingly, the exclusive use of Scopus represents a trade-off that prioritizes methodological rigor, comparability, and analytical robustness over sheer coverage, while maintaining sufficient disciplinary breadth for the purposes of this study.

2.2 Query design and refinement

The approach to data collection was divided into several stages: the process began with a broad search, to which restrictions were gradually applied in order to obtain a comprehensive and relevant final dataset. The initial query included several terms commonly associated with entrepreneurship and sustainability:

TITLE-ABS-KEY (startup OR "start-up*" OR entrepreneurship OR "new venture*")
AND TITLE-ABS-KEY ("sustainable development" OR "SDGs" OR "eco-innovation"
OR "circular economy" OR "green economy" OR "sustainab*" OR "green")*

This broad search, without any time or disciplinary restrictions, yielded a total of 11,124 articles. While this confirmed the relevance of the topic, it also revealed the need for a more focused scope, as many of these articles only marginally concerned about startup. In the second step, the query was refined to focus specifically on “*startup**” and “*start-up**” as keywords, removing the more general terms “*entrepreneurship*” and “*new venture*”, which often generated noise by retrieving papers outside the intended scope. This change significantly reduced the dataset to 3,248 articles, being more coherent with the research focus.

In the last step, further filters were then used to retain quality and relevance:

- Years of publication: 2015–2026, in order to make the comparison congruent with the onset of the SDGs (2015) as well as encapsulate the largest phase in sustainable entrepreneurship literature expansion.
- Paper typology: only articles, excluding conference papers, book chapters, and reviews in order to maintain comparability.
- Source: journals, in order not to incorporate non-peer-reviewed sources.
- Language: English only since it happens to be the leading language of academic publications internationally.
- Publication stage: only “final” articles without “in press” items for stability of bibliographic data.
- Field areas: “Business, Management and Accounting” (BUSI), “Economics, Econometrics and Finance” (ECON), and “Social Sciences” (SOCI) since they contain the areas of

disciplines that relate more closely than any other areas to startup and sustainability research.

The application of these restrictions has provided the following query *TITLE-ABS-KEY (startup* OR start-up*) AND TITLE-ABS-KEY(green OR sustainability OR "sustainable development" OR "SDGs" OR "eco-innovation") AND PUBYEAR > 2009 AND PUBYEAR < 2026 AND PUBYEAR > 2009 AND PUBYEAR < 2026 AND (LIMIT-TO (SUBJAREA,"BUSI") OR LIMIT-TO (SUBJAREA,"ECON") OR LIMIT-TO (SUBJAREA,"SOCI") OR LIMIT-TO (SUBJAREA,"ENVI")) AND (LIMIT-TO (DOCTYPE,"ar")) AND (LIMIT-TO (LANGUAGE,"English")) AND (LIMIT-TO (PUBSTAGE,"final"))* resulted in a final dataset of 1.119 articles, which constitutes the basis for the subsequent descriptive and network analyses.

2.3 Inclusion and exclusion criteria

The criteria for inclusion and exclusion were defined ex-ante to ensure methodological transparency and replicability. Specifically, articles were included if they met all of the following conditions:

- Explicit mention of startups (*startup**, *start-up**) in title, abstract, or keywords;
- Explicit mention of sustainability-related concepts (e.g., *sustainable development*, *SDGs*, *eco-innovation*, *circular economy*, *green economy*, *green*);
- Published between 2015 and 2026;
- Peer-reviewed journal article in English;
- Indexed in Scopus within the selected subject areas (BUSI, ECON, SOCI);
- Articles were excluded if they mentioned startups only at marginal level (e.g., as part of a list of organizational forms without specific analysis);
- They were published in languages other than English;
- They were conference papers, editorials, book chapters, or review articles.

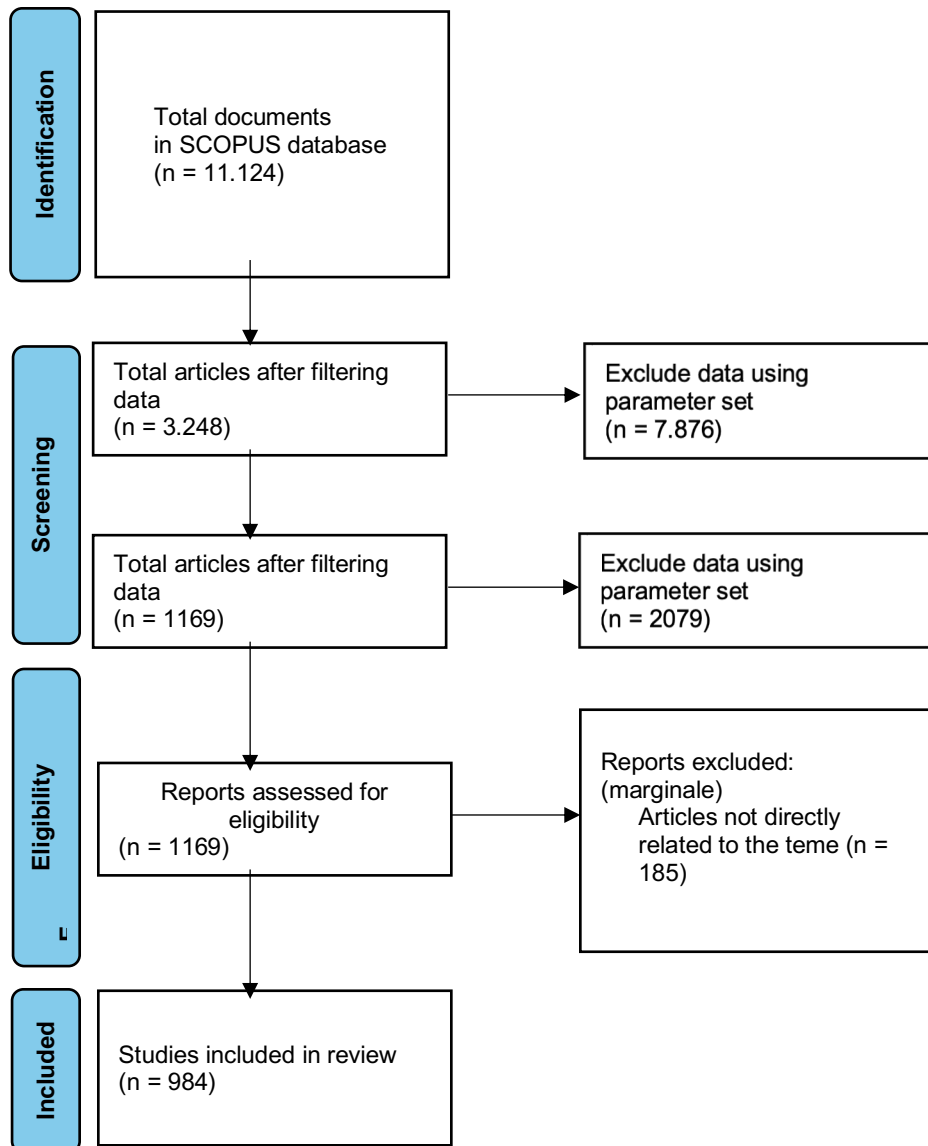


Figure 1: PRISMA Flow Diagram for systematic reviews

To enhance the transparency of the research design, the article screening process was documented following the PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) guidelines (Page et al., 2021). In this sense, PRISMA has emerged as the international standard for ensuring transparency and completeness in systematic reviews, providing a structured framework that improves both clarity and replicability. Its flow chart, in particular, is broadly used across disciplines to provide a structured framework that enhances both clarity and replicability (Liberati et al., 2009).

Figure 1 presents the PRISMA flow diagram summarizing the stages:

1. **Identification:** 11.124 records retrieved from the initial query.
2. **Screening:** restriction to *startup* and *start-up* reduced the dataset to 3,248 records.

3. **Eligibility:** application of filters (years, language, document type, subject areas, publication stage) resulted in 1.119 articles.
4. **Inclusion:** final dataset of 984 articles for bibliometric analysis.

The analysis combined basic statistical tools with VOSviewer software to ensure both descriptive rigor and advanced network visualization.

- Excel was used during the early stage of the analysis, in order to track publication trends by year, map contributions at the national level, rank the most important journals and authors, and then filter downloaded content. In addition, it enabled the use of pivot tables and bar charts, which facilitated the visualization and interpretation of large data sets, providing a clearer view of temporal and geographical patterns. In this sense, although Excel is not a specialized bibliometric tool, it is commonly used during the initial stages of analysis due to its versatility and ability to effectively manage structured metadata (Zupic & Čater, 2015).
- VOSviewer was used in order to conduct the network-based analyses, (including keyword co-occurrence, author and source co-citation, and co-authorship networks at both individual and country levels). VOSviewer is widely recognized as one of the most powerful and user-friendly tools for creating and visualizing bibliometric maps, thanks to its capacity to process large datasets and generate clear and interpretable visualizations of bibliographic networks (van Eck & Waltman, 2010; Waltman et al., 2010). Compared to other software such as CiteSpace or Gephi, VOSviewer is specifically optimized for bibliometric mapping and has been widely applied in research on management, entrepreneurship, and sustainability (Chen, 2017). Its clustering techniques and distance-based visualization algorithms permit the identification of thematic clusters and topic structures with high accuracy and readability (Cobo et al., 2011; Donthu et al., 2021).

In this sense, the combination of Excel for data collection and preliminary analysis and VOSviewer for mapping and creating maps and cluster links is a well-established practice, as it offers rigor in data analysis on the one hand and transparency and clarity in the reporting of processed data on the other.

2.4 Justification of methodological choices

Several methodological decisions were made deliberately to balance comprehensiveness and focus, in line with established practices in bibliometric research. Each choice is justified both theoretically and methodologically, to ensure transparency, rigor, and alignment with the research objectives of this study.

1. Database: as mentioned before, Scopus was chosen between the other available datasets due to its breadth, and compatibility with bibliometric tools. In addition, if compared to Web of Science, Scopus provides a larger number of journals in management and social sciences, thereby enhancing coverage and representativeness (Mongeon & Paul-Hus, 2016; Aghaei Chadegani et al., 2013), useful in order to conduct the interdisciplinary analysis. On the other hand, even if Google Scholar provides a broader coverage, its inclusion of non-peer-reviewed material and inconsistent metadata quality make it less reliable for systematic bibliometric analyses (Harzing & Alakangas, 2016;).
2. Period (2015-2026): the decision to start the analysis period in 2015 was determined by the publication, in the same year, of the United Nations Sustainable Development Goals (SDGs), which are considered worldwide as the basis for the debate on sustainability. In this sense, the inclusion of previous years (e.g., the 2000s), although it would have provided a larger sample size, would have potentially generated results that were far from the research objective. Furthermore, the inclusion of a previous period, which did not coincide with the boom in startups and sustainable startups in particular - would have provided less relevant results from a research perspective. The publication period in question should therefore be identified as between 2015 and September 2025.
3. Thematic areas (BUSI, ECON, SOCI): these thematic categories were selected in order to make the research interdisciplinary, without however generating results that were inconsistent with the research questions. Therefore, categories of journals belonging to business, economics, and social sciences were considered. On the other hand, although engineering and environmental science journals often publish research on sustainable technologies, they rarely address the entrepreneurial and organizational aspects that are central to this study, as was also evident during the determination and streamlining of the Scopus dataset. Considering this, in the field of study focused on economics, social sciences, and business sciences, it is in line with the recommendations of bibliometric

studies that aim to outline conceptual rather than purely technical fields (Zupic & Čater, 2015; Donthu et al., 2021).

4. Document type (journal articles): only peer-reviewed journal articles were included. Therefore, conference proceedings, reviews, book chapters, and similar items, although potentially useful for research purposes, were excluded due to their heterogeneous peer review standards and limited reliability in tracking citations. Journal articles, on the other hand, represent the most stable and comparable unit of analysis in bibliometric research, as they are consistently indexed and cited in all databases. Finally, only “final stage” articles were included (Cobo et al., 2011; Paul & Criado, 2020).
5. Language (English): the analysis was limited to publications in English. Although this choice inevitably excludes research published in other languages, English remains the dominant language in academic publications, particularly in management and economics. In contrast, the inclusion of articles in other languages would have created discrepancies in the analysis of co-occurrence and keywords, reducing the comparability and thus compromising the reliability of the study.
6. These methodological decisions reflect the objective to provide a comprehensive overview of the literature on sustainable startups, while ensuring consistency, transparency, and methodological rigor. In this sense, the methodology used is in line with the now well-established standards of bibliometric research.

2.5 Trade-offs, journal reputation, and non-measurable dimensions

A well-known limitation of bibliometric approaches is that they tend to treat publication outlets symmetrically, implicitly assuming that each journal carries the same epistemic weight. However, journal reputation, peer-review selectivity, and editorial strategies represent qualitative dimensions that cannot be fully captured by bibliometric indicators alone (Moed, 2005; Wallin, 2005). As emphasized by the *Leiden Manifesto for Research Metrics*, quantitative indicators should support—but never replace—expert judgment, particularly when evaluating research quality and scientific influence (Hicks et al., 2015).

This aspect is particularly evident in highly prolific open-access journals, which tend to rank prominently in terms of publication volume while adopting editorial strategies based on high throughput and extensive use of special issues. Conversely, highly selective journals that deliberately

limit publication volume may appear less central in quantitative rankings despite enjoying stronger reputational capital and long-term intellectual influence.

Rather than ignoring this issue, the present study explicitly acknowledges the trade-off between visibility-based metrics and qualitative academic judgment. Bibliometric indicators capture patterns of diffusion, thematic aggregation, and network centrality, but they do not provide a normative evaluation of scientific quality or theoretical depth. These non-measurable dimensions remain the domain of scholarly interpretation and disciplinary expertise (Moed, 2005). For this reason, bibliometric results are interpreted cautiously and contextualized within the broader literature on sustainable entrepreneurship. High publication volume is not equated with higher scientific quality, but rather with greater discursive presence within the field, reflecting how research topics circulate, consolidate, and gain visibility over time.

A similar trade-off applies to the selection of subject areas and language. Although sustainability-oriented entrepreneurship is inherently interdisciplinary, the analysis deliberately focuses on Business, Management and Accounting, Economics, and Social Sciences. This choice reflects the objective of capturing the organizational, economic, and institutional dimensions of sustainable startups, rather than their purely technical or engineering-related aspects. In bibliometric research, such disciplinary delimitation is considered appropriate when the aim is to map conceptual structures rather than technological trajectories (Zupic & Čater, 2015; Donthu et al., 2021).

Interdisciplinarity is therefore pursued within the social-scientific domain, ensuring conceptual coherence with the research questions addressed in this study, while still allowing for the integration of insights from sustainability science through cross-citations and thematic overlaps. A broader inclusion of technical fields could have increased heterogeneity but at the cost of interpretability and analytical focus.

Likewise, limiting the analysis to English-language publications introduces a known linguistic and geographic bias, particularly favouring Anglo-American research. However, English remains the dominant language of international scientific communication in management and economics, and its use ensures consistency in metadata, keyword structures, and citation practices—an essential requirement for reliable co-occurrence and network analyses (Mongeon & Paul-Hus, 2015; Zupic & Čater, 2015). The implications of these choices are explicitly acknowledged, and future research could extend the analysis through multilingual or region-specific bibliometric approaches.

3. Data Analysis

The following section presents the findings of the bibliometric study applied on the final set of 984 journal articles discussing the intersection of sustainability, startups, and adjacent concepts the Sustainable Development Goals (SDGs), the circular economy, as well as eco-innovation. In accord with established bibliometric research procedures, the study follows the two complementary axes on which the field gets organized as per usual procedures for bibliometric research (Zupic & Čater 2015; Donthu et al., 2021).

To begin with, a descriptive viewpoint is taken, looking at the time dynamics of publication production, the geographic spread of research activity, and the concentration of publications at the level of journals, institutions, and authors. Descriptive bibliometrics has itself been used for many years for the purpose of charting the growth and diffusion of knowledge in scientific disciplines for scholars to acquaint themselves with productivity trends, prolific writers, and top-performing outlets (Pritchard, 1969; Moed, 2005; Aria & Cuccurullo, 2017). It is especially useful for new fields because it affords the macroscopic view of how the literature develops over time as well as over space (Broadus, 1987; Mongeon & Paul-Hus, 2016).

Second, the field's intellectual and collaborative structures are approached through relational perspective using keyword co-occurrence, co-citation, and co-authorship analyses. Relational bibliometric methods allow for the identification of knowledge networks for visualization as well as the identification of thematic clusters for the identification of the field's conceptual foundations as well as the social organization of science fields (White & McCain, 1998; van Eck & Waltman, 2010; Cobo et al., 2011). Keyword co-occurrence analysis has been generally accepted as an efficient way of extracting the thematic evolution of a field of research (Callon et al., 1991), whereas co-citation mapping aids in the identification of the field's intellectual roots as well as the inter-connections between seminal works (Small, 1973; Chen, 2017). In the same way, co-authorship analysis illuminates the mode of collaboration between scholars, between institutions as well as between countries for the identification of the social structure of the production of knowledge (Newman, 2001; Glänzel & Schubert, 2004).

By integrating both descriptive and relational approaches, this study offers a holistic mapping of the research domain, identifying its principal trends, clusters, and gaps. In this sense it not only enhances the interpretability of results but also aligns with best practices in bibliometric methodology for management and entrepreneurship research (Zupic & Čater, 2015; Donthu et al., 2021; Paul & Criado, 2020).

3.1 Temporal evolution of publications

The temporal distribution of publications shows a marked evolution in academic discourse on the topic of startups and sustainability over the last decade and a half. In the early period (2010-2015), scientific output was relatively limited, with an average of less than 20 articles per year. This can be interpreted as an early stage of the sector, in which only sporadic contributions explored the links between entrepreneurship and environmental or social sustainability. These early works often laid the conceptual foundations rather than producing cumulative empirical evidence, in the face of policies still in development, which could explain the relatively modest visibility of the topic at this stage.

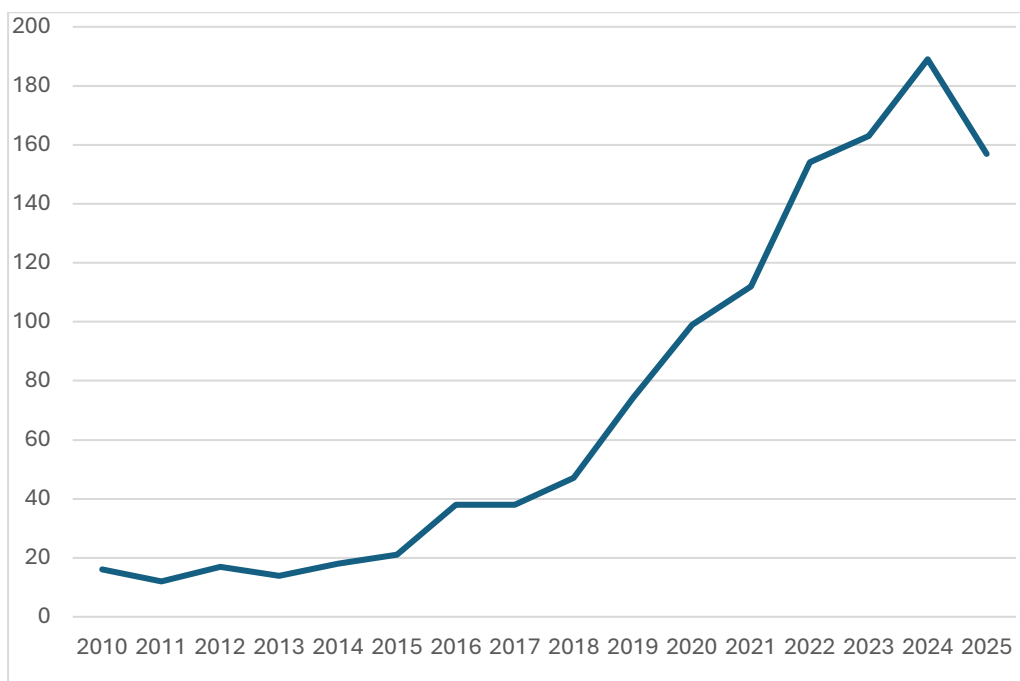


Figure 2: Growth pattern of sustainable startup literature in Scopus between 2015-2025

After 2016, there was an acceleration, with an increase in publications from 38 in 2016 to 74 in 2019. This increase coincides with the adoption and global dissemination of the United Nations Sustainable Development Goals (SDGs) in 2015, which provided a unifying framework for research on sustainable entrepreneurship. The SDGs seem to have acted as a catalyst, stimulating academic output on startups as potential vehicles for sustainable transition.

The period 2020-2022 can be seen as a phase of consolidation and expansion. Annual publication output exceeds 90 publications, reaching a peak of 154 in 2022. This indicates that the research community has begun to recognize sustainable startups as a topic of interest in the field of entrepreneurship and innovation studies. The growing number of articles during these years also

shows diversification in content, which includes bibliometric reviews, case studies, and analyses of one or more countries, among other things, helping to broaden the field of sustainable startups. The last few years, from 2023 to 2025, also demonstrate this trend. In fact, with 163 articles in 2023, 189 in 2024, and 157 in September 2025, we can see signs of a further acceleration in academic productivity. This is not a random increase, but rather a sign that the study of sustainable startups has become a stable, prolific, and increasingly central research topic. The volume of publications also suggests an increase in academic interest, as more economics, social sciences, and business journals are devoting space to entrepreneurship studies focused on sustainability.

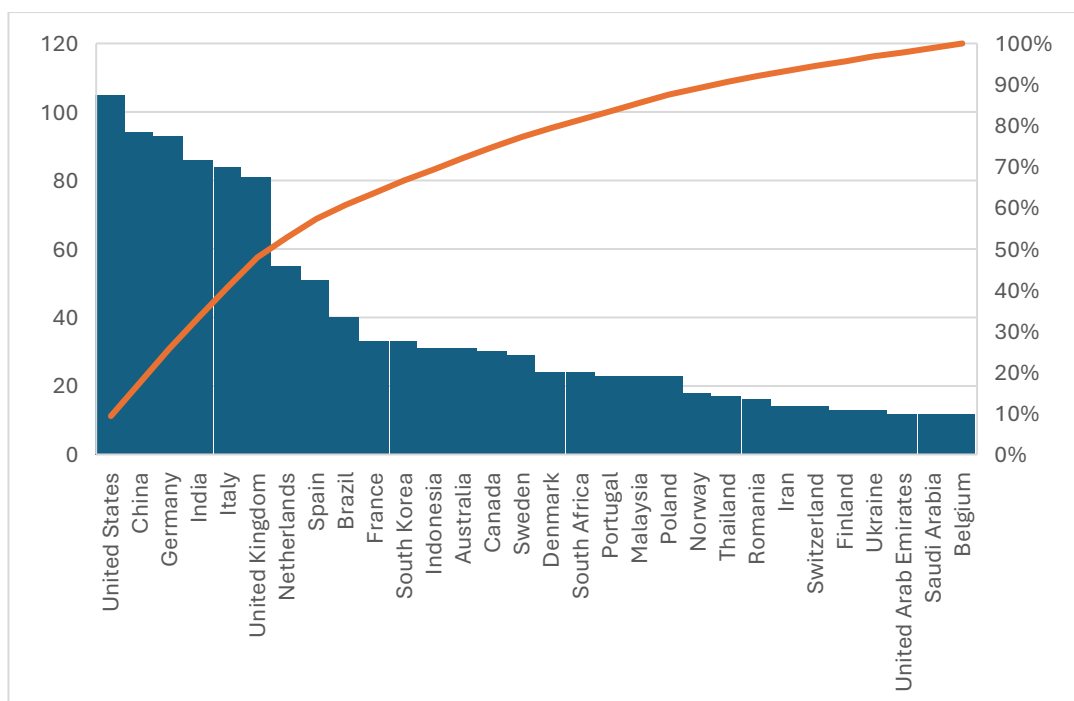


Figure 3: Geographical distribution of literature on sustainable startups in Scopus in the period 2015-2025

In terms of country publication and according to the 984-article dataset, the United States emerges as the top contributor with 105 articles (10.7%), followed by China with 94 articles (9.6%) and Germany with 93 articles (9.5%).

Then, India with 86 articles (8.7%), Italy with 84 articles (8.5%), and the United Kingdom with 81 articles (8.2%) also contribute significantly. In synthesis, the six countries share almost 55% of the articles, emphasizing their centrality within international research networks and their role in shaping dominant paradigms of scientific inquiry. The persistence of such concentration confirms earlier findings in the sociology of science, where a small number of countries function

as “leaders” within the global knowledge economy, effectively setting research agendas and epistemic priorities.

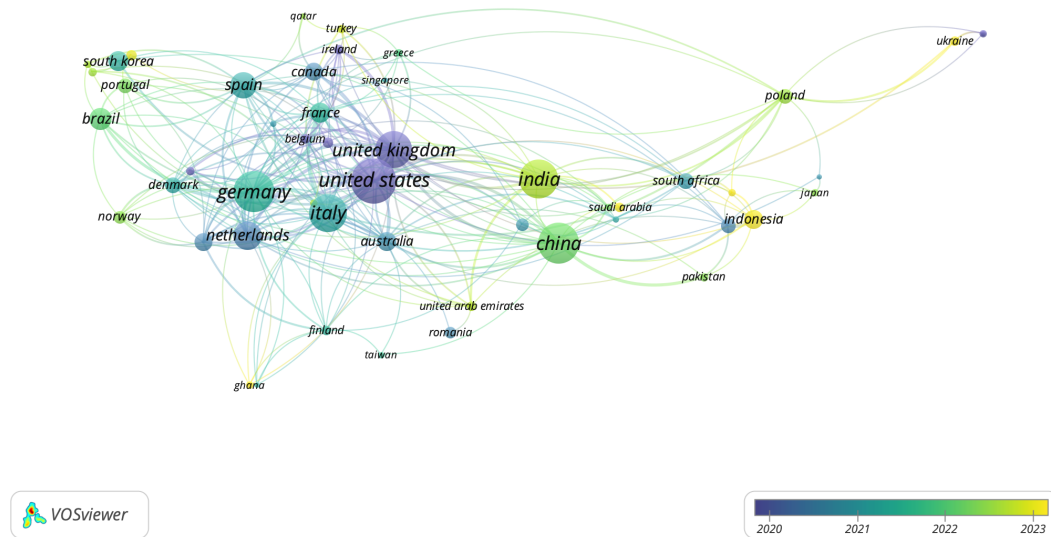


Figure 4: Co-author collaboration network by country on literature about sustainable startups in Scopus in the period 2015-2025

Regarding the map of the collaboration network between co-authors by country, based on the analysis of 984 documents indexed in the dataset, it is possible to highlight patterns of international collaboration that show how different countries group together and establish research links in the sector. In particular, the size of the nodes corresponds to the volume of publications associated with each country, while the thickness and intensity of the connecting lines indicate the strength of the links between co-authors. Distinct colours represent groups of countries that share relatively stronger intra-group collaborations, reflecting regional or thematic proximity (van Eck & Waltman, 2010; Waltman et al., 2010). Once again, we can see how the United States emerges as the most important player, acting as a central hub connecting almost all other major nodes. Their position highlights the country's fundamental role in promoting global academic exchange and acting as a bridge between clusters. In this sense, the United States collaborates extensively with European countries such as the United Kingdom, Germany, France, Italy, and Spain, but also establishes strong links with Asian partners, particularly China, India, and South Korea. Despite of this, China also appears as important node in the map, in close relation to other Asian and emerging economies, such as Indonesia, Pakistan, Bangladesh, and South Africa. This cluster seems to underline the increasing relevance of South–South collaborations and the growing involvement of developing countries in international research. As for European nations, it is easy to notice how the United Kingdom and Germany emerge as

pivotal nodes holding firm bilateral and plurilateral relationships. Sweden, Denmark, Switzerland, and Norway are also showing the existence of regional connections reflecting both geographical neighbourhood and deep-rooted collaborative traditions within the European attitude towards cooperation. Italy and Spain suggest the existence of bridges between Europe on the one hand and the Americas on the other, bridging both the Americas for Europe towards the East, particularly towards the Americas. Finally, the map points out Poland and Ukraine as a somewhat autonomous couple, holding scarce links towards the broader network. In this respect, the nations of the Gulf region and the Middle East (e.g., Saudi Arabia, Kuwait, United Arab Emirates, Turkey) are linked both towards European nodes and towards Asian ones, reflecting their role towards being intercontinental region mediators. From the methodological viewpoint, the map showcases the diversity of worldwide cooperation and points out the existence of both leading hubs and peripheral players. Overall, whereas some nations (e.g., China, the United States, Germany) hold a leading role towards framing the general network structure, others join local, modest clusters, reflecting differences towards research capacity buildings, at large, towards international exposure.

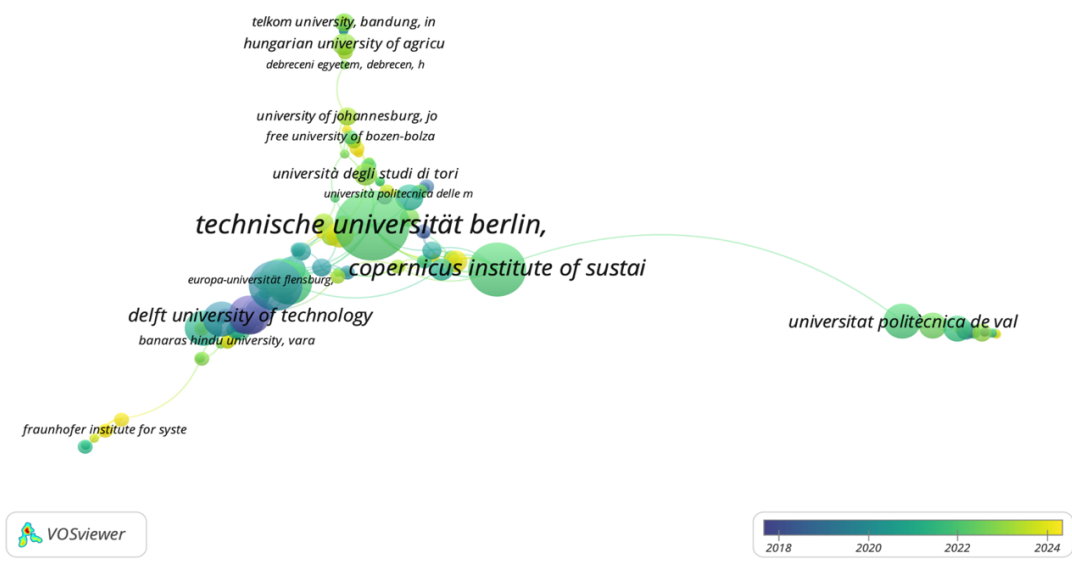


Figure 5: Co-authorship collaboration network by institutions on literature about sustainable startups in Scopus in the period 2015-2025

This trend is confirmed by the institutional co-authorship map generated through VOSviewer. In this sense it can be noticed a cohesive collaboration network among a set of European universities and research institutes, with temporal dynamics spanning from 2021 to 2024. The visualization reveals both the geographic clustering of institutions and their evolving research linkages in the domain of sustainability-oriented entrepreneurship and innovation.

The Technische Universitäten Berlin and the Copernicus-Institut des Nachhaltigen Developments (both based in Germany) clearly act as bridges between different institutions; as can be seen from the importance of the links, they play a key role in coordinating multi-institutional projects and transnational collaboration centers. Still within Germany, there is a very close national sub-cluster between the University of Oldenburg and Leuphana University in Lüneburg, characterized by long-standing collaborations in the field of sustainability science and entrepreneurship studies. Leuphana also has a particular research focus on transitions to sustainability and responsible innovation, which explains its close relationships with both national (Oldenburg) and international (Copernicus, TU Berlin) collaborators. The presence of the Technical University of Denmark within this sub-cluster describes a Nordic-German transnational relationship, likely linked to collaborative work on the circular economy, eco-innovation, and transition management.

Towards the right-side of the network, Universitat Politècnica de València appears as a separated yet interrelated actor. Connections with the Copernicus Institute and TU Berlin suggest being incorporated into wider European sustainability networks, such as EU-funded Horizon Europe or Erasmus+ research partnerships. That this node appears rather recent on the time-axis (green towards yellow, i.e., 2023–2024) confirms that it depicts newly growing partnerships, which adds credence towards the argument that Spanish institutions are getting increasingly active members of the sustainability-startup research landscape.

Temporal gradient (2021–2024) adds some more nuances. Old collaborations (blue hues) are seen between German institutions and the Copernicus Institute, which points at the deep history of such collaborations. newer collaborations (greenish-yellow hues) are clustered around the Universitat Politècnica de València, which points at expanding the EU-wide network southward and the progressive widening out of the landscape of collaborations. This points at a dynamic evolution: from a starting set of core German-Danish collaborations towards a widening out pan-European R&I ecosystem.

From a structural angle, the network exhibits a core-periphery setup, with TU Berlin and the Copernicus Institute being at the core, complemented by Leuphana and Oldenburg being local anchors, while newer additions like Valencia and Denmark shore up the periphery. This is a common structure for collaborative European research projects, which have a few experienced leaders undertake intellectual coordination while newer additions widen the spacial and disciplinary scope for such collaborations (Glänzel & Schubert, 2004; Hoekman et al., 2010).

In general, the map depicts that institutional partnerships for sustainable entrepreneurship and eco-innovation are rooted in Central and Northern Europe but have expanded towards Southern Europe, paving a way for knowledge recombination and broader sustainability practice diffusion. The trend depicts not just the solidification of prior partnerships, but it also pictures the forging of new connections which might form the next decade's knowledge agenda for such work.

3.2 Author Collaboration and Thematic Structures

To further explore the intellectual and thematic structure of the field, Figures 5 and 6 present complementary bibliometric visualizations derived from the 984 documents analysed. The first map illustrates the co-author network between individual scholars, while the second depicts the co-occurrence of keywords, offering an in-depth view of conceptual domains and their evolution over time. Both techniques are well established in bibliometric research and provide complementary perspectives on the social and intellectual organization of a field (Callon et al., 1991; van Eck & Waltman, 2010).

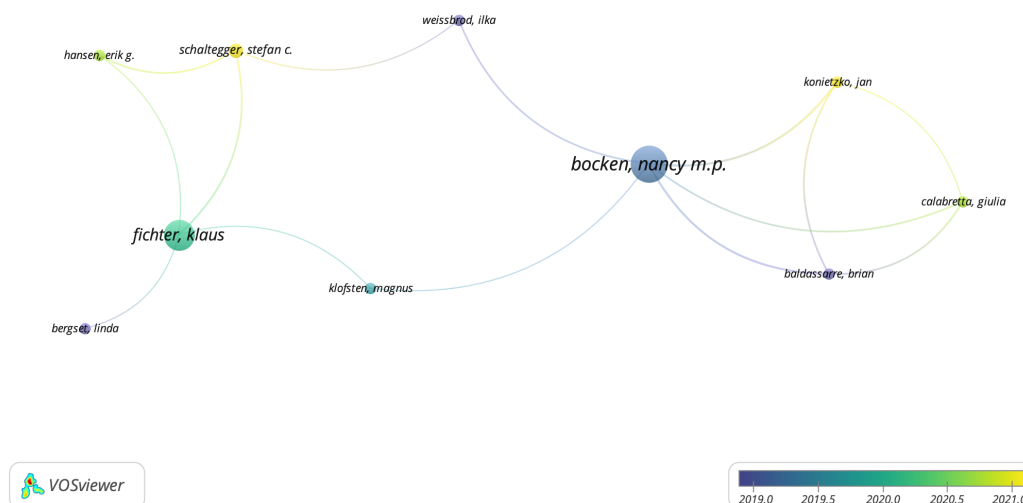


Figure 6: Co-authorship map of scholars between 2015 and 2025 (display 10 authors; threshold three articles).

According to the literature, the co-authorship network map (Figure 6) represents respectively different research group and scholars on sustainable startup during the period analysed. More in specific, Bocken, Nancy M. P., appears as the principal hub within this subfield. In co-authorship mapping, such a position typically reflects high degree and betweenness centrality—i.e., a

scholar who both collaborates widely and connects otherwise weakly connected author groups (van Eck & Waltman, 2010; Waltman et al., 2010). The temporal color gradient (legend 2019-2021) indicates that many of Bocken's collaborations on the right-hand side of the map are comparatively recent (green-to-yellow), and several connections on the left-hand side are slightly earlier (blue-to-teal), suggesting a two stages collaboration pattern: earlier ties with sustainability entrepreneurship scholars and more recent ties with design- and innovation-oriented teams.

It can be noted that Bocken's strongest collaborations are with Calabretta, Baldassarre, Konietzko, and Jan. These authors show a cohesive team working for sustainability and collaborating repeatedly rather than through occasional pairings. The recent collaboration in this case (yellowish tones, which can be traced back to 2021 and beyond) involves a steady stream of joint publications on sustainable/circular business models and experimentation, a reading that aligns with the broader literature on sustainable business model innovation (Boons & Lüdeke-Freund, 2013; Bocken et al., 2014). A central project group can therefore be assumed: high internal density (co-authors collaborating with each other, not just with the hub) and visible external outreach through the shared link with Bocken.

A cluster led by Fichter, Klaus, also occurs, which in turn is connected to Schaltegger, Stefan C., Hansen, Erik G., and Bergset, Linda, with an additional bridge from Klofsten, Magnus to Bocken. The color tones tend to be cool (2019-2020), indicating previous collaboration focused on sustainable entrepreneurship, incubation, and ecosystem perspectives. The link between Klofsten and Bocken is notable: it forms a cross-bridge between the entrepreneurship/eco-innovation cluster and the business model/design cluster, reinforcing Bocken's role as an intermediary between conceptual communities.

The relationship with Weissbrod, Ilka on the medium-high path continues Bocken's network towards sustainability assessment and impact measurement, with slightly lighter hues, indicating that this association perhaps acted as a stepping stone from assessment-analytical work towards subsequent design-orientation collaborations.

Considered in combination, such patterns characterize Bocken as a multi-cluster connector whose collaborations range (i) across sustainable business models/design-driven innovation, (ii) across sustainable entrepreneurship sustainability ecosystems, and (iii) across evaluation/impact areas, exactly the axes which have organized much of the literature developed recently. Examination of edge thinness (weakness of co-authorship) and node distance (collaboration in the VOSviewer layout corroborate three major inferences:

Unified subgroup founded on projects of design and circularity (Bocken-Calabretta-Baldassarre-Konietzko): compact connections, new findings, and prospective further

Entrepreneurship/transition cluster (Fichter with Schaltegger, Hansen, Bergset): strong history bases and conceptual impact, with quite old co-publications.

Bridge connections (Bridge of Bocken–Weissbrod; Bridge of Bocken–Klofsten): routes for knowledge recombination between the threads of design, entrepreneurship, and assessment

Methodologically, this landscape is a textbook example of a bridging-hub core-periphery network. These topologies frequently accompany field-shaping diffusion: innovations cultivated within the dense right-hand cluster (e.g., design methods, circular business experiments) diffuse easily through the hub to off clusters on the left (ecosystems/entrepreneurship) and, correspondingly, ideas developed there diffuse into the original, dense, high-innovative-capability, high-change-velocity, high-competitive-pressure cluster on the right (design-for-sustainability, business model experiments). Pragmatically, the map identifies at least two places for future interlinking: (a) deeper interlinking between design-for-sustainability approaches and entrepreneurial acceleration/scaling ideas; (b) closer interlinking of impact measurement methods with business model experiments, to make evidence on effects more robust and legitimization impacts more robust.

Finally, two caveats for the reader of the study: (i) visual salience of nodes is a function of thresholds (minimum co-authorship thresholds, time window), so omitting or small nodes don't necessarily mean absent of influence overall; and (ii) time colouring spans about 2019–2021, so quite recent collaborations outside of that window might be underrepresented.

Keeping those caveats in view, the map nonetheless gives a clear, empirically based picture of a triadic intellectual structure—design/circularity, entrepreneurship/ecosystems, and impact/assessment—tied together through one of the field's most active intermediaries.

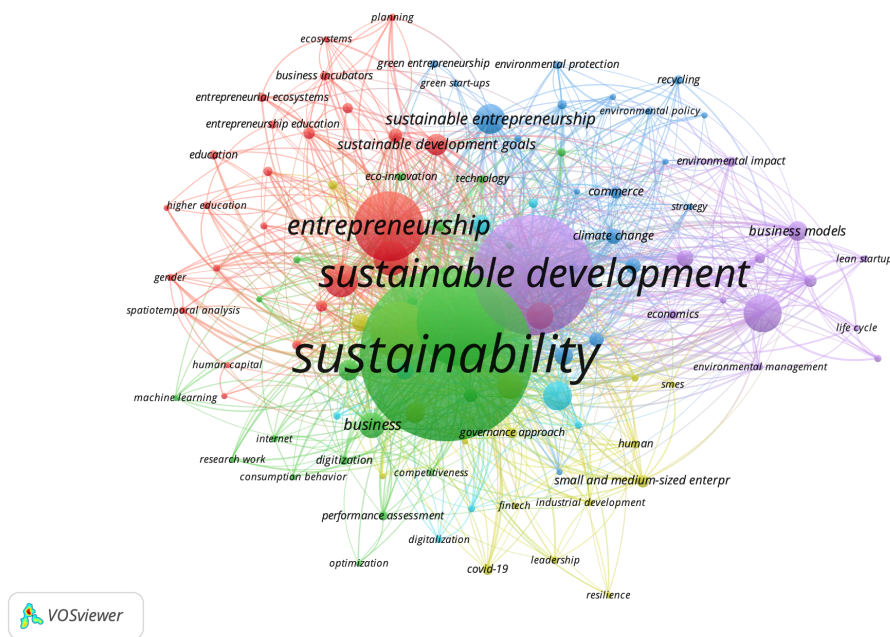


Figure 7: Keyword co-occurrence overlay visualization

Figure 7 provides a complementary picture of the intellectual structure. First, following van Eck and Waltman (2010) and Zupic and Čater (2015), co-keyword analysis was conducted to identify the key themes in sustainable startup literature. Specifically, figure & shows 107 keywords, corresponding to 107 nodes and at least 9 times occurrence. With this regard, the term “sustainability” appears as the central and most frequent occurring term, occupying the core of the network and connecting to a wide range of related concepts. Surrounding sustainability, large nodes such as “innovation,” “circular economy,” “entrepreneurship,” and “start-up(s)” delineate the principal thematic clusters that structure the research field. Temporal co-word analysis reveals the time when topics were at the height of their popularity, in particular green-yellow terms (like sustainability or sustainable development) appear to be more recent, instead more traditional topic in blue (like entrepreneurship).

Emerging themes such as artificial intelligence, digitization, and fintech are also visible, suggesting that technological change is increasingly integrated into debates on sustainability-oriented entrepreneurship. The keyword co-occurrence analysis also generated six distinct clusters, each representing a thematic pillar in the literature on startups and sustainability.

Cluster 1 (Red) concerns the theme of *entrepreneurship* and its multiple articulations in start-up ecosystems. It reflects the consolidation of entrepreneurship as a driver for sustainable development and as a vehicle for achieving broader societal objectives. Cluster 2 (Green) is centered on *sustainability and innovation*, where technological advances and strategic approaches converge. This cluster highlights the integration of digitalization, artificial

intelligence, and eco-innovation into sustainability studies, marking the field’s technological and managerial orientation. Cluster 3 (Blue) focuses on *sustainable entrepreneurship and environmental issues*, emphasizing the interplay between ecological challenges (e.g., climate change, recycling) and investment logics. It underscores the dual financial and environmental dimensions that shape the global research agenda. Cluster 4 (Yellow) reflects the intersection of *entrepreneurship, economic growth, and policy*. Here, economic development is tightly connected with governance and regulatory frameworks, with the inclusion of COVID-19 signalling responsiveness to global crises. Cluster 5 (Purple) is structured around *sustainable development and circular economy*, highlighting business model innovation and systemic transitions. This cluster embodies the normative core of the field, pointing to the reconfiguration of business practices for long-term sustainability. Cluster 6 (Cyan) addresses *start-up processes and stakeholder involvement*, with attention to decision-making, orientation, and sectoral applications such as agriculture. It represents the micro-level of analysis, focusing on organizational and relational dynamics within entrepreneurial ecosystems.

Taken together, the clusters reveal a multidimensional intellectual structure: (1) entrepreneurial ecosystems, (2) eco-innovation and circular economy, (3) digitalization and agriculture, (4) renewable energy and climate change, (5) business model innovation, and (6) CSR and social entrepreneurship. The relative size of clusters suggests that ecosystem and sustainability-oriented themes dominate, but the presence of technology-specific and social responsibility clusters demonstrates the field’s interdisciplinary character. This distribution is consistent with the increasing pluralization of sustainability entrepreneurship research, which spans policy, technology, and organizational studies.

Cluster	Color	Words	Number of words
1	Red	entrepreneurship (117), start-ups (55), startups (53), startup (42), sustainable development goals (33), sustainable development goal (20), entrepreneurial ecosystem (17), knowledge (17), social entrepreneurship (15), corporate social responsibility (14), education (14), open innovation (14), business incubators (13), entrepreneurial ecosystems (13), entrepreneurship education (12), gender (11), higher education (11), regional development (11), planning (10), spatiotemporal analysis (10), university sector (10), ecosystems (9), human capital (9), sdgs (9), social capital (9)	25
2	Green	sustainability (312), innovation (150), business (40), strategic approach (31), artificial intelligence (20), alternative energy (15), green economy (14), performance assessment (14), digitization (13), eco-innovation (13), technology (12), waste management (12), green innovation (11), internet (11), technological development (11), technology adoption (10), competitiveness (9), consumption behavior (9), learning (9), machine learning (9), optimization (9), research work (9)	22

3	Blue	sustainable entrepreneurship (47), investment (28), climate change (24), investments (24), venture capital (21), commerce (19), sustainable innovation (16), developing countries (14), recycling (14), environmental protection (12), green entrepreneurship (12), environmental policy (10), finance (10), developing world (9), economic and social effects (9), environmental technology (9), government (9), green start-ups (9), industrial enterprise (9), institutional theory (9), strategy (9)	21
4	Yellow	entrepreneur (95), business development (41), economic growth (30), environmental economics (27), economic development (26), small and medium-sized enterprise (18), covid-19 (16), governance approach (16), policy making (13), human (12), environmental sustainability (11), industrial development (11), leadership (10), financial system (9), fintech (9), resilience (9), smes (9), theoretical study (9)	18
5	Purple	sustainable development (210), circular economy (60), business models (30), business model (25), business model innovation (19), environmental impact (15), sustainable business (15), economics (14), environmental management (11), circular business model (10), lean startup (10), life cycle (9), sustainable business model (9)	13
6	Light blue	start-up (45), stakeholder (28), decision making (27), technological innovation (13), digitalization (11), entrepreneurial orientation (11), perception (11), agriculture (10)	8

Table 1: Cluster of words

Taken together, the six clusters illustrate both the maturity and diversification of the field. Large clusters, such as entrepreneurship and sustainability (clusters 1 and 2), indicate well-established areas, while smaller ones, such as the circular economy and stakeholder processes (clusters 5 and 6), reveal more specialized or emerging areas of study. The co-existence of these dynamics is a sign of a healthy and evolving research panorama, in which core concepts are well established, but new perspectives continue to emerge that redefine the intellectual contours of sustainable entrepreneurship.

3.3 Leading Journals, Contributors, and Articles

The analysis of the top 20 journals publishing on sustainable startups and related themes reveals a high concentration of output in leading Q1-ranked outlets, spanning business, management, economics, energy, and environmental science. This cross-disciplinary distribution underscores the inherently hybrid nature of the field, which bridges entrepreneurship and innovation studies with sustainability transitions, energy policy, and organizational research.

SOURCE	PUB	COUNTRY	SCOPE	Q(2024)	HI	TC	NP
Sustainability (Switzerland)	Multidisciplinary Digital Publishing Institute (MDPI)	CH	Computer Science; Energy; Environmental Science; Social Sciences	Q1	207	222186	150

Journal of Cleaner Production	Elsevier Ltd	UK	Business, Management and Accounting; Energy; Engineering; Environmental Science	Q1	354	183039	52
Business Strategy and the Environment	John Wiley and Sons Ltd	UK	Business, Management and Accounting; Environmental Science; Social Sciences	Q1	173	17347	25
Technological Forecasting and Social Change	Elsevier Inc.	US	Business, Management and Accounting; Psychology	Q1	209	41185	14
Small Business Economics	Springer Netherlands	NL	Business, Management and Accounting; Economics, Econometrics and Finance	Q1	180	5500	7
Resources Policy	Elsevier Ltd	UK	Economics, Econometrics and Finance; Environmental Science; Social Sciences	Q1	138	28215	6
Journal of Open Innovation: Technology, Market, and Complexity	Elsevier B.V.	CH	Economics, Econometrics and Finance; Social Sciences	Q1	63	6292	6
Management Decision	Emerald Group Publishing Ltd.	UK	Business, Management and Accounting; Decision Sciences	Q1	138	3031	6
Applied Energy	Elsevier B.V.	UK	Energy; Engineering; Environmental Science	Q1	323	61246	6
International Small Business Journal	SAGE Publications Ltd	UK	Business, Management and Accounting	Q1	120	903	6
Environmental Innovation and Societal Transitions	Elsevier B.V.	NL	Energy; Environmental Science; Social Sciences	Q1	86	2115	4
Journal of Business Research	Elsevier Inc.	US	Business, Management and Accounting	Q1	292	46180	4
Energy	Elsevier Ltd	UK	Energy; Engineering; Environmental Science; Mathematics	Q1	274	107755	4
Research Policy	Elsevier B.V.	NL	Business, Management and Accounting; Decision Sciences; Engineering	Q1	301	5916	4
Industrial Marketing Management	Elsevier Inc.	US	Business, Management and Accounting	Q1	187	6638	4
Energy Policy	Elsevier B.V.	UK	Energy; Environmental Science	Q1	292	17600	3

Journal of Business Venturing	Elsevier Inc.	US	Business, Management and Accounting	Q1	235	1970	2
Journal of Business Ethics	Springer Netherlands	NL	Arts and Humanities; Business, Management and Accounting; Economics, Econometrics and Finance; Social Sciences	Q1	277	11031	2
Business Horizons	Elsevier Ltd	UK	Business, Management and Accounting	Q1	131	2034	2
International Journal of Entrepreneurial Venturing	Inderscience	CH	Business, Management and Accounting	Q3	29	93	2

Table 2: Top 20 Journals on startups

With 150 publications, an outstanding h-index of 207, and more than 222,000 citations, Sustainability (Switzerland) (MDPI) is the most prolific journal at the top of the list. Though it has occasionally been the focus of discussion regarding selectivity and perceived rigor, its open access model and multidisciplinary field (computer science, energy, environmental, and social sciences) make it a privileged platform for timely dissemination and wide visibility (Gusenbauer, 2019). With 52 contributions, a solid h-index of 354, and more than 183,000 citations, the Journal of Cleaner Production (Elsevier) maintains its standing as a top journal. Its emphasis on eco-innovation, green business models, and sustainable production systems accounts for its prominence in the field and serves as a strict benchmark for conceptual and empirical research at the intersection of technology and management. *Business Strategy and the Environment* (Wiley), with 25 articles, stands out as a specialized business and sustainability journal and is widely recognized as one of the most influential outlets in the sustainable entrepreneurship domain. In the same way, *Technological Forecasting and Social Change* (Elsevier) plays a key role in bridging future-oriented innovation studies with sustainability research, providing a platform for foresight-driven analyses of startups and transitions. Ranking also includes entrepreneurship-oriented journals such as Small Business Economics (Springer) and International Small Business Journal (SAGE), which highlight the integration of sustainable entrepreneurship into small business research, although their results remain relatively modest (7 and 6 publications, respectively). In particular, the Journal of Business Venturing, one of the most prestigious journals in the field of entrepreneurship, has only 2 contributions, demonstrating that, although sustainable startups are gaining ground, they remain underrepresented in high-level journals dedicated to entrepreneurship, as in this case.

Applied Energy, Energy Policy, and Energy, on the other hand, illustrate the importance of technical and policy-oriented research for sustainable startups, although these journals focus on energy and policy in the context of renewable energy, clean technologies, and the transition to a low-carbon economy. These journals have very high citation rates and h-indices, confirming their influence in shaping the global debate on energy and sustainability. In addition to this, Environmental Innovation and Societal Transitions publish content related to transition management and sustainability science. Both generalist business and management journals also contribute to the domain. It's the case of the *Journal of Business Research* (Elsevier) and *Industrial Marketing Management*, which provide space for empirical studies on green startups and business model innovation. Also *Management Decision* (Emerald) and *Business Horizons* (Elsevier) further show that mainstream management journals are increasingly open to sustainability-oriented entrepreneurship topics. Finally, ethics and societal impact, in particular the *Journal of Business Ethics* (Springer), has published work on the normative foundations of sustainable entrepreneurship and the role of startups in advancing the UN Sustainable Development Goals. Though only 2 papers are included, the journal's very high h-index (277) reflects its broad disciplinary influence and relevance for research at the interface of business and society. Overall, three key patterns emerge:

1. Sustainability and energy journals (e.g., *Sustainability*, *Journal of Cleaner Production*, *Applied Energy*), which together account for a large proportion of publications.
2. Entrepreneurship and management journals (*Journal of Business Venturing*, *Small Business Economics*, *Business Strategy and the Environment*), with on the the entrepreneurial studies domain.
3. Cross-disciplinary journals, with contributions in policy, foresight, ethics, and innovation management.

This distribution illustrates that sustainable startup research is both anchored in specialized sustainability journals and progressively penetrating the mainstream entrepreneurship and management literature, though not yet at the same scale. The strong presence of Q1-ranked outlets across all categories reflects the high academic legitimacy of the field, while the spread across multiple domains points to its interdisciplinary consolidation.

Title	Author(s)	Source	Published Year	Total Citations (TC)	TC per Year
Greening Goliaths versus emerging Davids - Theorizing about	K.N., Hockerts, Kai N.; R., Wüstenhagen, Rolf	Journal of Business Venturing	2010	973	60, 8125

the role of incumbents and new entrants in sustainable entrepreneurship					
The influence of personality traits and demographic factors on social entrepreneurship start up intentions	J.K., Hwee Nga, Joyce Koe; G., Shanmuganathan, Gomathi	Journal of Business Ethics	2010	510	31,875
Innovative and sustainable business models in the fashion industry: Entrepreneurial drivers, opportunities, and challenges	B.V., Todeschini, Bruna Villa; M.N., Nogueira Cortimiglia, Marcelo Nogueira; D.C., De Menezes, Daniela Callegaro; A., Ghezzi, Antonio	Business Horizons	2017	420	46,66667
Experimenting with a circular business model: Lessons from eight cases	N.M.P., Bocken, Nancy M.P.; C.S.C., Schuit, Cheyenne S.C.; C., Kraaijenhagen, Christiaan	Environmental Innovation and Societal Transitions	2018	376	47
Rare earths supply chains: Current status, constraints and opportunities	A., Golev, Artem; M., Scott, Margaretha; P.D., Erskine, Peter D.; S.H., Ali, Saleem H.; G., Ballantyne, Grant	Resources Policy	2014	340	28,33333
Mapping out the sharing economy: A configurational approach to sharing business modeling	P., Muñoz, Pablo; B.D., Cohen, Boyd D.	Technological Forecasting and Social Change	2017	331	36,77778
A typology of circular start-ups: Analysis of 128 circular business models	M., Henry, Marvin; T., Bauwens, Thomas; M.P., Hekkert, Marko P.; J., Kirchherr, Julian	Journal of Cleaner Production	2020	319	53,16667
Bridging sustainable business model innovation and user-driven innovation: A process for	B., Baldassarre, Brian; G., Calabretta, Giulia; N.M.P., Bocken, Nancy M.P.; T.,	Journal of Cleaner Production	2017	307	34,11111

sustainable value proposition design	Jaskiewicz, Tomasz				
Barriers to circular business model innovation: A multiple-case study	E., Guldmann, Eva; R.D., Huulgaard, Rikke Dorothea	Journal of Cleaner Production	2020	306	51
Sustainable venture capital - Catalyst for sustainable start-up success?	N.M.P., Bocken, Nancy M.P.	Journal of Cleaner Production	2015	296	26,90909
Born to be green: new insights into the economics and management of green entrepreneurship	P., Demirel, Pelin; C.C., Li, Cher Cher; F., Rentocchini, Francesco; J.P., Tamvada, Jagannadha Pawan	Small Business Economics	2019	276	39,42857
Smart city governance in developing countries: A systematic literature review	S.Y., Tan, Si Ying; A., Taeihagh, Araz	Sustainability (Switzerland)	2020	237	39,5
Developing sustainable business experimentation capability – A case study	I., Weissbrod, Ilka; N.M.P., Bocken, Nancy M.P.	Journal of Cleaner Production	2017	176	19,55556
Open innovation 4.0 as an enhancer of sustainable innovation ecosystems	J., Costa, Joana; J.C.O., Matias, João Carlos O.	Sustainability (Switzerland)	2020	176	29,33333
A (new) role for business – Promoting the United Nations’ Sustainable Development Goals through the internet-of-things and blockchain technology	C.D., Villiers, Charl De; S.C., Kuruppu, Sanjaya Chinthana; D.M.P.P., Dissanayake, Dinithi M.P.P.	Journal of Business Research	2021	167	33,4
Sustainability-oriented business model development: Principles, criteria and tools	H., Breuer, Henning; K., Fichter, Klaus; F., Lüdeke-Freund, Florian; I., Tiemann, Irina	International Journal of Entrepreneurial Venturing	2018	156	19,5
User innovativeness and fintech adoption in indonesia	B., Setiawan, Budi; D.P., Nugraha, Deni Pandu; A., Irawan, Atika;	Journal of Open Innovation: Technology,	2021	154	30,8

	R.J., Nathan, Robert Jeyakumar; Z., Zoltan, Zeman	Market, and Complexity			
New formulations of the 'energy hub' model to address operational constraints	R., Evins, Ralph; K., Orehounig, Kristina; V., Dorer, Viktor; S.C., Li, Song C.	Energy	2014	149	12,41667
Green technology innovation: Anatomy of exploration processes from a learning perspective	S., Wicki, Samuel; E.G., Hansen, Erik G.	Business Strategy and the Environment	2019	139	19,85714
The impact of entrepreneurship on economic, social and environmental welfare and its determinants: a systematic review	T., Neumann, Thomas	Management Review Quarterly	2021	137	27,4

Table 3: Top 2020 papers on startups

In accordance with bibliographic research practice, we then proceeded to analyse the 20 authors who contributed the most (Donthu et al., 2021). Hockerts & Wüstenhagen (2010), “Greening Goliaths versus Emerging Davids” is by far the most cited contribution (973 citations; 61 per year), providing a fundamental framework that distinguishes between established companies and startups in promoting sustainable innovation, and remains the starting point for theorizing sustainable entrepreneurship and is frequently cited in the literature on management, policy, and sustainability. To complement this, Hwee Nga & Shanmuganathan (2010) (510 citations) connect social entrepreneurship to personality and demographics, emphasizing the role of individual -level antecedents in shaping startup intentions, thus linking entrepreneurship studies to psychology and ethics. In subsequent years, there has been a sharp increase in highly cited contributions devoted to sustainable business models and the circular economy. Todeschini et al. (2017) (420 citations), for example, analyse sustainable business models in the fashion industry, offering one of the first in-depth studies of the specific dynamics of the sector that promote or hinder sustainability in business contexts. Bocken et al. (2018), “Experimenting with a Circular Business Model” (376 citations), and Henry et al. (2020), “A Typology of Circular Startups” (319 citations), which have established themselves as central references in the literature on circular entrepreneurship, combining empirical case studies with a systematic classification of business model archetypes. These works have contributed decisively to defining the methodological and conceptual lexicon of

so-called “circular startups.” At the same time, several contributions have focused on barriers, challenges, and enablers of circular innovation. Guldmann et al. (2020) (306 citations) investigate barriers to innovation in circular business models, while Baldassarre et al. (2017) (307 citations) link the design of sustainable business models with user-driven innovation processes. These studies highlight a growing trend towards integrating design thinking, co-creation with users, and the circular economy in startup contexts. From a financial and ecosystem perspective, Bocken (2015) (296 citations) on sustainable venture capital, Demirel et al. (2019) with “Born to Be Green” (276 citations), emphasize the structural and institutional dimensions of green entrepreneurship, highlighting the link between startup success, financing mechanisms, and policy incentives. These contributions reinforce the idea that sustainable entrepreneurship requires not only individual initiative at the micro level, but also supportive infrastructure and favourable conditions at the macro level. Furthermore, Muñoz & Cohen (2017), “Mapping the Sharing Economy” (331 citations), place startups within the broader landscape of collaborative consumption and digital business models, while Tan & Taeihagh (2020) (237 citations) highlight the role of governance in smart cities, linking sustainable entrepreneurship to broader urban sustainability agendas. More recent contributions, such as Villiers et al. (2021) (167 citations), relate digital technologies—particularly IoT and blockchain—to the United Nations Sustainable Development Goals, representing the convergence between digitalization and sustainability that is redefining the field today. From a methodological point of view, Weissbrod & Bocken (2017) (176 citations) and Breuer et al. (2018) (156 citations) contribute by developing frameworks and tools for sustainable experimentation and business model development, respectively, reinforcing the importance of methodological innovation in advancing this literature. Similarly, Costa & Matias (2020) (176 citations) explore open innovation 4.0, emphasizing the ecosystemic nature of sustainable innovation. In terms of thematic evolution, three major waves are observable:

1. Foundational theorization (2010–2014) – Focus on incumbents vs. startups, personality traits, resource constraints (Hockerts & Wüstenhagen, Hwee Nga & Shanmuganathan, Golev et al.).
2. Business model and circularity (2015–2020) – Surge of empirical and conceptual contributions on sustainable and circular business models (Bocken, Baldassarre, Henry, Guldmann).
3. Digitalization and systemic integration (2019–2021) – Emergence of works linking startups with digital tools, smart cities, fintech, and the SDGs (Villiers et al., Tan & Taeihagh, Setiawan et al.).

Collectively, the top articles reveal that sustainable startup research is simultaneously grounded in theoretical foundations and increasingly future-oriented, incorporating business models, circular economy, financing, and digital transformation. The coexistence of entrepreneurship journals (*Journal of Business Venturing*), management outlets (*Journal of Cleaner Production*, *Business Horizons*), and technical/policy journals (*Resources Policy*, *Energy*) underscore the interdisciplinary nature of the field.

Author	ScopusID	h-index	Publications	Total Citations	PY start
N.M.P., Bocken, Nancy M.P.	24328581100	64	11	1597	2015
R., Wüstenhagen, Rolf	55970726900	34	1	973	2010
K.N., Hockerts, Kai N.	6505979814	24	1	973	2010
K., Fichter, Klaus	6602873863	18	9	667	2015
J., Kirchherr, Julian	57189004023	34	7	543	2020
G., Shanmuganathan, Gomathi	35272965600	1	1	510	2010
J.K., Hwee Nga, Joyce Koe	36196596900	11	1	510	2010
B., Baldassarre, Brian	57193409119	13	3	505	2017
M.P., Hekkert, Marko P.	6602626379	61	5	451	2020
G., Calabretta, Giulia	35786957200	14	2	429	2017
A., Ghezzi, Antonio	24831905500	39	2	427	2017
D.C., De Menezes, Daniela Callegaro	57208771341	6	1	420	2017
M.N., Nogueira Cortimiglia, Marcelo Nogueira	23093331600	24	1	420	2017
B.V., Todeschini, Bruna Villa	57195364407	3	1	420	2017
M., Henry, Marvin	57211926087	5	3	380	2020
C., Kraaijenhagen, Christiaan	57200817030	2	1	376	2018
C.S.C., Schuit, Cheyenne S.C.	57225138352	3	1	376	2018
B.D., Cohen, Boyd D.	7402977055	23	2	360	2017
P., Muñoz, Pablo	56494242900	27	2	360	2017
S.H., Ali, Saleem H.	11439396200	30	1	340	2014

Table 4: Top 20 Authors on startups

The analysis at the author level offers a privileged insight into intellectual leadership and collaboration dynamics in the field of sustainable entrepreneurship and green startups. The main contributors show an interesting combination: on the one hand, the pioneers who laid the theoretical

foundations of the sector; on the other, more recent and prolific scholars who have fostered its growth with empirical research on circular business models, sustainable innovation, and sustainability-oriented design. At the center of the network is Nancy M. P. Bocken, the most influential and prolific author, with 11 publications since 2015, an h-index of 64, and over 1,500 citations in this dataset. Her studies range from sustainable business models to experimentation to circular entrepreneurship (Bocken et al., 2014; 2018). Frequent collaborations with Brian Baldassarre, Giulia Calabretta, and Cheyenne Schuit have given rise to a solid core of research focused on design and innovation. Her central position reflects not only the volume of publications, but also her role as a “connector” between different sub-areas of sustainability research. In contrast, Rolf Wüstenhagen and Kai Hockerts stand out as founding theorists: both authors of a single, but fundamental contribution, the famous *Greening Goliaths versus Emerging Davids* (2010, 973 citations). Another prominent author is Klaus Fichter, with nine publications since 2015, an h-index of 18, and over 650 citations. His work focuses on entrepreneurial ecosystems, sustainability-oriented innovation, and business model experimentation, often in collaboration with Henning Breuer and Florian Lüdeke-Freund. His work represents the German-speaking tradition in sustainable entrepreneurship studies, capable of connecting management and innovation. Starting in 2017–2020, a new generation of scholars has made significant contributions. Julian Kirchherr (7 publications, 543 citations) and Marko P. Hekkert (5 publications, 451 citations; overall h-index 61) are very active in studies on the circular economy and transitions, with Kirchherr's (2020) typologies of circular startups now widely cited. Brian Baldassarre (3 publications, 505 citations), Giulia Calabretta (2 publications, 429 citations), and Antonio Ghezzi (2 publications, 427 citations) have brought an interdisciplinary perspective related to design and innovation. The number of citations accumulated by these authors clearly shows how they are helping to define the frontier of research. Alongside them are isolated but highly influential works. Joyce Koe Hwee Nga and Gomathi Shanmuganathan (2010, 510 citations) have authored a now classic study on personality traits and social entrepreneurial intentions. Similarly, Bruna Todeschini, Marcelo Nogueira Cortimiglia, and Daniela Callegaro De Menezes (2017, 420 citations) published a pioneering article on sustainable business models in the fashion industry, demonstrating how sector-specific studies can contribute to the evolution of the field. Although their output is more limited, these works are now considered essential references. Among the emerging authors, Marvin Henry (3 publications, 380 citations), author of circular startup typologies, and Cheyenne Schuit and Christiaan Kraaijenhagen (both with 376 citations), who collaborate with Bocken on experimental projects and case studies, stand out. Also noteworthy are Pablo Muñoz and Boyd Cohen (360 citations each), who stand out for their contributions on the sharing economy and sustainable entrepreneurship: their mapping of the sharing economy (2017) is now one of the most cited and influential works of

recent years. From an author-level analysis, three main groups can be distinguished. The first group, represented by Hockerts and Wüstenhagen, defined the fundamental concepts of the field through a limited number of seminal works. The second group, comprising Bocken, Fichter, Kirchherr, and Hekkert, has consistently expanded the literature with influential contributions on business models, circular startups, and transition pathways. The third group, consisting of Todeschini, Baldassarre, Calabretta, Muñoz, and Cohen, has enriched the field with high-impact thematic and sectoral studies, often the result of interdisciplinary collaborations that link conceptual and empirical perspectives. Overall, this configuration reflects the dynamics of a young and interdisciplinary research field: a few central figures, such as Bocken, coexist with a broader constellation of isolated but highly cited contributions. It is precisely the interaction between seminal works and collaborative clusters that has shaped the evolution of knowledge on sustainable entrepreneurship.

4. Conclusions

This study dives into a thorough bibliometric analysis of the research surrounding sustainable startups, mapping out the key intellectual, geographic, and thematic dimensions of this field from 2015 to 2025. By going through the research questions we outlined at the beginning, we've managed to stitch together a somewhat fragmented body of knowledge and set up a solid base for the empirical sections coming up in this research topic.

Publication trends (RQ1). The findings show a noticeable increase in academic work on sustainable startups. Before the United Nations rolled out the Sustainable Development Goals (SDGs) in 2015, most contributions were all over the place and mostly theoretical. But starting around 2016, we saw a significant rise in publications that reached a steady state by about 2020, coinciding with a stronger focus on sustainability in global policies and business strategies. This shift indicates that sustainable startups have moved from the sidelines of academic discussions to becoming a central focus in sustainability and entrepreneurship research. They're being recognized more for their role in driving ecological and social change.

Geographic, institutional, and journal distribution (RQ2). The production of knowledge is a bit uneven geographically but is becoming more diverse. Places like the United States, China, and some leading European countries, including Germany and the UK, are emerging as major hubs. While North America and Europe have provided a lot of the theoretical groundwork, Asian countries and emerging markets are offering valuable insights tailored to their contexts, especially in areas like energy, agriculture, and inclusive innovation. On the institution side, a strong European network led by TU Berlin and Leuphana University has steadily expanded to include institutions from Southern Europe, like Universitat Politècnica de València. The analysis of authorship reveals a two-tier

structure: early theorists like Hockerts and Wüstenhagen, whose 2010 piece is still a key reference, share the stage with consolidators such as Bocken, Fichter, Kirchherr, and Hekkert, who have expanded the field through ongoing discussions on circular business models and transition studies. When it comes to journals, the range of publications clearly shows the interdisciplinary nature of the field—*Sustainability* and *Journal of Cleaner Production* lead in terms of volume, while journals like *Business Strategy and the Environment* and *Small Business Economics* are helping to cement sustainable startup research within mainstream management and entrepreneurship literature.

Intellectual and thematic clusters (RQ3). Our co-occurrence and co-citation analyses uncovered six main thematic areas: (i) entrepreneurial ecosystems and support structures; (ii) eco-innovation and circular economy; (iii) digitalization and changes across sectors (with agriculture, fintech, and smart cities standing out); (iv) renewable energy and fighting climate change; (v) innovative sustainable business models; and (vi) social entrepreneurship and corporate responsibility. This fragmentation underscores the interdisciplinary character of the field, but it also highlights a growing convergence around sustainability as a shared framework. Concepts like the circular economy and sustainable business models are becoming crucial links that connect various research streams, indicating that a common conceptual language and intellectual agenda is starting to take shape—an essential development for the maturation of the field.

Research gaps and future directions (RQ4). There are still significant gaps to address. Even though sustainable startups are getting more attention in management and entrepreneurship journals, they're somewhat underrepresented in top publications like *Journal of Business Venturing* and *Entrepreneurship Theory and Practice*. This points to a chance for a deeper theoretical integration of sustainable entrepreneurship with traditional entrepreneurship studies. Another ongoing issue is the absence of standardized methods for measuring the environmental and social impacts of startups, which hinders comparability and weakens their relevance to policy. Crafting solid, replicable metrics could help bridge this divide. Additional research could look into how digital transformation intersects with green entrepreneurship—especially the roles of AI, blockchain, and fintech in scaling sustainable startups—as well as the contributions of emerging economies as testing grounds for frugal and inclusive innovation. These avenues could significantly broaden both the conceptual and empirical scope of the field.

All in all, the findings illustrate a field that has rapidly progressed from theoretical discussions to empirical research. Sustainable startup research today is characterized by a high level of interdisciplinarity, geographic diversity, and a growing link with broader conversations on sustainability and innovation systems. The evidence suggests that these startups are no longer just

minor players; they're increasingly recognized as crucial drivers of systemic change, linking technological advancement to social issues.

On a wider scale, sustainable startups wear two hats. On the micro level, they're innovators, trying out new technologies, business models, and organizational styles. On the macro level, they act as catalysts for structural change, helping to reshape industries and push forward global sustainability goals. The academic literature mirrors this dual role, weaving together detailed case studies of entrepreneurial practices with overarching analyses of policy structures, innovation ecosystems, and pathways to transition. In conclusion, this study not only lays out a structured overview of the scholarly output on sustainable startups but also pushes the field forward by clarifying its intellectual boundaries, highlighting key players, and pinpointing critical gaps. By providing a clear and replicable bibliometric map, it strengthens the methodological foundation of sustainability entrepreneurship research and creates a stepping stone for future studies. It's both a summary of past and present scholarship and a launchpad for a forward-thinking research agenda that aligns more closely with the urgent sustainability challenges of the twenty-first century.

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