www.gmsrjournal.com

GMSR
Global Management Sciences Review
managing humanity

- ISSN-P : 2708-2474
- ISSN-E : 2708-2482

VOL. XI ISSUE I, WINTER (MARCH-2026)

GMSR

GLOBAL MANAGEMENT SCIENES REVIEW

HEC-RECOGNIZED CATEGORY-Y

GLOBAL MANAGEMENT SCIENCES REVIEW

HumanityPublications
sharing research
www.humapub.com
US | UK | Pakistan

DOI (Journal): 10.31703/gmsr
DOI (Volume): 10.31703/gmsr.2026(XI)
DOI (Issue): 10.31703/gmsr.2026(XI-I)

Double-blind Peer-review Research Journal
www.gmsrjournal.com

Humanity Publications (HumaPub)
www.humapub.com
Doi: https://dx.doi.org/10.31703

Title: Sustainable Entrepreneurship as an Antecedent of Green Innovation in Emerging Economies: A Bibliometric and Integrative Review (2010–2025)

Abstract

This study maps the intellectual structure and thematic evolution of sustainable entrepreneurship and green innovation research. Applying a bibliometric and integrative review to 270 Scopus-indexed articles (2010–2026), findings reveal rapid interdisciplinary expansion (22.28% annual growth). Thematic mapping identifies climate change and entrepreneurship increasingly integrating artificial intelligence as motor themes, while sustainable development provides the foundational framework. Green innovation emerges as a fast-growing frontier alongside the circular economy as a specialized niche. Co-citation analyses expose a dual intellectual foundation anchored in corporate sustainability theory and robust PLS-SEM methodology. Acknowledging limitations regarding Scopus exclusivity and citation-window effects, this review urges future research to enforce strict construct separation between entrepreneurship and innovation outcomes. By advocating for longitudinal designs to clarify causal ordering, this synthesis offers a consolidated roadmap for advancing theoretical development.

Keywords: Sustainable Entrepreneurship; Green Entrepreneurship; Green Innovation; Sustainable Development; Circular Economy; Bibliometric Analysis

Authors:

Rao Usama Bin Nasir: Brunel Business School, Brunel University London, United Kingdom (UK).

Ammara Akram: Lecturer, Department of Commerce, Bahauddin Zakaria University Multan, Punjab, Pakistan.

Nasir Abbas: (Corresponding Author)
Lecturer, College of Commerce, Government College University, Faisalabad, Punjab, Pakistan.
(Email: nasirabbas@gcuf.edu.pk)

Pages: 70-101
DOI:10.31703/gmsr.2026(XI-I).05
DOI link: https://dx.doi.org/10.31703/gmsr.2026(XI-I).05
Article link: https://gmsrjournal.com/article/sustainable-entrepreneurship-as-an-antecedent-of-green-innovation-in-emerging-economies-a-bibliometric-and-integrative-review-20102025
Full-text Link: https://gmsrjournal.com/article/sustainable-entrepreneurship-as-an-antecedent-of-green-innovation-in-emerging-economies-a-bibliometric-and-integrative-review-20102025
Pdf link: https://www.gssrjournal.com/jadmin/Auther/31rvIolA2.pdf

Global Management Science Review

p-ISSN: 2708-2474 **e-ISSN:** 2708-2482
DOI(journal): 10.31703/gmsr
Volume: XI (2026)
DOI (volume): 10.31703/gmsr 2026(X)
Issue: I (Winter-March 2026)
DOI(Issue): 10.31703/gmsr.2026(XI-I)

Home Page
www.gmsrjournal.com
Volume: XI (2026)
https://www.gmsrjournal.com/Current-issues
Issue: I-Winter (March-2026)
https://www.gmsrjournal.com/issue/11/1/2026
Scope
https://www.gmsrjournal.com/about-us/scope
Submission
https://humaglobe.com/index.php/gmsr/submissions

Scan the QR to visit us

Humanity Publications (HumaPub)
www.humapub.com
Doi: https://dx.doi.org/10.31703

Citing this Article

Article Serial	05
Article Title	Sustainable Entrepreneurship as an Antecedent of Green Innovation in Emerging Economies: A Bibliometric and Integrative Review (2010–2025)
Authors	Rao Usama Bin Nasir Ammara Akram Nasir Abbas
DOI	10.31703/gmsr.2026(XI-I).05
Pages	70–101
Year	2026
Volume	XI
Issue	I

Referencing & Citing Styles

APA	Nasir, R. U. B., Akram, A., & Abbas, N. (2026). Sustainable Entrepreneurship as an Antecedent of Green Innovation in Emerging Economies: A Bibliometric and Integrative Review (2010–2025). *Global Management Sciences Review*, *XI*(I), 70-101. https://doi.org/10.31703/gmsr.2026(XI-I).05
CHICAGO	Nasir, Rao Usama Bin, Ammara Akram, and Nasir Abbas. 2026. "Sustainable Entrepreneurship as an Antecedent of Green Innovation in Emerging Economies: A Bibliometric and Integrative Review (2010–2025)." *Global Management Sciences Review* XI (I):70-101. doi: 10.31703/gmsr.2026(XI-I).05.
HARVARD	NASIR, R. U. B., AKRAM, A. & ABBAS, N. 2026. Sustainable Entrepreneurship as an Antecedent of Green Innovation in Emerging Economies: A Bibliometric and Integrative Review (2010–2025). *Global Management Sciences Review,* XI**,** 70-102.
MHRA	Nasir, Rao Usama Bin, Ammara Akram, and Nasir Abbas. 2026. 'Sustainable Entrepreneurship as an Antecedent of Green Innovation in Emerging Economies: A Bibliometric and Integrative Review (2010–2025)', *Global Management Sciences Review*, XI: 70-101.
MLA	Nasir, Rao Usama Bin, Ammara Akram, and Nasir Abbas. "Sustainable Entrepreneurship as an Antecedent of Green Innovation in Emerging Economies: A Bibliometric and Integrative Review (2010–2025)." *Global Management Sciences Review* XI.I (2026): 70-101. Print.
OXFORD	Nasir, Rao Usama Bin, Akram, Ammara, and Abbas, Nasir (2026), 'Sustainable Entrepreneurship as an Antecedent of Green Innovation in Emerging Economies: A Bibliometric and Integrative Review (2010–2025)', *Global Management Sciences Review,* XI (I), 70-101.
TURABIAN	Nasir, Rao Usama Bin, Ammara Akram, and Nasir Abbas. "Sustainable Entrepreneurship as an Antecedent of Green Innovation in Emerging Economies: A Bibliometric and Integrative Review (2010–2025)." *Global Management Sciences Review* XI, no. I (2026): 70-101. https://dx.doi.org/10.31703/gmsr.2026(XI-I).05.

Global Management Sciences Review
ISSN-P : 2708-2474 | DOI: https://dx.doi.org/10.31703/gmsr.2026(XI-I).05 | ISSN-E : 2708-2482
www.gmsrjournal.com

Sustainable Entrepreneurship as an Antecedent of Green Innovation in Emerging Economies: A Bibliometric and Integrative Review (2010–2025)

Rao Usama Bin Nasir[1], Ammara Akram[2] Nasir Abbas (Corresponding Author)3

[1] Brunel Business School, Brunel University London, United Kingdom (UK).
[2] Lecturer, Department of Commerce, Bahauddin Zakaria University Multan, Punjab, Pakistan.
[3] Lecturer, College of Commerce, Government College University, Faisalabad, Punjab, Pakistan. (Email: nasirabbas@gcuf.edu.pk)

Abstract

This study maps the intellectual structure and thematic evolution of sustainable entrepreneurship and green innovation research. Applying a bibliometric and integrative review to 270 Scopus-indexed articles (2010–2026), findings reveal rapid interdisciplinary expansion (22.28% annual growth). Thematic mapping identifies climate change and entrepreneurship increasingly integrating artificial intelligence as motor themes, while sustainable development provides the foundational framework. Green innovation emerges as a fast-growing frontier alongside the circular economy as a specialized niche. Co-citation analyses expose a dual intellectual foundation anchored in corporate sustainability theory and robust PLS-SEM methodology. Acknowledging limitations regarding Scopus exclusivity and citation-window effects, this review urges future research to enforce strict construct separation between entrepreneurship and innovation outcomes. By advocating for longitudinal designs to clarify causal ordering, this synthesis offers a consolidated roadmap for advancing theoretical development.

Keywords: *Sustainable Entrepreneurship; Green Entrepreneurship; Green Innovation; Sustainable Development; Circular Economy; Bibliometric Analysis*

Introduction

Sustainable entrepreneurship has also been placed more prominently as a central micro-level process by which environmental sustainability objectives are converted into market products and services, business operations and novel forms of organisation(Ferreira & Ferreira, 2024). One such policy-relevant, theory-challenging relationship that has been researched in this area is whether and under what conditions sustainable/green/environmental entrepreneurship can serve as a precursor to green innovation. This association has been considered particularly consequential in the emerging and developing economies, where pressures on environmental degradation have been accompanied by institutional and resource constraints and unequal application of environmental regulation(Ahmadov et al., 2026). In these circumstances, the transformation of entrepreneurial sustainability intent into quantifiable green output of innovation has been viewed as not only a pressing but also a challenging issue, and the entrepreneurship-innovation relationship has become a primary subject of empirical research (Appiah et al., 2023; Guo et al., 2020; Muangmee et al., 2021).

Sustainable entrepreneurship has been operationalised in the literature with various proximate constructs, the most common of which have been applied in firm and SME-level studies, green entrepreneurial orientation (GEO)(Gupta & Dharwal, 2021). GEO has generally been theorised as a

strategic stance which is proactively defined in terms of seeking out green product opportunities, a readiness to take a risk in green product development, and a determination to focus on green R&D or technological leadership(Rahmawati et al., 2024). Green innovation has also been operationalised in parallel as green product innovation, composite green innovation (usually with a combination of product and process components) or green innovation performance(Li et al., 2025). Notably, it has been established that the focal relationship can depend on the level and type of innovation. To illustrate, the green entrepreneurial orientation has been linked to both incremental and radical green innovation, with supply chain learning standing midway as a mediating capability that enables the conversion of entrepreneurial orientation into the realization of innovation(Soomro et al., 2023). These differences imply that entrepreneurship may not only enhance the probability of innovation, but it may also determine the originality and boldness of the environmental innovations sought.

The empirical research of the GEO to GI stream has been seen in SME settings in emerging economies, in which models have frequently been specified in a canonical form, sustainable/green entrepreneurship (or close variants) has been theorized as a antecedent of green innovation, which in turn has been connected to economic, environmental, and social performance implications(Aljaeed et al., 2026). The relationships between green entrepreneurial orientation and green innovation, as well as between green innovation and various aspects of green performance, have been confirmed through evidence of Thai SMEs(Muangmee et al., 2021). Equally, it has been shown that in Ghana, the orientation of green entrepreneurship leads to green innovative performance and overall firm performance, with green innovative capability conditioning the strength of the entrepreneurship-innovation connection(Appiah et al., 2023). These studies, together, have proposed the idea that entrepreneurship can be more appropriately viewed as an upstream orientation whose performance consequences are often achieved via the proximate mechanism of innovation(Narwal et al., 2025).

Meanwhile, the discipline is conceptually and methodologically heterogeneous. First, boundaries have not been effectively sustained in terms of constructs. Green entrepreneurship has been conceptualised in a manner that entrenches innovation (e.g. innovation of green products and processes) into the construct of entrepreneurship itself. Once innovation has been included in the definition and measurement of entrepreneurship, it becomes hard to estimate a distinct entrepreneurship to innovation effect since the relationship may be tautological instead of explanatory(Tekala et al., 2024). Second, causal ordering is not completely stabilised. Even though the prevailing paradigm has been entrepreneurship as a pre-condition to innovation, reverse-direction models have been documented where green innovation or green innovation performance is set as a predictor of green entrepreneurship orientation or green entrepreneurship (Abbas et al., 2025).

Green innovation and green market variables have been formulated as predictors of green entrepreneurship and sustainable development in Pakistan, which consequently suggests that the capabilities of innovation and market infrastructures can facilitate, but not necessarily be a product of sustainable entrepreneurship(Soomro et al., 2023). Similarly, the performance of green innovation has also been defined as a pre-condition to green entrepreneurial orientation and environmental performance, which once again presupposes alternative temporal order(Tang et al., 2020). Such divergences have indicated that the entrepreneurship-innovation nexus could be a contingency phenomenon, possibly mutual in the long run, even though reciprocal causality is seldom directly examined.

Third, translation processes and boundary conditions have been more foregrounded, which means that entrepreneurship might not be sufficient to create green innovation. The processes of knowledge and learning have again been subjected to critical treatment. Supply chain learning has been established as an intermediary where green entrepreneurial orientation is converted into incremental and radical green innovation(Jiwa et al., 2025). Knowledge sharing has been addressed as a moderator that enhances the relationship between the green entrepreneurial motivation and green innovation in small businesses, implying that the motivational antecedents need organisational and relational structures to produce innovation outputs(Shammre et al., 2023). Explanations based on capabilities are also eminent. Green innovative capability has been suggested as a moderator with strengthening effect on GEO to GI relationship, which admits a conception according to which

entrepreneurial intent is translated into innovation mainly when dynamic capabilities and innovation routines exist(Sulemana et al., 2026). Proximate translation layers have also been studied in the form of operational practice bundles. As an example, green and frugal innovation has been identified as part of entrepreneurship in terms of zero-waste management practice in a circular economy frame, suggesting that innovation can be created through operational redesign and resource-efficiency routines instead of simply being created via formal R&D(Li et al., 2025).

Emergent and developing economic contexts, complementary institutional and ecosystem variables have also been addressed as salient. In Bangladesh, the connection between green entrepreneurship and sustainable innovation is enhanced by the presence of supportive entrepreneurial ecosystems and institutional frameworks, which in turn suggest that entrepreneurial orientation and behaviour can be intensified in the face of supportive ecosystems that lower the transaction costs, mobilise resources, or offer legitimacy(Roshid et al., 2025). The concept of leadership has been established as a co-antecedent with the constructs of entrepreneurship. It has been found that green transformational leadership and green entrepreneurial orientation are related to green product innovation and SME performance in Jordan, although the statistical significance of mediation through innovation has been inconsistent, suggesting that transformation of innovation into performance gains may be conditional on the market absorption, competition, and willingness of customers to pay(Majali et al., 2022). All of this in sum has suggested that the SE to GI relationship is becoming theorised as more contingent, capability-embedded, than a mere disposition relationship.

The current study examined a Scopus-based corpus of 270 items that were published during the years 2010-2026 and analyzed it through a bibliometric integrative review model. The review has been framed in such a manner that (a) it maps the intellectual framework, thematic groups and contextual focuses in the sustainable/green entrepreneurship and green innovation literature; (b) it clarifies the boundaries of constructs by distinguishing between studies that model entrepreneurship as antecedent and green innovation as a different outcome and studies where innovation is defining to entrepreneurship (Appiah et al., 2023; Guo et al., 2020) With this synthesis and mapping, a research agenda is propelled in which construct validity, causal identification, and innovation heterogeneity (product/process; incremental/radical; performance versus output) is viewed as top priorities of future work in the discipline.

Conceptual Foundations

Positioning the Focal Nexus: Sustainable Entrepreneurship → Green Innovation

A key analytical nexus in the 2010-2026 Scopus-indexed literature on sustainability-oriented venturing and green innovation has been to consider whether sustainable/green entrepreneurship is a precursor to green innovation and to assess this issue within emerging and developing economies. Among the studies that best fit within this nexus, sustainable entrepreneurship has been operationalised as a strategic posture or entrepreneurial capability (most commonly green entrepreneurial orientation), as a behavioural manifestation of green entrepreneurship, or as a motivational antecedent (e.g. green entrepreneurial motivation). Green innovation has been approached as a specific organisational performance, which is usually quantified as green product innovation, composite green innovation or green innovation performance(Appiah et al., 2023; Guo et al., 2020; Muangmee et al., 2021).

However, conceptual consistency has not been consistently observed in wider corpora. There are two common problems that necessitate direct conceptual treatment. Some studies have also had definitional overlap, where green entrepreneurship was characterised by the introduction of green innovations, making it hard to interpret how the two independent variables (entrepreneurship and innovations) are independent of each other (Tekala et al., 2024). Second, alternative causal sequences have been proposed, such as models in which green innovation (or green innovation performance) is defined as a causal antecedent of green entrepreneurship constructs (Soomro et al., 2023; Tang et al., 2020). Consequently, construct clarification and model architecture classification have been handled as conceptual underpinnings of the synthesis necessities.

Core Constructs and Boundary Conditions

This study has employed a structured taxonomy to differentiate conceptually independent entrepreneurship constructs and innovation constructs, prior to the comparison of evidence across situations. Green entrepreneurial orientation (GEO) has been the most frequently used entrepreneurship-side construct, but it has been established as a strategic orientation towards identifying green opportunities, taking risks in green initiatives, and being proactive in green markets (Guo et al., 2020; Muangmee et al., 2021). Green entrepreneurial motivation (GEM) has been added to products as a complementary construct as an individual-level antecedent (Al Shammre et al., 2023), enviropreneurship as an environmentally oriented variant of entrepreneurship with a focus on the circular economy (Li et al., 2025), and general green entrepreneurship as a behavioural antecedent (Roshid et al., 2025)

Green innovation has been operationalised with important heterogeneity on the outcome side. The concept of green product innovation has often been applied in research designs of SMEs(Asad et al., 2024; Majali et al., 2022). Composite green innovation scales have been applied in cases of aggregation of product and process components (Muangmee et al., 2021; Al Shammre et al., 2023). Where innovation is considered a performance capability, as opposed to a particular form of innovation output, green innovation performance (or green innovative performance) has been used(Appiah et al., 2023; Makhloufi et al., 2021). One of the most noticeable exceptions is the explicit distinction between incremental and radical green innovation, which has allowed inferences of the depth of innovation at a higher resolution (Afzal et al., 2025; Guo et al., 2020).

Table 1

Construct Taxonomy Used To Interpret Se/Ge to Gi Models

Construct family	Typical operational form	Level of analysis most often implied	Representative examples
Green entrepreneurial orientation (GEO)	Strategic orientation (proactiveness, risk-taking, green innovativeness, competitive aggressiveness in green markets)	Firm/SME	Guo et al. (2020); Muangmee et al. (2021)
Green entrepreneurship (GE)	Behavioural identity or venture posture toward environmental goals	Firm/venture; startup	Roshid et al. (2025)
Green entrepreneurial motivation (GEM)	Entrepreneur motivation as antecedent to green outcomes	Individual/owner-manager	Al Shammre et al. (2023)
Enviropreneurship	Environment-problem-solving entrepreneurship, often circular-economy adjacent	Firm/manager	Li et al. (2025)
Green innovation (GI)	Composite green product/process innovation	Firm/SME	Muangmee et al. (2021); Al Shammre et al. (2023)
Green product innovation	Product-focused eco-innovation	SME	Majali et al. (2022); Asad et al. (2024)
Green innovation performance (GIP)	Innovation as performance/capability outcome	Firm	Appiah et al. (2023); Makhloufi et al. (2021)
Incremental vs radical green innovation	Disaggregated innovation depth	Firm	Guo et al. (2020)

Theoretical Lenses Anchoring the Se/Ge → Gi Relationship

Resource-based and capability-based reasoning have been the most commonly used anchors of the entrepreneurship-innovation linkage in the Scopus corpus in this field. The justification of why environmental orientation, institutionalised as an entrepreneurial posture, can be transformed into innovation routines that can minimise environmental impact and create competitive advantage has been made by the natural resource-based view (NRBV) and dynamic capability theory (Appiah et al., 2023; Guo et al., 2020; Makhloufi et al., 2021). Entrepreneurial orientation and leadership have been placed as intangible resources within the resource-based view (RBV), which helps create rare and hard-to-copy green innovation capabilities (Majali et al., 2022; Asad et al., 2024). The concepts of institutional theory and ecosystem views have been called upon in cases where the results of innovation were claimed to require institutional support, ecosystem resources, or regulatory limits (Roshid et al., 2025; Soomro et al., 2023). Circular economy framings have offered more conceptual scaffolding in which operational practices (e.g. zero-waste management) have been suggested as the translation layer between entrepreneurial intent and both green and frugal innovation (Li et al., 2025).

Table 2

Dominant theoretical lenses and their implied mechanisms

Theoretical lens	What is assumed to drive GI	What is predicted to moderate/mediate	Representative examples
NRBV / dynamic capabilities	GEO/GE enables sensing–seizing–reconfiguring for eco-innovation	Learning, absorptive capacity, innovation capability	Appiah et al. (2023); Makhloufi et al. (2021)
RBV	Entrepreneurial orientation and leadership are valuable strategic resources	Complementary assets, organisational support	Majali et al. (2022); Asad et al. (2024)
Institutional / ecosystem perspectives	GI depends on external supports and constraints	Institutional frameworks, ecosystem support, regulation	Roshid et al. (2025)
Circular economy / operations-based views	GI emerges through operational redesign and waste/resource routines	Zero-waste management and related practices	Li et al. (2025)

Interpretation. Convergence in theory has been theoretical convergence towards capability-based explanations, but the direction of causality of theory has not always aligned with the direction of empirical models. Indicatively, where innovation performance has been operationalised as a antecedent to entrepreneurial orientation, the conceptual focus has changed to be entrepreneurship-as-cause to innovation-capability-as-cause (Tang et al., 2020).

Mechanism Families: How Entrepreneurship Becomes Innovation in Constrained Contexts

Another common conceptualisation is that sustainable/green entrepreneurship alone is not sufficient; the transfer into green innovation has been argued to require learning processes, endowments of capabilities, leadership complements, and institutional support. Supply chain learning has been identified as a tool by which green entrepreneurial orientation can be transformed into either incremental or radical green innovation, which means that inter-firm learning promotes experimentation and execution (Guo et al., 2020). Knowledge sharing has been established as a conditioning factor enhancing the association between green entrepreneurial motivation and green innovation within small businesses, indicating that motivational intention needs information flows and internal cooperation to produce tangible innovation results (Al Shammre et al., 2023). Green innovative capability (or other dynamic capability constructs) has been considered as a moderator that reinforces the entrepreneurship-innovation relation, which is contingent in the sense that

entrepreneurial posture only brings about innovation in the presence of implementation capabilities (Appiah et al., 2023). Zero-waste management in the context of the circular economy has been placed as a mediating practice between entrepreneurship and green (and frugal) innovation to show that innovation can be operational and practice-based and not necessarily R&D-based (Li et al., 2025).

Table 3

Mechanism Map For SE/GE → GI Translation

Mechanism family	Mechanism statement (conceptual)	Example operationalisation	Representative examples
Learning and knowledge flows	GI is enabled when entrepreneurship is coupled with structured learning	Supply chain learning; knowledge sharing	Guo et al. (2020); Al Shammre et al. (2023)
Innovation/dynamic capabilities	GI is strengthened when implementation capability is high	Green innovative capability/dynamic capability	Appiah et al. (2023)
Leadership complements	GI is supported when leadership aligns resources and commitment with orientation	Green transformational leadership + GEO	Majali et al. (2022); Asad et al. (2024)
Ecosystem and institutions	GI increases when external supports and institutions reduce constraints	Startup ecosystem support; institutional frameworks	Roshid et al. (2025)
Circular-economy operational pathways	GI is produced through routine redesign and waste/resource practices	Zero-waste management	Li et al. (2025)

Interpretation. The mechanism families show that focal relationships have been conceptualised more as processual and contingent. Thus, it has been viewed as inadequate to explain a positive SE/GEto GI coefficient by not determining the translation mechanisms or boundary conditions under which green innovation becomes possible.

Methods

Research Design and Rationale

The mixed review design involved a synthesis of bibliometric science mapping with an integrative systematic review of substantive evidence around the sustainable/green entrepreneurship-green innovation nexus. This type of design was chosen due to the ability of bibliometric methods to map the intellectual organization and thematic development of a discipline on a larger scale, and integrative synthesis to critically compare boundaries of constructs, model architecture, and mechanisms across a heterogenous body of empirical research(Donthu et al., 2021; Zupic & Čater, 2015). Specially, the conceptual threat that green entrepreneurship is occasionally conceptualised in a fashion that entrenches innovation within the entrepreneurship construct, which may undermine the interpretability of an entrepreneurship -innovation relationship (Tekala et al., 2024). Moreover, the existence of reverse-directional models (innovation to entrepreneurship) was considered as a classification criterion, but not as an exclusion by default, since reverse-directional models present evidence about causal contestation in the field (Soomro et al., 2023; Tang et al., 2020).

Data Source and Time Window

The Scopus database has been chosen as the bibliographic record source due to its extensive coverage of peer-reviewed journals and conference materials related to the fields of management, sustainability, and innovation and the ability to export metadata to be applied in bibliometric analysis.

The search filter was 2010-2026 to include (a) the period of formative development of SE/GEGI research prior to the surge (2010-2026) and (b) the accelerated growth of SE/GEGI research, which has been evident since 2020 in several emerging economy contexts. A final sample of 270 records was retained after the screening and eligibility assessment.

Search Strategy

The title/abstract/keywords strategy was followed to maximise retrieval accuracy and cover terminology. Three concept blocks were used: Entrepreneurship block: "sustainable entrepreneurship, green entrepreneurship, environmental entrepreneurship, ecopreneurs, green entrepreneurial orientation, and similar terms. Innovation block: green innovation, eco-innovation, environmental innovation, green product innovation, and green innovation performance. Context block (not compulsory in refining): "emerging econom*", developing countr*", Global South, and/or country filters, where necessary to bring the data set into focus as required by the study context. Search refinement was performed in a loop by analysing keyword co-occurrence and false positives in pilot retrievals, and then the final query was run and exported.

Eligibility Criteria and Screening Procedure

Two-phase screening was adopted. To narrow down to a set of records that were within scope, first, titles and abstracts were filtered to eliminate those records that were obviously out of scope (e.g. engineering-only eco-innovation articles with no entrepreneurship construct). Second, full texts were rated where the separation of the construct or direction of causation could not be established based on the abstract. The main inclusion criterion was that sustainable/green entrepreneurship (or a close proxy such as green entrepreneurial orientation or green entrepreneurial motivation) and green innovation (or an explicit environmental innovation construct) were considered as two distinct constructs in the conceptual model of the study to be able to assess the relationship between entrepreneurship and innovation. When innovation defined entrepreneurship (Tekala et al., 2024) or when the direction of the main model was innovation 2 entrepreneurship (Soomro et al., 2023; Tang et al., 2020), the records were labelled as non-core. These studies were held back to map out the larger intellectual space, but were not integrated into the integrative synthesis.

Table 4

Inclusion, Exclusion, and Classification Rules

Category	Operational rule	Treatment in synthesis
Core SE/GE → GI	Entrepreneurship construct specified as antecedent; GI specified as distinct outcome	Included in evidence synthesis
Direction reversed	GI specified as antecedent of GE/GEO	Retained for mapping; discussed as causal contestation
Construct overlap	"Green entrepreneurship" defined by introducing green innovations (GI embedded in IV)	Retained for mapping; excluded from causal SE→GI inference
Innovation not explicitly "green"	DV is generic innovation with no environmental content	Excluded

Interpretation. These rules were required to protect construct validity and avoid treating tautological definitions as empirical support for SE/GE → GI effects (Tekala et al., 2024).

Bibliometric Analysis Procedures

Three layers of bibliometric analyses were performed: (a) performance analysis, (b) science mapping, and (c) robustness checks. They adhered to standardised workflow as suggested in the guidelines for bibliometric methodology (Donthu et al., 2021; Zupic and Čater, 2015).

Performance analysis: The trends of annual publications, types of documents, most significant sources, and the most-cited documents were summarised descriptively.

Science mapping: Thematically relevant clusters and their development were created using keyword co-occurrence networks. The intellectual base was determined using co-citation analysis (references cited together). Contemporary research fronts were identified by bibliographic coupling (shared references). The VOSviewer was the right choice in terms of network visualisation and clustering(Van Eck & Waltman, 2010), and Bibliometrix/Biblioshiny allowed reproducible pipelines in R(Aria & Cuccurullo, 2017).

Cleaning and normalisation of data: Spelling variants and synonyms (e.g. eco-innovation vs. eco innovation; green entrepreneurial orientation vs. GEO) were harmonised as author keywords. Where necessary, fractional counting was used to minimise the inflation of multi-author records.

Interpretation. Using multiple complementary maps reduces the risk that a single network view would overstate one structure (e.g. themes) while underrepresenting another (e.g. foundational intellectual base), thereby improving interpretive validity (Donthu et al., 2021; Zupic & Čater, 2015).

Results| Bibliometric Analysis

Main information about the Scopus dataset (2010–2026)

Figure 1

Table 5

Summary Statistics of Bibliographic Collection (Scopus)

Metric	Value
Timespan	2010–2026
Documents (articles)	270
Sources	151
Annual growth rate	22.28%
Document average age	2.96 years
Average citations per document	20.45
Total cited references	38,461
Keywords Plus	829
Author keywords	912
Authors	841
Co-authors per document	3.41
Single-authored documents	36
International co-authorships	36.3%

Annual scientific production (2010–2026)

A growth trend in annual production was evident. The increase in output was slow between 2010 and 2018, higher between 2019 and 2021, and then fast between 2022 and 2024. The strongest increase occurred in 2024 (48 articles) and 2025 (96 articles), constituting over half of the entire corpus. The 2026 year (25 articles) must be viewed with caution since it is not complete in calendar time, and it might contain early online entries.

Figure 2

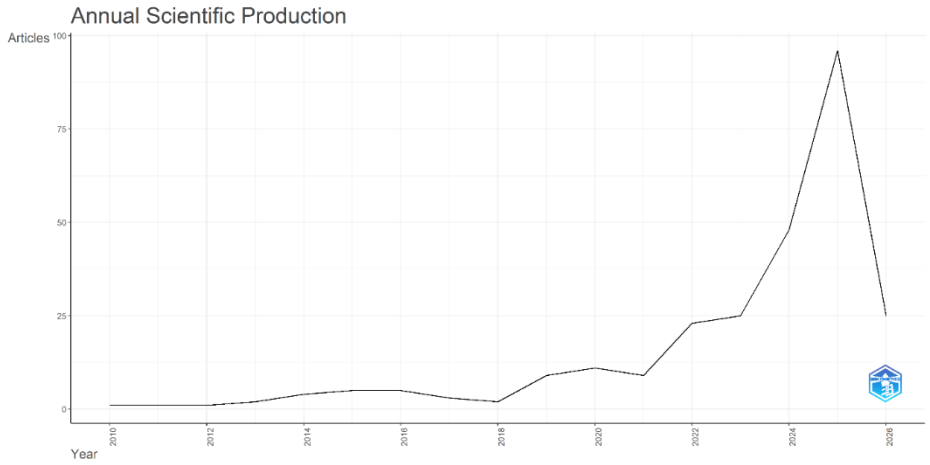


Table 6

Annual Scientific Production and Citation Maturation

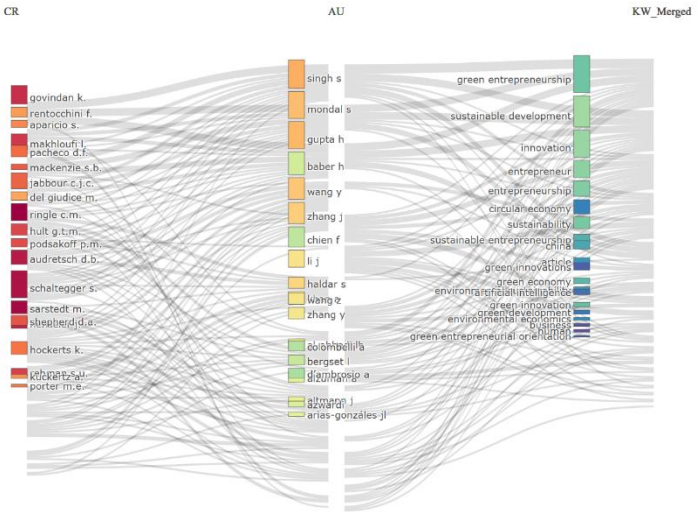
Year	Articles	Mean total citations per article	Mean citations per year	Citable years
2010	1	148.00	8.71	17
2011	1	3.00	0.19	16
2012	1	10.00	0.67	15
2013	2	19.50	1.39	14
2014	4	26.75	2.06	13
2015	5	102.80	8.57	12
2016	5	20.00	1.82	11
2017	3	35.00	3.50	10
2018	2	44.00	4.89	9
2019	9	30.89	3.86	8
2020	11	50.64	7.23	7
2021	9	34.56	5.76	6
2022	23	57.13	11.43	5
2023	25	31.40	7.85	4
2024	48	16.56	5.52	3

Year	Articles	Mean total citations per article	Mean citations per year	Citable years
2025	96	3.65	1.82	2
2026	25	0.68	0.68	1

Three-Field Plot

A more recent decline in citations in the corpus is simply a "citation-window effect", with high-cited 2022-2023 studies demonstrating that the field is having a quick impact. The intellectual lineage is mapped using a three-field plot; this is a plot depicting the intellectual roots of the foundations to the present topics. Central authors serve as essential intermediaries, traversing the traditional notions of entrepreneurship, sustainability, and rigorous quantitative research (such as PLS-SEM) in contemporary applied studies. Therefore, the prevailing trends are all about green entrepreneurship, sustainable development, the circular economy, and environmental AI. In general, the discipline shows swift development, systematically grounded in new ecological innovations to the existing strategic management and statistical frameworks.

Figure 3



Top Sources (Publication Outlets)

The overall dispersion of 151 sources focused on a small number of journals in terms of publication output. Sustainability (Switzerland) had the highest number (32 articles), followed by Sustainable Development (9). A second rank included sustainability-management and environmental strategy outlets, such as Business Strategy and the Environment and the Journal of Cleaner Production (7 each), International Entrepreneurship and Management Journal, and the Journal of Environmental Management (6 each). This dispersion signified that the field was established in sustainability-focused administration periodicals, in addition to continuing to be noticeable in environmental management and entrepreneurship-expert platforms.

Figure 4

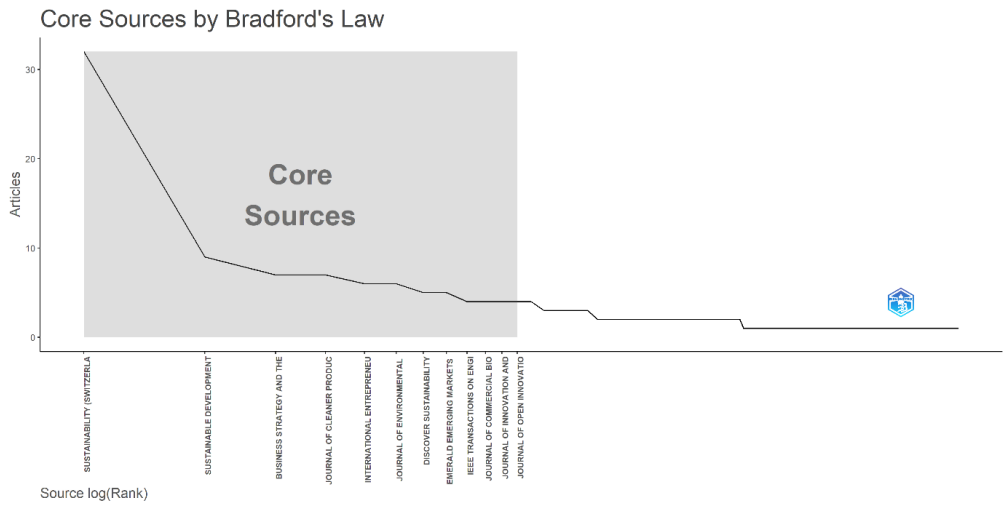


Figure 5

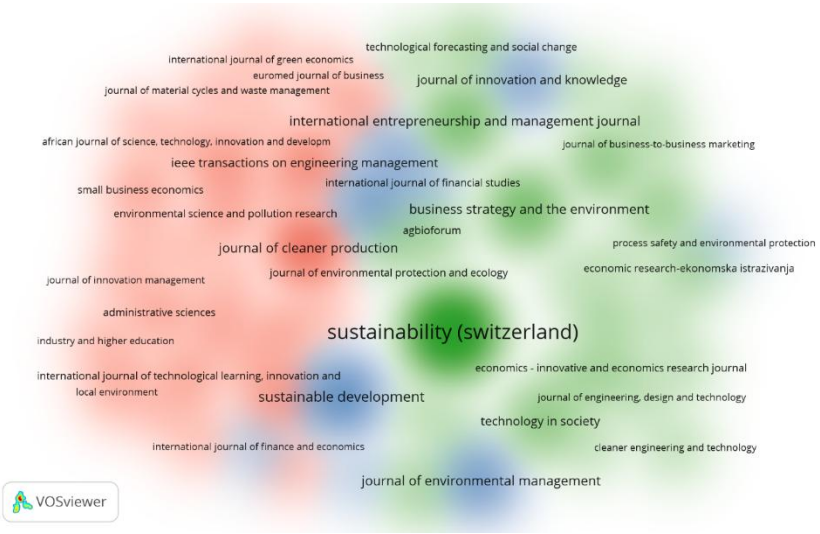


Figure 6

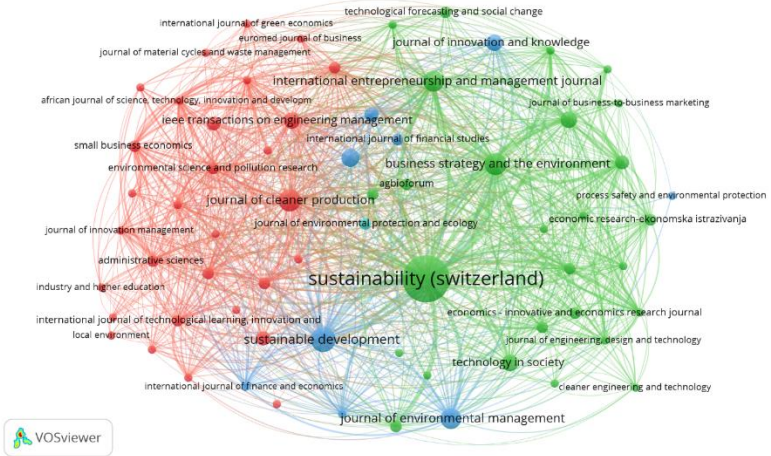


Table 7

Top Sources by Number of Articles

Source	Articles
Sustainability (Switzerland)	32
Sustainable Development	9
Business Strategy and the Environment	7
Journal of Cleaner Production	7
International Entrepreneurship and Management Journal	6
Journal of Environmental Management	6
Discover Sustainability	5
Emerald Emerging Markets Case Studies	5
IEEE Transactions on Engineering Management	4
Journal of Commercial Biotechnology	4

Top Authors (Productivity and Fractional Contribution)

The author with the largest number of articles was Singh S (five articles), then there were several authors with 4 articles (Gupta H, Mondal S, Wang Y, and Zhang J (four articles). Fractionalised counts, which adjust multi-authorship by giving partial credit to each article, presented a different picture: Haldar S had the largest fractionalised output (3.00), and Wang Y had a relatively high fractional output (2.08). This dispersion suggests that the productivity of some authors has been attained in part by multi-author collaboration (high full count, lower fractional count), whereas other authors contributed a higher fraction per paper.

Figure 7

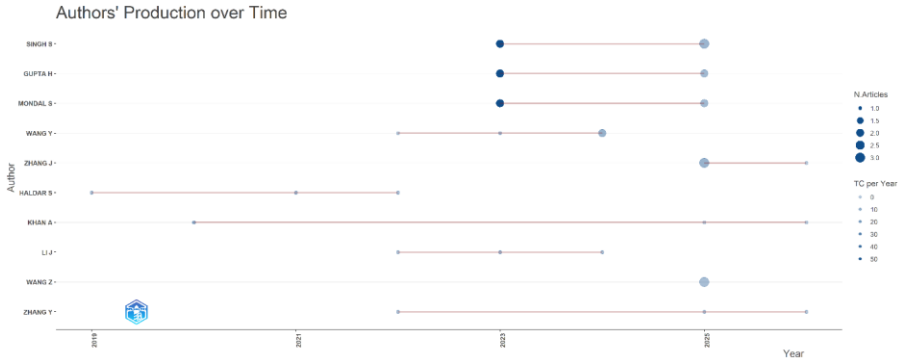


Figure 8

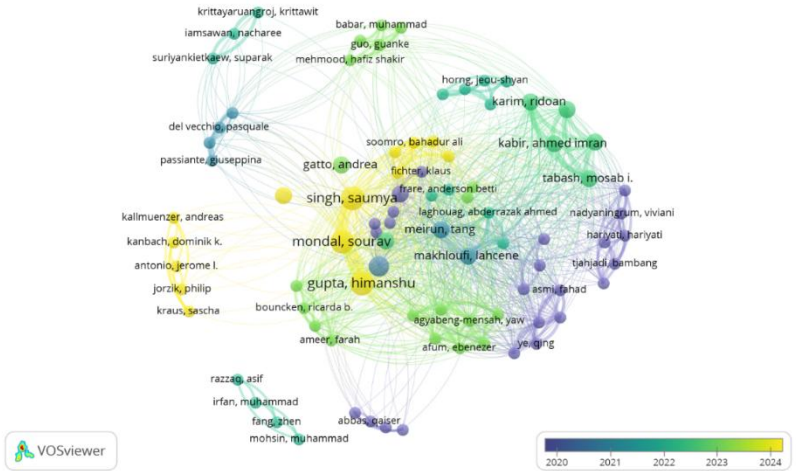


Figure 9

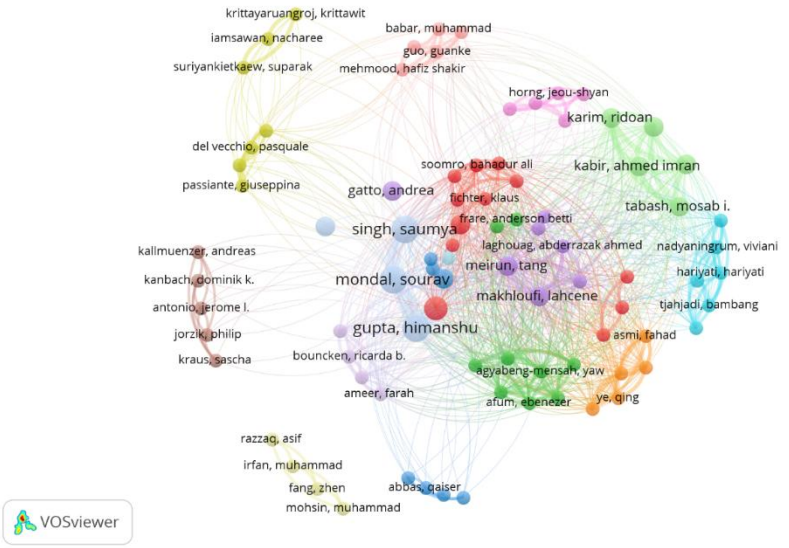


Table 8

Top authors by article count (full vs fractionalised)

Author	Articles	Articles (fractionalised)
Singh S	5	1.67
Gupta H	4	1.33
Mondal S	4	1.33
Wang Y	4	2.08
Zhang J	4	0.98
Haldar S	3	3.00
Khan A	3	0.70
Li J	3	1.00
Wang Z	3	0.83
Zhang Y	3	0.78

Interpretation. It is advisable to report full and fractionalised productivity in bibliometric best practice, as it differentiates between the volume of participation and the proportionate contribution in collaborative disciplines (Donthu et al., 2021; Zupic and Čater, 2015).

Top Affiliations (Institutional Productivity)

At the institutional level, there were five articles from City University of Macau, Guangzhou University, and the University of Beira Interior, followed by Jiangsu University, Taylor, Universiti Utara Malaysia, and the University of Bologna (four each). This trend implies that productivity has been decentralised to a few repeated institutions throughout Asia and Europe, in line with the internationalisation of the research field in general.

Figure 10

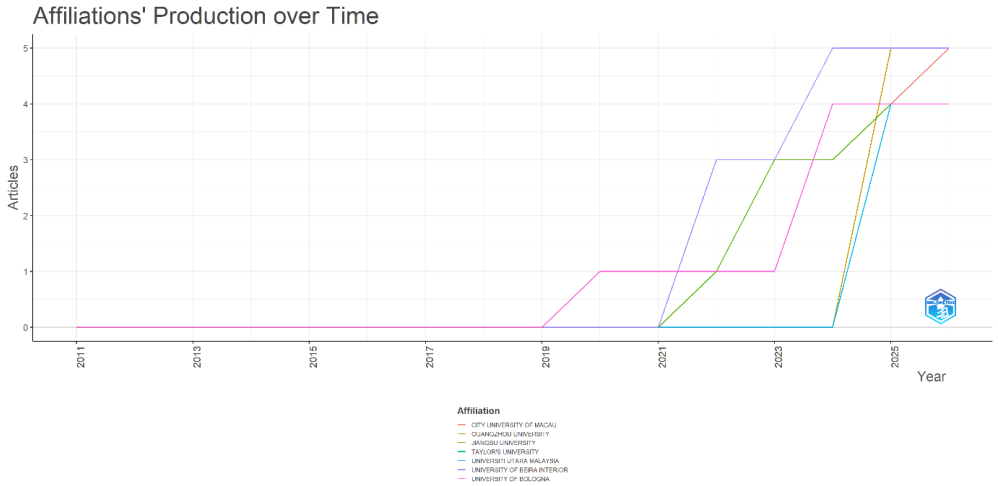


Table 9

Top affiliations by number of articles

Affiliation	Articles
City University of Macau	5
Guangzhou University	5
University of Beira Interior	5
Jiangsu University	4
Taylor's University	4
Universiti Utara Malaysia	4
University of Bologna	4
Al-Ahliyya Amman University	3
Amrita School of Business	3
Anhui University of Finance and Economics	3

Interpretation. The institutional distribution was a combination of universities in high-output countries (for example, China) and internationally collaborative systems (for example, European universities) which is consistent with the moderate-to-high rate of multi-country publications in the collaboration indicators of the dataset.

Top Countries by Articles (Productivity and Collaboration)

China (63 articles; 23.3% of the corpus) was the leader in country productivity. India was close (20), followed by Indonesia, Italy, and Malaysia with 11, 11, and 11, respectively. The patterns of collaboration varied significantly across countries. China had moderate international cooperation (MCP% = 39.7%). In comparison, production in India was mainly domestic (MCP% = 10.0%). There were very high collaboration ratios evident in Malaysia and the United Kingdom (81.8% and 83.3%, respectively), indicating that international co-authorship has been a key visibility mechanism of corresponding-authored production in these respective countries in this corpus.

Figure 11

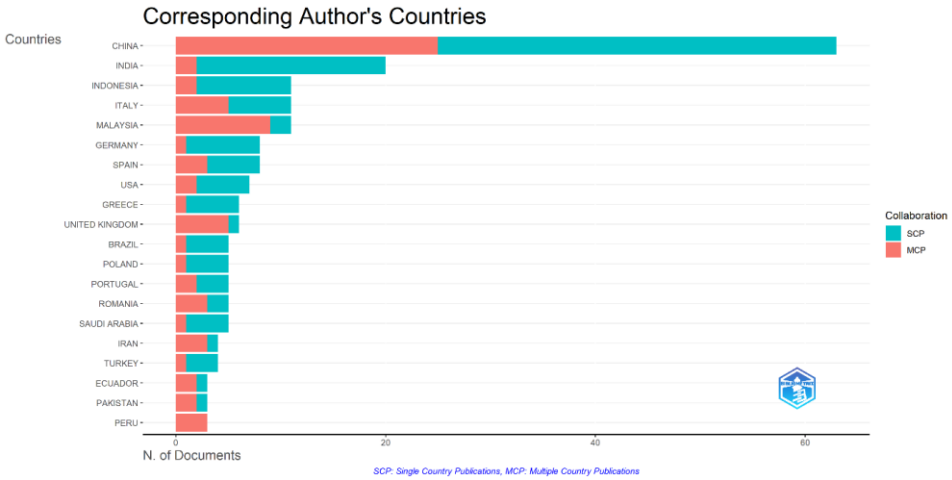


Table 10

Top Corresponding-Author Countries by Articles and Collaboration

Country	Articles	Articles %	SCP	MCP	MCP %
China	63	23.3	38	25	39.7
India	20	7.4	18	2	10.0
Indonesia	11	4.1	9	2	18.2
Italy	11	4.1	6	5	45.5
Malaysia	11	4.1	2	9	81.8
Germany	8	3.0	7	1	12.5
Spain	8	3.0	5	3	37.5
USA	7	2.6	5	2	28.6
Greece	6	2.2	5	1	16.7
United Kingdom	6	2.2	1	5	83.3

Interpretation. Heterogeneous participation strategies in the global knowledge network, represented by the divergence between high-volume domestic systems (for example, India) and high-collaboration systems (for example, Malaysia and the United Kingdom), are typical features of fast-growing interdisciplinary fields (Donthu et al., 2021).

Top Countries by Citations (Impact)

In the case of impacts determined using total citations (TC) and average citations per article, China still had the largest cumulative influence (TC = 1185). Nevertheless, the United Kingdom (67.8) and Thailand (61.0) had greater average citations per article, which means that certain countries produced less but with disproportionately large citation visibility. Malaysia was also highly cited (41.3) per article, which is in line with its high international collaboration ratio.

Figure 12

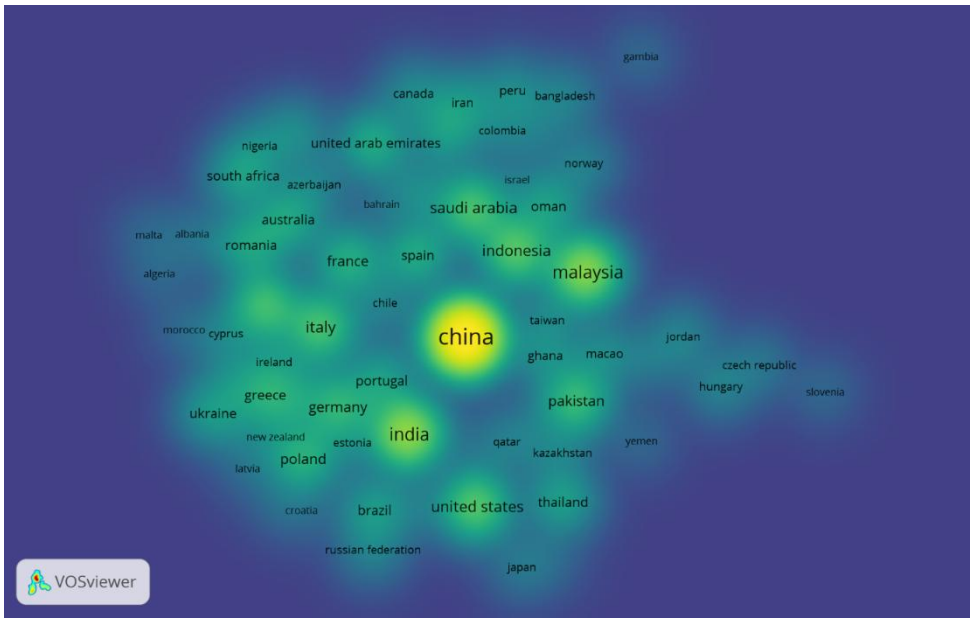


Figure 13

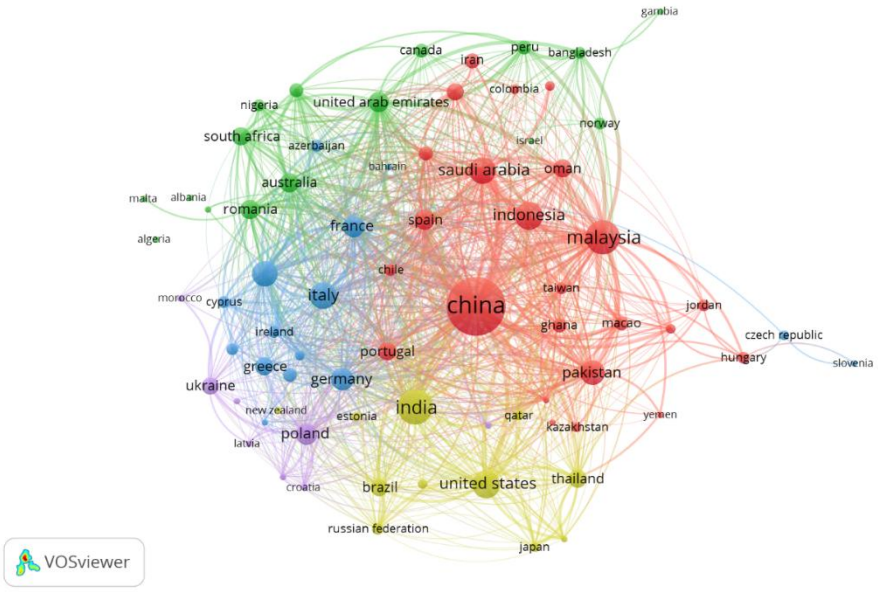


Table 11

Top Countries by Total Citations and Average Citations Per Article

Country	Total citations (TC)	Average citations per article
China	1185	18.80
Malaysia	454	41.30
India	427	21.40
United Kingdom	407	67.80
Spain	297	37.10

Country	Total citations (TC)	Average citations per article
Italy	236	21.50
Germany	195	24.40
Thailand	183	61.00
Brazil	179	35.80
Portugal	155	31.00

Top Documents (Most Cited)

The article with the most references in the corpus was Fang (2022) on Technological Forecasting and Social Change (TC = 335; TC/year = 67.0). A second significant anchor (TC = 318) was Bocken (2015) in the Journal of Cleaner Production. Business Strategy and the Environment by Makhloufi (2022) also had a high influence (TC = 266; TC/year = 53.2). The fact that these works are among the most referenced implies that the discipline has been influenced by (i) technology/transition-oriented sustainability research, (ii) foundations of cleaner production and sustainability strategy, and (iii) more recent analyses of sustainability/innovation at the firm level.

Figure 14

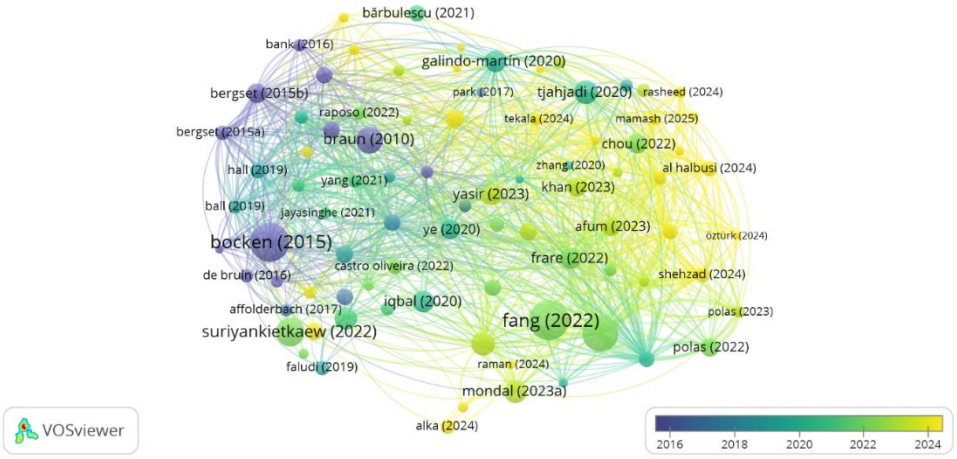


Figure15

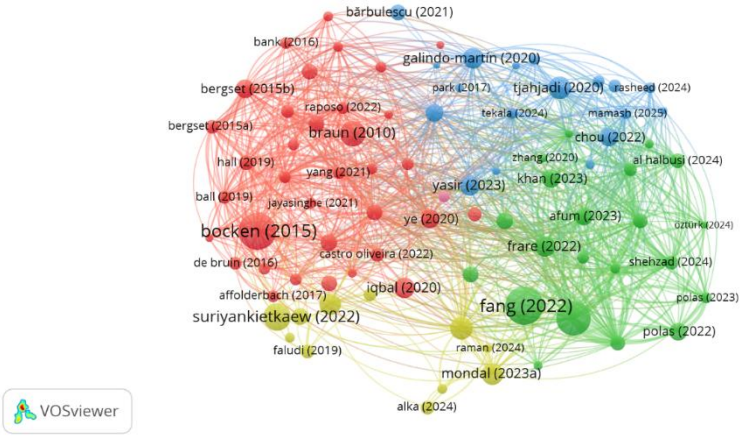


Table 12

Top Documents by Total Citations

Lead author (Year)	Source	DOI	Total citations	TC per year	Normalized TC
Fang (2022)	Technological Forecasting and Social Change	10.1016/j.techsoc.2021.101844	335	67.00	5.86
Bocken (2015)	Journal of Cleaner Production	10.1016/j.jclepro.2015.05.079	318	26.50	3.09
Makhloufi (2022)	Business Strategy and the Environment	10.1002/bse.2902	266	53.20	4.66
Suriyankietkaew (2022)	Sustainability	10.3390/su14105762	169	33.80	2.96
Braun (2010)	International Journal of Gender and Entrepreneurship	10.1108/17566261011079233	148	8.71	1.00
Tjahjadi (2020)	Journal of Open Innovation: Technology, Market, and Complexity	10.3390/joitmc6040173	115	16.43	2.27
Mondal (2023a)	Journal of Cleaner Production	10.1016/j.jclepro.2023.135999	115	28.75	3.66
Del Vecchio (2021)	International Journal of Entrepreneurial Behavior & Research	10.1108/IJEBR-03-2021-0210	105	17.50	3.04
Mondal (2023b)	Journal of Cleaner Production	10.1016/j.jclepro.2023.138433	104	26.00	3.31

Lead author (Year)	Source	DOI	Total citations	TC per year	Normalized TC
Galindo-Martín (2020)	Sustainability	10.3390/su12114467	99	14.14	1.96

Interpretation. The most mentioned set was based on two sets of foundational contributions (e.g. the 20102015 cohort) and high-velocity new papers (20222023), which points to a solid intellectual foundation and a fast-moving modern front. The inclusion of total citations along with citations-per-year assisted in dissociating the influence of history from that of acceleration.

Keyword Co-Occurrence (Cluster Structure)

Merged keywords (KW_Merged) were used to create a keyword co-occurrence network and partitioned using the Louvain community detection algorithm with association-based normalisation. The network was defined by a multi-centric form where sustainable development served as the main bridging concept, linking entrepreneurship- and innovation-oriented vocabularies. This type of clustering and co-word has been popularly applied to demonstrate conceptual organisation and research fronts in bibliometric reviews (Donthu et al., 2021; Zupic and Čater, 2015).

Figure 16

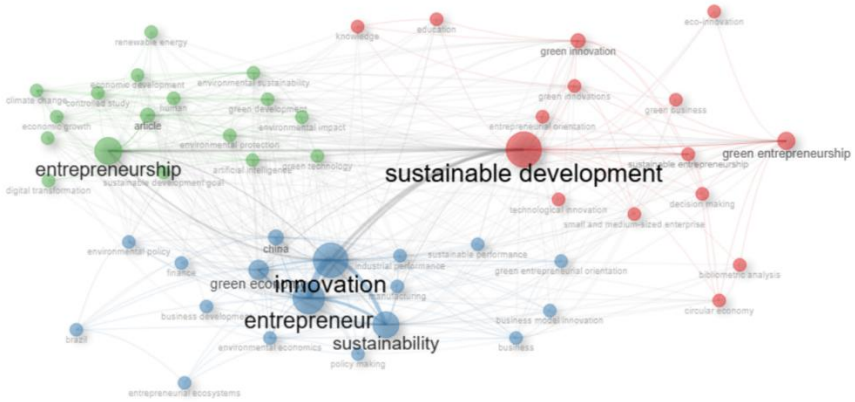


Figure 17

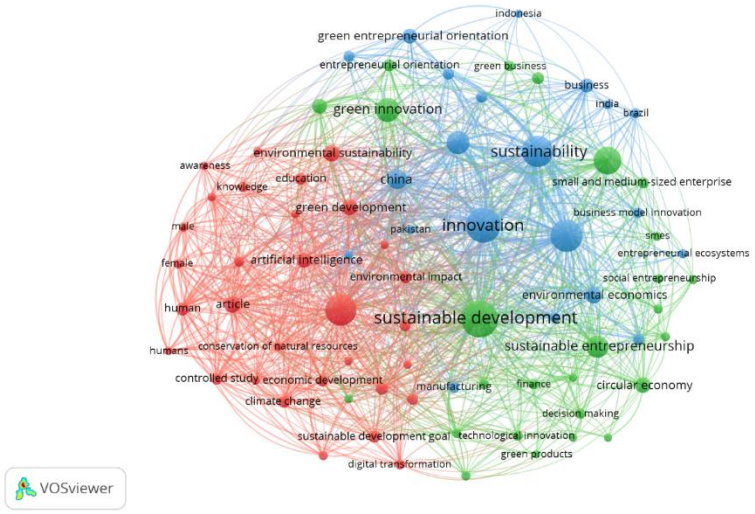


Figure 18

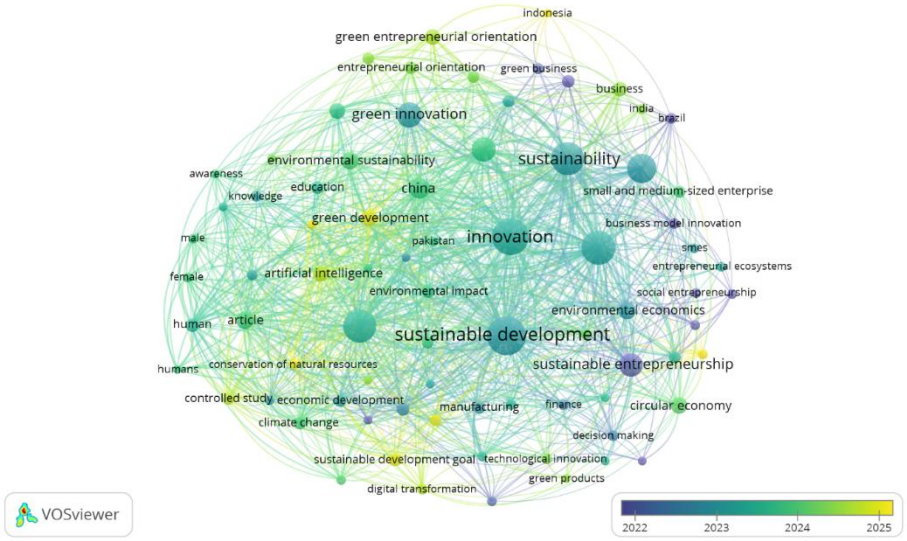


Table 13

Keyword Co-Occurrence Communities (All Keywords Network; Louvain)

Community	Core hubs (highest connectivity)	Secondary/bridging terms (illustrative)	Interpretation (concise)
Red: Green entrepreneurship & sustainable innovation	sustainable development; green entrepreneurship; green innovation; eco-innovation	sustainable entrepreneurship; entrepreneurial orientation; technological innovation; SMEs; decision making; circular economy; bibliometric analysis	The field's applied "business-for-sustainability" core was represented, in which entrepreneurship constructs were linked directly to green innovation and sustainable outcomes.
Green: Entrepreneurship in environmental & societal contexts	entrepreneurship; sustainable development; environmental sustainability	climate change; environmental impact; renewable energy; digital transformation; artificial intelligence; SDGs; green technology	A broader socio-environmental framing was reflected in which entrepreneurship was positioned within climate/energy transitions and policy-relevant sustainability agendas.
Blue: Eco-innovation, policy, and regional implementation	green eco-innovation; entrepreneur; sustainability	environmental policy; finance; manufacturing; industrial performance; environmental economics; entrepreneurial ecosystems; business model innovation; China; Brazil	Contextual and implementation-oriented work was emphasised, with policy, finance, and industrial settings shaping eco-innovation and green entrepreneurship pathways.

Interpretation. Sustainable development was introduced across communities as the overarching cross-cutting construct, and entrepreneurship and green eco-innovation served as key nodes, distinguishing between managerial/firm-level research and policy-wide policy/technology transition research. This trend is in line with how co-word analysis generally emerges in both overarching paradigms and sub-field specialisations (Donthu et al., 2021; Zupic and Čater, 2015).

Word Cloud (Dominant Terms)

A word cloud based on KW_Merged showed that the most common and defining words in the field were:

Sustainable development, green entrepreneurship, innovation, entrepreneurship/entrepreneur, circular economy, sustainability, sustainable entrepreneurship, green innovation/green innovations, green economy, green entrepreneurial orientation, and related application/method words such as environmental economics and artificial intelligence.

Figure 19

Interpretation. The fact that the terms green entrepreneurship and green innovation side by side with sustainable development hinted at the corpus being not organised as a niche, but as a broad sustainability paradigm with entrepreneurship and innovation being seen as practical instruments. The salience of artificial intelligence implies a new methodological/application change, which is in line with the theme of entrepreneurship motors outlined below.

Word tree (hierarchical co-occurrence narrative)

A word-tree style interpretation (root-to-branch thematic logic) was supported by the network structure:

Root: Sustainable Development

Branch 1: Entrepreneurship 1 - (green entrepreneurship; sustainable entrepreneurship; entrepreneurial orientation; SMEs)
Branch 2: Innovation = (green innovation; eco-innovation; technological innovation; green development)
•Branch 3: Circular economy —(environmental protection; decision making; business models)
Branch 4: Technology and methods: (artificial intelligence; digital transformation; environmental AI)

Figure 20

Interpretation. This domain was therefore understandable as a sustainability-focused research programme where entrepreneurship and innovation make up the primary explanatory variables, and circular economy and technology-enabled practices are significant specialisations.

Thematic (Strategic) Map: Centrality × Density (Kw_Merged)

Themes were categorised using a thematic strategic map according to centrality (relevance to the field) and density (internal development/cohesion). It is a typical bibliometric method for identifying mature (motor), basic (foundational), niche (specialised), and emerging/declining themes (Donthu et al., 2021; Zupic and Čater, 2015).

Figure 21

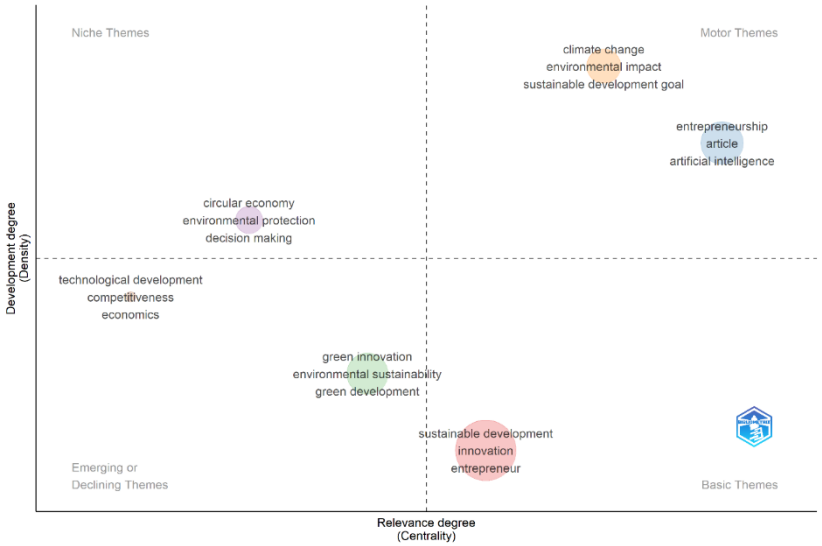


Table 14

Thematic Analysis

Cluster (color)	Quadrant classification	Defining keywords	Interpretation (concise)	Most central articles (PageRank as provided)
Climate Change (Orange)	Motor theme (high centrality, high density)	climate change; environmental impact; sustainable development goal	A mature, policy-anchored, and highly connected stream was indicated; SDGs operated as an explicit linkage to global sustainability governance.	Caglar AE (2025, Journal of Environmental Management, PR=0.35); Mai S (2025, Journal of Environmental Management, PR=0.273); Affolderbach J (2017, Local Environment, PR=0.174)
Entrepreneurship (Light Blue)	Motor theme (high centrality, high density)	entrepreneurship; article; artificial intelligence	Entrepreneurship research is positioned as the central engine of the field, with AI appearing as a contemporary driver of thematic consolidation and expansion.	Ye Q (2020, International Journal of Environmental Research and Public Health, PR=0.29); Zheng X (2025, PLOS ONE, PR=0.189); Zhang Q (2024, Sustainability, PR=0.142)
Circular Economy (Purple)	Niche theme (low centrality, high density)	circular economy; environmental protection; decision making	A specialised, internally cohesive stream was indicated, likely grounded in applied decision-making, sectoral implementations, and operational frameworks.	Burzyńska D (2018, Fibres & Textiles in Eastern Europe, PR=0.135); Mehmood K (2025, Technological Forecasting and Social Change, PR=0.132); Margherita A (2024, IEEE Transactions on Engineering Management, PR=0.132)
Technological Development (Brown)	Emerging/declining theme (low centrality, low density)	technological development; competitiveness; economics	A less-consolidated theme was indicated. The cluster appeared fragmented, suggesting a developing conceptual core or	Zhang J (2025, Journal of Environmental Management, PR=0.246); Zhang X (2020, International Journal of Environmental Research and Public

Cluster (color)	Quadrant classification	Defining keywords	Interpretation (concise)	Most central articles (PageRank as provided)
			heterogeneous operationalisation.	Health, PR=0.195); Chen P (2024, International Journal of Low-Carbon Technologies, PR=0.06)
Green Innovation (Green)	Emerging theme (moderate/low centrality; low density)	green innovation; environmental sustainability; green development	A rapidly growing research front was suggested, with boundaries still being consolidated. Interdisciplinarity is implied by the spread of sustainability, environmental systems, and service-oriented technology outlets.	Neupane BP (2025, Sustainability, PR=0.138); Dewiyani L (2025, Clean Environmental Systems, PR=0.116); Yin Y (2026, Service Oriented Computing and Applications, PR=0.107)
Sustainable Development (Red)	Basic theme (high centrality, low density)	sustainable development; innovation; entrepreneur	A foundational "connective tissue" theme was indicated. High centrality reflects field-wide dependence on the construct, whereas low density reflects broad, diffuse usage across multiple subfields.	Jorzik P (2024, Technological Forecasting and Social Change, PR=0.202); Zhao K (2025, Discover Sustainability, PR=0.198); Alka TA (2024, Discover Sustainability, PR=0.191)

Summed thematic implications of the study (terse): The corpus was structured in accordance with the major paradigm of sustainable development, and entrepreneurship and innovation became the key explanation levers. Motor themes were identified to include a mature climate-change/SDG stream and a central entrepreneurship stream (which is becoming increasingly associated with AI/digital transformation). Green innovation was also reported as a new frontier, which is consistent with the wider phenomenon that research on sustainability based on innovation has gained momentum over the past few years. Features: Specialisation and internal consistency circular economy: This implies high levels of deep-dive sub-analyses (e.g. industry-specific decision-making frameworks and implementation logics).

Co-citation Network (Intellectual Foundations)

Cited References

The cited-reference co-citation network was understood as a representation of the intellectual base of the field, as the pairs of references that are commonly cited are expected to indicate some common theoretical assumptions, methodological options, or mobilised explanatory mechanisms (Zupic & Čater, 2015). The co-citation pattern in the current data set was described by evident clustering and

significant overlap of the methodological and theoretical community, which means that conceptual evolution in the field has been highly influenced by sophisticated empirical modelling activities.

Methodological core: A common infrastructure of quantitative causal modelling.

A small number of nodes in the network were dominated by references related to quantitative causal modelling, especially the PLS-SEM tradition and associated advice on measurement validity, model evaluation, and mediation/moderation testing. The dominance of methodology experts (e.g. those often related to PLS-SEM and best practices in SEM, such as Sarstedt and Ringle) and moderation/mediation experts (for example, Preacher) implies that a large part of the empirical literature has been designed with a focus on variance-based SEM, moderated mediation, and construct validation. This focus was seen as reflecting the fact that the field is not yet purely conceptual or descriptive; instead, it has coalesced a relatively standardised repertoire of quantitative methods to test multi-path models that connect entrepreneurship constructs with the results of innovation and sustainability. This methodological clustering is characteristic of the area, where modelling based on surveys prevails, and the research questions are characterised by indirect effects and contingency hypotheses (Hair et al., 2019; Zupic and Čater, 2015).

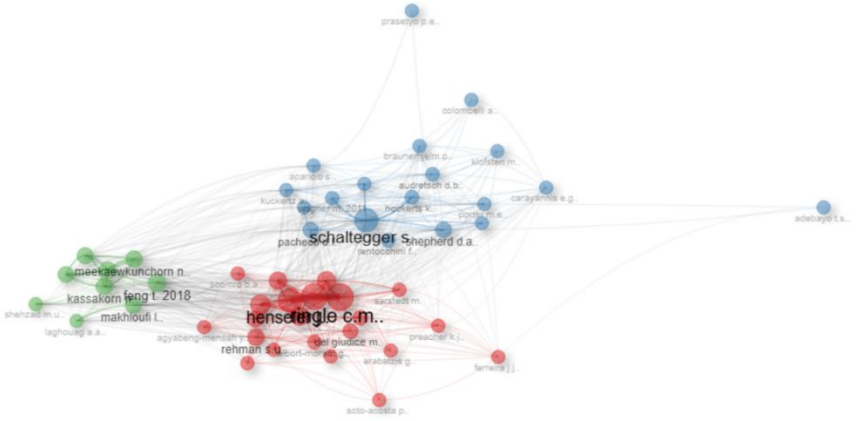
Theoretical community: Sustainability strategy and entrepreneurial cognition.

The second big community included the groundwork in corporate sustainability, sustainable entrepreneurship, and entrepreneurial cognition, as indicated by the high co-citation levels of authors such as Schaltegger, Audretsch, and Shepherd. This cluster was interpreted as the fundamental theoretical foundation on which the field conceives entrepreneurship as a driver of sustainability transitions and views innovation as the behavioral/strategic deliverable of sustainability-oriented venturing. The importance of these theorists suggests that sustainable entrepreneurship studies in this corpus have been inclined to be simultaneously informed by (a) sustainability management and strategy traditions and (b) the opportunity recognition, entrepreneurial action, and performance implications of this entrepreneurship theory. Consequently, the entrepreneurship-innovation nexus has been conceptualised as a resource/capability phenomenon as well as a cognition-driven and agency-driven process that is compatible with how sustainable entrepreneurship mediates between environmental management and entrepreneurship research (Schaltegger and Wagner, 2011; Shepherd and Patzelt, 2011).

Structural overlap: Theory and methods share development.

One of the most informative aspects of the network was the high level of interconnection between the methodological cluster and the sustainability/entrepreneurship theory cluster. This trend was seen to represent a sign that the theoretical statements of the field have been empirically operationalised and refined through sophisticated statistical testing, as opposed to being developed more through qualitative theorising. In practice, this overlap implies that constructs such as green entrepreneurial orientation, green entrepreneurship, and green innovation have been repeatedly defined in SEM-style path models, and mediators and moderators have been utilised to test mechanism-based explanations (e.g. learning, capabilities, and institutions). Such an overlap of co-citations tends to be an indicator that the engine of theory-building in a domain is tightly tied to a fixed methodological instrument (Donthu et al., 2021; Zupic and Čater, 2015).

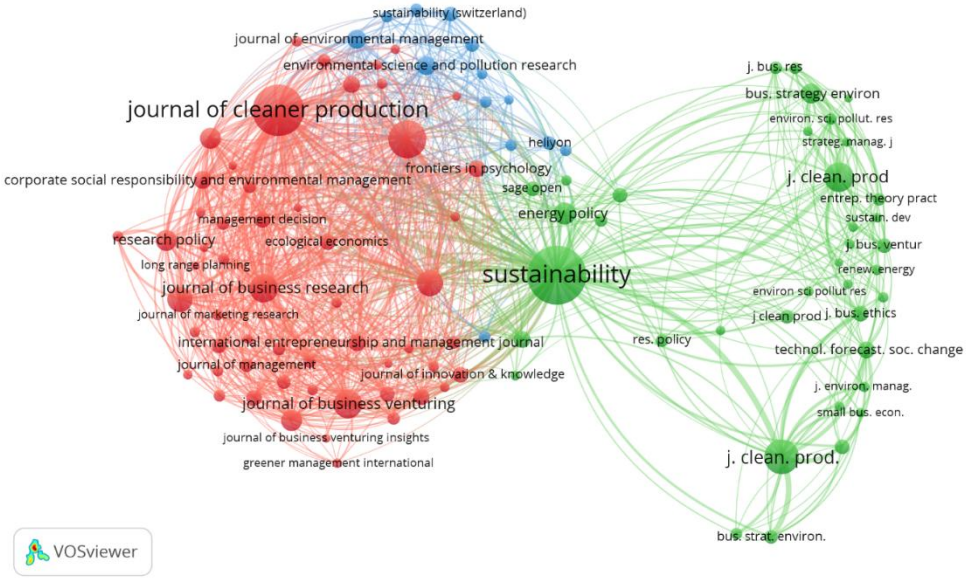
Figure 22



Source Co-citation Network (Journal-level intellectual structure)

The interdisciplinary but management-based intellectual foundation of the source co-citation network is mainly supported by a central business and environmental strategy cluster that includes journals such as the Journal of Cleaner Production and the Journal of Business Research. Two separate subsets are added to this core: one dedicated to sustainability transitions and technological forecasting, and the other to environmental science and applied management.

Figure 23

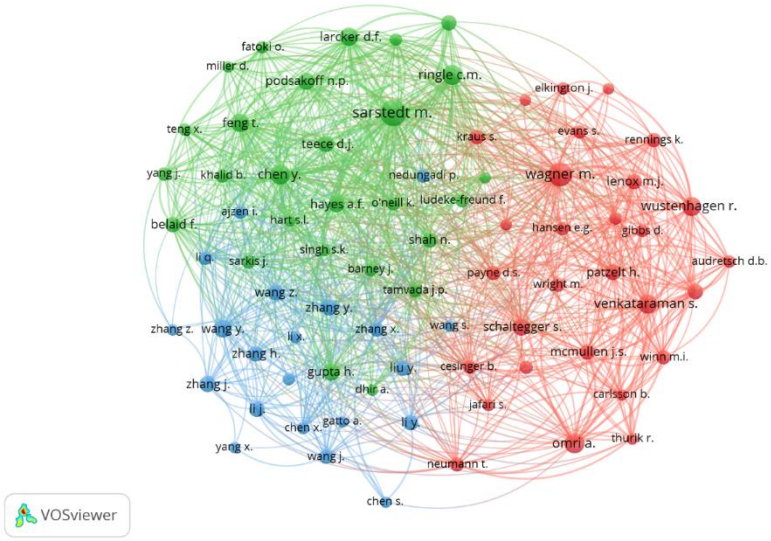


Author Co-citation Network (scholar communities: methods vs theory)

On the same basis as this systematised ground, the co-citation network of this author shows a well-defined bipolar split. It divides an integrated methodological community of heavy dependency on

SEM/PLS-SEM norms under the aegis of experts such as Sarstedt and Ringle by a consistent theoretical community of sustainable entrepreneurship and innovation theory led by Schaltegger, Wagner, and Venkataraman.

Figure 24



Interpretation. Hence, both the separation into method and theory communities, as well as their observed interconnection, indicated that the field has been marked by high methodological codification combined with tight theoretical anchoring. Such a structure aligns with a research field in which empirical advancement is achieved via repeated testing of hypothesis-rich models (direct effects, mediation, moderation) connecting constructs of sustainable entrepreneurship to outcomes of innovation and sustainability.

Discussion

Beyond the mere presentation of descriptive results, the bibliometric patterns revealed some implications. First, the broad distribution of 270 articles across 151 sources indicates that the knowledge base has developed more through outlet diversification than by concentrating around a narrow entrepreneurship or innovation core. Although Sustainability (Switzerland) served as a high-volume hub, the simultaneous prominence of the Journal of Cleaner Production, Journal of Business Research, Business Strategy and the Environment, and Technological Forecasting and Social Change suggests that communities of sustainability management, environmental strategy, and technology-transition have co-created the field. Such dispersion is considered indicative of an interdisciplinary field that defines its theoretical lexicon (Donthu et al., 2021; Zupic & Čater, 2015).

Second, the thematic map suggested a conceptual division of labour. Sustainable development was found to be a core theme (high centrality, low density), suggesting that it has functioned largely as an umbrella framing and not a tightly specified mechanism space. In contrast, climate change and entrepreneurship (with artificial intelligence in view) appeared as motor themes, suggesting that the field's most internally developed and externally connected discourses have been structured around climate-policy urgency and entrepreneurship-centred explanatory models. Green innovation has emerged as an emerging theme dominated by a number of influential recent papers, suggesting that theorisation specific to innovation is growing but not yet fully consolidated into a thick and standalone conceptual programme.

Third, the author and source co-citation structures demonstrated that theory building has been tightly coupled with a methodological infrastructure. A solid methodological foundation rooted in

PLS-SEM and mediation/moderation analytics was revealed, likely reflecting a specialisation with suggesting-mechanism model estimates as standard practice. This corresponds with the fact that constructs such as green entrepreneurial orientation and green innovation are also often subject to empirical testing in an SEM model (Appiah et al., 2023; Guo et al., 2020; Muangmee et al., 2021), together with reporting norms for methodological analysis of PLS-SEM (Hair et al., p. 2019). The implications of this are that a) theoretically, both methods driven construct convergence has emerged, meaning that repeated SEM operationalisations may be propelling standardisation further while simultaneously confirming the use of cross-sectional perceptual measurement underpinned by weak causal flow.

Fourth, collaboration and impact patterns suggest a networked effect of internationalisation that warrants explicit theorisation. High levels of citations at the same time as high international co-authorship (36.3%) and multiplied collaboration ratios for some countries (for Example Malaysia, United Kingdom) coexisted with high average citation rates, whereas much more domestication-concentrated systems (for example India) were less externally collaborative. Although causality cannot be inferred from these associations, it was hypothesised that internationally networked authorship benefitted from increased visibility via wider dissemination channels and access to diverse datasets and methods.

Separation between researchers and practitioners in the construct domain, flagged as the construct-boundary problem in the conceptual foundations, was further corroborated. Drawing on studies in which innovation is inherently rooted in green entrepreneurship, wherein the SE–GI relationship becomes nonobservational and risks tautological inference (Tekala et al., 2024), as described previously, future research should ensure discriminant validity by explicitly justifying causal ordering. Combined with reverse-direction models (i.e. innovation →entrepreneurship), these findings point to potential reverse dynamics and call for models able to make temporal inferences (Soomro et al., 2023; Tang et al., 2020). A next-step agenda is thus signalled whereby theory is developed by (i) untangling green innovation types (incremental/radical; product/process), (ii) integrating longitudinal or multi-source measures, and (iii) situating entrepreneurship–innovation linkages within the climate-policy domain and digital/AI transition contexts which have come to be regarded as motor themes.

Conclusion, Limitations, and Future Research Recommendations

Conclusion

The aim of this study is to map and synthesise a Scopus-indexed corpus on the interlinked area of sustainable/green entrepreneurship, green innovation, and sustainable development consisting of 270 articles covering the period from 2010 to 2026. The bibliometric evidence revealed a field with rapid growth, as seen in strong annual growth, and a sharp increase in publications after 2022, with particularly high output evident in 2024–2025. Despite this growth, there was a wide spread of dissemination across many different outlets, suggesting that the field is still interdisciplinary and not yet fully consolidated around a small number of specialist journals. Thematic (strategic) mapping, for instance, also indicated that sustainable development appears as a foundational but conceptually heterogeneous umbrella, while climate change and entrepreneurship (including new frontiers with artificial intelligence) both act as motor themes actively shaping the field's contemporary research agenda. In contrast, green innovation was identified as an emergent theme that is gaining traction, but the conceptual coherence within this theme is still under formation.

At the domain base level, citations-based and source co-citation structures suggested a field rooted in (a) sustainability strategy and sustainable entrepreneurship theorising and (b) a very strong quantitative-methodological basis/grounding, especially PLS-SEM, an mediation/moderation testing. This coupling means that theoretical development in the domain has mostly progressed through empirically testable, mechanism-rich modelling rather than purely conceptual work. In short, the findings underpin a perspective on a rapidly evolving research program where constructs of sustainable entrepreneurship and green entrepreneurship are increasingly employed to account for innovation pathways and sustainability outcomes, while at the same time, the thematic landscape

continues to expand across climate-policy and technology-facilitated sustainabilities (Donthu et al., 2021; Zupic & Čater, 2015).

Limitations

This study has several limitations. First, the dataset was limited to Scopus; therefore, relevant work published only in Web of Science, Google Scholar, or discipline-specific databases may have been neglected, and coverage biases by region/language or outlet type cannot be excluded. Second, bibliometric indicators (e.g. citation counts, PageRank, co-occurrence centrality) depend on time and availability; the inclusion of records from 2026 likely represents early access or in-press items, while more recent-year cohorts contain inherently reduced citation accumulation windows. Third, although useful for network interpretability, merged keywords can conceal nuances of the construct (e.g. differences between eco-innovation, green innovation performance, and green product innovation). Finally, bibliometric mapping does not establish cause and effect; it reveals structure and prominence, but cannot validate the substantive correctness of theoretical claims.

Future research Recommendations

Therefore, three directions are recommended. First, construct clarity should be reinforced by ensuring strict discriminant validity between constructs of entrepreneurship and innovation outcomes, especially avoiding green entrepreneurship definitions that embed innovation as part of the independent variable (tamping interpretability of entrepreneurship-to-innovation effects). Second, methodological diversity is required. Strong methodological clustering around PLS-SEM suggests a stronger call for longitudinal, multi-source, or quasi-experimental designs that could improve causal inference and help adjudicate alternative causal orderings (e.g. does innovation capability enable entrepreneurship orientation, or vice versa). Thematic opportunities from the strategic map suggest areas for targeted theory building: a green innovation position as an emergent topic area suggests there is scope for consolidating typologies (including incremental vs. radical; product vs. process; capability vs. output measures), while entrepreneurship appearing as a motor theme and the salience of artificial intelligence (AI) indicate that digitally enabled sustainability entrepreneurship and AI-supported environmental decision-making may be leading next-frontier topics. Such guidance would take the field from explosive growth into deeper theory building and more credible inference, aligned with best-practice expectations for cumulative bibilometric and integrative research in management and sustainability (Donthu et al., 2021; Zupic & Čater, 2015).

References

Abbas, N., Imtiaz, A., & Akram, A. (2025). INTEGRATING GREEN ENTREPRENEURSHIP WITH SUSTAINABILITY TRANSITIONS: A BIBLIOMETRIC SYNTHESIS AND FUTURE RESEARCH PATHWAYS. *Journal of Management Science Research Review*, *4*(4), 1298–1341. https://www.academia.edu/145351320/INTEGRATING_GREEN_ENTREPRENEURSHIP_WITH_SUSTAINABILITY_TRANSITIONS_A_BIBLIOMETRIC_SYNTHESIS_AND_FUTURE_RESEARCH_PATHWAYS
Google Scholar Worldcat Fulltext

Afzal, M. A., Ahmed, W., Abbas, N., & Shah, M. N. (2025). Exploring the Nexus Among Financial Advancement, Natural resources Rent, Green Innovation and Environmental Quality in Pakistan. *Sustainable Business and Society in Emerging Economies*, *7*(1), 39–52. https://doi.org/10.26710/sbsee.v7i1.3234
Google Scholar Worldcat Fulltext

Ahmadov, T., Nguyen, Q. M., Leitão, J., Chen, Q., Nhan, D. T. T., Burman, V., & Zhu, B. (2026). What Drives Open Innovation in Vietnamese Manufacturing Firms? Adaptive Capacity at the Nexus of Strategy and Orientation. *Journal of Open Innovation: Technology, Market, and Complexity*. https://doi.org/10.1016/j.joitmc.2026.100733
Google Scholar Worldcat Fulltext

Aljaeed, F., Alqahtani, N., & Khoja, B. (2026). Entrepreneurial Orientation and Knowledge-Driven Innovation. *Knowledge and Process Management*. https://doi.org/10.1002/kpm.70074
Google Scholar Worldcat Fulltext

Appiah, M., Sam, A., Twum, E., & Godslove, E. (2023). Modelling the influencing of green entrepreneurship orientation on sustainable firm performance: a moderated mediation model. *Economic Research-Ekonomska Istraživanja*, *36*. https://doi.org/10.1080/1331677X.2023.2179094
Google Scholar Worldcat Fulltext

Aria, M., & Cuccurullo, C. (2017). bibliometrix: An R-tool for comprehensive science mapping analysis. *Journal of Informetrics*, *11*(4), 959–975. https://doi.org/10.1016/j.joi.2017.08.007
Google Scholar Worldcat Fulltext

Asad, M., Sulaiman, M. A. B. A., Awain, A. M. S. B., Alsoud, M., Allam, Z., & Asif, M. (2024). Green entrepreneurial leadership, and performance of entrepreneurial firms: does green product innovation mediates? *Cogent Business & Management*, *11*. https://doi.org/10.1080/23311975.2024.2355685
Google Scholar Worldcat Fulltext

Donthu, N., Kumar, S., Mukherjee, D., Pandey, N., & Lim, W. M. (2021). How to conduct a bibliometric analysis: An overview and guidelines. *Journal of Business Research*, *133*, 285–296. https://doi.org/10.1016/j.jbusres.2021.04.070
Google Scholar Worldcat Fulltext

Ferreira, N., & Ferreira, J. J. M. (2024). Quo Vadis Sustainable Entrepreneurship? A Systematic Literature Review of Related Drivers and Inhibitors in SMEs. *IEEE Transactions on Engineering Management*, *71*, 9644-9660-9644–9660. https://doi.org/10.1109/TEM.2023.3305475
Google Scholar Worldcat Fulltext

Guo, Y., Wang, L., & Chen, Y. (2020). Green Entrepreneurial Orientation and Green Innovation: The Mediating Effect of Supply Chain Learning. *SAGE Open*, *10*. https://doi.org/10.1177/2158244019898798
Google Scholar Worldcat Fulltext

Gupta, M., & Dharwal, M. (2021). Green entrepreneurship and sustainable development: A conceptual framework. *Materials Today: Proceedings*. https://doi.org/10.1016/j.matpr.2021.08.148
Google Scholar Worldcat Fulltext

Jiwa, I. D. N. A., Arnawa, G., & Artaningsih, L. (2025). Green Entrepreneurial Orientation, Innovation Capability dan Kinerja Keberlanjutan Industri Garam Rakyat. *Widya Amerta*. https://doi.org/10.37637/wa.v12i1.2432
Google Scholar Worldcat Fulltext

Li, D., Gong, C., Palazzo, M., & Yousaf, Z. (2025). Unleashing Enviropreneurship Toward Innovation: Unraveling Frugal Innovation and Green Innovation Through Zero Waste Management in Circular Economy. *Corporate Social Responsibility and Environmental Management*. https://doi.org/10.1002/csr.3127

Google Scholar Worldcat Fulltext

Majali, T., Alkaraki, M., Asad, M., Aladwan, N., & Aledeinat, M. (2022). Green Transformational Leadership, Green Entrepreneurial Orientation and Performance of SMEs: The Mediating Role of Green Product Innovation. *Journal of Open Innovation: Technology, Market, and Complexity*. https://doi.org/10.3390/joitmc8040191
Google Scholar Worldcat Fulltext

Makhloufi, L., Tang, M., Belaîd, F., & Yaacob, N. (2021). Impact of Green Entrepreneurship Orientation on Environmental Performance: The Natural Resource-Based View Perspective. *Unknown Journal*. https://doi.org/10.21203/RS.3.RS-166004/V1
Google Scholar Worldcat Fulltext

Muangmee, C., Dacko-Pikiewicz, Z., Meekaewkunchorn, N., Kassakorn, N., & Khalid, B. (2021). Green Entrepreneurial Orientation and Green Innovation in Small and Medium-Sized Enterprises (SMEs). *Social Sciences*, *10*, 136. https://doi.org/10.3390/SOCSCI10040136
Google Scholar Worldcat Fulltext

Narwal, M., Purshotam, P., & Himanshi, H. (2025). Bibliometric Exploration of Innovation and Entrepreneurship in the Context of Sustainable Development Goals. *Journal of Management and Entrepreneurship*. https://doi.org/10.70906/20251902077088
Google Scholar Worldcat Fulltext

Rahmawati, R., Astuti, W., & Supanto, F. (2024). The Impact of Green Entrepreneurial Orientation and Greenmarket Orientation on SME's Performance: The Role of Green Innovation. *KnE Social Sciences*. https://doi.org/10.18502/kss.v9i29.17273
Google Scholar Worldcat Fulltext

Roshid, Md. M., Saiyed, S., Karim, R., Haque, T., Siddique, Md. S. R., Haque, M. A., Kumar, V., & Habib, S. (2025). The Role of Green Entrepreneurship in Driving Sustainable Innovation in Bangladesh's Startup Ecosystem: Insights from a Belt and Road Emerging Market. *Environment, Innovation and Management*. https://doi.org/10.1142/s3060901125500103
Google Scholar Worldcat Fulltext

Shammre, A. S. Al, Alshebami, A., Seraj, A. H. A., Elshaer, I., & Marri, S. H. Al. (2023). Unleashing environmental performance: The impact of green entrepreneurial motivation on small enterprises. *Unknown Journal*, *11*. https://doi.org/10.3389/fenvs.2023.1176804
Google Scholar Worldcat Fulltext

Soomro, B., Moawad, N. F., Saraih, U., Abedelwahed, N. A. A., & Shah, N. (2023). Going green with the green market and green innovation: building the connection between green entrepreneurship and sustainable development. *Kybernetes*, *53*, 1484-1504-1484–1504. https://doi.org/10.1108/k-09-2022-1353
Google Scholar Worldcat Fulltext

Sulemana, M., Tutu-Boahene, B., Owusu, S. O., & Akrofi, B. (2026). The role of absorptive capacity in strengthening entrepreneurial innovation and agribusiness competitiveness among food processing SMEs in Ghana. *Discover Agriculture*, *4*. https://doi.org/10.1007/s44279-025-00466-3
Google Scholar Worldcat Fulltext

Tang, M., Makhloufi, L., & Hassan, M. G. (2020). Environmental Outcomes of Green Entrepreneurship Harmonization. *Sustainability*. https://doi.org/10.3390/su122410615
Google Scholar Worldcat Fulltext

Tekala, K., Baradarani, S., Alzubi, A., & Berberoğlu, A. (2024). Green Entrepreneurship for Business Sustainability: Do Environmental Dynamism and Green Structural Capital Matter? *Sustainability*. https://doi.org/10.3390/su16135291
Google Scholar Worldcat Fulltext

Van Eck, N., & Waltman, L. (2010). Software survey: VOSviewer, a computer program for bibliometric mapping. *Scientometrics*, *84*(2), 523–538. https://doi.org/10.1007/s11192-009-0146-3
Google Scholar Worldcat Fulltext

Zupic, I., & Čater, T. (2015). Bibliometric methods in management and organization. *Organizational Research Methods*, *18*(3), 429–472. https://doi.org/10.1177/1094428114562629
Google Scholar Worldcat Fulltext