Revue Internationale des Sciences de Gestion
ISSN: 2665-7473
Volume 9 : Numéro 2

Dynamics of Entrepreneurship and Innovation: A Bibliometric Analysis

Les dynamiques de l'entrepreneuriat et de l'innovation : Une analyse bibliométrique

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Date submitted : 21/02/2026

Date of acceptance : 12/04/2026

To cite this article :

LAHMIDI W. & LAHMIDI Z. (2026) «Dynamics of Entrepreneurship and Innovation: A Bibliometric Analysis», Revue Internationale des Sciences de Gestion « Volume 9 : Numéro 2 » pp : 236 - 259

Abstract

Over the past two decades, scholarly interest in the relationship between entrepreneurship and innovation has grown markedly, reflecting their central role in economic transformation and sustainable development. Despite this expansion, a systematic understanding of how research at their intersection has evolved over time remains limited.
This study addresses this gap by examining the evolution, thematic structure, and research trajectories of entrepreneurship–innovation scholarship. A bibliometric analysis is conducted using 4,580 publications indexed in the Scopus database (2000–2025), analyzed through VOSviewer and Biblioshiny.
The results reveal strong and sustained growth in scientific output, with a marked acceleration after 2015, alongside increasing international collaboration. China and the United States emerge as leading contributors, while European institutions demonstrate consistent engagement. Core themes related to entrepreneurship and innovation remain dominant, while emerging topics emphasize sustainability, education, and digital transformation. These findings highlight a field in active thematic reconfiguration, with significant implications for both theory and practice. Unlike prior reviews focused on a single dimension, this study offers an integrative and reproducible mapping of the nexus over 25 years.

Keywords : Entrepreneurship, Innovation, Bibliometric Analysis, VOSviewer, Biblioshiny.

Résumé

Au cours des deux dernières décennies, l'intérêt académique pour la relation entre entrepreneuriat et innovation a considérablement progressé, reflétant leur rôle central dans la transformation économique et le développement durable. Malgré cette expansion, une compréhension systématique de l'évolution de la recherche à leur intersection demeure limitée.
Cette étude comble cette lacune en examinant l'évolution, la structure thématique et les trajectoires de recherche de la littérature sur le nexus entrepreneuriat–innovation. Une analyse bibliométrique est conduite à partir de 4 580 publications indexées dans la base de données Scopus (2000–2025), analysées via VOSviewer et Biblioshiny.
Les résultats révèlent une croissance forte et soutenue de la production scientifique, avec une accélération marquée après 2015, accompagnée d'une collaboration internationale croissante. La Chine et les États-Unis s'imposent comme les principaux contributeurs, tandis que les institutions européennes affichent un engagement constant. Les thèmes centraux liés à l'entrepreneuriat et à l'innovation restent dominants, tandis que les sujets émergents mettent l'accent sur la durabilité, l'éducation et la transformation numérique. Ces résultats témoignent d'un champ en recomposition thématique active, avec des implications significatives pour la théorie et la pratique. Contrairement aux revues antérieures centrées sur une seule dimension, cette étude propose une cartographie intégrative et reproductible du nexus sur 25 ans.

Mots clés : Entrepreneuriat, Innovation, Analyse bibliométrique, VOSviewer, Biblioshiny.

Introduction

Over the past two decades, scholarly interest in the relationship between entrepreneurship and innovation has grown markedly, reflecting their central role in shaping contemporary economic and social systems (Okuonzi et al., 2025).

Recent research increasingly portrays entrepreneurship as a practical channel through which innovative ideas are translated into action, particularly in response to pressing global challenges such as climate change, digital transformation, and the shift toward greener economic models (Bacigalupo et al., 2021; Kumar & Gundarapu, 2025). Innovation, in turn, sustains entrepreneurial activity by continuously renewing its foundations and preventing stagnation (Spena et al., 2025). Together, these two forces contribute not only to competitiveness and economic growth, but also to broader objectives related to sustainable development, social inclusion, and environmental responsibility (Singh & Aggarwal, 2021).

Despite this substantial body of work, existing bibliometric reviews have largely focused on single dimensions—either entrepreneurship or innovation—without systematically capturing their evolving intersection. In particular, the roles of sustainability transitions, digital transformation, and the post-2015 acceleration in knowledge production remain underexplored from a bibliometric standpoint. This study addresses this gap by mapping not only the structural growth of the field, but also its thematic reconfiguration in response to contemporary societal challenges—an endeavor that is especially timely given the expanding role of entrepreneurship and innovation in addressing complex economic and social transformations.

Against this background, the present study seeks to answer the following central research question: ***How has scientific research at the intersection of entrepreneurship and innovation evolved over time?*** This overarching question is further explored through three guiding sub-questions: Which conceptual and thematic patterns characterize the entrepreneurship–innovation literature? How have these patterns shifted over time, and what major research trajectories can be identified? And what do these developments imply for future academic inquiry and for entrepreneurial and innovation-oriented practice?

The contribution of this study is threefold. First, it documents the quantitative expansion of the entrepreneurship–innovation field over a 25-year period, with particular attention to the acceleration observed after 2015. Second, it maps the thematic reconfiguration of the field, evidencing a shift from firm-level performance topics toward sustainability, education, and digital transformation. Third, by combining VOSviewer network analysis with Biblioshiny's descriptive indicators, it offers an integrative and reproducible portrait of the field's intellectual structure—a methodological pairing not previously adopted in bibliometric reviews of this domain.

The article is organized as follows. Section 1 presents the conceptual framework, examining the nature of entrepreneurship and innovation and their interrelationship. Section 2 develops the theoretical framework underpinning the study. Section 3 outlines the methodological approach, including its justification and the scope of the analysis. Section 4 reports the bibliometric results. Section 5 discusses these findings and draws out their theoretical and practical implications.

1. Conceptual Framework

The conceptual framework aims to explain entrepreneurship and innovation.

1.1. Understanding Entrepreneurship

Entrepreneurship can be defined as the process of recognizing opportunities, mobilizing resources, and implementing ideas into viable ventures with the aim of generating both economic and social value (Priyadi & Mulyani, 2024). To support this process, entrepreneurial ecosystems evolve through recursive interactions among individuals, institutions, innovations, and ideologies, forming dynamic learning systems that facilitate adaptation and growth (Khurana & Dutta, 2025).

In recent years, entrepreneurship has increasingly been recognized as a multifaceted phenomenon, giving rise to distinct forms. One prominent form is technological entrepreneurship, defined as the

pursuit of opportunities enabled by technological innovation (Jermouni & El kadiri, 2026). It involves assembling resources, managing risks, and scaling ventures, with entrepreneurial activity shaped by the recognition of technological potential and its translation into viable commercial or societal solutions (Giones & Brem, 2021).

A second form is social entrepreneurship, which generates social value through the production or delivery of goods and services that address persistent societal problems (Maaroufi & Aamara, 2022). These enterprises place a social mission at the center of their strategies, prioritizing issues such as poverty, unemployment, education, health, local development, and environmental protection while maintaining economic activity (Osyka, 2021; Monteiro et al., 2022).

With the proliferation of digital technologies, digital entrepreneurship has emerged as a distinct domain in which new ventures are created or existing ones transformed through the development and commercialization of digital platforms and tools (Balan & Jiang, 2025). It encompasses the identification and exploitation of opportunities within the digital economy, the creation of digital products and services, and entry into digital markets (Bódis et Kiss, 2025).

Growing environmental and sustainability concerns have also given prominence to sustainable entrepreneurship, conceptualized as the integration of opportunity recognition with environmental stewardship and social responsibility to generate long-term value (Kraus et al., 2022). Closely related is green entrepreneurship, defined as entrepreneurial activity that directly contributes to environmental protection while maintaining economic viability, particularly through ecological innovation, green technologies, and sustainable business models (Parmentola et al., 2022).

1.2. Understanding Innovation

Innovation was initially conceptualized in predominantly technological terms, with emphasis placed on the development of new machines, tools, and production techniques designed to enhance industrial efficiency (Singh & Baral, 2025). In this early perspective, innovation was closely equated with scientific and engineering progress, where technological breakthroughs were regarded as the main drivers of productivity gains and industrial transformation (Anderson & Bhandari, 2025). Such a narrow understanding reflected the industrial revolutions of the nineteenth and early twentieth centuries, when advances such as the steam engine, electricity, and mechanized manufacturing reshaped economic systems and societal structures (Muralivallabhan, 2025; Li, 2025).
Over time, however, the concept of innovation has been broadened to encompass multiple forms beyond technology (Kaoutar, 2025). Recent scholarship has extended this scope to include social innovation, aimed at addressing societal challenges, and sustainable or green innovation, which emphasizes environmental stewardship and the creation of long-term value (Singh & Baral, 2025). This expanded view underscores that innovation cannot be confined to technological invention alone but should instead be understood as a multidimensional phenomenon integrating economic, social, organizational, and ecological dimensions (Muralivallabhan, 2025; Kaoutar, 2025).

2.Theoretical Framework

A multidimensional understanding of the entrepreneurship–innovation nexus has been developed through several theoretical perspectives, each highlighting different mechanisms by which innovation is generated, mobilized, and scaled through entrepreneurial action.
One of the most influential frameworks is the Schumpeterian Innovation Theory (Schumpeter, 1934). In this view, entrepreneurship is defined by the process of creative destruction (Schumpeter, 1934; 1942), whereby existing markets, industries, and technologies are disrupted through the introduction of new products, services, or processes. Entrepreneurs are thus portrayed not as routine managers but as agents of radical innovation who drive transformative economic change (Schumpeter, 1934; 1942). The core link advanced in this theory is that innovation defines entrepreneurship itself, with entrepreneurial behavior being equated to innovation (Sandal, 2022). Its significance lies in Schumpeter's seminal contribution of reframing entrepreneurs as proactive disruptors rather than passive economic agents, a view reinforced by Acs and Audretsch (2005), who emphasized that

entrepreneurship and innovation are inseparable and that entrepreneurs act as change agents driving knowledge spillovers, productivity, and growth.

A complementary perspective is offered by the Entrepreneurial Opportunity Theory. Whereas Schumpeter emphasized disruption, Kirzner (1973) described entrepreneurs as alert individuals who identify overlooked opportunities—such as technological advances or regulatory changes—and create new spaces for entrepreneurial action. The essence of this theory is that innovation results from entrepreneurs exploiting opportunities, whether through incremental improvements or novel solutions. Its importance lies in broadening the conceptualization of innovation-driven entrepreneurship by recognizing that innovation can be both radical and adaptive, depending on the environmental context (Foss & Klein, 2010).

The Knowledge Spillover Theory of Entrepreneurship (Audretsch & Keilbach, 2007) further explains the nexus by conceptualizing entrepreneurship as the conduit through which unused or underutilized knowledge, often originating in universities or R&D laboratories, is transformed into innovation. Knowledge spillovers do not automatically yield economic or social value; instead, entrepreneurs are required to commercialize them through venture creation (Audretsch & Lehmann, 2005; Acs et al., 2009).

A dynamic dimension of the nexus is captured by the Dynamic Capabilities Theory (Teece et al., 1997). In this perspective, innovation is framed as a continuous and strategic process, embedded in the capacity of firms to integrate, build, and reconfigure competencies in response to volatile environments (Teece, 2009). Innovation is not regarded as a one-off outcome but as a core component of adaptive organizational behavior. The central link is that entrepreneurial action drives innovation through the reconfiguration of resources, enabling firms to sense opportunities, seize them, and transform capabilities accordingly. This theory's significance lies in positioning innovation as an ongoing, embedded process through which entrepreneurial firms achieve competitiveness and resilience.

Finally, the Triple Helix Model of Innovation (Etzkowitz & Leydesdorff, 2000) situates entrepreneurship and innovation within broader institutional interactions. Here, innovation is seen as the product of collaboration among universities, industry, and government, with entrepreneurs functioning as integrators and transformers of resources within these ecosystems. Its importance lies in recognizing that entrepreneurship is not an isolated endeavor but is embedded in systemic frameworks, where innovation flourishes through institutional co-evolution and collaboration (Etzkowitz, 2008).

3. Methodological framework

This section presents the methodological framework, beginning with the justification of the chosen approach, then defining the scope of the research.

3.1. Methodological Justification

The choice of bibliometric analysis as the methodological approach for this study is justified by its ability to provide a systematic, objective, and replicable assessment of the scientific knowledge base on innovation and entrepreneurship. Unlike narrative reviews, which are more susceptible to subjective interpretation, bibliometric methods rely on quantifiable indicators such as publication volume, citation impact, keyword co-occurrence, and thematic clustering, thereby ensuring a high level of methodological rigor (Karaduman & Başak, 2025; Santos et al., 2024).

Bibliometric analysis is particularly well suited to examining a field as dynamic as the intersection of entrepreneurship and innovation. It enables the identification of global research trends, intellectual structures, and thematic evolutions over time, making it possible to trace the historical underpinnings of the field while simultaneously detecting emerging topics and paradigmatic shifts (Harandi & HabibBeygi, 2025; Dima, 2021). This capacity is crucial for understanding how the research landscape evolves in response to technological, economic, and societal transformations.

The use of VOSviewer and Biblioshiny as data analysis tools is also methodologically justified due to their complementarity and efficiency in handling bibliometric datasets. VOSviewer is a powerful

software solution for visualizing collaboration networks and thematic relationships (Kaniawati et al., 2024). It enables the intuitive and graphical mapping of research dynamics and the identification of emerging themes (İRİ & Ünal, 2024). In parallel, Biblioshiny, developed under the R-Bibliometrix environment, provides robust descriptive and comparative analyses of scientific production, facilitating the evaluation of research trends and the measurement of academic impact (Mortazavi et al., 2021). The combined use of VOSviewer and Biblioshiny ensures a complete and rigorous bibliometric assessment, integrating intuitive network visualizations with in-depth quantitative analysis (Ertz & Leblanc-Proulx, 2019).

3.2. Research Scope

The search query combined entrepreneurship-related terms — including "entrepreneurship", "entrepreneurial", "social", "digital", "green", and "sustainable entrepreneurship" AND "innovation", "technological", "social", "green", "business model", and "digital innovation".
The field of study selected for this research comprises scientific publications indexed in the Scopus database over a 25-year period (2000–2025). This choice is supported by several methodological and scientific considerations. First, Scopus is one of the most comprehensive databases available, offering broader discipline coverage than Web of Science, particularly in social sciences and emerging economies (Baas et al., 2020; Mongeon & Paul-Hus, 2016). Second, the time frame of 2000–2025 was selected to capture the contemporary evolution of research at the intersection of entrepreneurship and innovation. This period enables the analysis of long-term trends, the identification of conceptual turning points, and the observation of how emerging themes—such as digitalization, sustainability, and green entrepreneurship—have progressively reshaped the field. Beginning in 2000 allows for the inclusion of the surge in scientific output associated with globalization and technological transformation, while extending the analysis to 2025 ensures the consideration of the most recent contributions.
Furthermore, the dataset was delimited by subject area. Specifically, the analysis focused on publications indexed under Business, Management and Accounting; Economics, Econometrics and Finance; Decision Sciences; Social Sciences; and Environmental Science. These fields were retained because they represent the core academic domains in which the entrepreneurship–innovation nexus has been most extensively examined, spanning organizational, economic, strategic, societal, and sustainability-related perspectives.

In terms of document types, this study concentrated on peer-reviewed journal articles, review papers, conference proceedings, and selected books or book chapters indexed in Scopus. Journal articles constitute the primary units of analysis in bibliometrics (Aria & Cuccurullo, 2017). Review papers also strengthen bibliometric analyses by consolidating knowledge domains and identifying the intellectual structures that guide research trajectories (Zupic & Čater, 2015). Conference proceedings were included because they play a particularly significant role in research areas such as innovation, entrepreneurship, and technology management, where emerging ideas are often first presented prior to journal publication (Hofer et al., 2010). Likewise, books and book chapters were retained to reflect the disciplinary traditions of entrepreneurship and innovation studies, in which foundational contributions have historically appeared in monographs or edited volumes rather than journal articles (Ferreira et al., 2019).

The corpus was restricted to English-language documents, as English dominates high-impact publishing in management and innovation studies (Donthu et al., 2021; Mongeon & Paul-Hus, 2016) and ensures the metadata standardization required for reliable keyword co-occurrence analysis and thematic mapping (Zupic & Čater, 2015).

Following initial extraction of 5,099 documents from Scopus, 519 were excluded through a three-step cleaning process: removal of 287 duplicates via Biblioshiny's deduplication function, exclusion of 94 records lacking abstracts, and elimination of 138 irrelevant documents through manual screening — yielding a final corpus of 4,580 publications.

4. Bibliometric Results

The bibliometric results are presented in two complementary stages. First, a descriptive analysis is conducted to provide an overview of the scientific production at the intersection of entrepreneurship and innovation. This analysis examines annual publication trends, source dynamics, authors' productivity, country and institutional contributions, as well as citation patterns. Second, a network analysis is performed to explore the underlying collaborative and intellectual structures of the field. This includes co-authorship networks at the author, country, and journal levels, keyword co-occurrence networks, document co-citation analysis, bibliographic coupling, and thematic mapping.

4.1 Descriptive Analysis

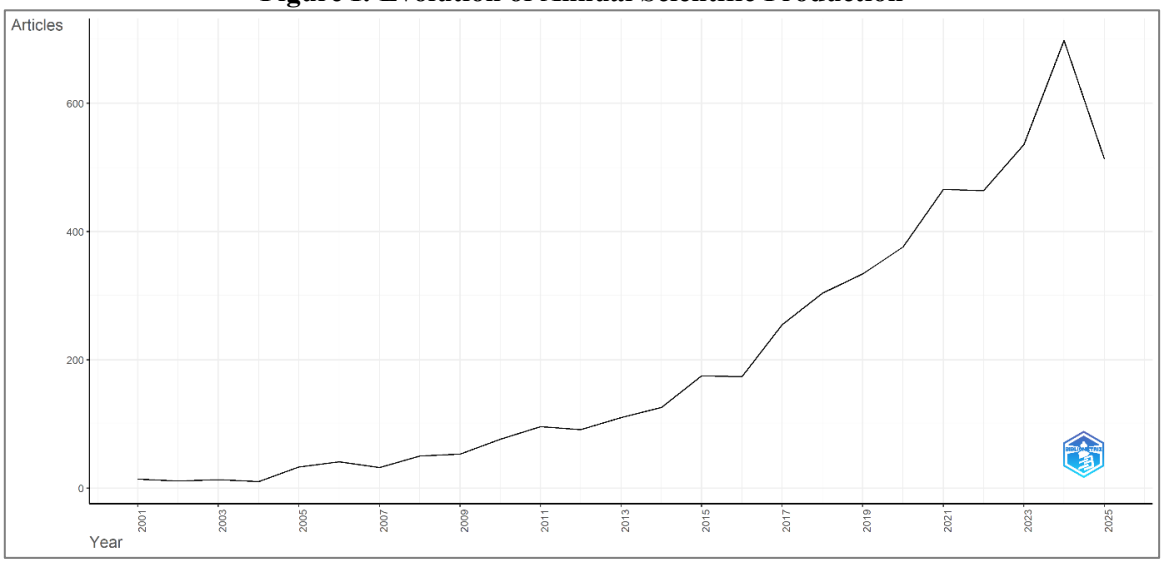
The descriptive analysis encompasses annual scientific production, source dynamics, authors' production, country contributions, affiliations' contributions, and citation patterns.

4.1.1. Annual Scientific Production

Figure I shows a clear and sustained increase in annual scientific publications between 2001 and 2025. Early research activity (2001–2008) remains limited, followed by a gradual rise after 2009 and a marked acceleration from 2015 onward, with a peak observed around 2024. The slight decline in 2025 is likely due to incomplete indexing of the most recent year rather than a reversal of the trend.

The 16.8% CAGR observed between 2001 and 2025 is not merely a proxy for growing academic interest; it reflects three identifiable structural drivers. First, the post-2015 acceleration coincides with the global adoption of the Sustainable Development Goals and the Paris Agreement, which repositioned entrepreneurship and innovation as policy-relevant mechanisms for addressing systemic challenges (United Nations, 2015). Second, the surge in output from 2017 onward aligns with the exponential growth of digital entrepreneurship as a distinct research domain, driven by platform economies and AI-enabled business models. Third, the proliferation of interdisciplinary journals—notably Sustainability (MDPI)—created new publication channels that absorbed a growing volume of empirically diverse contributions. This tripartite explanation moves beyond a simple 'interest' narrative toward a structured account of the field's expansion.

Figure I: Evolution of Annual Scientific Production



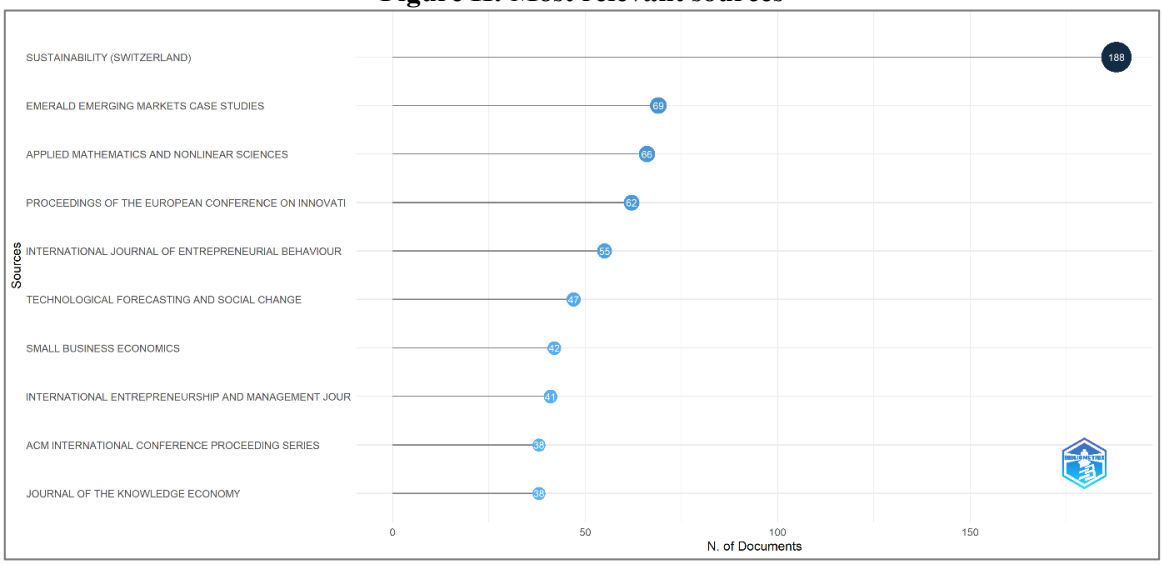
Source: Scopus, 2025

4.1.2. Source dynamics

Figure II reports the most productive publication sources within the dataset, revealing a pronounced concentration of scholarly output. Sustainability (Switzerland) clearly dominates, with 188 publications, substantially outperforming all other outlets. This prominence reflects the journal's broad interdisciplinary orientation and its strong positioning at the nexus of entrepreneurship, innovation, and sustainability research.

A second tier of sources—namely Emerald Emerging Markets Case Studies, Applied Mathematics and Nonlinear Sciences, and the Proceedings of the European Conference on Innovation and Entrepreneurship—demonstrates the complementary role of specialized journals and conference proceedings in structuring knowledge dissemination. Additional contributions from established outlets such as the International Journal of Entrepreneurial Behaviour and Research, Technological Forecasting and Social Change, and Small Business Economics further confirm the field's consolidation within leading entrepreneurship and innovation journals.

Figure II: Most relevant sources

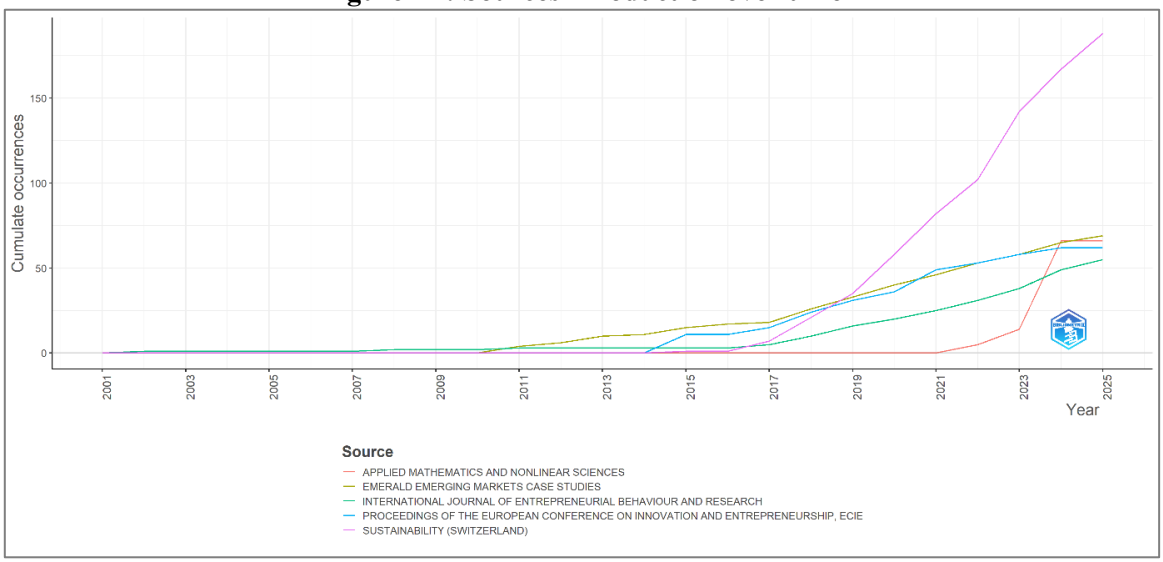


Source: Scopus, 2025

Figure III illustrates the temporal evolution of publication output across the most productive sources between 2001 and 2025, revealing differentiated growth trajectories. While most outlets display a gradual increase until the mid-2010s, a marked acceleration is observed after 2017, coinciding with the broader expansion of research at the intersection of entrepreneurship, innovation, and sustainability.

Sustainability (Switzerland) exhibits a particularly steep growth pattern, with a sharp rise in cumulative publications from 2018 onward, indicating its rapid consolidation as a leading outlet in the field. In contrast, sources such as Emerald Emerging Markets Case Studies, the Proceedings of the European Conference on Innovation and Entrepreneurship, and the International Journal of Entrepreneurial Behaviour and Research show more moderate yet steady growth, reflecting their consistent but less expansive publication dynamics. The late surge observed in Applied Mathematics and Nonlinear Sciences suggests a recent diversification of methodological and interdisciplinary contributions.

Figure III: Sources' Production over time



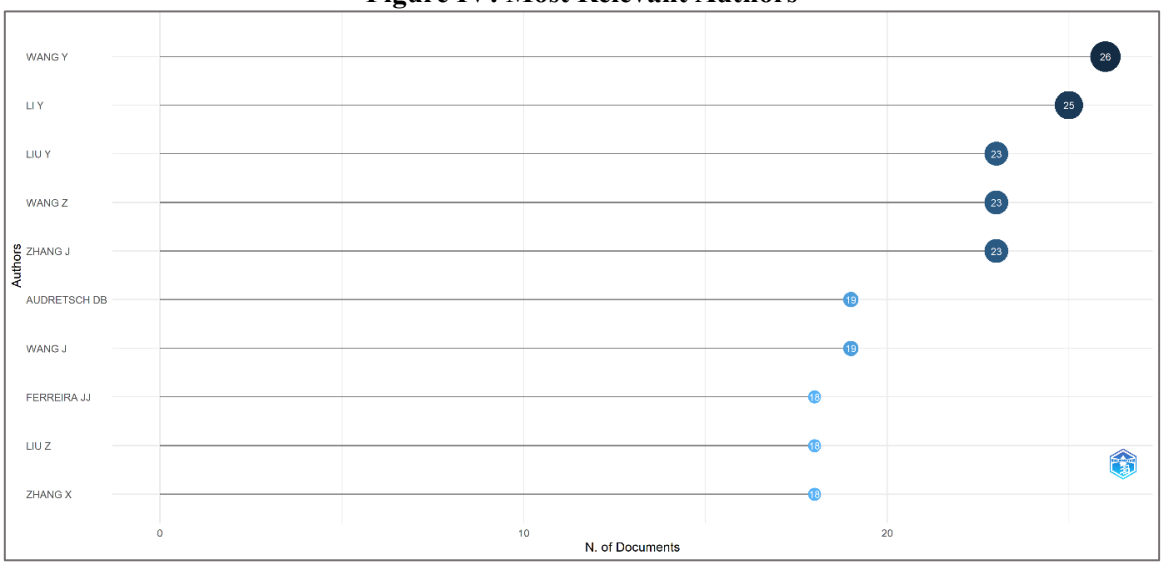
Source: Scopus, 2025

4.1.3. Authors Productivity Dynamics

Authors' productivity is examined through two complementary perspectives. The most relevant authors **(Figure IV)** identify the most productive contributors in the field, highlighting those with the highest publication output. The authors' production over time **(Figure 5)** complements this static ranking by revealing when productivity occurs, thereby capturing temporal patterns, continuity, and recent intensification of individual research trajectories.

Figure IV presents the most productive authors within the dataset, highlighting a clear concentration of scholarly output among a limited group of contributors. *Wang Y* emerges as the leading author with *26 publications*, followed closely by *Li Y (25 documents*) and *Liu Y, Wang Z, and Zhang J,* each contributing *23 publications*. This clustering at the top indicates a relatively competitive distribution among the most prolific authors rather than dominance by a single individual. A second tier of contributors, including *Audretsch D.B., Wang J., Ferreira J.J., Liu Z., and Zhang X.,* shows moderate yet substantial productivity, confirming their sustained engagement with the field.

Figure IV: Most Relevant Authors

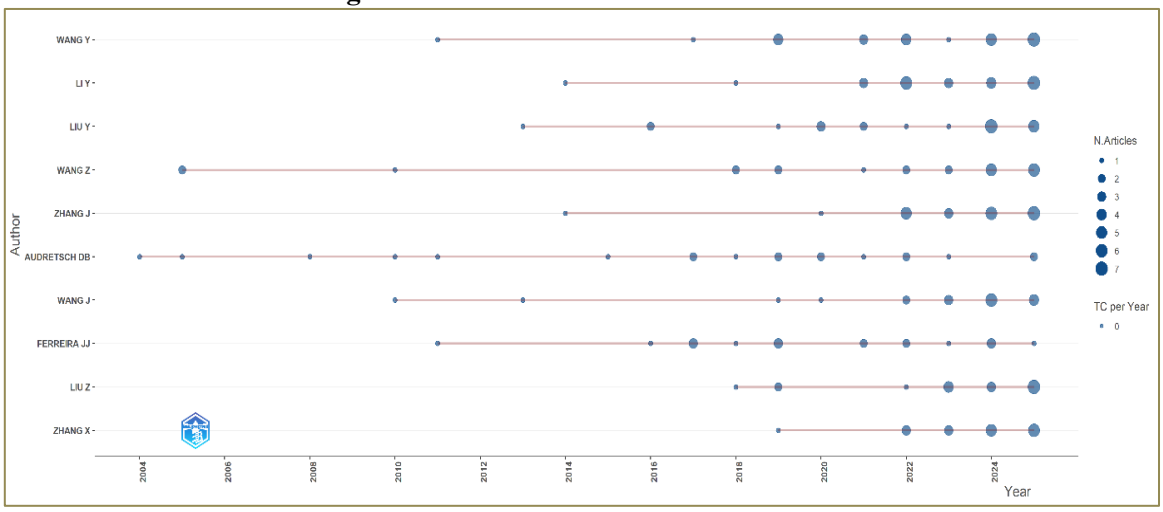


Source: Scopus, 2025

Figure V depicts the temporal evolution of publication activity among the most productive authors between 2001 and 2025, revealing heterogeneous productivity patterns. While several authors exhibit early but sporadic contributions, a marked intensification of output is observed after 2016, indicating the consolidation of sustained research trajectories within the field.

Leading authors such as Wang Y, Li Y, and Liu Y demonstrate continuous and increasingly dense publication activity in recent years, reflecting their long-term engagement and growing influence. In contrast, contributors including Audretsch D.B**.** and Ferreira J.J. display more evenly distributed outputs over time, suggesting consistent but less accelerated publication dynamics. The increasing size and frequency of markers in the later period further point to a rise in annual productivity, as well as greater citation visibility.

Figure V: Authors' Production over Time



Source: Scopus, 2025

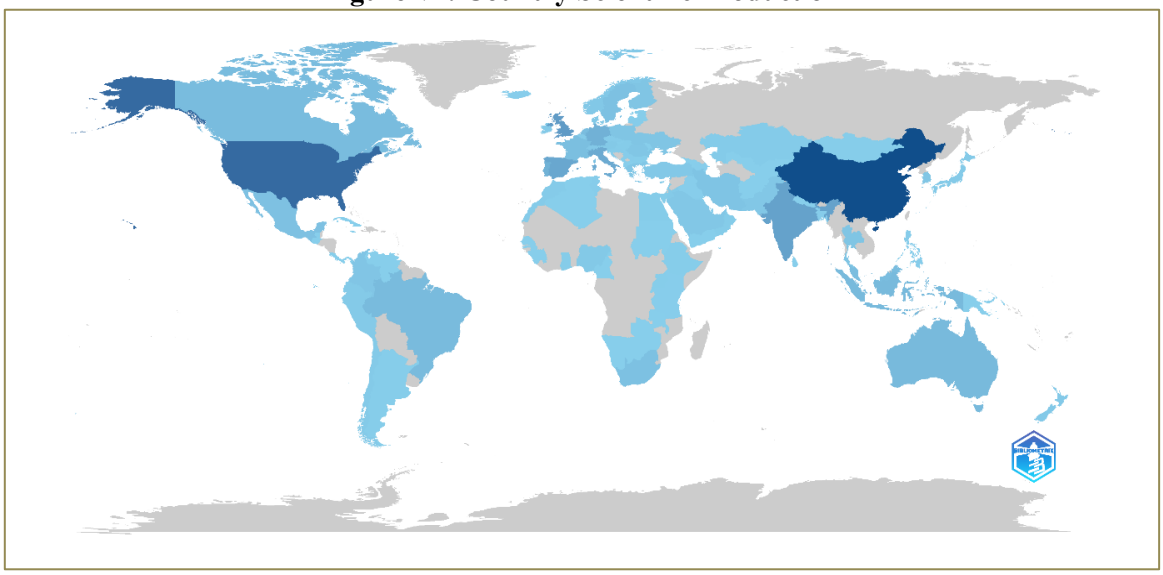
4.1.4. Country Contribution

Country contributions are examined using two complementary analytical lenses. Country Scientific Production **(Figure VI)** depicts the most productive countries, offering a global spatial representation of scientific output and revealing patterns of geographical concentration. Country Production over time (**Figure VII)** extends this perspective by tracing country-level production over time, thereby illustrating the timing of growth and highlighting dynamic shifts in national research leadership.

Figure VI illustrates the geographical distribution of scientific production across countries, revealing a marked spatial concentration of research output. China and the United States emerge as the most prolific contributors, exhibiting the highest levels of publication activity and confirming their central role in shaping global research on entrepreneurship, innovation, and sustainability. High production levels are also observed in several European countries, including the United Kingdom, Germany, Italy, Spain, and France, reflecting the strong institutionalization of research in these regions.

In contrast, developing and emerging economies across Africa, parts of Latin America, and Southeast Asia display comparatively lower publication intensity, although visible contributions indicate a gradual broadening of the research landscape. There is a pronounced North–South asymmetry in scientific output, suggesting unequal research capacities and access to academic resources.

Figure VI: Country Scientific Production



Source: Scopus, 2025

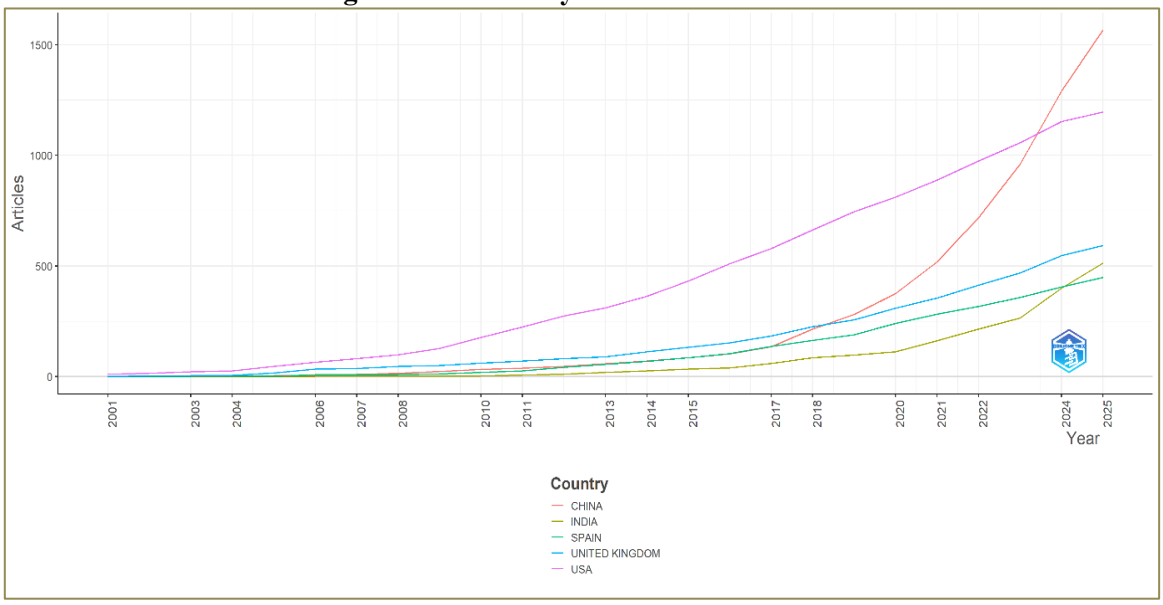
The country production trajectories **(Figure VII)** reveal a fundamental reordering of global knowledge leadership rather than uniform growth.

The USA's steady linear curve represents institutionally stable, incremental accumulation. China's trajectory tells a structurally different story: near-zero output until 2015, followed by exponential growth overtaking the USA around 2023. This is not organic scholarly development but reflects deliberate state-driven research mobilization — raising legitimate questions about whether volume translates into theoretical influence.

The convergence of the UK, Spain, and India into a tight mid-tier band suggests that field-level dynamics — journal access, international networks, thematic alignment with global agendas — matter more than national research capacity alone.

Most critically, the post-2020 divergence between China and all other countries signals an accelerating concentration of output that risks producing a geographically skewed knowledge base, where one country's research priorities increasingly shape a field claiming global relevance.

Figure VII: Country Production over time



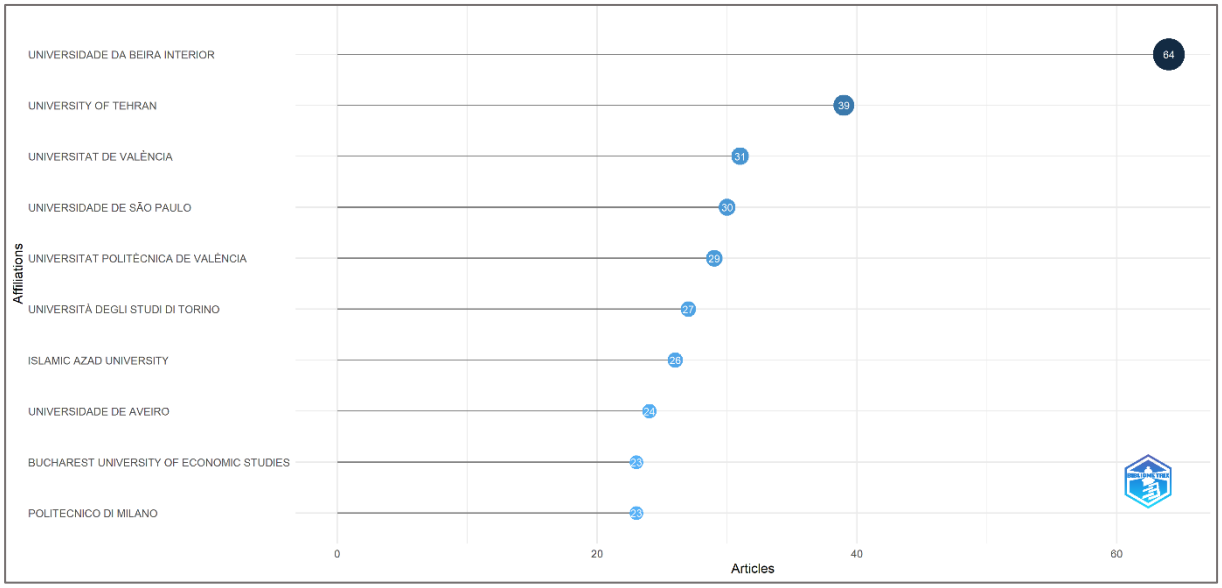
Source: Scopus, 2025

4.1.5. Affiliations Contributions

Figure VIII presents the most productive institutional affiliations within the dataset, revealing a notable concentration of scientific output among a limited number of universities. Universidade da Beira Interior emerges as the leading institution, with 64 publications, clearly outperforming all other affiliations. This result indicates a strong institutional focus and sustained research activity in the field.

A second group of highly productive institutions includes the University of Tehran (39 publications), Universitat de València (31), Universidade de São Paulo (30), and Universitat Politècnica de València (29), reflecting the prominent role of universities from Southern Europe, Latin America, and the Middle East. Additional contributions from institutions such as Università degli Studi di Torino, Islamic Azad University, and Universidade de Aveiro further underscore the geographic diversity of leading research hubs.

Figure VIII : Most Relevant Affiliations

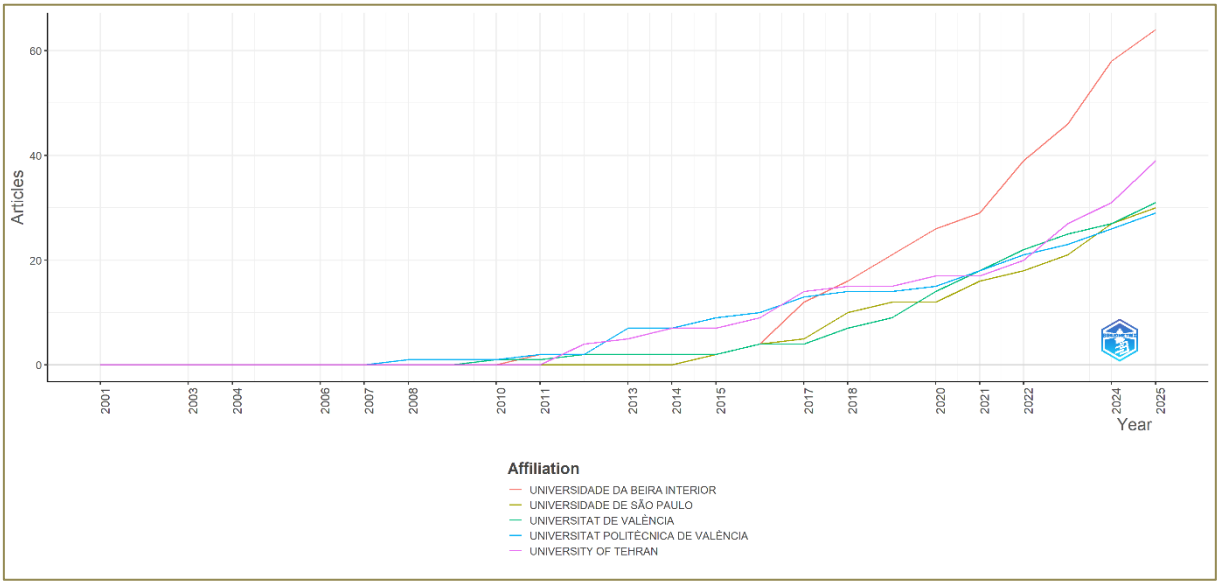


Source : Scopus, 2025

Figure IX illustrates the temporal evolution of scientific output among the most productive institutional affiliations between 2001 and 2025, revealing differentiated growth trajectories. While publication activity remains limited prior to the mid-2000s, a clear acceleration is observed from around 2015 onward, indicating the consolidation of institutional research capacity in the field.

Universidade da Beira Interior exhibits the most pronounced growth pattern, with a sharp and sustained increase in publications after 2017, confirming its position as the leading institutional contributor. Other affiliations, including the University of Tehran, Universitat de València, Universidade de São Paulo, and Universitat Politècnica de València, display more gradual yet steady growth, reflecting continuous engagement rather than rapid expansion.

Figure IX: Affiliations' Production over Time



Source: Scopus, 2025

4.1.6. Citation Dynamics

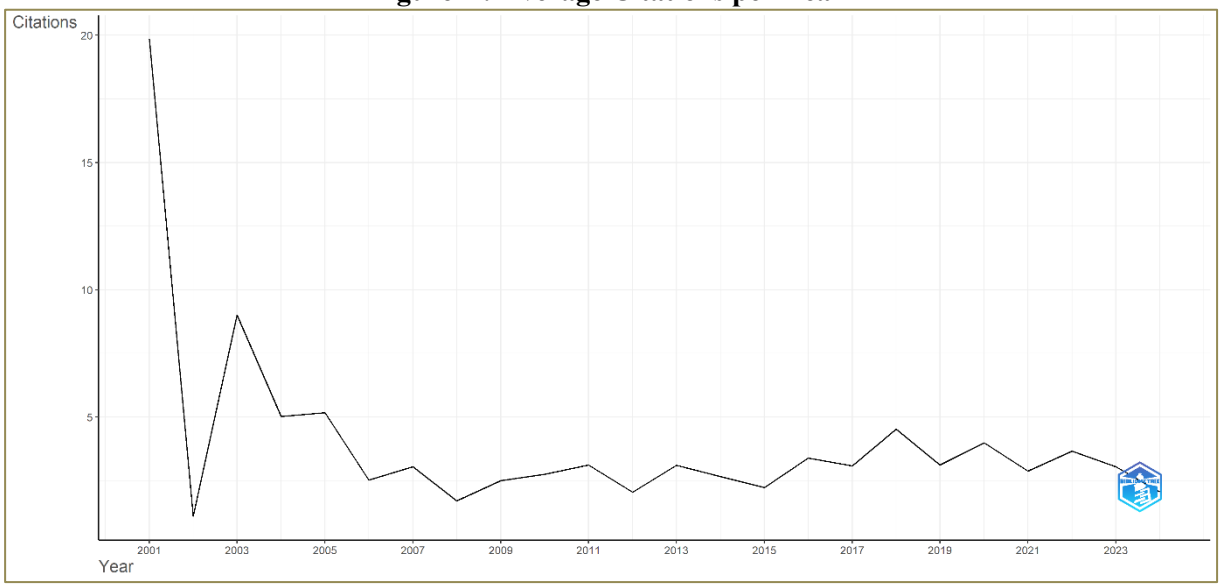
The average citations per year curve **(Figure X)** tells a story of disciplinary maturation rather than declining impact.

The sharp peak in 2001 reflects the classic dilution effect: a small corpus of early seminal works accumulated citations across a growing body of subsequent literature, artificially inflating per-publication averages. The steep drop through 2002–2003 is not a sign of waning influence but a mathematical consequence of corpus expansion — as more publications enter the field, citations are distributed across a larger denominator.

The long plateau stabilizing around 2–4 citations per year from 2007 onward is analytically significant: it indicates that influence in the field has shifted from concentration in a few foundational texts toward distributed relevance across a broad and diversified body of work — a pattern characteristic of fields that have moved from paradigm-building to normal science.

The slight uptick after 2017 suggests growing citation efficiency among recent contributions, potentially reflecting the field's increasing policy relevance and interdisciplinary visibility rather than a reversal of the dilution trend.

Figure X: Average Citations per Year



Source: Scopus, 2025

4.2. Network Analysis

Network analysis is conducted through co-authorship networks and keyword networks, capturing both collaborative relationships and thematic interconnections.

4.2.1. Co-authorship Networks

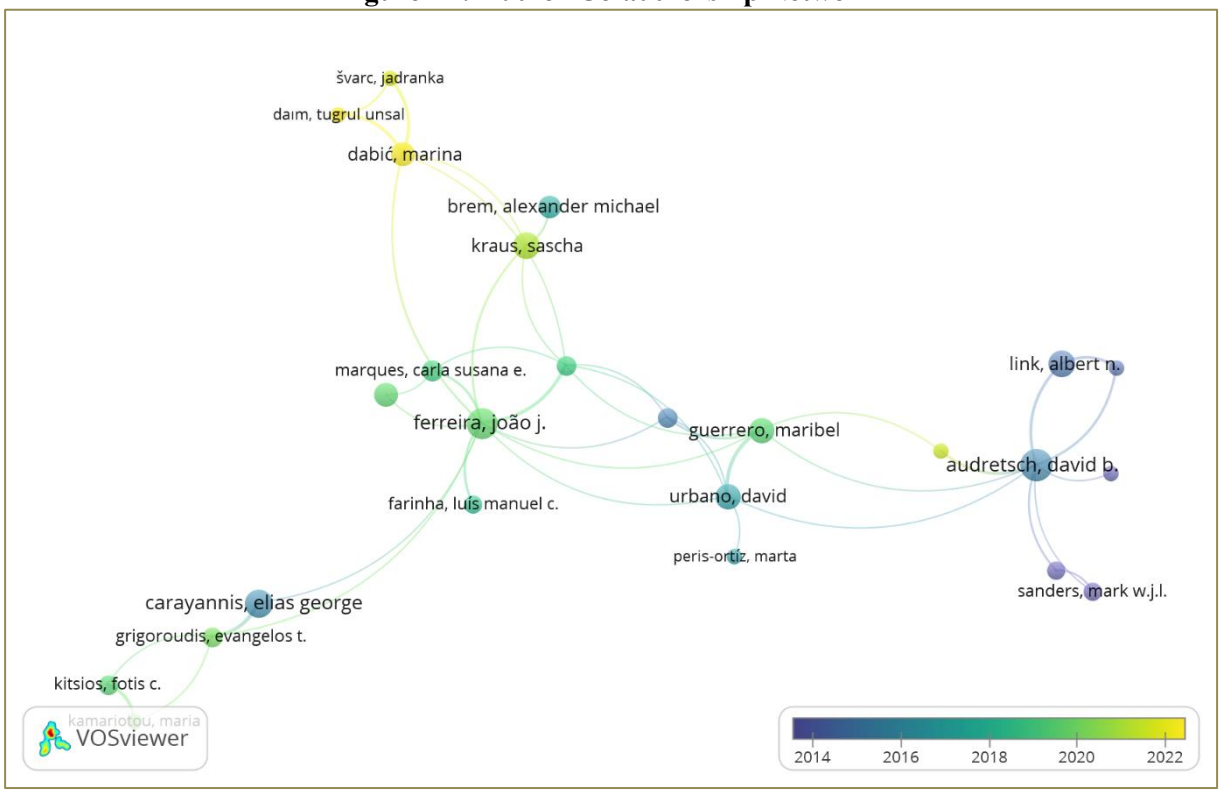
The co-authorship analysis encompasses authors, countries, and journals, enabling a multi-level examination of collaborative structures.

4.2.1.1 Authors

The author co-authorship network **(Figure XI)** exposes the relational architecture through which the field's knowledge is produced — and its structural vulnerabilities.

The network's most analytically significant feature is not its density but its sparsity: a small number of scholars — Audretsch, Ferreira, Guerrero, and Urbano — function as the primary bridges connecting otherwise disconnected research communities. Following Burt's (2004) structural holes theory, these authors occupy brokerage positions that give them disproportionate influence over knowledge circulation, but simultaneously create fragility: the field's intellectual integration depends on a handful of individuals rather than on institutionalized collaborative infrastructure. The temporal gradient further reveals a generational tension. Audretsch's deep blue node signals foundational, pre-2016 centrality — his influence is inherited rather than actively growing. In contrast, the yellow-green cluster around Dabić, Brem, and Kraus represents an emerging collaborative frontier, more recent and dynamic but not yet structurally central. Ferreira occupies a transitional position, bridging these two generations without fully belonging to either.
The network's overall sparseness — few nodes, thin connections, large empty spaces — suggests that co-authorship in this field remains organized around personal academic relationships rather than thematic research programs, pointing to a collaboration culture that is productive but not yet systematically coordinated.

Figure XI: Author Co-authorship Network



Source: Scopus, 2025

4.2.1.2. Countries

The country co-authorship network **(Figure XII)** reveals the geopolitical structure of knowledge production in the field — and its underlying asymmetries.

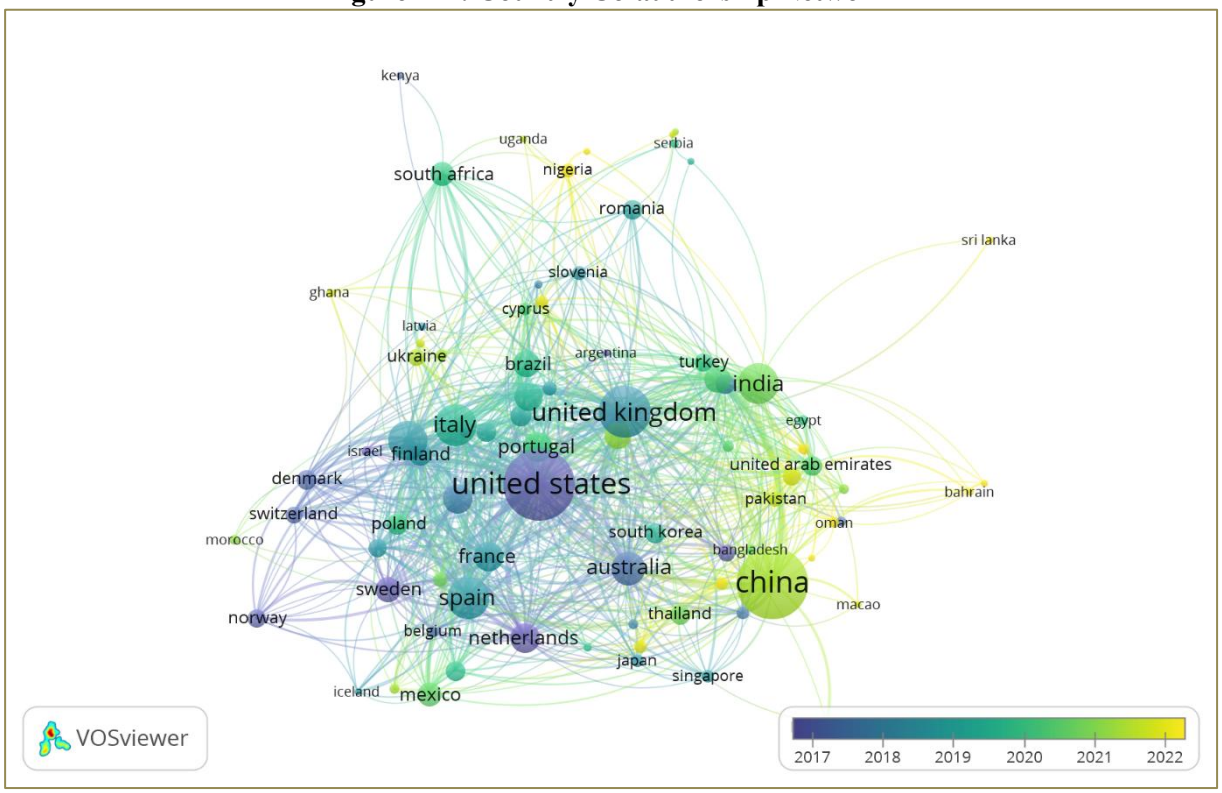
The United States' deep purple node signals long-standing centrality, but its color places it firmly in the pre-2019 era, suggesting that while it remains structurally pivotal, its relative dominance is being actively challenged. China's conspicuously yellow-green node — large in size yet recent in color — is the network's most analytically telling feature: it represents rapid, late-entry mass production rather than accumulated collaborative tradition, raising questions about whether China's volume reflects genuine intellectual leadership or institutional publishing pressure.

The tightly interconnected European cluster — Spain, Italy, Netherlands, Portugal, France — displays intermediate coloring, indicating sustained but not accelerating engagement. This regional cohesion suggests collaborative infrastructure built on shared funding frameworks rather than purely intellectual convergence.

Most critically, the network's periphery — Ghana, Uganda, Nigeria, Morocco, Bangladesh — shows recent yellow nodes with thin connection lines, revealing that Global South integration remains superficial: these countries are joining the network temporally but not structurally, as junior partners rather than co-producers of knowledge.

The network exposes a collaboration landscape that is globalizing in appearance but remains hierarchically organized — with volume increasingly concentrated in China and structural brokerage still controlled by Western institutions.

Figure XII: Country Co-authorship Network



Source : Scopus, 2025

4.2.1.3. Journals

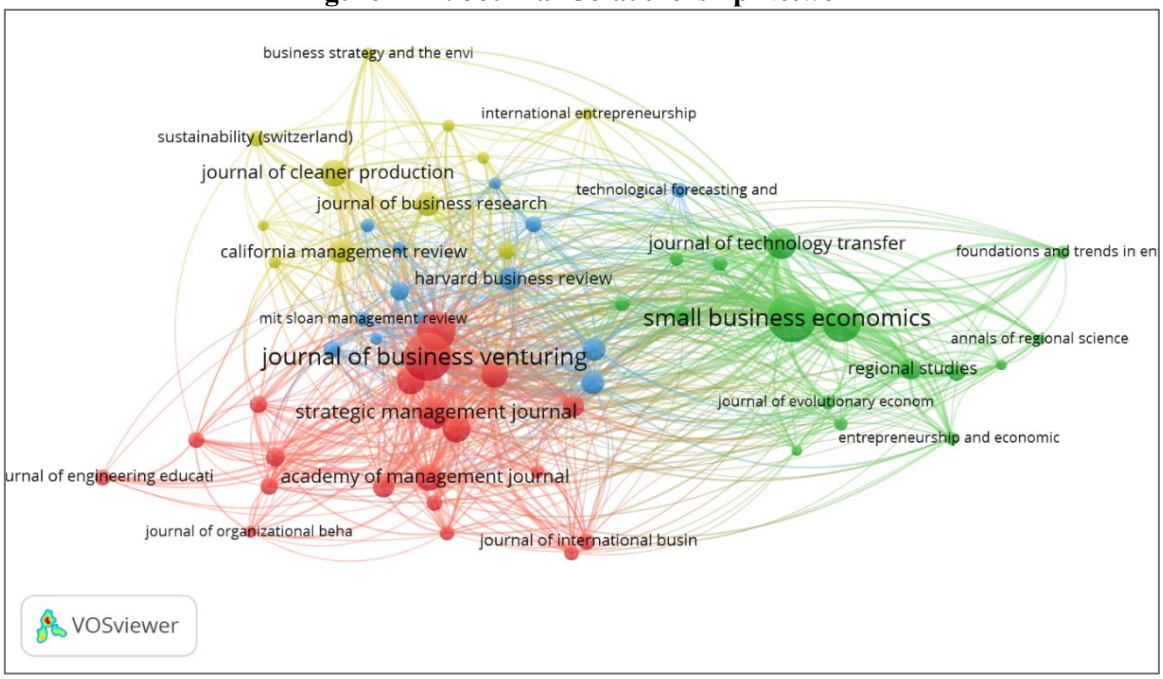
The journal co-citation network **(Figure XIII)** reveals how knowledge circulates across the field's publication landscape — and where its disciplinary boundaries are being negotiated.

The red cluster's dominance, anchored by Journal of Business Venturing, Strategic Management Journal, and Academy of Management Journal, confirms that the field's intellectual legitimacy remains institutionally grounded in mainstream management and strategy outlets. This concentration signals a persistent disciplinary hierarchy where high-impact generalist journals continue to set the theoretical agenda.

The green cluster — centered on Small Business Economics, Journal of Technology Transfer, and Regional Studies — is analytically significant: it represents the field's spatial and systemic dimension, where entrepreneurship is theorized as a regionally embedded and knowledge-driven process consistent with Audretsch's spillover framework. Its strong internal cohesion suggests this stream operates with considerable autonomy from the mainstream management core.

The yellow cluster's grouping of Sustainability, Journal of Cleaner Production, and Business Strategy and the Environment reveals that sustainability has developed its own publication infrastructure within the field — yet its bridging position between clusters suggests it functions more as a thematic add-on than a fully integrated theoretical perspective.

Figure XIII: Journal Co-authorship Network



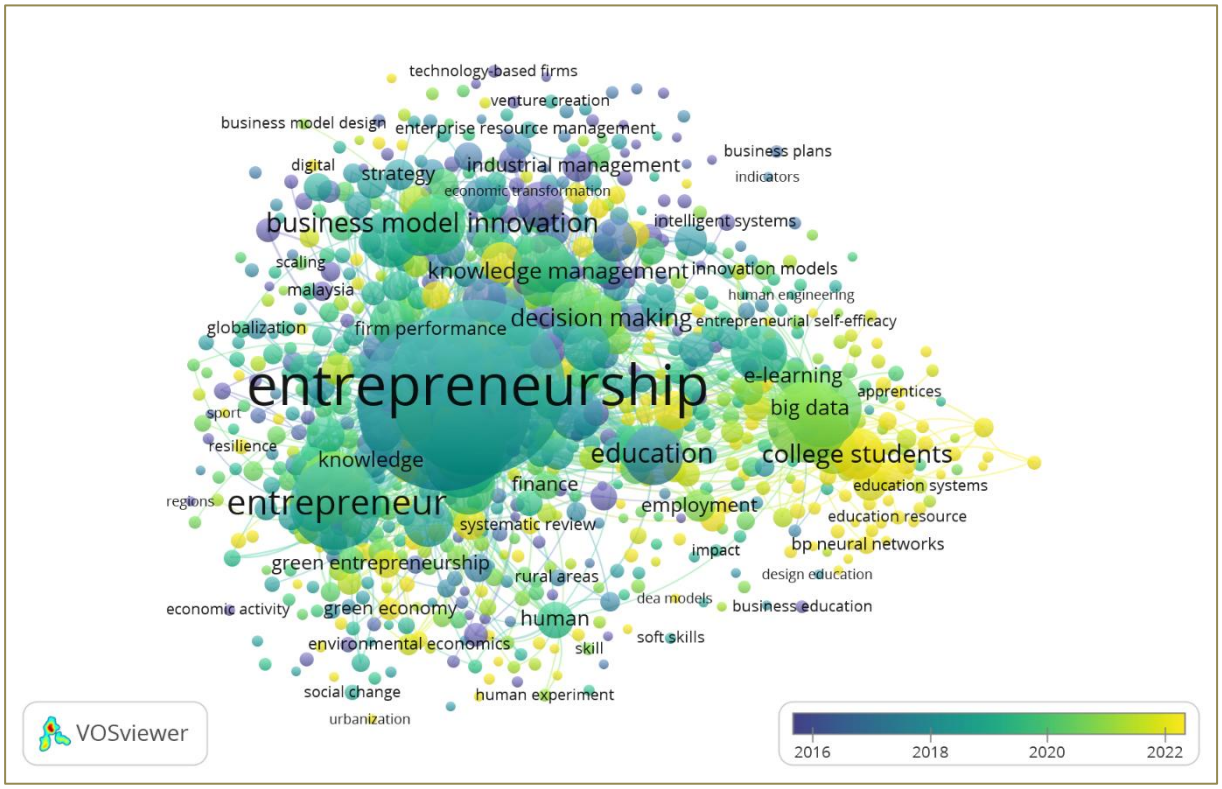
Source: Scopus, 2025

4.2.2. Keyword Co-occurrence networks

The keyword co-occurrence network **(Figure XIV)** highlights the conceptual structure and thematic concentration of the research field. Entrepreneurship occupies a dominant and highly central position, confirming its role as the core concept around which the literature is organized. Closely connected keywords such as entrepreneur, business model innovation, knowledge management, and decision making indicate a strong focus on firm-level processes, innovation mechanisms, and strategic managerial capabilities.

The prominence of an education-oriented cluster—anchored by keywords such as entrepreneurial self-efficacy, college students, and skills—reflects a broader theoretical shift from structural to agentic accounts of entrepreneurship. Whereas earlier literature emphasized macro-level drivers (institutions, policies, ecosystems), this cluster signals a growing interest in the microfoundations of entrepreneurial behavior, consistent with Ajzen's Theory of Planned Behavior and Bandura's self-efficacy framework. This reorientation may be interpreted as a response to the recognized 'black box' problem in entrepreneurship research: aggregate-level findings increasingly call for individual-level mediating mechanisms to explain how and why entrepreneurial innovation occurs. The co-occurrence of digitalization keywords (big data, e-learning, digital strategy) within adjacent clusters further suggests a convergence between digital capability-building and entrepreneurship education, which prior bibliometric reviews (e.g., Ferreira et al., 2019) had not yet documented.

Figure XIV: Keyword Co-occurrence Network



Source: Scopus, 2025

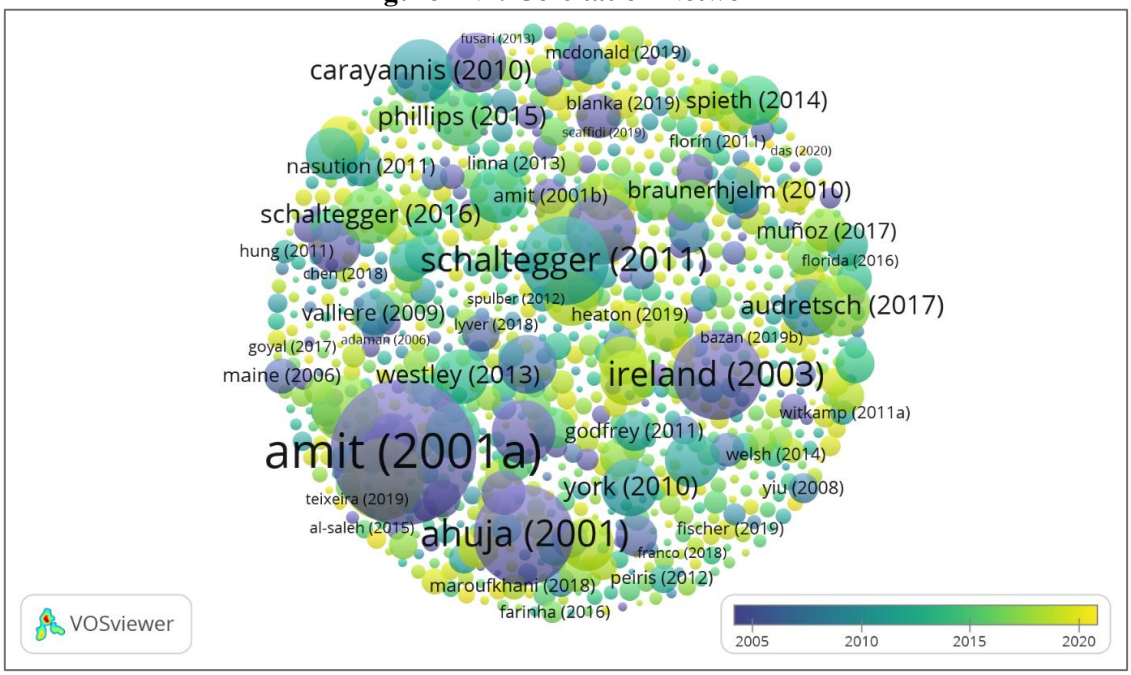
4.2.3. Co-citation Network

The co-citation network **(Figure XV)** exposes the theoretical foundations upon which the field has built — and, critically, the foundations it has begun to move beyond.

The dominance of Amit (2001a), Ahuja (2001), and Ireland (2003) — all pre-2010 works colored in deep purple — indicates that the field's intellectual core remains anchored in value creation, network theory, and strategic entrepreneurship frameworks developed over two decades ago. This temporal lag between foundational references and current research output is theoretically significant: it suggests the field is expanding thematically faster than it is renewing its theoretical base.

The mid-tier prominence of Schaltegger (2011; 2016), Westley (2013), and Braunerhjelm (2010) — in transitional blue-green tones — reflects the progressive incorporation of sustainability and knowledge spillover logics, signaling a partial but incomplete theoretical renewal. Meanwhile, the lighter yellow nodes clustering toward 2018–2020 remain smaller in size, confirming that recent contributions have yet to achieve the citation mass needed to displace the classical foundations.

Figure XV : Co-citation Network



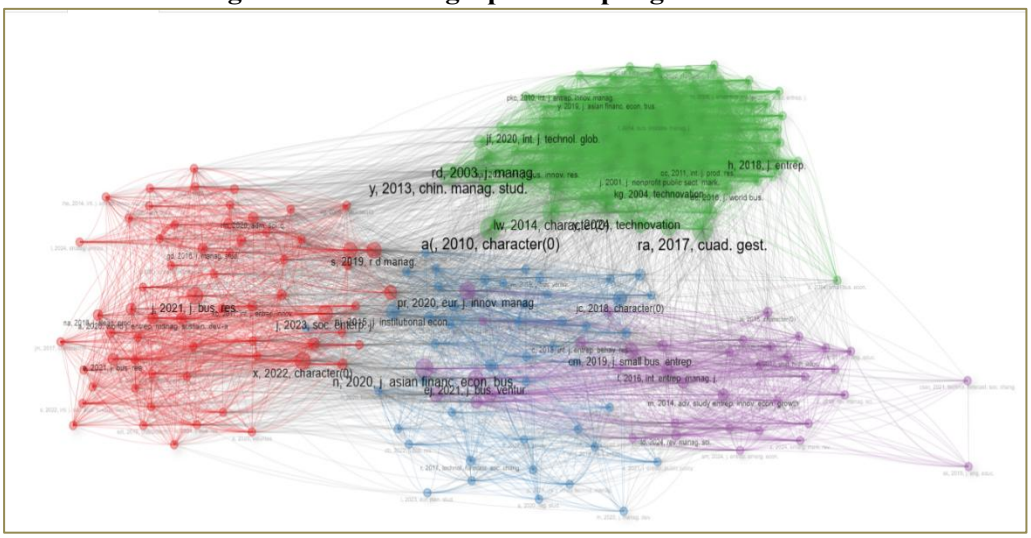
Source: Scopus, 2025

4.2.4. Bibliographic Coupling Network

The bibliographic coupling network **(Figure XVI)** reveals three competing theoretical logics currently shaping the field's research front, which notably remain unintegrated.

The red cluster's consolidation around sustainability and institutional contexts signals a paradigmatic shift: entrepreneurship is increasingly theorized as a response to systemic societal challenges rather than a purely economic phenomenon — a reorientation that classical Schumpeterian frameworks struggle to accommodate. The green cluster's strong internal cohesion around digital transformation suggests that technology-driven entrepreneurship has matured into an autonomous research agenda; however, its relative disconnection from sustainability themes points to a theoretical gap that future integrative work must address. The purple cluster's co-presence of ecosystems, internationalization, and education themes reflects a systemic turn consistent with Triple Helix logic (Etzkowitz & Leydesdorff, 2000), where entrepreneurial value creation is understood as institutionally embedded rather than individually driven.

Figure XVI : Bibliographic Coupling Network



Source: Scopus, 2025

4.2.5. Thematic Mapping of Keywords

The thematic mapping **(Table I)** positions keyword clusters according to their centrality and density, revealing a field that is consolidated at its core yet actively diversifying at its periphery.
Entrepreneurship and innovation occupy the motor themes quadrant — high centrality and high density — confirming their role as the intellectual engine of the field. Clusters linking entrepreneurship with dynamic capabilities and business model innovation reflect mature, theoretically consolidated research streams, while themes related to entrepreneurship education and entrepreneurial intention emerge as developing areas, signaling a growing interest in the microfoundations of entrepreneurial behavior.
Social entrepreneurship and sustainable development occupy a bridging position between the entrepreneurship-innovation core and sustainability-oriented research, reflecting an ongoing negotiation between economic performance logics and broader societal value creation imperatives. The thematic map points to a field with a stable theoretical center progressively expanding toward applied, context-sensitive, and interdisciplinary research directions.

Table I: Thematic Mapping of Keywords

label	group	freq	centrality	impact	color
social entrepreneurship - conf 77.1% innovation - conf 22.5% business model innovation - conf 57.7%	1	64	0.366	1.000	#E41A1C80
entrepreneurship - conf 19.3% innovation - conf 21.1% entrepreneur - conf 33.3%	2	46	0.323	1.000	#377EB880
entrepreneurship - conf 44.6% innovation - conf 47.9% dynamic capabilities - conf 78.6%	3	102	0.473	1.000	#4DAF4A80
entrepreneurship - conf 18.1% innovation - conf 8.5% entrepreneurial intention - conf 100%	4	38	0.353	1.000	#984EA380

Source: Scopus, 2025

5. Discussion

Three convergent signals emerge from the bibliometric results, collectively pointing to a structural reorientation rather than mere quantitative growth. The dominance of *Sustainability* (Switzerland) as the leading outlet, the post-2015 entry of ecosystems, digital transformation, and social impact into the field's core lexicon, and the decentralized co-authorship structure together indicate that the entrepreneurship–innovation nexus has migrated from firm-level performance logics toward responsibility-driven, institutionally embedded frameworks.

This reorientation creates measurable theoretical tension. The Schumpeterian framework — which equates entrepreneurship with radical firm-level disruption — is only partially confirmed: while technological innovation clusters remain prominent, the field's dominant growth trajectory favors sustainability and ecosystem-based approaches that classical theory cannot accommodate. The field is gravitating toward the systemic logics of the Triple Helix Model (Etzkowitz & Leydesdorff, 2000), where innovation emerges from university–industry–government collaboration rather than individual disruption. Simultaneously, the rise of education, self-efficacy, and social entrepreneurship clusters signals a microfoundational turn privileging individual agency over macro-structural determinants. These two trajectories — systemic and individual — remain theoretically unreconciled, identifying synthesis as the field's most pressing scholarly need.

At the structural level, knowledge production is neither dominated by a single intellectual elite nor geographically concentrated. The plural, multi-hub co-authorship architecture suggests that theoretical advances are shaped through cumulative collaboration, while the growing participation of emerging economy institutions points to a gradual but incomplete rebalancing of global knowledge production — incomplete because, as the country trajectories reveal, volume remains increasingly concentrated in China, raising questions about whether quantitative expansion translates into genuine theoretical diversification.

Conceptually, the field has undergone a clear evolution: early work centered on firm performance, opportunity recognition, and technological change, whereas recent research integrates education, ecosystems, sustainability, and social impact — reflecting a growing recognition that entrepreneurial innovation is institutionally and socially embedded, and cannot be adequately explained through purely economic lenses. The bibliographic coupling results reinforce this point: entrepreneurship is no longer theorized solely as a growth driver but increasingly as a mechanism for responsible value creation operating within spatially embedded, system-level processes.

Finally, the interdisciplinarity finding warrants critical nuance. The concentration of output in *Sustainability* (Switzerland) is consistent with Rotolo et al.'s (2015) characterization of emerging research areas, but may equally reflect publication strategy effects rather than genuine intellectual convergence — a distinction future co-citation analysis should examine. Citation dynamics similarly confirm a transition from foundational dependence to distributed relevance, characteristic of a field that has moved from paradigm-building to normal science, with influence now spread across a diversified and methodologically plural corpus.

Conclusion

The results clearly show that interest in the entrepreneurship–innovation nexus has intensified over the past two decades, with particularly strong momentum since the mid-2010s. What began as a relatively scattered body of work has gradually developed into a more organized and recognizable research field, supported by expanding international collaboration, a wider range of contributing institutions, and increasingly interdisciplinary publication outlets. Entrepreneurship and innovation are no longer examined in isolation; instead, they are increasingly treated as closely intertwined processes that unfold within complex economic, social, and environmental settings.

From a thematic perspective, entrepreneurship and innovation remain at the core of the literature, but their scope has broadened considerably. Recent research places growing emphasis on sustainability, social entrepreneurship, education, digital transformation, and entrepreneurial ecosystems. This evolution suggests a shift away from narrowly defined performance-oriented approaches toward a more holistic understanding of entrepreneurial innovation—one that acknowledges its societal impact, its institutional embeddedness, and its role in addressing contemporary global challenges.

This study has several limitations that should be considered when interpreting its findings. First, the exclusive use of Scopus introduces a database coverage bias: despite its broad disciplinary scope, Scopus excludes a portion of social science literature indexed in Web of Science, and does not capture grey literature or practitioner-oriented publications. Future reviews should triangulate findings across multiple databases. Second, the restriction to English-language publications creates a systematic geographical underrepresentation of research from Francophone, Lusophone, and Arabic-speaking regions—areas where entrepreneurship and innovation scholarship is growing rapidly. Third, the data cleaning process, while documented in this revised version, involved subjective title/abstract screening decisions that introduce a degree of irreducible subjectivity. Fourth, bibliometric methods, by design, capture structural and quantitative features of the literature; they cannot access the conceptual depth, methodological quality, or empirical contribution of individual studies. This limitation calls for complementary systematic or meta-analytic reviews of the entrepreneurship–innovation nexus. Finally, the bibliometric snapshot reflects the state of the field as of early 2025 and should be periodically updated given the rapid growth of the corpus.

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