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Review Article

Entrepreneurial Competencies, Innovation, and Business Sustainability in SMEs: A Bibliometric Analysis

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Abstract: Research on entrepreneurial competencies, innovation, business incubation, and business sustainability in small and medium-sized enterprises (SMEs) has expanded rapidly yet remains conceptually dispersed. This study employs a quantitative bibliometric analysis of Scopus-indexed publications, using performance indicators and keyword co-occurrence mapping supported by VOSviewer to examine publication trends, thematic structures, and collaboration patterns. The results indicate substantial growth in research output over the past decade, accompanied by increasing thematic convergence around sustainability-oriented SME development. Business incubators appear as central institutional mechanisms that connect entrepreneurial competencies with innovation processes. Innovation, particularly business model innovation, emerges as a pivotal mechanism linking entrepreneurial capabilities to long-term business sustainability outcomes. The findings further show strong international collaboration across developed and emerging economies, reflecting the global relevance of sustainability-driven SME research. Overall, the analysis demonstrates that innovation functions as a key mediating construct between entrepreneurial competencies and sustainable SME performance, suggesting the need for integrative research frameworks that align micro-level capabilities with broader sustainability outcomes.

Keywords: Entrepreneurial competencies; Innovation; Business sustainability; SMEs; Bibliometric analysis

1. Introduction

Small and medium-sized enterprises (SMEs) play a central role in economic development, particularly in emerging and developing economies, where they contribute to employment generation, the diffusion of innovation, and economic resilience (Organization for Economic Co-operation and Development, 2023). Beyond their economic significance, SMEs are increasingly expected to operate in ways that support long-term business sustainability. Sustainable performance now encompasses not only economic viability but also environmental responsibility and social value creation (Bansal & DesJardine, 2014; Elkington, 2013). In this context, entrepreneurial competencies have gained attention as critical micro-level capabilities within SMEs. Entrepreneurial competencies refer to the knowledge, skills,

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and attitudes that enable entrepreneurs to identify opportunities, mobilize resources, and manage uncertainty (Man et al., 2002; Mitchelmore & Rowley, 2010). Because SMEs typically rely on owner-managers for strategic decision-making, these competencies directly influence firm behavior and strategic orientation. Innovation represents a key mechanism through which entrepreneurial competencies translate into performance and sustainability outcomes. Innovation, whether in products, processes, services, or business models, enables SMEs to adapt to environmental change and maintain competitiveness (Teece et al., 2009).

Prior research suggests that entrepreneurial judgment and learning orientation strengthen innovation capabilities, which in turn enhance firm resilience and long-term sustainability (Rosenbusch et al., 2011). Business sustainability, therefore, can be understood as an outcome shaped by the interaction between entrepreneurial competencies and innovation. Despite increasing interest in these constructs, the literature remains fragmented. Studies on entrepreneurial competencies often focus on intentions or short-term performance, while sustainability-oriented SME research frequently emphasizes environmental practices or digital transformation without explicitly linking them to underlying competencies. This separation limits theoretical integration and obscures the role of innovation as a bridging mechanism**.** To address this fragmentation, a bibliometric synthesis is needed. Bibliometric analysis provides a systematic and objective approach to mapping intellectual structures, identifying thematic evolution, and detecting research gaps across large bodies of literature (Donthu et al., 2021). Unlike narrative reviews, bibliometric methods allow for quantitative examination of publication trends, keyword co-occurrence, and collaboration networks, enabling a clearer understanding of how research streams intersect and evolve over time.

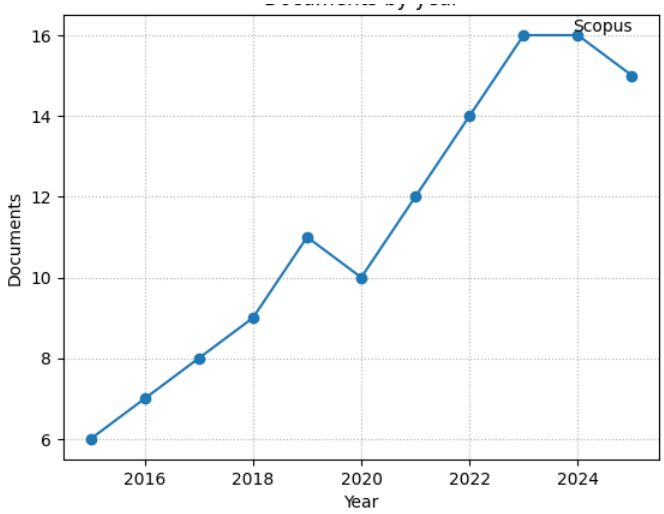

Figure 1. Trend of Scientific Publications related to entrepreneurial competencies, innovation, and business sustainability in small and medium-sized enterprises (SMEs)

Figure 1 captures that the relatively low number of publications during the early period (2015–2017) indicates that research on entrepreneurial competencies, innovation, and business sustainability was initially fragmented. During this phase, entrepreneurial competencies were primarily examined in relation to firm performance or growth, while innovation and sustainability were treated as separate research streams. This limited integration suggests that sustainability had not yet been widely recognized as a strategic outcome of entrepreneurial competencies mediated by innovation, particularly in small and medium-sized enterprises (SMEs). The gradual increase in publications during 2018–2019 reflects a critical transition in the literature. This period coincides with growing academic recognition that entrepreneurial competencies such as opportunity recognition, strategic thinking, and learning orientation play a key role in strengthening innovation capabilities that support sustainable business practices. Fluctuations in publication trends during 2020–2021 can be attributed to the global COVID-19 pandemic, which significantly affected SME operations and shifted research agendas toward resilience, adaptability, and crisis management. In this context, innovation emerged as a primary mechanism enabling SMEs to maintain operational sustainability amid unprecedented uncertainty. These trends support the core argument of this study that innovation serves as a critical link between entrepreneurial competencies and business sustainability, thereby reinforcing the need for more integrative, theory-driven research in this domain. Accordingly, this study conducts a bibliometric analysis of Scopus- and Web of Science-indexed publications to examine the evolution and structure of research on entrepreneurial competencies, innovation, and business sustainability in SMEs. The study addresses the following research questions:

1. How have publication trends, intellectual structures, and thematic evolution developed in this research domain?
2. How is innovation positioned within the literature as a linking mechanism between entrepreneurial competencies and business sustainability?
3. What research gaps and future directions emerge from the current knowledge structure?

This study makes three contributions. First, it provides a structured mapping of the intellectual landscape connecting entrepreneurial competencies, innovation, and sustainability in SMEs. Second, it clarifies the positioning of innovation as a central bridging construct within the literature. Third, it identifies thematic gaps and future research directions to support more integrated, theory-informed studies of sustainable SME development.

2. Literature Review

2.1. SMEs and Business Sustainability

Small and medium-sized enterprises (SMEs) are central to economic development, contributing significantly to employment, innovation, and regional growth (Organization for Economic Co-operation and Development, 2021). However, SMEs face structural constraints, including limited access to capital, managerial expertise, and advanced technologies (Beck & Demirguc-Kunt, 2006). These limitations make sustainability particularly challenging. Business sustainability in SMEs refers to the ability to create long-term economic value while simultaneously addressing environmental and social responsibilities (Bansal & DesJardine, 2014). Unlike large corporations that often adopt formal sustainability reporting systems, SMEs typically integrate sustainability informally through operational efficiency, resource conservation, eco-friendly product design, and community engagement (Johnson & Schaltegger, 2015). For example, many SMEs adopt energy-saving production methods, reduce waste through process innovation, or develop environmentally friendly products to maintain competitiveness. These practices suggest that internal capabilities are critical drivers of sustainable performance.

2.2. Entrepreneurial Competencies: Micro-Level Capabilities

Entrepreneurial competencies represent the individual-level knowledge, skills, and behaviors that enable entrepreneurs to perform entrepreneurial roles effectively (Man et al., 2002; Mitchelmore & Rowley, 2010). Contemporary research adopts a competency-based perspective, emphasizing learnable and observable capabilities rather than innate traits (Boyatzis, 2008). (Man et al., 2002) categorize entrepreneurial competencies into opportunity, relationship, conceptual, organizing, strategic, and commitment competencies. Empirical evidence consistently shows that these competencies enhance SME growth, performance, and adaptability (Tehseen & Ramayah, 2015). Importantly, entrepreneurial competencies operate at the micro level, shaping decision-making processes and strategic orientation within SMEs. While research on competencies has expanded, much of it focuses on performance outcomes rather than sustainability. This indicates a need to examine how entrepreneurial competencies influence sustainability indirectly through other mechanisms.

2.3. Innovation Capabilities in SMEs

Innovation capabilities refer to a firm's capacity to develop, adopt, and implement new products, processes, or business models. Unlike entrepreneurial competencies, which reside at the individual level, innovation capabilities operate at the organizational level. In SMEs, innovation often emerges from entrepreneurial initiative rather than formal R&D structures (Rosenbusch et al., 2011). SMEs engage in product innovation, process improvement, digital transformation, and green innovation. For instance, SMEs may implement digital platforms to expand market access or introduce eco-efficient production systems to reduce environmental impact. From the dynamic capabilities perspective, firms must sense opportunities, seize them through innovation, and reconfigure resources to remain competitive (Teece et al., 2009). Entrepreneurial competencies serve as microfoundations of these dynamic capabilities, enabling the development of organizational-level innovation capacity.

2.4. Linking Entrepreneurial Competencies and Innovation

A substantial body of research confirms that entrepreneurial competencies positively influence innovation performance in SMEs. Competencies such as creativity, strategic thinking, networking ability, and learning orientation enhance experimentation and resource mobilization (Mitchelmore & Rowley, 2010). From a capability-based perspective, entrepreneurial competencies enable SMEs to overcome resource limitations and generate innovative outcomes. Thus, innovation can be conceptualized as the organizational manifestation of entrepreneurial competencies.

2.5. Innovation as a Driver of Business Sustainability

Innovation plays a crucial role in enabling SMEs to achieve sustainable outcomes. Sustainability-oriented innovation helps firms reduce environmental impacts, improve resource efficiency, and create social value while maintaining economic viability (Klewitz & Hansen, 2014). Empirical studies show that SMEs implementing green innovation and sustainable business models experience improved resilience, stronger stakeholder trust, and enhanced long-term performance (Porter & Kramer, 2011). Digital innovation also contributes to sustainability by increasing operational transparency and efficiency. These findings suggest that innovation acts as a mechanism translating entrepreneurial capabilities into sustainable performance outcomes

2.6. Innovation as a Mediating Mechanism

Recent research increasingly conceptualizes innovation as a mediating link between entrepreneurial competencies and business sustainability (Koliby et al., 2022). Entrepreneurial competencies strengthen firms' innovation capabilities, which in turn drive sustainable business performance. This mediating relationship aligns with both the resource-based view and dynamic capabilities theory, which emphasize the transformation of individual-level competencies into organizational outcomes. However, empirical findings remain dispersed across industries and regions, indicating the need for integrative analysis. Bibliometric studies have examined entrepreneurial competencies, innovation in SMEs, and sustainability-oriented entrepreneurship separately (Aria & Cuccurullo, 2017; Donthu et al., 2021). Although research in each domain has grown rapidly, explicit integration of these constructs remains limited. Most prior studies focus on dyadic relationships, such as competencies–performance or innovation–sustainability, without examining the full causal chain connecting entrepreneurial competencies, innovation, and business sustainability. Moreover, existing bibliometric analyses rarely synthesize these constructs within a unified intellectual framework. This fragmentation underscores the need for a comprehensive bibliometric synthesis to map intellectual convergence, thematic evolution, and research gaps in the field of entrepreneurial competencies, innovation, and sustainability in SMEs (see Figure 2).

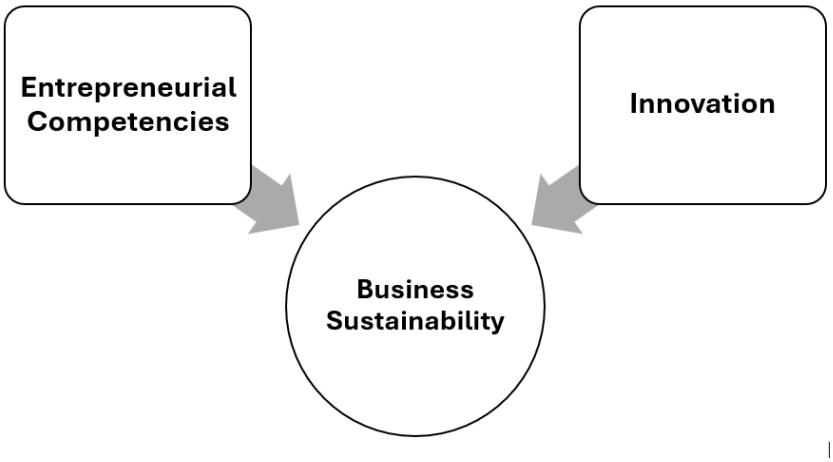

Figure 2. Conceptual Framework

3. Materials and Methods

3.1. Research Design and Paradigm

This study employs a quantitative bibliometric research design grounded in positivist epistemology. Bibliometric analysis is based on the assumption that scientific knowledge production can be systematically measured and mapped through objective bibliographic indicators, including publications, citations, keywords, authorship, and institutional affiliations (Zupic & Čater, 2015). This approach is particularly suitable for examining extensive and fragmented bodies of literature, enabling the identification of intellectual structures, thematic trajectories, and collaboration patterns within a research domain. Rather than relying on a single database extraction, this study adopts a bibliometric synthesis strategy that integrates multiple bibliometric datasets. This integrative approach enhances analytical robustness and provides a more comprehensive mapping of research on entrepreneurial competencies, innovation, and business sustainability in SMEs.

3.2. Data Sources, Time Span, and Selection Criteria

Bibliometric evidence was obtained from Scopus and Web of Science (WoS), two leading citation databases in management and social science research. The integrated dataset spans 1999 to 2024 and comprises 1,602 peer-reviewed journal articles. The dataset consolidates four major thematic domains: entrepreneurial competencies in SMEs (220 articles), green and sustainable innovation in SMEs (496 articles), innovative entrepreneurship and sustainability in emerging economies (132 articles), and digital innovation, marketing, and sustainability in SMEs (754 articles). The inclusion criteria were limited to peer-reviewed journal articles indexed in Scopus and/or WoS that explicitly focus on SMEs and address at least two of the following constructs: entrepreneurial competencies, innovation, and business sustainability. Conference proceedings, book chapters, and non-indexed publications were excluded to ensure methodological consistency and quality control.

3.3. Analytical Framework

The bibliometric synthesis was structured around three analytical dimensions: performance analysis, relational analysis, and thematic evolution analysis. Performance analysis examines research productivity and scientific impact through annual publication trends, citation metrics, leading journals, and contributions by country and institution. These indicators provide insight into the maturity and influence of the research field. Relational analysis, or science mapping, was conducted using VOSviewer. The analysis applied a minimum keyword occurrence threshold of 5, using the full-counting method, and employed association-strength normalization. Clustering was performed using the VOS algorithm with a resolution parameter of 1.00. Network and overlay visualizations were generated to identify thematic clusters, structural linkages, and central concepts connecting entrepreneurial competencies, innovation, and sustainability. Thematic evolution analysis was conducted to examine temporal shifts in research focus. Publications were categorized by developmental phase to identify mature themes, emerging research directions, and areas of conceptual convergence, particularly in digital and green innovation.

3.4. Data Synthesis and Theoretical Integration

The synthesis process followed four stages: (1) extraction of bibliometric indicators from each dataset, (2) cross-dataset comparison to detect convergent and divergent patterns, (3) integration of findings into a unified analytical narrative, and (4) interpretation through established theoretical frameworks, including dynamic capabilities theory and the triple bottom line framework. This structured procedure ensures that the analysis extends beyond descriptive mapping and contributes to theory-information of knowledge. Several limitations warrant consideration. First, restricting the analysis to Scopus and Web of Science may exclude relevant publications from other indexing platforms. Second, limiting inclusion to English-language articles may introduce language bias. Third, the use of secondary bibliometric datasets may reflect methodological choices embedded in the original studies. Finally, while bibliometric analysis effectively identifies structural and thematic patterns, it does not establish causal relationships among constructs

4. Results and Discussion

4.1. Publication Trends and Conceptual Evolution

Table 1 shows the bibliometric findings indicate that research on entrepreneurial competencies, innovation, and business sustainability in SMEs has developed gradually and cumulatively. Rather than experiencing abrupt shifts, the field evolved through progressive conceptual integration. During the early period (1985–1994), studies were predominantly exploratory and treated entrepreneurship and innovation as separate constructs. Sustainability concerns were largely absent, reflecting the prevailing economic growth–oriented paradigm of that era. From the mid-1990s onward, publication growth coincided with the emergence of strategic management perspectives emphasizing firm-specific capabilities and long-term competitiveness. The introduction of the dynamic capabilities framework represented a significant conceptual shift by underscoring the importance of managerial and entrepreneurial capabilities in sustaining innovation under conditions of environmental uncertainty (Teece et al., 1997). Beginning in the mid-2000s, sustainability concepts became increasingly integrated into the research agenda, influenced by the diffusion of the triple bottom line framework (Elkington & Rowlands, 1999). Innovation was progressively reframed not only as a competitiveness tool but also as a mechanism for achieving broader sustainable development objectives. This transformation is reflected in the substantial increase in publication output and the growing thematic convergence identified in the bibliometric analysis.

Table 1. Conceptual Evolution of Research on Entrepreneurial Competencies, Innovation, and Sustainability

Period	Dominant Research	Role of Innovation	Position of Entrepreneurial Competencies	Sustainability Orientation
1985-1994	Economic growth & entrepreneurship	Outcome of entrepreneurship	Implicit/trait-based	Absent
1995-2004	Competitiveness & Innovation	Strategic Driver	Emerging capability-based view	Peripheral
2005-2024	Capability & sustainability integration	Bridging mechanism	Foundational micro capability	Explicit and growing

Source: Data extracted from Scopus and Web of Science (1985–2024).

4.2. Journal Distribution

Figure 3 indicates that the research domain is anchored in a diverse yet relatively concentrated set of academic journals, reflecting both thematic specialization and intellectual consolidation. A number of entrepreneurship- and innovation-oriented journals, such as the International Journal of Entrepreneurship and Small Business, Journal of Technology Transfer, and Journal of Entrepreneurship Education, have experienced steady increases in publication output. This pattern suggests that these outlets have become central platforms for scholarship integrating entrepreneurship, innovation, and sustainability within the SME context. In contrast, journals such as Technovation and Journal of Business Research show more variable publication patterns. Although they publish fewer studies specifically focused on SME sustainability, their contributions tend to be selective and high-impact, consistent with their broader strategic and innovation-oriented positioning. The noticeable expansion of sustainability-related entrepreneurship research across multiple journals after 2017 indicates a diffusion process, with the topic extending beyond specialized outlets into mainstream management and innovation journals. In general, the distribution of journals highlights the growing cross-fertilization between entrepreneurship and innovation research streams. The presence of studies across both entrepreneurship-focused and innovation-oriented outlets suggests that entrepreneurial competencies increasingly occupy an integrative position within the literature. Furthermore, the rising prominence of sustainability-oriented, interdisciplinary journals reflects a shift in emphasis, positioning entrepreneurial competencies not merely as drivers of firm creation or short-term performance, but as enabling capabilities that support sustainable, innovation-based business models in SMEs.

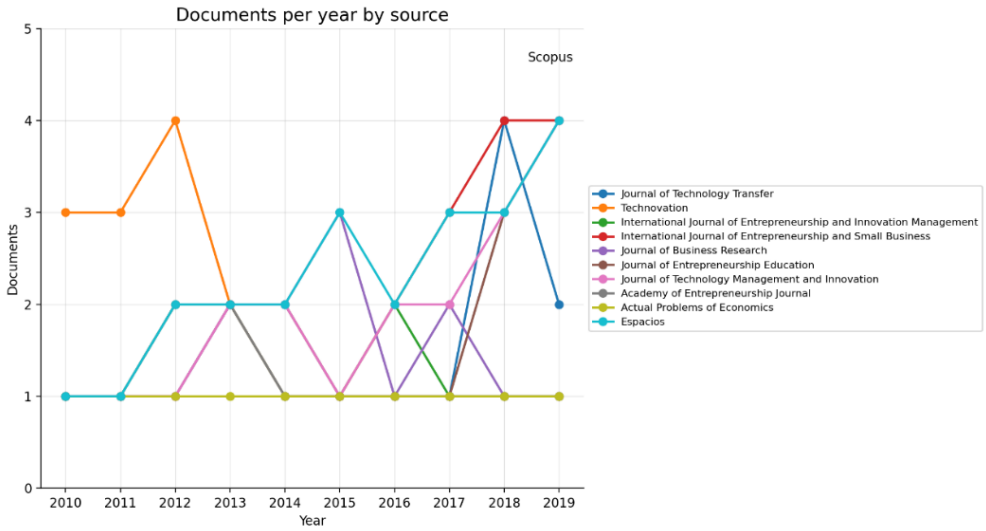

Figure 3. Journal Distribution

4.3. Subject Area Distribution

Figure 4 reports that the research domain is inherently multidisciplinary, although it remains primarily anchored in business and management disciplines. The largest proportion of publications falls within Business, Management, and Accounting (approximately 35–36%), suggesting that entrepreneurial competencies and innovation are predominantly examined from strategic and managerial perspectives. Within this stream, emphasis is placed on decision-making processes, capability development, and performance outcomes in SMEs. This distribution also reflects the tendency to conceptualize business sustainability as a strategic management challenge rather than solely a technical issue. Social

Sciences represent the second-largest category (around 17–18%), highlighting the increasing attention to institutional, behavioral, and societal dimensions in sustainability-oriented entrepreneurship research. Studies in this area frequently address stakeholder engagement, social impact, and the broader socio-economic environment influencing SME operations. Economics, Econometrics, and Finance account for approximately 14–15% of publications, underscoring the importance of financial viability, productivity, and economic efficiency in sustainability-driven innovation. Meanwhile, Engineering (10–11%) reflects the technological dimension of innovation, particularly in product development, process improvement, and technology transfer.

Although smaller in proportion, contributions from Computer Science and Environmental Science signal the growing relevance of digitalization and environmental considerations in sustainable business practices. Additional subject areas, such as Energy, Arts and Humanities, and Mathematics, further demonstrate the field's expanding interdisciplinary scope, indicating that sustainability challenges in SMEs require diverse analytical lenses. The subject area distribution suggests that research on entrepreneurial competencies, innovation, and business sustainability in SMEs is led by managerial and socio-economic perspectives, with technological and environmental disciplines playing complementary but increasingly significant roles. The convergence across these subject areas reinforces the view that innovation operates at the intersection of managerial capabilities, technological development, and sustainability objectives. In this respect, innovation functions not only as an outcome of entrepreneurial competencies but also as an integrative mechanism that connects multiple knowledge domains to support sustainable SME performance

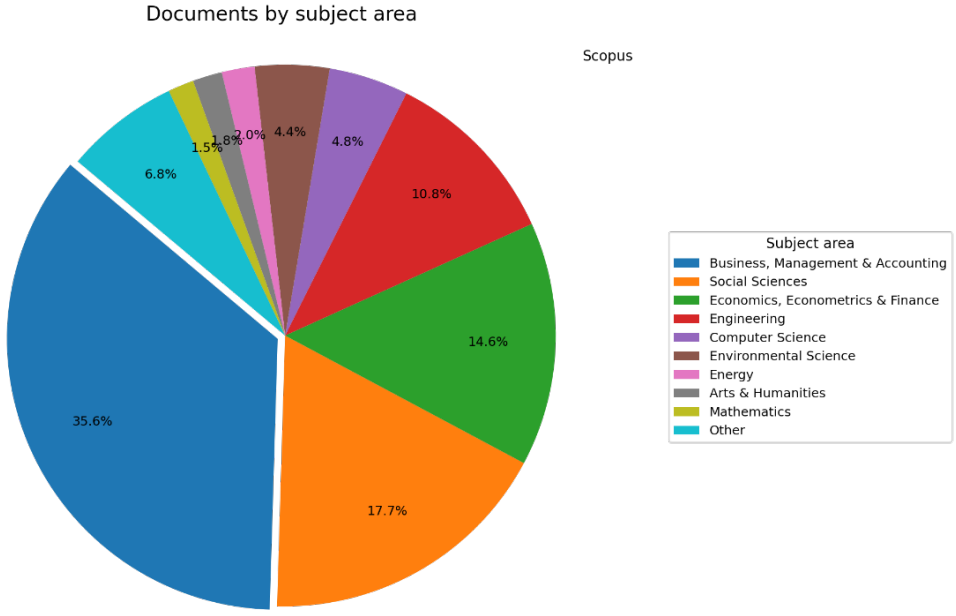

Figure 4. Subject Area Distribution

4.4. Keyword Co-occurrence Network

Table 2. Keyword Business Model Innovation

Cluster Color (VOSViewer)	Core Keyword	Associated Keywords	Conceptual Focus	Theoretical Implications	Practical Implication
Red Cluster	Business Model Innovation	Sustainability	Innovation-driven value reconfiguration for sustainability	Business model innovation as a mechanism linking innovation and sustainability theory	Firms need to redesign value creation to achieve long-term sustainability
Green Cluster	Business Model	Business Digitalization	Structural foundation and digital	Support dynamic capabilities and	Managers should align digital technologies

Cluster Color (VOSViewer)	Core Keyword	Associated Keywords	Conceptual Focus	Theoretical Implications	Practical Implication
			transformation of firms	business model theory	with core business models
Blue Cluster	Review	New Business Model	Knowledge consolidation and conceptual synthesis	Indicates maturity and consolidation of the research field	Provides frameworks and best practices for practitioners and policymakers
Yellow Cluster	Sustainability	Linked to business model innovation	Environmental and social value creation	Reinforces triple bottom line and sustainable innovation theory	Encourages sustainability-oriented strategic decision-making

Table 2 describes keyword business model innovation. The result of VOSviewer clustering analysis reveals four interconnected thematic structures that explain the intellectual development of business model innovation research within the broader sustainability discourse. The Red Cluster centers on business model innovation and its strong linkage with sustainability. This cluster conceptualizes innovation as a process of value reconfiguration, where firms redesign value creation, delivery, and capture mechanisms to achieve long-term sustainability. Theoretically, it positions business model innovation as a bridging mechanism that connects innovation and sustainability theories. Practically, it implies that firms must move beyond incremental improvements and fundamentally rethink their business models to ensure enduring economic, environmental, and social value. The Green Cluster emphasizes the business model as the structural foundation of firms, closely associated with digitalization and transformation. This cluster supports dynamic capabilities and business model theory, highlighting the importance of aligning digital technologies with strategic configurations. The Blue Cluster, centered on review and a new business model, reflects knowledge consolidation and signals the maturity of the research field, providing conceptual synthesis and best-practice frameworks. Meanwhile, the Yellow Cluster focuses on sustainability as a core theme linked to business model innovation, reinforcing the triple bottom line perspective and sustainable innovation theory. Collectively, these clusters demonstrate that business model innovation operates as an integrative construct that connects digital transformation, sustainability objectives, and strategic management practices.

4.5. Innovation as a Connecting Mechanism

Table 3. Mechanisms Linking Competencies, Innovation, and Sustainability

Level	Entrepreneurial Competencies	Innovation Processes	Sustainability Outcomes
Individual	Opportunity recognition, creativity, and learning orientation	Idea generation, experimentation	Long-term strategic orientation
Organizational	Strategic thinking, networking, and leadership	Product/process innovation	Economic sustainability
Systemic	Vision adaptability	Sustainable & digital innovation	Environmental and social sustainability

Across the integrated datasets, Table 3 shows that innovation consistently appears as the primary structural link between entrepreneurial competencies and business sustainability. The keyword co-occurrence analysis places innovation-related concepts at the intersection of clusters focused on competencies and sustainability, highlighting their role as connecting mechanisms. This pattern aligns with prior empirical findings indicating that innovation mediates the relationship between entrepreneurial competencies and sustainable performance (Mokbel Al Koliby & Abdullah, 2022). Through innovation, SMEs translate entrepreneurial capabilities into measurable outcomes, including improved resource efficiency, enhanced environmental performance, and greater long-term resilience.

4.6. Country Collaboration Network

Figure 5 displays that the collaboration network exhibits a highly interconnected, multi-centered structure, indicating that knowledge development in this field is primarily shaped by cross-national partnerships rather than

isolated national contributions. Several countries function as key hubs within the network. China occupies a central position, maintaining extensive collaborative linkages across Asia, Europe, and Africa. This prominence reflects its expanding research capacity in entrepreneurship, innovation, and SME development, particularly in areas such as industrial transformation, incubation systems, and sustainable growth. The United States and India are also major nodes. The United States maintains broad connections with European and emerging economies, reinforcing its role as a global knowledge intermediary, while India's growing connectivity signals its increasing participation in international research on innovation-driven entrepreneurship and SME sustainability.

The United Kingdom and South Africa assume intermediary roles, linking collaborations between advanced and emerging economies. Their positions suggest strategic importance in facilitating knowledge exchange across diverse institutional environments. Regional patterns are also visible. Asian countries such as Malaysia, Pakistan, and Bangladesh form dense collaboration clusters around China and India, while European countries, including Spain, Germany, and the Netherlands, demonstrate strong intra-regional cooperation alongside connections to global hubs. African nations, notably Nigeria and South Africa, are increasingly integrating into these networks, reflecting the expanding geographical scope of the research domain.

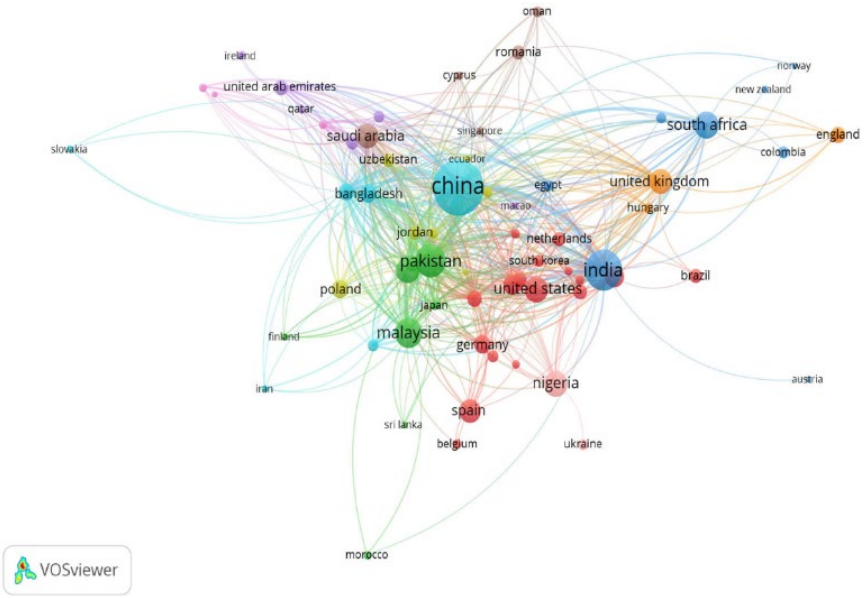

Figure 5. Country Collaboration Network

The structure is polycentric, with multiple countries contributing to knowledge creation and diffusion rather than a single dominant center. The breadth and diversity of collaborations indicate that research on entrepreneurial competencies, innovation, and business sustainability is influenced by varied institutional, cultural, and economic contexts. Theoretically, this pattern supports the need for multi-level and cross-contextual frameworks capable of explaining differences in entrepreneurial behavior, innovation dynamics, and sustainability outcomes across countries. The prominent roles of emerging economies underscore the importance of incorporating insights beyond advanced-economy perspectives. Practically, the collaboration structure highlights the value of international knowledge exchange. Policymakers, incubator managers, and SME support institutions can leverage cross-country partnerships to share best practices in incubation, innovation policy, and sustainability strategies. Thus, the collaboration network underscores the need for globally informed, context-sensitive approaches to advancing sustainable entrepreneurship research and practice.

This study aimed to explore the intellectual evolution, structural relationships, and research gaps concerning entrepreneurial competencies, innovation, and business sustainability in SMEs. The findings demonstrate a progressive and cumulative integration of these constructs over time. Prior to the mid-2000s, research streams largely developed in parallel, with entrepreneurial competencies linked primarily to firm performance and innovation examined as a competitiveness tool. From approximately 2005 onward, however, sustainability considerations became increasingly embedded in innovation-oriented research, leading to a more integrated, capability-driven perspective. This shift reflects a paradigmatic transition toward long-term value creation and resilience in SME research. Also, the bibliometric mapping and keyword co-occurrence analysis consistently position innovation at the intersection of competency-oriented and sustainability-oriented clusters. The multi-level synthesis further confirms that entrepreneurial competencies operate at the individual level, innovation processes function at the organizational level, and sustainability outcomes emerge at the systemic level. This structural configuration supports the interpretation of innovation as a connecting mechanism

that translates entrepreneurial capabilities into sustainable business performance. Lastly, the analysis identifies several research gaps. While entrepreneurial competencies are widely acknowledged as important, they are often insufficiently operationalized within sustainability-oriented frameworks. Many studies refer to “entrepreneurship” in general terms without clearly specifying measurable competency dimensions. This limits theoretical precision and suggests the need for more integrative and empirically grounded models.

5. Conclusions

This study provides a structured bibliometric synthesis of research on entrepreneurial competencies, innovation, business incubation, and business sustainability in SMEs. By analyzing Scopus-indexed publications through performance indicators and science-mapping techniques, the study clarifies the intellectual evolution, thematic convergence, and global collaboration patterns within this domain. The findings indicate a clear shift from fragmented examinations of entrepreneurship and innovation toward an integrated, sustainability-oriented perspective. Innovation, particularly business model innovation, emerges as the key bridging construct that connects entrepreneurial competencies with long-term sustainability outcomes. Business incubators are identified as important institutional platforms that facilitate this transformation by supporting knowledge transfer, capability development, and ecosystem collaboration. This study contributes to three main ways. Theoretically, it advances an integrative multi-level perspective linking entrepreneurial competencies (Micro level), innovation and incubation mechanisms (Meso level), and sustainability outcomes (Macro level). Methodologically, it demonstrates the value of bibliometric synthesis in mapping structural relationships and identifying research gaps across fragmented streams of literature. In practice, it highlights the importance of strengthening innovation ecosystems and developing competencies to foster sustainable SME performance.

Future research should move beyond structural mapping to empirically test the proposed integrative relationships. Further investigation is needed into the mediating role of business model innovation, the interaction between digital and green innovation, and cross-country comparisons that account for institutional diversity. Expanding data sources beyond English-language publications and incorporating longitudinal empirical designs would also enhance the robustness of future studies. Overall, integrating entrepreneurial competencies, innovation processes, and sustainability objectives provides a coherent pathway for advancing sustainable entrepreneurship in SMEs. The findings yield several theoretical implications. First, entrepreneurial competencies should be conceptualized as micro-foundations of sustainable innovation. Rather than treating innovation as an autonomous organizational process, the evidence indicates that it is rooted in individual-level cognitive and behavioral capabilities, particularly within SMEs where decision-making authority is concentrated. Second, dynamic capabilities theory provides a coherent explanatory mechanism. Entrepreneurial competencies enable firms to sense opportunities, seize them through innovation, and reconfigure resources in response to environmental change. This dynamic process explains how competencies are transformed into sustainable innovation outcomes. Third, the triple bottom line (TBL) framework clarifies sustainability as a long-term, multidimensional outcome encompassing economic, environmental, and social performance. The integration of competency-based and dynamic capability perspectives with TBL strengthens theoretical coherence across levels of analysis.

Importantly, bibliometric evidence highlights business model innovation as a key bridging construct. Business model innovation operationalizes the transformation of competencies and technological innovation into sustainable value creation, aligning economic viability with environmental and social objectives. This construct integrates micro-level competencies, meso-level innovation processes, and macro-level sustainability outcomes within a unified framework. The results also reveal expanding subfields that shape the future research agenda. Digital innovation has become increasingly prominent as SMEs adopt digital technologies to enhance efficiency, scalability, and resilience. Simultaneously, green innovation is gaining momentum as environmental concerns intensify. The convergence of these themes suggests the emergence of hybrid capability models that combine technological competencies with sustainability-oriented strategic capabilities. Future research should examine how digital and green innovation jointly mediates the relationship between entrepreneurial competencies and sustainability outcomes, particularly in resource-constrained SME environments

The findings carry differentiated implications for key stakeholders. For policymakers, strengthening SME innovation ecosystems is essential. Policies should support business incubation programs, cross-sector collaboration, and capability-building initiatives that integrate innovation with sustainability objectives. For SME owners and managers, the results underscore the importance of developing strategic and adaptive competencies. Beyond incremental improvements, firms should prioritize business model innovation to align value creation mechanisms with long-term sustainability goals. For incubator managers, structured programs that facilitate digital transformation, sustainability alignment, and competency development can enhance the effectiveness of incubation support. Integrating mentorship, knowledge exchange, and ecosystem partnerships will further strengthen sustainable entrepreneurial outcomes. Several limitations must be acknowledged. The study relies on Scopus and Web of Science databases, which may introduce database bias by excluding regional or non-indexed publications. Excluding English-language articles may

result in language bias. Additionally, bibliometric methods identify structural patterns and thematic relationships but do not establish causal relationships between constructs. Future empirical studies are therefore required to validate the proposed integrative relationships.

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