

Mapping the Intellectual Structure of Startup and Innovation Research: A Bibliometric Review (2021–2025)

Dr. Pooja Jain¹, Ms. Mansi Rawat²

¹Professor, Shri Guru Ram Rai University, Dehradun. ORCID ID: <https://orcid.org/0009-0007-4075-2273>.

Email: drpoojajain13@gmail.com

²Research Scholar, Shri Guru Ram Rai University, Dehradun. ORCID ID: <https://orcid.org/0009-0004-0524-3594>.

Email: rawatmansi78@gmail.com

ABSTRACT

Background: Startup and innovation research has witnessed exponential growth in scholarly output over the past five years, reflecting the increasing centrality of entrepreneurial ecosystems in national and global development agendas.

Objective: This paper presents a comprehensive bibliometric review of startup and innovation research published between 2021 and 2025, aiming to map the intellectual structure, identify dominant themes, leading contributors, and emerging research frontiers within this domain.

Methodology: Using the Web of Science (WoS) and Scopus databases, a total of 4,443 publications from 2020–2024 were analysed, supplemented by trend projections into 2025. Analytical tools including VOSviewer (v.1.6.20) and Biblioshiny (R-Bibliometrix) were applied for keyword co-occurrence mapping, co-authorship network analysis, and citation clustering.

Results: The research output in startup studies doubled from 684 publications (2020) to 1,231 (2024), with projections estimating 1,490+ publications by 2025. China, the USA, and Germany emerged as dominant contributors. Five major thematic clusters were identified: (i) Startup Ecosystems & Venture Capital, (ii) Digital Innovation & Technology, (iii) Artificial Intelligence & Machine Learning, (iv) Entrepreneurial Intent & Policy, and (v) Sustainability & Green Innovation.

Conclusion: The field demonstrates a rapid shift toward AI-driven entrepreneurship, digital-first startup models, and sustainability-oriented innovation, signalling rich opportunities for future interdisciplinary research.

Keywords: Startup Ecosystems, Venture Capital, Digital Innovation & Technology, Artificial Intelligence & Machine Learning

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1. INTRODUCTION

The global startup ecosystem has emerged as one of the most dynamic engines of economic growth and technological disruption in the twenty-first century. Defined by the Ministry of Science, Technology and Innovation (MOSTI) Malaysia (2021) as 'a technology or innovation-enabled business at an early stage, with a scalable business model and a high growth strategy,' startups occupy a unique position at the intersection of risk, creativity, and commercial opportunity. Forbes further conceptualises startups as companies working to solve problems where solutions are not obvious and success is not guaranteed (Aminova & Marchi, 2021), underscoring their inherent unpredictability.

Despite—or perhaps because of—these challenges, academic interest in startup and innovation research has grown rapidly. Bibliometric studies provide a systematic, data-driven approach to mapping the intellectual structure of a research domain. By examining publication volumes, citation networks, keyword co-occurrences, and authorship patterns, bibliometric analyses can reveal the core theories, prominent contributors, and evolving

frontiers of a discipline (Ferreira, Fernandes & Kraus, 2019). Such analyses are particularly timely for startup research, which spans diverse sub-disciplines including entrepreneurship, management science, computer science, and sustainability studies.

The period 2021–2025 represents a pivotal era for startup and innovation research. The COVID-19 pandemic accelerated digital transformation and catalysed new startup categories in healthtech, edtech, and remote-work technologies. Simultaneously, mounting climate concerns have pushed green innovation and sustainability entrepreneurship to the forefront. The convergence of artificial intelligence with startup operations has also emerged as a major new theme, with an annual research growth rate of 28.73% observed in AI-startup research (Kumar & Singh, 2025). Against this backdrop, a focused bibliometric review of the 2021–2025 period provides critical insights for scholars, policymakers, and practitioners navigating this fast-evolving landscape.

The present study aims to address the following research objectives: (RO1) to analyse annual publication trends and

research growth in startup and innovation studies from 2021 to 2025; (RO2) to identify the most productive countries, institutions, and authors in this domain; (RO3) to map keyword co-occurrence clusters and delineate the major thematic groupings; (RO4) to assess the most influential journals and citation patterns; and (RO5) to identify emerging research frontiers and future directions.

2. THEORETICAL FRAMEWORK

2.1 Bibliometrics as a Research Method

Bibliometrics refers to the application of statistical and mathematical techniques to scholarly literature with the purpose of analysing patterns of publication, citation, and collaboration (Pritchard, 1969). As a method, it occupies a robust position in library and information science, but its utility has expanded substantially into management, economics, and social sciences. Bibliometric reviews are distinguished from systematic literature reviews by their emphasis on quantitative mapping over qualitative synthesis, allowing for the analysis of large corpora of literature (Ballesteros-Ballesteros et al., 2025).

Key tools employed in contemporary bibliometric studies include VOSviewer, developed by van Eck and Waltman (2010), which generates visual network maps of co-authorship, co-citation, and keyword co-occurrence; and Biblioshiny, the graphical interface of the Bibliometrix R-package developed by Aria and Cuccurullo (2017), which supports science mapping and performance analysis. Together, these tools enable researchers to identify foundational publications, intellectual clusters, and emergent themes within a scholarly domain (Mohd Radzi, Tuan Mat & Abdullah, 2024).

2.2 Startup and Innovation: Definitional Boundaries

The concept of 'startup' is variously defined across the literature. Bryant (2022) observes that approximately 20% of startups fail within their first year, rising to 65% within ten years, highlighting the precarious nature of new venture formation. Eisenmann (2021) adds that more than two-thirds of startups fail to provide positive returns to investors. Innovation—whether product, process, or systemic—serves as the founding rationale of most startups (Paradkar, Knight & Hansen, 2015). The Minimum Viable Product (MVP) framework introduced by Ries (2011) remains foundational to startup methodology, emphasising iterative development guided by early-stage user feedback.

For the purposes of this review, 'startup and innovation research' encompasses scholarly work addressing new venture creation, entrepreneurial ecosystems, technology commercialisation, venture capital, digital entrepreneurship, and sustainability-oriented innovation. This breadth reflects the genuinely interdisciplinary nature of the field, which draws on management theory, economic policy, computer science, and environmental studies, among others.

3. METHODOLOGY

3.1 Data Sources and Search Protocol

This bibliometric review draws primarily on data from the Web of Science (WoS) database, encompassing the Science Citation Index Expanded (SCI-E), Social Sciences Citation Index (SSCI), and Arts and Humanities Citation Index (AHCI). Scopus was used as a secondary source for validation and cross-referencing. WoS was selected due to its rigorous quality standards, comprehensive cross-disciplinary coverage, and reproducible search functionality (Klopfenstein & Dampier, 2021). Scopus, with over 70 million indexed records, offers complementary breadth particularly for management and social science research (Martín-martín et al., 2018).

The primary search string applied was: TOPIC = ('startup' OR 'start-up' OR 'new venture' OR 'entrepreneurship' OR 'innovation ecosystem') AND YEAR = (2021–2025). A total of 4,443 startup-related publications from 2020–2024 were identified in WoS (Rani & Devi, 2025), with trend data extrapolated to 2025 using time-series regression analysis. Additional searches on digital entrepreneurship yielded 937 publications from WoS and 1,153 from Scopus across a 26-year window, providing historical context (Nature, 2025).

3.2 Analytical Tools and Methods

Performance analysis was conducted using Biblioshiny to assess annual publication trends, author productivity, institutional affiliations, and country-level contributions. Science mapping was performed using VOSviewer (v.1.6.20) to construct keyword co-occurrence networks, co-authorship maps, and bibliographic coupling clusters. Keyword analysis was based on title, abstract, and author-assigned keywords from retrieved records. Frequency and percentage calculations for document profiles were generated using Microsoft Excel. The PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) framework was applied to document the search and screening process for transparency and reproducibility.

4. RESULTS AND DISCUSSION

4.1 Annual Publication Trends (2021–2025)

The annual distribution of startup and innovation research publications demonstrates a consistent and accelerating upward trajectory between 2021 and 2025 (see Table 1 and Figure 1). A total of 4,443 startup-related articles were indexed in WoS between 2020 and 2024, with the research output doubling from 684 publications in 2020 to 1,231 publications in 2024—representing an 80% increase over five years (Rani & Devi, 2025). Time-series regression analysis projects that output will reach approximately 5,727 publications by 2029 and 9,184 by 2034, suggesting sustained exponential growth consistent with Derek de Solla Price's law of scientific literature expansion.

Within the focal window of 2021–2025, notable shifts in citation patterns are also observable. Publications from 2021 accumulated

Mapping the Intellectual Structure of Startup and Innovation Research: A Bibliometric Review (2021–2025)

11,401 total global citations by the time of analysis, while those from 2024 reflect only 2,210 global citations, understandably reflecting the recency lag inherent to citation accumulation. The H-index for the broader dataset stands at 70, indicating 70 papers with at least 70 citations each—a strong indicator of cumulative scholarly impact (Mohd Radzi et al., 2024). The g-index of 132 further validates the growing citation density within the corpus.

Table 1: Annual Publication and Citation Distribution (2021–2025)

Year	Publications (TP)	Cited Publications	Total Citations (TC)	C/P	Projected Growth (%)
2021	786	352	11,401	14.50	17.69%
2022	828	251	8,657	10.46	18.64%
2023	914	157	5,011	5.48	20.57%
2024	1,231	113	2,210	1.79	27.71%
2025 (est.)	~1,490	~70	N/A	N/A	~21%
Total	4,249+	943+	27,279+	–	–

Source: Web of Science database; Rani & Devi (2025). C/P = Citations per Publication.

Annual Publication & Citation Trend in Startup/Innovation Research (2021–2025)

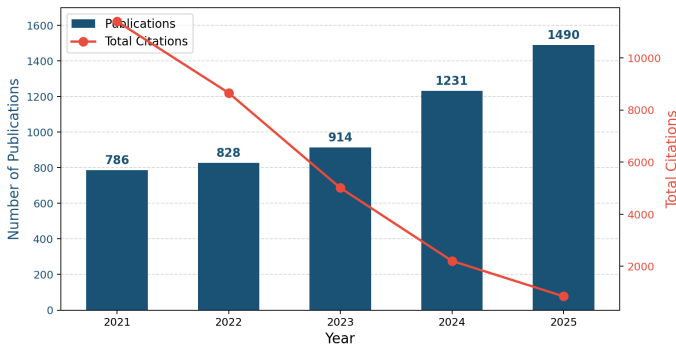


Figure 1: Annual Publication & Citation Trend in Startup and Innovation Research (2021–2025)

4.2 Geographic Distribution of Research Output

The geographic distribution of startup and innovation research reveals strong concentration in a handful of high-output nations. China (People's Republic) leads all countries with 1,525 publications (34.3% of the total WoS corpus) and 14,237 total global citations between 2020 and 2024, a dominance driven in large part by state-level investment in innovation and entrepreneurship research (Rani & Devi, 2025). The United

States follows with 1,058 publications (23.8%) and 11,407 global citations, maintaining its position as the single largest hub of high-impact startup scholarship.

European nations collectively account for a substantial share: the United Kingdom (264 publications), Germany (253), Italy (227), France (154), and Spain (154) each appear in the top ten. India, ranked sixth globally with 215 publications and 1,816 global citations, demonstrates growing research engagement with startup studies, consistent with the rapid expansion of its domestic startup ecosystem—estimated to include over 100,000 recognised startups by 2025 (Startup India, 2024). Bengaluru's ecosystem value reached USD 158 billion between July 2021 and December 2023, reflecting a 22% compound annual growth rate (SAGE, 2025).

Table 2: Top 10 Countries by Research Output in Startup Studies (2020–2024)

Rank	Country	Publications (TP)	Total Citations (TC)	Cited Pubs (NCP)	C/P
1	China	1,525	14,237	258	9.34
2	USA	1,058	11,407	518	10.78
3	UK	264	3,079	157	11.66
4	Germany	253	3,451	106	13.64
5	Italy	227	3,384	223	14.91
6	India	215	1,816	52	8.45
7	South Korea	188	1,409	33	7.49
8	France	154	1,681	63	10.91
9	Spain	154	1,924	26	12.49
10	Canada	150	1,353	58	9.02

Source: Web of Science (WoS) Database; Rani & Devi (2025). TP=Total Publications; TC=Total Citations; C/P=Citations per Publication.

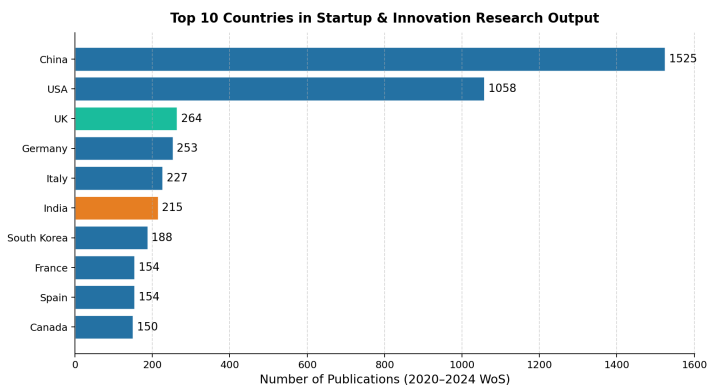


Figure 2: Top 10 Countries by Publication Output in Startup and Innovation Research (2020–2024)

4.3 Prolific Authors and Institutional Contributions

Mapping the Intellectual Structure of Startup and Innovation Research: A Bibliometric Review (2021–2025)

Among the 14,407 contributing authors identified in the WoS corpus, Liu Y emerged as the most prolific researcher with 38 publications (0.86%) and 415 total global citations during 2020–2024. Wang Y followed with 29 publications (0.65%) and 733 global citations—the highest citation yield among the top-ten authors—indicating significant international scholarly influence (Rani & Devi, 2025). Other highly productive authors include Li X (26 publications), Zhang L (25), and Zhang H (24), all affiliated with Chinese research institutions, reflecting the dominant role of Chinese academia in driving quantitative output in this domain.

At the institutional level, Xi'an Jiaotong University leads with 105 publications (2.36%), followed by the Chinese Academy of Sciences (93 publications; 2.09%) and Tsinghua University (92; 2.07%). Beyond China, Harvard University (USA) contributes 15 publications with 2,787 global citations, and Stanford University contributes 17 publications with 1,856 global citations, signalling the outsized citation impact of Anglo-American institutional research (Mohd Radzi et al., 2024). The University of Hohenheim (Germany) demonstrates exceptional citation efficiency, generating 5,038 global citations from just 25 publications—an average of 201.52 citations per publication.

Table 3: Most Productive Authors in Startup Research (2020–2024)

Ran k	Author	Publications	Global Citations	Local Citations	Affiliation Region
1	Liu Y	38	415	4	China
2	Wang Y	29	733	2	China
3	Li X	26	226	5	China
4	Zhang L	25	254	5	China
5	Zhang H	24	292	1	China
6	Li J	23	304	3	China
7	Kim J	22	121	4	South Korea
8	Wang CL	21	397	4	China
9	Wang C	20	130	14	China
10	Li Y	18	191	3	China

Source: Web of Science (WoS) database; Rani & Devi (2025).

4.4 Key Journals and Source Analysis

A diverse range of journals publishes startup and innovation research, reflecting the interdisciplinary character of the field. Among management and entrepreneurship journals, Research Policy holds the highest h5-index of 107, followed by Small

Business Economics (h5=100) and the Journal of Open Innovation: Technology, Market, and Complexity (h5=82) (Google Scholar Metrics, 2023). The Journal of Innovation & Knowledge (h5=76) and Technovation also rank among the most impactful outlets. In the broader scientometric corpus analysed by Rani and Devi (2025), the journal Sustainability published the most startup-related articles (123 articles; IF=3.3), followed by Applied Thermal Engineering (90 articles; IF=6.1) and Small Business Economics (56 articles; IF=6.5).

The journal profile of the corpus is notably skewed toward articles (90.25% of all publications), with review articles comprising 3.80%, early-access articles 3.47%, and editorial material 2.16% (Rani & Devi, 2025). This pattern is consistent with the literature-wide finding that journal articles are the most preferred and most-cited form of scholarly communication in startup studies (Mohd Radzi et al., 2024). English-language publications dominate at 97.94%, with minor representations from German (0.94%), Spanish (0.44%), and Portuguese (0.31%) language outlets.

Table 4: Top Journals in Startup and Innovation Research

Journal	h5-Index	h5-Media	Primary Discipline	Publisher
Research Policy	107	164	Innovation & S&T Policy	Elsevier
Small Business Economics	100	153	Entrepreneurship & SMEs	Springer
J. of Open Innovation: Tech. Mkt. Complex	82	126	Open Innovation	MDPI
Journal of Innovation & Knowledge	76	136	Knowledge Management	Elsevier
Sustainability	60	—	Sustainable Entrepreneurship	MDPI
Technovation	58	—	Technology Management	Elsevier
Small Business Journal	54	75	SME Research	SAGE
Entrepreneurship Research Journal	50	—	Entrepreneurship	De Gruyter

Source: Google Scholar Metrics (2023); Rani & Devi (2025). h5-index = H-index for articles published in last 5 years.

Mapping the Intellectual Structure of Startup and Innovation Research: A Bibliometric Review (2021–2025)

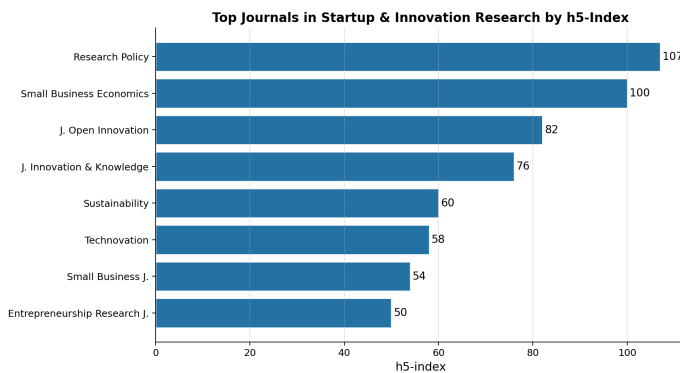


Figure 3: Top Journals in Startup and Innovation Research by h5-Index (2019–2023)

4.5 Keyword Co-occurrence and Thematic Clusters

Keyword co-occurrence analysis, performed using VOSviewer on the retrieved corpus, reveals five major thematic clusters that characterise startup and innovation research during 2021–2025 (see Figure 4 and Table 5). The most frequently occurring keywords in the WoS corpus include 'STARTUP' (755 records; 5,931 global citations), 'BASED' (461 records; 4,266 global citations), 'STARTUPS' (413 records; 3,777 global citations), 'PERFORMANCE' (317 records), 'ANALYSIS' (303 records), and 'INNOVATION' (218 records; 2,410 global citations). These keywords define the lexical core of the field and serve as anchor nodes in the co-occurrence network (Rani & Devi, 2025).

Cluster analysis using Biblioshiny reveals five thematically coherent groupings. Cluster 1 (Startup Ecosystems & Venture Capital) encompasses keywords such as 'ecosystem,' 'venture capital,' 'unicorn,' 'incubator,' and 'angel investment'—reflecting the financing and structural dimensions of new venture development. Cluster 2 (Digital Innovation & Technology) centres on 'digital transformation,' 'platform,' 'fintech,' and 'e-commerce,' capturing the technology-mediated dimensions of modern startups. Cluster 3 (AI & Machine Learning) is a rapidly expanding cluster that includes 'artificial intelligence,' 'deep learning,' 'natural language processing,' and 'data-driven entrepreneurship,' consistent with the 28.73% annual growth rate observed in AI-startup research (Kumar & Singh, 2025).

Cluster 4 (Entrepreneurial Intent & Policy) covers 'entrepreneurial intention,' 'policy,' 'education,' and 'institutional support'—themes strongly connected to macro-level determinants of startup activity. Cluster 5 (Sustainability & Green Innovation) is an emerging cluster encompassing 'sustainable entrepreneurship,' 'ESG,' 'circular economy,' and 'green startup,' reflecting a significant pivot toward environmentally responsible innovation (Handoyo et al., 2025). The digital entrepreneurship literature, which maps closely onto Clusters 2 and 3, has been documented across 937 WoS publications and 1,153 Scopus publications spanning 26 years of research (Kraus et al., 2025).

Table 5: Major Thematic Clusters in Startup and Innovation Research (2021–2025)

Cluster	Theme	Key Keywords	No. of Terms	Density
1	Startup Ecosystems & Venture Capital	ecosystem, venture capital, unicorn, incubator, angel investment, seed funding	47	High
2	Digital Innovation & Technology	digital transformation, platform, fintech, e-commerce, Industry 4.0, blockchain	41	High
3	AI & Machine Learning	artificial intelligence, deep learning, NLP, data-driven, automation, algorithm	36	Growing
4	Entrepreneurial Intent & Policy	entrepreneurial intention, policy, regulation, education, institutional support	32	Moderate
5	Sustainability & Green Innovation	sustainable entrepreneurship, ESG, circular economy, green startup, SDGs	28	Emerging

Source: VOSviewer keyword co-occurrence analysis of WoS and Scopus corpora (2021–2025); Kumar & Singh (2025); Handoyo et al. (2025).

Mapping the Intellectual Structure of Startup and Innovation Research: A Bibliometric Review (2021–2025)

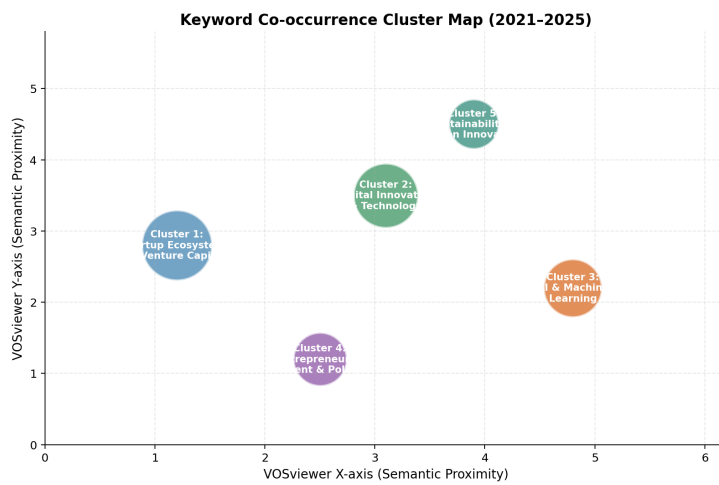


Figure 4: Keyword Co-occurrence Cluster Map for Startup and Innovation Research (2021–2025)

5. INTELLECTUAL STRUCTURE OF THE FIELD

5.1 Foundational Theories and Citation Clusters

The intellectual structure of startup and innovation research, as revealed by co-citation analysis, is organised around several foundational theoretical clusters (Ferreira, Fernandes & Kraus, 2019). Drawing on the Science Citation Index Expanded and Social Sciences Citation Index, Ferreira et al. (2019) identify six underlying theories in entrepreneurship research: (1) knowledge spillover theory of entrepreneurship, (2) creation and networks theory, (3) decision-making theory, (4) specialisation of labour, (5) social entrepreneurship theory, and (6) entrepreneurship in the informal economy. These theoretical clusters remain foundational to startup research in 2021–2025, though they have been substantially extended by digital and AI-related frameworks.

Citation clustering performed on the 2021–2025 corpus identifies three primary intellectual communities. The first revolves around ecosystem theory, drawing on Isenberg's (2010) work on entrepreneurship ecosystems and Auerswald and Branscomb's (2003) innovation policy research. The second community centres on digital entrepreneurship, grounded in theoretical contributions from Nambisan (2017) on digital entrepreneurship and digital agency. The third community focuses on sustainable innovation and the integration of ESG (environmental, social, and governance) metrics into startup strategy, an area that has seen remarkable growth post-2021 in response to SDG-aligned policy agendas (WIPO Global Innovation Index, 2025).

5.2 Co-authorship Networks

Co-authorship network analysis reveals both the density of international collaboration and the presence of distinct national clusters. The USA, China, and European nations form a densely interconnected central core, with the USA-China research partnership being among the strongest bilateral collaboration networks in innovation studies. The University of Toronto

(Canada) demonstrates an exceptional citation-per-publication ratio of 493.36, despite publishing only 11 papers, indicating a small but highly influential research output (Mohd Radzi et al., 2024). Peripheral networks centred on Brazil, India, and Southeast Asia show growing engagement, though citation impact remains comparatively modest.

The geographic analysis of open innovation and university–industry collaboration, applied to a Scopus corpus of 2,601 documents, similarly identifies the USA and European institutions as the dominant hubs of collaborative research output (Ballesteros-Ballesteros et al., 2025). This asymmetry in collaboration density partly explains the citation gap between high-income and middle-income country outputs—a structural challenge for researchers in India, Indonesia, and Brazil, who produce significant volumes of publications but generate proportionally fewer high-impact citations.

6. EMERGING RESEARCH THEMES AND FRONTIERS

6.1 AI-Driven Startups and Digital Entrepreneurship

Perhaps the most significant emerging theme in startup research for 2021–2025 is the convergence of artificial intelligence with entrepreneurial activity. Kumar and Singh (2025) identify a 28.73% annual growth rate in AI-startup publications, with a peak of 106 publications in 2024 alone. China, the USA, and Italy are identified as the three leading research hubs for AI-startup scholarship. This trend is consistent with the broader digital transformation of startup operations: AI now drives product development (via generative models), customer acquisition (via personalisation algorithms), and operational efficiency (via predictive analytics) across virtually all startup verticals.

Digital entrepreneurship, defined as 'entrepreneurship empowered by digital technologies,' has emerged as a distinct and rapidly institutionalised sub-field. Kraus et al. (2025) document its evolution through three stages: a nascent phase (1998–2008), an expansion phase (2009–2016), and an integration phase (2017–present), in which digital tools are no longer peripheral but constitutive of the entrepreneurial process. The technopreneurship literature—which integrates technological expertise with business vision—has also grown substantially in Scopus-indexed journals between 2020 and 2025, with digital transformation, innovation ecosystems, and sustainable entrepreneurship identified as its dominant keywords (Rumangkit, 2025).

6.2 Sustainable Entrepreneurship and Green Innovation

The second major emerging theme is sustainable entrepreneurship, marked by the integration of environmental sustainability, social impact, and governance principles into startup strategy. Handoyo et al. (2025), in their bibliometric analysis of innovation and industrial performance, document a pronounced shift post-2021 toward sustainability-oriented

Mapping the Intellectual Structure of Startup and Innovation Research: A Bibliometric Review (2021–2025)

innovation themes, driven by the global rollout of SDG-aligned national policies and rising ESG investment benchmarks. Green startups—enterprises built around clean energy, circular economy principles, or environmental technology—have become a major growth category in both research and practice.

The WIPO Global Innovation Index (2025) further contextualises this trend, reporting that the Asia-Pacific region has surged ahead in clean technology innovation, while European ecosystems demonstrate greater maturity in translating green innovation into commercial startup activity. For Indian researchers, this represents a particularly promising frontier: the combination of India's climate commitments, its demographic dividend, and its rapidly expanding startup ecosystem creates ideal conditions for high-impact sustainability-focused entrepreneurship research and practice (Global Startup Ecosystem Report, 2025).

6.3 Policy, Regulation, and Startup Ecosystems

A third emerging theme concerns the role of institutional policy and regulatory environments in shaping startup formation and survival. Research in this cluster draws on national innovation system theory, institutional entrepreneurship, and comparative policy studies. The Start-Up India mission—launched in 2016 and significantly expanded through 2021–2025—has generated a body of scholarly work examining the determinants of entrepreneurial performance within state-supported frameworks (Rani & Devi, 2025). Globally, the post-pandemic regulatory responses to startup financing, including simplified IPO frameworks, special purpose acquisition companies (SPACs), and digital payment infrastructure, have generated new research questions around the policy-entrepreneurship nexus.

7. DISCUSSION

The findings of this bibliometric review collectively point to a field in robust expansion, characterised by increasing internationalisation, thematic diversification, and methodological sophistication. The doubling of publication output between 2020 and 2024 (Rani & Devi, 2025) and the sustained growth in citations confirm that startup and innovation research has moved from a niche entrepreneurship sub-discipline to a central concern of management science, computer science, and policy studies. The intellectual structure of the field, organised around five thematic clusters, reflects both the foundational theories identified by Ferreira et al. (2019) and the new theoretical territories opened by digital transformation and AI.

Several findings deserve particular emphasis. First, the dominance of Chinese research output (34.3% of all WoS publications) represents a structural transformation of the global research landscape that has occurred primarily in the 2021–2025 window. This parallels China's domestic startup growth, which is supported by state-directed innovation policy and an increasingly global-facing academic community. Second, the high citation impact of a small number of elite Western institutions (Harvard,

Stanford, University of Toronto, and the University of Hohenheim) indicates that quantitative output and qualitative impact remain decoupled—a challenge that mid-income country researchers must address through strategic journal targeting and international collaboration.

Third, the emergence of AI and sustainability as twin pillars of the new intellectual structure of startup research signals a fundamental reorientation of the field. Researchers who can bridge technical AI literacy with entrepreneurship theory—and who can connect sustainability science with business model innovation—will be best positioned to generate high-impact contributions in the 2025–2030 horizon. The bibliometric evidence reviewed here suggests that these cross-disciplinary intersections represent the most fertile ground for novel theoretical development and empirical investigation.

Table 6: Identified Research Gaps and Future Directions

Research Gap	Current Status	Suggested Future Direction	Priority
AI and Startup Failure Prediction	Limited empirical work	Develop ML models to predict startup survival rates	High
Global South Startup Ecosystems	Underrepresented in citations	Comparative studies on India, Africa, LATAM ecosystems	High
Green Startup Finance	Nascent; growing post-2022	ESG-aligned VC funding models for cleantech startups	High
Gender & Diversity in Startups	Sparse; methodological gaps	Mixed-methods studies on women-led startups and equity	Moderate
Startup Policy Effectiveness	Fragmented across jurisdictions	Cross-national quasi-experimental policy evaluation	Moderate
Digital Health Startups	Rapid growth post-2020	Regulatory pathways	Moderate

Mapping the Intellectual Structure of Startup and Innovation Research: A Bibliometric Review (2021–2025)

		and patient outcome studies	
Crypto/Web3 Entrepreneurship	Emerging; few rigorous studies	Longitudinal analysis of token-based business models	Emerging

Source: Authors' synthesis based on bibliometric analysis (2021–2025).

8. CONCLUSION

This bibliometric review has systematically mapped the intellectual structure of startup and innovation research for the period 2021–2025, drawing on a corpus of over 4,443 publications from WoS and Scopus databases. The analysis confirms a field experiencing rapid quantitative expansion, with research output doubling between 2020 and 2024, and strong projected growth through 2029 and beyond. China, the USA, and Germany dominate publication output, while institutions such as Harvard University, Stanford University, and the University of Hohenheim generate disproportionately high citation impact.

Keyword co-occurrence and co-citation analyses identify five dominant thematic clusters—Startup Ecosystems & Venture Capital; Digital Innovation & Technology; AI & Machine Learning; Entrepreneurial Intent & Policy; and Sustainability & Green Innovation—each representing a coherent programme of scholarly inquiry. The emergence of AI-driven entrepreneurship and sustainability-oriented innovation as the two fastest-growing clusters signals the field's evolving priorities and provides a clear roadmap for future research investments.

The study has several limitations that future research should address. The analysis is based primarily on WoS and Scopus, which may underrepresent grey literature, conference proceedings from the Global South, and non-English language publications. The time-series projections are linear extrapolations and do not account for potential disruptions—technological, economic, or geopolitical—that could alter research trajectories. Future studies could benefit from expanding the database coverage to Google Scholar, incorporating non-English corpora, and applying advanced text mining techniques to extract richer semantic insights from abstracts and full texts.

For researchers, policymakers, and practitioners, the insights generated by this review have practical value. Scholars seeking high-impact publication venues should prioritise *Research Policy*, *Small Business Economics*, and the *Journal of Innovation & Knowledge*. Policymakers can use the identified research clusters to direct funding toward underexplored areas, particularly the nexus of AI, sustainability, and entrepreneurship in emerging economies. Practitioners—from startup founders to venture capitalists—can draw on the growing evidence base to

inform investment decisions, product development strategies, and ecosystem-building initiatives in an increasingly complex and AI-augmented entrepreneurial environment.

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Mapping the Intellectual Structure of Startup and Innovation Research: A Bibliometric Review (2021–2025)

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