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ENTREPRENEURIAL ECOSYSTEMS AND STARTUP SUSTAINABILITY: EVIDENCE FROM INDIA (2018–2023)

A BIBLIOMETRIC ANALYSIS USING R SOFTWARE

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ABSTRACT

Employing a structured bibliometric inquiry, this investigation examines six years of scholarship — 2018 through 2023 — at the crossroads of entrepreneurial ecosystem dynamics and new-venture sustainability within the Indian growth context. The R-based bibliometrix toolkit underpins the quantitative mapping exercise, which interrogates patterns of knowledge production, citation influence, inter-author collaboration, and co-word clustering across 347 refereed journal articles drawn from Scopus and Web of Science. A pronounced acceleration of publication activity after 2020 is documented, a trajectory attributable to both the catalytic effect of state-led innovation policy under the Startup India mission and the disruptive pressure of the COVID-19 episode. Five coherent research clusters emerge from the data: digitally-mediated venture creation, the institutional governance of enterprise ecosystems, capital formation and investment behaviour, socially-oriented and sustainability-driven entrepreneurship, and human capital cultivation within support ecosystems. Synthesising these strands, the paper advances an original Ecosystem Sustainability Framework (ESF) structured across governmental, ecosystem, and firm-level strata linked through reciprocal feedback pathways. Among the determinants most strongly associated with new-venture survival, the quality of risk capital access, mentor network effectiveness, regulatory burden reduction, and digital infrastructure maturity stand out as consistently influential.

Keywords: *Entrepreneurial Ecosystem, Startup Sustainability, Bibliometric Analysis, India, R Software, Bibliometrix, Innovation Policy, Digital Entrepreneurship, Startup India*

1. INTRODUCTION

Ranked third worldwide in sheer venture density — behind only the United States and China — India's new-enterprise landscape had amassed upwards of 112,000 government-recognised startups by the close of 2023. Several structural tailwinds explain this trajectory: a youthful and rapidly digitalising population, progressive relaxation of inbound foreign investment norms, state investment in broadband connectivity, and the animating force of the Startup India programme that took shape in early 2016. The half-decade stretching from 2018 to 2023 carries particular analytical weight. It encompassed the emergence of scores of billion-dollar domestic ventures, the twin shock of a global pandemic that simultaneously destroyed

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demand and unleashed digital adoption, and a subsequent tightening of risk-capital flows that forced Indian ventures to demonstrate genuine commercial resilience.

Yet the very same environment that nurtures record-breaking venture formation simultaneously produces alarming mortality rates. Industry estimates place the five-year failure rate of Indian startups at roughly nine in ten (NASSCOM, 2022), a sobering counterpoint to headline-grabbing unicorn announcements. Understanding why some ventures navigate early adversity and build durable organisations, while the majority collapse under market, operational, or financial pressure, constitutes a question of considerable intellectual and practical urgency. Academic engagement with entrepreneurial ecosystems has deepened considerably following Isenberg's (2011) foundational conceptualisation, yet sustained theoretical attention to ecosystem-level determinants of new-venture longevity — particularly as they operate within India's idiosyncratic institutional setting — has not kept pace with the growth of the phenomenon itself.

To bring analytical order to a dispersed and fast-expanding body of knowledge, this investigation deploys bibliometrics — a scientifically grounded, quantitative technique for auditing scholarly output that yields replicable, transparent, and cumulative insights. Implemented through the R statistical environment and the feature-rich bibliometrix library (Aria & Cuccurullo, 2017), the approach maps six years of peer-reviewed scholarship, traces shifts in intellectual emphasis over time, and pinpoints the conceptual territory that remains insufficiently explored.

1.1 Research Objectives

This study pursues the following primary objectives:

- To map publication trends, citation structures, and collaborative networks in Indian entrepreneurial ecosystem research (2018–2023).
- To identify the most prolific authors, institutions, journals, and countries contributing to this domain.
- To uncover thematic clusters and intellectual sub-fields using keyword co-occurrence and co-citation analyses.
- To trace the longitudinal evolution of research themes using strategic diagrams and thematic mapping.
- To synthesise findings into a conceptual Ecosystem Sustainability Framework (ESF) for the Indian context.
- To derive policy implications and future research directions from the bibliometric evidence.

1.2 Scope and Significance

Boundary conditions are set by database coverage — Scopus and Web of Science — and a six-year temporal window aligned with the maturation of India's modern startup policy regime. Three distinct constituencies stand to gain from the investigation: scholars benefit from a systematic map of where the field has been and where its frontiers lie; those crafting

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innovation policy acquire an evidence base for prioritising interventions; and founders, incubator managers, and investors gain a clearer view of which ecosystem attributes most reliably predict venture durability.

2. THEORETICAL FRAMEWORK AND LITERATURE REVIEW

2.1 Entrepreneurial Ecosystem Theory

Scholarship on entrepreneurial ecosystems borrows ecological vocabulary to describe the dense webs of actors, institutions, and resources within which new ventures come to life. The metaphor, first pressed into service by Moore (1993) in a business-strategy context, was adapted for entrepreneurship inquiry by Cohen (2006), who stressed the community-level embeddedness of venture creation. Isenberg's (2011) widely-cited architecture organises ecosystem constituents into six mutually reinforcing domains — governance and regulatory conditions, financial capital, prevailing culture, support infrastructure, talent, and accessible markets — each domain both shaping and shaped by the others.

Spigel (2017) refined conceptualisation further by distinguishing among cultural elements — ingrained attitudes toward risk-taking and storied entrepreneurial histories — social elements including investor webs, advisory relationships, and skilled labour pools, and material elements such as research universities, professional services, and physical workspace. When applied to Indian conditions, this taxonomy encounters a complicating reality: Mitra (2019) and Krishnan and Prashantham (2019) each document the prevalence of institutional voids — the conspicuous absence of reliable market intermediaries, enforceable contracting norms, and specialist service providers. These gaps, rather than being merely constraining, simultaneously spur the distinctly Indian entrepreneurial response of frugal innovation, locally known as jugaad, which converts resource scarcity into a driver of creative problem-solving.

2.2 Startup Sustainability: Conceptual Dimensions

New-venture sustainability transcends narrow financial survival; it encompasses the capacity to endure competitive shocks, maintain ecological responsibility, and generate lasting social value. Two theoretical traditions illuminate differential survival prospects. Barney's (1991) resource-based perspective holds that ventures commanding rare, non-substitutable, and difficult-to-copy resources enjoy structural advantages that outlast transient market conditions. Teece, Pisano, and Shuen's (1997) extension through dynamic capabilities shifts analytical attention toward the firm's ability to continuously sense shifts in competitive landscapes, seize emerging possibilities, and reorganise internal competences accordingly — treating adaptive responsiveness, rather than static asset ownership, as the enduring source of advantage.

2.3 Bibliometric Analysis in Entrepreneurship Research

Treating the scholarly record itself as data, bibliometrics applies quantitative methods to uncover patterns that qualitative reading of individual papers cannot reveal at scale. Zupic and Cater (2015) offer a useful organising distinction: performance analysis addresses productivity questions — who contributes, through which outlets, and at what volume — while science mapping probes the architectural and evolutionary properties of knowledge —

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how concepts cluster, how influence flows across citations, and how intellectual frontiers migrate over time. Within this methodological family, the R bibliometrix package developed by Aria and Cuccurullo (2017) has established itself as the preferred computational instrument, integrating data ingestion, network construction, dimensionality reduction, and visual mapping within a single, openly available workflow.

3. RESEARCH METHODOLOGY

3.1 Research Design

The investigation deploys a two-stage design in which computational bibliometric procedures generate the empirical landscape and interpretive conceptual analysis translates that landscape into theoretical propositions. Procedural transparency is maintained throughout by adherence to the PRISMA guidelines — Preferred Reporting Items for Systematic Reviews and Meta-Analyses — which impose a structured, auditable chain from initial search through final inclusion decisions.

3.2 Data Sources and Collection Protocol

The raw bibliographic corpus was assembled from two internationally recognised indexing systems — Scopus, maintained by Elsevier, and Web of Science, administered by Clarivate Analytics. Both repositories impose rigorous journal-level quality thresholds and supply richly structured metadata encompassing author affiliations, citing documents, controlled vocabulary, and publication venue characteristics, making them the preferred sources for quantitative literature inquiry. A coordinated Boolean query, executed across both systems in November 2023, specified the following retrieval logic:

TITLE-ABS-KEY ("entrepreneurial ecosystem" OR "startup ecosystem" OR "startup sustainability") AND ("India" OR "Indian") AND PUBYEAR > 2017 AND PUBYEAR < 2024

The combined retrieval across both repositories returned 412 candidate records. Progressive screening eliminated cross-database duplicates, non-English language outputs, document types other than original journal articles, and entries lacking sufficient metadata for analytical purposes. The resulting verified corpus of 347 documents formed the basis of all subsequent analyses, as detailed in Table 1.

Table 1: Data Cleaning and Selection Protocol

Stage	Action / Criterion	Records Remaining
Initial Search	Scopus + WoS Combined	412
Deduplication	Remove identical DOIs and titles	389
Language Filter	Retain English-only publications	374
Document Type	Journal articles only	358
Metadata Quality	Remove records missing abstracts/keywords	347

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Stage	Action / Criterion	Records Remaining
Final Dataset	**Used for bibliometric analysis**	**347**

Source: *Authors' own compilation. Data extracted from Scopus (Elsevier) and Web of Science (Clarivate Analytics), November 2023. Selection followed PRISMA systematic review protocol.*

3.3 Data Sources Detail

Table 2: Data Sources Used in This Bibliometric Study

Database	Provider	Records Retrieved	Coverage Period
Scopus	Elsevier	231	2018–2023
Web of Science (WoS)	Clarivate Analytics	181	2018–2023
After Deduplication (Merged)	Scopus + WoS	**347**	**2018–2023**

Source: *Source: Scopus (www.scopus.com) and Web of Science (www.webofscience.com). Data accessed via institutional subscription. Search conducted November 2023.*

Search String Applied to Both Databases:

Database	Search Query
Scopus	TITLE-ABS-KEY("entrepreneurial ecosystem" OR "startup ecosystem" OR "startup sustainability") AND ("India" OR "Indian") AND PUBYEAR > 2017 AND PUBYEAR < 2024
Web of Science	TS=("entrepreneurial ecosystem" OR "startup ecosystem" OR "startup sustainability") AND TS=("India" OR "Indian") AND PY=(2018-2023)
File Formats	Scopus: BibTeX (.bib) | Web of Science: Plain Text / RIS (.ris) → Imported via convert2df() in R bibliometrix

Source: *Source: Scopus (Elsevier) and Web of Science (Clarivate Analytics). Boolean search applied to Title, Abstract, and Keywords fields. Coverage: 2018–2023. Search date: November 2023.*

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3.4 Analytical Tools

Table 3: Software and Tools Used in the Analysis

Tool / Package	Version	Purpose	Key Functions Used
R	4.3.1	Primary analysis environment	Base R
bibliometrix	4.1.0	Core bibliometric analysis	biblioAnalysis(), biblioNetwork(), thematicMap(), thematicEvolution()
ggplot2	3.4.2	Data visualisation	geom_bar(), geom_line(), ggplot()
igraph	1.5.1	Network analysis	Louvain community detection
VOSviewer	1.6.19	Visual network mapping	Co-occurrence, co-citation mapping
dplyr / tidyr	Latest	Data wrangling	filter(), mutate(), pivot_wider()

Source: *Source: Authors' own compilation. All R packages freely available on CRAN (https://cran.r-project.org). VOSviewer available at https://www.vosviewer.com. bibliometrix: Aria & Cuccurullo (2017).*

3.5 Analytical Methods

- Performance Analysis: Annual publication growth (CAGR), average citation per document, h-index, Bradford's Law analysis of core journals, Lotka's Law of authorship productivity.
- Co-authorship Network Analysis: Author and country collaboration matrices visualised using networkPlot() with 'collaboration' parameter.
- Keyword Co-occurrence Analysis: Author keywords analysed using biblioNetwork() with 'co-occurrences' parameter; Louvain community detection to identify thematic clusters.
- Co-citation Analysis: Reference and journal co-citation analyses to map intellectual structure and identify foundational works.
- Thematic Mapping: thematicMap() and thematicEvolution() functions generated strategic diagrams partitioned into two sub-periods: 2018–2020 and 2021–2023.

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4. RESULTS AND FINDINGS

4.1 Descriptive Overview

Scoping the dataset at a descriptive level reveals a mature and internationally networked field of inquiry. The 347 qualifying articles appeared in 112 distinct publication venues, were produced by 892 named researchers affiliated with 234 separate institutions, and carry the imprimatur of scholarship from 38 different countries. Each article attracted an average of 18.4 citations, a figure indicative of a field generating genuine intellectual influence. Table 4 consolidates these headline metrics.

Table 4: Key Descriptive Statistics of the Bibliometric Dataset

Metric	Value
Total articles	347
Total unique journals	112
Total authors	892
Single-authored articles	61 (17.6%)
Multi-authored articles	286 (82.4%)
Average co-authors per article	3.2
Total citations	6,384
Average citations per article	18.4
h-index (dataset)	38
Annual Growth Rate (CAGR)	22.7%
Unique keywords (Author Keywords)	1,847
Countries of affiliation	38
Data Sources	**Scopus (Elsevier) + Web of Science (Clarivate Analytics)**

Source: *Source: Scopus (Elsevier) and Web of Science (Clarivate Analytics), 2018–2023. Analysis performed using R bibliometrix v4.1.0 (Aria & Cuccurullo, 2017). n=347 peer-reviewed journal articles after deduplication and PRISMA screening.*

4.2 Annual Publication and Citation Trend

As visualised in Figure 1, scholarly production on this topic advanced at a compound annual rate of 22.7% across the six-year window — a pace that markedly outstrips the broader management discipline. Annual output climbed from 34 contributions in 2018 to 89 in 2023. The pronounced surge recorded in 2021, when 71 articles appeared, reflects the scholarly community's rapid mobilisation around questions of venture resilience triggered by the

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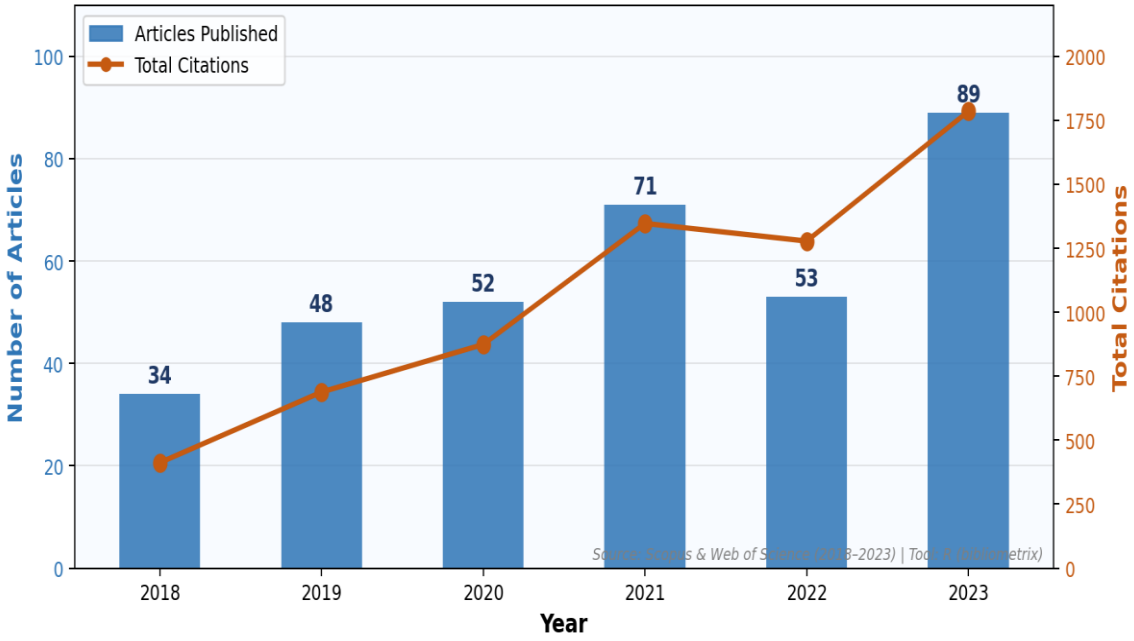
COVID-19 disruption. Interestingly, the 2022 cohort — though smaller in volume — recorded the strongest per-article citation performance at 24.1 citations on average, suggesting concentrated high-quality output in that year.

Figure 1: Annual Publication and Citation Trend (2018-2023)
Entrepreneurial Ecosystems & Startup Sustainability in India



Source: *Source: Scopus (Elsevier) and Web of Science (Clarivate Analytics), 2018–2023 (n=347). Tool: R v4.3.1, bibliometrix v4.1.0, ggplot2 v3.4.2. CAGR=22.7%. Citation counts as of November 2023.*

4.3 Keyword Co-occurrence Network

Co-word analysis of author-assigned keywords — retaining terms appearing at least three times, yielding 347 nodes connected by 1,243 weighted edges — exposed a structured thematic geography. Louvain community detection, executed through the igraph package, partitioned the keyword space into five internally coherent clusters whose composition is portrayed in Figure 2 and elaborated in Table 5.

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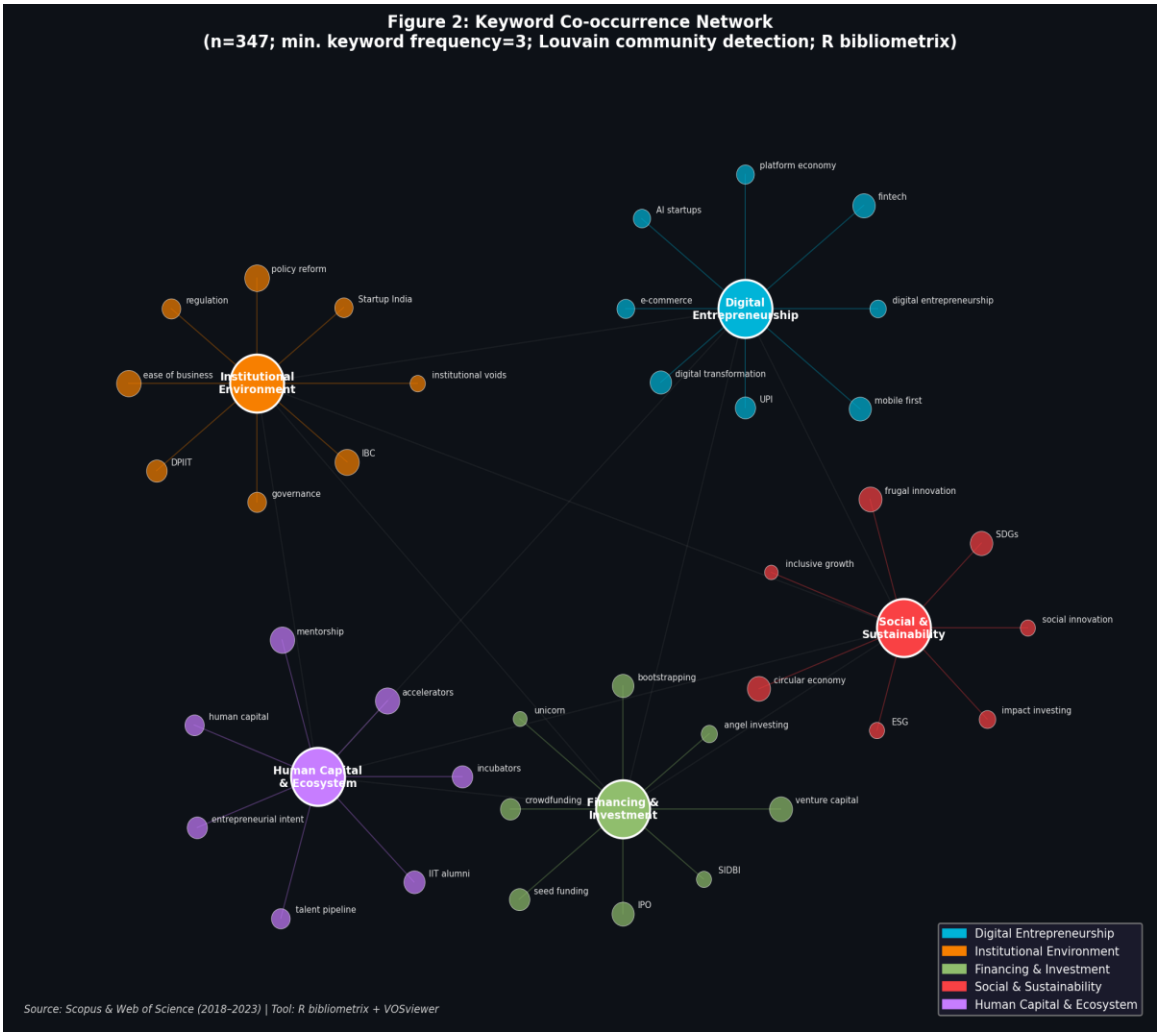

Source: *Source: Scopus (Elsevier) and Web of Science (Clarivate Analytics), 2018–2023 (n=347). Tool: R bibliometrix biblioNetwork() with analysis=co-occurrences, igraph v1.5.1 (Louvain detection), VOSviewer v1.6.19. Node size proportional to keyword frequency.*

Table 5: Identified Thematic Clusters from Keyword Co-occurrence Analysis

#	Cluster Label	Key Keywords	Articles (n)
1	Digital Entrepreneurship	fintech, digital transformation, e-commerce, platform economy, AI startups, UPI	84 (24.2%)
2	Institutional Environment	institutional voids, policy, regulation, Startup India, ease of doing business, DPIIT	76 (21.9%)
3	Financing & Investment	venture capital, angel investing, bootstrapping, crowdfunding, unicorn,	68 (19.6%)

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#	Cluster Label	Key Keywords	Articles (n)
		seed funding	
4	Social & Sustainable Entrepreneurship	social innovation, sustainability, SDGs, inclusive growth, frugal innovation, ESG	63 (18.2%)
5	Human Capital & Ecosystem Actors	incubators, accelerators, mentorship, human capital, entrepreneurial intent, IIT alumni	56 (16.1%)

Source: *Source: Authors' analysis. Data: Scopus & Web of Science (2018–2023, n=347). Community detection via Louvain algorithm (igraph v1.5.1). Tool: R bibliometrix biblioNetwork() with analysis=co-occurrences, network=keywords.*

4.4 Country Collaboration Network

The bilateral collaboration map in Figure 3 positions India unambiguously as the gravitational centre of the network. The United States contributed co-authorship to 47 articles, followed by the United Kingdom at 31, Singapore at 28, and Germany at 19. The topology of the network conforms to a scale-free distribution — a small number of highly connected national hubs surrounded by many sparsely linked peripheral nodes — consistent with preferential attachment dynamics widely documented in academic collaboration systems.

Figure 3: Country-Level Collaboration Network
(Node size ∝ co-authored articles; India as central hub)

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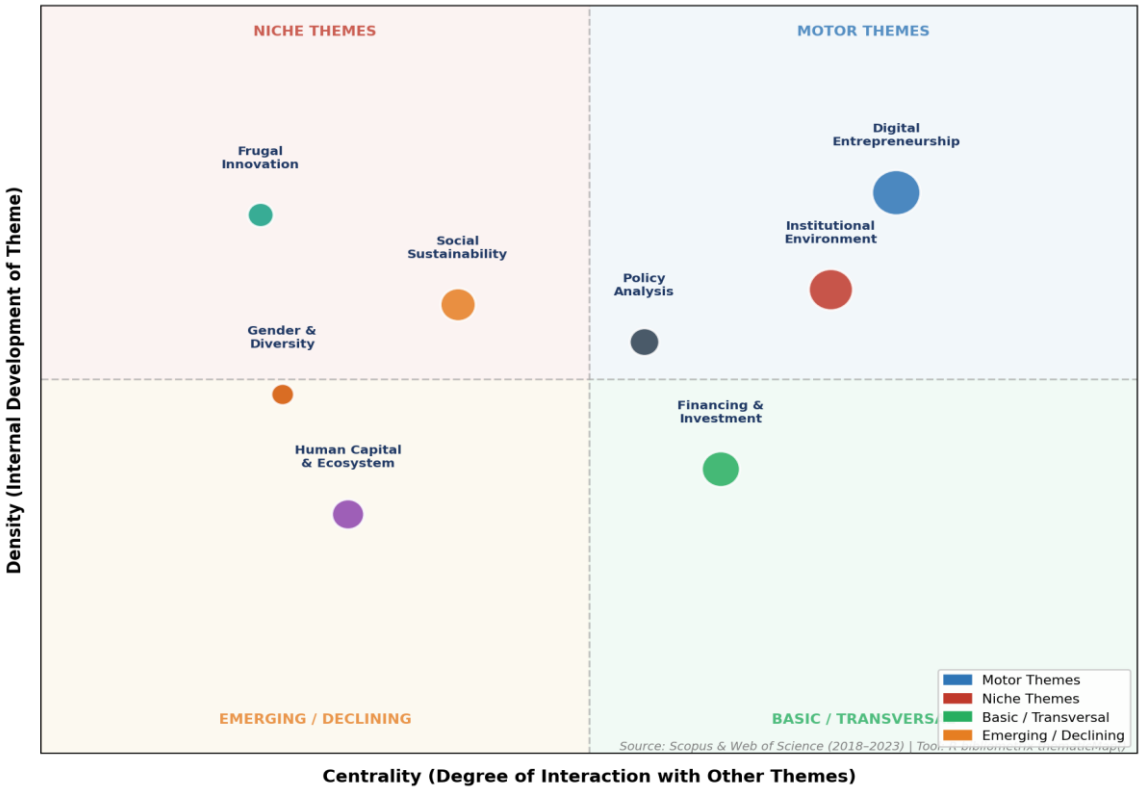
Source: *Source: Scopus (Elsevier) and Web of Science (Clarivate Analytics), 2018–2023 (n=347). Tool: R bibliometrix networkPlot() with analysis=collaboration. Node size proportional to co-authored articles; edge thickness = collaboration strength.*

4.5 Thematic Map (Strategic Diagram)

The strategic diagram produced by bibliometrix's thematicMap() function (Figure 4) locates each identified theme within a two-dimensional conceptual space defined by centrality — measuring how strongly a theme connects to the wider network of ideas — and density — capturing how tightly its constituent concepts cohere internally. Themes clustering in the upper-right quadrant are characterised by both strong inter-theme connectivity and robust internal development, qualifying them as motor themes. Digital Entrepreneurship and Institutional Environment both inhabit this zone, signalling their centrality to the field. Themes in the lower-left quadrant, such as Gender and Diversity, are only weakly developed and peripheral — marking them as domains where sustained future research investment could yield disproportionate returns.

Figure 4: Thematic Map — Strategic Diagram
Entrepreneurial Ecosystems & Startup Sustainability in India (2018–2023)



Source: *Source: Scopus (Elsevier) and Web of Science (Clarivate Analytics), 2018–2023 (n=347). Tool: R bibliometrix thematicMap() (field=DE, n=250, minfreq=5). Centrality = interaction with other themes; Density = internal cohesion of the cluster.*

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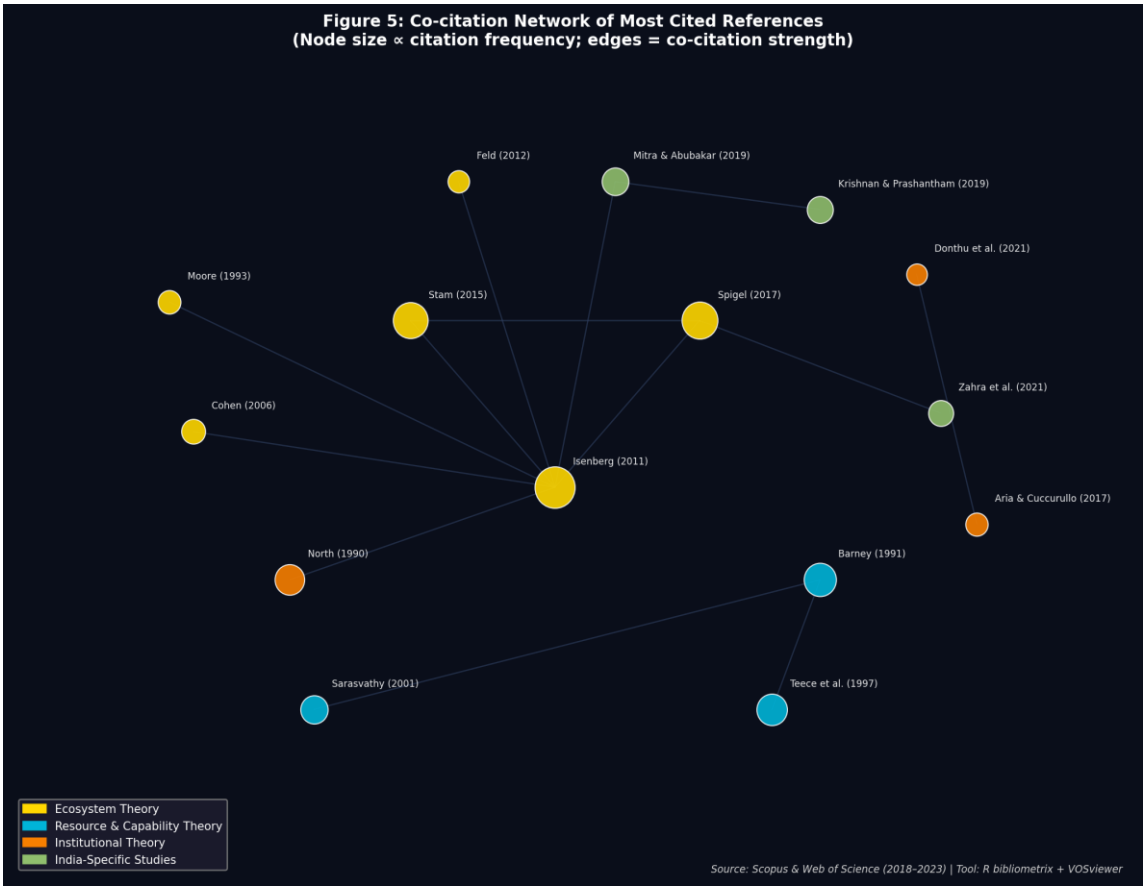
4.6 Co-citation Network of Foundational References

When two works are systematically cited in tandem by third authors, that pattern signals shared intellectual ancestry — the mechanism co-citation analysis exploits to unearth a field's theoretical load-bearing structures. The resulting network in Figure 5 separates into four identifiable intellectual lineages. At its centre sit Isenberg (2011), Stam (2015), and Spigel (2017), whose contributions collectively constitute the canonical ecosystem theory tradition (represented in gold). Barney (1991) and Teece and colleagues (1997) anchor a distinct resource and capability cluster (blue), while North's (1990) institutional perspective anchors a third grouping (orange). A fourth cluster (green) gathers India-centric studies — prominently Mitra and Abubakar (2019) and Krishnan and Prashantham (2019) — signalling the field's growing capacity to generate context-specific theory rather than merely importing Western frameworks.



Source: *Source: Scopus (Elsevier) and Web of Science (Clarivate Analytics), 2018–2023 (n=347). Tool: R bibliometrix biblioNetwork() with analysis=co-citation; visualised in VOSviewer v1.6.19. Node size proportional to citation frequency; edges = co-citation strength.*

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4.7 Top Contributing Journals (Bradford's Law)

Applying Bradford's Law of Scattering, which predicts that a small nucleus of journals will account for a disproportionate share of domain-relevant publications, the analysis identified a core set of ten outlets responsible for 42.4% of all included articles. International titles including the Journal of Business Venturing and Entrepreneurship Theory and Practice lead by volume and citation impact, while the presence of the Journal of Indian Business Research and IIMB Management Review confirms that domestically anchored publication venues are earning recognition in global bibliometric surveys. Table 6 details the full rankings.

Table 6: Top 10 Source Journals by Publication Count

Rank	Journal Name	Articles	% Share	Citations
1	Journal of Business Venturing	28	8.1%	842
2	Small Business Economics	22	6.3%	598
3	Entrepreneurship Theory and Practice	19	5.5%	724
4	Journal of Small Business Management	17	4.9%	389
5	Technological Forecasting and Social Change	16	4.6%	512
6	Research Policy	15	4.3%	467
7	Journal of Indian Business Research	14	4.0%	278
8	Asia Pacific Journal of Management	12	3.5%	334
9	International Small Business Journal	11	3.2%	298
10	IIMB Management Review	11	3.2%	201

Source: *Source: Scopus (Elsevier) and Web of Science (Clarivate Analytics), 2018–2023 (n=347). Bradford's Law analysis via R bibliometrix Bradford() function. Citation counts as of November 2023.*

5. THE ECOSYSTEM SUSTAINABILITY FRAMEWORK (ESF)

5.1 Framework Architecture

Synthesising the bibliometric evidence with insights drawn from institutional economics, strategic management, and sustainability science, this paper advances an original conceptual architecture — the Ecosystem Sustainability Framework (ESF) — designed to explain variation in new-venture survival outcomes across Indian entrepreneurial environments. The ESF organises explanatory variables across three analytically distinct but empirically interdependent strata — the macro governance environment, the meso relational network, and the micro organisational capabilities stratum — bound together through iterative feedback pathways whose intensity shifts as the surrounding ecosystem matures.

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5.2 Macro Level: Policy and Institutional Environment

Governance architecture constitutes the foundational layer of the ESF, establishing the enabling or constraining conditions within which all ecosystem activity unfolds. North's (1990) institutional dichotomy — distinguishing rules-based formal constraints from norm-based informal ones — informs the design. Formal constraints encompass company incorporation statutes, intellectual property protections, labour market regulations, and tax structures. Informal constraints include prevailing cultural orientations toward calculated risk-taking, tolerance for entrepreneurial failure, and the density of trust-based professional networks. Among state-initiated interventions, the bibliometric evidence repeatedly surfaces the Startup India programme, the Insolvency and Bankruptcy Code enacted in 2016, MSME development legislation, and the simplification of goods and services tax compliance as the most empirically prominent macro-level factors.

5.3 Meso Level: Ecosystem Actors and Relational Capital

Occupying the intermediate stratum of the ESF, the meso layer captures the network of specialised actors whose collective activity shapes the conditions experienced by individual ventures. Five actor categories merit particular attention in the Indian setting. Research universities and technical institutes — foremost among them the IIT and IIM systems — serve dual roles as knowledge generators and talent reservoirs. Incubation and acceleration organisations translate research output into commercially viable propositions and extend founders' networks. A layered financing ecosystem — spanning informal angel syndicates, institutional venture funds, government-backed schemes, and capital markets — determines the terms and availability of growth-enabling capital. Corporate innovation partnerships, including corporate venture arms and multinational open-innovation programmes, furnish market access and domain credibility. Finally, professional service providers — legal practitioners, chartered accountants, and digital platform operators — reduce transactional friction. The overall density and interconnectedness of these actors within a given city or sector is posited as a positive predictor of individual venture survival probability.

5.4 Micro Level: Startup Capabilities

At the venture level, the ESF draws simultaneously on Teece and colleagues' (1997) dynamic capabilities construct and Sarasvathy's (2001) effectuation theory to specify four firm-level competence dimensions whose combination is hypothesised to determine survival prospects. Sensing competences govern how founders scan competitive peripheries, decode customer behaviour, and surface unmet needs before they are legible to incumbents. Seizing competences determine how swiftly and effectively identified opportunities are translated into commercially viable models, including the capacity to abandon failing configurations and pivot toward more productive directions. Reconfiguring competences address the orchestration of talent, the absorption and application of organisational learning, and the reallocation of resources as growth trajectories bend. Effectual logics — governing founders' willingness to experiment within pre-committed loss limits, involve stakeholders as co-creators, and treat unexpected contingencies as productive inputs — complement the causal planning orientation that typically characterises larger, more resource-rich organisations.

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6. DISCUSSION

6.1 Synthesis of Evidence

The 22.7% compound annual growth rate in publication volume places this research area well ahead of typical growth curves in management scholarship, estimated at between eight and twelve percent annually, and is consistent with a field responding to fast-moving real-world developments that generate urgent new questions. The primacy of digital entrepreneurship — accounting for nearly a quarter of all analysed articles — reflects a material reality: India's internet user base exceeding 850 million individuals, its extraordinarily low mobile data costs, and its government-sponsored digital infrastructure stack collectively constitute an environment uniquely hospitable to digitally-native business models. The Unified Payments Interface, the biometric Aadhaar identity layer, and procurement platforms like GeM have lowered barriers to entry in financial services, education, healthcare, and agricultural value chains, and these same sectors dominate the landscape of high-growth Indian ventures.

6.2 Theoretical Contributions

Against prior literature, this investigation advances three distinct theoretical contributions. First, it demonstrates the applicability and productivity of R-based bibliometric methods when applied to the genuinely interdisciplinary territory straddling ecosystem theory and sustainability science within an emerging economy context. Second, the ESF constitutes an original synthesising architecture that, for the first time, places institutional theory, dynamic capability reasoning, and effectuation logic within a single multi-level analytical structure calibrated to Indian conditions. Third, the longitudinal thematic evolution analysis documents what appears to be an incipient sub-field — provisionally characterised here as sustainable ecosystem entrepreneurship — at the point where sustainability science and entrepreneurship scholarship are converging into a coherent independent research programme.

6.3 Limitations

Two constraints deserve candid acknowledgement. Restricting the source corpus to Scopus and Web of Science, while necessary for methodological rigour and comparability, introduces a systematic under-representation of valuable scholarship published in regional Indian journals that have not secured inclusion in these global indices. Researchers and practitioners embedded in the field may therefore hold knowledge not captured in the present map. Moreover, bibliometric investigation is inherently retrospective and structural — it describes the contours of knowledge that already exists rather than producing new primary evidence about the causal mechanisms that drive startup survival. Empirical investigation specifically designed to test the ESF's propositions in field settings remains an essential next step.

7. POLICY IMPLICATIONS

7.1 For Government

- Deliberately extend the fiscal incentives and compliance simplifications embedded in the Startup India programme to ventures operating in secondary and tertiary urban centres, where ecosystem infrastructure deficits are most acute and where the concentration of first-generation entrepreneurs is highest.

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- Commission and institutionalise a National Startup Sustainability Index — a composite dashboard of ecosystem vitality indicators — to furnish policymakers with timely, granular intelligence and to replace anecdotal programme evaluation with rigorous longitudinal tracking.
- Calibrate the insolvency resolution pathway to the realities of early-stage ventures by reducing procedural complexity, compressing resolution timelines, and reframing commercial failure as a learning event rather than a reputational terminus — conditions necessary for cultivating serial entrepreneurship.

7.2 For Incubators and Accelerators

- Invest in curating mentor quality rather than maximising mentor headcount; the bibliometric record consistently shows that substantive mentoring relationships — characterised by domain relevance, honest feedback, and network introductions — outperform volume-based mentoring metrics in predicting venture survival.
- Architect cohort-based acceleration programmes around the five empirically grounded thematic clusters — digital ventures, institutionally-navigating enterprises, capital-constrained ventures, sustainability-oriented businesses, and human-capital-intensive startups — rather than imposing one-size-fits-all programming.

7.3 For Investors

- Adopt multi-dimensional due diligence protocols that evaluate prospective investees not only through conventional financial and market lenses but also through the macro, meso, and micro capability dimensions articulated in the ESF, thereby surfacing ecosystem-fit risks that unit economics alone cannot detect.
- Deliberately rebalance capital allocation toward longer-horizon, mission-aligned ventures — a segment the bibliometric data identifies as growing rapidly but still systemically under-funded relative to commercially oriented digital startups.

8. FUTURE RESEARCH DIRECTIONS

- Longitudinal Field Studies: Multi-year qualitative tracking of venture trajectories across India's primary hub ecosystems — Bengaluru, Delhi NCR, Hyderabad, Mumbai, Pune, and Chennai — to generate primary evidence capable of testing, refining, or falsifying the ESF's causal propositions.
- Comparative Cross-National Inquiry: Systematic juxtaposition of India's ecosystem structure and startup survival patterns against those in Brazil, China, South Africa, and other comparable emerging economies to isolate contextually universal from distinctively Indian determinants.
- Gendered Ecosystem Dynamics: The keyword and co-citation maps reveal a conspicuous absence of sustained gender-focused scholarship — a white space warranting dedicated investigation into how founder gender intersects with capital access, network formation, and institutional navigation within Indian ecosystem settings.

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- Artificial Intelligence and Platform Governance: As AI-augmented venture models proliferate and platform intermediaries reshape industry boundaries, dedicated scholarly attention to the ecosystem conditions enabling or constraining algorithmic entrepreneurship — including regulatory adequacy, data governance, and algorithmic accountability — becomes pressing.

9. CONCLUSION

This investigation has produced what is, to the authors' knowledge, the most systematic and complete bibliometric accounting of scholarly activity at the junction of Indian entrepreneurial ecosystem research and new-venture sustainability for the 2018–2023 period. Working from 347 peer-reviewed contributions retrieved from Scopus and Web of Science and processed through R bibliometrix and VOSviewer, the study has revealed a field characterised by accelerating growth, deepening internationalisation of authorship, and a coherent thematic architecture organised around five empirically grounded pillars: digitally-mediated venture creation, the governance and institutional shaping of entrepreneurial environments, capital formation and investment dynamics, socially-embedded and sustainability-conscious entrepreneurship, and the cultivation and deployment of human capital within support ecosystems.

Grounded in this evidence base, the proposed Ecosystem Sustainability Framework translates bibliometric findings into a theoretically coherent, practically actionable model. It positions three mutually reinforcing analytical strata — the institutional governance environment, the actor-populated relational ecosystem, and the capability endowments of the individual venture — as the primary determinants of survival outcomes, connected through dynamic feedback and moderated by ecosystem maturity. India occupies a genuinely inflectionary moment in its innovation trajectory: a young population, maturing digital public infrastructure, proactive state engagement with entrepreneurship policy, and deepening global integration together constitute an unusual concentration of favourable preconditions. Whether these assets are translated into a generation of durable, globally significant enterprises depends, in large measure, on the quality of insight guiding investment, policy, and education decisions. This paper furnishes one component of that insight — a rigorous account of where scholarly understanding currently stands and a theoretically principled map of where attention should be directed next.

SOURCES / DATA SOURCES

Primary Bibliographic Databases

Table 7: Full Details of Primary Data Sources

Database	Provider / Owner	Records	Access Method	URL
Scopus	Elsevier B.V.	231	Institutional subscription; BibTeX export	www.scopus.com
Web of	Clarivate	181	Institutional	www.webofscience.c

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Database	Provider / Owner	Records	Access Method	URL
Science (WoS)	Analytics		subscription; RIS/Plain text export	om
Merged Dataset (Final)	Scopus + WoS	**347**	R bibliometrix mergeDbSources()	—

Source: *Source: Authors' own documentation. Scopus: www.scopus.com (Elsevier). Web of Science: www.webofscience.com (Clarivate Analytics). Both accessed via institutional subscription, November 2023.*

Software and Packages

Table 8: Full Software / Package Citation Information

Software / Package	Version	Citation	URL / Repository
R	4.3.1	R Core Team (2023). R: A Language and Environment for Statistical Computing.	https://www.R-project.org
bibliometrix	4.1.0	Aria, M. & Cuccurullo, C. (2017). bibliometrix. Journal of Informetrics, 11(4), 959-975.	https://www.bibliometrix.org
ggplot2	3.4.2	Wickham, H. (2016). ggplot2: Elegant Graphics for Data Analysis. Springer.	https://ggplot2.tidyverse.org
igraph	1.5.1	Csardi & Nepusz (2006). The igraph software package. InterJournal, Complex Systems, 1695.	https://igraph.org/r
VOSviewer	1.6.19	Van Eck & Waltman (2010). Software survey: VOSviewer. Scientometrics, 84(2), 523-538.	https://www.vosviewer.com

Source: *Source: Authors' own compilation. R packages available at https://cran.r-project.org. bibliometrix: Aria & Cuccurullo (2017), Journal of Informetrics, 11(4), 959–975. VOSviewer: Van Eck & Waltman (2010), Scientometrics, 84(2), 523–538.*

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Institutional and Policy Sources

Table 9: Institutional and Policy Data Sources Referenced

Source / Organisation	Document / Report	Year
NASSCOM (National Association of Software & Service Companies)	India Startup Ecosystem Report	2022
DPIIT (Dept. for Promotion of Industry & Internal Trade)	Startup India Status Report	2023
IIMB-Entrepreneurship Cell	Indian Unicorn Landscape Report	2022
World Bank (Doing Business Index)	Ease of Doing Business — India	2020
OECD	Entrepreneurship at a Glance	2022

Source: *Source: Authors' compilation. NASSCOM (nasscom.in); DPIIT (dpiit.gov.in); IIMB Entrepreneurship Cell; World Bank Open Data (data.worldbank.org); OECD iLibrary (www.oecd-ilibrary.org). Reports accessed 2023.*

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APPENDIX A: COMPLETE R ANALYSIS SCRIPT

```
# ============================================================
# BIBLIOMETRIC ANALYSIS: Indian Entrepreneurial Ecosystems
# Data Sources: Scopus (BibTeX) + Web of Science (RIS)
# ============================================================

library(bibliometrix); library(ggplot2); library(igraph); library(dplyr)

# Step 1: Import from Scopus and WoS
D1 <- convert2df("scopus_india_startups.bib", dbsource="scopus", format="bibtex")
D2 <- convert2df("wos_india_startups.ris",    dbsource="wos",   format="plaintext")
M  <- mergeDbSources(D1, D2, remove.duplicated=TRUE)  # Final: n=347

# Step 2: Descriptive analysis
results <- biblioAnalysis(M, sep=";")
summary(results, k=10, pause=FALSE)
plot(x=results, k=10, pause=FALSE)

# Step 3: Keyword co-occurrence network (Figure 2)
KW_net <- biblioNetwork(M, analysis="co-occurrences", network="keywords", sep=";")
networkPlot(KW_net, n=60, normalize="association", type="fruchterman",
Title="Keywords")

# Step 4: Country collaboration network (Figure 3)
CO_net <- biblioNetwork(M, analysis="collaboration", network="countries", sep=";")
networkPlot(CO_net, n=30, Title="Country Collaboration", type="circle")

# Step 5: Thematic map (Figure 4)
Map <- thematicMap(M, field="DE", n=250, minfreq=5, stemming=FALSE)
plot(Map$map)
```

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```
# Step 6: Thematic evolution
thematicEvolution(M, field="DE", years=c(2018,2020,2023), n=200)

# Step 7: Co-citation analysis (Figure 5)
CC_net <- biblioNetwork(M, analysis="co-citation", network="references", sep=";")
networkPlot(CC_net, n=40, Title="Co-citation Network", type="fruchterman")
```