



REVIEW ARTICLE



<https://doi.org/10.1057/s41599-024-02817-9>

OPEN

Innovation dynamics within the entrepreneurial ecosystem: a content analysis-based literature review

Rishi Kant Kumar ^{1✉}, Srinivas Subbarao Pasumarti², Ronnie Joshe Figueiredo³, Rana Singh¹, Sachi Rana⁴, Kumod Kumar¹ & Prashant Kumar ⁵

Entrepreneurial ecosystems (EEs) delineate concepts from varied streams of literature originating from multiple stakeholders and are diagnosed by different levels of analysis. Taking up a sample of 392 articles, this study examines how innovation fosters the emergence of self-operative and self-corrective entrepreneurial ecosystems in the wake of automatic market disruptions. It also finds that measures lending vitality and sustainability to economic systems across the world through a mediating role played by governments, along with synergies exhibited by academia and “visionpreneurs” at large, give rise to aspiring entrepreneurs. The study also aligns past practices with trending technologies to enrich job markets and strengthen entrepreneurial networks through spillover and speciation. The research offers valuable insights into entrepreneurial ecosystems’ practical policy implications and self-regulating mechanisms, and it suggests that governments overseeing these entrepreneurial ecosystems should identify and nurture the existing strengths within them. Additionally, entrepreneurial ecosystems can benefit from government support through subsidies and incentives to encourage growth. In collaboration with university research, specialized incubation centers can play a pivotal role in creating new infrastructures that foster current and future entrepreneurial development.

Introduction

Innovation provides a gateway to products/services in varied market dynamism by transcending time horizons. Innovations work on the back and call of automatic disruptions that happen in markets through the mediating role of governments, institutions, and academicians, leading to “self-operative” and “self-corrective ecosystems.” Most of the time, innovative processes are self-corrective and operate without much effort. As innovations in products keep evolving, they rekindle customers’ interest and increase the prospects of products for better sales and a long-life cycle (for example, entrepreneurs may offer new features or new looks to older products). To undertake this sort of initiative, commercial freedoms must be guaranteed, which

¹ Chandragupt Institute of Management Patna, Patna, India. ² Department of Management studies, NALSAR University of Law, Hyderabad, India. ³ Centre of Applied Research in Management and Economics, Polytechnic Leiria, Leiria, Portugal. ⁴ Dewan Institute of Management Studies CCS University, Meerut, India. ⁵ O.P. Jindal Global University, Sonapat, Haryana, India. ✉email: rishinit14@gmail.com

can be used to create, deploy, and protect intangible assets (Teece, 2007; Sprinkle, 2003). Thus, innovations together with entrepreneurial networks or ecosystems provide dynamic capabilities to the economy by imparting continuity. In that process, entrepreneurs, through their better learning skills and novel methods, create opportunities in changing markets (Garnsey and Leong, 2008; Garnsey et al., 2008; Kantarelis, 2009; Levinson, 2010; Biggs et al., 2010), as markets are always fueled by disruptions in entrepreneurial ventures, and old products must be replaced by newer ones.

Further, synergy between entrepreneurial ecosystems and research plays a pivotal role in fostering disruptive innovations within contemporary markets. This collaboration, exemplified by the establishment of “spin-off companies” from academic research, is instrumental in guiding aspiring talent and cultivating growth in local economies. However, despite this symbiosis, a notable gap exists in knowledge spillovers between universities and their surrounding entrepreneurial and innovation ecosystems. To address this, collaborative and interactive research is recommended, as proposed by Mehta et al. (2016). Such initiatives not only facilitate self-operative and self-corrective entrepreneurial ecosystems but also contribute to knowledge spillovers that fuel product development and speciation. The interconnected processes of institutionalizing methods, policy entrepreneurship, and knowledge spillovers underscore the intricate relationship between academia, institutional research, and market dynamics, emphasizing the need for cohesive strategies to bridge existing gaps and maximizing the impact of disruptive tendencies in entrepreneurship. This mechanism can receive a boost with the assistance of sustainable innovation of society through “social entrepreneurship education (SEE) programs” (Kim et al., 2020), which can be designed and operated to cultivate social entrepreneurial abilities and contribute to the development of innovation hubs for entrepreneurial ecosystems (EEs). For example, a study by Igwe et al. (2020) focused on frugal innovations and informal entrepreneurship, which could lead to the creation of fresh, innovative tendencies in informal sectors of different nations.

So, looking forward, the relevance for the development of entrepreneurial networks (Teece, 2007), where innovation can accentuate the need for the intersection of researchers, entrepreneurship, and regional economic development while holding entrepreneurship as a key mechanism. Although there has been much innovative research done in recent years using a systematic literature review approach, it was observed that existing literature typically lacked the required comprehensive theoretical foundations; more work can contribute to the development of suitable theoretical methodologies for practical results in economic development. For example, past literature is focused on intervention of innovation with digital entrepreneurship (Satalkina and Steiner, 2020), social entrepreneurship (Fauzi et al., 2022). In a similar way, Montes-Martínez and Ramírez-Montoya (2022) oriented their research towards finding the relationship between educational and social entrepreneurship innovations using a systematic mapping technique and suggested a potential research gap in this area by collating the number of articles published and geographical contributions. Further, the literature also talked about sustainable entrepreneurship (Thananusak, 2019), technological innovation and entrepreneurship in management science (Shane and Ulrich, 2004), or the role of open innovation in entrepreneurship (Portuguez-Castro, 2023).

Conversely, most of these studies deliberated on the genesis, development, and operation of innovative entrepreneurial ecosystems and subsidiary literature contributing to their existence and growth, then those for laying down foundations for newer tendencies the world is witnessing and vying to enable and

sustain them during the times of “Contaminant Economic Trends” (abrupt economic disruptions due to the advent of some natural, environmental, or manmade phenomenon such as COVID-19). It is essential to combine and progress research in several important areas to fill the current gaps in the literature on innovation and entrepreneurship. First, a thorough investigation of information effects is necessary for the present connection between innovation and entrepreneurial ecosystems, especially through subsidiaries businesses. Mehta et al. (2016) support collaborative research, but more research is required to understand the mechanisms and obstacles preventing knowledge transfer from institutions to entrepreneurial ecosystems. This research aims to examine the following research questions:

1. What are the key thematic progressions in innovation research within the field of entrepreneurial ecosystems?
2. What conceptual models can be recommended based on the existing literature to guide and inform future research endeavors at the intersection of innovation and entrepreneurial ecosystems?

To examine the research questions, we applied the text mining approach of the content analysis method on the articles collected on the keywords related to innovation and entrepreneurship for a selected period. This study also aims to fill this gap by designing a model of EE offering multidimensional insights into recent developments in the field of entrepreneurial ecosystems. This study contributes theoretically by synthesizing insights from a systematic literature review to construct a comprehensive model elucidating the intricate dynamics influencing entrepreneurial ecosystems. Identified decisive components—namely, “Evolutionary Theories,” “Governmental Assistance,” “Global Outreach of Academic Innovations,” “Open and Distributed Models of Innovation,” “Entrepreneurial Learning Experience,” and “Social Entrepreneurship”—provide a nuanced understanding of factors shaping enhanced entrepreneurial landscapes. The structured model unveils the synergies underpinning ecosystem development across diverse nations and economies amid economic uncertainties. Moreover, the study posits that government policies, such as subsidized infrastructural support, play a pivotal role in fostering entrepreneurial growth, thereby contributing novel perspectives to the scholarly discourse on entrepreneurial ecosystem evolution.

From this point forward, the paper progresses as follows: Section “Theoretical background and analysis” explains the meaning of innovation and its place in entrepreneurship development and entrepreneurial ecosystem networks; Section “Methodology” reviews prior literature on innovation in the entrepreneurship context; Section “Results” discusses the methodology adopted for the present study and delves into the methods of data collection and analysis for present research; Section “Discussion” discusses the results and analysis done in the present study; Section “Implications, Limitations, and Future Trends” delineates the theoretical implications of the present research and proposes a conceptual model for better innovation in entrepreneurship; and Section “Conclusion” takes up the conclusion part of the study.

Theoretical background and analysis

Past research has mainly focused on developing entrepreneurial ecosystems and their genesis. They hardly focused on what is mainly lacking in the growth process of these ecosystems and why academic knowledge fully fails to translate into entrepreneurial achievements. Moreover, past studies have explored and delineated the extant ecosystems with their peculiarities without looking deep down into the self-operative and self-corrective

Table 1 Definition of the core concepts of innovation and entrepreneurial ecosystems.

S. No.	Concept	Meaning	Reference
1.	Speciation	Shifting and branching of extant technologies for new domains of application.	Garnsey et al. (2008)
2.	Value Co-Creation	Transformation in the way value is created and experienced by producers and consumers.	Le and Tarafdar (2009).
3.	Social Innovation Framework	Framework outlining the concept, process, product, and change in organizational framework.	Biggs et al. (2010).
4.	Innovation Ecosystems	A network of individuals, companies, and entities co-evolve by observing and sharing capabilities.	Zahra and Nambisan (2011)
5.	Triple Helix Innovation Model	Focusing on University-industry-government relations.	Yoda and Kuwashima, (2020)
6.	Quadruple Helix Innovation systems	A system of bringing in the perspectives of the media-based and culture-based public, along with the civil society.	Carayannis and Campbell (2011)
7.	Open Innovation Diplomacy (OID)	It encompasses the practice of bridging distance in cultural, socio-economic, and technological divides with focused and targeted initiatives for connecting ideas and solutions.	Peña Gallo (2021)
8.	Entrepreneurial Driven Innovation Ecosystems (EDIE)	Entrepreneurial ecosystems constantly vie for innovation research and their implementation.	Groth, Esposito and Tse (2015)
9.	Policy Entrepreneurs	Individuals who exploit opportunities to influence policy outcomes to seek and promote their own goals.	Brown (2016)
10.	Humanitarian Engineering and Social Entrepreneurship (HESE) Program	This program engages studies and students in rigorous research design and yields tests to launch technology-based social enterprises.	Mehta et al. (2016)
11.	University-Business Cooperation (UBC)	Academic research assisting in business operations.	Ranga, Perälampi, and Kansikas (2016)

mechanisms of entrepreneurial ecosystems, which have their own strengths that make them resilient to economic turbulences. The present study highlights this mechanism and forwards a model that explains the process of enhanced ecosystems.

What is innovation? As per the Schumpeterian view, the practical implementation of ideas for developing new goods and services is innovation (Mehmood et al., 2019). ISO TC 279, in the standard of ISO 56000:2020, states that innovation is “a new or changed entity realizing or redistributing value” (ISO, 2020). Definitions of innovations focus on newness, improvement, and the spread of ideas or technologies, products, processes, services, technologies, and artworks (Lijster, 2018). Business models that are brought forward by innovators to the market, governments (Bhasin, 2012), and society are certain modes through which innovation takes place.

Innovation and entrepreneurship. The advancement of entrepreneurial innovation has necessitated an increased demand for policy interventions that encourage and complement entrepreneurial ecosystems. These interventions are crucial for managing and containing emerging disruptions by introducing effective strategies. The goal is to harness these disruptions for the development of newer and improved entrepreneurial ecosystems, ultimately bringing greater benefits to entrepreneurial ventures. By employing business strategies in indigenous markets, entrepreneurs can carve out niches to meet existing demands and expand into international markets (Sprinkle, 2003).

This approach not only enhances enterprise performance in an open economy but also stimulates rapid innovation and disperses dynamic capacities across enterprises, entities, and institutions. According to Teece (2007), it establishes micro-foundations for entrepreneurial ecosystems, contributing to the formation of innovative networks that support emerging industries (Garnsey and Leong, 2008). Additionally, it generates conceptual dimensions by developing complementarities that assist in the adoption of compatible applications (Garnsey et al., 2008).

For instance, recent literature on entrepreneurial practices during the ongoing COVID-19 pandemic and post-pandemic business activities catalyzed by the digital revolution highlights the acceleratory role of digitization in expanding the business world. This digital transformation has led to the development of novel social innovations, transforming entrepreneurial practices and liberating the workforce from being “cabin cooped in individuals” to “flexible timers.” These social disruptors have also prompted the exploration of groundbreaking approaches for assessing nuances that emphasize sustainable entrepreneurial ecosystems. Lastly, we present the core concepts related to these domains in Table 1.

Methodology

Many researchers have applied different methodologies for literature review, such as theory-based review (Debellis et al., 2021); framework-based systematic review (Rosado-Serrano et al., 2018); theme-based structured review (Pansari and Kumar, 2017); techno-commercial literature review (Chatterjee et al., 2018; Kumar et al., 2020); and literature review based on text mining (Kumar et al., 2019). As for article selection, researchers indicate selecting a database such as Scopus or Web of Science (Kumar et al., 2023; Donthu et al., 2021), with which researchers get a better grasp of a specific domain of research (Alvesson & Sandberg, 2020) and set the stage for future research (Elsbach & Knippenberg, 2020). By looking at our research questions, we have employed content analysis with a text mining approach in this study, which presents thematic analysis and helps present contextual analysis.

Database preparation. The present study seeks to explore the themes underlying the domain of innovation in entrepreneurial ecosystems. Considering the methodology followed by Akter and Wamba (2016), we searched keywords such as “business entrepreneurship,” “entrepreneurial ecosystem,” and “entrepreneurial networks” on Scopus in the abstract, title, and keywords fields to search relevant documents. There were 2136 articles matching the keywords in January 2023; following this, a search for “innovation”

yielded 772 documents. The final filter was performed to select articles and reviews only, which left us with a batch of 392 documents belonging to different subject areas like business management (34.6%), followed by Social Sciences (17.0%), Economics (14.4%), Engineering (7.7%), Environmental Sciences (6.4%), Computer Sciences (3.1%), Decision Sciences (3.1%), Energy (2.7%), Psychology (1.9%), Biochemistry (1.7%), and others (7.4%). All 392 articles' abstracts were subjected to content analysis (text mining) after selecting the timeframes outlining the extracted themes to showcase the changes in the research.

Different approaches exist for selecting time duration: while Leone et al. (2012) proposed three years, Kumar et al. (2019) suggested five years for getting ideal time durations. In this study, the initial timeframe covered research for 13 years (2003–15) as in these years there were very few publications. Afterward, two sets of two-year durations of 2016–17 and 2018–19 were included, followed by three sets of single-year durations (2020, 2021, and 2022). We initially categorized articles by year but found that there were relatively few articles published in the earlier years, with a significant increase after 2010. Consequently, selecting either a 3-year or 5-year timeframe would have resulted in sample size variation by including the number of articles in each timeframe. To address this, we segmented the articles into eight periods, each containing over 40 articles in each timeframe. The year selection was done to reduce the redundancy found during the content analysis of the abstracts.

Analysis method. Looking toward our first research question of key thematic progressions in the selected domain, we applied the content analysis method to the abstract of 392 articles. In the content analysis approach, text mining (Kumar et al., 2019, Tiwary et al., 2021) is a natural language processing (NLP) technique used to explore valuable insights and uncover relationships from unstructured text data. Text mining provides various benefits due to its feature of processing and analyzing large volumes of data quickly, which allows researchers to find trends and patterns effectively, which could be difficult using human approaches. Furthermore, text mining makes it possible to generate useful numerical indices that support the quantification and methodical examination of word clusters, thereby improving the accuracy and effectiveness of content analysis techniques. Text mining is being used in academic research to speed up the analytical process and improve the quality and scope of insights obtained from unstructured textual material (Karami et al., 2020; Gurcan and Cagiltay, 2023). We applied text mining to capture the themes that emerged from the articles and to create meaningful numeric indices to analyze word clusters (Feldman & Sanger, 2007). As for text mining, we used the widely accepted bibliometric tool “VOSViewer” (Van Eck and Waltman, 2010) to analyze the abstract by creating a term co-occurrence map.

Results

Following our RQ1 of exploring maturity and themes of innovations in entrepreneurial ecosystems, we first analyzed all the articles published annually as per maturity and research exploration. We present the results from each year group below separately:

Theme that emerged during the year 2003–2015

Conceptual visualization. During this period, the focus was on exploring themes that were categorized under specific clusters (see Fig. 1), “business ecosystem, capability, customer, development, ecosystem service, entrepreneur, Europe, firm, goal, innovation ecosystem, new venture, opportunity, resource, student, success.” These word clusters indicate *entrepreneurial symphony*,

especially capturing *nurturing success in the business ecosystem*. Further, a cluster containing words like “adoption, case study, culture, ecosystem, emergence, knowledge, phenomenon, small firm, society, strategy, transformation, value” indicates its connection with *Cultural Catalysts*, unveiling *small firm transformation through ecosystem adoption*. The third theme under these years contains words like “entrepreneurial innovation, entrepreneurship framework, government, innovation, issue, policy, region, Silicon Valley, university,” indicating its connection with *Elevate by Innovation* by crafting a *robust entrepreneurship framework for regional growth and navigating government policies*. The last theme under these years contains words such as “business, case, company, consumer, convergence, enterprises, factor, growth, medium, product, technology” grouping theme under *TechConverge Enterprises*, which *navigates business growth through consumer-centric mediums and product innovation*.

Together, these four themes delve into the complex worlds of innovation, company culture, and entrepreneurship. The focus on cultural catalysts and technological convergence offers a comprehensive knowledge of entrepreneurial alterations, geographic expansion strategies, and the complex aspects influencing global business performance, even while the European and regional views offer specialized insights. For example, Sprinkle (2003) drew attention to concurrent policy restrictions on commercial and entrepreneurial freedoms that inhibit bioscience advancement. Teece (2007) explored the globally dispersed sources of invention, innovation, and dynamic manufacturing capabilities to create a self-operative and self-corrective entrepreneurial network based on creative destruction, commercialization, and transformation of product technologies. Le and Tarafdar (2009) underscored the importance of interactive collaboration and value co-creation in the era of commerce and the Web 2.0 version, as took place on Facebook, Google, and Myspace.

Theoretical aspects. During this period, entrepreneurial success became synonymous with innovation research, primarily stemming from university research efforts. This led to creative destruction, fostering the commercialization, speciation, and transformation of existing products and strategies. Companies sought value co-creation, supported by government policies and academic advancements. Teece (2007) emphasized the importance of dynamic capabilities, in which firms deploy tangible assets for business through innovative networks. Governmental R&D played a pivotal role in shaping these networks, aligning research with policies. The collaborative nature of business models, as highlighted by Garnsey and Leong (2008), facilitated speciation, branching, and technological advancement, contributing to “techno-organizational speciation spin-offs” and niche creation for transformative innovations (Kantarelis, 2009). However, this perspective is challenged by evolving policies and practices leading to urbanization, expanding markets, and technological speciation across different geographic areas, negatively impacting rural vitality (Nybakk et al., 2009).

Proposition: *University-driven efforts, collaborative business models, and government policies combined to drive the intersection of innovation research and entrepreneurial success, which resulted in commercialization and transformation. In addition, changing policies and practices have affected rural vitality through urbanization, market expansion, and technological evolution.*

Theme emerged during the year 2016–2017

Conceptual visualization. The emergence of clusters (see Fig. 2) during the timeframe of 2016–2017 majorly saw research surrounding themes of *innovative interactions through entrepreneurial university dynamics community-driven economies* (e.g.,

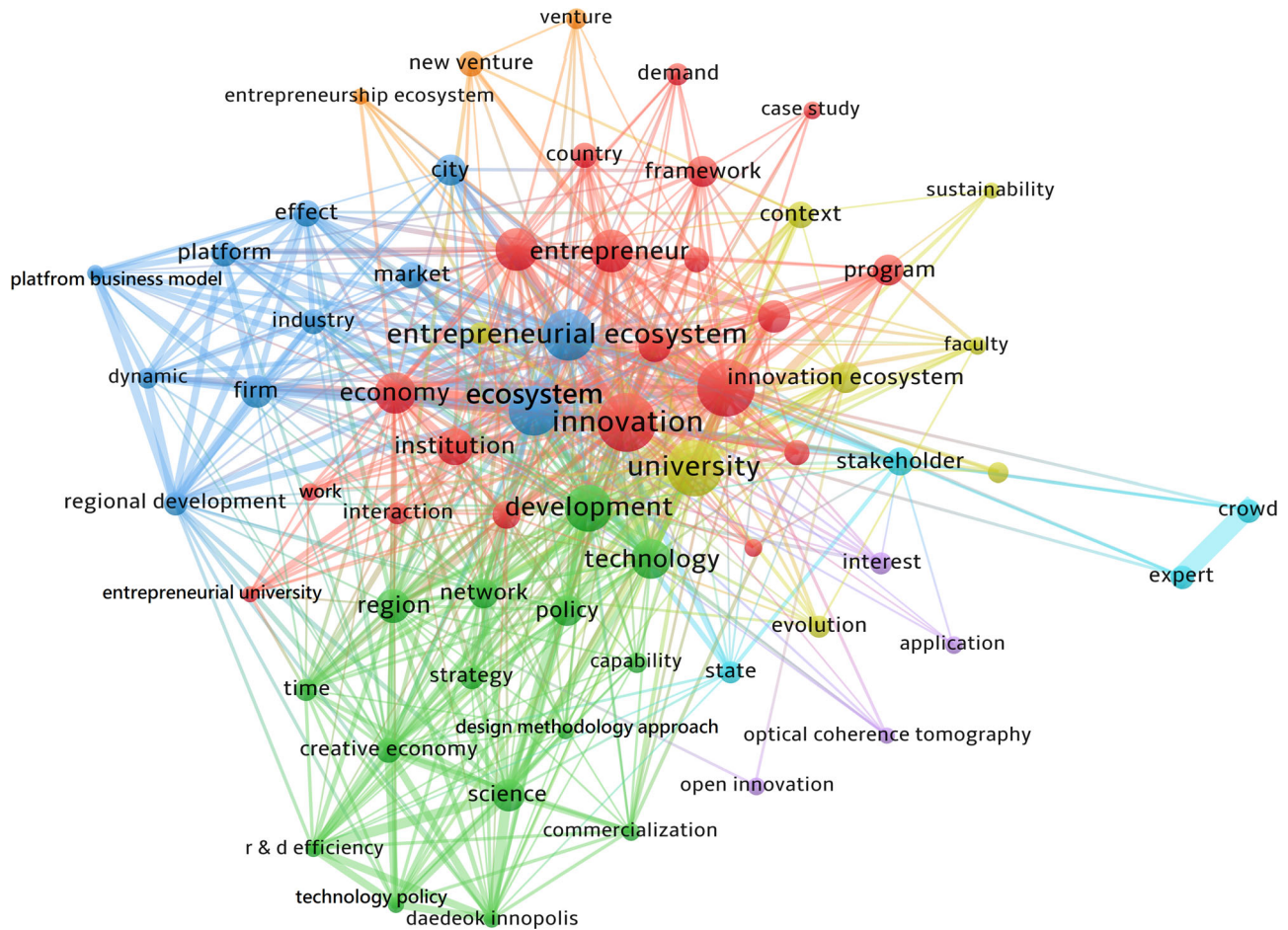


Fig. 2 Theme of study during the year 2016–2017.

Theoretical aspects. The most prominent of all themes were “startups” and “networks,” fueling regional entrepreneurship and leading to radically innovative products and services (de Vasconcelos Gomes et al., 2018). The cross-connection of entrepreneurial factors and networks in academic and industrial circles is key to transmitting knowledge bases (Qian, 2018), leading to the growth of startups. Furthermore, the government’s innovation policies lead to the development of “services innovation” and “social entrepreneurship” through the supportive programs of entrepreneurial development that are further boosted by strong networks created by startups advancement in any regional or national entrepreneurial ecosystem. However, it is still unknown how knowledge networks (Miller et al., 2018) influence entrepreneurship processes through supportive environments fostering innovative startups (Spigel and Harrison, 2018).

Proposition: *The symbiotic relationship between startups, knowledge networks, and government innovation policies may be pivotal in driving regional entrepreneurship, particularly in the development of services innovation and social entrepreneurship, yet the specific influence of knowledge networks on entrepreneurial processes within supportive environments remains unclear and requires further exploration.*

Theme that emerged during the year 2020

Conceptual visualization. The themes that originated during this timeframe (see Fig. 4) were associated with “academic entrepreneurship,” “social entrepreneurship,” “urban-rural divide,” “disruptive innovation,” and “tourism,” the origination of which was

based on tagged-in factors such as “innovation hubs for Entrepreneurial Ecosystems (EEs),” “informal entrepreneurship,” “frugal innovation,” “utility-maximization,” “business incubators,” “innovation transition,” etc.

Theoretical aspects. “Academic” and “social” were the most prominent themes that emerged during this timeframe, encompassing “academic entrepreneurship,” “social entrepreneurship,” “urban-rural divide,” and “disruptive innovation.” The theme emphasized that academic and social are the two most basic and crucial benchmarks for any economy to have the presence of entrepreneurial ecosystems. They are the only factors that give rise to social entrepreneurship that use social issues as the basis for developing new entrepreneurial ideas to establish social enterprises. This is not only blurring the urban-rural divide but is also using this divide to determine, locate, and pick new opportunities and turn them into successful social entrepreneurship model firms, giving rise to informal and frugal innovations that are leading to utility maximization in resource-scarce ecosystems. This even helps in attaining sustainable innovation, which is the only way for nations to balance industrial growth and the sustainability of resources. For example, Kim et al. (2020) discussed the role of social entrepreneurship programs in developing sustainable innovation through balanced industrial growth and opined for internal and external connectivity through innovations and sustainable informal entrepreneurship (Igwe et al. 2020).

Proposition: *The intertwining of academic and social themes within entrepreneurial ecosystems may serve as a foundational*

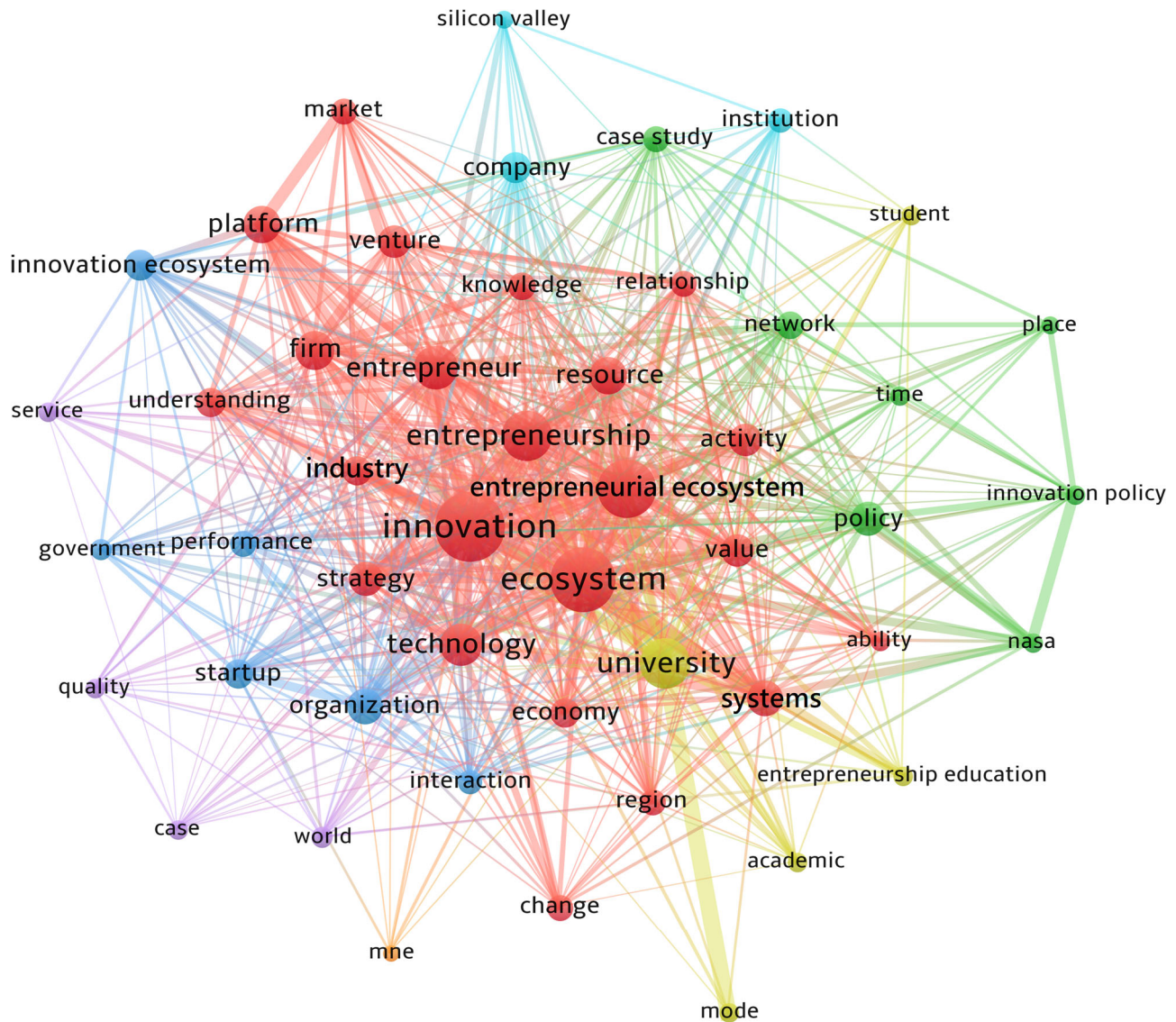


Fig. 3 Theme of study during the years 2018–2019.

driver for social entrepreneurship, blurring the urban–rural divide and fostering sustainable innovations that balance industrial growth with resource sustainability.

Theme that emerged during the year 2021

Conceptual visualization. During this timeframe (see Fig. 5), the research focused on “policy implication,” “frugal innovation,” “research,” “innovative behavior,” “intermediary,” “open innovation,” “empirical evidence,” “agent,” “community,” and “social entrepreneurship,” driving on concepts such as “digitization,” “digital platform,” “digital entrepreneurial ecosystems,” “COVID-19,” “pandemic” and “women entrepreneurship,” “circular entrepreneurship,” “sociology,” “emergent entrepreneurship,” “phenomenological inquiry,” “nascent,” “knowledge-intensive,” “returnee entrepreneurial firms,” “Entrepreneurial Discovery Theory,” and “artistic place-making,” among others, which were recurrently referred to by authors in their research works. Furthermore, these themes were spawned from the factors and concepts related to “moderate innovation ecosystems,” “digital platform ecosystems,” “innovation leaders,” “culture entrepreneurship,” “interacting predictors,” etc.

Theoretical aspects. Out of all themes, the most important themes that emerged were policy implication, frugal innovation (Frugal innovations encompass affordable new products, methods, and designs developed for or emerging from the underserved lower segment of the mass market, often referred to as the ‘bottom of the pyramid), and “innovative behavior,” which were heavily drawn from “digital” associated with terms such as “digitization,” “COVID-19”, “pandemic” etc., and “women entrepreneurship,” “women entrepreneurs,” “women economic empowerment,” “job losses,” and “COVID-19 impact”. These themes essentially and visibly emanated from the term COVID-19, which has been the most effective disruption witnessed in several centuries, sending shock waves and necessitating ‘totally out of the box,’ yet basic and indigenous thought processes and helping the creation of innovations outposts (Decreton et al., 2021). The COVID-19 crisis prompted impactful frugal innovations, particularly among jobless women, fostering widespread women’s entrepreneurship amid the digital revolution (Cullen & De Angelis, 2021). Digitalization facilitated startups as effective innovation brokers, connecting ecosystems, and promoting synergies. The “Waste Not” strategy contributed to resource-efficient production, circular entrepreneurship, and social purpose organizations. This global

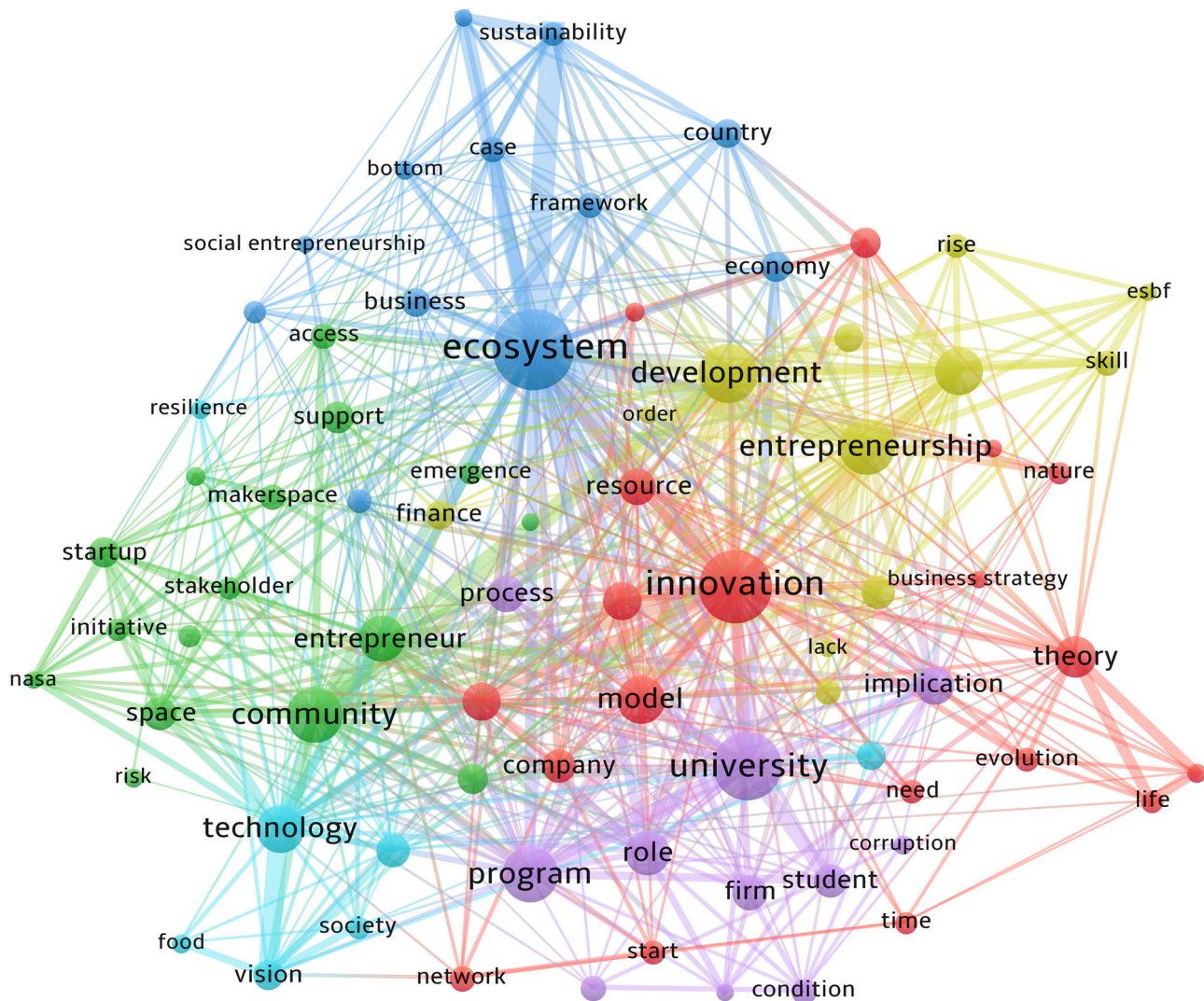


Fig. 4 Theme of study during the year 2020.

shift towards novel economic empowerment models, including priority action roadmaps for women, emerged in response to the pandemic’s impact, creating innovative approaches and strategies (Cullen & De Angelis, 2021).

Proposition: The unprecedented disruption caused by COVID-19 has catalyzed transformative innovations, particularly in frugal entrepreneurship driven by jobless individuals, notably women, harnessing digital revolution and waste reduction strategies, thereby fostering women’s entrepreneurship, circular economies, and social purpose organizations on a global scale.

Theme that emerged during the year 2022

Conceptual visualization. The clusters that were accentuated in this timeframe (see Fig. 6) were: “biomedical entrepreneurship,” “sustainability,” “translational research,” “demand,” “databases,” “social innovator,” etc. among others, which had their origination from themes such as “digital entrepreneurship,” “digital entrepreneurial ecosystems,” “smart cities,” “circular business models,” “incremental innovation,” “Schumpeterian Entrepreneurship,” “social innovations’ systems,” “Isenberg’s Entrepreneurial Ecosystem Model” (international reference guide for collecting and using data on innovation), “Financial Technology (FinTech) Innovation,” “investment advisory sector,” “trans-disciplinary

research,” and “cross cutting themes,” which got frequently referred to by authors in their articles.

Theoretical aspects. This time period saw the emergence of many “incremental innovations” adding to and revitalizing the existing ones in the wake of COVID-19 (Henrekson et al., 2022). To this end, every nation was endeavoring to get hold of resources and diverting them towards translational research, comprising academic entrepreneurial innovations and social innovations (Audretsch et al., 2022), culminating in biomedical research and entrepreneurship. Biomedical entrepreneurship was in its heyday as it was the most important aspect related to the major disruptor COVID-19 at the time. As a result, there was a mushrooming of startups catering to biomedical resources to fulfill the demand that was extant in almost all the markets of the world. In addition, the most prominent entrepreneurial success was witnessed in “digital entrepreneurial enterprises,” which rose quickly due to the widespread digitization of almost all of the world’s economies in the wake of COVID-19. This trend of enterprises surpassed all records of success and they skipped decades in their growth journey.

Proposition: The aftermath of COVID-19 witnessed a global pursuit of resources for translational research encompassing social innovations, fueling a surge in biomedical entrepreneurship and

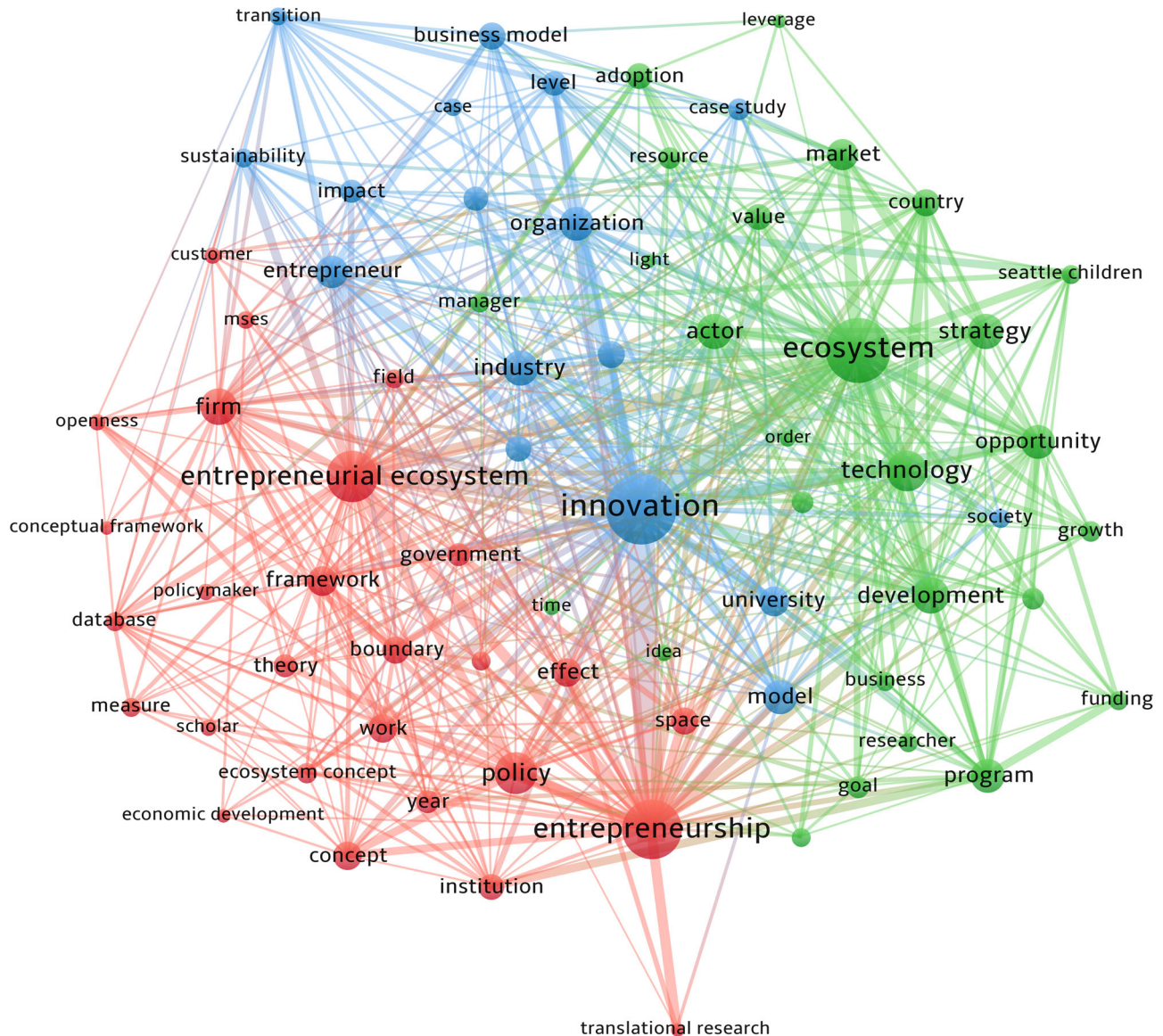


Fig. 6 Theme of study during the year 2022.

of dangerous innovative products, which is why it is necessary to foresee and assist scientific and commercial freedoms (Hayter, 2016) with precautions that should be taken to prevent scientific inventions and innovations from harming society in general (Roundy, 2016).

Insight 3: Government assistance generating synergies for growth. Government assistance by funding innovations leads to better academic research and innovation-centric activities that generate synergies, impacting and enhancing innovative business ecosystems (Harper-Anderson, 2018). Even in developing countries, governments have come forward with schemes for payment for ecosystem services (PES), as done in Costa Rica, for biodiversity protection and conservation endeavors (Fischer et al., 2018). The heterogeneity among ventures is largely facilitated by knowledge spillovers and dispersion at the global level (Autio et al., 2018), corporate research development (Eckhardt et al., 2018), and the regional economic development policy agenda of the nations (Crammond et al., 2018), which takes up corporate research to bring about regional-level multidimensional economic systems. To further this process, the traditional “Triple Helix

Innovation Model,” focusing on the university-industry-government relationship, and the “Quadruple Helix Innovation Systems” can be used to bring about the required synergies (Mirvis and Googins, 2018) and ensure success in business ecosystems based on collaboration and competition (Hu, Yu & Chia, 2018; Carayannis et al., 2018).

Insight 4: Regional transformation and platformization. Regional transformation through open and distributed models of innovation facilitates the pursuit of entrepreneurship. Regional transformation can be hailed as the “basic innovation driver,” disgorging newer approaches toward entrepreneurship (Igwe et al., 2020) and helping policymakers and practitioners (Guerero et al., 2020). Moreover, regional transformation together with platformization creates a typology of different ecosystem structures, thereby shaping high-growth entrepreneurship. Furthermore, they help in exploring the dynamics of entrepreneurial ecosystems for rural and urban areas (Huggins and Thompson, 2020). To this end, many regions are following the “educate, deregulate, and finance” approach to entrepreneurship, as happened in the case of “Financial and Institutional Reforms for

Entrepreneurial Society” in Europe (Lyons et al., 2020). Another example is the “Innovation Hub Organizations” in African cities, which have become “Fixtures” (Švarc et al., 2020). However, regional transformation is not possible without a proper policy (Jia & Desa, 2022) that works on key components and factors influencing entrepreneurial processes (Halbinger, 2020).

Insight 5: Management of collective risk for radically innovative products. The management of collective risk by social entrepreneurial ecosystems helps in strengthening institutional environmental and bridges uncertainties to radically innovative products (Khurana and Dutta, 2021). Investigating innovation drivers in the informal sector may scrutinize the impact of “complementors” within business owners’ strategies, navigating formal and informal rules (Gifford et al., 2021). Further, regional economic ecosystems, influenced by human behavior, culture, and environment, require the measurement and development of skills. Tools like “Entrepreneurship Skill-Building Framework (ESBF)” and “Readiness Inventory for Successful Entrepreneurship (RISE),” based on “communimetrics: theory of measurement,” are crucial (Nthubu, 2021). The European Smart Specialization Strategy (S3) reflects the latest entrepreneurial ecosystem developments (Khatami et al., 2022).

In addition, addressing systematic inequities involves social innovations and financial models like “blended financing” and “public-private partnerships” (PPP) (Volkman et al., 2021). Other factors include affordable business models for resource settings (Guerrero et al., 2021), knowledge economy expansion (Plata et al. 2021), and new evaluative approaches to local entrepreneurial ecosystems (Liu et al., 2021). Innovation strategies by companies like Apple and Uber, financial technology ecosystem development (Canh et al., 2021), growth-oriented entrepreneurship in the African business environment (McDaniel et al., 2021), and risk mitigation through public-private ownership (Moraes et al. 2023 contribute to assessing and enhancing the global entrepreneurial climate, including the US (Schaeffer, Guerrero & Fischer, 2021).

Insight 6: Discovering latent entrepreneurship for emergent entrepreneurship. Empirical studies underscore the crucial role of entrepreneurial learning and experience in unlocking latent resources and hidden capabilities within social and economic ecosystems. A prime example is the transformative impact observed in the US drone industry (Henrekson et al., 2022). Innovative ecosystems, particularly those with a knowledge-intensive focus, foster emergent entrepreneurship, notably when returnee entrepreneurs contribute to local firms, enhancing innovation performance in their home countries (Bakry et al., 2022). The “discovery theory” further illuminates how digital applications stimulate entrepreneurial alertness, especially in diverse innovation ecosystems, such as the influence of creative industries on social entrepreneurship (Ho and Yoon, 2022). The success of new ventures hinges on navigating multifaceted components within entrepreneurship ecosystems (EE) and the broader business environment (Johnson et al., 2022).

To overcome these challenges, entrepreneurs strategically establish complex ecosystems, temporarily gaining monopolistic advantages by eliminating competition during the development phase (Raposo et al., 2022). Various factors shape entrepreneurial sustainable innovations (ESIs),” with distinct emphasis on policy, finance, human capital, support, and culture within entrepreneurial ecosystems (Berman et al., 2021). While creating new businesses is essential, the establishment of institutions supporting entrepreneurial growth is equally vital. Although “Schumpeterian entrepreneurs play a role, the limitations of “top-down

policies” in fostering thriving ecosystems for Schumpeterian entrepreneurship are evident (Henrekson et al., 2022). Social entrepreneurship, guided by local actors and social innovators with insights into emerging needs, can lead to profit-oriented innovations (Audretsch et al., 2022; Bakry et al., 2022). Implementing these strategies demands entrepreneurial ecosystems equipped with tools that address the complex and dynamic aspects of development (Johnson et al., 2022; Schmutzler et al., 2022).

Model for enhanced entrepreneurial ecosystems. The systematic literature review conducted for the present study has yielded insights that can be utilized to enhance entrepreneurial ecosystems. These insights have been integrated into a model explaining the relationship between various decisive components crucial for achieving improved entrepreneurial ecosystems. The key insights of the model are outlined below.

First, the attainment of enhanced entrepreneurial ecosystems is influenced by several factors that interact and synergize, ultimately resulting in the creation of new ecosystems or the enhancement of existing ones. “Evolutionary Theories,” “Governmental Assistance,” “Global Outreach of Academic Innovations,” “Open and Distributed Models of Innovation,” “Entrepreneurial Learning Experience,” and “Social Entrepreneurship” are identified as decisive components in this research. Alongside underlying factors, these components promote and contribute to the enhancement of entrepreneurial ecosystems.

Figure 7 illustrates that entrepreneurial ecosystems develop unique synergies in all nations and economies in response to different types of economic disturbances arising from individual and collective uncertainties. Although there is a pattern and path with the highest probability of yielding better network creation and rapid development of entrepreneurial ecosystems, it is generally guided by the path of economic turmoil or uncertainty they face. Additionally, government policies play a significant role in influencing the creation, operation, and pace of the progress of entrepreneurial ecosystems. For instance, in countries such as South Korea, where entrepreneurs are provided with free or subsidized space for their ventures, there is a notable boost in entrepreneurial growth, leading to the creation of a higher-quality entrepreneurial ecosystem with better services and growth prospects.

Government assistance and support are crucial components that contribute to the development of entrepreneurial ecosystems. *Evolutionary theories* from different fields serve as a repository of past initiatives that have proven successful, guiding and enlightening the thought processes of entrepreneurs. These theories often emerge as corrective responses to individual and collective uncertainties or as attempts to rectify anomalies in different ecosystems. Furthermore, government assistance, when integrated into academic research programs, fosters the creation of heterogeneous, innovative models that can be emulated by others. Support for research projects aids in the development of entrepreneurial ecosystem models aligned with market trends and economic turbulence, providing a foundation for theories and fostering entrepreneurial growth.

In addition, the *global outreach of academic innovations* plays a crucial role in disseminating these innovative models. Through concerted paths, it leads to the development of newer technologies and products. The *open and distributed models* involved in this process facilitate knowledge spillovers, permeating and transforming the urban and rural economies of nations. Subsequently, this transformative process initiates knowledge spillovers and the diffusion of technology across nations, ushering in uncharted methodologies for addressing challenges and seizing

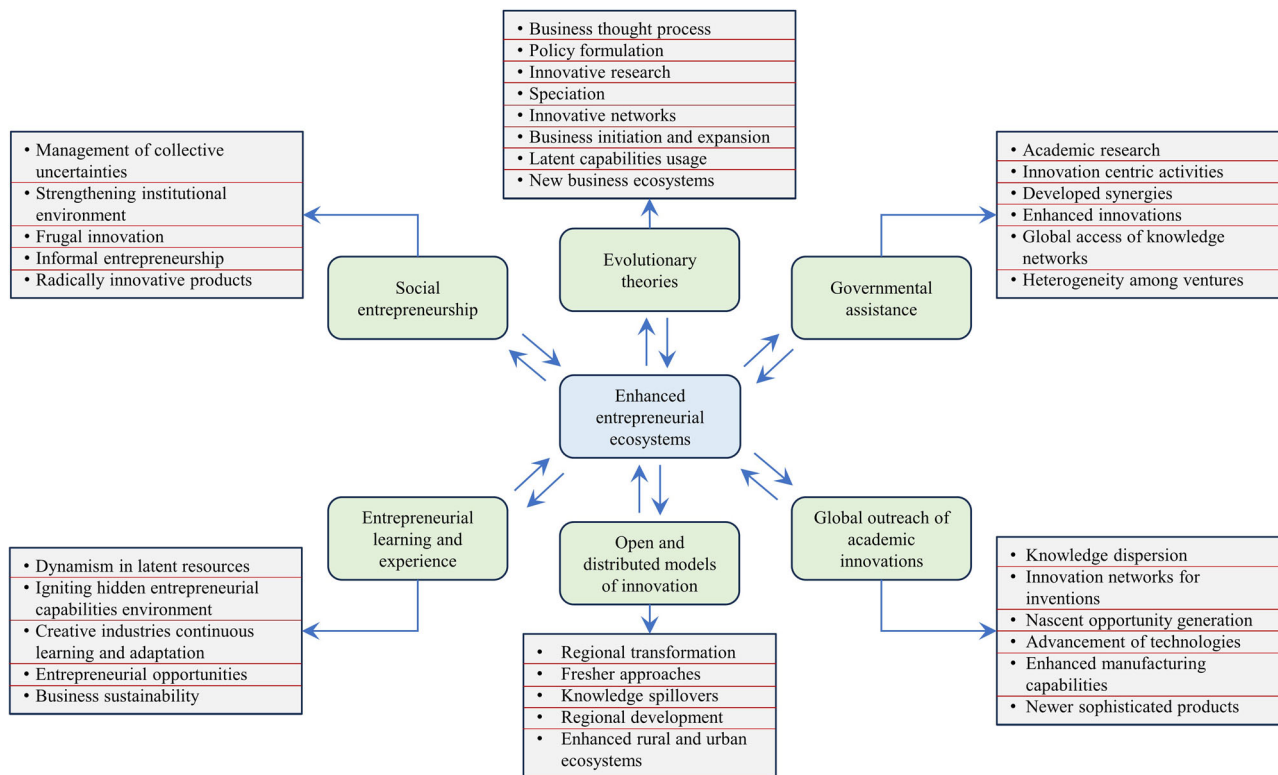


Fig. 7 Model for Enhanced Entrepreneurial Ecosystems (bidirectional arrow represents interaction between those factors; unidirectional arrow represents research related to innovation across different domains).

opportunities. This dynamic gives rise to creative industries, fostering a culture of continuous learning and adaptation essential for achieving business sustainability. The enrichment of *entrepreneurial learning and experience* is evident across diverse nations. Ultimately, this interconnected synergy propels actors and agents of change toward assuming collective responsibilities and championing the cause of *social entrepreneurship* for greater good and universal growth. The diverse trajectories of entrepreneurial growth invariably encompass these interconnected elements and sequential steps, underscoring the complexity and interdependence inherent in entrepreneurial growth.

Implications, limitations, and future trends

The following section provides implications and limitations.

Theoretical implications. The study underscores crucial theoretical implications, emphasizing that innovation not only introduces novel attributes to business culture but also gives rise to ecosystems capable of developing self-operative and self-corrective mechanisms in response to market disruptions. It asserts that innovation and entrepreneurial ecosystems play pivotal roles in implementing sustainable measures to invigorate global economic systems. An examination of the specified period reveals noteworthy themes that significantly contribute to existing knowledge in business and entrepreneurship. The onset of the pandemic triggered a transformative shift in entrepreneurial ecosystems, leading to “venture mushrooming” driven by dynamic factors (Castellani et al., 2022). The disruption prompted a strategic response from entrepreneurial think tanks, showcasing their adept management of unprecedented challenges and highlighting the resilience and adaptability of entrepreneurial ecosystems (Ramezani and Camarinha-Matos, 2020). Moreover, the disruptions unveiled opportunities and novel resources,

particularly in the digital realm, fostering niche entrepreneurial ecosystems driven by individuals, especially women, responding to COVID-19-related challenges (Cullen & De Angelis, 2021). The evolution of these ventures highlighted the self-operative and self-corrective nature of entrepreneurial ecosystems, offering insights into the evolving dynamics of the business environment.

Given the unified global markets and increasing trade transactions, entrepreneurial innovations emerge as essential tools to counter challenges to the global economy. To establish effective progressive and corrective mechanisms for market disruptions, there is a pressing need for innovative speciation that addresses specific market needs and customer bases. Global outreach of innovations is crucial for swift knowledge dissemination, and governments should develop collaborative assistance mechanisms to foster growth. Regional transformation and platformization are equally vital for cultivating novel entrepreneurial tendencies among youth. Creating a catalytic environment requires managers to take initiative in dealing with collective uncertainties, fostering the creation of radically innovative products. Finally, to facilitate the process of creating entrepreneurial ecosystems, emphasis should be placed on recognizing emerging entrepreneurial tendencies at regional, national, and international levels through timely support—technical, economic, and moral—to budding entrepreneurs and “visionpreneurs”.

Practical implications. The study underscores critical policy implications by highlighting the role of entrepreneurial ecosystems in fostering and empowering aspiring entrepreneurs. However, it acknowledges the challenges posed by unprecedented changes, which may prove difficult to address. These situations, whether rooted in knowledge banks or not, often present formidable obstacles that cannot be easily overcome with existing skill sets. The study emphasizes the need for emergent entrepreneurs to draw on their previous exposures, urging them to

boldly anticipate and explore future trends, particularly as technologies and skill sets evolve with increasingly shorter product life cycles.

Furthermore, the study advocates for close collaboration between governments and entrepreneurial faculties to mitigate negative economic downturns. Given the interconnected and inseparable nature of international trade indices, this research stresses the importance of collective action to prevent potential cascading effects that could lead to significant economic damage in a short period. The research contributes practical policy implications by proposing a model for entrepreneurial ecosystems with self-operative and self-corrective mechanisms. It suggests that governments support the strengths inherent in their ecosystems, providing subsidies, incentives for growth, and specialized incubation center facilities. These facilities, collaboratively developed with university research outcomes, aim to build new infrastructures for entrepreneurial development, ensuring both present and future entrepreneurial growth.

Limitations. This study presents a comprehensive review of collected papers utilizing text mining and content analysis to delve into the dynamics of entrepreneurial ecosystems. However, it acknowledges certain limitations that could impact the breadth and clarity of perspectives. The review focused exclusively on papers matching specific keywords like “Innovation,” “Business Entrepreneurship,” “Entrepreneurial Ecosystem,” and “Entrepreneurial Networks.” Notably, the exclusion of other keywords such as “academic entrepreneurship,” “spillover effects,” and “speciation” might have yielded different insights not covered in this analysis.

Additionally, the choice of the Scopus database as the sole source for article extraction poses another limitation, as utilizing different databases could have resulted in a diverse set of research articles, potentially altering the domain and theme structures. The study’s methodology is also recognized as a limiting factor, as alternative approaches could have produced varied results. Furthermore, the consideration of a nearly two-decade timeframe raises concerns about the relevance of earlier reviews in the rapidly evolving landscape of entrepreneurial needs and trends.

Despite these limitations, the paper makes a noteworthy contribution by providing a general outline and direction for the development of enhanced entrepreneurial ecosystems. It acknowledges the lack of first-hand exposure to entrepreneurial ecosystems, which could have enriched the output. Nevertheless, the study’s significant contribution lies in its comprehensive analysis of entrepreneurial ecosystems and their interplay, aiming for greater output generation, improved growth for the collective good, and the overall welfare of economies, beyond mere economic gains.

Conclusion

In conclusion, while innovations and entrepreneurial ecosystems have been extensively explored in research, a collaborative effort between governments and the intelligentsia is essential to reshape policies. Addressing the identified gap in the literature, the research emphasizes that entrepreneurial ecosystems are not confined to traditional business circles but have evolved through the ingenuity of individuals facing job losses or career shifts. Therefore, this paper aims to provide the thematic improvement that happens in literature and based on that, present the enhanced entrepreneurial ecosystems. This study’s result indicates the necessity of global outreach for swift knowledge dissemination and emphasizes collaborative efforts between governments and entrepreneurial entities to foster growth. Regional transformation and platformization are identified as

pivotal in nurturing novel entrepreneurial tendencies, particularly among youth.

This study elucidates critical theoretical implications, highlighting the transformative power of innovation in shaping not only novel attributes within business culture but also the creation of adaptive entrepreneurial ecosystems. The study underscores the need for proactive policymaking and infrastructure support to empower these ecosystems to navigate the evolving landscape. The collaboration between governments and the intelligentsia is highlighted as crucial for ensuring that entrepreneurial ventures thrive and contribute significantly to the broader economic context. This integrated approach aligns policy measures with the dynamic needs of entrepreneurial ecosystems, fostering resilience, adaptability, and sustained success in the face of emerging global challenges. In essence, this research not only contributes to the existing knowledge but also fills a crucial gap by shedding light on the dynamic nature of entrepreneurial ecosystems in the face of unprecedented challenges, providing valuable insights for future research and practical applications.

Data availability

All data generated or analyzed during this study are included in this published article.

Received: 25 September 2023; Accepted: 9 February 2024;

Published online: 06 March 2024

References

- Akter S, Wamba SF (2016) Big data analytics in E-commerce: a systematic review and agenda for future research. *Electron Mark* 26:173–194
- Alvesson M, Sandberg J (2020) The problematizing review: A counterpoint to Elsbach and Van Knippenberg’s argument for integrative reviews. *J Manag Stud* 57(6):1290–1304
- Audretsch DB, Eichler GM, Schwarz EJ (2022) Emerging needs of social innovators and social innovation ecosystems. *Int Entrepreneurship Manag J* 18:217–254
- Autio E, Nambisan S, Thomas LD, Wright M (2018) Digital affordances, spatial affordances, and the genesis of entrepreneurial ecosystems. *Strateg Entrep J* 12(1):72–95
- Bakry DS, Daim T, Dabic M, Yesilada B (2022) An evaluation of the effectiveness of innovation ecosystems in facilitating the adoption of sustainable entrepreneurship. *J Small Bus Manag* <https://doi.org/10.1080/00472778.2022.2088775>
- Berman A, Cano-Kollmann M, Mudambi R (2021) Innovation and entrepreneurial ecosystems: fintech in the financial services industry. *Rev Manag Sci* 16(1):45–64
- Bhasin K (2012) This Is The Difference Between ‘Invention’ And ‘Innovation’. *Business insider*, 2–4. <https://www.businessinsider.com/this-is-the-difference-between-invention-and-innovation-2012-4?IR=T>
- Biggs R, Westley FR, Carpenter SR (2010) Navigating the back loop: fostering social innovation and transformation in ecosystem management. *Ecol Soc* 15:2
- Brown R (2016) Mission impossible? Entrepreneurial universities and peripheral regional innovation systems. *Ind innov* 23(2):189–205
- Canh NP, Nguyen B, Thanh SD, Kim S (2021) Entrepreneurship and natural resource rents: evidence from excessive entrepreneurial activity. *Sustain Prod Consum* 25:15–26
- Carayannis EG, Campbell DF (2011) Open innovation diplomacy and a 21st century fractal research, education and innovation (FREIE) ecosystem: building on the quadruple and quintuple helix innovation concepts and the “mode 3” knowledge production system. *J Knowl Econ* 2:327–372
- Carayannis EG, Grigoroudis E, Campbell DF, Meissner D, Stamati D (2018) The ecosystem as helix: an exploratory theory-building study of regional co-competitive entrepreneurial ecosystems as Quadruple/Quintuple Helix Innovation Models. *Rd Manag* 48(1):148–162
- Castellani D, Perri A, Scalera VG, Zanfei A (Eds) (2022) *Cross-border innovation in a changing world: players, places, and policies*. Oxford University Press
- Chatterjee S, Kumar P, Chatterjee S (2018) A techno-commercial review on grid connected photovoltaic system. *Renew Sustain Energy Rev* 81:2371–2397
- Crammond R, Omeihe KO, Murray A, Ledger K (2018) Managing knowledge through social media: Modelling an entrepreneurial approach for Scottish

- SMEs and beyond. *Baltic J Manag* 13(3):303–328. <https://doi.org/10.1108/BJM-05-2017-0133>
- Cullen UA, De Angelis R (2021) Circular entrepreneurship: A business model perspective. *Resour Conserv Recycl* 168:105300
- de Vasconcelos Gomes LA, Salerno MS, Phaal R, Probert DR (2018) How entrepreneurs manage collective uncertainties in innovation ecosystems. *Technol Forecast Soc Change* 128:164–185
- Debellis F, Rondi E, Plakoyiannaki E, De Massis A (2021) Riding the waves of family firm internationalization: a systematic literature review, integrative framework, and research agenda. *J World Bus* 56(1):101144
- Decreton B, Monteiro F, Frangos JM, Friedman L (2021) Innovation outposts in entrepreneurial ecosystems: how to make them more successful. *Calif Manag Rev* 63(3):94–117
- Donthu N, Kumar S, Pandey N, Lim WM (2021) A bibliometric retrospective of marketing from the lens of psychology: insights from psychology & marketing. *Psychol Mark* 38(5):834–865
- Eckhardt JT, Ciuchta MP, Carpenter M (2018) Open innovation, information, and entrepreneurship within platform ecosystems. *Strateg Entrepreneurship J* 12(3):369–391
- Elsbach KD, van Knippenberg D (2020) Creating high-impact literature reviews: An argument for 'integrative reviews'. *J Manag Stud* 57(6):1277–1289
- Fauzi MA, Muhamad Tamyez PF, Kumar S (2022) Social entrepreneurship and social innovation in ASEAN: past, present, and future trends. *J Soc Entrepreneurship* <https://doi.org/10.1080/19420676.2022.2143870>
- Feldman R, Sanger J (2007) *The text mining handbook: advanced approaches in analyzing unstructured data*. Cambridge university press
- Fischer BB, Schaeffer PR, Vonortas NS, Queiroz S (2018) Quality comes first: university-industry collaboration as a source of academic entrepreneurship in a developing country. *J Technol Transf* 43:263–284
- Ganzaroli A, De Noni I, Pilotti L (2014) The role of social entrepreneurship in leveraging exaptation in locked-in industrial districts: the case of Idrogenet in the industrial district of Lumezzane. *Innov Eur J Soc Sci Res* 27(3):254–274
- Garney E, Leong YY (2008) Combining resource-based and evolutionary theory to explain the genesis of bio-networks. *Ind Innov* 15(6):669–686
- Garney E, Lorenzoni G, Ferriani S (2008) Speciation through entrepreneurial spin-off: the Acorn-ARM story. *Res Policy* 37(2):210–224
- Gifford E, McKelvey M, Saemundsson R (2021) The evolution of knowledge-intensive innovation ecosystems: co-evolving entrepreneurial activity and innovation policy in the West Swedish maritime system. *Ind Innov* 28(5):651–676
- Groth OJ, Esposito M, Tse T (2015) What Europe needs is an innovation-driven entrepreneurship ecosystem: Introducing EDIE. *Thunderbird Int Bus Rev* 57(4):263–269
- Guerrero M, Santamaría-Velasco CA, Mahto R (2021) Intermediaries and social entrepreneurship identity: implications for business model innovation. *Int J Entrepreneurial Behav Res* 27(2):520–546
- Guerrero M, Urbano D, Gajón E (2020) Entrepreneurial university ecosystems and graduates' career patterns: do entrepreneurship education programmes and university business incubators matter? *J Manag Dev* 39(5):753–775
- Guerrero M, Urbano D, Fayolle A, Klofsten M, Mian S (2016) Entrepreneurial universities: emerging models in the new social and economic landscape. *Small Bus Econ* 47:551–563
- Gurcan F, Cagiltay NE (2023) Research trends on distance learning: a text mining-based literature review from 2008 to 2018. *Interact Learn Environ* 31(2):1007–1028
- Halbinger MA (2020) The relevance of makerspaces for university-based venture development organizations. *Entrepreneurship Res J* 10(2)
- Harper-Anderson E (2018) Intersections of partnership and leadership in entrepreneurial ecosystems: Comparing three US regions. *Econ Dev Q* 32(2):119–134
- Hayter CS (2016) A trajectory of early-stage spin-off success: the role of knowledge intermediaries within an entrepreneurial university ecosystem. *Small Bus Econ* 47:633–656
- Henrekson M, Kärnä A, Sanandaji T (2022) Schumpeterian entrepreneurship: coveted by policymakers but impervious to top-down policymaking. *J Evolut Econ* 32(3):867–890
- Ho JY, Yoon S (2022) Ambiguous roles of intermediaries in social entrepreneurship: the case of social innovation system in South Korea. *Technol Forecast Soc Change* 175:121324. <https://doi.org/10.1016/j.techfore.2016.11.009>
- Huggins R, Thompson P (2020) Human agency, entrepreneurship, and regional development: A behavioural perspective on economic evolution and innovative transformation. *Entrepreneurship Reg Dev* 32(7–8):573–589
- Hu TS, Yu CW, Chia PC (2018) Knowledge exchange types and strategies on the innovation interactions between KIBS firms and their clients in Taiwan. *Cogent Bus Manag* 5(1):1534527
- Igwe PA, Odunukan K, Rahman M, Rugara DG, Ochianwata C (2020) How entrepreneurship ecosystem influences the development of frugal innovation and informal entrepreneurship. *Thunderbird Int Bus Rev* 62(5):475–488
- Jia X, Desa G (2022) Social entrepreneurship and impact investment in rural-urban transformation: An orientation to systemic social innovation and symposium findings. In *Social Innovation and Sustainability Transition* (pp. 283–305). Cham: Springer Nature Switzerland
- Johnson E, Hemmatian I, Lanahan L, Joshi AM (2022) A framework and databases for measuring entrepreneurial ecosystems. *Res Policy* 51(2):104398
- Kantarelis D (2009) Entrepreneurship in the USA: architecture, market structure and incentives. *Int J Entrepreneurship Innov Manag* 9(3):191–203
- Karami A, Lundy M, Webb F, Dwivedi YK (2020) Twitter and research: a systematic literature review through text mining. *IEEE Access* 8:67698–67717
- Khatami F, Scuotto V, Krueger N, Cantino V (2022) The influence of the entrepreneurial ecosystem model on sustainable innovation from a macro-level lens. *Int Entrepreneurship Manag J* 18:1419–1451. <https://doi.org/10.1007/s11365-021-00788-w>
- Khurana I, Dutta DK (2021) From latent to emergent entrepreneurship in innovation ecosystems: the role of entrepreneurial learning. *Technol Forecast Soc Change* 167:120694
- Kim MG, Lee JH, Roh T, Son H (2020) Social entrepreneurship education as an innovation hub for building an entrepreneurial ecosystem: The case of the KAIST social entrepreneurship MBA program. *Sustainability* 12(22):9736
- Kumar P, Hollebeek LD, Kar AK, Kukkk J (2023) Charting the intellectual structure of customer experience research. *Mark Intell Plan* 41(1):31–47
- Kumar P, Sharma A, Salo J (2019) A bibliometric analysis of extended key account management literature. *Ind Mark Manag* 82:276–292
- Kumar R, Anand A, Kumar P, Kumar RK (2020) Internet of Things and social media: a review of literature and validation from Twitter Analytics. In *2020 International Conference on Emerging Smart Computing and Informatics (ESCI)* (pp. 158–163). IEEE
- Le TT, Tarafdar M (2009) Business ecosystem perspective on value co-creation in the Web 2.0 era: implications for entrepreneurial opportunities. *Int J Entrepreneurial Venturing* 1(2):112–130
- Leone RP, Robinson LM, Bragge J, Somervuori O (2012) A citation and profiling analysis of pricing research from 1980 to 2010. *J Business Res* 65(7):1010–1024
- Levinson NS (2010) Innovation in cross-national alliance ecosystems. *Int J Entrepreneurship Innov Manag* 11(3):258–263
- Lijster T (2018) The future of the new: Artistic innovation in times of social acceleration. *Valiz*
- Liu H, Kulturel-Konak S, Konak A (2021) A measurement model of entrepreneurship education effectiveness based on methodological triangulation. *Stud Educ Eval* 70:100987
- Lyons TS, Lyons JS, Jolley GJ (2020) Entrepreneurial skill-building in rural ecosystems: a framework for applying the Readiness Inventory for Successful Entrepreneurship (RISE). *J Entrepreneurship Public Policy* 9(1):112–136
- McDaniel M, Sutter C, Webb JW, Elgar FJ, Parker KF, Nwachu J (2021) Breaking the cycle of crime: promoting the positive social spillover potential of entrepreneurship. *J Bus Venturing Insights* 16:e00249
- Mehmood T, Alzoubi HM, Alshurideh M, Al-Gasaymeh A, Ahmed G (2019) Schumpeterian entrepreneurship theory: evolution and relevance. *Acad Entrepreneurship J* 25(4):1–10
- Mehta K, Zappe S, Brannon ML, Zhao Y (2016) An educational and entrepreneurial ecosystem to actualize technology-based social ventures. *Adv Eng Educ* 5(1):n1
- Miller K, Alexander A, Cunningham JA, Albats E (2018) Entrepreneurial academics and academic entrepreneurship: a systematic literature review. *Int J Technol Manag* 77(1–3):9–37
- Mirvis P, Googins B (2018) Engaging employees as social innovators. *Calif Manag Rev* 60(4):25–50
- Montes-Martínez R, Ramírez-Montoya MS (2022) Systematic mapping: educational and social entrepreneurship innovations (2015–2020). *Educ+ Train* 64(7):923–941
- Moraes GHSM, Spers EE, Mendes L, Silva HMRD (2023) Corporate entrepreneurship at the university: the influence of managerial support, autonomy and reward on the innovative behavior of university professors. *J Entrepreneurship Emerg Econ* 15(2):404–424
- Nthubu B (2021) The value of a co-design visualization approach: Enhancing the understanding of local entrepreneurial ecosystems. *Des J* 24(5):749–760
- Nybakk E, Crespell P, Hansen E, Lunnan A (2009) Antecedents to forest owner innovativeness: An investigation of the non-timber forest products and services sector. *For Ecol Manag* 257(2):608–618
- Pansari A, Kumar V (2017) Customer engagement: the construct, antecedents, and consequences. *J Acad Mark Sci* 45:294–311
- Peña Gallo ML (2021) The European Social Innovation Diplomacy, a post-2020 Strategy to put the EU at the Global Scene: The role of Sweden as an innovative leader
- Plata G, Aparicio S, Scott S (2021) The sum of its parts: examining the institutional effects on entrepreneurial nodes in extensive innovation ecosystems. *Ind Mark Manag* 99:136–152
- Portuguez-Castro M (2023) Exploring the potential of open innovation for co-creation in entrepreneurship: a systematic literature review. *Adm Sci* 13(9):198

- Qian H (2018) Knowledge-based regional economic development: a synthetic review of knowledge spillovers, entrepreneurship, and entrepreneurial ecosystems. *Econ Dev Q* 32(2):163–176
- Ramezani J, Camarinha-Matos LM (2020) Approaches for resilience and anti-fragility in collaborative business ecosystems. *Technol Forecast Soc Change* 151:119846
- Ranga M, Perälampi J, Kansikas J (2016) The new face of university–business cooperation in Finland. *Sci Public Policy* 43(5):601–612
- Raposo M, Fernandes CI, Veiga PM (2022) We dreamed a dream that entrepreneurial ecosystems can promote sustainability. *Manag Environ Qual: Int J* 33(1):86–102
- Rosado-Serrano A, Paul J, Dikova D (2018) International franchising: a literature review and research agenda. *J Bus Res* 85:238–257
- Roundy PT (2016) Start-up community narratives: The discursive construction of entrepreneurial ecosystems. *J Entrepreneurship* 25(2):232–248
- Satalkina L, Steiner G (2020) Digital entrepreneurship and its role in innovation systems: a systematic literature review as a basis for future research avenues for sustainable transitions. *Sustainability* 12(7):2764
- Schaeffer PR, Guerrero M, Fischer BB (2021) Mutualism in ecosystems of innovation and entrepreneurship: A bidirectional perspective on universities' linkages. *J Bus Res* 134:184–197
- Schmutzler J, Pugh R, Tsvetkova A (2022) Contextual and evolutionary perspectives on entrepreneurial ecosystems. insights from Chris. Freeman's Think Innov Dev 12(1):13–21
- Shane SA, Ulrich KT (2004) 50th anniversary article: technological innovation, product development, and entrepreneurship in management science. *Manag Sci* 50(2):133–144
- Soundarajan N, Camp SM, Lee D, Ramnath R, Weide BW (2016) NEWPATH: an innovative program to nurture IT entrepreneurs. *Adv Eng Educ* 5(1):n1
- Spigel B, Harrison R (2018) Toward a process theory of entrepreneurial ecosystems. *Strateg Entrepreneurship J* 12(1):151–168
- Sprinkle RH (2003) The biosecurity trusts. *BioScience* 53(3):270–277
- Švarc J, Dabić M, Daim TU (2020) A new innovation paradigm: European cohesion policy and the retreat of public science in countries in Europe's scientific periphery. *Thunderbird Int Bus Rev* 62(5):531–547
- Teece DJ (2007) Explicating dynamic capabilities: the nature and micro foundations of (sustainable) enterprise performance. *Strateg Manag J* 28(13):1319–1350
- Tiwary NK, Kumar RK, Sarraf S, Kumar P, Rana NP (2021) Impact assessment of social media usage in B2B marketing: A review of the literature and a way forward. *J Bus Res* 131:121–139
- Thananusak T (2019) Science mapping of the knowledge base on sustainable entrepreneurship, 1996–2019. *Sustainability* 11(13):3565
- Van Eck N, Waltman L (2010) Software survey: VOSviewer, a computer program for bibliometric mapping. *Scientometrics* 84(2):523–538
- Volkman C, Fichter K, Klofsten M, Audretsch DB (2021) Sustainable entrepreneurial ecosystems: an emerging field of research. *Small Bus Econ* 56(3):1047–1055
- Yoda N, Kuwashima K (2020) Triple helix of university–industry–government relations in Japan: transitions of collaborations and interactions. *J Knowl Econ* 11:1120–1144

- Zahra SA, Nambisan S (2011) Entrepreneurship in global innovation ecosystems. *AMS Rev* 1:4–17

Author contributions

Rishi and Srinivas designed the study, performed data analysis, and wrote the manuscript. Ronnie contributed to data collection, interpretation of results. Rana and Sachi contributed to the interpretation of the data and critical revision of the manuscript. Kumod assisted in data acquisition and manuscript preparation. Prashant provided critical feedback, improvised network diagram and model, and revised the manuscript for intellectual content. All authors have read and approved the final version of the manuscript. All contributed authors have been listed in this article.

Competing interests

The authors declare no competing interests.

Ethical approval

Ethical approval was not required as the study did not involve human participants.

Informed consent

This article does not contain any studies with human participants performed by any of the authors.

Additional information

Correspondence and requests for materials should be addressed to Rishi Kant Kumar.

Reprints and permission information is available at <http://www.nature.com/reprints>

Publisher's note Springer Nature remains neutral with regard to jurisdictional claims in published maps and institutional affiliations.



Open Access This article is licensed under a Creative Commons Attribution 4.0 International License, which permits use, sharing, adaptation, distribution and reproduction in any medium or format, as long as you give appropriate credit to the original author(s) and the source, provide a link to the Creative Commons licence, and indicate if changes were made. The images or other third party material in this article are included in the article's Creative Commons licence, unless indicated otherwise in a credit line to the material. If material is not included in the article's Creative Commons licence and your intended use is not permitted by statutory regulation or exceeds the permitted use, you will need to obtain permission directly from the copyright holder. To view a copy of this licence, visit <http://creativecommons.org/licenses/by/4.0/>.

© The Author(s) 2024