New developments in innovation and entrepreneurial ecosystems

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Abstract

In this article, we provide a rationale for this Special Section on innovation and entrepreneurial ecosystems. We also present a summary of the papers presented in the Special Section, highlighting research questions, theories, data and methods, and principal findings and conclusions. A research agenda is also identified, involving multi-level research on agents, institutions, and regions on the context, process, and impact of innovation and entrepreneurial ecosystems.

JEL classification: M13, D24, L31, O31, O32

1. Introduction

Innovation is most likely to occur within an entrepreneurial ecosystem that typically involves a set of agents, institutions, activities or processes, and surrounding culture. Entrepreneurial ecosystems may be conceived in terms of institutional, geographic, economic, or industrial contexts and can be analyzed at different levels of aggregation (e.g. firms, industries, universities, regions, and nations). In recent years, we have witnessed a substantial rise in academic interest in this topic (Autio et al., 2014, 2018). For example, given the rise of technology commercialization at universities, via patenting, licensing, research joint ventures with private companies, and startup creation, many academics and policymakers have explored the development and expansion of entrepreneurial ecosystems at research universities (e.g. see Link et al., 2015 for reviews). Some key agents, institutions, and initiatives defining university ecosystems include faculty, post-docs, students, alumni, technology transfer offices, science and technology parks, incubators/accelerators, venture capitalists and angel investors, alumni commercialization funds, and a plethora of entrepreneurship programs and centers on campus. Entrepreneurial ecosystems, more generally, benefit from a variety of intermediate organizations (see Clayton et al., 2018 for a review).

We also know that ecosystems are evolving complex, diverse, and potentially quite fragile. The open innovation movement along with a growing consensus on the importance of collaborative research and the role of networks also have a major impact on how academics analyze innovation ecosystems (see West and Bogers, 2017 for a review).

The convergence of these trends have critical managerial and policy implications, which this Special Section brings together. In a first step we issued an open call to solicit extended abstracts, from which we invited a selection...
of authors to submit full papers. These papers were subject to normal Industrial and Corporate Change (ICC) review, and those that successfully negotiated this process are presented here.

In this introduction, we summarize the papers in the special issue and outline an agenda for further research, as well as highlighting some policy implications.

2. Papers in the Special Section

The papers in the Special Section are summarized in Table 1. These studies employ a variety of methodological approaches, including both large scale longitudinal quantitative analysis and detailed qualitative analysis. The papers also illustrate the variety in scope that ecosystems might take, including regional level ecosystems (Vedula et al.; Donegan et al.; Lai and Vonortas) and those based around or associated with universities (Breznitz and Zhang; Heaton et al.; Qin et al.). The studies also analyze a variety of dependent variables at different levels of analysis. Some studies explore the impact of individual and organizational resources and capabilities on the ecosystem (Breznitz and Zhang; Qin et al.). Other studies focus on the impact of the nature of ecosystems on venture level performance (Breznitz and Zhang) and survival (Vedula et al.).

The study by Vedula and Kim (2019) examines an important research question: to what extent does location matter for startup performance? To assess this question in the context of entrepreneurial ecosystems, they construct a regional entrepreneurial ecosystem quality index. This index is based on five key underlying components: (i) supportive entrepreneurial culture; (ii) access to finance; (iii) availability of human capital; (iv) innovation capacity; and (v) formal support organizations. The authors analyzed the relationship between this index and startup survival, along with the moderating role of founders’ experience. They find that higher quality ecosystems nurture startups, especially for fledgling entrepreneurs, while startups located in lower quality ecosystems are more likely to fail.

Donegan et al.’s (2019) study of the impact of different prior work experiences on entrepreneurial firm performance in one particular region highlights the importance of recognizing within regional differences among economic actors. This paper offers new insight into multiple pathways for entrepreneurship that exist and intersect in one region. The paper delineates several of the economic and innovation outcomes associated with prior work experience which have varying influences on how entrepreneurs start and develop their firms. The study shows that the fact whether entrepreneurs’ prior work experience was in large corporations, entrepreneurial firms, or academia had a significant impact on short-term and long-term performance of their firms.

Breznitz and Zhang’s (2019) study of nine accelerators illustrates the heterogeneity of goals and support mechanisms for student entrepreneurship that may be present within a particular entrepreneurial ecosystem at a single university. There were some commonalities in terms of providing assistance in securing external finance and the use of a final event where students pitch to potential investors. However, they also identify the influence of variety in agent expertise and of the processes in the ecosystem on venture outcomes. Ventures in accelerators with directors who were habitual entrepreneurs were more likely to experience product growth. Accelerators with a screening process that required all applicants to have a proof of concept and those with more intensive programs showed stronger venture performance.

Qin et al. (2019) add to understanding of the role of individual agents in ecosystem processes by tracking a cohort of ventures in a single accelerator. Their study highlights that, in addition to comparing ecosystems, there is a need to understand intra-ecosystem heterogeneity. They show that the effect of the elements of an accelerator program vary as entrepreneurs adopt different approaches to engage other actors in the ecosystem to acquire resources.

Heaton et al. (2019) assess research universities and their impact on innovation ecosystems. They study this issue through the lens of dynamic capabilities, or the ability of organizations to integrate, build, and reconfigure internal and external competences to address rapidly changing environments. The authors outline the dynamic capabilities framework, which can be used to guide university management of innovation ecosystems. Specifically, they focus on the organizational and individual dynamic capabilities the university needs to enable innovation ecosystems to flourish through different stages in their life-cycles relating to initial emergence, development, and renewal. Of particular note is the importance attached to the need to change capabilities across these stages as the role of the university changes.
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<th>Authors</th>
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| Vedula and Kim   | To what extent does the quality of a region’s entrepreneurial ecosystem matter for venture survival? | Entrepreneurial ecosystem theory, focused on social, finance, human, innovation, and support capital | Longitudinal firm level data on 301 US Metropolitan Statistical Areas from 2004 to 2011 comprising 2600 ventures and 14,379 venture-years | Higher quality ecosystems (based on a time-varying index of five key characteristics: supportive entrepreneurial culture, access to finance, availability of human capital, innovation capacity, and formal support organizations) shelter ventures, while ventures in weaker ecosystems are more likely to fade away and fail.  
Serial entrepreneurs can use their experience to offset shortcomings in some aspects of the quality of the EE such as entrepreneurial culture, access to loans and grants, and resources provided by formal support organizations.  
Actors embedded in regions that constrain their operations need to find ways to compensate for the lack of positive regional ecosystems influence, of which entrepreneurial experience is an important compensating factor. |
| Breznitz and Zhang | When universities do not enforce a single approach to commercialization, what are the implications for students’ startups that participate in university accelerators? | Entrepreneurial ecosystems theory, focused on human capital, knowledge creation, and other innovation and support systems. Theoretical model includes factors that have both direct and indirect effects. | 9 accelerators across the University of Toronto campuses, part of the Campus-Linked Accelerators (CLAs) program comprising university-wide support mechanisms, and six accelerators created by particular faculty and/or dedicated to particular disciplines. | Firms that spend time in accelerators whose director is a habitual entrepreneur are more likely to experience product growth. |
| Lai and Vonortas | What are the key factors that drive the development of a regional entrepreneurial ecosystems? | Entrepreneurial ecosystem theory, focused on human capital, knowledge creation, and other innovation and support systems. Theoretical model includes factors that have both direct and indirect effects. | Panel dataset on 263 Chinese cities over the time period 2007–2015 | Human capital, knowledge creation, access to finance, and market access are the four key determinants of local entrepreneurial activity.  
Also, the presence of high growth firms in the region, startup companies, university graduates, as well as city openness are significant predictors of both the regional stock of human capital and knowledge creation.  
Risk finance is found to be strongly associated with the presence of high growth firms and startups. The presence of research-intensive universities has a strong positive impact on regional entrepreneurial ecosystems. |

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<td>Donegan et al.</td>
<td>How do different local pre-entrepreneurial employment experiences within one regional ecosystem impact the differential contribution of entrepreneurial firms to the ecosystem?</td>
<td>Organizational imprinting</td>
<td>924 founders and 488 firms founded between 1990 and 2012 in North Carolina’s Research Triangle region’s life sciences cluster</td>
<td>There is considerable intra-regional career heterogeneity among entrepreneurial founders that influences the impact of their firms. Firms with founders with prior big pharma affiliation only achieve significantly higher positive employment from year three. Firms started by founders previously employees at a local entrepreneurial firm start with larger numbers of employees but do not necessarily maintain this lead long-term. Firms with higher proportions of academic experience start with lower employment numbers, but subsequently have growth rates above surpassing both second generation entrepreneurial founders and big pharma founders. Firms with founders with a hybrid of big pharma and entrepreneurial experiences produce more patents. Firms founded by academics are more successful at raising public funding.</td>
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<td>Heaton et al.</td>
<td>How can universities actively stimulate the life-cycle of regional innovation ecosystems in ways that support their core missions of education and research?</td>
<td>Dynamic capabilities</td>
<td>Longitudinal archival, interview and database data on three case studies of universities engaging with local economy partners to launch new industries to foster entrepreneurship, and revitalize neighborhoods</td>
<td>Research universities with strong dynamic capabilities are well positioned to drive the development of new scientific and industrial fields that corporate research is increasingly reluctant to explore. Senior campus leaders must create and implement an organizational culture and vision that accepts improvisation, rewards creativity, and embraces change, and proactively orchestrate assets both within and outside direct university control in a manner sensitive to local needs and market opportunities. The initial stage, development stage, and renewal stage of an innovation ecosystem are each associated with a different set of university roles and capabilities.</td>
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<td>Johnson et al.</td>
<td>How does the relationship between the built environment and individual behaviors drive the evolution of university-centered entrepreneurial ecosystems?</td>
<td>Entrepreneurial university</td>
<td>Mixed-methods approach; computer-aided text analysis of 400 pages and 34 narrative interviews; regenerative medicine at University of Edinburgh, UK and University of Wisconsin-Madison, USA</td>
<td>When entrepreneurial orientation and innovativeness is low, the ecosystem focuses on emotion-based coping responses, individuals, and ventures learn via externalization and adapt through perseverance to new processes and resources. With high entrepreneurial orientation and innovativeness, the ecosystem emphasizes problem-based coping, individuals, and ventures learn by collaboration, and adapt through pivoting by exploring new solutions and business models.</td>
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<td>Qin et al.</td>
<td>How do entrepreneurs in the accelerator ecosystem organize their activities to speed up the entrepreneurial process? How are the effects of time compression addressed effectively for the accelerator process to yield desirable outcome?</td>
<td>Resource acquisition; time compression diseconomies</td>
<td>Longitudinal data from cohort of 25 ventures in a Chinese accelerator</td>
<td>Entrepreneurs adopt two different strategies to achieve accelerated development—acceleration with focus and acceleration with foresight. The effectiveness of these strategies are moderated by venture entrepreneurs' agency in how they leverage the accelerator offerings for resource acquisition. Entrepreneurs adopting the focused acceleration strategy benefit from a more targeted, proactive resource acquisition approach; Entrepreneurs follow an open and receptive resource acquisition approach</td>
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EE, entrepreneurial ecosystem.
Table 2. Additional research questions relating to innovation and entrepreneurial ecosystems

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<th>Level</th>
<th>Contextual elements</th>
<th>Process</th>
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<td>Macro/region</td>
<td>How should we characterize an innovation or entrepreneurial ecosystem? Is there an appropriate taxonomy?</td>
<td>What is the life-cycle and longevity of innovation and entrepreneurial ecosystems?</td>
<td>How do we evaluate the effectiveness of an innovation or entrepreneurial ecosystem?</td>
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<td>To what extent are innovation and entrepreneurial ecosystems different from biological ecosystems?</td>
<td>How do they renew themselves?</td>
<td>What is the impact of such ecosystems on economic growth at the regional and national levels?</td>
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<td>How do new developments in innovation and entrepreneurial ecosystems relate to national innovation systems?</td>
<td>How are innovation and entrepreneurial ecosystems “coordinated”?</td>
<td>How do we frame goals against which ecosystem impact can be measured?</td>
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<td>What are the appropriate public policies to support such ecosystems?</td>
<td>What are the implications for geographical configurations of innovation and entrepreneurial ecosystems of open science?</td>
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<td>Institutions/organizations</td>
<td>What is the role of public–private partnerships in such ecosystems?</td>
<td>How are university–industry collaborations in such ecosystems negotiated and structured? What is their duration? How stable are these arrangements?</td>
<td>How does the rise of innovation and entrepreneurial ecosystems affect the traditional academic culture of “open science”?</td>
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<td>What is the role of national/federal labs in such ecosystems?</td>
<td>How do universities formulate and implement entrepreneurial/technology commercialization strategies in ecosystems?</td>
<td>What will the long-term effects be for universities?</td>
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<td>How do the roles of universities vary across innovation and entrepreneurial ecosystems and over time?</td>
<td>How do the goals of universities influence the manner in which they develop entrepreneurial ecosystems?</td>
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<td>To what extent does the historical context of universities influence their approaches to the development of entrepreneurial ecosystems?</td>
<td>How does the nature of agent interactions impact the performance/outcomes of innovation and entrepreneurial ecosystems?</td>
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<td>To what extent do innovation and entrepreneurial ecosystems involve elements that are geographically and internationally dispersed?</td>
<td>How does the variety of experience and behavior of entrepreneurial agents impact performance/outcomes of innovation and entrepreneurial ecosystems?</td>
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<tr>
<td>Agents</td>
<td>What is the scope of the agents involved in different types of innovation and entrepreneurial ecosystems?</td>
<td>What is the nature of configurations of agent interactions in innovation and entrepreneurial ecosystems?</td>
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<tr>
<td></td>
<td>How does agent behavior vary within different innovation and entrepreneurial ecosystems?</td>
<td>How do these interactions vary across different stages in the evolution of such systems?</td>
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3. An agenda for further research

We outline an agenda for further research in Table 2. The framework we adopt for developing this agenda involves, on the one axis, three different levels that relate to the macro/region, institutions/organizations, and agents. On the other axis, we consider the elements of the context, the nature of the process, and the impact.

Heaton et al. (2019) usefully provide a more precise definition of innovation and entrepreneurial ecosystems (see e.g. Autio et al., 2014, 2018; Mason and Brown, 2014; Spigel and Harrison, 2018; Stam and Spigel, 2018). This is important both theoretically and empirically, and hence has implications for the design of further research and policy.
For example, the aforementioned Vedula and Kim (2019) study used five characteristics to measure the quality of entrepreneurial ecosystems, which are only a subset of the 14 elements identified by Acs et al. (2014a,b) to rank countries and regions covering ability to identify and develop entrepreneurial opportunities; startup skills; risk acceptance; networking; cultural support; opportunity rather than necessity motivation; size of technology sector and ability of business to adopt new technology; human capital/expertise; competitiveness of entrepreneurial products/services; extent of product innovation; extent of process innovation; high growth intentions of businesses; internationalization focus of entrepreneurs; and availability of risk capital.

Also, although the concepts of innovation and entrepreneurship are often merged, they are actually quite distinct. For example, Autio et al. (2014) note that not all entrepreneurs innovate. At the same time, not all innovations are associated with entrepreneurial opportunities, with much of the innovation literature traditionally ignoring entrepreneurship (Acs et al., 2014a). In light of this heterogeneity there remains a need to develop a taxonomy of innovation and entrepreneurial ecosystems. The results of such studies may then provide insights into the more fine-grained design of policy on innovation and entrepreneurial ecosystems.

While considerable attention has been devoted to the contexts of academic entrepreneurship involving faculty (e.g. for reviews see Link et al., 2015), we know relatively little about the institutional contexts relating to the rapidly growing area of student entrepreneurship. Wright et al. (2017) outlined a general framework for understanding a student entrepreneurship ecosystem, and Breznitz and Zhang’s (2019) paper in this issue sheds light on one aspect of this ecosystem relating to accelerators. The nature of the development of student entrepreneurship ecosystems depends on the strategy adopted by universities and the resources they employ (Wright et al., 2019).

In some cases, the emergence of the ecosystem may be initiated by a top-down university strategy, in other cases it may emerge bottom-up by entrepreneurial faculty. These ecosystems may also evolve over time. For example, institutions may develop their strategies and resource commitment university-wide building on initiatives by individual faculty or departments. The nature of the student entrepreneurship ecosystem and its interaction with the environment external to the university may also influence the extent to which graduating students locate their ventures in the region close to the university or move elsewhere (Larson et al., 2017). At present, systematic evidence on the processes involved in these different approaches to student entrepreneurship ecosystems, their evolution and their impact at macro, institutional, and agent levels is lacking.

The studies in this Special Section also point to the need for further research on the nature of individual agents between and within entrepreneurial ecosystems and the processes involved in their interactions. Both the papers by Breznitz and Zhang (2019) and by Vedula and Kim (2019) show the importance of the contribution of experienced entrepreneurs, while Donegan et al. (2019) highlight the varying impact of different types of prior employment experience and Qin et al. (2019) show the different approaches adopted by entrepreneurs in how they use elements in the ecosystem to acquire the resources needed to develop their ventures.

We know from various studies of academic entrepreneurship that experienced entrepreneurs can play an important role in enabling faculty to shape their ventures by helping fill gaps in their commercial expertise and social capital (Franklin et al., 2001; Mosey and Wright, 2007; Rasmussen et al., 2016). However, such habitual entrepreneurs also vary in terms of their entrepreneurial human and social capital, their ability to access and coordinate resources, as well as their success (Westhead and Wright, 2017). This raises important challenges and associated research questions relating to the recruitment of experienced entrepreneurs and their role in different types of entrepreneurial ecosystems. For example, what has been the scope of the experienced entrepreneurs’ interactions with other agents in the ecosystem? More generally, given that papers in this special section examine very specific contexts, studies analyzing other contexts are needed to confirm generalizability and boundary conditions.

There is increasing recognition of the heterogeneity of goals, at both different levels of analysis as well as within levels of analysis, and the need therefore to measure impacts in relation to these goals (Kotlar et al., 2018). Similarly, as universities make their own strategic choices, and associated implementation efforts regarding the development of entrepreneurial activities (Clarysse, et al., 2005; Horner et al., 2019), assessment of the impact of innovation and entrepreneurial ecosystems needs to be made in relation to the goals underlying these choices. At the macro/region level in particular, a major challenge likely concerns the need to tradeoff potential conflicting social, economic, and financial goals.

Although the papers in this special issue have gone some way to exploring the evolution of ecosystems over their life-cycle, and Arora et al. (2019) have explored the evolution of the US innovation ecosystem relating to corporate labs, further research is needed especially in relation to the processes by which this evolution occurs. In particular,
we know little about to what extent, in what contexts and how innovation and entrepreneurial ecosystems are created and coordinated. For example, what are the roles and goals of the many stakeholders who may be engaged as co-creators such as university managers, faculty, heads of departments, students, investors, angel networks, local and regional authorities, startup entrepreneurs, and corporations? Initial work on co-creation in the context of open labs and accelerators, suggests that the roles of these different agents may vary depending on the emphasis on commercial, social, or hybrid goals (De Silva and Wright, 2019) but further analysis is needed that goes beyond a bilateral focus on two actors to adopt a systemic perspective.

Furthermore, university approaches to the development of entrepreneurial ecosystems may also be related to the historical factors that have influenced their development trajectories over time, which in turn influence the nature of their relationship with stakeholders. These differences may be present between universities within the same groups, such as Research One universities in the USA or Russell Group universities in the UK (Wright et al., 2008; Holstein et al., 2018). Research is therefore needed to explore how these differences influence the development of entrepreneurial ecosystems, including analysis of the extent to which universities seek to or are able to depart from their historical trajectories.

The spatial diversity of innovation and entrepreneurial ecosystem also warrants further attention (Autio et al., 2014). Such ecosystems may involve elements that are geographically proximate but they may also involve elements spread across regions and countries. Leading universities may have major international links with corporations, faculty may be from other countries and also have international links with other faculty, and graduate and undergraduate student bodies may also be very international. Internationalizing new ventures may involve the development of an entrepreneurial ecosystem that involves customers, suppliers, and intermediaries across different regulatory regimes. The advent of digitization may even facilitate virtual ecosystems in which the elements do not have any common physical space (Nambisan et al., 2019). To what extent and in what ways do spatial factors limit the boundary and composition of an innovation and entrepreneurial ecosystem? Is spatial dispersion essential for effective ecosystems and what factors influence the extent of such dispersion? How and by whom are spatially dispersed ecosystems constructed for new entrepreneurial ventures?

4. Policy implications

Each of the papers presented in this Special Section has identified policy implications relating to the particular topic they address. Without repeating those recommendations here, we would suggest the following challenges as warranting policy attention.

At the macro/region level, it is important to frame the goals for policy support for the development of innovation and entrepreneurial ecosystems. While goal framing is important and potentially conflictual for all policy interventions, it would appear to be especially challenging in this context because of the complexity of the interactions and the longevity of the time-scales involved. This may be an especially important issue given the typically relatively short electoral and associated policy life-cycles. Establishing the nature of market failures as the basis for policy intervention is also challenging but assessment of the characteristics of high-quality ecosystems as identified by Vedula and Kim (2019) in this Special Section may provide a step in the appropriate direction.

At the agent level, there appear to be clear policy implications regarding the recruitment, retention, and replacement of individuals and teams who can enable ecosystem development through its life-cycle. Differences between entrepreneurial agents and their mode of entry into entrepreneurship, as highlighted in a number of studies in this special issue (e.g. Donegan et al., 2019) also implies that policy support to develop entrepreneurial ecosystems in a particular region may need to take account of the configuration of industrial ownership and individual experience. For example, rather than simply focusing on encouraging startups, policy may need to provide incentives for employees to spin-off from current employers or to encourage experienced entrepreneurs to become involved in creating further ventures.

5. Conclusions

The papers in this Special Section have examined innovation and entrepreneurial ecosystems at different levels of aggregation (e.g. firm, university, region, and national levels), using multiple theoretical perspectives and both quantitative and qualitative research. One key finding is that research universities play a critical role in organizing and
implementing these ecosystems. It appears that this is part of a regional economic development strategy that benefits both these institutions and regions as well. For example, given the rise of technology commercialization at universities, via patenting, licensing, research joint ventures with private companies, and startup creation, many academics and policymakers have weighed in on the development and expansion of entrepreneurial ecosystems at research universities. Some key agents, institutions, and initiatives defining such ecosystems include faculty, post-docs, students, alumni, technology transfer offices, science and technology parks, incubators/accelerators, venture capitalists and angel investors, alumni commercialization funds, and a plethora of entrepreneurship programs and centers on campus.

In sum, the papers in this Special Section also demonstrate that the “success” of innovation and entrepreneurial ecosystems, as best we can measure it, are influenced by five key factors: (i) human capital, some of which is developed and nurtured at local research universities and other organizations; (ii) knowledge creation, which also mainly emanates from research universities and also from local high-tech firms and startup; (iii) access to finance; (iv) market access; and (v) the built environment and infrastructure relevant to innovation and entrepreneurship. Our Special Section also confirms the view that such ecosystems are evolving complex, diverse, and potentially quite fragile.

References


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