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Editorial : Innovation policies and practices within innovation ecosystems

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Abstract: We explore the growth, scope and impact of the academic literature that has arisen around the concept of innovation ecosystems. We highlight some of the most important definition, the place of innovation policies and the next accomplishments that could be made.

Keywords: Innovation ecosystems, co-creation, opportunity recognition, agenda.

1. Definition and growth of the notion of ecosystems in management science

A considerable academic literature in the domain of management has arisen in the past two decades around the notion of ecosystems, and in particular around the notion of innovation ecosystems. A number of academic and practitioner journals, conferences and workshops have been organized in recent years on those topics. The academic interest is nowadays matched by managerial, industrial and policy makers uptake and operationalisation of the concept. The paragraphs below seek to provide an overview of the work undertaken so far, identify key areas of progress and forthcoming research possibilities.

Anchored in the biological metaphor, several definitions of the ecosystem concept within the management literature have emerged over the years. For instance, an ecosystem encompasses “the alignment structure of the multilateral set of partners that need to interact in order for a focal value proposition to materialize” (Adner, 2016, p.40). This definition embraces all types of ecosystems that can be found in the literature. In an extensive review of papers defining specifically innovation ecosystems Granstrand and Holgersson (2020) summarize many different approaches. They conclude that an innovation ecosystem corresponds to “the evolving set of actors, activities, and artefacts, and the institutions and relations, including complimentary and substitute relations that are important for the innovative performance of an actor or a population of actors”. Moreover, Adner’s work propose a synthesis of governance of an ecosystem and of the business model of the system. Each ecosystem can be described from an actor-centric point of view and from a structure centric point of view, the business model of the whole ecosystem reconciles these points.

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Drawing on this biological metaphor, a significant amount of works in the management literature since the mid 90's focused on two main conceptual clarifications:

- 1) The differences between the notion of "systems" and the notion of "ecosystems", in particular in a territorial context (local, regional, national). Most of the key contributions in this perspective (Torre & Zimmermann, 2015; Bassis & Armellini, 2018) highlight a strong contrast between the static point of view of the notion of systems with the dynamic perspective inherent to the notion of ecosystem: In a static vision the notion of system of innovation is a set of existing formal entities "which jointly and individually contribute to the development and diffusion of new technologies, and which provides the framework within which governments form and implement policies to influence the innovation process" (Metcalfe, 1995). A system of innovation focuses on how the nature of interactions between existing institutions (which remain unchanged in the process) conditions innovation trajectories ('how institutions drive action').

On the contrary, in a dynamic perspective, the notion of ecosystem refers to a set of heterogeneous formal entities and informal actors (users, diverse communities, individual talents) engaged in a process of knowledge co-building. The notion of ecosystem does not assume that institutions already exist. Instead, it concentrates on the dynamics of innovation that lead to the transformation of institutions or the formation of new institutions and practices ('how action drives institutions') (Bresnahan, Gambardella, and Saxenian 2001).

- 2) The characterization of the different types of ecosystems. Initially the first notion to be introduced in the literature was the concept "business ecosystem" by Moore (1993), followed by "innovation ecosystem" (Adner, 2006; Autio and Thomas 2014), "entrepreneurial ecosystem" (Pitelis, 2012; Stam and Spigel, 2016), "knowledge ecosystem" (van der Borgh et al., 2012; Clarysse et al., 2014), "service ecosystem" (Vargo et al., 2015), "platform ecosystem" (Gawer and Cusumano, 2014). Each of these notions of ecosystems differ from the focus on the types of partners involved and the nature of the proposition of value at stake. As illustrated by Figure 1, the literature mostly concentrated on three of these concepts of ecosystems: Innovation, business and entrepreneurial ecosystems. They followed similar trends. Figure 1 represents the annual number of articles reported in Google Scholar for search criteria's including "innovation ecosystem", "business ecosystem" and "entrepreneurial ecosystem". With a lag of a couple of years, all three notions follow the same growth trend. In very early 2000, the Business Ecosystems set the pace, closely followed by Innovation Ecosystems. From 2013, Innovation Ecosystems took over as the dominating trend. In the early period, Entrepreneurial Ecosystems were less a focus, but gathered more interest as a niche concept that has almost caught up with Business Ecosystems in recent years.

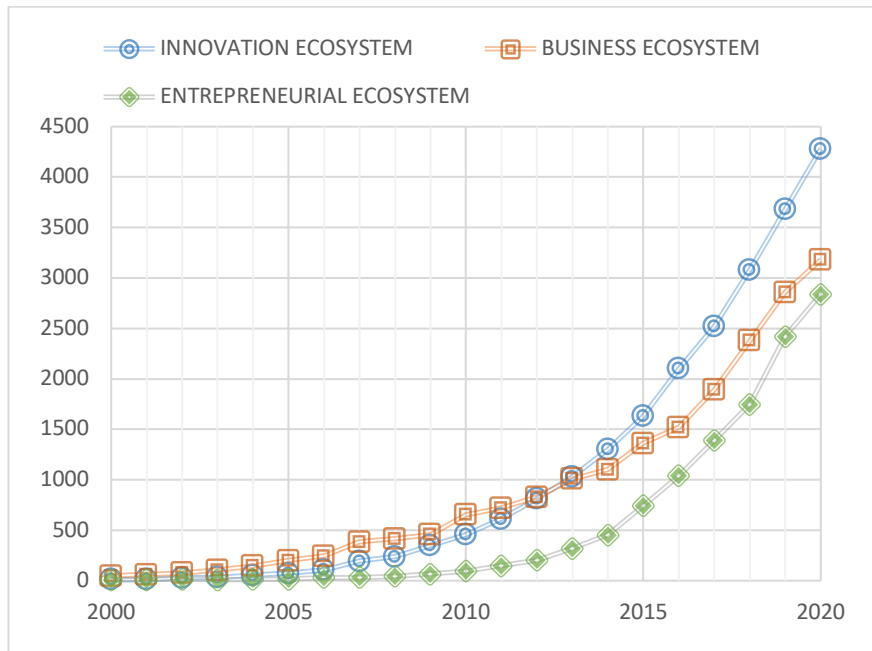


Figure 1: Annual number of articles reported in Google Scholar (search criteria “innovation ecosystems”, “business ecosystems” and “entrepreneurial ecosystems”)

Progressively, the literature clarified the differences between these main types of ecosystems. Whereas the notion of business ecosystem construct is generally used to analyze how a given organization manages to capture value, notably by orchestrating its interactions with various stakeholders, the notion of innovation ecosystem shifts the focus to the issue of value creation by analyzing how a structure of heterogeneous actors engaged in a process of knowledge and insight exchange, act on its environment, develop new solutions, and co-create value. In a more focused perspective, the notion of entrepreneurial ecosystem refers to a set of interdependent actors and factors coordinated in such a way that they enable productive entrepreneurship within a particular territory.

It is the notion of innovation ecosystems which receives today the most attention from academic scholars. This notion echoes many topics linked to innovation management. In an extensive review, Gomes *et al.* (2018) list a wide variety of strategic management related terms linked to innovation ecosystems². Borrowing the relevant word cloud procedure from Chesbrough and Bogers (2014) on open innovation, we took 18 seminal papers on innovation ecosystems identified by Granstrand and Holgersson (2020)³ and collected the academic

² Strategic Management is increasingly taking ecosystems into account. It is or will undoubtedly be a central strategic concept in the coming years. The inclusion of the term into the mainstream strategic management literature is however quite recent. Many strategic books, handbooks and encyclopædia only recently acknowledged the concept of innovation ecosystems or ecosystems in general. For instance, Faulkner and Campbell (2006) handbook on strategy do not mention ecosystems, and in the 1800 pages of Augier and Teece (2020) encyclopædia of strategic management, only business ecosystems appear, only hinting at innovation ecosystems as examples around leading technology firms such as Apple.

³ The papers are Adner, 2006; Autio and Thomas, 2014; Bomtempo *et al.*, 2017; Carayannis and Campbell, 2009; Dattée *et al.*, 2018; Gastaldi *et al.*, 2015; Gobble, 2014; Gomes *et al.*, 2018; Guerrero *et al.*, 2016; Jackson, 2011; Kukk *et al.*, 2015; Nambisan and Baron, 2013; Scozzi *et al.*, 2017; Still *et al.*, 2014; Tamayo-Orbegozo *et al.*, 2017; Tsujimoto *et al.*, 2018; Walrave *et al.*, 2018; Witte *et al.*, 2018. The words corresponding to a limited or specific application of the ecosystems e.g. automobile or chemistry, are not taken into account, we kept only the academic concepts.

concept most frequently used in the abstracts and keywords of these papers. The word cloud of Figure 2 indicates a strong link with the other concepts of ecosystem (business and entrepreneurial) and the “co-”concepts (co-creation, competition co-evolution, and so on).



Figure 2: Innovation ecosystems word cloud based on abstract and key words, top words

2. Innovation ecosystems and policies

Innovation ecosystems are drastically changing the way firms are designing, prototyping, testing and manufacturing new products and services. The uptake of these innovations requires intersectional investments and collaboration across a wide range of organizations on an unprecedented scale (Stefani et al., 2019).

Models of “co-innovation” (Lee et al., 2012) both at the technological and organizational level are required along with a new set of adapted policies to support ecosystem-based innovations. Research equips organizational actors with frameworks for thinking, public policies, decision-making tools, means of action and indicators to bring about the necessary transformations in ecosystem innovation.

Ecosystems are indeed not static, but evolve as innovations develop (Attour and Burger-Helmchen, 2014). While countries obsess about scaling up, i.e. to create the next generation of multinational enterprises (MNE), and capitalizing on their S&T investments, well-organized innovation and business ecosystems may provide an interesting and potentially more agile model to consider as an alternative. However, how to scale up ecosystems remains a challenge to be surmounted especially in the presence of complexity resulting from the extensive combination of knowledge and technologies that spans widely across numerous sectors and disciplines. In this context, governments need to co-develop new, adapted and targeted public policies as well as appropriate regulations with the right stakeholders to ensure innovation success. Breaking down disciplinary and sectoral silos within ecosystems will be crucial. In line with these public policies and government programs as mechanisms of their implementation, industrial processes and practices will need to be put in place to benefit from this multiplicity of discontinuous technologies that will soon be available to a vast array of sectors.

Innovation policies need to be adapted on the right scale of the systems they want to support. Recent work on innovation ecosystems explores their dynamic cycles (Cohendet et al., 2020; Ghazinoory et al., 2020) and pinpoints the different needs that emerge with time. Innovation ecosystems exist both at nationwide scale as in more geographically bounded areas. Therefore, the innovation policy concepts that are relevant are numerous. They include national innovation systems that encompass the very broad aspects affecting learning/exploration of new knowledge, but also the diffusion of information and financial aid (Lundvall, 1992). At a smaller scale, regional innovation systems, usually more turned toward production, can support innovation ecosystems (Asheim et al., 2011).

On a different level, sectoral innovation systems, i.e. more focused on a precise domain with an increased competition tension, are right for ecosystems with actors that are prone to market interaction already in possession of more advanced products or services (Malerba, 2004). Finally, at micro level, corporate innovation systems, often structured around platforms or entrepreneurship policies, may exist (Granstrand and Holgersson, 2020; Isckia et al., 2020). However, this last type of ecosystem maybe less in need of innovation policies, or with the limitation of policies to supervise the position of the leading actor in the ecosystems and avoid monopole behaviours.

Further work is needed to understand the organizational structures of innovation ecosystems and how these are managed in order to accelerate and improve the innovation process and lead to better economic development and wealth creation. The goal of the special issue is therefore to provide a critical review of the past and current innovation policies and practices within and outside of innovation ecosystems in order to assess their appropriateness and effectiveness.

3. Overview of the special issue

While intense efforts of clarification have been made in the academic literature to distinguish between the concept of system and ecosystem, and between the different forms of ecosystems, very few academic works have addressed the issues of how these different forms of ecosystems are interacting in a dynamic perspective, or of how the notion of a dynamic ecosystem could emerge from the static frame of a system approach. The five articles that compose this special issue precisely aim at adding to this literature in highlighting the interplay between different types of innovation systems. A common thread among the five papers of the special issue is the recognition of the need to develop new lenses to formally account for adaptive behaviour within clusters, networks or regional innovation systems using the ecosystem metaphor. In essence, the five papers build upon these fields of the literature, by adding various complexity dimensions (relationships, knowledge, systems, etc.). As suggested by Boyer, Rondé and Ozor (2021) “the diversity and heterogeneity of agents, the complexity of relationships, and new forms of organization (underground, middleground, and upperground) are the main characteristics of innovation ecosystems, in contrast to more traditional concepts like clusters or networks”.

The work of Rong, Lin, Yu and Radziwon (2020) intends to explore this theoretical and practical gap with a focus on the regional innovation ecosystems in China. Their work shows how to build on the relatively static views associated with regional, sectoral and national innovation systems

(RIS, SIS and NIS), in order to construct the dimensions of regional innovation ecosystems (RIE) that takes into account not only economic but also social factors. Maintaining links to RIS and SIS, these intertwined, dynamic and coevolving RIEs offer a strong value network to the actors of the ecosystem, and all together, they constitute the NIS as a whole. The findings also highlight how appropriate and well-informed governmental supports to these RIEs can significantly boost the national innovation system.

Based on a field study in Tuscany, Mazzoni and Lazzeretti (2020) present how sectoral interaction can lead to the emergence and reinforcement of an entrepreneurial ecosystems and to better innovation management. The case-study based on 24 entrepreneurs shows that the innovation ecosystems allow better coordination, cooperation and cognition between the actors. The paper bridges the gap between complex adaptive systems (CAS) and entrepreneurial ecosystems. In contrast to Rong, Lin, Yu and Radziwon (2020), for this study, it is the entrepreneurship ecosystem lens that is not dynamic enough to account for the emergence of an entrepreneurship order. The authors categorize the entrepreneurial properties around three spheres (“cognition”, “coordination”, “cooperation”) and explain their dynamic generative process, underlining the necessity to embrace a holistic unit of analysis, to fully understand the entrepreneurial emergent order. As the authors suggest, “each component acts following its ‘genetic heritage’ but modifies its individual”, these modifications are therefore more akin to ‘genetic mutations’. As theories build upon each other, we suspect that entrepreneurship ecosystem, and innovation ecosystem theories may very likely borrow from CAS in the future to properly model such mutations and their impact.

It is accepted that the complexity of a system is both a source of richness and value creation, and a potential limit to good interaction (Heraud et al., 2019). Organisations most probably adapt their behaviour to overcome these limitations. The study of such mutations is indeed suggested in the conclusion of the third paper of this special issue: Reischauer, Güttel and Schüssler (2021) recommend to study how Technology Transfer Organisations (TTOs) change their “designs [activities and structure] with respect to ecosystem evolution”. Their work takes a close look at the role of intermediary organizations and how their design can be better aligned with the ecosystems. They argue that coupling, specialization, centralization, and formalization are the key structural dimensions of TTOs. The authors propose some key points to ensure a better governance and design of TTOs interacting with ecosystems. For instance, when the complexity of the solution sought warrants to search far and wide for new non-local knowledge, these TTOs are likely to play an important intermediary role within inter-RIE networks of the first paper of this special issue.

The smaller local innovation ecosystem studied in the fourth paper is a perfect microcosm of the RIE, entrepreneurship and innovation ecosystems studied in the other contributions of this special issue. Taking a quantitative approach, on more micro data, Boyer, Rondé and Ozor (2021) show how local innovation ecosystem brings together a set of heterogeneous actors, leading to a higher diversity of outcomes for those firms. The study covers ecosystems related to health and nutrition green chemistry and agro-sourced material, fashion and textiles and digital /IoT, offering a large spectre of results. The paper empirically shows that the “innovation ecosystem impacts adaptive capacities of firms”, hence contributing the ‘mutations’ mentioned above, but also rendering the local innovation ecosystem more resistant to shocks. In

particular, the results highlight that firms belonging to local innovation ecosystems centered on innovation parks are both more innovative and more technologically diversified than others.

Finally, Gifford, McKelvey and Saemundsson (2021) study the co-evolution of an entrepreneurial ecosystem and innovation policies in the Swedish maritime system. The authors propose a governance model where the policy activity (top-down) and entrepreneurial activity (bottom-up) are interrelated to build an effective innovation ecosystem, promoting both public and private returns. This last paper of the special issue echoes the first in that it promotes a mixed-driven policy approach that encompasses both purely policy-driven and spontaneously driven policy approaches. Focusing partly on sustainable development goals within the knowledge-intensive innovation ecosystem, the authors argue that “the existing actors need to be incentivised to change their business to accommodate sustainable development”, ergo favouring a beneficial ‘mutation’ for the ecosystem. This of course requires experimentation, but also exploring policies in other sectors. As a consequence, adaptation and sustainability of innovation ecosystems requires intersectoral in addition to inter-RIE.

Those papers highlight the variety of interactions at the heart of an innovation ecosystems, but also the numerous interactions with a more global environment. Those interactions impact the structure and governance of the ecosystems creating spaces of improvisation and creation of new routines or reshaping of existing routines. The circumstances of those evolutions are among next challenges research needs to answer about Innovation ecosystems (Attour et al., forthcoming).

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