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## Innovation ecosystems: A critical examination ☆, ☆ ☆

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## ABSTRACT

Publications pushing the “innovation ecosystem” meme have added valuable dimensions to the economic development discussion. The phrase has captured the imagination of policy makers and has motivated public initiatives of substantial magnitude. This paper reviews the concept of innovation ecosystems as it is set forth in the academic and trade literature, and asks, “What is gained from adding ‘eco-’ to our treatment of national and regional innovation systems?”

The answer is, “Very little, and the risks outweigh the benefits.” Innovation ecosystem is not yet a clearly defined concept, much less a theory. Moreover, the idea carries pitfalls, notably its over-emphasis on market forces, and its flawed analogy to natural ecosystems.

The prospect that the phrase “innovation ecosystem” is here to stay, in investment and economic development circles, implies a research gap, and indicates caution in using the phrase in rigorous research. The paper describes the gap, indicates directions for bridging it, and offers recommendations for prudent use of “ecosystem” terminology.

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## 1. Introduction: “Innovation ecosystems”

The term ‘innovation ecosystems’ has become popular in industry, academia, and government. It is used in corporate, national, or regional contexts, in idiosyncratic ways. It implies a faulty analogy to natural ecosystems, and is therefore a poor basis for the needed multi-disciplinary research and policies addressing emerging concepts of innovation.

Frenkel and Maital (2014) find an early use of “innovation ecosystem” in a *New York Times* op-ed by William Kennard, a former Chairman of the US Federal Communications Commission. Other earlier comparisons of business environments to ecological systems include Carroll (1988), Hannan and Freeman (1989), Moore (1993), and Schot (1998). (All owe intellectual debt to

Nelson and Winter (1982), though the latter's work on evolution of technology did not imply there is an ecology of innovation.) However, these researchers may not have been aware that other social scientists had already left the questionable ecosystem analogy behind; see especially Haynes (1971).

Jackson (2011) defines an *innovation ecosystem* as “the complex relationships that are formed between actors or entities whose functional goal is to enable technology development and innovation.” (A supplementary file, giving more background on innovation systems and their relation to technology-based economic development, accompanies this article.) He continues,

The actors include the material resources (funds, equipment, facilities, etc.) and the human capital (students, faculty, staff, industry researchers, industry representatives, etc.) that make up the institutional entities participating in the ecosystem (e.g. the universities, colleges of engineering, business schools, business firms, venture capitalists, industry-university research institutes, federal or industrial supported centers of excellence, and state and/or local economic development and business assistance organizations, funding agencies, policy makers, etc.).

The innovation ecosystem comprises two distinct, but largely separated economies, the research economy, which is driven by fundamental research, and the commercial economy, which is driven by the marketplace.

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This paper will explore the idea that tension between these two economies may be the driver behind the newer terminology of “innovation ecosystems,” as it contrasts with the older terms technopolis initiative, cluster initiative, and triple-helix initiative.

Aside from naming the actors, Jackson’s definition distinguishes an innovation ecosystem from any generic system only in its *purpose* – to innovate. Thus the comparison of an innovation system to a biological ecosystem rests on a teleological fallacy (Ulrich, 1980; Chase, 1985). Furthermore, Jackson’s definition does not specify the locations of the actors (geography being pertinent to innovation systems), or the kinds of interactions/relationships among them.

The private sector’s affection for the *eco-* prefix has infected governments. A supplementary file accompanying this article describes government innovation “ecosystem” initiatives in USA, South Korea, and other countries. These efforts are somewhat systematic, but in no way isomorphic to a natural ecology. The word “system,” *sans* “eco-,” would have sufficed to describe these government developments.

This paper is a critical review of the ‘innovation ecosystem’ idea, as it compares to the more traditional notion of innovation system. Literature review, logical argumentation, and examination of national projects conducted under the ecosystem banner support our contention that loose and inconsistent use of the term ‘innovation ecosystem’ adds no value to the scholarly discourse and may cause harm. The innovation *eco-*literature makes positive contributions, but these contributions do not depend on the *eco-* prefix, and their *eco-* pretensions are metaphorical rather than rigorous. Following the examples of Linton (2009), Ruddiman et al. (2015) and Lilienfeld et al. (2015), who in their respective fields offered guidance for use of terminology, the present paper issues cautions and recommendations for researchers and policymakers, urging usages that reduce rather than increase confusion among researchers.

## 2. “Innovation ecosystem” literature: Differentiators, contributions and implications

Reviewing the literature of innovation environments, Durst and Poutanen (2013) found very few scholarly articles that called those environments “innovation ecosystems.” Those papers they did find, they note, paid little attention to the dialog with multiple constituencies, which (as Jackson’s definition implies) the topic seems to call for. Likewise Niosi (2010) addressed national and regional innovation systems (NIS and RIS) without using the prefix “eco-.”

Frenkel and Maital’s introduction to their 2014 book *Mapping National Innovation Ecosystems* considers biological ecosystems only as a loose metaphor. Despite the book’s title, neither the ecosystem term nor the metaphor appears anywhere else in the volume. Speakers at the 2014 World Technopolis Association Workshop and UNESCO-Daejeon Global Innovation Forum used “innovation support systems” (Chen, 2014) and “innovation support platforms” (Seo, 2014) as satisfactory equivalents to “innovation ecosystems.” Thus, ‘innovation ecosystem’ is identical to ‘innovation system,’ at present.

Our own literature search likewise found few academic articles using “innovation ecosystem” in a manner that would distinguish an innovation ecosystem from an innovation system. The *eco-* term appears in a great many trade publications (for example, Barclay, 2014; Bruns, 2013; Butcher, 2014; Feld, 2012; Hannes, 2014; Hwang, 2013; Leach, 2014; Moore, 1993; Site Selection Magazine, 2014). It is difficult to know whether these non-peer-reviewed articles, authored by industry people, use the term in an intentional way, or simply in an imitative way.

What makes “innovation ecosystems” different from the earlier concepts of S&T parks, technopoles, regional innovation systems, science cities, or innovation clusters? The distinguishing features of recent publications using “ecosystem” seem to be:

1. *More explicitly systemic.* Rogers (1962) emphasized that innovation diffuses through a social system. The innovation ecosystem literature shows a greater appreciation of the connections among the many innovation actors. Enumerating the interactions among the ecosystem’s component organizations (as Fetters et al. (2010, p.181)) have done, in the case of university entrepreneurial ecosystems) highlights the richness and diversity of actors that can, in principle, give rise to emergent behavior.
2. *Digitalization.* The central role of information and communication technologies (ICT) in new products and services, and in connecting the innovation actors is recognized.
3. *Open innovation.* The borrowing, licensing, open-sourcing, crowd-sourcing, and alliances that allow ideas from diverse sources to be combined into new products and services.
4. The *mimetic quality* of the term “innovation ecosystem,” and its appeal to the news media. This demonstrates the public relations value of the term, but not its value in research.
5. A greater emphasis on differentiated *roles*, or “niches” occupied by organizations and industries. See Frenken et al. (1999) and Raven (2005). These niches can correspond to links in industry value chains. This emphasis contrasts with the more amorphous “It takes a village to raise an entrepreneur” and “Everybody in the community pull together” approaches taken by past technopolis initiatives.
6. Greater importance of *market forces*, relative to government- or NGO-push.

That sixth point may imply the innovation ecosystem movement is an attempt to privatize the technopolis movement, which has heretofore been characterized by triple-helix and public-private partnerships (PPPs). Though FCC Chairman Kennard was business-oriented (he had been Managing Director of a \$100 billion private equity firm), he did give due credit to educational institutions and government regulatory environment for the blossoming of Internet-based innovation. Other writers, e.g. Hannes (2014) have not been as generous.

## 3. Ecosystem terminology: disadvantages and dangers

The ecological metaphor is in line with trends toward biomimicry and bio-inspired design, i.e., learning from natural and biological (evolved) systems. This is admirable, despite that it risks false analogies between biological and artificial ecosystems.

An innovation ecosystem is not an evolved entity. Rather, it is designed. Papaioannou et al. (2007) note innovation ecosystems differ from natural ecosystems in (i) the presence of intention and teleology, and (ii) the acknowledged importance of governance. The latter point is reinforced by the venture capital firm T2 Venture Creation, who in promoting their Global Innovation Summit ([www.innosummit.com](http://www.innosummit.com)), write:

How do we *build* startup communities? How do we *catalyze* systemic sustainable innovation across companies, cities, and countries? How do we *design* entire ecosystems to drive entrepreneurship, technology, and economic impact? [Emphasis ours.]

“Shanghai Scores As Top New Tech Hub In The World As Silicon Valley Gap Grows,” reads one headline (Fannin, 2014). Another says, “Munich edges out London as Europe’s top tech city” (Ranger,

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