The emergence of entrepreneurial ecosystems: A complex adaptive systems approach

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ABSTRACT

Entrepreneurial ecosystems are receiving heightened attention from scholars and practitioners. Studies have focused on isolating entrepreneurial ecosystems’ components; however, prior research has not offered a theory of entrepreneurial ecosystems that embraces their complexity. To address this omission in ecosystems research, we contend that entrepreneurial ecosystems can be more fully understood if examined through the lens of complexity science and conceptualized as complex adaptive systems. We contribute to entrepreneurship research by developing a complexity-based definition of entrepreneurial ecosystems. Building on this definition, we connect the research on entrepreneur- and venture-level complexity to work on entrepreneurial ecosystems and propose three related forces that will influence entrepreneurial ecosystem emergence: intentionality of entrepreneurs, coherence of entrepreneurial activities, and injections of resources. Beyond developing theory, we describe how scholars can examine entrepreneurial ecosystems as complex systems using qualitative comparative analysis, agent-based modeling, and interpretivist methods. Our theorizing also has implications for entrepreneurs and policymakers.

1. Introduction

The linkages between entrepreneurial activity – the creation of innovative organizations, products, and initiatives that generate value for society – and regional economic development are receiving growing interest from scholars and policymakers (Audretsch, Keilbach, & Lehmann, 2006; Galindo & Méndez, 2014). Acknowledging the social and cultural embeddedness of entrepreneurial activities, researchers have increasingly shifted their focus from studies of entrepreneurs and ventures to the creation of entrepreneurial ecosystems (EEs): the sets of actors, institutions, social networks, and cultural values that produce and sustain entrepreneurial activity (e.g., Ács, Stam, Audretsch, & O’Connor, 2017; Auerswald, 2015; Brown & Mason, 2017; Stam, 2015). The EE approach draws attention to the configuration of individual, organizational, and societal forces that is necessary to promote and support entrepreneurial activities (Berger & Kuckertz, 2016a; Roundy, Brockman, & Bradshaw, 2017; Spigel, 2017; Spilling, 1996).

In studies of EEs, scholars have focused primarily on identifying the core attributes of established ecosystems, such as Tel Aviv (Klingler-Vidra, Kenney, & Breznitz, 2016) and Edinburgh (Spigel, 2016). For instance, Bahrami and Evans (1995) found that the Silicon Valley ecosystem’s critical features include a deep reservoir of venture capital, knowledgeable labor, research institutions, professional services infrastructure, and lead users of innovations (also cf. Kenney & Von Burg, 1999). Although these studies and others (e.g., Isenberg, 2010) have isolated the key components of several high-profile ecosystems, it is increasingly clear that to understand EEs and how they emerge, it is necessary to go beyond producing lists of attributes (Auerswald, 2015). Indeed, Mack and Mayer (2016: 2118) argue that a key limitation of the current work on EEs is its focus on “documenting the presence of system components, [with] little understanding of interdependencies between components.”

We agree with these scholars and others (e.g., Spigel, 2017; Stam, 2015) that what is missing from the prior work on EEs is a guiding theoretical framework that acknowledges the complexity of the phenomenon. EEs have been the target of academic and practitioner attention for over 25 years; however, by not focusing on the complex interactions among agents, organizations, and socio-cultural forces, we know surprisingly little about how ecosystems emerge (Auerswald, 2015). Attempts have been made to explain entrepreneurial- and venture-
level emergence (e.g., Lichtenstein, Carter, Dooley, & Gartner, 2007; McKelvey, 2004); however, a theory has not been put forth that specifically addresses the complexity and emergence of EEs.

A clue as to the type of theory that could illuminate the study of EEs and provide insights into their emergence can be found in the aforementioned calls for studying the complex constellation of connections among ecosystem components, which suggest that EEs are best treated as systems and that systems theory, an analytical approach representing phenomena as sets of stocks and flows regulated by interactions (e.g., Hartvigsen, Kinzig, & Peterson, 1998), might provide an appropriate lens for understanding EEs. Work in systems theory has taken two approaches. The first approach assumes that systems are commonly in (or near) equilibrium, which negates the need to examine dynamic relationships and nonlinear interactions among the systems’ elements and instead focuses on isolating and parameterizing stable, individual components (Manson, 2001). Although the “simple” systems approach is appropriate for explaining the behavior of some types of systems, a second approach used by a variety of disciplines, including biology, ecology, chemistry, economics, and management (cf. Eisenhardt & Piezunka, 2011), suggests that there is a second type of system that does not operate at equilibrium. There is a subset of these non-equilibrium systems – complex adaptive systems (CAS) – that cannot be explained using general systems theory.

The study of complex adaptive systems – systems in which macro-level behaviors both emerge from and influence the micro-level interactions of the elements of the system (Levin, 2002; Lissack & Letiche, 2002) – has led to an interdisciplinary branch of scholarship referred to as complexity science (Manson, 2001). The aim of this research is to provide a framework for analyzing the characteristics of complex systems, such as nonlinearity, self-organization, cross-scale interactions, and emergence (Arthur, 1999; Berger & Kuckertz, 2016b).

We theorize that EEs are complex adaptive systems. Moreover, we contend that by analyzing EEs through the lens of complexity science we can move past lists of ecosystem components, provide a framework that can be used to respond to calls for studies of the emergence of EEs, and connect micro- and macro-level research in entrepreneurship. Thus, in this paper, we build on complexity science to offer a framework for the study of EEs.

The remainder of the paper is structured as follows. First, we review work on EEs, highlighting the approach’s history and key insights. We then review research on complexity and entrepreneurship focused on the individual- and venture-levels, describe how this research has not been extended to the ecosystem-level, and explain how complexity science can be used to connect work on the emergence of innovations, entrepreneurs, and ventures to research on the emergence of EEs. Next, we apply the lens of complexity to EEs, establish the appropriateness of conceptualizing EEs as complex adaptive systems, and introduce a complexity-based definition of EEs. We then theorize about the emergence of EEs as complex systems. Finally, we discuss the contributions of our theorizing for scholars, propose three methods for studying EEs as complex systems, and suggest implications for practitioners and policymakers.

2. Literature review

2.1. Entrepreneurial ecosystems

Bahrami and Evans (1995) were the first in the academic entrepreneurship literature to invoke the term “ecosystem” in their study of Silicon Valley. Similarly, Spilling (1996: 91) emphasized the “entrepreneurial system,” describing it as the actors, roles, and environmental factors that interact to determine the entrepreneurial performance of a region. Motoyama and Knowlton (2017) focused more directly on the connections among the agents in an EE. In doing so, they point out that while the system of connections among the agents in an EE is important, very little investigation into the complexities of this system has been done. They also note that the emergence of EEs has been recognized by researchers; however, direct theorizing about the emergence process (i.e., how an ecosystem form) is lacking (Motoyama & Knowlton, 2017).

Several themes appear in prior studies of EEs. Findings suggest that EEs emerge over time through multiple components and micro-level processes (e.g., the intentions of entrepreneurs, meso-level processes (e.g., the provisioning of resources to entrepreneurs from support organizations), and macro-level processes (e.g., the influence of ecosystem culture) (e.g., Ilsenberg, 2010). There is also some recognition of the complexity of the agents in an EE and that the interactions among them are paramount in developing the ecosystem (Motoyama & Knowlton, 2017; Spilling, 1996). Finally, although there is a vibrant stream of research on EEs, scholars have yet to converge on a widely accepted definition and one that is theoretically grounded. In sum, researchers have produced insights regarding the general nature of EEs, including identifying their most common components and drawing attention to the relevance of the relationships among agents. To move forward, however, what is needed is a theoretical framework that ties together disparate insights. In the next section, we suggest that complex adaptive systems theory provides such a framework.

2.2. Complexity science, entrepreneurship, and emergence

A common conceptual lens – complexity science – has developed to analyze systems in which the interactions between components result in the emergence of novel, seemingly unpredictable patterns, behaviors, and structures (Anderson, Drakopoulou Dodd, & Jack, 2012; Fuller & Moran, 2001). In such systems, the patterns of action produced at one level both emerge from and are influenced by processes operating at different levels and by the behaviors of the overall system (Hartvigsen et al., 1998; Lissack & Letiche, 2002), a characteristic referred to as complexity (Arthur, 1999; Lansing, 2003). Systems that exhibit complexity and are adaptive (i.e., have the capacity to change based on experience) are referred to as complex adaptive systems (Schindehutte & Morris, 2009). In such systems, the individual components are constantly reacting to one another (and to the environment) across levels, modifying the system and its response to disturbances and allowing it to adapt to changes (Messier & Puettmann, 2011: 250).

At the core of both complexity science and entrepreneurship scholarship is a focus on the concept of emergence, “the creation of new ‘order’ – structures, processes, and system-wide properties that come into being within and across system levels” (Lichtenstein, 2011a: 486). Emergence is central to entrepreneurship research, which has emphasized “the coming-into-being of new organizational means (e.g., resources) that in turn lead to the creation of new entities, e.g., technologies, firms, networks, clusters and markets, industries, [and] institutions” (Gartner, 1993; Lichtenstein, 2011a: 474). Studies of complexity science and entrepreneurship also align in their emphasis on how innovations both influence and are an outcome of emergence (Fleming & Sorenson, 2001; Garud & Karnoe, 2003; McKelvey, 2004). Because of the conceptual fit between complexity and entrepreneurship, complexity science has been used, primarily at the individual- and organizational-levels, to study the emergence of entrepreneurial behaviors and new ventures (Lichtenstein, 2011b; Lichtenstein et al., 2007).

The application of complexity science to the study of entrepreneurs and new ventures was, in part, a reaction to the focus in most entrepreneurship research on specific components of the entrepreneurship process (e.g., developing a business model, hiring early-stage employees, attracting investment) instead of on the recursive and nonlinear interactions among these sets of activities (Gartner & Carter, 2003). Thus, before the complexity lens was used, studies of founder- and organization-level entrepreneurship had a similar focus as prior EE research: identifying the components of the entrepreneurial process rather than exploring “interactions and emergent phenomena at multiple levels of analysis” and highlighting the importance of “nonlinear
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