Time and the Dynamics of Entrepreneurial Ecosystems

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"The fundamental impulse that sets and keeps the capitalist engine in motion comes from the new consumers' goods, the new methods of production or transportation, the new markets, the new forms of industrial organization that capitalist enterprise creates."

Schumpeter, 1942, 72-73

INTRODUCTION

Building on the ecological concepts formulated by organizational theorists (see Hannan and Freeman 1977), the entrepreneurial ecosystem (EE) concept has been gaining prominence since at least the early nineteen-nineties. While the term EE is still considered relatively new (Spigel 2017; Shepherd 2015), the concept of an ecosystem is anything but novel. The economist Joseph Schumpeter, as quoted above, in building his case for the waves of change known as creative destruction, implicitly connects the enterprise to the dynamics among levels of analysis that produce new forms of industrial organization acting as a fuel for the capitalist engine.

One of the earliest and more explicit references to an ecological perspective of entrepreneurship can be found with Aldrich (1990), who, in an interdisciplinary forum, offered the ecological perspective as an alternate way to consider the 'rates' of business founding occurring within a given environment. When borrowed, adapted, and applied to entrepreneurship, Aldrich argued that an ecological conception of entrepreneurship, when viewed as business founding, gave focus to the dynamics, the ability to account for differing scales of social interactions, and the potential to produce new and interesting hypotheses. Since then, an increasing number of works have examined and categorized the contexts for entrepreneurship that span organizational, institutional, industrial, social, and regional forms of definition (Autio et al. 2014).

One of the glaring limitations of the extant literature is that entrepreneurial ecosystems have generally been analysed from a static perspective (Stam and van de Ven, 2019; and Bhawe and Zahra, 2019). While a plethora of important insights have been garnered about the structure and interactions characterizing entrepreneurial ecosystems, little is known about how they develop and evolve over time. The purpose of this special issue is to address this striking gap in the literature by focusing on the dynamics of entrepreneurial ecosystems. The concept of entrepreneurial ecosystems (EEs) has emerged in recent years as a framework to understand the nature of places in which entrepreneurial activity flourishes. Spigel (2017) defines entrepreneurial ecosystems as follows: 'combinations of social, political, economic, and cultural elements within a region that support the development and growth of innovative start-ups and encourage nascent entrepreneurs and other actors to take the risks of starting, funding, and otherwise assisting high-risk ventures'.

However, the existing literature has several shortcomings. Despite some progress (Acs et al. 2017b), the concept is under-theorised. While it is evident that the entrepreneur is central to an EE perspective, it remains unclear how entrepreneurial ecosystems bring about distinctive performances over time from other concepts that seek to explain the geographical concentration of entrepreneurial activity (e.g. clusters, learning regions, regional innovation systems). Much of the literature comprises 'superficial generalisations … rather than rigorous social science research' (Stam and Spigel 2017, 408). Specifically, empirical studies are static rather than dynamic which does not capture the genesis and evolution of EEs (Mason and Brown 2014; Mack and Mayer 2016; Alvedalen and Boschma 2017). There is little consideration of the context in which entrepreneurial ecosystems emerge (Mack and Mayer 2016). The network of interactions of individual elements in the EEs has not been sufficiently explored (Motoyama and Watkins 2014). And the causal mechanisms are weak: it is not clear how the various elements in entrepreneurial ecosystems enhance entrepreneurship (Alvedalen and Boschma 2017; Stam and Spigel 2017).

In this special issue, we are primarily concerned with the dynamics of EEs, and therefore it follows that we need to take into account the influence and role of time. The recent work on this aspect has generally treated time as an evolutionary element for shaping and forming the EE (Autio et al. 2018). For instance, Thompson, Purdy, and Ventresca (2018) articulate the time-dependent pattern of ecosystem formation. Others have suggested that time is related to the change in entrepreneur and network profiles within a region, although the dynamics as such have not been explicitly examined (Cowell 2018). Some scholars have also noted how EEs are affected over time by increases in degrees of such things as intentions, coherence, and resources (Roundy, Bradshaw, and Brockman 2018). Furthermore, over time the changing sources and profile of resources (e.g., entrepreneurial knowledge, financial capital, mentors, etc.) will also alter the EE attractiveness for entrepreneurs (Mason, Cooper and Harrison 2002; Spigel and Harrison 2018). Apart from the explicit reference to evolution of the EE, these various observations about time have not particularly examined and contextualized the specific effect of time as it intersects with the various levels of analysis.

Entrepreneurship is a multi-level phenomenon, and the EE can be considered as a composite construct that fits within an eclectic paradigm of entrepreneurship reflecting theories of behavior, organization, and performance (Audretsch, Kuratko and Link 2015). Through the behavioral lens, actors, being individuals with motivations and traits, and organizations with cultures and intent, each play a role in shaping the nature of the EE from the inside. Organizational theories of people, teams, and firms provide the relational and interactional understandings between these actors and how they transact entrepreneurship. To this we can add the institutional setting (Denzau and North 1994; North 1990; Scott 1987) that comprises the political, social, and legal formal and informal 'rules' that contribute to new venture creation, opportunity, support and legitimacy, shaping and influencing the mental models of actors (Lim et al. 2010). The organization does not occur isolated from the institutional settings found in places or contexts. Performance theories can only be exhibited over time through the objective outcomes of entrepreneurs and firms, typically measured as new firm formations, firm growth and/or innovation, and socio-economic contribution (Audretsch, Kuratko and Link 2015). While multi-level understanding and methods of analysis are needed, we argue that an EE is not only a multi-level phenomenon but also a multi-temporal one whereby the levels themselves are subject to different perceptions of time horizons; historic, present and future. In contrast to the extant literature, we invited authors to examine more particularly the dynamics of the EE as it is influenced by time.

The extant EE literature tends to assume that time hosts entrepreneurial activity by actors. We adopt an alternate view, that time is an instrument of entrepreneurial actors and their activity that, over time, evolves the ecosystem. This alternate concept accepts that entrepreneurial activity is in the hands of entrepreneurial actors be they at micro, macro or meso levels. In this framing, time is a concept that works for and/or potentially against the entrepreneurial actor. The entrepreneurial actor will be both influenced by and influence time in the past, present and future. Time for the ecosystem is established by the pace of the actors rather than the pace of the ecosystem determining the time for entrepreneurial activity. The ecosystem is conceptually inert but representational of the actors and activities that give it life and dynamics. The EE does not have volution or action, but the actors have both, and the pace of their interactions determines the profile, the intensity, the rate of output, and, ultimately, the outcomes of the EE.

This is a major departure from previous conceptions of the EE, whereby the focus of an EE study has been on how the EE stimulates additional entrepreneurial activity. We suggest instead that entrepreneurial activity is the driver of the ecosystem, and this conception is consistent with Schumpeter's original framing of economic development (Schumpeter 1942). This does not debase the idea that entrepreneurial activity is important, but it places the outcomes of EE in the hands of the entrepreneurial actors and their interactivity (Harrison, Cooper and Mason 2004). By default, actors are inside the ecosystem, and the entrepreneurial activity is not dependent on the ecosystem, but the EE is a framing of interdependent entrepreneurial activity. This conceptualization is consistent with the earlier views proposed by Van de Ven (1993, 211-212), who argued that individual entrepreneurs "construct and change the industrial infrastructure" and that "infrastructure does not emerge and change all at once by the actions of one or even a few key entrepreneurs. Instead, it emerges through the accretion of numerous institutional, resource, and proprietary events that co-produce each other over an extended period". Entrepreneurship observed through the lens of an EE is not just about new firm creation, but holistically it is about the disruption and change of the ecosystem, and the primary concern is how actors may vary the pattern of interaction to alter the entrepreneurial outcomes.

The remainder of this paper includes the following sections. The next section undertakes a brief definitional analysis to make apparent the consistencies and contrasts that exist within various versions of the EE definition. This is followed by an exploration of related ecosystem concepts to draw out the distinctive attributes of the EE viewpoint. A discussion then ensues to articulate various approaches to defining what might be in or out of the analysis of the EE. It is proposed that temporal boundaries need to define the levels of analysis of the EE. We then present a conclusion that suggests EE research has strong relevance to 'how' and 'why' questions of entrepreneurship as they are relevant to place and time. In this way EE research is a tool of analysis rather than a field of research. When used as a tool, the variation of entrepreneurial dynamics comes into focus revealing the homogeneity rather than the generalized and homogenized understanding of an EE that is invariably, although unintentionally, presumed to fit all. Lastly the papers in this issue are then introduced.

TIME AND DYNAMICS IN ENTREPRENEURIAL ECOSYSTEMS

The consideration of time in entrepreneurship spans a number of areas such as a focus on the entrepreneur and how they manage time and/or decisions (Lévesque, Minniti and Shepherd 2009; Miller and Sardais 2015; Slevin and Covin 1998), the influence of time on risk behavior (Das and Teng 1997), how entrepreneurs allocate time in transitioning into a start-up (Lévesque and Maccrimmon 1998), and the temporal effects related to opportunity evaluation

(Tumasjan, Welpe and Spörrle 2013). For example, entrepreneurs need time to recover from failure, to make sense of the experience, deal with negative emotions and self-reflect (Byrne and Shepherd, 2015). Time is also a primary concern in considerations of new venture start-up, survival, and growth reflected in studies of firm life cycles, stages, and phases (Churchill and Lewis 1983; Lichtenstein and Lyons 2008; Levie and Lichtenstein 2010). Time further features in the evolutionary perspective of entrepreneurship (Ahlstrom and Bruton 2010; Vanacker, Manigart and Meuleman 2014; Hite 2005). However, while these perspectives deal with the dynamics imposed by time at different levels of analysis, little has been done in the EE domain to reconcile the multi-level implications of variations in time perspectives and the influence of such variations on entrepreneurship using the analytical lens of an EE. Indeed, the uncertainty of how to deal with time is raised when we consider the analysis of history – do we read it backwards – i.e. respondents explaining why they did what they did in the past, relying on retrospection, or do we read it forwards – either using contemporary documents or via series of longitudinal data collection exercises, to illustrate a trajectory. In either case the reliability and stability of findings must be questioned when time is taken into account (Mason and Harvey, 2013).

Bygrave and Hofer once said of entrepreneurship research that 'good science starts with good definitions' (1991, 13). Examining a number of more recent definitions of EE (see Table 1), it can be seen that a time dimension is implied by terms such as 'dynamic', 'interact and influence', 'support and facilitation', 'that combine', 'coalesce to connect, mediate, and govern', 'heightened levels of entrepreneurial activity', 'new ventures form and dissolve over time', 'development and growth', and 'enable'. The often implicit inference is that the analysis of the activity and interactivity of the range of entrepreneurial actors is undertaken across a window of time. Overall, while a number of these authors would likely argue that culture is shaped by history (Walsh and Winsor 2019), and hence the historic time perspective is tacitly included, the dimension of time is mostly implicit and mostly acknowledged as 'time' in the present as it influences business foundation activity, development, and growth. That is, time is considered as it unfolds and reveals the outputs that are observed by cross-sectional accounts of firm formation, entrepreneurial activity, and allocation of resources.

Table 1: Definitional Approaches to an Entrepreneurial Ecosystem

Author (alphabetical order)	**Definition**
Acs et al. (2017a, 479)	A National System of Entrepreneurship is the dynamic, institutionally embedded interaction between entrepreneurial attitudes, ability, and aspirations, by individuals, which drives the allocation of resources through the creation and operation of new ventures.
Audretsch and Belitski (2016)	We define systems of entrepreneurship (further ecosystem) as institutional and organizational as well as other systemic factors that interact and influence the identification and commercialization of entrepreneurial opportunities. Systems of entrepreneurship are geographically bounded…
Cohen (2006, 3)	Sustainable entrepreneurial ecosystems are defined as an interconnected group of actors in a local geographic community committed to sustainable development through the support and facilitation of new sustainable ventures.
Isenberg (2010, 43)	The entrepreneurship ecosystem consists of a set of individual elements—such as leadership, culture, capital markets, and open-minded customers—that combine in complex ways.
Mason and Brown (2014, 5)	A set of interconnected entrepreneurial actors (both potential and existing), entrepreneurial organisations (e.g. firms, venture capitalists, business angels, banks), institutions (universities, public sector agencies, financial bodies) and entrepreneurial processes (e.g. the business birth rate, numbers of high growth firms, levels of 'blockbuster entrepreneurship', number of serial entrepreneurs, degree of sell-out mentality within firms and levels of entrepreneurial ambition) which formally and informally coalesce to connect,

	mediate and govern the performance within the local entrepreneurial environment.
Regele and Neck (2012, 25)	…the interaction of people, roles, infrastructure, organizations, and events creates an environment for heightened levels of entrepreneurial activity.
Roundy, Bradshaw, and Brockman (2018, 5)	Is a self-organized, adaptive, and geographically bounded community of complex agents operating at multiple, aggregated levels, whose non-linear interactions result in the patterns of activities through which new ventures form and dissolve over time?
Spigel (2017, 50)	Entrepreneurial ecosystems are combinations of social, political, economic, and cultural elements within a region that support the development and growth of innovative start-ups and encourage nascent entrepreneurs and other actors to take the risks of starting, funding, and otherwise assisting high-risk ventures.
Stam (2015, 1765)	The entrepreneurial ecosystem is a set of interdependent actors and factors coordinated in such a way that they enable productive entrepreneurship.

The definitions furthermore reveal a focus on a number of different outputs from an EE, including innovative start-ups (Spigel 2017), venture creation and growth (Isenberg 2010) or venture creation and operation (Acs et al. 2017a), or heightened entrepreneurial activity (Regele and Neck 2012) or, more particularly, new sustainable ventures (Cohen 2006). Roundy, Bradshaw, and Brockman (2018) go beyond the new venture formation to include firms that also dissolve. Audretsch and Belitski (2016) suggest the identification and commercialization of entrepreneurial opportunities, while Mason and Brown (2014) highlight entrepreneurial processes as an output. These conceptions suggest the importance of a cross-sectional view or snapshot of the outputs at a specific moment in time that can account for an EE.

Extending beyond outputs to outcomes draws attention to the inclusion of macroeconomic views of resource allocation (Acs et al. 2017a) or, more specifically, productive entrepreneurship (Stam 2015). Mason and Brown (2014), by contrast, assume the type of general performance as an outcome. Four of the nine definitions are silent on this aspect, presumably preferring to focus on the output. The specification and scope of outcome remains unclear, which further complicates the study of EEs. More importantly, for this article, the various outputs and outcomes are subject to variations in time, scope and scale which invariably all are occurring simultaneously. However, we find that the concept of time in its historical and future contexts has received less attention.

EXPLORING RELATED ECOLOGICAL LINKS

The concept of the EE borrows from a branch of the biological sciences that deals with the relations between organisms and their environment (Aldrich 1990). The first use of the term 'ecosystem' in a business context is often attributed to Moore (1993), who drew upon the term to explain business innovation in an article where he argued that businesses do not evolve as isolated entities but develop through interaction with suppliers, financiers, and customers. In this way, the *relational* view among the business entities is highlighted, drawing attention to industrial organization theories.

Also worth noting is that ecology has meaning and a derivative within the sociological sciences as a branch that deals specifically with human ecology being a 'consideration of the relations of individuals to their surroundings, their habits, and modes of life [that] include almost all aspects of what are now seen as *contextual effects'* (author added emphasis, Appold 2007, I-444). The ecological view, therefore, is not as foreign as may first appear as the EE

refers to relations in a specific context and of a specific form that is reiteratively influencing and is influenced by the contextual effects.

These conceptions of the ecosystem also lend credence to the earlier observation that relational elements could be defined as factors and processes. Adopting the view of Aldrich (1990), three types of processes are highlighted. The first is between the actors and the historical context, and the second is between the various actors and organizations within the current situational context. Third, factors are also highlighted as institutional, and therefore these institutional factors combine as a composite to define a set of processes shaping the contextual setting. In Aldrich's view, the ecosystem becomes the combination of these three forms of processes that to various extents affect the resources available to new venturing in the defined region. These processes shape the historical context and 'experience' of entrepreneurship, the competitive and collaborative influences on resource availability, and the composite of institutional factors that influence the types and forms of new ventures created.

Around the same time as Aldrich's work, the application of an ecological perspective was also being applied to industrial and manufacturing process design, which became known as industrial ecology (Graedel 1994). Frosch and Gallopoulos (1989, 144) noted that

> "The industrial ecosystem would function as an analog of biological ecosystems. (Plants synthesize nutrients that feed herbivores, which in turn feed a chain of carnivores whose wastes and bodies eventually feed further generations of plants.) An ideal industrial ecosystem may never be attained in practice. But both manufacturers and consumers must change their habits to approach it more closely if the industrialized world is to maintain its standard of living – and the developing nations are to raise theirs to a similar level – without adversely affecting the environment."

It is interesting to also note that industrial ecology examines how economic systems work in concert with other surrounding systems (Graedel 1994). This view suggests that adopting an ecological perspective does not intend to isolate a single system as an ecosystem but looks at how a set of systems interact to optimize resource factors within that set of systems (O'Rourke, Connelly, and Koshland 1996). It may be particularly instructive to note these original salient points that the borrowing from biological ecology was considered a means to understand and improve socioeconomic systems and that an ecosystem perspective is an interactive view of multiple systems that can lead to resource optimization (Autio et al. 2018).

The ecological perspective of ecosystems also alerts us to other distinct conceptualizations of the EE (McKenzie and Sud 2009). First, a perspective that assumes an ecosystem maintains equilibrium, although vulnerable to external shocks, gives grounds to the analysis of births, deaths and survival rates of firms and how various internal and external influences may control or impact the survival of a new firm 'species'. In this case, the 'species' is the new venture, and the analysis takes into account the forming and subsequent survival of young new ventures guided by the 'entrepreneurial' actor. For instance, at an extreme, the imposition of a communist government to socialize a market-based system could completely destroy (make extinct) the species of the private firm, making the EE analysis of new firm formation redundent.

McKenzie and Sud's (2009) alternate perspective is one of ecological succession or evolution that studies populations and how they change over time, what causes the demise of some and the emergence of new populations and how some transform, mutate, or migrate. An example in today's world would be the emergence of digital technology firms and the diminution of traditional manufacturing firms among advanced economies. 'Digital technology' and 'traditional manufacturing' can be seen as different firm populations. We can

also readily observe that digital and physical products and services differ in time dimensions in terms of rate of development, distribution time and the pace of customer experiences.

In brief, this exploration of the foundational concepts reveals that ecosystems are concerned with interacting systems and can be viewed through alternate perspectives that are consistent with alternate conceptualizations of entrepreneurship. The first perspective brings into focus the rates of business founding as the objective with a primary focus on the influence of the EE on firm birth rates. This view suggests that EE research is concerned with the systemic relational and institutional influences on new venture births as an indicator of entrepreneurship as a collective 'species.' A researcher working from this perspective may be concerned with the proliferation of new ventures and therefore we label this first concern of EE research entrepreneurial proliferation. The historic time that sets the pattern of firm formation along with the influence in the present combine to deliver the rate of new venture formations.

A second perspective suggests that EE may be conceptualized as the preservation of the new venture through 'healthy' creation, survival, continuity, and/or growth. This view, accepting the unit of analysis and object of study as the new firm, seeks to account for entrepreneurship as more than firm creation; it also encompasses how new firms survive and grow within a set of systemic relations. In brief, then, a researcher concerned with the influences on new venture survival beyond start-up will need to take longitudinal influences into account and examine the various effects on a new venture experienced over time until it becomes a firmly established trading entity. This second perspective of an EE we label entrepreneurial survival.

The third perspective is concerned with new venture creation that influences equilibrium and disequilibrium forces among markets and business populations, causing change and evolution, seeing the demise of some business populations and the emergence of new ones (Mason and Harrison 2006). This third viewpoint follows a structural level of analysis acknowledging the duality and reciprocity of the new firm and structural influences relative to new firms. The unit of analysis and object of study is the various categories of system interactions that influence the evolution of types and scope of firm populations. We call this third perspective entrepreneurial evolution. Time dimensions are further extended to examine the historical, to present, to future continuum with the entrepreneurial firm being either the disruptor or driver of, respectively, the established or new market equilibrium.

DISTINCTIONS IN TIME

By examining the roots of the ecological conceptions of entrepreneurship, it is apparent that different views of time emerge; that is, the 'what' or the unit of analysis differs, which in turn imposes a different sense of time. Returning to our sample of definitions these multi-time dimensional views can also readily be observed. For instance, eight of the nine definitions make specific reference to firm creation either explicitly through terms such as creating, starting, or forming a new venture or implicitly through the reference to entrepreneurial activities, processes, or commercializing opportunities. This frames time around the individual entrepreneur and the process of firm formation. Five of the eight definitions refer to sustaining the new venture through terms such as growth, operation, sustainable, supporting development, or, perhaps ambiguously, through concerns with firms that dissolve. The unit of analysis, therefore shifts to the firm and time as relevant to the firm's survival and growth. In four of the nine definitional examples there seems to be yet longer-term or broader concerns although perhaps less explicitly stated. These views can be observed through references to outcomes of

sustainable development, productive entrepreneurship, allocation of resources, and innovative start-ups. Each of these terms reveals a concern with the broader state of the economy or community resources or the disruptiveness and growth of innovative firms that may influence socioeconomic status quo. Time in this broader community sense follows patterns of evolution in time frames broader again.

EE analysis, therefore, is not only a static cross-sectional 'snapshot' account of the start-up community actors and inter-relationships with interests in the start of new ventures (the proliferation or birth rate of new ventures) in a specific point in time. Although this information is important, it does not account for the more inclusive influences that are responsible for the births and deaths or demise of entrepreneurial ventures or the rates of business survival and growth over sustained time periods. Furthermore, the interests of an EE analysis may also focus on how entrepreneurial actors acquire and generate different attributes that manifest as industrial evolution (phylogeny or the evolution and branching of species in ecological terms). This is represented in our definitional samples by interests in the environmentally sustainable ventures of Cohen (2006) or the innovative ventures of Spigel (2017), both specific types of ventures. This focus on types of ventures can be further extended to specific industry identifications, for example, digital, defense, creative, or manufacturing. In these interests the EE analysis narrows to the specific types of new ventures and tends, therefore, to look at evolutionary perspectives of the EE, considering the emergence and demise of different sub-species among the general species of new ventures. These sub-species may affect and influence the larger social and economic systems and evolution of our human societies and communities.

It should not be ignored that all three perspectives—proliferation, survival, and evolution—are acting concurrently and new venture founding, or start-up, is insufficient as a measure for any defined geo-socio-political performance. We must have evidence of new ventures (and the form of these is a point for further discussion beyond the scope of this article) in an EE, but they also must survive and grow after founding (Brown and Mason 2017). Stam (2015) goes one step further, describing the new ventures as outputs of an EE and new value created as outcomes, thus signaling the evolutionary interests. Hence, for analysis purposes, there are three specific time horizons that one may specify in researching an EE. The first is the formational time involved in business founding that examines the historical and contextual influences on new venture births (Aldrich 1990); the proliferation of new ventures. The second perspective focus is on longer periods of time to allow for new venture survival and growth that addresses, for instance, the sufficiency of resources to sustain new ventures through their initial cycle of development (Brown and Mason 2017). While the third perspective is that the longer-term evolutionary time phase of the ecosystem itself traces the development and demise of species as may be accounted for in terms of economic transitions through industry sectors (Auerswald and Dani 2017); for example, agrarian to industrial or manufacturing to knowledge economies; the evolutionary effect of new and growing firms. Evolutionary perspectives are important as the over-reliance of a region on one particular industry has the effect of stifling diversification, hence the region then lacks the resilience to adapt when a dominant industry declines. This situation has been superbly exemplified for Glasgow by Checkland (1976). Figure 1 isolates the EE and depicts the three temporal boundary specifications that may distinguish the three distinct perspectives that may be relevant to EE analysis.

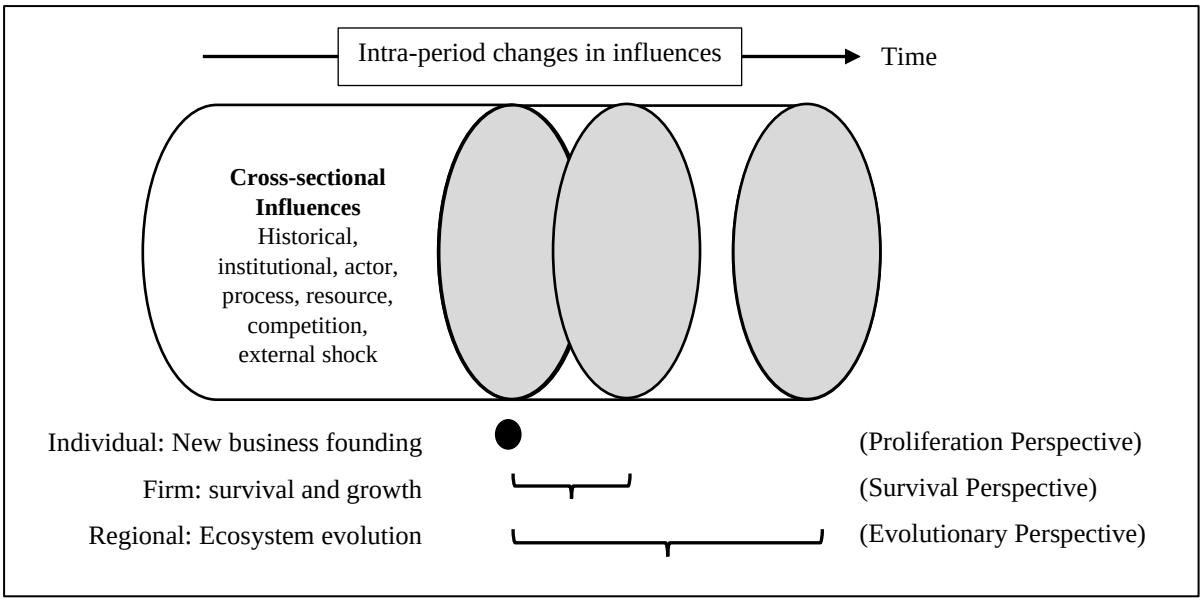

Figure 1: The Three Temporal Perspectives of an Entrepreneurial Ecosystem

DISCUSSION

The extant research has generally focused on EEs as distinct and as an alternative to or substitute for the more established and familiar ecosystems, such as the regional system of innovation. By contrast, this paper considers the EE as a complementary and interactive concept. Perhaps oddly from a systems perspective, in trying to understand the concept, its analysis, why it is important, and how it can be applied, it has been necessary to de-construct the EE into time dependent conceptual pieces. In doing so it is not intended to convey that the EE concept can be analyzed particularly well through the lens of only one of its conceptual pieces. Ecosystems of any form operate as a set of systems, each being deeply embedded within supra-systems and dependent to some extent on sub-systems and related systems. In this article, an attempt has been made to draw out the layers of systemic effects and show the inter-relationships between the layers of time within the ecosystem analysis.

To illustrate, if the analysis of the EE intends to target the rate of start-ups in a defined boundary space, then one would need to consider that the start-up rates are affected and perhaps dependent upon other sub, supra, or related systems. For instance, these could be the institutional effects such as the education system or the banking and finance system or the entrepreneurial support system. The rate of founding itself, if it is to be understood in a system sense, is not simply a count of firm births, but it is an account of the historic and present systemic influences on firm births or the 'species' called new firms. The conceptual development undertaken in this introductory paper to this Special Issue illustrates however that a focus on the counts new firms is based on a very limited understanding of the scope of an EE.

It is also essential to state that the temporal boundaries of an EE analysis are fuzzy, and this is largely unavoidable. For example the truncated idea to new business formation analysis at the decision level of business founding may not detect the multiple influences on the new venture idea but instead may focus on access to networks, family experience, financial accessibility,

and available support infrastructures such as local incubators. This may overlook the influence of either the university or business sectors on a broader temporal scale. The decisions taken by the limited view of the ecosystem analysis can suppress identification of influences. A decision to change either the geo-socio-political or time boundary conditions would add new information. In turn, the degree of complexity of the business founding analysis increases with the broader time span identifying the influences on the idea that shaped the new venture creation and hence introducing more influencers over the time span of analysis.

To comprehend the entire EE, a layered analysis anchored on each specific time perspective described here, to first distinctly and then to overlay the influences identified to eliminate duplication and note the variation of the influence over time, is required. To address the evolutionary case, the surrounding knowledge and business ecosystems need to be accounted for through other institutional and organizational influences. Lastly, depending on the industry level specification the related ecosystems that intersect with the EE—whether that be the health care ecosystem for a biomedical start-up or the effects of the education ecosystem on skilled labor for robotics manufacturing or the transport and logistics ecosystem for food processing industries—all need to be considered — the broader the specification parameters, the more complex the system and its analysis.

CONCLUSION

While research on EEs is relatively new and replete with a plethora of views and definitions of what actually constitutes a bona fide EE, a common trait of extant research is the attempt to differentiate the EE concept as an alternative to or substitute for other more conventional and established system concepts, such as regional innovation systems. Reviewing a sample of past definitions revealed the diversity of views on what constitutes an EE. The definitions were conflicted on the unit of analysis as to whether the entrepreneurial actor, the new firm creation, the early-stage start-up, and growth or the socioeconomic system was the focus of the analysis. There were observable variations in boundaries and purpose. These differing perspectives impede the empirical development of the concept. Hence this paper examined the ecological origins and identified three temporal variations that have been embedded in the research to date that needs to be reconciled in an EE analysis.

Entrepreneurship is a concept that has inherent difficulty in empirical analysis. Over the years, the field has flip-flopped over whether the entrepreneur, their organization, the process of new venture creation, or whether opportunity is centric to entrepreneurship research. The rise of an EE view amplifies this uncertainty making it difficult to pin down who or what is influenced and is influencing in an EE research design. This article sets out an argument that suggests an EE has multiple conceptualizations, including the act and process of new venture creation, the subsequent survival, and growth of new ventures and the impact these new ventures have on the socioeconomic evolution. Moreover and importantly for this Special Issue, we contend that the dynamics among these place and time dependent layers mean that there is no basis for a ‘one size fits all’ approach to an EE.

EE research, therefore, needs to account for conflicts in influence that vary in and over time and is essentially a tool or framework of analysis that examines the entrepreneurial effects across time and levels. This is the polyrhythm effect whereby within an EE, the pace of entrepreneurship in proliferation, survival, and evolution are occurring simultaneously but differently, creating cross-variation in rhythm each affected by the other. In this article we have considered that the analysis is concerned with the relatively cross-sectional substantiation of

new venture creation, the longer view of survival and growth of new ventures, or the generational time view to account for industry transitions and transformations.

Gartner (1988) proposed that the 'who is an entrepreneur' question should be replaced with questions about what entrepreneurs do embracing the behavioral research design. Shane and Venkataraman (2000) shifted the emphasis toward the opportunity space in entrepreneurship. This has ultimately led entrepreneurship research full circle back toward its origin in economic interests (Minniti and Lévesque 2008) to an appreciation that it is "an important mechanism to explain the outcome of economic systems" (Acs et al. 2017b, 2). In other words, the questions that EE research brings into focus are both 'how' and 'why' questions. Grappling with the 'how' question means acknowledging that entrepreneurship, as new venture creation, is influenced by factors beyond any particular entrepreneur, notwithstanding that the entrepreneur is a central character. But more importantly, coming to grips with the 'why' question means dealing with the fundamental alignment of perhaps the more neglected side of Shane and Venkataraman's (2000) definition of entrepreneurship research to ask, with what effect? This special issue and its conceptual framework of EEs offer researchers a useful way to conceptualize alignment between the entrepreneur, time, and the ultimate socioeconomic effect.

SPECIAL ISSUE PAPERS

To shed light on the relatively unexplored area of entrepreneurship ecosystem dynamics, the papers included in the special issue provide new approaches to analyzing and thinking about how entrepreneurial ecosystems develop and evolve over time. In "From orchards to chips: Silicon valley's evolving Entrepreneurial ecosystem" Stephen B. Adams examines how entrepreneurial ecosystems evolve and adapt over time to the changing needs of industry. He reminds us that the region that is now known as Silicon Valley has long established roots. By the 1960s – well before scholars first started to write about the region - it was already a leading high technology region based around electronics and telecommunications that was supported by an existing ecosystem of institutions – which was more geographically extensive than the contemporary ecosystem - and by the repurposing of capital from previous industrial activity. This paper reveals the evolutionary perspective of EE dynamics.

Paul Ryan, Majella Giblin, Giulio Buciuni and Dieter F. Kogler examine the role of multinational enterprise (MNE) subsidiaries in the genesis and evolution of entrepreneurial ecosystems. Their longitudinal study of Galway in the Republic of Ireland shows how two MNE subsidiaries specialising in medical devices that located in the region several decades ago, attracted by government financial incentives, have evolved from manufacturing plants into advanced R&D centres of excellence. This shift to higher value-added and knowledge-based activities has led to them becoming catalysts for the emergence of an entrepreneurial ecosystems as employees have drawn upon the market and technical knowledge that they accrued while working in the companies to start new 'born global' ventures, initially in related technologies but subsequently in unrelated technologies. Some of these firms have become incubators for further business formation. The authors argue that the resulting technological heterogeneity has produced a more resilient entrepreneurial ecosystem. The framing of this paper illustrates how the analysis over time is necessary to uncover the roles and influences of elements within an EE on its evolution.

The paper by Ben Spigel and Tara Vinodra offers novel insights into the process of entrepreneurial recycling as a stimulus for business creation. By analyizing the career paths and transistions of the human capital dimension of the Waterloo, Canada entrepreneurial ecosystem this study explores the temporal dynamics of entrepreneurial recycling on the development of an EE through the lens of the Blackberry's former employees. Prior to 2008 the Waterloo EE was driven primarily by Blackberry which, similar to Fairchild's role in the development of Silcon Valley (Agarwal, Audretsch and Sarkar 2007), was the anchor that developed the Waterloo EE. The paper deals more specifically with the interplay effects of firm demise and creation when longer time periods are drawn into the analysis.

In Degrees of integration: How a fragmented entrepreneurial ecosystem promotes different types of entrepreneurs Katharina Scheidgen challenges the view that entrepreneurial ecosystems are necessarily highly integrated, suggesting that they may, in fact, be fragmented. Focusing on how entrepreneurs make use of the entrepreneurial ecosystem to acquire resources, her study of Berlin identifies that its entrepreneurial ecosystem comprises two sub-systems comprising different types of entrepreneurs who have different resourcing practices. The paper exposes the multiple system effects that simultaneously occur within an EE to influence its development over time.

The final two papers each focuses on the role of government programmnes to support the emergence and growth of entepreneurial ecosystems. They each show how institutional interventions shape and influence the EE leaving residual effects that either positively or negatively influence EE productivity with respect to new firm creation, survival, growth and entrepreneurial evolution. Aki Harima, Jan Harima, and Jörg Freiling investigate how a region without a rich resource base – 'fertile soil' (Mason and Brown, 2014) – can use the injection of external resources, specifically transnational entrepreneurs, to facilitate the emergence and growth of entrepreneurial ecosystems. The paper looks at the case of Start Up Chile – a government programme that attracts transnational entrepreneurs – albeit often on a temporary basis – with incentives to create an ecosystem. They identify several positive impacts: a change in the Chilean perception towards entrepreneurship, creating an entrepreneurial culture, stronger entrepreneur mindsets, the elevation of the social status and image of entrepreneurs, strengthened interactions and the emergence of autonomous networks, and building regional confidence, all of which increase the legitimacy of the local entrepreneurial ecosystem. However, the downside of the over-reliance on policy instruments to achieve these outcomes has created a dependency relationship which has prevented the region from transforming into a self-sustaining and resilient entrepreneurial ecosystem.

Finally, Ashenafi Biru, David Gilbert and Pia Arenius, in "Unhelpful help: The state of support programs and the dynamics of entrepreneurship ecosystems in Ethiopia" provides insights into the interrelationship of entrepreneurship support programs and the development of EEs in an developing economy**.** Their analysis focuses on how the structure and implementation of entrepreneurship support programs in Ethiopia influence firm behavior within the context of an ecosystem. In particular, they find that entrepreneurship support programs that do not prioritize innovative and competitive firms when distributing resources actually deter entrepreneurial behaviour and impede the development of the entrepreneurial ecosystem.

Time is fundamental to the analysis of the dynamics of an EE. New firm creation, survival, growth and demise all occur within a temporal context. Systems approaches

invariably model the influential effects of the actors and elements that shape, re-shape, maintain, shift and change the system itself. An EE point of view therefore is inherently time dependent and provides an analytical framework that reveals how the number and diversity of entrepreneurial actors situated in a place and time influence the creation of new firms, their survival, growth, and ultimately the equilibrium dynamics of markets and industry. Whether for better or worse, the historic and present time dimensions underpin the trajectory of and future of EE performances regardless of how they are measured.

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